INFORMATION HANDOUT

MATERIALS INFORMATION

UNDERGROUND CLASSIFICATION FOR POTENTIALLY GASSY with Special Conditions FOR TUNNELS

GEOTECHNICAL ENGINEERING INVESTIGATION EAST CONTRA COSTA TRANSIT DEVELOPMENT (eBART) AT CENTURY BOULEVARD UNDERCROSSING (BRIDGE NO. 28C484)

GEOTECHNICAL ENGINEERING INVESTIGATION EAST CONTRA COSTA TRANSIT DEVELOPMENT (eBART) AT UTILITY CORRIDOR UNDERCROSSING (BRIDGE NO. 28X0483)

FINAL FOUNDATION REPORT, LOVERIDGE ROAD OVERCROSSING (REPLACE) (BRIDGE NO. 28-0394)

FINAL FOUNDATION REPORT, UTILITY UNDERCROSSING (WIDEN) (BRIDGE NO. 28-0105)

FINAL FOUNDATION REPORT, CENTURY BOULEVARD UNDERCROSSING (REPLACE) (BRIDGE NO. 28-0395)

FOUNDATION REPORT, RETAINING WALLS NO. 1, 2A, 2B, 3A, 3B, 4, 5, AND 6

FOUNDATION REPORT EAST CONTRA COSTA TRANSIT DEVELOPMENT eBART-RETAINING WALLS IN THE MEDIAN (WALLS 1A, 1B, 2A, 2B)

GEOTECHNICAL DESIGN AND MATERIALS REPORT

MATERIALS HANDOUT REPORT

NON-STORMWATER INFORMATION HANDOUT

HAZARDOUS MATERIALS INVESTIGATION (DRAFT REPORT)

PROPOSAL FOR ASBESTOS AND LEAD-BASED PAINT SAMPLING

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD WASTE DISCHARGE REQUIREMENTS FOR DEWATERING AND OTHER LOW THREAT DISCHARGES TO SURFACE WATERS

PERMITS

U.S. ARMY CORPS OF ENGINEERS (PERMIT NO. 2002-267468)

DEPARTMENT OF FISH AND GAME (NOTIFICATION NO. 1600-2008-0217-3)

BUREAU OF RECLAMATION (JOINT USE AGREEMENT)

STATE WATER RESOURCES CONTROL BOARD (CORPS FILE NO. 2002-26746N)

ROUTE: 04-CC-4-37.9/41.3

STATE OF CALIFORNIA ARNOLD SCHWARZENEGGER, Governor

DEPARTMENT OF INDUSTRIAL RELATIONS
DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT
2211 Park Towne Circle, Suite 2
Sacramento, California 95825

Telephone (916) 574-2540
FAX (916) 574-2542

July 17, 2008

URS Corporation
3440 Vincent Road
Pleasant Hill, California 94523

Attention: Ben Razeghi, Design Manager

Subject: Underground Classification Nos. C016-013-09T through C019-013-09T
State Route 4 Widening Project

Owner: Department of Transportation
111 Grand Avenue
Oakland, California 94623

Mr. Razeghi:

The information provided to this office relative to the above project has been reviewed. On the basis of this analysis, Underground Classifications of "Potentially Gassy with Special Conditions" have been assigned to the tunnels identified on your submittal. Please forward the original Classifications to the Owner and retain true and correct copies of these Classifications for your records.

When the contractor who will be performing the work is selected, please deliver to them a true and correct copy of the Classification for posting at the job site and advise them to notify this office to schedule the mandated Prejob Conferences with the Division prior to commencing any activity associated with construction of the tunnels.

Please be informed that whenever an employee enters any bore or shaft being constructed under 30 inches in diameter, the Mining and Tunneling Unit then has immediate jurisdiction over that job. Please contact the Mining and Tunneling Unit prior to entering such spaces.

If you have any questions on this subject, please contact this office at your earliest convenience.

Sincerely,

John R. Leahy
Senior Engineer

cc: Sabino DeGuzman
File

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

Underground Classification

C016-013-09T

DEPARTMENT OF TRANSPORTATION

(NAME OF TUNNEL OR MINE AND COMPANY NAME)

of 111 Grand Avenue, Oakland, California 94623

(MAILING ADDRESS)

at STATE ROUTE 4 WIDENING PROJECT – 24i & 24j

(LOCATION)

has been classified as *** POTENTIALLY GASSY with Special Conditions***

(CLASSIFICATION)

as required by the California Labor Code Section 7955.

The Division shall be notified if sufficient quantities of flammable gas or vapors have been encountered underground. Classifications are based on the California Labor Code Part 9, Tunnel Safety Orders and Mine Safety Orders.

SPECIAL CONDITIONS

1. A Certified Gas Tester shall perform pre-entry and continuous monitoring of the underground environment to measure Oxygen and detect explosive, flammable, and toxic gasses whenever an employee is working in the underground environment.
2. Mechanical ventilation shall provide for continuous exhaust of fumes and air at any time an employee is working in the underground environment. The primary ventilation fans must be located outside of the underground environment and shall be reversible by a single switch near the fan location.
3. The Division shall be notified immediately if any **Flammable Gas** or **Petroleum Vapor** exceeds 5% of the Lower Explosive Limit.
4. All utilities that may be in conflict with the project shall be identified and physically located (potholed) prior to the start of project operations.

The 30-inch diameter by 111 feet long tunnel bore project located beneath Route 4 approximately 50 feet west of the intersection of Route 4 and Loveridge Road, Pittsburg, Contra Costa County.

This classification shall be conspicuously posted at the place of employment.

Date July 17, 2008

John R Leahy

(SENIOR ENGINEER)

John R. Leahy

03 77089

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

Underground Classification

C017-013-09T

DEPARTMENT OF TRANSPORTATION

(NAME OF TUNNEL OR MINE AND COMPANY NAME)

of 111 Grand Avenue, Oakland, California 94623

(MAILING ADDRESS)

at STATE ROUTE 4 WIDENING PROJECT – 37i & 37n

(LOCATION)

has been classified as *** POTENTIALLY GASSY with Special Conditions***

(CLASSIFICATION)

as required by the California Labor Code Section 7955.

The Division shall be notified if sufficient quantities of flammable gas or vapors have been encountered underground. Classifications are based on the California Labor Code Part 9, Tunnel Safety Orders and Mine Safety Orders.

SPECIAL CONDITIONS

1. A Certified Gas Tester shall perform pre-entry and continuous monitoring of the underground environment to measure Oxygen and detect explosive, flammable, and toxic gasses whenever an employee is working in the underground environment.
2. Mechanical ventilation shall provide for continuous exhaust of fumes and air at any time an employee is working in the underground environment. The primary ventilation fans must be located outside of the underground environment and shall be reversible by a single switch near the fan location.
3. The Division shall be notified immediately if any **Flammable Gas** or **Petroleum Vapor** exceeds 5% of the Lower Explosive Limit.
4. All utilities that may be in conflict with the project shall be identified and physically located (potholed) prior to the start of project operations.

The 30-inch diameter by 82 feet long tunnel bore project located beneath Route 4 approximately 65 feet east of the intersection of Route 4 and Loveridge Road, Pittsburg, Contra Costa County.

This classification shall be conspicuously posted at the place of employment.

Date July 17, 2008

John R Leahy

(SENIOR ENGINEER)

John R. Leahy

03 77089

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

Underground Classification

C018-013-09T

DEPARTMENT OF TRANSPORTATION

(NAME OF TUNNEL OR MINE AND COMPANY NAME)

of 111 Grand Avenue, Oakland, California 94623

(MAILING ADDRESS)

at STATE ROUTE 4 WIDENING PROJECT – 59f

(LOCATION)

has been classified as *** POTENTIALLY GASSY with Special Conditions***

(CLASSIFICATION)

as required by the California Labor Code Section 7955.

The Division shall be notified if sufficient quantities of flammable gas or vapors have been encountered underground. Classifications are based on the California Labor Code Part 9, Tunnel Safety Orders and Mine Safety Orders.

SPECIAL CONDITIONS

1. A Certified Gas Tester shall perform pre-entry and continuous monitoring of the underground environment to measure Oxygen and detect explosive, flammable, and toxic gasses whenever an employee is working in the underground environment.
2. Mechanical ventilation shall provide for continuous exhaust of fumes and air at any time an employee is working in the underground environment. The primary ventilation fans must be located outside of the underground environment and shall be reversible by a single switch near the fan location.
3. The Division shall be notified immediately if any **Flammable Gas** or **Petroleum Vapor** exceeds 5% of the Lower Explosive Limit.
4. All utilities that may be in conflict with the project shall be identified and physically located (potholed) prior to the start of project operations.

The 30-inch diameter by 58 feet long tunnel bore project located beneath eastbound Route 4 approximately 1,300 feet east of the intersection of Route 4 and Loveridge Road, Pittsburg, Contra Costa County.

This classification shall be conspicuously posted at the place of employment.

Date July 17, 2008

(SENIOR ENGINEER)

John R. Leahy

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

Underground Classification

C019-013-09T

DEPARTMENT OF TRANSPORTATION

(NAME OF TUNNEL OR MINE AND COMPANY NAME)

of 111 Grand Avenue, Oakland, California 94623

(MAILING ADDRESS)

at STATE ROUTE 4 WIDENING PROJECT – 2g

(LOCATION)

has been classified as *** POTENTIALLY GASSY with Special Conditions***

(CLASSIFICATION)

as required by the California Labor Code Section 7955.

The Division shall be notified if sufficient quantities of flammable gas or vapors have been encountered underground. Classifications are based on the California Labor Code Part 9, Tunnel Safety Orders and Mine Safety Orders.

SPECIAL CONDITIONS

1. A Certified Gas Tester shall perform pre-entry and continuous monitoring of the underground environment to measure Oxygen and detect explosive, flammable, and toxic gasses whenever an employee is working in the underground environment.
2. Mechanical ventilation shall provide for continuous exhaust of fumes and air at any time an employee is working in the underground environment. The primary ventilation fans must be located outside of the underground environment and shall be reversible by a single switch near the fan location.
3. The Division shall be notified immediately if any **Flammable Gas** or **Petroleum Vapor** exceeds 5% of the Lower Explosive Limit.
4. All utilities that may be in conflict with the project shall be identified and physically located (potholed) prior to the start of project operations.

The 54-inch diameter by 253 feet long tunnel bore project located beneath eastbound Route 4 approximately 3,200 feet east of the intersection of Route 4 and Loveridge Road, Pittsburg, Contra Costa County.

This classification shall be conspicuously posted at the place of employment.

Date July 17, 2008

(SENIOR ENGINEER)

John R. Leahy

GEOTECHNICAL ENGINEERING INVESTIGATION
EAST CONTRA COSTA TRANSIT DEVELOPMENT
eBART) AT CENTURY BOULEVARD UNDERCROSSING
PITTSBURG, CALIFORNIA

For

PARIKH

Practicing in the Geosciences

GEOTECHNICAL ENGINEERING INVESTIGATION
EAST CONTRA COSTA TRANSIT DEVELOPMENT
(eBART) AT CENTURY BOULEVARD UNDERCROSSING
PITTSBURG, CALIFORNIA

For

PGH WONG ENGINEERS
300 Lakeside Drive, 21st Floor
Oakland, California

PARIKH CONSULTANTS, INC.
1243 Alpine Road, Suite 110
Walnut Creek, CA 94596
(925) 933-6336

December 2007

Job No. 205124.CEN

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GEOTECHNICAL ENGINEERING INVESTIGATION
EAST CONTRA COSTA TRANSIT DEVELOPMENT (eBART)
AT CENTURY BOULEVARD UNDERCROSSING
PITTSBURG, CALIFORNIA

INTRODUCTION

This report presents the results of our geotechnical engineering investigation for the proposed new bridge for eBART between the eastbound and westbound bridges on Highway 4 crossing at Century Boulevard Undercrossing in Pittsburg, California. Our work was performed generally in accordance with the scope of work as per our agreement. The general location of the site and its vicinity are shown on the Project Location Map, Plate 1.

The geotechnical recommendations presented in this report are intended for design input and are not intended to use as specifications. These recommendations should not be used for direct bidding purposes.

PROPOSED CONSTRUCTION

A General Plan and a Foundation Plan for the project were provided to us by Beyaz and Patel, the Structural Engineer for the project. Per the plans, the eBART structure will consist of a single span cast-in-place, prestressed concrete box girder bridge, with walkways on either side. The structure will be 29.6 meters long and 9.6 meters wide. It will be constructed between the new eastbound and westbound highway bridges along Route 4 crossing Century Blvd to be constructed under a separate program and will be separated from the highway bridges by concrete traffic barriers. Two parallel railroad tracks with associated ballast and railroad ties will be installed on top of the box girder structure. The bridge abutments will be founded on 355mm square precast prestressed concrete piles (Caltrans Class 625, Alt "X" Modified).

PURPOSE AND SCOPE

URS Consultants of Oakland, California performed a geotechnical investigation and prepared a foundation report (February, 2007) for Rte 4 widening (Century Blvd UC (Replace), Br. No. 28-0395). The purpose of their investigation was to evaluate the general soil conditions at the site of the two new highway bridges on either side of the eBART structure, to evaluate their

engineering properties, and to provide recommendations for foundation support of the two bridges. Since the two new highway bridges will be located on either side of the proposed eBART structure, it was decided by Contra Costa County Traffic Authority and PGH Wong that this information should be used for the eBART structure between the two bridges to the extent possible. No new field investigation or laboratory testing was performed specifically for this project; rather, we are directed to use this data for the eBART structure foundation report. Therefore, pertinent information from the URS report, including methods of obtaining representative soil samples and logging soil materials encountered, two cone penetrometer tests (CPT), and laboratory testing of the collected samples have been included in the present report. Per contract conditions, we are not responsible for the information in the URS report regarding the results of their field investigation and laboratory testing.

The scope of work performed for this investigation included a review of the URS foundation report, review of other readily available soils and geologic literature, engineering analysis of the field and laboratory data, and preparation of this report. We have presented the descriptive log of the boreholes and CPT data from URS work in Appendix A.

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

Our recommendations in this report are based on the above information. Any major deviation should be reported to this office for consideration.

SITE CONDITIONS

Per the As-Built drawings, the existing undercrossing (to be demolished) consists of two parallel single span bridges, constructed in 1953. The structures consist of concrete slabs on closed

abutments with straight wing walls. The abutments are founded on 2.29 m (7.5-ft) wide spread footings, the footing bottoms are at an approximate elevation of 15.2 meters. An allowable bearing pressure of 120 kPa (2500 ksf) is noted on the As-Built drawings. The abutment wall at each end is continuous for the two bridges, i.e. the wall spans across the space between the bridges where the eBART bridge is planned.

FIELD EXPLORATION AND LABORATORY TESTING

This section of the report is primarily conveying what is included in the URS report. Per the URS foundation report, initially two (2) exploratory borings were drilled as part of the current study. The borings were drilled on January 4 and 10, 2005. Subsequently, two cone penetration test (CPT) soundings were performed adjacent to the two borings to provide more definitive information for assessment of liquefaction potential. The CPT soundings were performed on July 21, 2005. The borings and the adjacent CPTs were located on Century Boulevard on either side of Route 4. The boring and CPT locations are shown on Plate 6. The boring and the CPT locations are also shown on the plan portion of the Log of Test Borings in Appendix A.

Soil Borings

The borings were drilled by Taber Consultants of West Sacramento, California, using a truck-mounted drill rig. Initial drilling (to depths of 6.1m and 13.7m) was performed using a solid stem auger. Subsequent drilling was performed using the rotary wash drilling method. Both the borings were drilled to depths of about 27.9 m below the existing ground surface. .

Selected samples were obtained at various depths generally at 1.5 m intervals to a depth of 15 meters and at 3 m intervals thereafter. Samples were obtained using 63 mm O.D. & 51 mm I.D. (Modified California) samplers fitted with brass liners for the clayey material and 51 mm O.D. & 35 mm I.D. (Standard Penetration Test) samplers for the granular material. The samplers were driven in subsurface soils under the impact of a 63.5 kg safety hammer having a free fall of 762 mm. The blow counts are presented on the "Log of Test Borings". (When correlating standard penetration data in similar soils, the blow counts for the Modified California Sampler can be taken as roughly 1.2 times that for the Standard Penetration Test in similar soils). The samples were

sealed and transported to the URS laboratory for further evaluation and testing. The field investigation was conducted under the supervision of a URS field engineer who logged the test borings and prepared the samples for subsequent laboratory testing and evaluation.

Cone Penetration Testing (CPT)

On July 21, 2005, Gregg Drilling & Testing of Martinez, California performed CPT work using a truck mounted CPT rig. The CPTs were conducted using a 20-ton capacity cone with a tip area of 15 square centimeters and a friction sleeve area of 225 square centimeters. The soil resistance exerted to the tip and side of the cone were recorded and correlated to soil type, classification and strength characteristics. Groundwater level was estimated from pore pressure measurements during CPT operation.

Laboratory Testing

Laboratory tests were performed on selected samples obtained during field exploration to determine the physical and engineering properties of the subsoils. Laboratory data of moisture contents, total density, grain size distribution, Atterberg Limits and unconfined compression strengths are presented on the Log of Test Borings. Other tests performed include an Unconsolidated Undrained (UU) triaxial test and three consolidation tests. A detailed description of laboratory testing performed is presented in Appendix B. Appendix B also includes Plasticity Charts for Atterberg Limits, grain size distribution curves, stress-strain curve for the UU test and the load-deformation curves for the consolidation tests.

Boring and CPT Logs

A copy of the log of test borings (LOTB) sheets presented in the URS report is provided in Appendix A. Sheet 3 of 3 was not available and is therefore not included. The abrupt stratum changes shown on these logs may be gradual and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations. CPT logs are also presented on the LOTB sheets at appropriate locations.

SUBSURFACE CONDITIONS

The borings and CPT data indicate that the surficial fill and the underlying native soils were both predominantly stiff to hard lean clays to a depth of approximately 26 meters below ground surface. The clays were stiff near the surface, increasing in strength with depth; hard clays were encountered at a depth of approximately 20meters in boring B-20 and 22 meters in B-21. Very stiff to hard silts and sandy silts occurred below the clay soils at 26-meter depth.

Groundwater was encountered during drilling at depths ranging from 13.3 to 13.7 meters below ground surface (El 4.0 to El 4.7). However, groundwater level may vary with passage of time due to seasonal groundwater fluctuation, surface and subsurface flows, ground surface run-off, and other factors that may not be present at the time of investigation. A design groundwater table at El 5.0 as suggested in the URS geotechnical report is found reasonable and has been used in this study.

In addition to the new borings and CPT soundings, we reviewed the boring in the LOTB sheet from the as-built drawings for the Standard Oil Road undercrossing, which is also presented in Appendix A. The boring indicates predominantly silty soils. The discrepancy between the two sets of boring may be attributed to changes in soil classification over the years – the borings were drilled in 1952.

GEOLOGY

General geologic features pertaining to the site were evaluated by reference to the "Geologic Map of Contra Costa County, Geologic Map of the San Francisco Bay Region" by Graymer, R. W. et. al., 2006 (USGS Scientific Investigations Map 2918). Based on the publication, the project site subsoils mainly consist of Pleistocene alluvium deposits. A geologic map is attached (Plate 2).

EARTHQUAKE CONSIDERATIONS

Seismic Sources

The project site is located in a seismically active part of Northern California. Many faults exist in the San Francisco Bay Area. These faults, which are capable of producing earthquakes, may cause strong ground shaking at the site. Maximum credible earthquake magnitudes for some of the faults in the area determined by Mualchin (1996) are summarized below. These maximum credible earthquakes represent the largest earthquakes that could occur on the given fault based on the current understanding of the regional tectonic structure.

SEISMIC DATA

Fault	Type	Estimated Nearest Distance From Project Site (Km)	Maximum Credible Earthquake
Antioch Fault	Strike-slip	4.6	6.75
Coast Ranges – Sierran Block Boundary Zone	Reverse	6.2	7.00
Greenville Fault	Strike-slip	8.3	7.25

Seismic Hazards/Liquefaction Impact

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction. Since no active faults pass through the site, the potential for fault rupture is relatively low. Based on available geological and seismic information, the possibility of the site to experience strong ground shaking may be considered significant.

Liquefaction is a phenomenon in which saturated soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged, cohesionless sands and silts of low relative density are the type of soils which usually are susceptible to liquefaction - the susceptibility increases with decreasing relative density (reflected by the number of blows to drive a sampler), and decreasing fines content.

Accepted procedures for the assessment for liquefaction potential for cohesionless soils have evolved over the years through research and field observations (Youd et al, 2001). Recent research and field observations have shown that clays of low plasticity are also potentially liquefiable, based on the moisture content and plasticity characteristics of the clay. Procedures for the assessment of liquefaction potential for clay soils have also been established and have received general acceptance. (Bray et. al., 2004). The liquefaction potential for the general area is found to be relatively low. The URS geotechnical report presents the results of their assessment of liquefaction potential, using the CPT information. The only potentially liquefiable layer identified is a 1-meter thick sand layer at a depth of 17 m below ground surface in CPT-1 on the north side of Route 4. Analyses further indicate negligible post liquefaction settlements. The consequences of potential liquefaction on the foundations of the eBART structure are thus considered inconsequential.

FINDINGS AND RECOMMENDATIONS

General

Based on the findings of the investigation, it is our opinion that the site is feasible for the planned bridge structure provided the recommendations presented in this report are incorporated into the final design and construction.

This report was prepared specifically for the proposed bridge structure according to the plans provided to us. Normal construction procedures were assumed throughout our analysis and represent one of the bases of recommendations presented herein. Our design criteria have been based upon the materials encountered at the site. Therefore, we should be notified in the event that these conditions are changed, so as to modify or amend our recommendations.

Foundations

Per the Foundation Plan for the project, Caltrans Alt."X" Class 625 Modified (355 mm square) precast prestressed concrete piles are noted for foundation support at the abutment locations. It

may be noted that driven precast concrete piles are recommended in the URS geotechnical report for the adjacent highway bridges across Century Boulevard

Estimation of the pile capacities was made using the site-specific subsurface conditions. The top of pile (bottom of footing) elevations were based on the Foundation Plan provided by the Structural Engineer. The computer program APILE developed by Ensoft, Inc. was used for the computations. The program computes pile capacities for driven piles using four different methods: FHWA Method; US Corps of Engineers Method; Lambda Method; and API-RP2A Method from the American Petroleum Institute. The FHWA Method was chosen as the basis for the recommended pile tip elevations, since this method was judged to be the most appropriate for concrete piles in stiff clay soils. Pile capacity computations (APILE output) are presented in Appendix C.

PILE DATA TABLE – 355 mm Square Concrete Piles

Location	Pile Type	Design Loading (Service)	Nominal Resistance		Cut-off Elev. (m)	Design Tip Elev. (m)	Specified Tip Elev. (m)
			Compression	Tension			
Abut 1	Class 625 Alt. "X"	525 kN	1170 kN	540 kN	15.95	5.0 (1); 4.4 (2) 8.0 (3)	4.4
Abut 2	Class 625 Alt. "X"	525 kN	1170 kN	540 kN	15.95	5.0 (1); 4.4 (2) 8.0 (3)	4.4
Design Tip Elevation is controlled by the following demands: (1) Compression; (2) Tension; (3) Lateral Loads Cut off elevation provided by the Structural Designer							

Pile Driving

An adequate hammer should be chosen for the pile driving through the very stiff clays at the site. It is recommended that prior to start of production pile driving, a pile driveability analysis be performed to assess the adequacy of the hammer and to establish a field pile driving criterion. Also, in view of the fact that procedures for estimation of pile capacities in very stiff to hard clays are somewhat uncertain, it is recommended that a selected number of piles be monitored to assure that the desired capacity is achieved. The monitoring should be performed using a Pile Driving Analyzer (PDA) and the associated CAPWAP program should be used to estimate the pile capacities both during driving and with restrike after a few days for effects of set-up.

Lateral Pile Capacity

Per instructions from the Structural Engineer, lateral load analyses were performed for the piles at the two abutments for loads up to 178 kN (60 kips), using the LPILE program and appropriate soil properties for the site. A free head condition (no bending moments) at the pile head was assumed for all the analyses per instructions of the Structural Engineer. Additionally, a group reduction factor of 0.6 was used to reflect a pile spacing of three times the pile 'diameter', consistent with recent discussions with Caltrans. Detailed output from the LPILE runs, including plots of deflection and bending moments along the lengths of the piles, are presented in Appendix C. A summary of the results is presented below.

Location	Pile Type	Lateral Load (kN)	Displacement at pile top (mm)	Maximum Bending Moment (kN-m)	Depth of Maximum Bending Moment (m)
Abutments 1 and 2	Class 625 Alt. "X" (355 mm)	44.5	3.5	35.6	1.5
		89.0	14.1	91.9	2.0
		133.5	32.2	162.3	2.2
		178.0	58.7	246.0	2.5
		222.5	111.1	277.2	2.7
		267.0	233.9	602.9	3.3

Generally, abutment piles are designed for service loads only, whereas, bent piles are governed by seismic loading conditions. A maximum deflection of 6.5mm is recommended at the top of the pile for service loads. For standard driven piles such as proposed for this project, Caltrans standard design of a maximum shear capacity of 178 kN per pile may apply for seismic design conditions.

Seismic Design Criteria

The governing fault is the Coast Ranges Sierran Block (CRSB) Boundary Zone (Mw=7.00, style of faulting: Reverse) located at about 6 kilometers from the project site. The closest mapped fault on the seismic hazard map prepared by Mualchin (Caltrans 1996) is the Antioch Fault, but the California Geological Survey does not consider this fault active. It had previously been mapped in 1976 as an Alquist-Priolo fault rupture zone, but more recent studies resulted in the fault no longer being classified as active (Wills, 1991). Even if the Antioch Fault were considered active, the ground

motions would be lower than those from the CRSB, due to the larger magnitude and reverse style faulting for the CRSB.

Recommended peak acceleration and Acceleration Response Spectra (ARS) curve based on Caltrans Seismic Design Criteria (SDC, v 1.4) are provided below. Recommended peak acceleration and ARS curve based on the AREMA Code for a 2400-year interval are also presented for reference purposes.

Caltrans SDC

Recommended Peak Rock Acceleration (PBA): 0.58g

A value of 0.48g is obtained using the fault distance and MCE noted above and the attenuation relationship per Sadigh (1997) correlating PBA to fault distance and MCE. The site falls between 0.4g and 0.5g contours on the Caltrans Seismic Hazard Map. The computed PBA (0.58g) is increased by 20%, also per Sadigh (1997), to account for the governing reverse fault effect (Coast Ranges – Sierran Block).

Soil Profile: Type D

Design ARS Curve (see Plate 4): Curve based on Caltrans SDC (v. 1.4, 6/2006) for different structural periods. The curve is based on (Governing Fault – Coast Ranges – Sierran Block; Mw = 7.00) Figure B.8, PBA = 0.58g. The curve for PBA=0.58g was obtained by interpolation of the 0.5g and 0.6g curves.

AREMA Code

Per AREMA Chapter 9, the 2400-year return interval represents the survivability state, described as 'a very rare or maximum credible event with a very low probability of being exceeded during the life of the structure'. The corresponding ARS curve shown on Plate 4 is based on a peak acceleration of 0.6g (established from Figure 9-1.3) and a site coefficient of 1.2, representative of the site subsurface conditions.

Lateral Earth Pressures

Abutment Retaining Walls and Wing Walls

Recommended earth pressures for design of abutment retaining walls and wing walls:

Active Condition (flexible wall - wall free to rotate at least 0.4 percent of wall height

Structure Backfill: Equivalent Fluid Pressure (EFP) – 5.65 kN/m^3

Surcharge (dead or live load): 0.3 times surcharge load

At-Rest Condition (rigid wall - wall not free to rotate at least 0.4 percent of wall height

Structure Backfill: Equivalent Fluid Pressure (EFP) – 8.65 kN/m^3

Surcharge (dead or live load): 0.5 times surcharge load

Passive Resistance for Seismic Design of Abutment Wall

Height of wall – 1.7 meters or higher: 265 kN/m^2 (ultimate)

Height of wall – less than 1.7 meters: 265 X (H/1.7) kN/m^2 (ultimate)

Seismic increment of Lateral Earth Pressure (based on BART Facilities Standards)

$2.15H^2$ (kN) per meter of wall, acting at 0.6H above the base

(The earth pressures are based on Mononobe-Okabe formulation. The accelerations used are half of the corresponding peak acceleration per BART Facilities Standards)

Passive Resistance for Abutment Footings

Ultimate passive resistances on the sides of the abutment footings offered by the adjacent soils were computed, using the following assumptions:

- Footing bottom at El 15.95 (consistent with the Foundation Plan)
- Footing thickness = 1.25 m;
- Top of footing at 0.9 m below ground surface
- The footings are placed in 'neat cut' excavations

Computed ultimate passive resistances acting on the footing sides are presented below:

- Static: 110 kPa
- Seismic: 165 kPa

The actual passive resistance mobilized is a function of the lateral movement of the footing and the ultimate passive resistance. It may be computed using the passive pressure mobilization curve (FEMA 356), which is presented as Plate 5.

Grading

All grading operations should be performed in accordance with the project specifications and Caltrans Standard Specifications for Earthwork (Section 19). A representative from our office or regulating agency should observe all excavated areas during grading and perform moisture and density tests on prepared subgrade and compacted fill material. Any fill material imported to the site should be non-expansive, relatively granular material having a Plasticity Index (PI) of less than 15. It should also be non-corrosive, free of deleterious material and should be reviewed by the Geotechnical Engineer.

Should there be any alterations of the proposed construction that will affect the stated bases of our recommendations, we should be informed so that we can review such changes and amend our recommendations or submit additional recommendations.

Engineered Fill. Engineered fill should be non-expansive and consist of relatively granular material having a PI of less than 15. In addition, the material should be consistent with the requirements of the pavement design.

Compaction of Fill and Subgrades. The project specific recommendations for required compaction as per Caltrans standards are as follows:

- 90% for subgrade preparation, general fill and backfilling after removing buried utilities and depressions caused due to construction activities, etc.
- 95% for all engineered fill for structural backfill of bridge abutments, footing subgrade, and for upper 6 inches of pavement subgrade and aggregate base of pavement sections.

Slope Ratio. No new permanent fill slopes are proposed for this project. For temporary slopes during construction, a slope ration of up to 1H: 1V may be used under dry conditions and up to 1.5H: 1V under submerged conditions. It should be noted that local irregularities such as loose layers and pockets might require flattening of the slope.

Our office should review the final grading plans relevant to the structure prior to grading to see that

the intent of our recommendations is included in the plans.

Corrosion

The results of corrosion investigations performed under URS study are included in Appendix B.. A summary of the corrosion test data is presented below.

Boring	Depth (m)	pH	Resistivity (ohms-cm)	Sulfate (ppm)	Chloride (ppm)
B-20	4	8.2	1200 * 1000 **	39	ND
B-21	2	7.6	4300 * 2300 **	---	---
ND – Not Detected; * - As Received; ** - Minimum					

Based on the data, the site subsoil is non-corrosive per Caltrans corrosion design guidelines, and standard Type II modified or Type I-P (MS) modified cement may be used for the concrete substructures. The minimum cement factor and cover thickness should be per Caltrans Bridge Design Specifications (Section 8.22).

Plan Review

We recommend that final plans for foundations be reviewed by this office prior to construction, so that the intent of our recommendations is included in the project plans and specifications. This also serves the purpose to further see that no misunderstandings or misinterpretations have occurred.

Construction Observation

To a degree, the performance of any structure is dependent upon construction procedures and quality. Hence, observation of foundation excavations, and pile installations should be carried out by the regulating agencies. If the subsurface conditions different from those forming the basis of

our recommendations are encountered, this office should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our site reconnaissance and the assumption that the subsurface conditions encountered in the URS explorations do not deviate from observed conditions. All work done is in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

This report has been prepared for the proposed project as described earlier, to assist the engineer in the design of this project. In the event any changes in the design or location of the facilities are planned, or if any variations or undesirable conditions are encountered during construction, our conclusions and recommendations shall not be considered valid unless the changes or variations are reviewed and our recommendations modified or approved by us in writing. This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

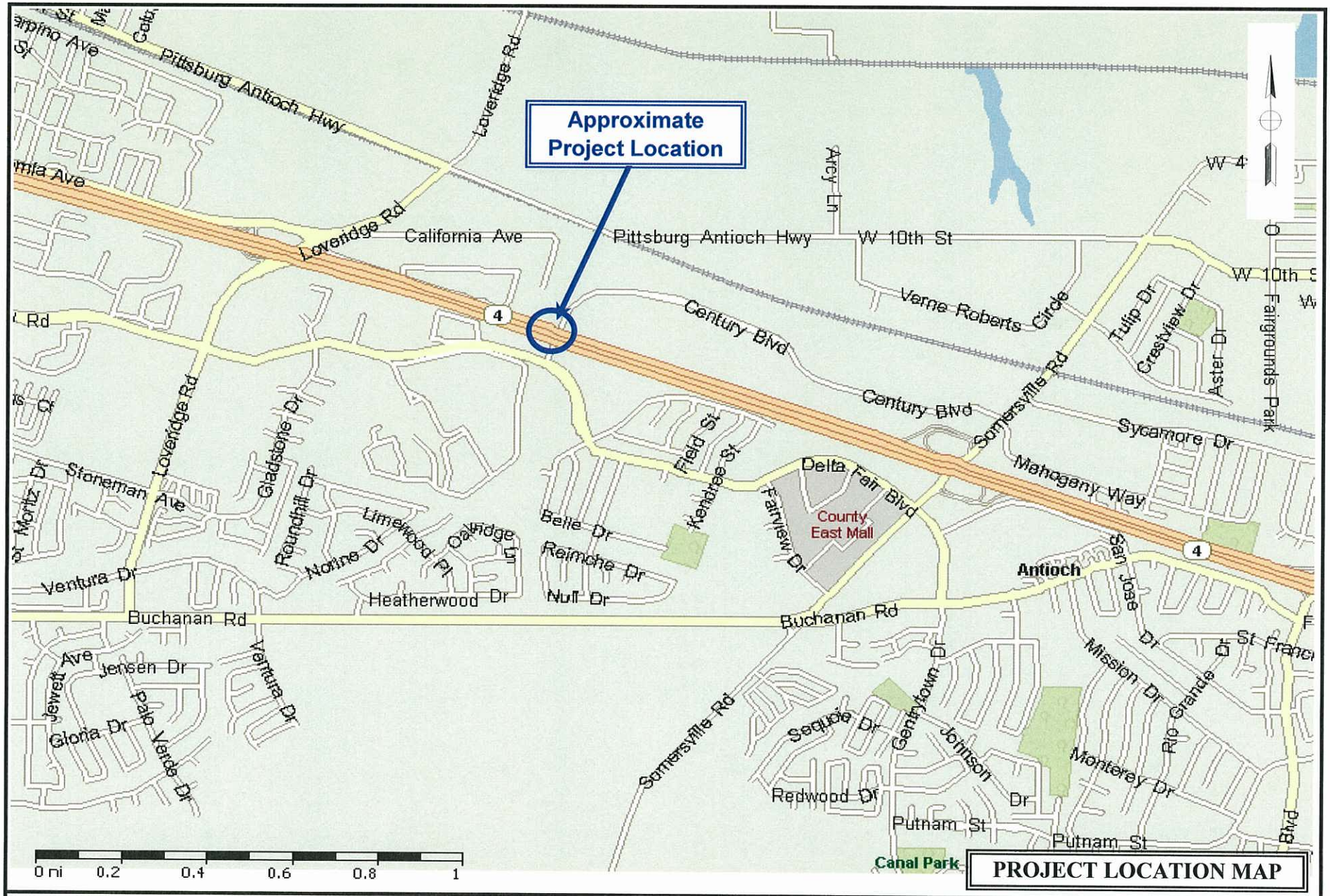
The findings in this report are valid as of the present date. However, changes in the subsurface

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

Respectfully submitted,
PARIKH CONSULTANTS, INC.

Partha Sircar, Ph.D., P.E. C54619
Senior Engineer

Gary Parikh, G.E. 666
Project Manager

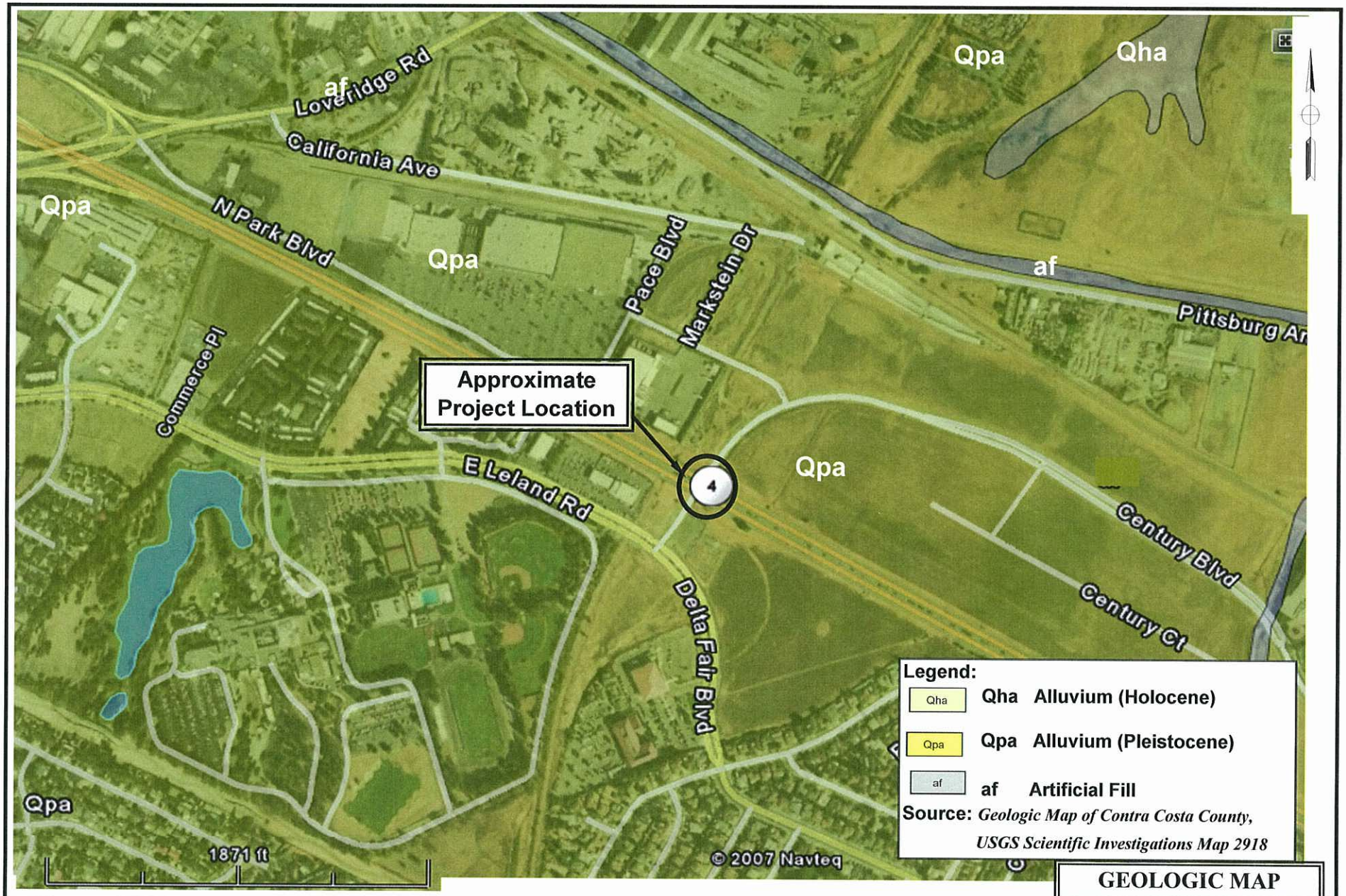


PROJECT LOCATION MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

EAST CONTRA COSTA COUNTY TRANSIT DEVELOPMENT (eBART)
AT CENTURY BOULEVARD, PITTSBURG, CALIFORNIA

JOB NO.: 205124.10	PLATE NO.: 1

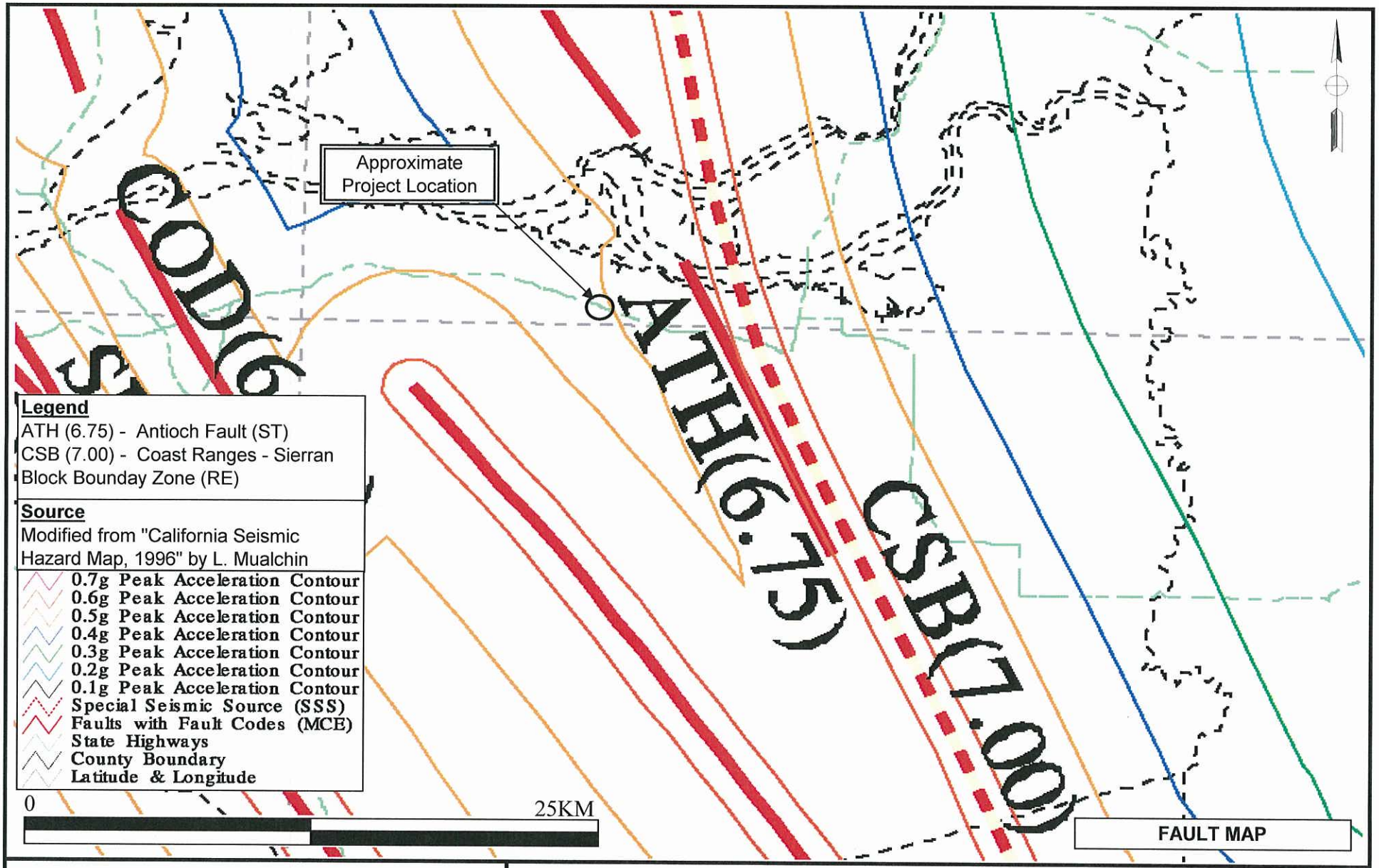


GEOLOGIC MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

EAST CONTRA COSTA COUNTY TRANSIT DEVELOPMENT (eBART)
AT CENTURY BOULEVARD, PITTSBURG, CALIFORNIA

JOB NO.: 205124.10	PLATE NO.: 2



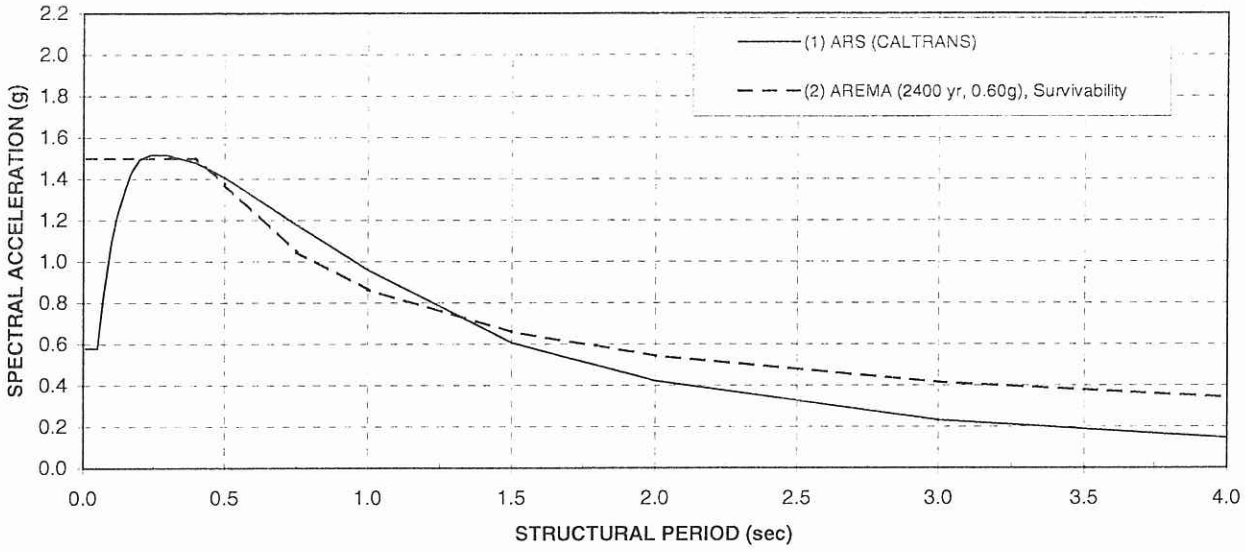
FAULT MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

EAST CONTRA COSTA COUNTY TRANSIT DEVELOPMENT (eBART)
AT CENTURY BOULEVARD, PITTSBURG, CALIFORNIA

JOB NO.: 205124.10

PLATE 3



(1) Caltrans SDC (v 1.4, June 2006), Figure B.8
Governing Fault: Coast Ranges - Sierran Block Boundary Zone (Mw=7.0, Soil Profile Type D, PBA= 0.58 g)
The PBA is obtained by incorporating the Mw and fault distance into the relationship per Sadigh (1997) and then increasing the PBA computed by 20% to account for the reverse fault effect.
The curve for PBA=0.58g was obtained by interpolation of the PBA=0.5g and PBA=0.6g curves

(2) AREMA (with MAX=2.5 AD)
Performance Criteria Limit State = Survivability
Use 2400-year standard return period (USA) and Base Acceleration Coefficient = 0.60 g
Site Coefficient = 1.2 (Soil Type 2), D (Damping Factor) = 1.0 (for 5%)
AREMA (with MAX=2.5 AD)

The moment capacity of a pile group shall be determined assuming a rigid pile cap. Lower-bound moment capacity shall be based on triangular distribution of axial pile loading and lower-bound axial capacity of the piles. Upper-bound moment capacity shall be based on a rectangular distribution of axial pile load using full, upper-bound axial capacity of the piles.

The lateral capacity of a pile group shall include the contributions of the piles (with an appropriate modification for group effects) and the passive resistance of the pile cap. The lateral capacity of the piles shall be calculated using the same method used to calculate the stiffness. The lateral capacity of the pile cap, due to passive pressure, shall be calculated using established principles of soil mechanics. Passive pressure mobilization shall be calculated using Figure 4-6.

C4.4.2.2.2 Capacity Parameters

The lateral capacity of a pile cap should be calculated in the same way that the capacity of a shallow foundation is computed, except that the contribution of base traction should be neglected. Section C4.4.2.1.5 provides a more detailed description of the calculation procedure.

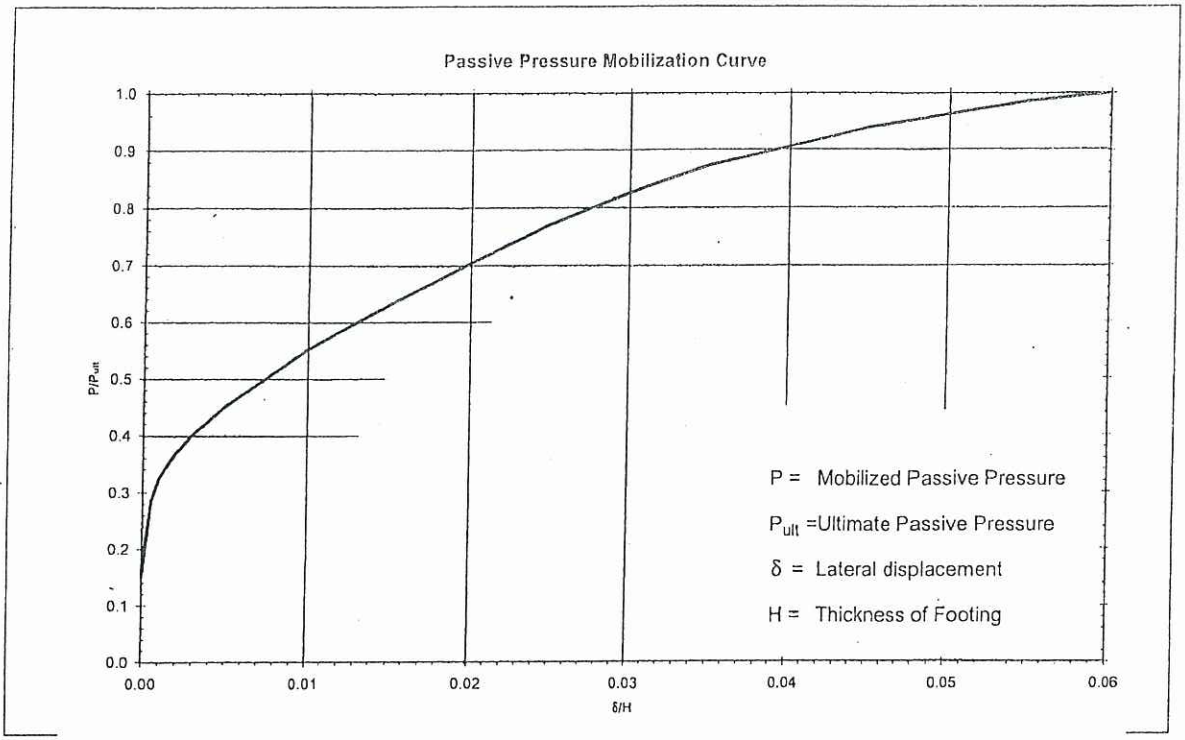


Figure 4-6 Passive Pressure Mobilization Curve

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

EAST CONTRA COSTA COUNTY TRANSIT DEVELOPMENT (eBART) AT CENTURY BOULEVARD, PITTSBURG CALIFORNIA

JOB NO.: 205124.10 PLATE NO.: 5

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER Philip Meymond No. 2596 Exp. 6/30/09 GEOTECHNICAL STATE OF CALIFORNIA

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PLEASANT HILL, CA 94523

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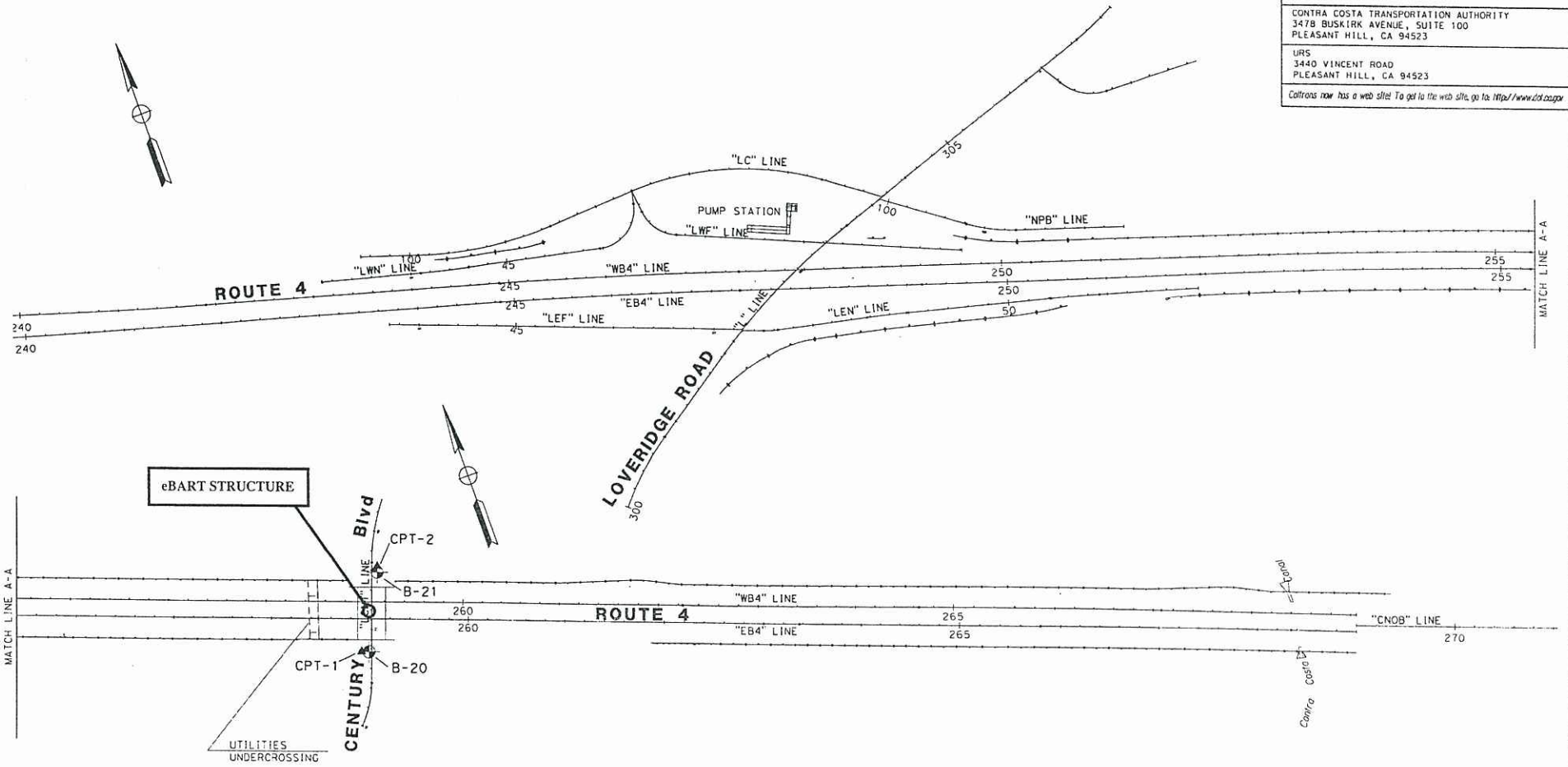
Caltrans Metric



(From URS Foundation Report)

CENTURY BLVD UC FOUNDATION REPORT
SITE AND BORING LOCATIONS

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

PLATE 6

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

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CU 04275

EA 228591

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

DESIGN OVERSIGHT: SOTERO ANGELES

CALCULATED/DESIGNED BY: EAJ DATE: 06/06

CHECKED BY: BR 06/06

REVISED BY

DATE REVISED

APPENDIX A

(includes all plates in Appendix B and As-Built LOTB Sheet in Appendix A from URS Report)

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

Philip Meymand
No. 2596
Exp. 6/30/09
REGISTERED PROFESSIONAL ENGINEER
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

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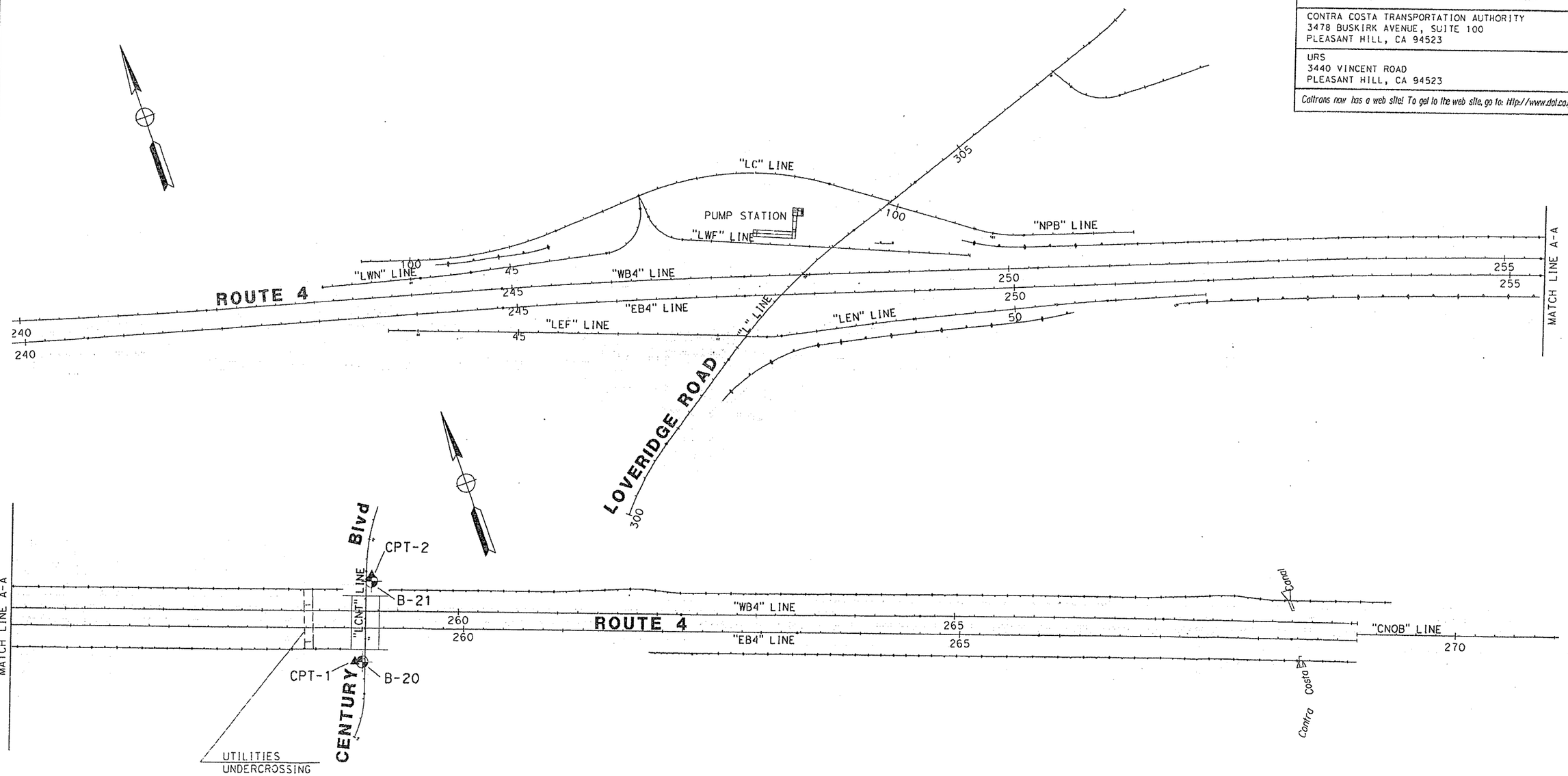
DATE	REVISED BY
06/06	DATE REVISED

CALCULATED/DESIGNED BY: EAJ
CHECKED BY: BR 06/06

DESIGN OVERSIGHT
SOTERO ANGELES

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans



CENTURY BLVD UC FOUNDATION REPORT
SITE AND BORING LOCATIONS

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

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CU 04275

EA 228591

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BENCH MARKS

BENCH MARK DATA
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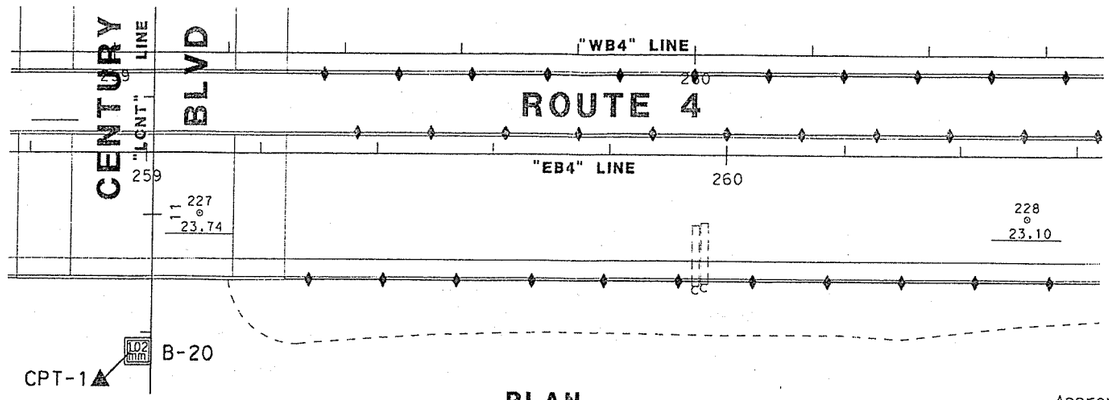
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



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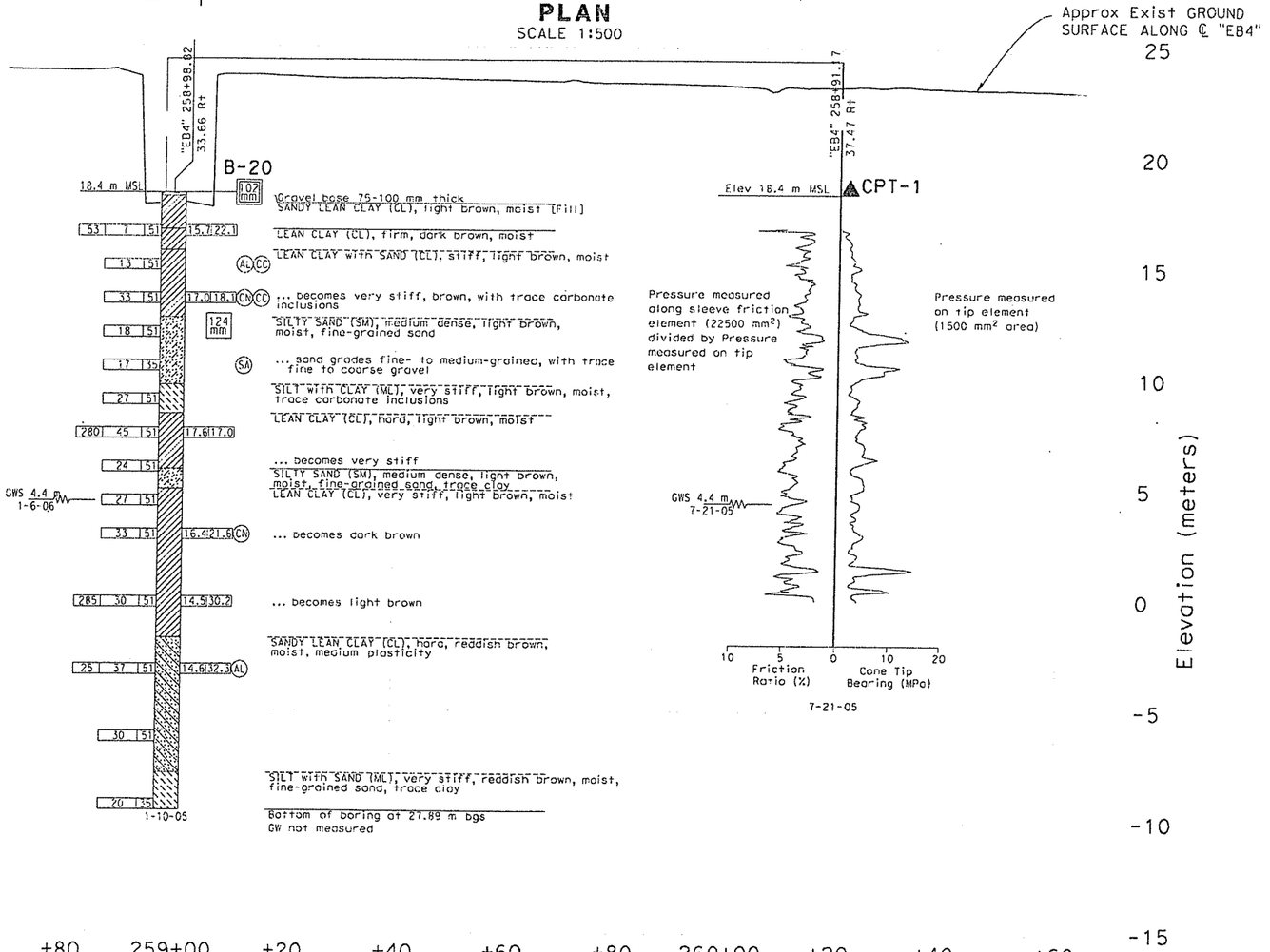

PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

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URS
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PLEASANT HILL, CA 94523

LEGEND OF BORING OPERATIONS

TEST TYPE: Atterberg Limit; Corrosivity Test; Consolidation; Direct Shear; Hydrometer; Gas Density (Lab Compaction Test); Resistance R-value; Sieve Analysis; Swell/Settlement Test; Unconsolidated Undrained Triaxial Compression; Wash Sieve

ROTARY SAMPLE BORING (WET)

AUGER BORING (DRY)

ELECTRONIC CONE PENETROMETER TEST

57 mm CONE PENETRATION; SAMPLE BORING (DRY); ROTARY SAMPLE BORING (WET); AUGER BORING (DRY); TEST PIT; DIAMOND CORE BORING; JET BORING; ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS: GRAVEL; SAND; SILT; CLAY; CLAYEY SILT; PEAT and/or ORGANIC MATTER; FILL MATERIAL; COBBLE; CHUCKS ROCK; SEDIMENTARY ROCK; METAMORPHIC; SANDY CLAY or CLAYEY SAND; SANDY SILT or SILTY SAND; SILTY CLAY

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test				According to the Unconfined Compression Test	
SPT N Value (Blows/0.3m)	Granular	SPT N Value (Blows/0.3m)	Cohesive	Unconfined Compression Strength (kPa)	Cohesive
0-4	Very Loose	<2	Very Soft	<25	Very Soft
5-10	Loose	2-4	Soft	25-50	Soft
11-30	Medium Dense	5-8	Firm	50-100	Firm
31-50	Dense	9-15	Stiff	100-200	Stiff
>50	Very Dense	16-30	Very Stiff	200-400	Very Stiff
		>30	Hard	>400	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO. 28-0395	CENTURY BLVD UC (REPLACE)
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/10/05		PROJECT ENGINEER	KILOMETER POST 40.0	LOG OF TEST BORINGS 1 OF 3

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228591

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DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/24/05; 01/26/06; 02/28/07; 10/25/07

SHEET 19 OF 20

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BENCH MARKS

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EASTING=1878040.53361
ELEVATION=17.943 m

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No. BART-185

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EASTING=1879751.30811
ELEVATION=16.434 m

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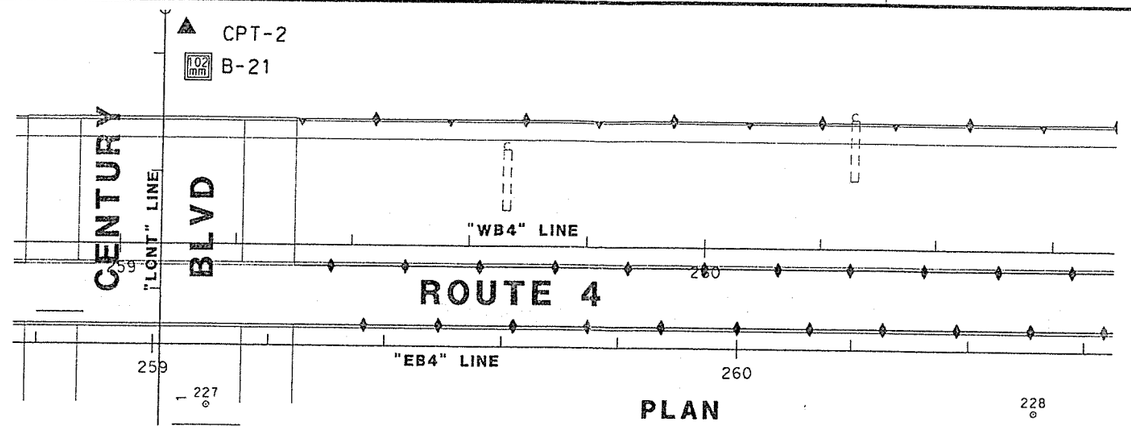

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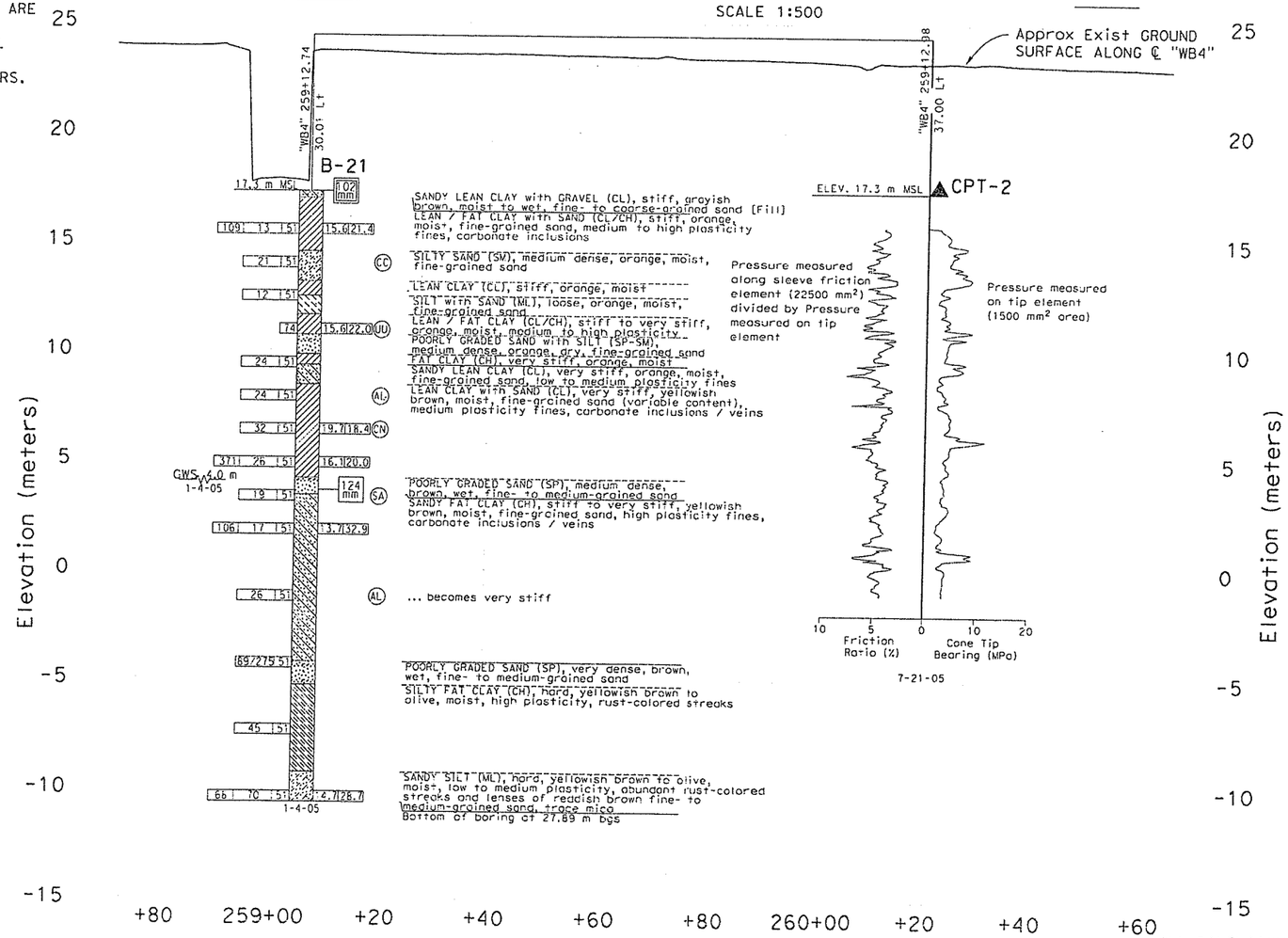


PROFILE VIEW

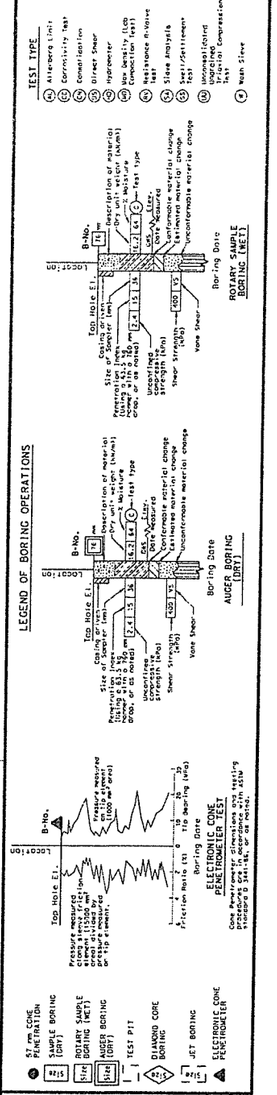
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

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

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5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

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DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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PLEASANT HILL, CA 94523

DESIGN OVERSIGHT
SIGN OFF DATE

DRAWN BY: C. SOMERA
CHECKED BY: N. MEYER

P. RESPESS
FIELD INVESTIGATION BY:
DATE: 01/04/05

PREPARED FOR THE STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

H. BERGER
PROJECT ENGINEER

BRIDGE NO. 28-0395
KILOMETER POST 40.0

CENTURY BLVD UC (REPLACE)

LOG OF TEST BORINGS 2 OF 3

CU 04275
EA 228591

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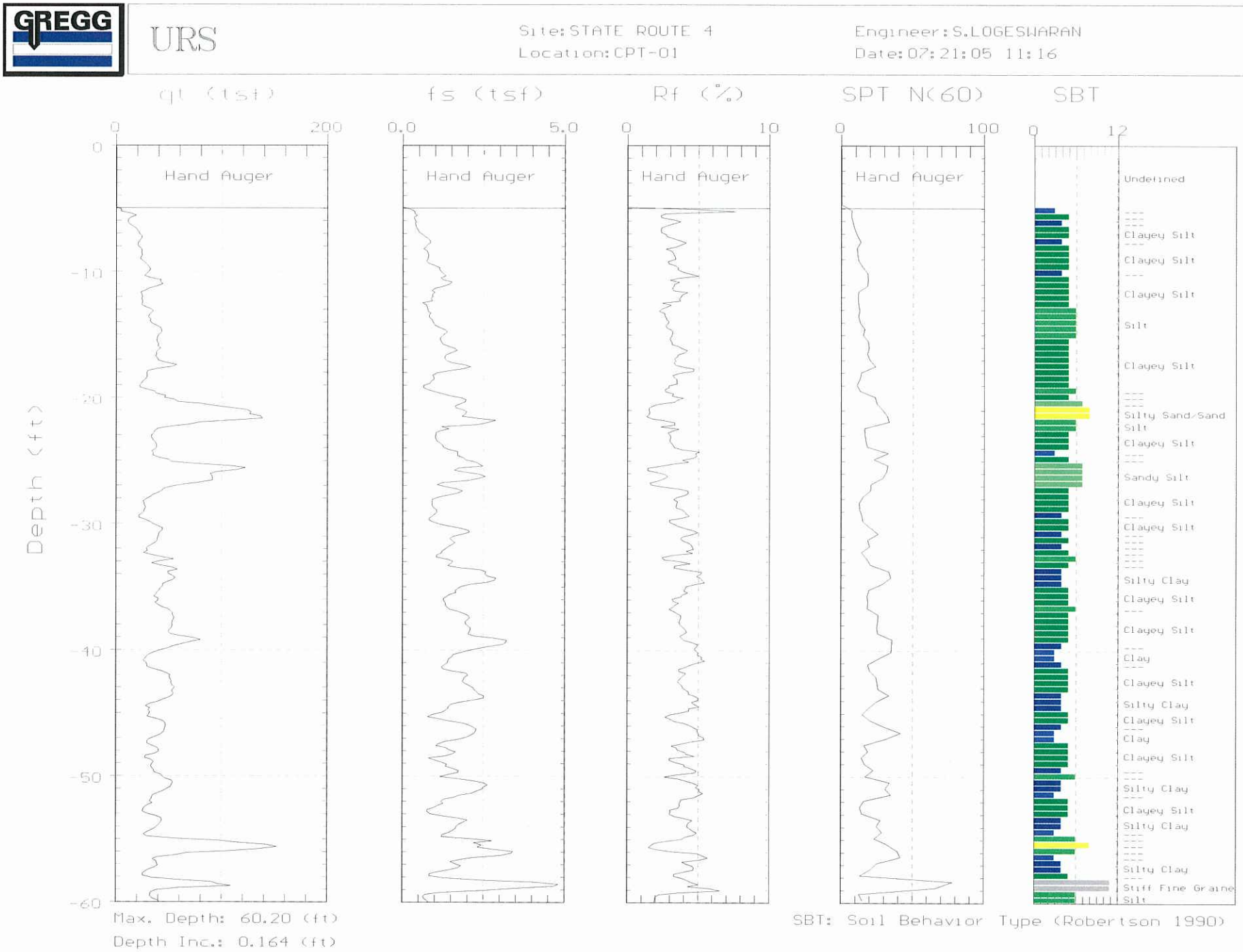
CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

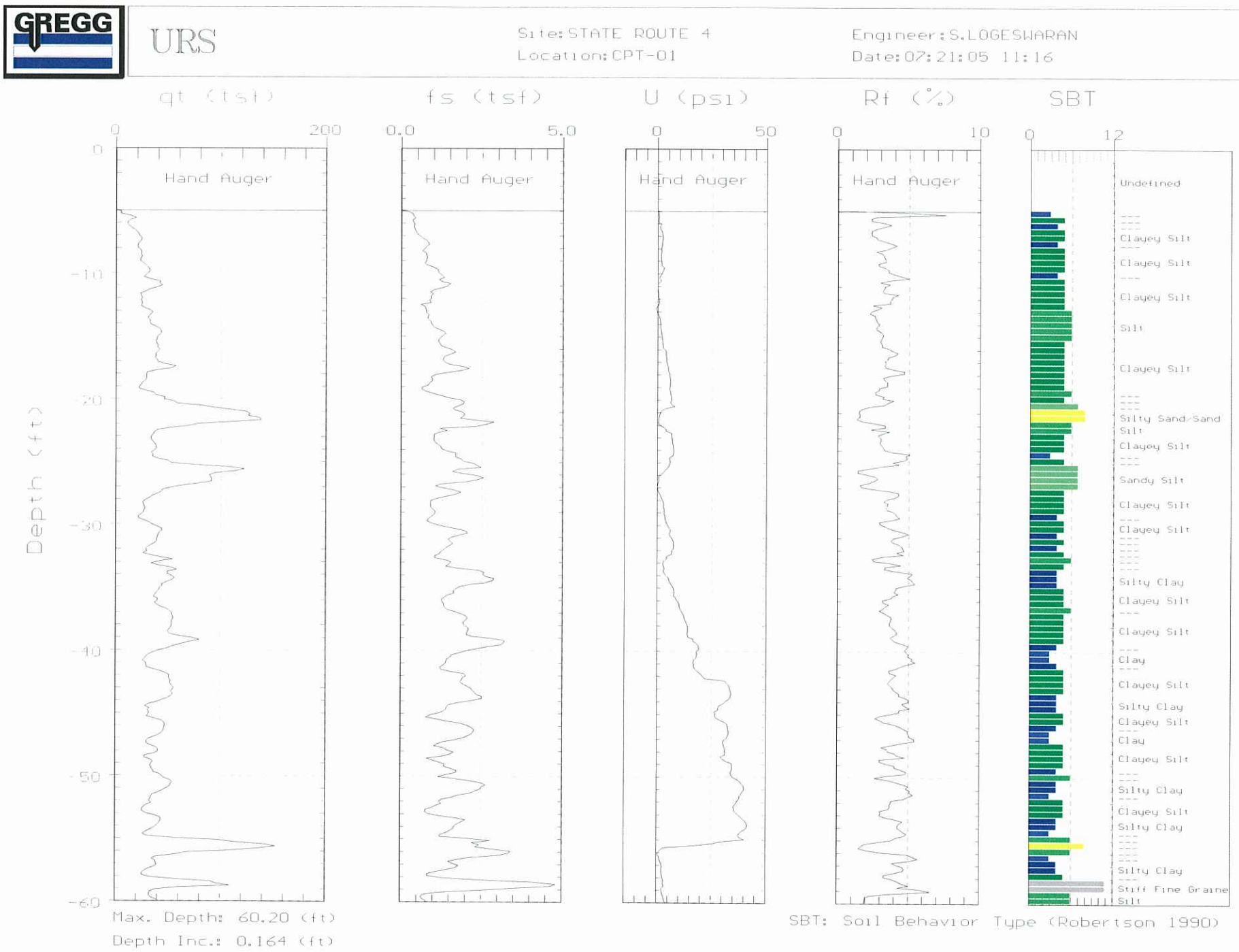
ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/31/05 | 01/05/06 | 02/28/07 | 10/25/07

SHEET 20 OF 21


GREGG
URS
Site: STATE ROUTE 4
Location: CPT-01
Engineer: S.LOGESWARAN
Date: 07:21:05 11:16
qt (tsf)
fs (tsf)
Rf (%)
SPT N(60)
SBT
Hand Auger
Depth (ft)
Undefined
Clayey Silt
Silty Sand/Sand Silt
Sandy Silt
Silty Clay
Clay
Stiff Fine Grained Silt
Max. Depth: 60.20 (ft)
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson 1990)


GREGG
URS
Site: STATE ROUTE 4
Location: CPT-01
Engineer: S.LOGESWARAN
Date: 07:21:05 11:16
qt (tsf)
fs (tsf)
U (psi)
Rf (%)
SBT
Hand Auger
Depth (ft)
Undefined
Clayey Silt
Silt
Silty Sand/Sand Silt
Sandy Silt
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Clay
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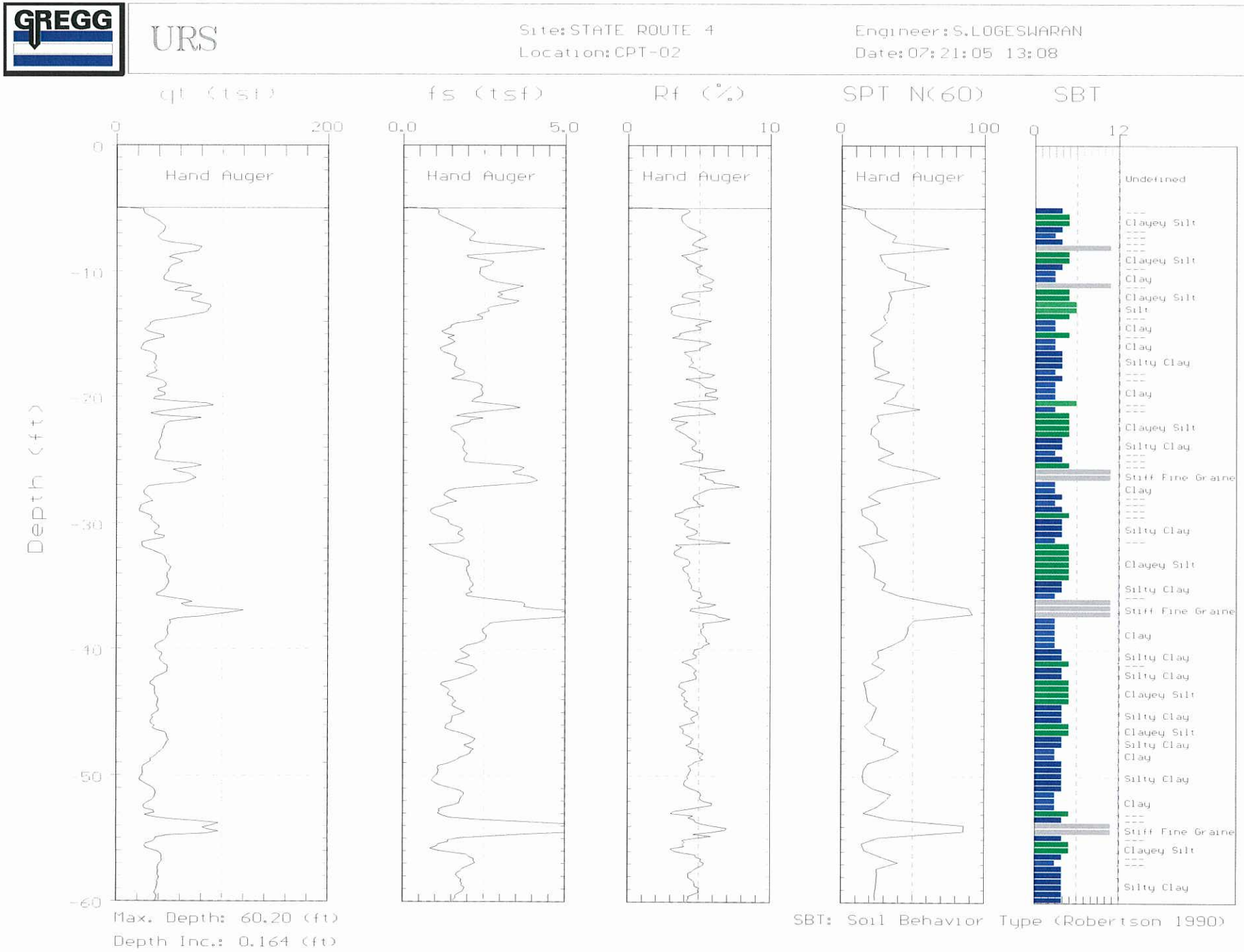
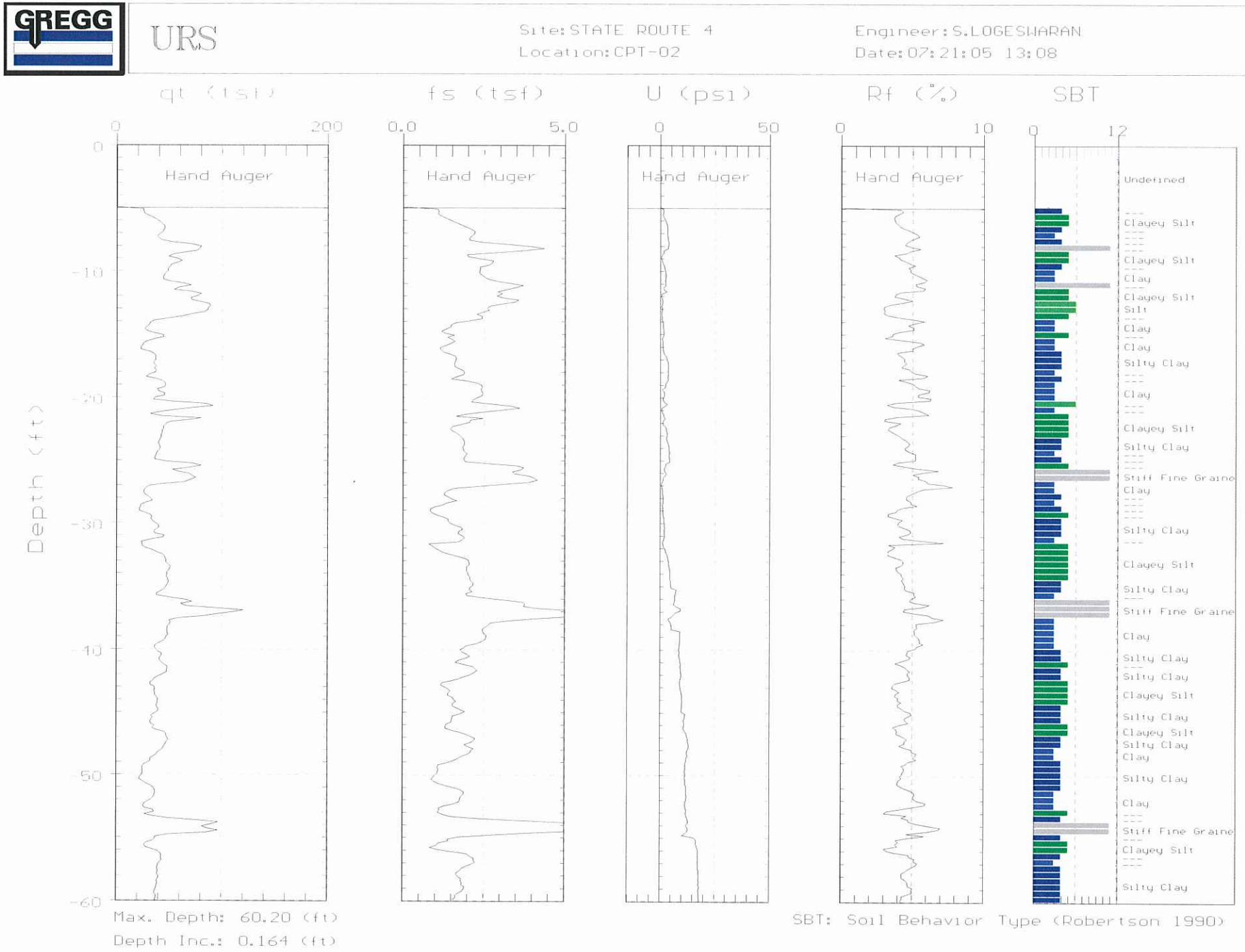
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson 1990)


GREGG
URS
Site: STATE ROUTE 4
Location: CPT-02
Engineer: S.LOGESWARAN
Date: 07:21:05 13:08
qt (tsf)
fs (tsf)
Rf (%)
SPT N(60)
SBT
Hand Auger
Depth (ft)
Undefined
Clayey Silt
Clay
Silty Clay
Stiff Fine Grained
Max. Depth: 60.20 (ft)
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson 1990)

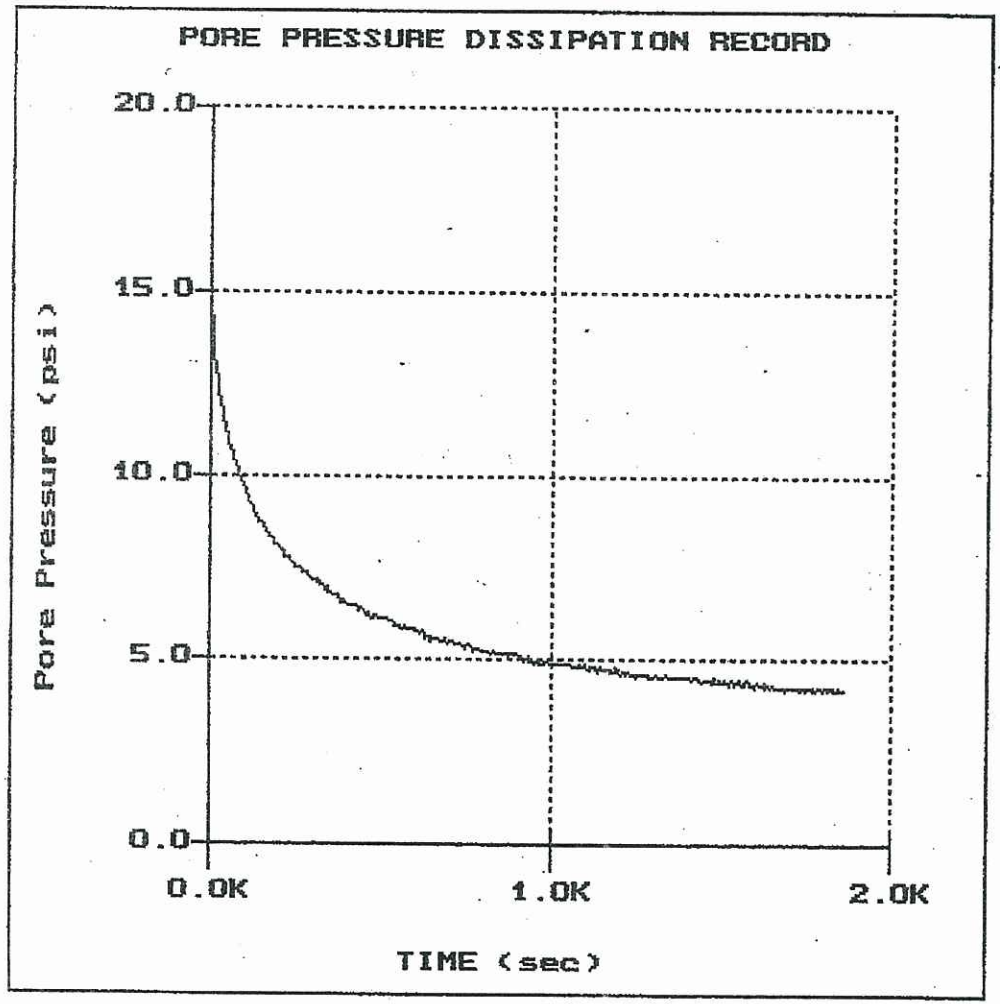

GREGG
URS
Site: STATE ROUTE 4
Location: CPT-02
Engineer: S.LOGESWARAN
Date: 07:21:05 13:08
qt (tsf)
fs (tsf)
U (psi)
Rf (%)
SBT
Hand Auger
Depth (ft)
Undefined
Clayey Silt
Clay
Silty Clay
Stiff Fine Graine
Max. Depth: 60.20 (ft)
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson 1990)

URS

Site:STATE ROUTE 4
Location:CPT-01

Engineer:S.LOGESWARA
Date:07:21:05 11:16

File: 293C01.PPC
Depth (m): 16.90
(ft): 55.45
Duration : 1860.0s
U-min: 4.15 1840.0s
U-max: 14.93 0.0s



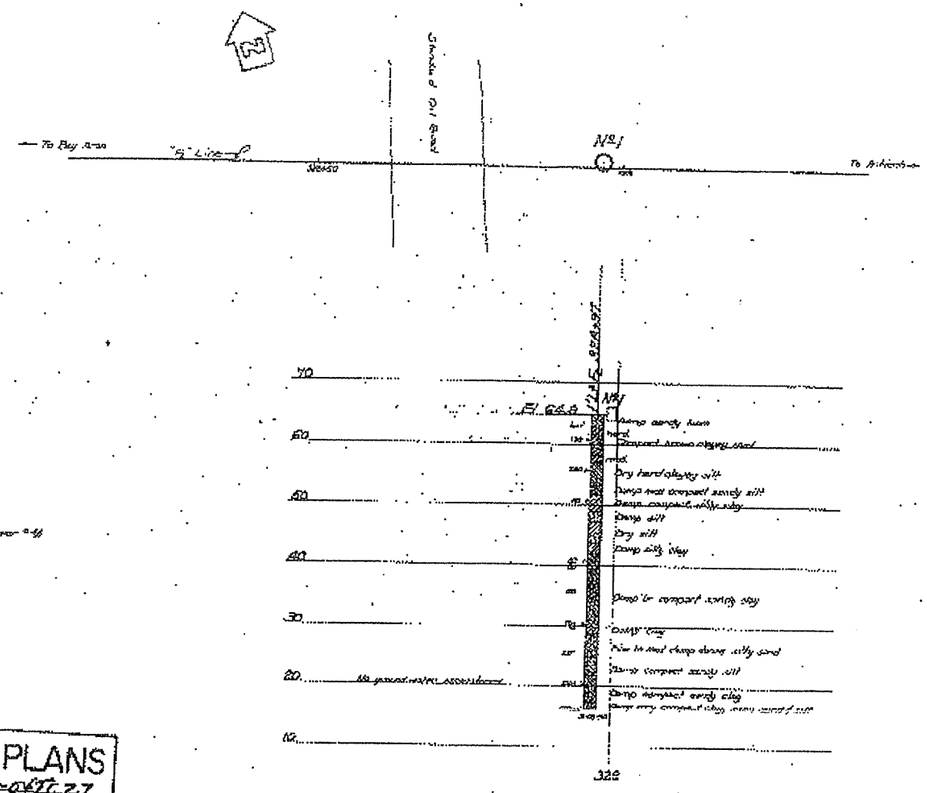
F-246(3)

187 140

12 CC 246 F 27 44

General Utility

August 27, 1951



DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES					
As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.					
DIST.	COUNTY	ROUTE	KILOMETER POST-TOTAL PROJECT	Sheet No.	Total Sheets
04	CC	4	37.9/41.3		
REGISTERED GEOTECHNICAL ENGINEER			DATE		
CENTURY Blvd UC (REPLACE)					
AS-BUILT LOG OF TEST BORINGS					
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENANCE AND INVESTIGATIONS, SACRAMENTO, CALIFORNIA		CU: 04275 EA: 228591	BRIDGE No. 28-0395	Sheet 20	of 20

Philip Meymand
No. 2596
Exp. 6/30/07
REGISTERED PROFESSIONAL ENGINEER
GEOTECHNICAL
STATE OF CALIFORNIA

Revisions made to this Log of Test Borings from the original 1951 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from "EB4" Line
N-1	258+55.06	0.84 Rt

Notes:

1. See the General Plan and/or Foundation Plan for Metric Stationing.
2. Structure Design produced the data presented in the table above. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.

N251 22x88 ppc-feet wide mode
Strip 1, 08 lt. Steel interior
with 6 39 inch free rods

AS BUILT PLANS
Contract No. 12-0K1227
Date Completed
Document No. 1002562

No Charge
THIS SET OF PLANS WAS FREE DUPLICATED AS
REQUIRED BY THE LAW BUREAU SECURITY AGENCY
DATED 7-12-95 PURSUANT TO
CALIFORNIA GOVERNMENT CODE SECTION 6253(b)

CLASSIFICATION OF MATERIALS BASED ON STANDARD GRADE SIZE LIMITS

LEGEND OF BORING OPERATIONS

LEGEND OF EARTH MATERIALS

ABBREVIATIONS

NOTES

MICROFILMED

STANDARD OIL ROAD UNDERCROSSING

1" = 10'

25-99 C-2548-4

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY SUPERVISION AND CONTROL ON FILM MADE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION OF THE DIRECTOR OF PUBLIC WORKS.

DATE 9/21/77 SIGNATURE [illegible] TITLE [illegible]

Appendix A
1

Appendix B

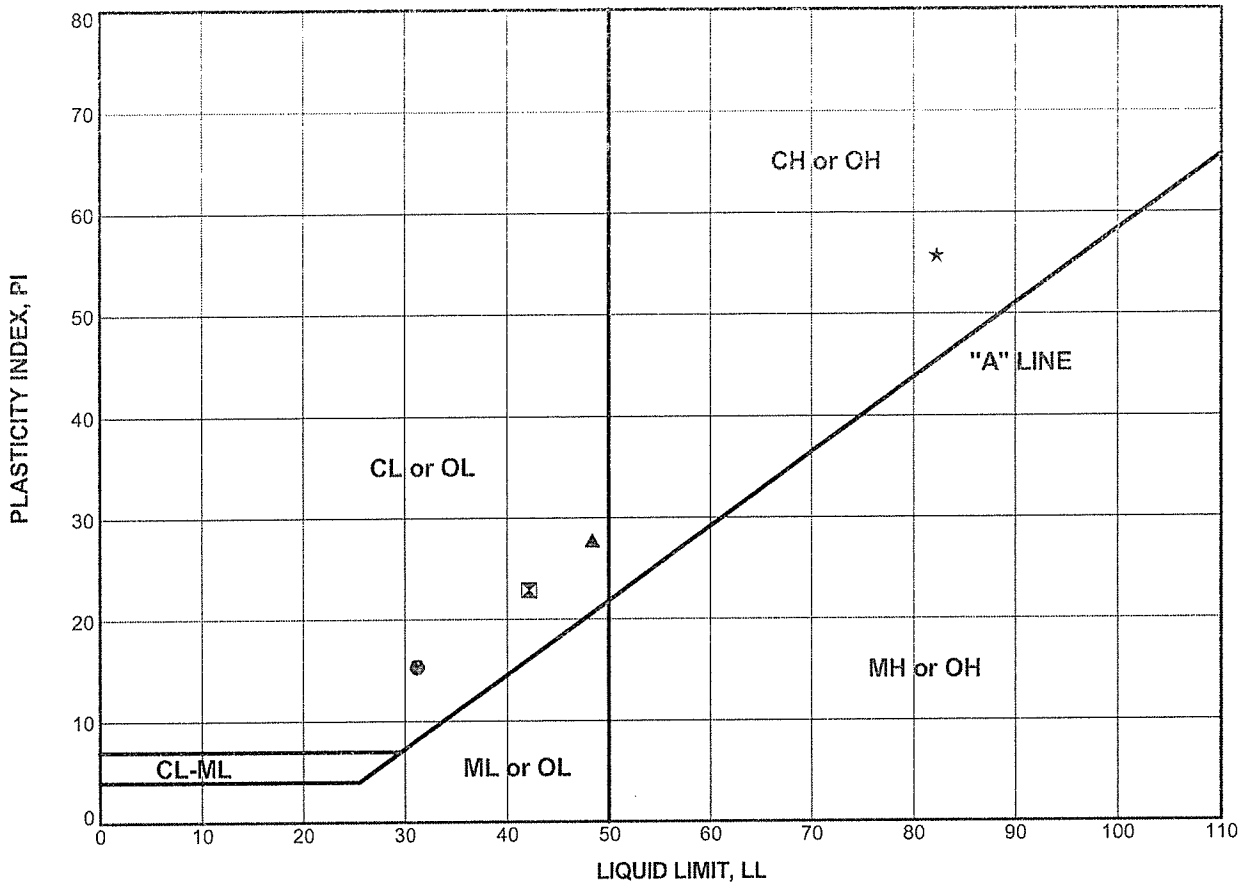
(Laboratory Tests (Appendix C) and Corrosion Tests (Appendix D) in URS Report)

TABLE C-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information			USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, kN/m³	Sieve			Atterberg Limits			Unconfined Compressive Strength, kPa	UU Triaxial		Other Tests
Boring Number	Sample Number	Depth, meters				Gravel, %	Sand, %	<#200, %	LL	PL	PI		Peak Deviator Stress, kPa	Confining Pressure, kPa	
B-20	20-1-4	1.83	CL	22.1	15.7							53			
B-20	20-2-3	3.20	CL						31	16	15				
B-20	20-3-3	4.72	CL	18.1	17.0										CONS
B-20	20-5	7.77	SM			3	72	25							
B-20	20-7-4	10.97	CL	17.0	17.6							280			
B-20	20-10-4	15.54	CL	21.6	16.4										CONS
B-20	20-11-4	18.59	CL	30.2	14.5							285			
B-20	20-12-4	21.64	CL	32.3	14.6				42	19	23	25			
B-21	21-1-3	1.83	CL/CH	21.4	15.6							109			
B-21	21-4	6.10	CL/CH	22.0	15.6								135	86	
B-21	21-6-3	9.45	CL						48	21	27				
B-21	21-7-3	10.97	CL	18.4	16.6										CONS
B-21	21-8-3	12.50	CL	20.0	16.1							371			
B-21	21-9-2	13.87	CH			1	30	70							
B-21	21-10-2	15.39	CH	32.9	13.7							106			
B-21	21-11-2	18.44	CH						82	26	56				
B-21	21-14-2	27.58	ML	28.7	14.7							68			

The laboratory tests were performed in general accordance with the following ASTM standards:

Water Content - ASTM Test Method D2216
Dry Unit Weight - ASTM Test Method D2937
Particle Size Distribution Analysis by Mechanical Sieving - ASTM Test Method D422
Atterberg Limits - ASTM Test Method D4318
Unconfined Compressive Strength Test (UC, q_u in kPa) - ASTM Test Method D2166
Unconsolidated Undrained Triaxial Compression Test (UU Triaxial) - ASTM Test Method D2850
One-dimensional Consolidation Test (CONS) - ASTM Test Method 2435
One-dimensional Swell/Settlement Potential Test (SWELL) - ASTM Test Method 4546



Boring Number	Sample Number	Depth (meters)	Test Symbol	Moisture Content (%)	LL	PL	PI	Classification
B-20	20-2-3	3.20	●		31	16	15	Sandy Lean Clay (CL)
B-20	20-12-4	21.64	⊠	32	42	19	23	Sandy Lean Clay (CL)
B-21	21-6-3	9.45	▲		48	21	27	Lean Clay with Sand (CL)
B-21	21-11-2	18.44	★		82	26	56	Sandy Fat Clay (CH)

Report: ATTERBERG_PLOT_12 PTS; File: OAK_SR4PITTS.GPJ; 2/19/2005 B-21

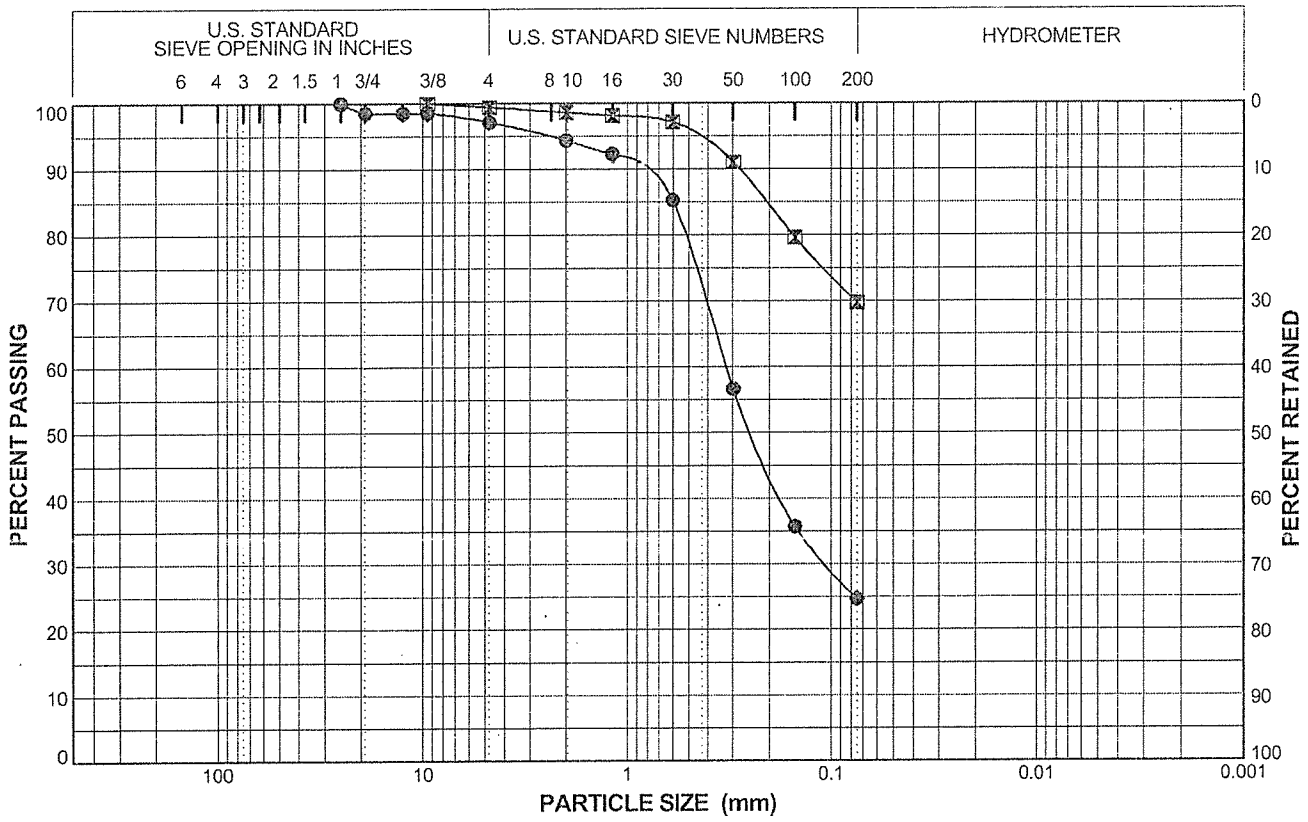
State Route 4 Loveridge to Somersville Road
Century Boulevard Undercrossing
26814910.24000

PLASTICITY CHART

Figure C-1

URS

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (meters)	Symbol	LL	PI	Classification
B-20	20-5	7.77	●			Silty Sand (SM)
B-21	21-9-2	13.87	⊠			Sandy Fat Clay (CH)

Report: SIEVE_5_CURVES_OAK; File: OAK_SR4PITTS.GPJ; 2/19/2005 B-21

State Route 4 Loveridge to Somersville Road
Century Boulevard Undercrossing
26814910.24000

PARTICLE SIZE DISTRIBUTION CURVES

Figure C-2

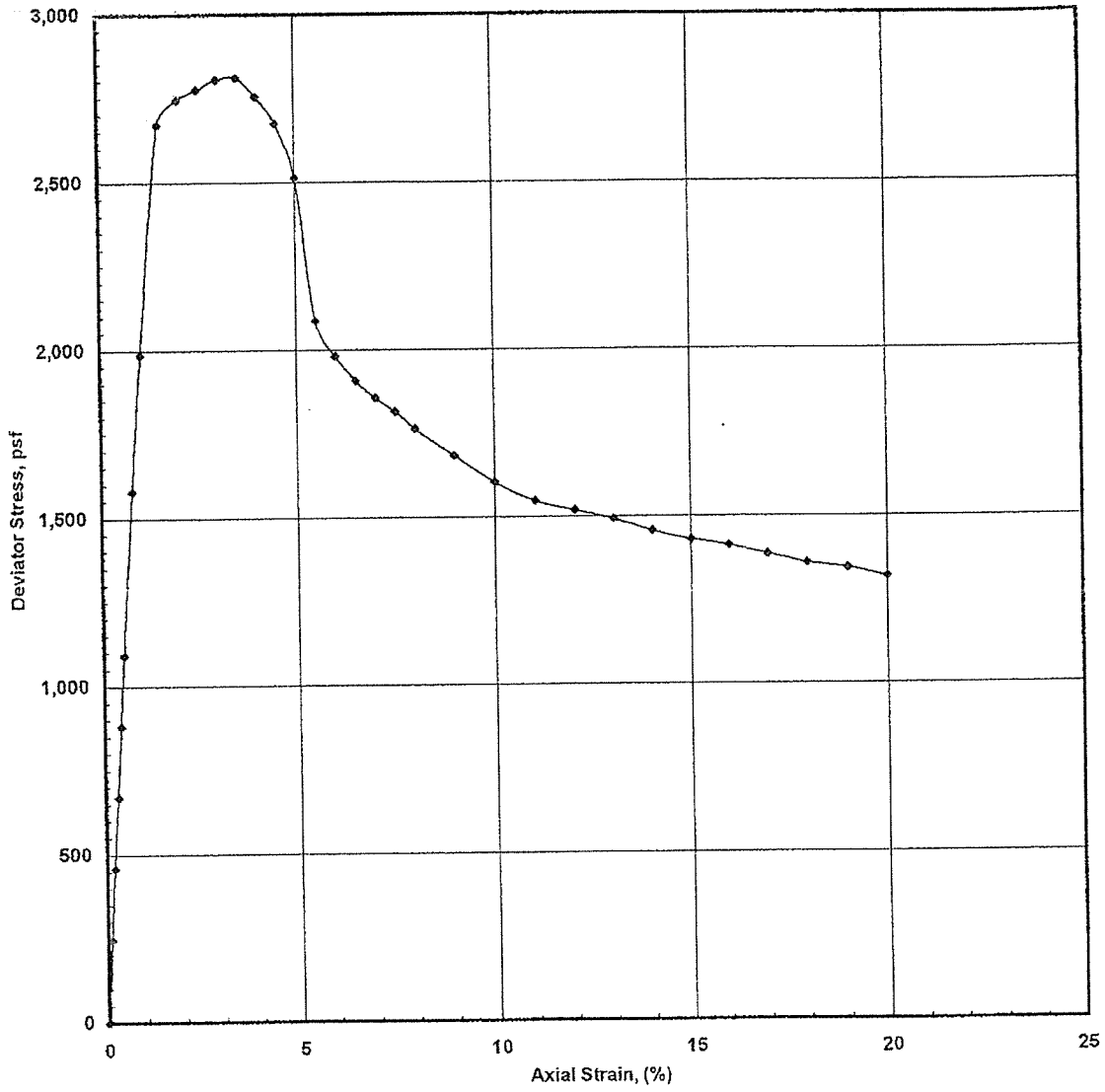
URS

URS

Unconsolidated Undrained Triaxial Test
ASTM D2850

Project Name:	SR 4 Loveridge to Somersville Rd.	Total Unit Weight, pcf:	121.2
Project Number:	26814910.24000	Dry Unit Weight, pcf:	99.3
Location:	Pittsburg, CA	Moisture Content, %:	22.04
Boring Number:	CB-21	Saturation, %:	87.7
Sample Number:	4	Void Ratio:	0.666
Depth, ft:	20-22	Confining Pressure, psf:	1,800
Date Tested:	01/21/05	Peak Deviator Stress, psf:	2,812
Description:	Brown sandy clay	Strain @ Failure, %:	3.50
Sample Diameter, in:	2.860	Sample Height, in:	5.945

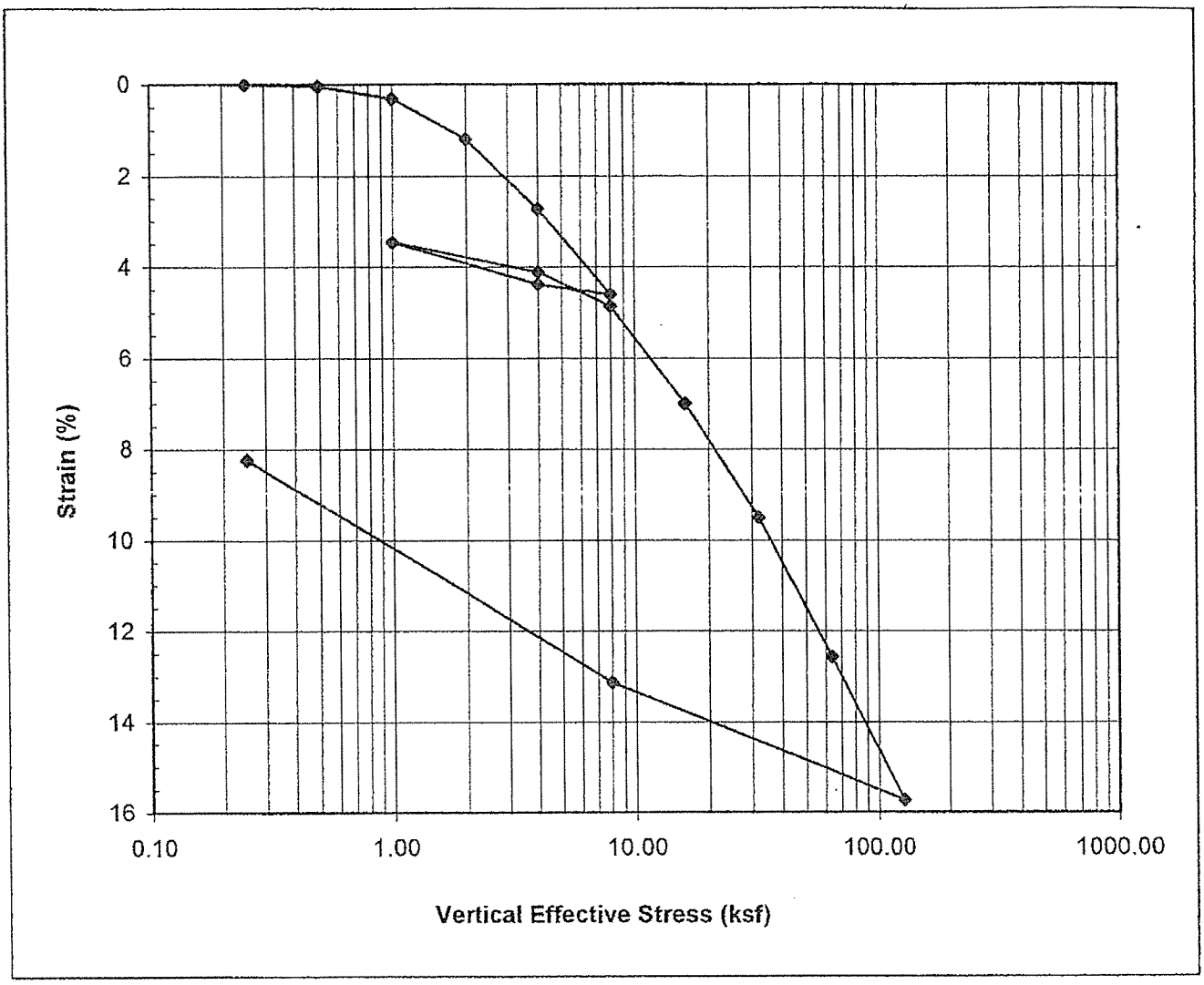
Dial Reading, inches	Load Reading, pounds	Axial Strain, percent	Deviator Stress, psf
0.000	0.0	0.00	0.0
0.006	11.0	0.10	246
0.012	20.5	0.20	459
0.018	30.0	0.30	670
0.024	39.5	0.40	882
0.030	49.0	0.50	1093
0.045	71.0	0.75	1580
0.059	89.5	1.00	1986
0.089	121.0	1.50	2672
0.119	125.0	2.00	2746
0.149	127.0	2.50	2776
0.178	129.0	3.00	2805
0.208	130.0	3.50	2812
0.238	128.0	4.00	2754
0.268	125.0	4.50	2676
0.297	118.0	5.00	2513
0.327	98.5	5.50	2086
0.357	94.0	6.00	1981
0.386	91.0	6.50	1907
0.416	89.0	7.00	1855
0.446	87.5	7.50	1814
0.476	85.5	8.00	1763
0.535	82.5	9.00	1683
0.595	79.5	10.00	1604
0.654	77.5	11.00	1546
0.713	77.0	12.00	1519
0.773	76.5	13.00	1492
0.832	75.5	14.00	1455
0.892	75.0	15.00	1429
0.951	75.0	16.00	1412
1.011	74.5	17.00	1386
1.070	74.0	18.00	1360
1.130	74.0	19.00	1344
1.189	73.5	20.00	1318



Description: Brown sandy clay

Boring Number	Sample Number	Sample Depth (feet)	Dry Unit Weight (pcf)	Initial Moisture Content (%)	Specific Gravity (assumed)	Void Ratio	Initial Saturation (%)	Height/ Diameter Ratio	Rate of Shearing (%/min)	Confining Pressure (psf)	Peak Deviator Stress (psf)	Peak Shear Stress (psf)
CB-21	4	20-22	99.3	22.0	2.65	0.666	87.7	2.08	0.75	1,800	2,812	1,406

Project Name: SR 4	**UNCONSOLIDATED UNDRAINED TRIAXIAL TEST STRESS VS. STRAIN ASTM D2850**	URS
Project Number: 26814910.24000		Figure No. C-3
Location: Pittsburg, , CA		



Boring: CB-20 Sample: 3-3 Depth, ft: 15.5

Description: Brown sandy clay

	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est.	Liquid Limit	Plasticity Index
Initial	18.05	128.0	108.5	0.611	82.7	0.9000	1.926	2.800	NA	NA
Final	17.07	138.4	118.2	0.478	99.9	0.8259				

Project: **SR 4**

Project #: **26814910**

Date: **01/20/05**

URS

Consolidation Test

Figure: C-4

URS

Consolidation Test
ASTM D2435 Method A

Project Name: SR 4 **Date:** 01/20/05

Project Number: 26814910 .24000

Boring Number: CB-20 **Sample Number:** 3-3

Depth, ft: 15.5

Location: Pittsburg, CA

Load, Grams	Load, ksf	Load, tsf	Initial Dial, Inches	Frame Corr.	Dial Change	Final Dial, Inches	Change in Height, in.	Strain, Incre., %	Strain, Cum., %
250	0.25	0.13	0.3000	0.0009	0.0009	0.2991	0.0000	0.00	0.00
500	0.50	0.25	0.2991	0.0007	0.0010	0.2981	0.0003	0.03	0.03
1000	1	0.5	0.2981	0.0007	0.0032	0.2949	0.0025	0.28	0.31
2000	2	1	0.2949	0.0010	0.0090	0.2859	0.0080	0.89	1.20
4000	4	2	0.2859	0.0012	0.0149	0.2710	0.0137	1.52	2.72
8000	8	4	0.2710	0.0010	0.0179	0.2531	0.0169	1.88	4.60
4000	4	2	0.2531	0.0005	-0.0024	0.2555	-0.0019	-0.21	4.39
1000	1	0.50	0.2555	0.0010	-0.0094	0.2649	-0.0084	-0.93	3.46
4000	4	2	0.2649	0.0009	0.0068	0.2581	0.0059	0.66	4.11
8000	8	4	0.2581	0.0007	0.0074	0.2507	0.0067	0.74	4.86
16000	16	8	0.2507	0.0009	0.0202	0.2305	0.0193	2.14	7.00
32000	32	16	0.2305	0.0005	0.0231	0.2074	0.0226	2.51	9.51
64000	64	32	0.2074	0.0008	0.0283	0.1791	0.0275	3.06	12.57
128000	128	64	0.1791	0.0016	0.0301	0.1490	0.0285	3.17	15.73
8000	8	4	0.1490	0.0015	-0.0249	0.1739	-0.0234	-2.60	13.13
250	0.25	0.13	0.1739	0.0036	-0.0477	0.2216	-0.0441	-4.90	8.23
					Total	Change	0.0741		
					in	Height, in.			

URS

Consolidation Test
ASTM D2435 Method A

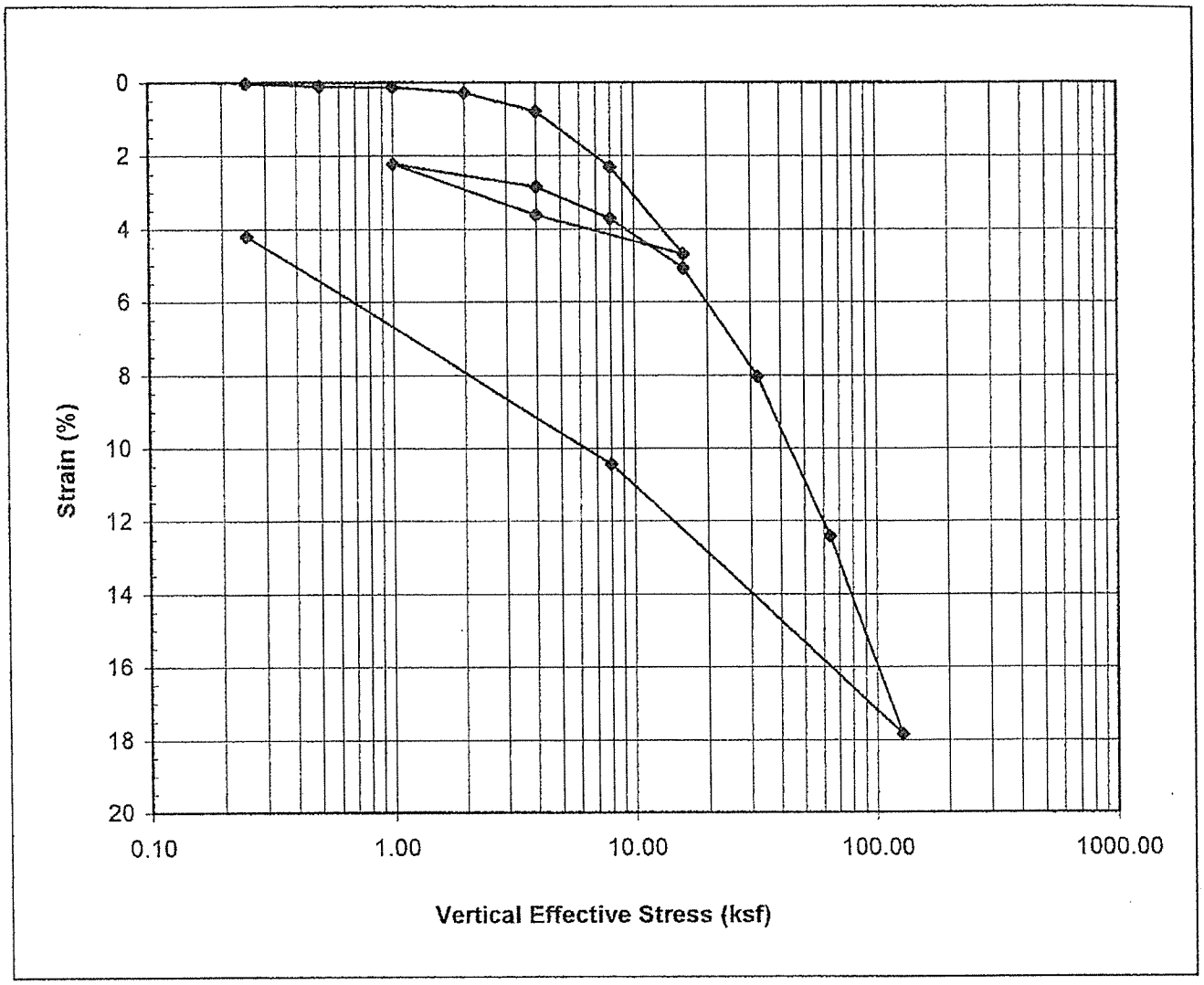
Frame 5

Project Name: SR 4
Project Number: 26814910.24000
Boring Number: CB-20
Depth, ft: 15.5
Location: Pittsburg, CA

Date: 01/20/05
Sample Number: 3-3
Description: Brown sandy clay
Liquid Limit: NA
Plastic Limit: NA
Plasticity Index: NA

Tested By: S. Capps
Reviewed By: R. Taraya

Water Content Determination	Soil Adjacent to Sample	Sample at Start of Test	Sample at End of Test
Wet Soil + Tare, grams	315.8	297.5	296.77
Dry Soil + Tare, grams	283.48	284.02	284.02
Tare, grams	104.56	209.34	209.34
Weight of Water, grams	32.32	13.48	12.75
Weight of Dry Soil, grams	178.92	74.68	74.68
Water Content, %	18.06	18.05	17.07
Height of Gage Block, in:	0.7160	Dial Reading on Gage Block, in:	0.7450
Dial Reading on Sample, in:	0.9290		
Height of Sample, initial, in:	0.9000	Height of Sample, Final, in:	0.8259
Change in Height during Test, in:	0.0741	Estimated Specific Gravity:	2.80
Diameter of Ring, in:	1.926	Ring Number	R-7
Initial Area of Sample, cm^2:	18.80	Volume of Solids, Vs=Ws/Gs:	26.67
Volume of Sample, Initial, cm^3:	42.97	Volume of Sample, Final, cm^3	39.43
Volume of Voids, Initial, Vei, cm^3	16.30	Volume of Voids, Final, Vef, cm^3:	12.76
Volume of Water, Initial, Wwi, cm^3:	13.48	Volume of Water, Final, Wwf, cm^3:	12.75
Degree of Saturation, Initial, %	82.7	Degree of Saturation, Final, %	99.9
Total Unit Weight, Initial, pcf:	128.0	Total Unit Weight, Final, pcf:	138.4
Dry Unit Weight, Initial, pcf:	108.5	Dry Unit Weight, Final, pcf:	118.2
Initial Void Ratio:	0.6110	Final Void Ratio:	0.4784



Boring: CB-20 Sample: 10-4 Depth, ft: 51.0

Description: Brown sandy clay

	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est.	Liquid Limit	Plasticity Index
Initial	21.60	126.8	104.2	0.610	95.2	0.8940	1.939	2.690	NA	NA
Final	20.17	130.8	108.8	0.543	100.0	0.8565				

Project: **SR 4**

Project #: **26814910**

Date: **01/20/05**

URS

Consolidation Test

Figure: C-5

URS

Consolidation Test
ASTM D2435 Method A

Project Name: SR 4 Date: 01/20/05

Project Number: 26814910 .24000

Boring Number: CB-20 **Sample Number:** 10-4

Depth, ft: 51.0

Location: Pittsburg, CA

Load, Grams	Load, ksf	Load, tsf	Initial Dial, Inches	Frame Corr.	Dial Change	Final Dial, Inches	Change in Height, in.	Strain, Incre., %	Strain, Cum., %
250	0.25	0.13	0.3000	0.0008	0.0010	0.2990	0.0002	0.02	0.02
500	0.50	0.25	0.2990	0.0006	0.0012	0.2978	0.0006	0.07	0.09
1000	1	0.50	0.2978	0.0007	0.0010	0.2968	0.0003	0.03	0.12
2000	2	1	0.2968	0.0009	0.0023	0.2945	0.0014	0.16	0.28
4000	4	2	0.2945	0.0010	0.0055	0.2890	0.0045	0.50	0.78
8000	8	4	0.2890	0.0014	0.0149	0.2741	0.0135	1.51	2.29
16000	16	8	0.2741	0.0015	0.0230	0.2511	0.0215	2.40	4.70
4000	4	2	0.2511	0.0024	-0.0120	0.2631	-0.0096	-1.07	3.62
1000	1	0.50	0.2631	0.0011	-0.0136	0.2767	-0.0125	-1.40	2.23
4000	4	2	0.2767	0.0010	0.0066	0.2701	0.0056	0.63	2.85
8000	8	4	0.2701	0.0013	0.0090	0.2611	0.0077	0.86	3.71
16000	16	8	0.2611	0.0013	0.0135	0.2476	0.0122	1.36	5.08
32000	32	16	0.2476	0.0011	0.0275	0.2201	0.0264	2.95	8.03
64000	64	32	0.2201	0.0013	0.0404	0.1797	0.0391	4.37	12.40
128000	128	64	0.1797	0.0020	0.0506	0.1291	0.0486	5.44	17.84
8000	8	4	0.1291	0.0035	-0.0697	0.1988	-0.0662	-7.40	10.44
250	0.25	0.13	0.1988	0.0041	-0.0599	0.2587	-0.0558	-6.24	4.19
					Total	Change	0.0375		
					in	Height, in.			

Consolidation Test
ASTM D2435 Method A

Frame_6

URS

Project Name: SR 4 **Date:** 01/20/05

Project Number: 26814910.24000

Boring Number: CB-20 **Sample Number:** 10-4

Depth, ft: 51.0 **Description:** Brown sandy clay

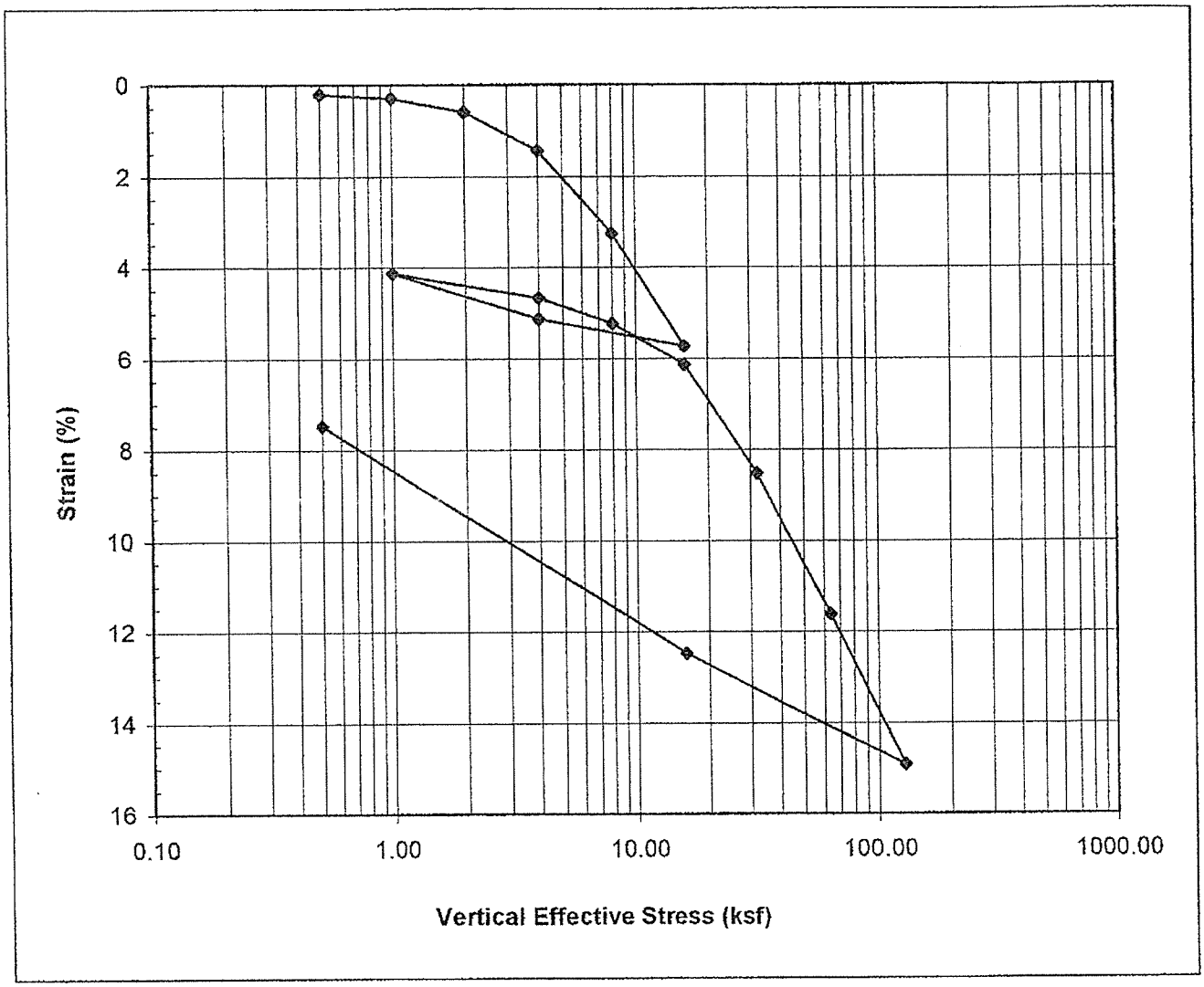
Location: Pittsburg, CA **Liquid Limit:** NA

Plastic Limit: NA

Plasticity Index: NA

Tested By: S. Capps **Reviewed By:** R. Taraya

Water Content Determination	Soil Adjacent to Sample	Sample at Start of Test	Sample at End of Test
Wet Soil + Tare, grams	339.57	307.42	306.39
Dry Soil + Tare, grams	298.31	291.81	291.81
Tare, grams	107.3	219.54	219.54
Weight of Water, grams	41.26	15.61	14.58
Weight of Dry Soil, grams	191.01	72.27	72.27
Water Content, %	21.60	21.60	20.17
Height of Gage Block, in:	0.7160	Dial Reading on Gage Block, in:	0.7280
Dial Reading on Sample, in:	0.9060		
Height of Sample, initial, in:	0.8940	Height of Sample, Final, in:	0.8565
Change in Height during Test, in:	0.0375	Estimated Specific Gravity:	2.69
Diameter of Ring, in:	1.939	Ring Number	R-8
Initial Area of Sample, cm^2:	19.05	Volume of Solids, Vs=Ws/Gs:	26.87
Volume of Sample, Initial, cm^3:	43.26	Volume of Sample, Final, cm^3	41.45
Volume of Voids, Initial, Vei, cm^3	16.39	Volume of Voids, Final, Vef, cm^3:	14.58
Volume of Water, Initial, Wwi, cm^3:	15.61	Volume of Water, Final, Wwf, cm^3:	14.58
Degree of Saturation, Initial, %	95.2	Degree of Saturation, Final, %	100.0
Total Unit Weight, Initial, pcf:	126.8	Total Unit Weight, Final, pcf:	130.8
Dry Unit Weight, Initial, pcf:	104.2	Dry Unit Weight, Final, pcf:	108.8
Initial Void Ratio:	0.6102	Final Void Ratio:	0.5427



Boring: CB-21 Sample: 7-3 Depth, ft: 36.0

Description: Brown sandy clay

	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est	Liquid Limit	Plasticity Index
Initial	18.41	125.4	105.9	0.585	84.7	0.8960	1.938	2.690	NA	NA
Final	17.33	134.3	114.5	0.466	100.0	0.8291				

Project: **SR 4**

Project #: **26814910**

Date: **01/20/05**

URS

Consolidation Test

Figure: C-6

URS

Consolidation Test
ASTM D2435 Method A

Project Name: SR 4 **Date:** 01/20/05

Project Number: 26814910 .24000

Boring Number: CB-21 **Sample Number:** 7-3

Depth, ft: 36.0

Location: Pittsburg, CA

Load, Grams	Load, ksf	Load, tsf	Initial Dial, Inches	Frame Corr.	Dial Change	Final Dial, Inches	Change in Height, in.	Strain, Incre., %	Strain, Cum., %
500	0.50	0.25	0.3000	0.0008	0.0026	0.2974	0.0018	0.20	0.20
1000	1.00	0.50	0.2974	0.0004	0.0013	0.2961	0.0009	0.10	0.30
2000	2	1	0.2961	0.0006	0.0032	0.2929	0.0026	0.29	0.59
4000	4	2	0.2929	0.0003	0.0079	0.2850	0.0076	0.85	1.44
8000	8	4	0.2850	0.0008	0.0170	0.2680	0.0162	1.81	3.25
16000	16	8	0.2680	0.0007	0.0230	0.2450	0.0223	2.49	5.74
4000	4	2	0.2450	0.0008	-0.0062	0.2512	-0.0054	-0.60	5.13
1000	1	0.50	0.2512	0.0007	-0.0097	0.2609	-0.0090	-1.00	4.13
4000	4	2	0.2609	0.0001	0.0049	0.2560	0.0048	0.54	4.67
8000	8	4	0.2560	0.0007	0.0058	0.2502	0.0051	0.57	5.23
16000	16	8	0.2502	0.0008	0.0089	0.2413	0.0081	0.90	6.14
32000	32	16	0.2413	0.0009	0.0223	0.2190	0.0214	2.39	8.53
64000	64	32	0.2190	0.0014	0.0291	0.1899	0.0277	3.09	11.62
128000	128	64	0.1899	0.0020	0.0316	0.1583	0.0296	3.30	14.92
16000	16	8	0.1583	0.0030	-0.0249	0.1832	-0.0219	-2.44	12.48
500	0.50	0.25	0.1832	0.0018	-0.0467	0.2299	-0.0449	-5.01	7.47
					Total	Change	0.0669		
					in	Height, in.			

URS

Consolidation Test
ASTM D2435 Method A

Frame 7

Project Name:	SR 4	**Date:**	01/20/05
Project Number:	26814910.24000		
Boring Number:	CB-21	**Sample Number:**	7-3
Depth, ft:	36.0	**Description:**	Brown sandy clay
Location:	Pittsburg, CA	**Liquid Limit:**	NA
		Plastic Limit:	NA
		Plasticity Index:	NA
Tested By:	S. Capps	**Reviewed By:**	R. Taraya

Water Content Determination	Soil Adjacent to Sample	Sample at Start of Test	Sample at End of Test
Wet Soil + Tare, grams	331.5	314.86	314.06
Dry Soil + Tare, grams	294.4	301.32	301.32
Tare, grams	92.84	227.79	227.79
Weight of Water, grams	37.1	13.54	12.74
Weight of Dry Soil, grams	201.56	73.53	73.53
Water Content, %	18.41	18.41	17.33
Height of Gage Block, in:	0.7160	Dial Reading on Gage Block, in:	0.7470
Dial Reading on Sample, in:	0.9270		
Height of Sample, initial, in:	0.8960	Height of Sample, Final, in:	0.8291
Change in Height during Test, in:	0.0669	Estimated Specific Gravity:	2.69
Diameter of Ring, in:	1.938	Ring Number	R-6
Initial Area of Sample, cm^2:	19.03	Volume of Solids, Vs=Ws/Gs:	27.33
Volume of Sample, Initial, cm^3:	43.31	Volume of Sample, Final, cm^3	40.08
Volume of Voids, Initial, Vei, cm^3	15.98	Volume of Voids, Final, Vef, cm^3:	12.74
Volume of Water, Initial, Wwi, cm^3:	13.54	Volume of Water, Final, Wwf, cm^3:	12.74
Degree of Saturation, Initial, %	84.7	Degree of Saturation, Final, %	100.0
Total Unit Weight, Initial, pcf:	125.4	Total Unit Weight, Final, pcf:	134.3
Dry Unit Weight, Initial, pcf:	105.9	Dry Unit Weight, Final, pcf:	114.5
Initial Void Ratio:	0.5845	Final Void Ratio:	0.4662

STATE ROUTE 4 HIGHWAY WIDENING PROJECT
WEST OF LOVERIDGE ROAD, PITTSBURG, CA
TO SOMERSVILLE ROAD, ANTIOCH, CA

CENTURY BOULEVARD UNDERPASS
FOUNDATION INVESTIGATION REPORT

Prepared for:

URS Corporation
1333 Broadway, Suite 800
Oakland, CA 94612

Prepared By:

V&A CONSULTING ENGINEERS, INC.
Lake Merritt Plaza
1999 Harrison Street, Suite 975
Oakland, CA 94612

March 2006

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EXECUTIVE SUMMARY

V&A Consulting Engineers (V&A) was retained by URS Corporation to perform a Soil Corrosivity Investigation for the proposed State Route 4 Highway Widening Project Between Loveridge Road in Pittsburg, CA to Somersville Road in Antioch, CA. The objective of this investigation is to measure various soil parameters and evaluate the results to determine the corrosivity of the soil to the proposed underpass at Century Boulevard associated with the highway widening project. Corrosivity was determined at the underpass site to depths ranging from 0 to 6 meters below grade.

The California Department of Transportation, Division of Engineering Services, Materials Engineering and Testing Services, Corrosion Technology Branch has published "Corrosion Guidelines" (Guidelines) to define corrosive soil. The Guidelines consider soil to be corrosive to structural elements (steel reinforced concrete) if one or more of the following conditions exist for water or soil samples:

> ***"Chloride concentration is 500 ppm (mg/kg) or greater, sulfate concentration is 2,000 mg/kg or greater, or the pH is 5.5 or less."***

A wide variety of soluble salts is typically found in soils. Two soils having the same resistivity may have significantly different corrosion characteristics, depending on the specific ions available. The major constituents that accelerate corrosion are chlorides, sulfates and the acidity (pH) of the soil. Chloride ions tend to break down otherwise protective surface deposits, and can result in corrosion of reinforcing steel in concrete structures. Sulfates in soil can be highly aggressive to portland cement concrete by combining chemically with certain constituents of the concrete, principally tricalcium aluminate. This reaction is accompanied by expansion and eventual disruption of the concrete matrix. High concentrations of bicarbonates tend to decrease soil resistivities. Although bicarbonates are not aggressive to buried concrete, bicarbonates will lower the soil resistivity which can promote corrosion activity.

This report provides recommendations for corrosion control for the various structural foundation materials under consideration. This foundation investigation is in accordance with Caltrans Corrosion Guidelines dated September 2003 (Guidelines). The materials considered as part of this investigation include buried reinforced concrete, prestressed concrete piles, and steel pipe piles.

Acidity, as indicated by the pH of the soil, is another important factor of soil. The lower the pH (the more acidic the environment), the higher the corrosivity will be with respect to buried metallic and concrete structures. As pH increases above 7 (the neutral value), conditions become increasingly more alkaline and passive to buried structures.

Evaluation of the soil environment is reported in terms of potential damage to the structures due to corrosion. Soil resistivity measurements were conducted in the field during the initial stages of the work. In addition, soil samples collected by URS during the geotechnical investigation were forwarded to Sequoia Analytical Laboratory in Sacramento, CA, for testing. The soil borings were analyzed for 'as-received' resistivity, minimum resistivity, and pH. The soil borings with a minimum resistivity of 1,000 ohm-cm or less were analyzed for water soluble chloride ion concentration and water soluble sulfate ion concentration.

Based on the results of the corrosion analyses, the soil is determined to be *non-corrosive* in accordance with the Guidelines.

The pH of the soil samples analyzed ranged from 7.6 to 8.2 and the soil is considered to be *non-corrosive* in accordance with the Guidelines.

The water soluble chloride ion concentration is below the detection level of 15 milligrams per kilogram (mg/kg), and the water soluble sulfate ion concentration of the soil sample tested is 39 mg/kg. The chloride ion and sulfate ion concentrations are determined to be *non-corrosive* in accordance with the Guidelines.

CONCLUSIONS

- Soil samples were obtained for corrosion analysis at boring locations B-20 and B-21. Based on the results of the corrosion analyses, the site is considered non-corrosive.
- The proposed structure is not within 300 m (1000 ft.) of salt or brackish water.
- The in-situ resistivity measured at the Century Boulevard Underpass site is considered to be non-corrosive to steel pipe piles in accordance with the Guidelines.
- The chloride ion concentration is less than 15 mg/kg for Soil Samples B-20 and B-21 and is considered to be non-corrosive to buried reinforced concrete, cast in place piles, and prestressed concrete piles in accordance with the Guidelines.
- The sulfate ion concentration is less than 50 mg/kg for Soil Samples B-20 and B-21 and is considered to be non-corrosive to buried reinforced concrete, cast in place piles, and prestressed concrete piles in accordance with the Guidelines.
- The pH of the soil is greater than 7.0 for Soil Samples B-20 and B-21 and is considered to be non-corrosive to buried reinforced concrete, cast in place piles, and prestressed concrete piles in accordance with the Guidelines.

RECOMMENDATIONS

Based on the test data and review of the project requirements, specific recommendations for each structural foundation material alternative are listed below:

Buried Reinforced Concrete Structures, Prestressed Concrete Piles and Cast in Place Concrete Piles

Buried concrete structures should be constructed of durable concrete as described in Section 8.22 of the Caltrans Bridge Design Specifications and ACI Standards 201.2R and 222R. These recommendations include, but are not limited to, the following:

- The water/cement ratio should not exceed 0.50.
- A concrete cover of a minimum of 5.1 centimeters should be applied over all steel reinforcement.
- Salt-free sand and potable water should be used.
- Type II modified cement should be used.
- The concrete should be allowed to cure according to the manufacturer's recommendations.

Steel Pipe Piles

A conservative approach for the design of pipe piles would be to assume that corrosion will occur at a rate of 0.025 millimeters per year between grade and a depth 1 meter below the water table, in accordance with the Guidelines. It is important to note that structural considerations for pipe piles may require increases in metal wall thickness to withstand both installation and structural loadings, as they have not been considered in this analysis.

TEST METHODS

In attempting to predict corrosion problems associated with a particular type of structure prior to installation, it is necessary to investigate the soil conditions the structure will encounter. Since corrosion is an electrochemical process accompanied by current flow, the electrochemical characteristics of a soil are of primary importance when evaluating corrosivity. Test methods utilized during this investigation reflect the most practical methods of evaluating corrosivity.

Soil Resistivity

In-situ resistivity of the soil was measured at four locations at the Century Boulevard Underpass site. Figure 1 shows the project vicinity map. Figure 2 shows the in-situ soil resistivity and soil boring locations.

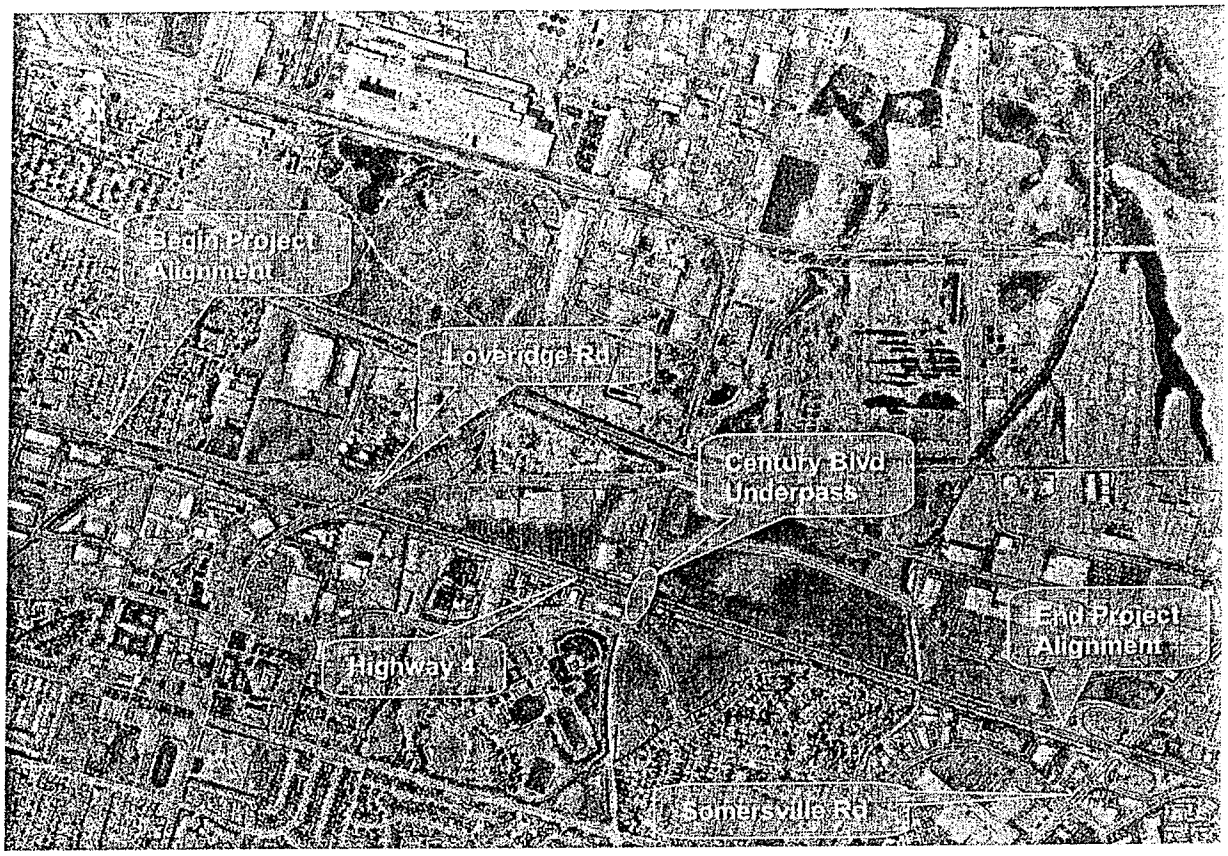
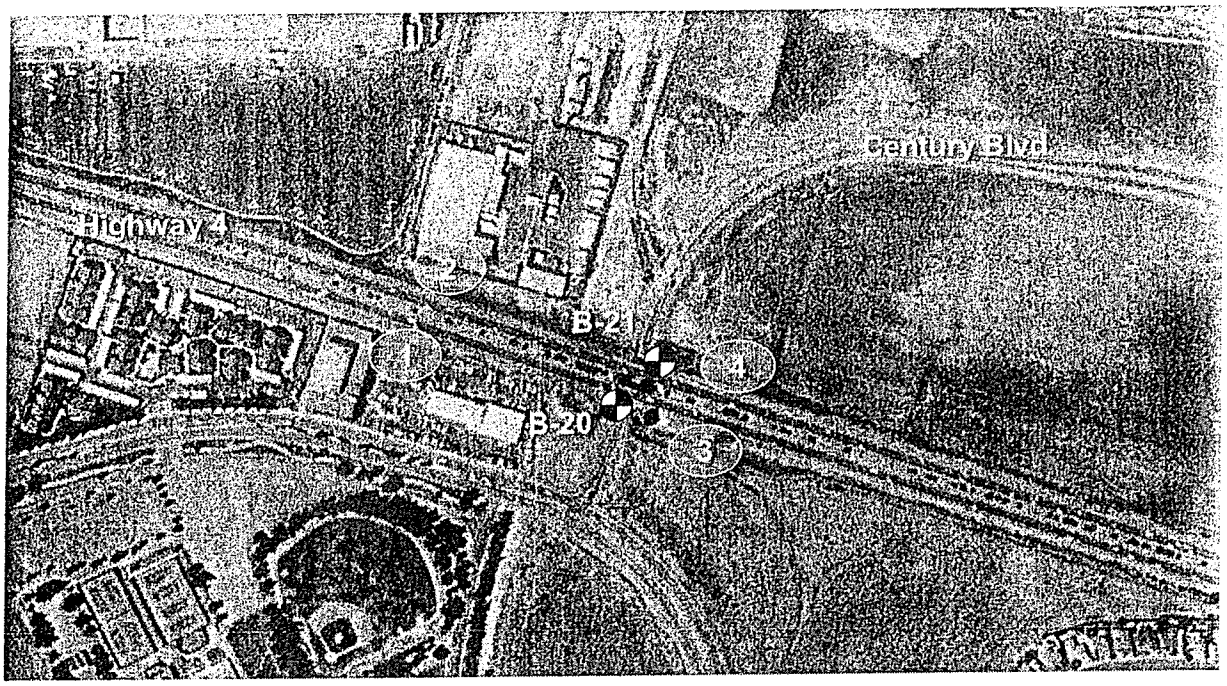


Figure 1 - Vicinity and Project Site Map[1]

[1] Map courtesy of the USGS and the TerraServer Team



In-Situ Soil Resistivity Location, See Table 1 (Typical of 4)
Soil Sample Location, See Table 2 (Typical of 2)

Figure 2 - Soil Resistivity Testing and Soil Sample Locations[2]

In-situ soil resistivity was measured using the Wenner 4-Electrode Method, with a Model 400 Soil Resistance Meter, manufactured by Nilsson Electrical Laboratory, Inc. The Wenner Method involves the use of four metal probes or electrodes, driven into the ground along a straight line, equidistant from each other, as shown in Figure 3.

[2] Map courtesy of the USGS and the TerraServer Team

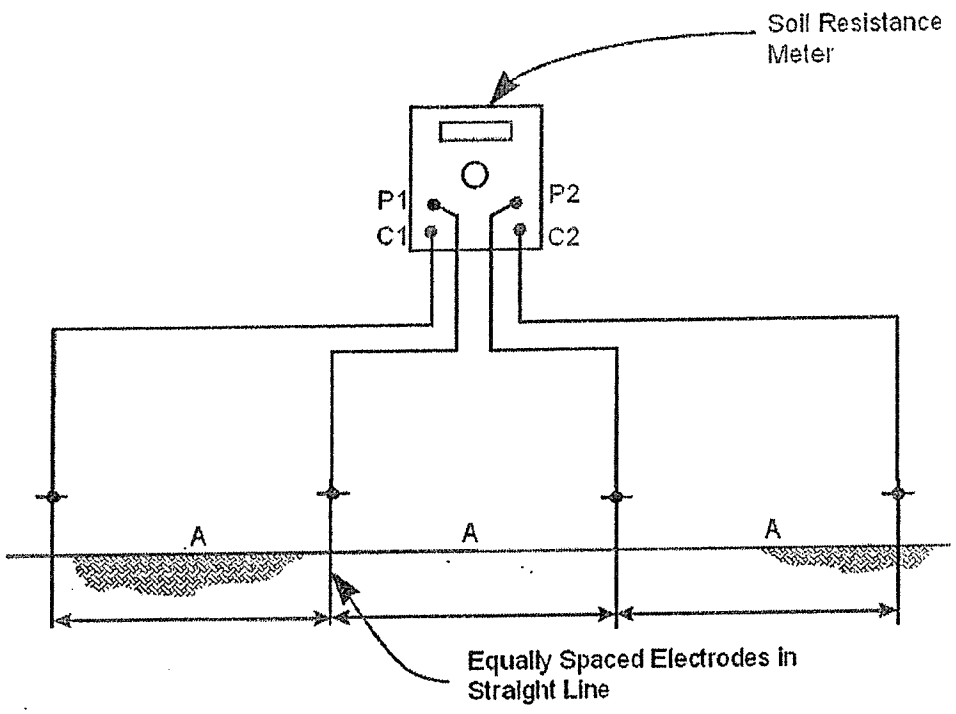


Figure 3 - Soil Resistivity Measurement Using the Wenner 4-Electrode Method

An alternating current from the Soil Resistance Meter causes a current to flow through the soil between the outside electrodes, C1 and C2. Due to the resistance of the soil, the current creates a voltage gradient, which is proportional to the average resistance of the soil mass to a depth equal to the distance between electrodes. The voltage drop is then measured across pins, P1 and P2. Resistivity of the soil is then computed from the instrument reading according to the following formula:

$$\rho = 2 \cdot \pi \cdot A \cdot R$$

Where:

ρ	=	soil resistivity (ohm-cm)
A	=	distance between electrodes (cm)
R	=	soil resistance, instrument reading (ohms)
π	=	3.14 (approx.)

Soil resistivity measurements were conducted with electrodes spaced at 1.5, 3, 4.5, and 6 meters. The resistivity values obtained represent the average resistivity of the soil to a depth equal to the electrode spacing. An additional method of calculating the soil resistivity using the data from the 4-Electrode Method is the Barnes-Layer Resistivity Calculation. The Barnes Layer Calculation is used to determine the resistivity of the soil for each soil layer. While the 4-Electrode Method at 3-meter

electrode spacing will consider all 3 meters of soil below the surface, the Barnes-Layer method will consider the resistivity of only the layer of soil between 1.5 and 3 meters below the surface. This method assumes the soil layers are a uniform thickness and parallel to the surface.

$$\rho_{b-a} = KR_{b-a}$$

and

$$\frac{1}{R_{b-a}} = \frac{1}{R_a} - \frac{1}{R_b}$$

Where:

ρ_{b-a}	=	Soil resistivity of layer depth b-a (ohm-cm)
a	=	Soil depth to top of layer (cm)
b	=	Soil depth to bottom of layer (cm)
R_a	=	Soil resistance read at depth a (ohms)
R_b	=	Soil resistance read at depth b (ohms)
R_{b-a}	=	Resistance of soil layer from a to b (cm)
K	=	Layer constant (cm)
	=	2π (b-a)

Soil resistance is measured at electrode spacings of 1.5, 3, 4.5, and 6 meters. Barnes Layer resistivity is calculated for layers 0 to 1.5, 1.5 to 3, 3 to 4.5, and 4.5 to 6 meters below grade. The results of both methods are listed on Table 1.

To supplement the resistivity data obtained during field testing, two soil samples from the Century Boulevard Underpass site were obtained from URS for analysis of minimum soil resistivity using a soil box, as shown in Figure 4.

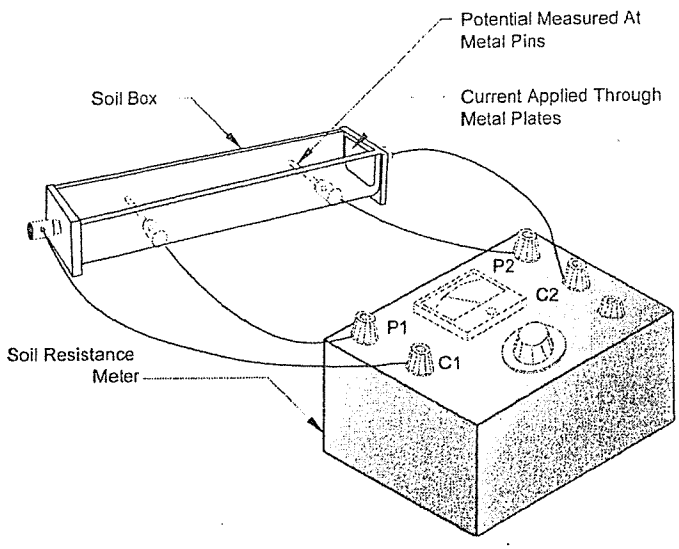


Figure 4 - Soil Resistivity Measurement Using the Soil Box Method

The soil box apparatus consists of a small plastic box with metal end plates. Dirt from the soil sample is tightly packed into the box and current is passed through the soil sample. The current causes a voltage drop across the soil sample and soil resistivity is determined using the above referenced Soil Resistance Meter.

The soil samples were placed in the soil box and the soil resistivity was measured in the "as-received" state. Distilled water was added to the soil sample in 10-mL increments and the resistivity was measured after each watering. As the soil sample became more saturated, the soil resistivity decreased until the minimum soil resistivity was reached.

Laboratory Analysis of Soil

The soil samples have a minimum resistivity greater than or equal to 1,000 ohm-cm and were forwarded to CERCO Analytical Laboratory in Pleasanton, CA, for testing. Both samples were tested for pH, and Soil Sample B-20 with a minimum resistivity of 1,000 ohm-cm was also tested for water soluble chloride and water soluble sulfate ion concentration.

TEST RESULTS

Data obtained during this investigation has been summarized in tabular form for analysis and presentation. Table 1 lists the results of the in-situ soil resistivity measurements conducted at the site. Table 2 lists the "as-received" and minimum soil resistivity for each sample collected as well as

the chemical analysis of the sample. The locations of the soil samples and the in-situ resistivity test locations are shown on Figure 2.

In-Situ Soil Resistivity

Table 1 - In-Situ Soil Resistivity Data

Site*	Depth (meters)	Resistivity (ohm-cm)	Layer Resistivity (ohm-cm)	Layer (meters)
1	1.5	1,053	1,053	0 – 1.5
	3.0	823	676	1.5 – 3.0
	4.5	747	630	3.0 – 4.5
	6.0	728	676	4.5 – 6.0
2	1.5	1,149	1,149	0 – 1.5
	3.0	785	596	1.5 – 3.0
	4.5	1,034	2,827	3.0 – 4.5
	6.0	1,187	2,137	4.5 – 6.0
3	1.5	1,436	1,436	0 – 1.5
	3.0	1,111	906	1.5 – 3.0
	4.5	948	733	3.0 – 4.5
	6.0	651	336	4.5 – 6.0
4	1.5	1,053	1,053	0 – 1.5
	3.0	938	846	1.5 – 3.0
	4.5	891	808	3.0 – 4.5
	6.0	728	470	4.5 – 6.0

Since corrosion is a natural electrochemical process accompanied by the flow of electrical current, it is important to understand how easily current will travel through the soil surrounding the steel or steel reinforced concrete structure. Resistivity is a measure of the ability of a soil to conduct an electric current. Soil resistivity is primarily dependent on the chemical and moisture content of the soil. As the concentration of chemical constituents increases, the soil resistivity will decrease. Additional moisture generally decreases the soil resistivity up to the point where the maximum solubility for the dissolved ionic chemicals is achieved. Beyond the maximum solubility, an increase in moisture generally increases the resistivity as the chemicals become more and more diluted. Since corrosion rate depends on current flow through the soil to and from the metal, soil corrosivity normally increases as soil resistivity decreases.

Based upon analysis of the in-situ soil resistivity results for the Century Boulevard Underpass site, shown in Table 1, the soil is determined to be *non-corrosive* to a depth of 6 meters below grade to the buried reinforced concrete, cast in place concrete piles, and prestressed concrete piles, in accordance with the Guidelines.

Soil samples were obtained for corrosion analyses at the following locations:

Laboratory Analysis of Soil Samples

Table 2 - Soil Resistivity and Chemical Data

Item No.	Boring No.	Station	Sample No.	Depth (meters)	Soil Resistivity (ohm-cm)		Chemical Data		
					As-Received	Minimum	pH	Sulfate (mg/kg)	Chloride (mg/kg)
1	B - 20	259	2	4	1,200	1,000	8.2	39	ND
2	B - 21	259	2	2	4,300	2,300	7.6	--	--

ND – Not Detected. Below the detection level of 15 mg/kg.

Based on the results of the corrosion analyses, the site is considered to be *non-corrosive.*

APPENDIX C

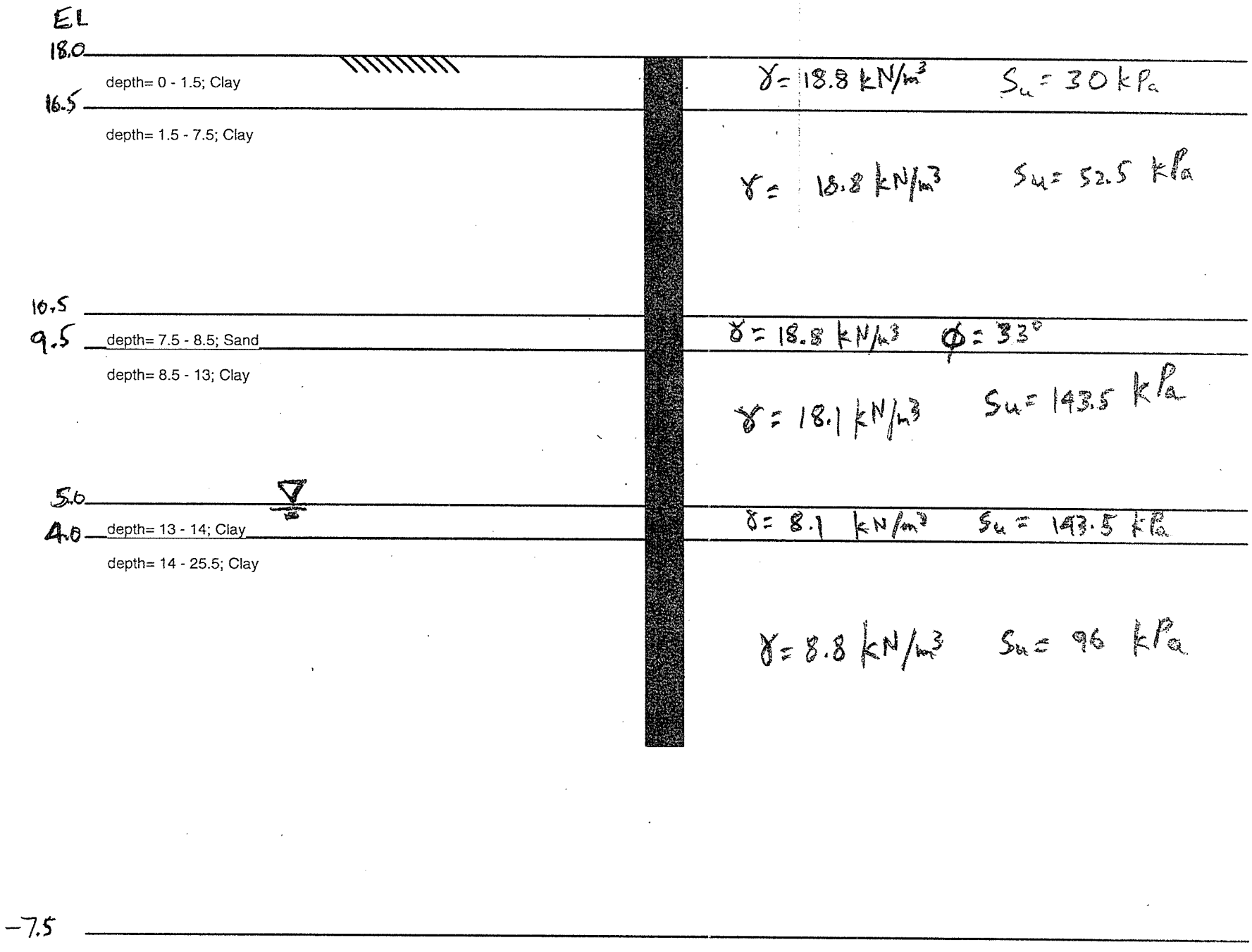
APILE Runs – 355mm PPC Piles
eBART – Century Boulevard
Job No. 205124.10

Pile capacities computed using FHWA Method in APILE program
Ground Surface Elevation = 18.0

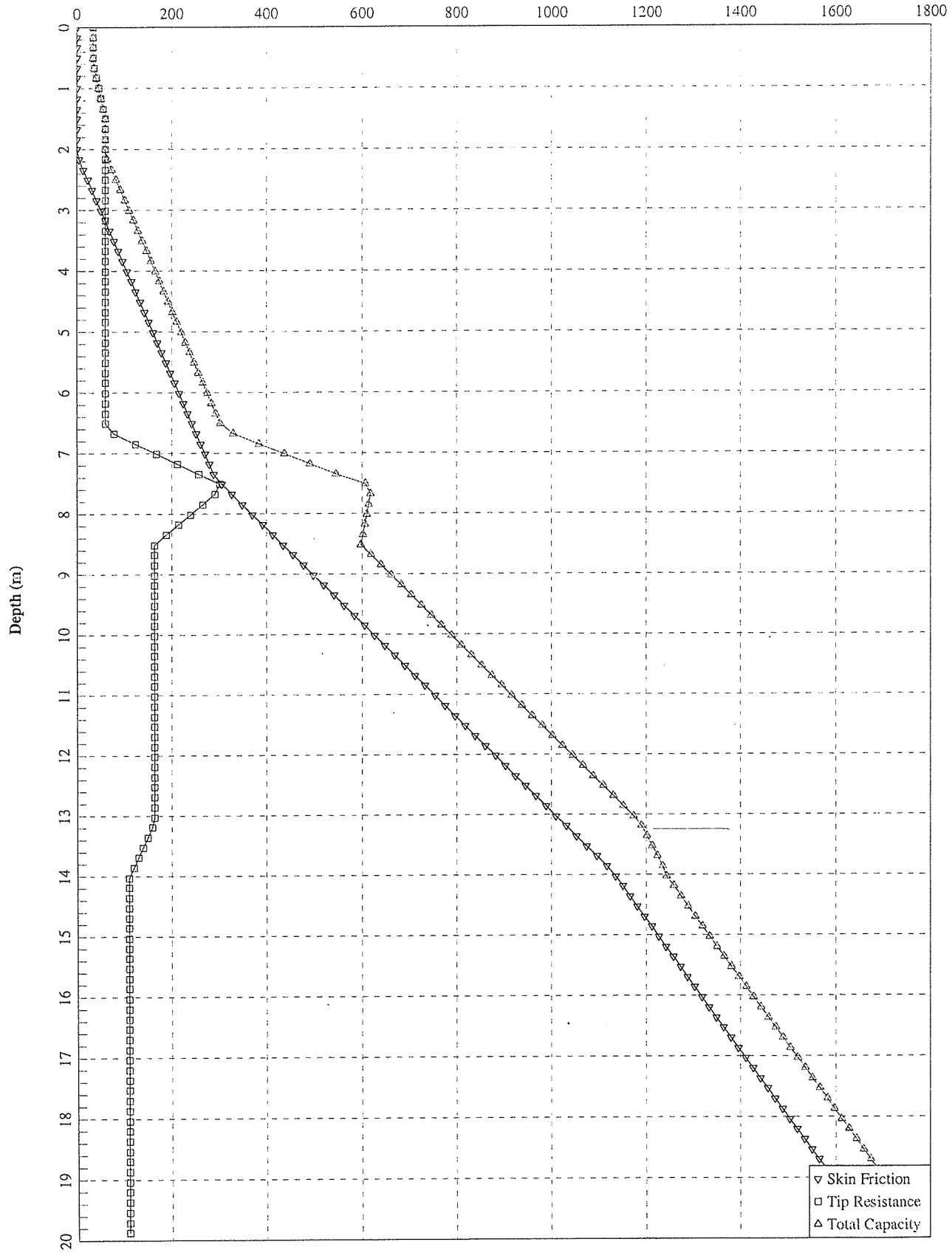
Nominal Compression Load = 1170 kN
Reqd. Penetration per APILE output = 13.0m
Reqd. Tip Elevation = 18.0 – 13.0 = 5.0

Nominal Tension Load = 540 kN
Required Skin Friction = 540/0.5 = 1080 kN
Reqd. Penetration per APILE output = 13.6m
Reqd. Tip Elevation = 18.0 – 13.6 = 4.4

(Output for APILE Program follows)



APILE Runs – 355mm PPC Piles
eBART – Century Boulevard
Job No. 205124.10


Axial Capacity (kN)
0
200
400
600
800
1000
1200
1400
1600
1800
Depth (m)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Skin Friction
Tip Resistance
Total Capacity

1

AXIALLY LOADING PILE ANALYSIS PROGRAM - APILEplus
VERSION 4.0 - (C) COPYRIGHT ENSOFT,INC.,1987-2004.

Century Blvd Abutments - 355 mm SquarePPC Pile

DESIGNER : Partha Sircar

DATE : 11/30/07

PILE PROPERTIES :

PERIMETER OF PILE WITH NONCIRCULAR SECTION	=	1420.00 MM.
TIP AREA OF PILE WITH NONCIRCULAR SECTION	=	0.13 SQM
OUTSIDE DIAMETER OF CIRCULAR PILE	=	0.00 MM.
INTERNAL DIAMETER OF CIRCULAR PILE	=	0.00 MM.
PILE LENGTH	=	20.00 M.
MODULUS OF ELASTICITY	=	0.296E+08 KPA

LENGTH OF SURFACE SECTION WITH ZERO SKIN FRICTION = 2.05 M.
INCREMENT OF PILE LENGTH USED IN COMPUTATION = 0.17 M.

SOIL INFORMATIONS :

DEPTH M.	SOIL TYPE	LATERAL EARTH PRESSURE	EFFECTIVE UNIT WEIGHT KN/CM	FRICTION ANGLE DEGREES	BEARING CAPACITY FACTOR
0.00	CLAY	0.00	18.80	0.00	0.00
1.50	CLAY	0.00	18.80	0.00	0.00
1.50	CLAY	0.00	18.80	0.00	0.00
7.50	CLAY	0.00	18.80	0.00	0.00
7.50	SAND	0.00	18.80	33.00	32.00
8.50	SAND	0.00	18.80	33.00	32.00
8.50	CLAY	0.00	18.10	0.00	0.00
13.00	CLAY	0.00	18.10	0.00	0.00
13.00	CLAY	0.00	8.10	0.00	0.00
14.00	CLAY	0.00	8.10	0.00	0.00
14.00	CLAY	0.00	8.80	0.00	0.00
25.50	CLAY	0.00	8.80	0.00	0.00

MAXIMUM UNIT FRICTION KPA	MAXIMUM UNIT BEARING KPA	UNDISTURB SHEAR STRENGTH KPA	REMOLDED SHEAR STRENGTH KPA	BLOW COUNT	UNIT SKIN FRICTION KPA	UNIT END BEARING KPA
30.00	270.00	30.00	15.00	0.00	0.00	0.00
30.00	270.00	30.00	15.00	0.00	0.00	0.00
52.50	472.50	52.50	26.00	0.00	0.00	0.00
52.50	472.50	52.50	20.00	0.00	0.00	0.00

91.00	7660.00	0.00	0.00	0.00	0.00	0.00
91.00	7660.00	0.00	0.00	0.00	0.00	0.00
143.50	1300.00	143.50	71.50	0.00	0.00	0.00
143.50	1300.00	143.50	71.50	0.00	0.00	0.00
143.50	1300.00	143.50	71.50	0.00	0.00	0.00
143.50	1300.00	143.50	71.50	0.00	0.00	0.00
9999.00	99999.00	96.00	48.00	0.00	0.00	0.00
9999.00	99999.00	96.00	48.00	0.00	0.00	0.00

1

****
* COMPUTATION RESULT *
****

PILE PENETRATION M.	FED. HWY. METHOD TOTAL SKIN FRIC KN.	FED. HWY. METHOD END BEARING KN.	FED. HWY. METHOD ULTIM CAPACITY KN.	ARMY CORPS METHOD TOTAL SKIN FRIC KN.	ARMY CORPS METHOD END BEARING KN.	ARMY CORPS METHOD ULTIM CAPACITY KN.	LAMBDA 2 METHOD TOTAL SKIN FRIC KN.	LAMBDA 2 METHOD END BEARING KN.	LAMBDA 2 METHOD ULTIM CAPACITY KN.
0.0	0.	34.	34.	0.	34.	34.	0.	34.	34.
0.2	0.	34.	34.	0.	34.	34.	0.	34.	34.
0.3	0.	34.	34.	0.	34.	34.	0.	34.	34.
0.5	0.	34.	34.	0.	34.	34.	0.	34.	34.
0.7	0.	36.	36.	0.	36.	36.	0.	36.	36.
0.8	0.	41.	41.	0.	41.	41.	0.	41.	41.
1.0	0.	45.	45.	0.	45.	45.	0.	45.	45.
1.2	0.	50.	50.	0.	50.	50.	0.	50.	50.
1.3	0.	55.	55.	0.	55.	55.	0.	55.	55.
1.5	0.	60.	60.	0.	60.	60.	0.	60.	60.
1.7	0.	60.	60.	0.	60.	60.	0.	60.	60.
1.8	0.	60.	60.	0.	60.	60.	0.	60.	60.
2.0	0.	60.	60.	0.	60.	60.	0.	60.	60.
2.2	5.	60.	64.	4.	60.	64.	12.	60.	72.
2.3	14.	60.	73.	13.	60.	73.	17.	60.	77.
2.5	23.	60.	82.	22.	60.	81.	22.	60.	82.
2.7	32.	60.	92.	31.	60.	90.	27.	60.	87.
2.8	41.	60.	101.	39.	60.	99.	32.	60.	92.
3.0	50.	60.	110.	48.	60.	108.	38.	60.	97.
3.2	60.	60.	119.	57.	60.	116.	43.	60.	103.
3.3	69.	60.	128.	66.	60.	125.	49.	60.	108.
3.5	78.	60.	137.	74.	60.	134.	54.	60.	114.
3.7	87.	60.	147.	83.	60.	143.	60.	60.	120.
3.8	96.	60.	156.	92.	60.	151.	66.	60.	125.
4.0	105.	60.	165.	101.	60.	160.	72.	60.	131.
4.2	115.	60.	174.	109.	60.	169.	78.	60.	137.
4.3	124.	60.	183.	118.	60.	178.	84.	60.	144.
4.5	133.	60.	192.	127.	60.	186.	90.	60.	150.
4.7	142.	60.	202.	136.	60.	195.	97.	60.	156.
4.8	151.	60.	211.	144.	60.	204.	103.	60.	163.
5.0	160.	60.	220.	153.	60.	213.	110.	60.	169.
5.2	170.	60.	229.	162.	60.	221.	116.	60.	176.
5.3	179.	60.	238.	171.	60.	230.	123.	60.	183.
5.5	188.	60.	247.	179.	60.	239.	130.	60.	190.
5.7	197.	60.	257.	188.	60.	248.	137.	60.	196.
5.8	206.	60.	266.	197.	60.	257.	144.	60.	204.
6.0	215.	60.	275.	206.	60.	265.	151.	60.	211.

6.2	224.	60.	284.	214.	60.	274.	158.	60.	218.
6.3	234.	60.	293.	223.	60.	283.	166.	60.	225.
6.5	243.	60.	302.	232.	60.	292.	173.	60.	233.
6.7	252.	78.	330.	241.	100.	340.	181.	99.	280.
6.8	261.	123.	384.	249.	197.	447.	189.	195.	384.
7.0	270.	168.	438.	258.	294.	553.	197.	294.	490.
7.2	279.	212.	492.	267.	392.	659.	204.	395.	599.
7.3	289.	257.	546.	276.	489.	765.	212.	498.	711.
7.5	305.	302.	607.	280.	586.	866.	221.	604.	825.
7.7	327.	291.	618.	280.	554.	834.	225.	580.	805.
7.8	349.	265.	614.	280.	476.	756.	230.	501.	731.
8.0	370.	240.	610.	280.	397.	678.	235.	420.	655.
8.2	392.	214.	606.	280.	319.	599.	240.	337.	577.
8.3	413.	188.	602.	297.	241.	538.	245.	251.	496.
8.5	435.	163.	598.	314.	163.	477.	251.	163.	413.
8.7	456.	163.	619.	331.	163.	494.	265.	163.	428.
8.9	477.	163.	640.	348.	163.	511.	280.	163.	443.
9.0	499.	163.	661.	365.	163.	528.	296.	163.	458.
9.2	520.	163.	683.	382.	163.	545.	311.	163.	474.
9.4	541.	163.	704.	399.	163.	562.	326.	163.	489.
9.5	563.	163.	725.	416.	163.	579.	341.	163.	504.
9.7	584.	163.	747.	433.	163.	596.	357.	163.	520.
9.9	605.	163.	768.	450.	163.	613.	373.	163.	535.
10.0	627.	163.	789.	467.	163.	630.	388.	163.	551.
10.2	648.	163.	811.	484.	163.	647.	404.	163.	567.
10.4	669.	163.	832.	501.	163.	664.	420.	163.	583.
10.5	690.	163.	853.	518.	163.	681.	436.	163.	599.
10.7	712.	163.	875.	535.	163.	698.	452.	163.	615.
10.9	733.	163.	896.	552.	163.	715.	468.	163.	631.
11.0	754.	163.	917.	569.	163.	732.	485.	163.	647.
11.2	776.	163.	938.	586.	163.	749.	501.	163.	664.
11.4	797.	163.	960.	603.	163.	766.	517.	163.	680.
11.5	818.	163.	981.	620.	163.	783.	534.	163.	697.
11.7	840.	163.	1002.	637.	163.	800.	551.	163.	714.
11.9	861.	163.	1024.	654.	163.	817.	568.	163.	730.
12.0	882.	163.	1045.	671.	163.	834.	584.	163.	747.
12.2	904.	163.	1066.	688.	163.	851.	601.	163.	764.
12.4	925.	163.	1088.	705.	163.	868.	619.	163.	781.
12.5	946.	163.	1109.	723.	163.	885.	636.	163.	799.
12.7	968.	163.	1130.	740.	163.	902.	653.	163.	816.
12.9	989.	163.	1152.	757.	163.	919.	670.	163.	833.
13.0	1010.	163.	1173.	774.	163.	936.	688.	163.	851.
13.2	1031.	159.	1190.	791.	159.	949.	706.	159.	864.
13.4	1053.	149.	1201.	808.	149.	956.	723.	149.	872.
13.5	1074.	139.	1213.	825.	139.	963.	741.	139.	880.
13.7	1095.	129.	1224.	842.	129.	970.	759.	129.	887.
13.9	1117.	119.	1235.	859.	119.	977.	776.	119.	895.
14.0	1135.	109.	1244.	873.	109.	982.	794.	109.	903.
14.2	1150.	109.	1259.	884.	109.	993.	809.	109.	918.
14.4	1166.	109.	1275.	896.	109.	1004.	824.	109.	932.
14.5	1181.	109.	1290.	907.	109.	1016.	838.	109.	947.
14.7	1196.	109.	1305.	918.	109.	1027.	853.	109.	962.
14.9	1212.	109.	1321.	930.	109.	1039.	868.	109.	977.
15.0	1227.	109.	1336.	941.	109.	1050.	883.	109.	992.
15.2	1243.	109.	1351.	953.	109.	1061.	898.	109.	1007.
15.4	1258.	109.	1367.	964.	109.	1073.	913.	109.	1022.
15.5	1273.	109.	1382.	975.	109.	1084.	928.	109.	1037.
15.7	1289.	109.	1398.	987.	109.	1096.	943.	109.	1052.
15.9	1304.	109.	1413.	998.	109.	1107.	958.	109.	1067.
16.0	1319.	109.	1428.	1009.	109.	1118.	974.	109.	1083.
16.2	1335.	109.	1444.	1021.	109.	1130.	989.	109.	1098.
16.4	1350.	109.	1459.	1032.	109.	1141.	1004.	109.	1113.
16.5	1365.	109.	1474.	1044.	109.	1152.	1020.	109.	1129.

Compression

Tension

16.7	1381.	109.	1490.	1055.	109.	1164.	1035.	109.	1144.
16.9	1396.	109.	1505.	1066.	109.	1175.	1051.	109.	1159.
17.0	1412.	109.	1520.	1078.	109.	1187.	1066.	109.	1175.
17.2	1427.	109.	1536.	1089.	109.	1198.	1082.	109.	1190.
17.4	1442.	109.	1551.	1100.	109.	1209.	1097.	109.	1206.
17.5	1458.	109.	1566.	1112.	109.	1221.	1113.	109.	1222.
17.7	1473.	109.	1582.	1123.	109.	1232.	1129.	109.	1238.
17.9	1488.	109.	1597.	1135.	109.	1244.	1144.	109.	1253.
18.0	1504.	109.	1613.	1146.	109.	1255.	1160.	109.	1269.
18.2	1519.	109.	1628.	1157.	109.	1266.	1176.	109.	1285.
18.4	1534.	109.	1643.	1169.	109.	1278.	1192.	109.	1301.
18.5	1550.	109.	1659.	1180.	109.	1289.	1208.	109.	1317.
18.7	1565.	109.	1674.	1192.	109.	1300.	1224.	109.	1333.
18.9	1581.	109.	1689.	1203.	109.	1312.	1240.	109.	1349.
19.0	1596.	109.	1705.	1214.	109.	1323.	1256.	109.	1365.
19.2	1611.	109.	1720.	1226.	109.	1335.	1272.	109.	1381.
19.4	1627.	109.	1735.	1237.	109.	1346.	1288.	109.	1397.
19.5	1642.	109.	1751.	1248.	109.	1357.	1305.	109.	1414.
19.7	1657.	109.	1766.	1260.	109.	1369.	1321.	109.	1430.
19.9	1673.	109.	1782.	1271.	109.	1380.	1337.	109.	1446.

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* API RP-2A (1994) *
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PILE PENETRATION M.	TOTAL SKIN FRICTION KN.	END BEARING KN.	ULTIMATE CAPACITY KN.
0.00	0.0	34.0	34.0
0.17	0.0	34.0	34.0
0.33	0.0	34.0	34.0
0.50	0.0	34.0	34.0
0.67	0.0	36.0	36.0
0.83	0.0	40.7	40.7
1.00	0.0	45.4	45.4
1.17	0.0	50.1	50.1
1.34	0.0	54.8	54.8
1.50	0.0	59.5	59.5
1.67	0.0	59.5	59.5
1.84	0.0	59.5	59.5
2.00	0.0	59.5	59.5
2.17	2.9	59.5	62.5
2.34	8.8	59.5	68.4
2.50	14.8	59.5	74.4
2.67	20.9	59.5	80.5
2.84	27.2	59.5	86.7
3.01	33.5	59.5	93.1
3.17	40.1	59.5	99.6
3.34	46.8	59.5	106.3
3.51	53.7	59.5	113.2
3.67	60.7	59.5	120.3
3.84	68.0	59.5	127.5
4.01	75.3	59.5	134.9
4.17	82.9	59.5	142.4
4.34	90.6	59.5	150.1
4.51	98.4	59.5	157.9
4.68	106.4	59.5	165.9
4.84	114.5	59.5	174.1
5.01	122.8	59.5	182.3
5.18	131.2	59.5	190.7
5.34	139.7	59.5	199.3

5.51	148.4	59.5	207.9
5.68	157.2	59.5	216.8
5.84	166.2	59.5	225.7
6.01	175.3	59.5	234.8
6.18	184.6	59.5	244.2
6.35	194.1	59.5	253.6
6.51	203.6	59.5	263.2
6.68	213.3	98.7	312.0
6.85	223.1	195.1	418.2
7.01	233.0	293.8	526.8
7.18	243.1	394.9	638.0
7.35	253.2	498.3	751.5
7.51	258.3	604.0	862.4
7.68	258.3	579.6	838.0
7.85	258.3	500.9	759.3
8.02	258.3	419.9	678.2
8.18	258.3	336.5	594.9
8.35	258.3	250.8	509.1
8.52	267.4	162.8	430.2
8.68	285.6	162.8	448.4
8.85	304.0	162.8	466.8
9.02	322.6	162.8	485.3
9.18	341.3	162.8	504.1
9.35	360.2	162.8	522.9
9.52	379.2	162.8	542.0
9.69	398.4	162.8	561.2
9.85	417.8	162.8	580.6
10.02	437.3	162.8	600.1
10.19	457.0	162.8	619.7
10.35	476.8	162.8	639.6
10.52	496.8	162.8	659.6
10.69	516.9	162.8	679.7
10.85	537.2	162.8	700.0
11.02	557.6	162.8	720.4
11.19	578.2	162.8	741.0
11.36	599.0	162.8	761.7
11.52	619.8	162.8	782.6
11.69	640.9	162.8	803.6
11.86	662.0	162.8	824.8
12.02	683.3	162.8	846.1
12.19	704.8	162.8	867.5
12.36	726.4	162.8	889.1
12.52	748.1	162.8	910.9
12.69	770.0	162.8	932.8
12.86	792.0	162.8	954.8
13.03	814.1	162.8	976.9
13.19	836.3	158.6	994.9
13.36	858.5	148.7	1007.2
13.53	880.8	138.7	1019.6
13.69	903.2	128.8	1032.0
13.86	925.6	118.8	1044.5
14.03	946.0	108.9	1054.9
14.19	964.5	108.9	1073.4
14.36	983.0	108.9	1091.9
14.53	1001.5	108.9	1110.4
14.70	1020.1	108.9	1129.0
14.86	1038.8	108.9	1147.7
15.03	1057.5	108.9	1166.4
15.20	1076.3	108.9	1185.2
15.36	1095.1	108.9	1204.0
15.53	1114.0	108.9	1222.8
15.70	1132.9	108.9	1241.8
15.86	1151.9	108.9	1260.7

16.03	1170.9	108.9	1279.8
16.20	1190.0	108.9	1298.8
16.37	1209.1	108.9	1318.0
16.53	1228.3	108.9	1337.2
16.70	1247.5	108.9	1356.4
16.87	1266.8	108.9	1375.7
17.03	1286.1	108.9	1395.0
17.20	1305.5	108.9	1414.4
17.37	1325.0	108.9	1433.8
17.53	1344.4	108.9	1453.3
17.70	1364.0	108.9	1472.9
17.87	1383.6	108.9	1492.5
18.04	1403.2	108.9	1512.1
18.20	1422.9	108.9	1531.8
18.37	1442.7	108.9	1551.5
18.54	1462.4	108.9	1571.3
18.70	1482.3	108.9	1591.2
18.87	1502.2	108.9	1611.1
19.04	1522.1	108.9	1631.0
19.20	1542.1	108.9	1651.0
19.37	1562.2	108.9	1671.0
19.54	1582.3	108.9	1691.1
19.71	1602.4	108.9	1711.3
19.87	1622.6	108.9	1731.5

AN ASTERISK WILL BE PLACED IN THE END-BEARING COLUMN
IF THE TIP RESISTANCE IS CONTROLLED BY THE FRICTION
OF SOIL PLUG INSIDE AN OPEN-ENDED PIPE PILE.

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**************************************************
* COMPUTE LOAD-DISTRIBUTION AND LOAD-SETTLEMENT *
* CURVES FOR AXIAL LOADING                       *
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T-Z CURVE NO.	NO. OF POINTS	DEPTH TO CURVE M.	LOAD TRANSFER KPA	PILE MOVEMENT M.
1	10	0.0000E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.7232E-03
			0.0000E+00	0.1401E-02
			0.0000E+00	0.2576E-02
			0.0000E+00	0.3616E-02
			0.0000E+00	0.4520E-02
			0.0000E+00	0.9040E-02
			0.0000E+00	0.1356E-01
			0.0000E+00	0.2260E-01
			0.0000E+00	0.9040E-01
2	10	0.7500E+00		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.7232E-03
			0.0000E+00	0.1401E-02
			0.0000E+00	0.2576E-02
			0.0000E+00	0.3616E-02
			0.0000E+00	0.4520E-02
			0.0000E+00	0.9040E-02
			0.0000E+00	0.1356E-01
			0.0000E+00	0.2260E-01
			0.0000E+00	0.9040E-01

3	10	0.1400E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.7232E-03
			0.0000E+00	0.1401E-02
			0.0000E+00	0.2576E-02
			0.0000E+00	0.3616E-02
			0.0000E+00	0.4520E-02
			0.0000E+00	0.9040E-02
			0.0000E+00	0.1356E-01
			0.0000E+00	0.2260E-01
			0.0000E+00	0.9040E-01
4	10	0.1500E+01		
			0.0000E+00	0.0000E+00
			0.0000E+00	0.7232E-03
			0.0000E+00	0.1401E-02
			0.0000E+00	0.2576E-02
			0.0000E+00	0.3616E-02
			0.0000E+00	0.4520E-02
			0.0000E+00	0.9040E-02
			0.0000E+00	0.1356E-01
			0.0000E+00	0.2260E-01
			0.0000E+00	0.9040E-01
5	10	0.4500E+01		
			0.0000E+00	0.0000E+00
			0.1159E+02	0.7232E-03
			0.1932E+02	0.1401E-02
			0.2898E+02	0.2576E-02
			0.3477E+02	0.3616E-02
			0.3864E+02	0.4520E-02
			0.3477E+02	0.9040E-02
			0.3477E+02	0.1356E-01
			0.3477E+02	0.2260E-01
			0.3477E+02	0.9040E-01
6	10	0.7400E+01		
			0.0000E+00	0.0000E+00
			0.2129E+02	0.7232E-03
			0.3548E+02	0.1401E-02
			0.5322E+02	0.2576E-02
			0.6386E+02	0.3616E-02
			0.7096E+02	0.4520E-02
			0.6386E+02	0.9040E-02
			0.6386E+02	0.1356E-01
			0.6386E+02	0.2260E-01
			0.6386E+02	0.9040E-01
7	10	0.7500E+01		
			0.0000E+00	0.0000E+00
			0.7096E+01	0.2513E-03
			0.1419E+02	0.5026E-03
			0.2838E+02	0.1005E-02
			0.4258E+02	0.1508E-02
			0.5677E+02	0.2011E-02
			0.6386E+02	0.2262E-02
			0.7096E+02	0.2513E-02
			0.7096E+02	0.1257E-01
			0.7096E+02	0.5026E-01
8	10	0.8000E+01		
			0.0000E+00	0.0000E+00
			0.9100E+01	0.2513E-03
			0.1820E+02	0.5026E-03
			0.3640E+02	0.1005E-02
			0.5460E+02	0.1508E-02
			0.7280E+02	0.2011E-02
			0.8190E+02	0.2262E-02

			0.9100E+02	0.2513E-02
			0.9100E+02	0.1257E-01
			0.9100E+02	0.5026E-01
9	10	0.8400E+01		
			0.0000E+00	0.0000E+00
			0.9043E+01	0.2513E-03
			0.1809E+02	0.5026E-03
			0.3617E+02	0.1005E-02
			0.5426E+02	0.1508E-02
			0.7234E+02	0.2011E-02
			0.8138E+02	0.2262E-02
			0.9043E+02	0.2513E-02
			0.9043E+02	0.1257E-01
			0.9043E+02	0.5026E-01
10	10	0.8500E+01		
			0.0000E+00	0.0000E+00
			0.2713E+02	0.7232E-03
			0.4521E+02	0.1401E-02
			0.6782E+02	0.2576E-02
			0.8138E+02	0.3616E-02
			0.9043E+02	0.4520E-02
			0.8138E+02	0.9040E-02
			0.8138E+02	0.1356E-01
			0.8138E+02	0.2260E-01
			0.8138E+02	0.9040E-01
11	10	0.1075E+02		
			0.0000E+00	0.0000E+00
			0.2696E+02	0.7232E-03
			0.4493E+02	0.1401E-02
			0.6739E+02	0.2576E-02
			0.8087E+02	0.3616E-02
			0.8986E+02	0.4520E-02
			0.8087E+02	0.9040E-02
			0.8087E+02	0.1356E-01
			0.8087E+02	0.2260E-01
			0.8087E+02	0.9040E-01
12	10	0.1290E+02		
			0.0000E+00	0.0000E+00
			0.2696E+02	0.7232E-03
			0.4493E+02	0.1401E-02
			0.6739E+02	0.2576E-02
			0.8087E+02	0.3616E-02
			0.8986E+02	0.4520E-02
			0.8087E+02	0.9040E-02
			0.8087E+02	0.1356E-01
			0.8087E+02	0.2260E-01
			0.8087E+02	0.9040E-01
13	10	0.1300E+02		
			0.0000E+00	0.0000E+00
			0.2696E+02	0.7232E-03
			0.4493E+02	0.1401E-02
			0.6739E+02	0.2576E-02
			0.8087E+02	0.3616E-02
			0.8986E+02	0.4520E-02
			0.8087E+02	0.9040E-02
			0.8087E+02	0.1356E-01
			0.8087E+02	0.2260E-01
			0.8087E+02	0.9040E-01
14	10	0.1350E+02		
			0.0000E+00	0.0000E+00
			0.2696E+02	0.7232E-03
			0.4493E+02	0.1401E-02
			0.6739E+02	0.2576E-02

			0.8087E+02	0.3616E-02
			0.8986E+02	0.4520E-02
			0.8087E+02	0.9040E-02
			0.8087E+02	0.1356E-01
			0.8087E+02	0.2260E-01
			0.8087E+02	0.9040E-01
15	10	0.1390E+02		
			0.0000E+00	0.0000E+00
			0.2320E+02	0.7232E-03
			0.3866E+02	0.1401E-02
			0.5799E+02	0.2576E-02
			0.6959E+02	0.3616E-02
			0.7732E+02	0.4520E-02
			0.6959E+02	0.9040E-02
			0.6959E+02	0.1356E-01
			0.6959E+02	0.2260E-01
			0.6959E+02	0.9040E-01
16	10	0.1400E+02		
			0.0000E+00	0.0000E+00
			0.2320E+02	0.7232E-03
			0.3866E+02	0.1401E-02
			0.5799E+02	0.2576E-02
			0.6959E+02	0.3616E-02
			0.7732E+02	0.4520E-02
			0.6959E+02	0.9040E-02
			0.6959E+02	0.1356E-01
			0.6959E+02	0.2260E-01
			0.6959E+02	0.9040E-01
17	10	0.1975E+02		
			0.0000E+00	0.0000E+00
			0.1943E+02	0.7232E-03
			0.3239E+02	0.1401E-02
			0.4859E+02	0.2576E-02
			0.5830E+02	0.3616E-02
			0.6478E+02	0.4520E-02
			0.5830E+02	0.9040E-02
			0.5830E+02	0.1356E-01
			0.5830E+02	0.2260E-01
			0.5830E+02	0.9040E-01
18	10	0.2540E+02		
			0.0000E+00	0.0000E+00
			0.1943E+02	0.7232E-03
			0.3239E+02	0.1401E-02
			0.4859E+02	0.2576E-02
			0.5830E+02	0.3616E-02
			0.6478E+02	0.4520E-02
			0.5830E+02	0.9040E-02
			0.5830E+02	0.1356E-01
			0.5830E+02	0.2260E-01
			0.5830E+02	0.9040E-01

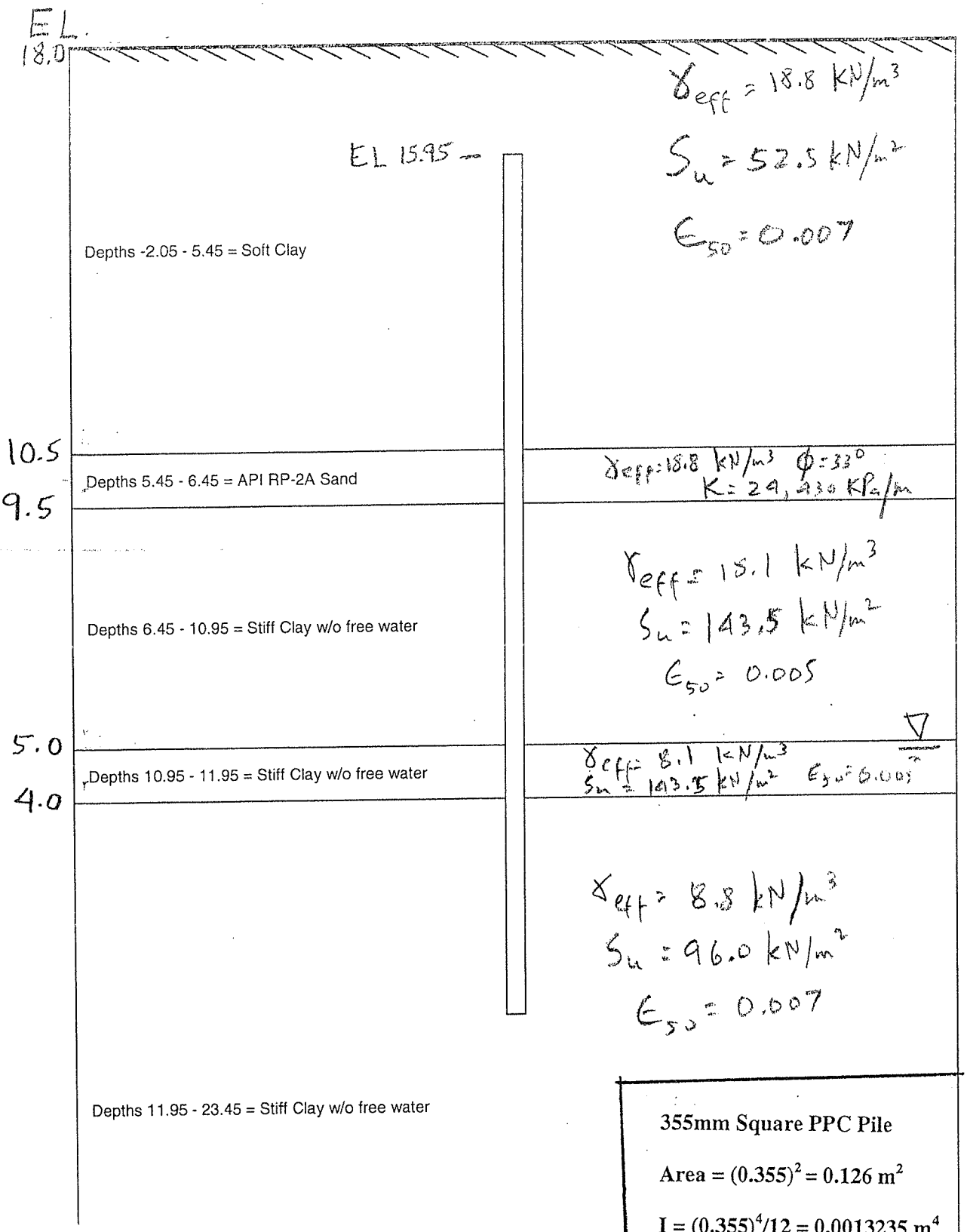
TIP LOAD KN.	TIP MOVEMENT M.
0.0000E+00	0.0000E+00
0.6805E+01	0.2260E-03
0.1361E+02	0.4520E-03
0.2722E+02	0.9040E-03
0.5444E+02	0.5876E-02
0.8166E+02	0.1898E-01
0.9800E+02	0.3300E-01

0.1089E+03	0.4520E-01
0.1089E+03	0.6780E-01
0.1089E+03	0.9040E-01

LOAD VERSUS SETTLEMENT CURVE
****

TOP LOAD KN.	TOP MOVEMENT M.	TIP LOAD KN.	TIP MOVEMENT M.
0.3058E+01	0.1117E-04	0.7568E-01	0.2513E-05
0.3058E+02	0.1117E-03	0.7568E+00	0.2513E-04
0.1529E+03	0.5585E-03	0.3784E+01	0.1257E-03
0.3047E+03	0.1116E-02	0.7568E+01	0.2513E-03
0.1108E+04	0.4577E-02	0.2915E+02	0.1257E-02
0.1536E+04	0.7305E-02	0.3603E+02	0.2513E-02
0.1647E+04	0.1795E-01	0.6834E+02	0.1257E-01
0.1667E+04	0.3063E-01	0.8883E+02	0.2513E-01
0.1687E+04	0.5587E-01	0.1089E+03	0.5026E-01

LPILE Runs – 355mm PPC Piles
eBART – Century Boulevard
Job No. 205124.10



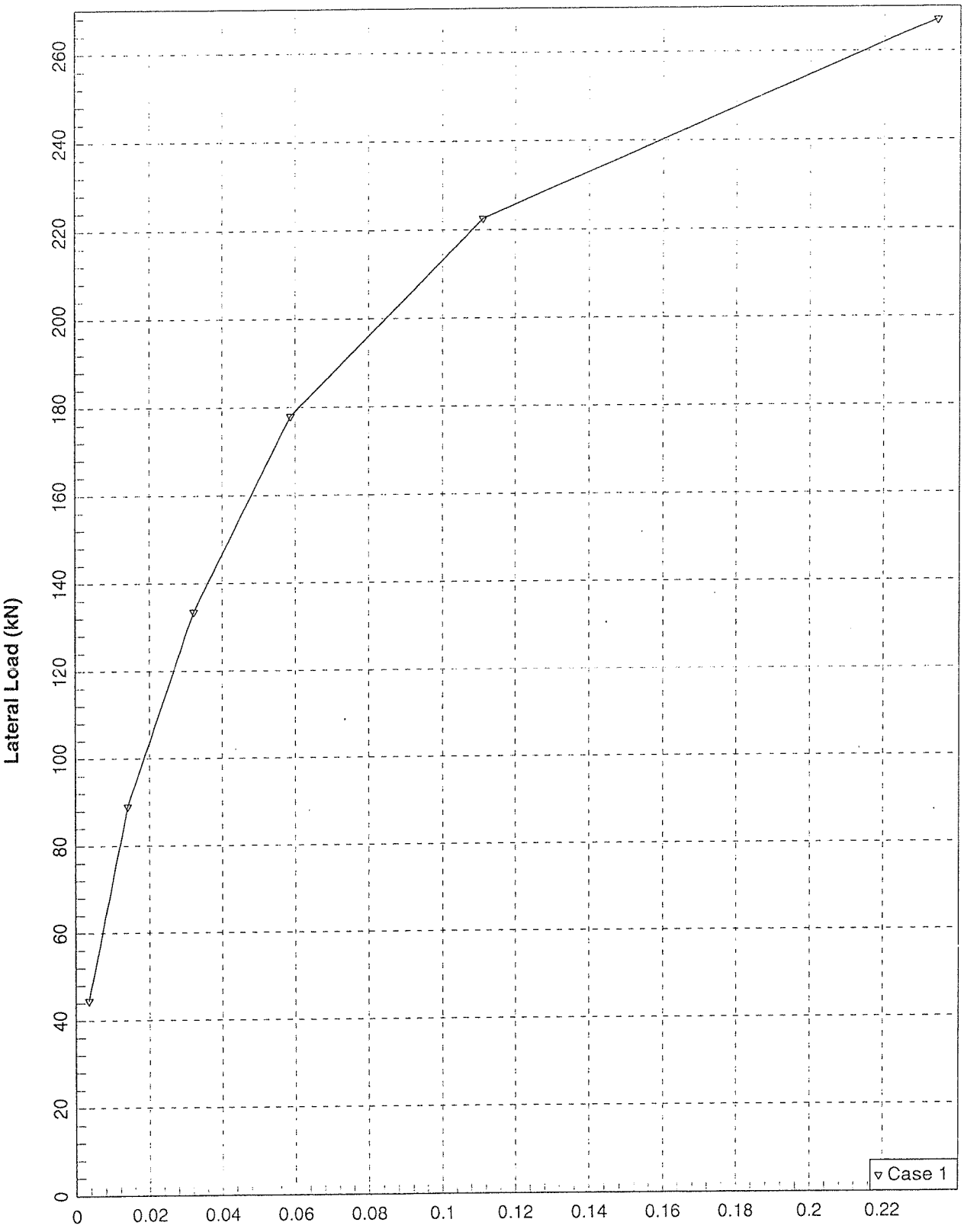
355mm Square PPC Pile

Area = $(0.355)^2$ = 0.126 m^2

I = $(0.355)^4/12$ = 0.0013235 m^4

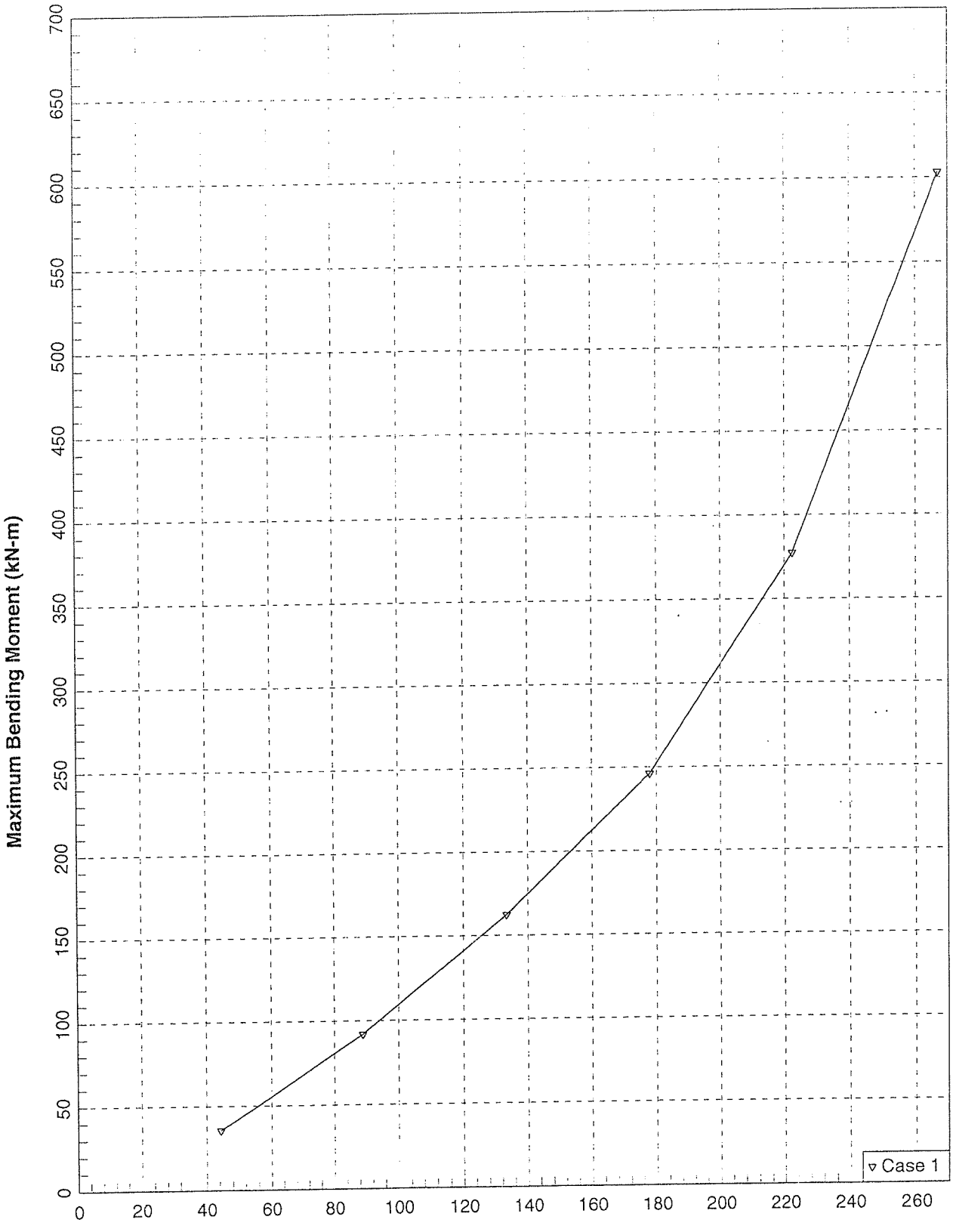
E = 30,000,000 kN/m^2
(4.3 X 10^6 psi)

Windows 5.0.33 (Single User), (c) 2006 by Ensoft, Inc.

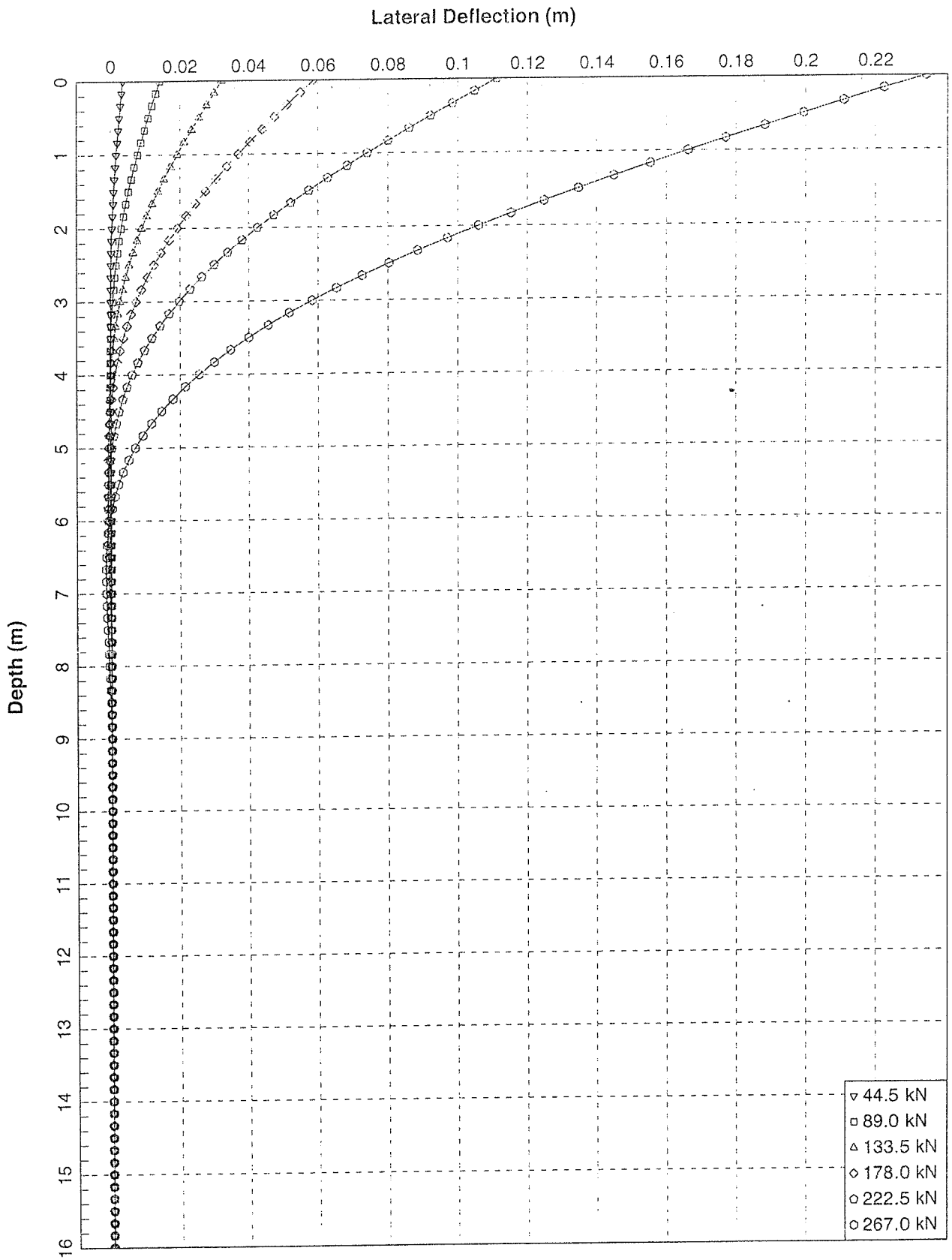


Pile-head Deflection (m)

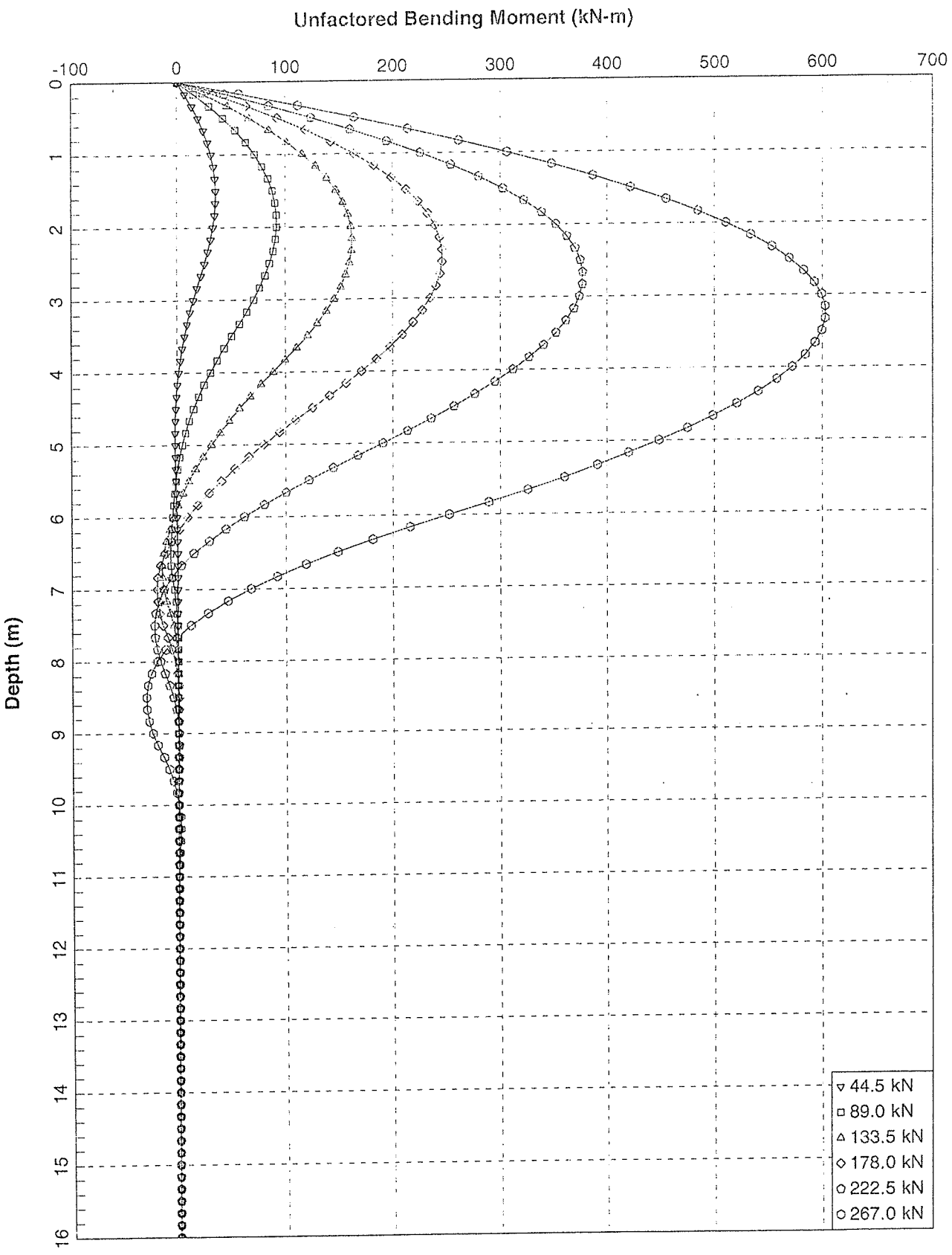
eBART Century Boulevard - 355mm PPC Pile - Free Head



eBART Century Boulevard - 355mm PPC Pile - Free Head



eBART Century Boulevard - 355 mm PPC Pile - Free Head



eBART Century Boulevard - 355mm PPC Pile - Free Head

LPILE Plus for Windows, Version 5.0 (5.0.33)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

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This program is licensed to:

Kirtha Sircar
Parikh Consultants

Path to file locations: S:\Orgoing Projects\2005\205124.10 eBART\CENTURY BOULEVARD\LPILE\
Name of input data file: Run No 1.lpd
Name of output file: Run No 1.lpo
Name of plot output file: Run No 1.lpp
Name of runtime file: Run No 1.lpr

Time and Date of Analysis

Date: December 5, 2007 Time: 15:37:25

Problem Title

BART Century Boulevard - 1

Program Options

Units Used in Computations - SI Units: Meters, Kilopascals

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multipliers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 96

- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 2.5400E-07 m
- Maximum allowable deflection = 2.5400E+00 m

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 16.00 m
Depth of ground surface below top of pile = -2.05 m
Slope angle of ground surface = .00 deg.

Structural properties of pile defined using 2 points

Point No.	Depth X m	Pile Diameter m	Moment of Inertia m**4	Pile Area Sq. m	Modulus of Elasticity kN/Sq. m
1	0.0000	.35500000	.0013235	.1260000	30000000.
2	16.0000	.35500000	.0013235	.1260000	30000000.

Soil and Rock Layering Information

The soil profile is modelled using 5 layers

Layer 1 is soft clay, p-y criteria by Matlock, 1970
Distance from top of pile to top of layer = -2.050 m
Distance from top of pile to bottom of layer = 5.450 m

Layer 2 is sand, p-y criteria by API RP-2A, 1987
Distance from top of pile to top of layer = 5.450 m
Distance from top of pile to bottom of layer = 6.450 m
p-y subgrade modulus k for top of soil layer = 24430.000 kN/ m**3
p-y subgrade modulus k for bottom of layer = 24430.000 kN/ m**3

Layer 3 is stiff clay without free water
Distance from top of pile to top of layer = 6.450 m
Distance from top of pile to bottom of layer = 10.950 m

Layer 4 is stiff clay without free water
Distance from top of pile to top of layer = 10.950 m
Distance from top of pile to bottom of layer = 11.950 m

Layer 5 is stiff clay without free water
Distance from top of pile to top of layer = 11.950 m
Distance from top of pile to bottom of layer = 23.450 m

(Depth of lowest layer extends 7.45 m below pile tip)

Effective Unit Weight of Soil vs. Depth

Distribution of effective unit weight of soil with depth
is defined using 10 points

Point No.	Depth X m	Eff. Unit Weight kN/ m**3
1	-2.05	18.80000
2	5.45	18.80000
3	5.45	18.80000
4	6.45	18.80000
5	6.45	18.10000
6	10.95	18.10000
7	10.95	8.10000
8	11.95	8.10000
9	11.95	8.80000
10	23.45	8.80000

Shear Strength of Soils

Distribution of shear strength parameters with depth
defined using 10 points

Point No.	Depth X m	Cohesion C kN/ m**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-2.050	52.50000	.00	.00700	.0
2	5.450	52.50000	.00	.00700	.0
3	5.450	.00000	33.00	------	------
4	6.450	.00000	33.00	------	------
5	6.450	143.50000	.00	.00500	.0
6	10.950	143.50000	.00	.00500	.0
7	10.950	143.50000	.00	.00500	.0
8	11.950	143.50000	.00	.00500	.0
9	11.950	96.00000	.00	.00700	.0
10	23.450	96.00000	.00	.00700	.0

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

p-y Modification Factors

Distribution of p-y multipliers with depth defined using 2 points

Point No.	Depth X m	p-mult	y-mult
1	.000	.6000	1.0000
2	16.000	.6000	1.0000

Loading Type

Static loading criteria was used for computation of p-y curves

Pile-Head Loading and Pile-Head Fixity Conditions

Number of loads specified = 6

Load Case Number 1

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head = 44.500 kN
Bending moment at pile head = .000 m- kN
Axial load at pile head = 1170.000 kN

(Zero moment at pile head for this load indicates a free-head condition)

Load Case Number 2

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head = 89.000 kN
Bending moment at pile head = .000 m- kN
Axial load at pile head = 1170.000 kN

(Zero moment at pile head for this load indicates a free-head condition)

Load Case Number 3

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head = 133.500 kN
Bending moment at pile head = .000 m- kN
Axial load at pile head = 1170.000 kN

(Zero moment at pile head for this load indicates a free-head condition)

Load Case Number 4

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head = 178.000 kN
Bending moment at pile head = .000 m- kN
Axial load at pile head = 1170.000 kN

(Zero moment at pile head for this load indicates a free-head condition)

Load Case Number 5

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head = 222.500 kN
Bending moment at pile head = .000 m- kN
Axial load at pile head = 1170.000 kN

(Zero moment at pile head for this load indicates a free-head condition)

Load Case Number 6

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Shear force at pile head = 267.000 kN
Bending moment at pile head = .000 m- kN
Axial load at pile head = 1170.000 kN

(Zero moment at pile head for this load indicates a free-head condition)

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Specified shear force at pile head = 44.500 kN
Specified moment at pile head = .000 m- kN
Specified axial load at pile head = 1170.000 kN

(Zero moment for this load indicates free-head conditions)

Depth Ys*h X m	Deflect. y m	Moment M kN- m	Shear V kN	Slope S Rad.	Total Stress kN/ m**2	Soil Res. p kN/ m
0.000	.003489	1.0538E-11	44.5000	-.0020898	9285.7143	-30.5466
729.5518 .167	.003141	7.3999	39.3873	-.0020743	10278.1481	-30.8059
1634.6670 .333	.002798	13.9381	34.2449	-.0020295	11155.0054	-30.9026
1840.9036 .500	.002464	19.6064	29.1003	-.0019591	11915.2085	-30.8326
2085.2031 .667	.002145	24.4022	23.9816	-.0018667	12558.3957	-30.5923
2377.3154 .833	.001842	28.3283	18.9174	-.0017561	13084.9357	-30.1781
2730.3267 1.000	.001559	31.3929	13.9370	-.0016307	13495.9407	-29.5862
3162.1573 1.167	.001299	33.6099	9.0705	-.0014943	13793.2793	-28.8125
3697.9342 1.333	.001061	34.9991	4.3484	-.0013503	13979.5907	-27.8520
4373.9095 1.500	.000848	35.5860	-.1323316	-.0012021	14058.3004	-25.9171
5090.8370 1.667	.000661	35.4239	-4.2790	-.0010531	14036.5523	-23.8426
6015.5863 1.833	.000497	34.5704	-8.0736	-.0009062	13922.0924	-21.6924
7267.8303 2.000	.000359	33.0861	-11.5020	-.0007642	13723.0248	-19.4495
9041.7820 2.167	.000243	31.0344	-14.5461	-.0006296	13447.8680	-17.0793
11727.7827 2.333	.000149	28.4829	-17.1782	-.0005047	13105.6774	-14.5054
16264.9459 2.500	7.45E-05	25.5052	-19.3473	-.0003914	12706.3217	-11.5248
25788.8591 2.667	1.82E-05	22.1865	-20.9089	-.0002913	12261.2319	-7.2140
66170.7019						

2.833	-2.26E-05	18.6492	-20.8661	-.0002056	11786.8316	7.7279
56941.6376 3.000	-5.04E-05	15.3113	-19.3803	-.0001343	11339.1736	10.1017
33430.2191 3.167	-6.74E-05	12.2415	-17.6106	-7.6492E-05	10927.4676	11.1344
27536.1367 3.333	-7.59E-05	9.4709	-15.7174	-3.0922E-05	10555.8979	11.5837
25449.7967 3.500	-7.77E-05	7.0144	-13.7790	3.6776E-06	10226.4422	11.6773
25047.6831 3.667	-7.46E-05	4.8765	-11.8457	2.8634E-05	9939.7188	11.5220
25730.0787 3.833	-6.82E-05	3.0546	-9.9540	4.5280E-05	9695.3840	11.1787
27336.3339 4.000	-5.95E-05	1.5408	-8.1319	5.4925E-05	9492.3589	10.6865
29913.9326 4.167	-4.98E-05	.3225747	-6.4020	5.8836E-05	9328.9761	10.0720
33676.3607 4.333	-3.99E-05	-.6161490	-4.7832	5.8220E-05	9368.3485	9.3540
39045.2008 4.500	-3.04E-05	-1.2945	-3.2916	5.4210E-05	9459.3296	8.5452
46786.6490 4.667	-2.19E-05	-1.7345	-1.9418	4.7852E-05	9518.3341	7.6521
58346.1329 4.833	-1.45E-05	-1.9605	-.7481520	4.0097E-05	9548.6413	6.6720
76745.2097 5.000	-8.49E-06	-1.9995	.2731550	3.1786E-05	9553.8773	5.5836
109580. 5.167	-3.89E-06	-1.8818	1.1392	2.3640E-05	9538.0926	4.8094
205836. 5.333	-6.13E-07	-1.6290	1.6031	1.6271E-05	9504.1842	.7564610
205836. 5.500	1.53E-06	-1.3538	1.6591	1.0011E-05	9467.2789	-.0839544
9147.9396 5.667	2.72E-06	-1.0799	1.6391	4.9033E-06	9430.5377	-.1561984
9555.1060 5.833	3.16E-06	-.8093526	1.6103	9.3821E-07	9394.2599	-.1891237
9962.2725 6.000	3.04E-06	-.5434439	1.5788	-1.9011E-06	9358.5978	-.1889677
10369.4392 6.167	2.53E-06	-.2823394	1.5494	-3.6342E-06	9323.5800	-.1636092
10776.6061 6.333	1.83E-06	-.0255486	1.5256	-4.2804E-06	9289.1407	-.1225192
11183.7729 6.500	1.10E-06	.2278599	.9215552	-3.8558E-06	9316.2735	-7.1259
1076250. 6.667	5.41E-07	.2831403	.0368318	-2.7833E-06	9323.6874	-3.4908
1076250. 6.833	1.76E-07	.2412226	-.3486347	-1.6828E-06	9318.0656	-1.1348
1076250. 7.000	-2.03E-08	.1675850	-.4322537	-8.2476E-07	9308.1898	.1313870
1076250. 7.167	-9.92E-08	.0974597	-.3679305	-2.6848E-07	9298.7850	.6404905
1076250. 7.333	-1.10E-07	.0450462	-.2554479	3.0608E-08	9291.7556	.7093009
1076250. 7.500	-8.90E-08	.0122985	-.1484556	1.5096E-07	9287.3637	.5746066
1076250. 7.667	-5.95E-08	-.0044979	-.0685424	1.6734E-07	9286.3175	.3843514
1076250. 7.833	-3.32E-08	-.0106142	-.0186451	1.3562E-07	9287.1378	.2144165
1076250. 8.000	-1.43E-08	-.0107659	.0069257	9.0745E-08	9287.1581	.0924335

1076250. 8.167	-2.96E-09	-.0083411	.0162191	5.0643E-08	9286.8329	.0190874
1076250. 8.333	2.57E-09	-.0053792	.0164284	2.1847E-08	9286.4357	-.0165765
1076250. 8.500	4.33E-09	-.0028735	.0127188	4.5263E-09	9286.0997	-.0279386
1076250. 8.667	4.08E-09	-.0011414	.0081973	-3.9001E-09	9285.8674	-.0263194
1076250. 8.833	3.03E-09	-.0001395	.0043754	-6.5885E-09	9285.7330	-.0195436
1076250. 9.000	1.88E-09	.0003196	.0017353	-6.2105E-09	9285.7572	-.0121376
1076250. 9.167	9.56E-10	.0004413	.0002092	-4.6133E-09	9285.7735	-.0061756
1076250. 9.333	3.42E-10	.0003911	-.0004894	-2.8661E-09	9285.7667	-.0022074
1076250. 9.500	9.71E-13	.0002793	-.0006739	-1.4590E-09	9285.7517	-6.2702E-06
1076250. 9.667	-1.44E-10	.0001671	-.0005967	-5.3206E-10	9285.7367	.0009330
1076250. 9.833	-1.73E-10	8.0629E-05	-.0004258	-2.1613E-12	9285.7251	.0011175
1076250. 10.000	-1.45E-10	2.5150E-05	-.0002545	2.1985E-10	9285.7177	.0009377
1076250. 10.167	-9.98E-11	-4.3025E-06	-.0001227	2.6360E-10	9285.7149	.0006442
1076250. 10.333	-5.73E-11	-1.5856E-05	-3.8171E-05	2.2129E-10	9285.7164	.0003702
1076250. 10.500	-2.60E-11	-1.7112E-05	6.6746E-06	1.5210E-10	9285.7166	.0001679
1076250. 10.667	-6.64E-12	-1.3691E-05	2.4237E-05	8.7450E-11	9285.7161	4.2855E-05
1076250. 10.833	3.15E-12	-9.0674E-06	2.6114E-05	3.9684E-11	9285.7155	-2.0337E-05
1076250. 11.000	6.59E-12	-5.0016E-06	2.0872E-05	1.0156E-11	9285.7150	-4.2566E-05
1076250. 11.167	6.53E-12	-2.1141E-06	1.3808E-05	-4.7785E-12	9285.7146	-4.2198E-05
1076250. 11.333	5.00E-12	-3.9699E-07	7.6018E-06	-1.0049E-11	9285.7143	-3.2280E-05
1076250. 11.500	3.19E-12	4.2377E-07	3.1978E-06	-9.9925E-12	9285.7143	-2.0568E-05
1076250. 11.667	1.67E-12	6.7283E-07	5.8617E-07	-7.6910E-12	9285.7144	-1.0771E-05
1076250. 11.833	6.22E-13	6.2216E-07	-6.4587E-07	-4.9730E-12	9285.7144	-4.0134E-06
1076250. 12.000	1.03E-14	4.5948E-07	-9.8373E-07	-2.7029E-12	9285.7143	-4.0939E-08
661912. 12.167	-2.79E-13	2.9530E-07	-8.9466E-07	-1.1187E-12	9285.7143	1.1098E-06
661912. 12.333	-3.63E-13	1.6170E-07	-6.8217E-07	-1.5957E-13	9285.7143	1.4401E-06
661912. 12.500	-3.33E-13	6.7970E-08	-4.5208E-07	3.2246E-13	9285.7143	1.3210E-06
661912. 12.667	-2.55E-13	1.0881E-08	-2.5756E-07	4.8796E-13	9285.7143	1.0132E-06
661912. 12.833	-1.70E-13	-1.8074E-08	-1.1687E-07	4.7286E-13	9285.7143	6.7507E-07
661912. 13.000	-9.75E-14	-2.8262E-08	-2.8352E-08	3.7561E-13	9285.7143	3.8719E-07
661912. 13.167	-4.48E-14	-2.7671E-08	1.8733E-08	2.5822E-13	9285.7143	1.7783E-07
661912.						

13.333	-1.14E-14	-2.2118E-08	3.7332E-08	1.5372E-13	9285.7143	4.5354E-08
661912. 13.500	6.46E-15	-1.5287E-08	3.8972E-08	7.5215E-14	9285.7143	-2.5670E-08
661912. 13.667	1.37E-14	-9.1567E-09	3.2315E-08	2.3912E-14	9285.7143	-5.4218E-08
661912. 13.833	1.44E-14	-4.5249E-09	2.3019E-08	-4.8027E-15	9285.7143	-5.7325E-08
661912. 14.000	1.21E-14	-1.4817E-09	1.4254E-08	-1.7409E-14	9285.7143	-4.7860E-08
661912. 14.167	8.63E-15	2.3323E-10	7.4091E-09	-2.0030E-14	9285.7143	-3.4278E-08
661912. 14.333	5.37E-15	9.9579E-10	2.7738E-09	-1.7450E-14	9285.7143	-2.1344E-08
661912. 14.500	2.81E-15	1.1646E-09	6.3726E-11	-1.2916E-14	9285.7143	-1.1177E-08
661912. 14.667	1.07E-15	1.0221E-09	-1.2215E-09	-8.3264E-15	9285.7143	-4.2459E-09
661912. 14.833	3.89E-17	7.6072E-10	-1.5882E-09	-4.5846E-15	9285.7143	-1.5447E-10
661912. 15.000	-4.59E-16	4.9445E-10	-1.4492E-09	-1.9503E-15	9285.7143	1.8233E-09
661912. 15.167	-6.11E-16	2.7843E-10	-1.0949E-09	-3.2816E-16	9285.7143	2.4274E-09
661912. 15.333	-5.68E-16	1.2960E-10	-7.0450E-10	5.2822E-16	9285.7143	2.2578E-09
661912. 15.500	-4.35E-16	4.3387E-11	-3.7235E-10	8.9129E-16	9285.7143	1.7281E-09
661912. 15.667	-2.71E-16	5.1390E-12	-1.3852E-10	9.9314E-16	9285.7143	1.0779E-09
661912. 15.833	-1.04E-16	-3.1727E-12	-1.4250E-11	9.9726E-16	9285.7143	4.1335E-10
661912. 16.000	6.10E-17	0.0000	0.0000	9.9061E-16	9285.7143	-2.4235E-10
330956.						

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1:

Pile-head deflection	=	.00348920	m
Computed slope at pile head	=	-.00208981	
Maximum bending moment	=	35.58601513	kN- m
Maximum shear force	=	44.50000000	kN
Depth of maximum bending moment	=	1.50000000	m
Depth of maximum shear force	=	0.00000	m
Number of iterations	=	20	
Number of zero deflection points	=	10	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 2

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Specified shear force at pile head = 89.000 kN
Specified moment at pile head = .000 m- kN
Specified axial load at pile head = 1170.000 kN

(Zero moment for this load indicates free-head conditions)

Depth X m	Deflect. y m	Moment M kN- m	Shear V kN	Slope S Rad.	Total Stress kN/ m**2	Soil Res. p kN/ m
Es*h F/L kN/ m						
0.000	.014119	-3.2235E-11	89.0000	-.0067731	9285.7143	-48.6753
287.2940						
.167	.012990	15.4780	80.8231	-.0067406	11361.5379	-49.4470
634.4210						
.333	.011872	29.5699	72.5335	-.0066461	13251.4530	-50.0285
702.3301						
.500	.010775	42.2478	64.1632	-.0064953	14951.7463	-50.4150
779.8356						
.667	.009707	53.4908	55.7432	-.0062944	16459.5862	-50.6016
868.8237						
.833	.008677	63.2844	47.3130	-.0060493	17773.0433	-50.5840
971.6600						
1.000	.007690	71.6211	38.9012	-.0057662	18891.1079	-50.3578
1091.3455						
1.167	.006755	78.5003	30.5448	-.0054511	19813.7076	-49.9187
1231.7391						
1.333	.005873	83.9286	22.2798	-.0051102	20541.7230	-49.2622
1397.8777						
1.500	.005051	87.9198	14.2606	-.0047495	21077.0040	-46.9677
1549.7483						
1.667	.004290	90.5345	6.6400	-.0043750	21427.6603	-44.4802
1727.9437						
1.833	.003593	91.8394	-.5605422	-.0039922	21602.6721	-41.9259
1944.9127						
2.000	.002960	91.9046	-7.3295	-.0036066	21611.4115	-39.3021
2213.2943						
2.167	.002391	90.8028	-13.6549	-.0032231	21463.6463	-36.6025
2551.8371						
2.333	.001885	88.6099	-19.5232	-.0028465	21169.5542	-33.8165
2989.6789						
2.500	.001442	85.4052	-24.9183	-.0024813	20739.7549	-30.9252
3574.9430						
2.667	.001058	81.2715	-29.8200	-.0021315	20185.3717	-27.8950
4393.9654						
2.833	.000731	76.2965	-34.1999	-.0018008	19518.1469	-24.6634
5621.2000						
3.000	.000458	70.5739	-38.0135	-.0014925	18750.6659	-21.0997
7681.2187						
3.167	.000234	64.2074	-41.1772	-.0012096	17896.8329	-16.8656
12025.2851						
3.333	5.46E-05	57.3199	-43.4488	-.0009546	16973.1206	-10.3931
31722.8943						
3.500	-8.44E-05	50.0968	-43.3146	-.0007291	16004.3973	12.0037
23691.8964						
3.667	-.000188	43.1661	-41.0067	-.0005334	15074.8928	15.6906
13877.4846						
3.833	-.000262	36.6359	-38.2393	-.0003659	14199.1033	17.5190
11134.1480						
4.000	-.000310	30.5624	-35.2350	-.0002249	13384.5570	18.5325
9950.5393						
4.167	-.000337	24.9786	-32.1030	-.0001083	12635.6964	19.0513
9416.4730						

4.333	-.000347	19.9036	-28.9133	-1.4100E-05	11955.0671	19.2253
9247.0992						
4.500	-.000342	15.3463	-25.7162	5.9883E-05	11343.8745	19.1397
9330.1482						
4.667	-.000327	11.3082	-22.5505	.0001158	10802.3001	18.8490
9620.3196						
4.833	-.000303	7.7843	-19.4472	.0001559	10329.7042	18.3905
10106.1511						
5.000	-.000275	4.7650	-16.4321	.0001822	9924.7656	17.7910
10798.8094						
5.167	-.000243	2.2359	-13.5270	.0001969	9585.5823	17.0703
11730.0489						
5.333	-.000209	.1791952	-10.7509	.0002020	9309.7469	16.2424
12956.2704						
5.500	-.000175	-1.4265	-8.5961	.0001994	9477.0273	9.6150
9146.1455						
5.667	-.000142	-2.7639	-7.1142	.0001906	9656.3967	8.1674
9553.9601						
5.833	-.000112	-3.8722	-5.8774	.0001767	9805.0358	6.6751
9961.5919						
6.000	-8.36E-05	-4.7920	-4.8877	.0001585	9928.3824	5.2007
10369.0702						
6.167	-5.89E-05	-5.5633	-4.1372	.0001367	10031.8282	3.8056
10776.4289						
6.333	-3.80E-05	-6.2243	-3.6075	.0001120	10120.4860	2.5508
11183.7012						
6.500	-2.15E-05	-6.8095	-.3701813	8.4644E-05	10198.9580	36.2969
281063.						
6.667	-9.80E-06	-6.3807	5.1391	5.6961E-05	10141.4622	29.8143
507140.						
6.833	-2.54E-06	-5.1186	8.9887	3.2826E-05	9972.1958	16.3810
1076250.						
7.000	1.14E-06	-3.3973	9.7383	1.4952E-05	9741.3419	-7.3853
1076250.						
7.167	2.45E-06	-1.8784	7.8059	3.8796E-06	9537.6280	-15.8036
1076250.						
7.333	2.44E-06	-.7968451	5.1776	-1.7352E-06	9392.5824	-15.7361
1076250.						
7.500	1.87E-06	-.1517969	2.8606	-3.7262E-06	9306.0724	-12.0686
1076250.						
7.667	1.19E-06	.1581358	1.2119	-3.7129E-06	9306.9225	-7.7154
1076250.						
7.833	6.31E-07	.2536215	.2292386	-2.8487E-06	9319.7285	-4.0766
1076250.						
8.000	2.45E-07	.2356596	-.2424510	-1.8218E-06	9317.3196	-1.5836
1076250.						
8.167	2.40E-08	.1735150	-.3873595	-9.6300E-07	9308.9851	-.1552670
1076250.						
8.333	-7.58E-08	.1069154	-.3595306	-3.7443E-07	9300.0531	.4892134
1076250.						
8.500	-1.01E-07	.0538175	-.2645393	-3.7077E-08	9292.9320	.6506831
1076250.						
8.667	-8.81E-08	.0187501	-.1628972	1.1523E-07	9288.2289	.5690219
1076250.						
8.833	-6.24E-08	-.0005265	-.0819242	1.5348E-07	9285.7849	.4026537
1076250.						
9.000	-3.70E-08	-.0086179	-.0284811	1.3428E-07	9286.8701	.2386641
1076250.						
9.167	-1.76E-08	-.0100726	.0008749	9.5056E-08	9287.0652	.1136074
1076250.						
9.333	-5.27E-09	-.0083633	.0131801	5.6363E-08	9286.8359	.0340556
1076250.						
9.500	1.19E-09	-.0057012	.0153753	2.6844E-08	9286.4789	-.0077134

1076250.						
9.667	3.67E-09	-.0032487	.0127554	8.0599E-09	9286.1500	-.0237261
1076250.						
9.833	3.88E-09	-.0014525	.0086897	-1.8070E-09	9285.9091	-.0250624
1076250.						
10.000	3.07E-09	-.0003514	.0049481	-5.5931E-09	9285.7614	-.0198365
1076250.						
10.167	2.02E-09	.0001990	.0022098	-5.9130E-09	9285.7410	-.0130231
1076250.						
10.333	1.10E-09	.0003875	.0005321	-4.6820E-09	9285.7663	-.0071088
1076250.						
10.500	4.56E-10	.0003782	-.0003057	-3.0750E-09	9285.7650	-.0029450
1076250.						
10.667	7.59E-11	.0002868	-.0005919	-1.6793E-09	9285.7527	-.0004899
1076250.						
10.833	-1.04E-10	.0001815	-.0005770	-6.9632E-10	9285.7386	.0006696
1076250.						
11.000	-1.56E-10	9.4743E-05	-.0004371	-1.1644E-10	9285.7270	.0010089
1076250.						
11.167	-1.43E-10	3.5890E-05	-.0002763	1.5773E-10	9285.7191	.0009202
1076250.						
11.333	-1.04E-10	2.5688E-06	-.0001439	2.3845E-10	9285.7146	.0006694
1076250.						
11.500	-6.30E-11	-1.2160E-05	-5.4171E-05	2.1832E-10	9285.7159	.0004070
1076250.						
11.667	-3.09E-11	-1.5573E-05	-3.6342E-06	1.6011E-10	9285.7164	.0001995
1076250.						
11.833	-9.65E-12	-1.3433E-05	1.8182E-05	9.9232E-11	9285.7161	6.2328E-05
1076250.						
12.000	2.19E-12	-9.5512E-06	2.2652E-05	5.0992E-11	9285.7156	-8.6885E-06
661912.						
12.167	7.35E-12	-5.9025E-06	1.9497E-05	1.8558E-11	9285.7151	-2.9172E-05
661912.						
12.333	8.37E-12	-3.0594E-06	1.4295E-05	-2.5169E-13	9285.7147	-3.3256E-05
661912.						
12.500	7.26E-12	-1.1375E-06	9.1204E-06	-9.0600E-12	9285.7144	-2.8839E-05
661912.						
12.667	5.35E-12	-1.5704E-08	4.9454E-06	-1.1480E-11	9285.7143	-2.1262E-05
661912.						
12.833	3.43E-12	5.1547E-07	2.0368E-06	-1.0431E-11	9285.7144	-1.3641E-05
661912.						
13.000	1.88E-12	6.6730E-07	2.7906E-07	-7.9490E-12	9285.7144	-7.4522E-06
661912.						
13.167	7.85E-13	6.1159E-07	-6.0177E-07	-5.2649E-12	9285.7144	-3.1177E-06
661912.						
13.333	1.21E-13	4.6877E-07	-9.0179E-07	-2.9974E-12	9285.7143	-4.8249E-07
661912.						
13.500	-2.14E-13	3.1216E-07	-8.7113E-07	-1.3584E-12	9285.7143	8.5031E-07
661912.						
13.667	-3.31E-13	1.7892E-07	-6.9063E-07	-3.2770E-13	9285.7143	1.3158E-06
661912.						
13.833	-3.23E-13	8.2079E-08	-4.7397E-07	2.2008E-13	9285.7143	1.2841E-06
661912.						
14.000	-2.58E-13	2.0843E-08	-2.8159E-07	4.3610E-13	9285.7143	1.0244E-06
661912.						
14.167	-1.78E-13	-1.1954E-08	-1.3732E-07	4.5475E-13	9285.7143	7.0681E-07
661912.						
14.333	-1.06E-13	-2.5108E-08	-4.3218E-08	3.7696E-13	9285.7143	4.2242E-07
661912.						
14.500	-5.23E-14	-2.6507E-08	9.2988E-09	2.6863E-13	9285.7143	2.0778E-07
661912.						
14.667	-1.68E-14	-2.2113E-08	3.2180E-08	1.6659E-13	9285.7143	6.6794E-08
661912.						

14.833	3.21E-15	-1.5846E-08	3.6684E-08	8.6918E-14	9285.7143	-1.2751E-08
661912.						
15.000	1.22E-14	-9.9193E-09	3.1598E-08	3.2843E-14	9285.7143	-4.8270E-08
661912.						
15.167	1.42E-14	-5.3256E-09	2.2890E-08	8.4657E-16	9285.7143	-5.6229E-08
661912.						
15.333	1.24E-14	-2.2895E-09	1.4088E-08	-1.5136E-14	9285.7143	-4.9391E-08
661912.						
15.500	9.11E-15	-6.2358E-10	6.9565E-09	-2.1250E-14	9285.7143	-3.6192E-08
661912.						
15.667	5.35E-15	3.7573E-11	2.1689E-09	-2.2480E-14	9285.7143	-2.1259E-08
661912.						
15.833	1.62E-15	1.0816E-10	-1.3866E-10	-2.2174E-14	9285.7143	-6.4316E-09
661912.						
16.000	-2.04E-15	0.0000	0.0000	-2.1947E-14	9285.7143	8.0956E-09
330956.						

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 2:

Pile-head deflection	=	.01411890	m
Computed slope at pile head	=	-.00677310	
Maximum bending moment	=	91.90456467	kN- m
Maximum shear force	=	89.00000000	kN
Depth of maximum bending moment	=	2.00000000	m
Depth of maximum shear force	=	0.00000	m
Number of iterations	=	25	
Number of zero deflection points	=	9	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 3

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Specified shear force at pile head = 133.500 kN
Specified moment at pile head = .000 m- kN
Specified axial load at pile head = 1170.000 kN

(Zero moment for this load indicates free-head conditions)

Depth X m	Deflect. y m	Moment M kN- m	Shear V kN	Slope S Rad.	Total Stress kN/ m**2	Soil Res. p kN/ m
Es*h F/L kN/ m						
0.000	.032182	1.3886E-10	133.5000	-.0135583	9285.7143	-64.0588
165.8744						
.167	.029923	24.0042	122.7198	-.0135080	12505.0116	-65.3031
363.7325						
.333	.027680	46.1747	111.7498	-.0133607	15478.3942	-66.3377
399.4361						
.500	.025469	66.4647	100.6252	-.0131243	18199.5738	-67.1572

439.4684 .667	.023305	84.8349	89.3824	-.0128067	20663.2700	-67.7564
484.5630 .833	.021200	101.2535	78.0585	-.0124161	22865.2341	-68.1304
535.6107 1.000	.019166	115.6967	66.6914	-.0119608	24802.2704	-68.2745
593.7028 1.167	.017213	128.1487	55.3199	-.0114490	26472.2568	-68.1841
660.1885 1.333	.015350	138.6018	43.9833	-.0108892	27874.1629	-67.8548
736.7538 1.500	.013584	147.0565	32.8859	-.0102896	29008.0681	-65.3136
801.3794 1.667	.011920	153.5767	22.2323	-.0096586	29882.5112	-62.5305
874.3024 1.833	.010364	158.2342	12.0479	-.0090042	30507.1445	-59.6818
959.7593 2.000	.008919	161.1043	2.3438	-.0083340	30892.0692	-56.7675
1060.8357 2.167	.007586	162.2657	-6.8690	-.0076553	31047.8272	-53.7863
1181.6955 2.333	.006367	161.8002	-15.5792	-.0069751	30985.3972	-50.7353
1328.0974 2.500	.005261	159.7929	-23.7745	-.0063002	30716.1965	-47.6091
1508.2438 2.667	.004267	156.3324	-31.4418	-.0056367	30252.0915	-44.3988
1734.2507 2.833	.003382	151.5106	-38.5659	-.0049906	29605.4220	-41.0896
2024.8572 3.000	.002603	145.4234	-45.1281	-.0043674	28789.0453	-37.6571
2410.8309 3.167	.001926	138.1712	-51.1045	-.0037722	27816.4169	-34.0603
2946.9419 3.333	.001346	129.8597	-56.4616	-.0032096	26701.7326	-30.2240
3742.5989 3.500	.000856	120.6024	-61.1466	-.0026839	25460.1963	-25.9965
5059.0345 3.667	.000451	110.5242	-65.0628	-.0021988	24108.5736	-20.9984
7754.7538 3.833	.000123	99.7723	-67.9490	-.0017575	22666.5907	-13.6349
18402.3523 4.000	-.000135	88.5600	-67.9166	-.0013622	21162.8597	14.0227
17373.5082 4.167	-.000331	77.6647	-65.1709	-.0010133	19701.6469	18.9257
9541.7702 4.333	-.000472	67.2316	-61.8174	-.0007092	18302.4140	21.3163
7522.2365 4.500	-.000567	57.3355	-58.1531	-.0004478	16975.2123	22.6553
6659.6327 4.667	-.000622	48.0218	-54.3185	-.0002266	15726.1163	23.3602
6263.9313 4.833	-.000643	39.3177	-50.4035	-4.3334E-05	14558.7744	23.6202
6126.8808 5.000	-.000636	31.2376	-46.4735	.0001047	13475.1106	23.5399
6168.7745 5.167	-.000608	23.7857	-42.5798	.0002202	12475.7131	23.1845
6359.4434 5.333	-.000563	16.9584	-38.7646	.0003057	11560.0756	22.5971
6694.3948 5.500	-.000506	10.7449	-34.5723	.0003639	10726.7594	27.7112
9133.0201 5.667	-.000441	5.2924	-30.1572	.0003975	9995.4989	25.2704
9544.1246						

5.833	-.000373	.5374913	-26.1938	.0004098	9357.7994	22.2894
9954.6742 6.000	-.000305	-3.5987	-22.7574	.0004034	9768.3511	18.9481
10364.5337 6.167	-.000239	-7.2056	-19.8924	.0003807	10252.0887	15.4318
10773.6871 6.333	-.000178	-10.3780	-17.6123	.0003438	10677.5457	11.9292
11182.2020 6.500	-.000124	-13.2105	-11.9306	.0002943	11057.4224	56.2507
75523.9406 6.667	-7.97E-05	-14.4696	-3.0469	.0002362	11226.2932	50.3539
105296. 6.833	-4.54E-05	-14.3182	4.7947	.0001758	11205.9875	43.7462
160564. 7.000	-2.11E-05	-12.9399	11.4510	.0001185	11021.1384	36.1287
285043. 7.167	-5.89E-06	-10.5474	17.6331	6.9251E-05	10700.2750	38.0570
1076250. 7.333	1.96E-06	-7.0892	19.7505	3.2235E-05	10236.4766	-12.6491
1076250. 7.500	4.85E-06	-3.9765	16.0857	9.0099E-06	9819.0230	-31.3284
1076250. 7.667	4.96E-06	-1.7308	10.8047	-2.9688E-06	9517.8432	-32.0429
1076250. 7.833	3.86E-06	-.3737968	6.0563	-7.3860E-06	9335.8457	-24.9380
1076250. 8.000	2.50E-06	.2908220	2.6328	-7.5602E-06	9324.7176	-16.1444
1076250. 8.167	1.34E-06	.5067460	.5653530	-5.8862E-06	9353.6761	-8.6647
1076250. 8.333	5.38E-07	.4815686	-.4462340	-3.8119E-06	9350.2994	-3.4743
1076250. 8.500	7.12E-08	.3594880	-.7740532	-2.0467E-06	9333.9267	-.4595062
1076250. 8.667	-1.44E-07	.2243491	-.7347408	-8.2136E-07	9315.8027	.9312546
1076250. 8.833	-2.03E-07	.1148948	-.5480967	-1.0935E-07	9301.1233	1.3085
1076250. 9.000	-1.81E-07	.0416929	-.3418374	2.1930E-07	9291.3059	1.1666
1076250. 9.167	-1.30E-07	.0008634	-.1749142	3.0861E-07	9285.8301	.8364417
1076250. 9.333	-7.78E-08	-.0167322	-.0633486	2.7531E-07	9287.9583	.5023465
1076250. 9.500	-3.78E-08	-.0203601	-.0011662	1.9746E-07	9288.4449	.2438423
1076250. 9.667	-1.20E-08	-.0171979	.0255973	1.1863E-07	9288.0208	.0773188
1076250. 9.833	1.78E-09	-.0118740	.0310814	5.7614E-08	9287.3068	-.0115096
1076250. 10.000	7.23E-09	-.0068600	.0262310	1.8295E-08	9286.6343	-.0466950
1076250. 10.167	7.88E-09	-.0031374	.0180990	-2.6878E-09	9286.1351	-.0508893
1076250. 10.333	6.34E-09	-.0008259	.0104491	-1.1006E-08	9285.8251	-.0409096
1076250. 10.500	4.21E-09	.0003499	.0047734	-1.2005E-08	9285.7612	-.0271986
1076250. 10.667	2.33E-09	.0007699	.0012511	-9.6551E-09	9285.8175	-.0150683
1076250. 10.833	9.94E-10	.0007707	-.0005392	-6.4217E-09	9285.8176	-.0064161
1076250. 11.000	1.93E-10	.0005926	-.0011777	-3.5604E-09	9285.7938	-.0012455

1076250. 11.167	-1.93E-10	.0003795	-.0011775	-1.5201E-09	9285.7652	.0012477
1076250. 11.333	-3.14E-10	.0002007	-.0009047	-3.0230E-10	9285.7412	.0020264
1076250. 11.500	-2.94E-10	7.8053E-05	-.0005776	2.8278E-10	9285.7248	.0018984
1076250. 11.667	-2.20E-10	8.0600E-06	-.0003013	4.6351E-10	9285.7154	.0014177
1076250. 11.833	-1.39E-10	-2.2558E-05	-.0001081	4.3308E-10	9285.7173	.0009007
1076250. 12.000	-7.52E-11	-2.8139E-05	-8.1524E-06	3.2668E-10	9285.7181	.0002986
661912. 12.167	-3.06E-11	-2.5403E-05	2.6852E-05	2.1430E-10	9285.7177	.0001215
661912. 12.333	-3.75E-12	-1.9272E-05	3.8216E-05	1.2054E-10	9285.7169	1.4898E-05
661912. 12.500	9.60E-12	-1.2711E-05	3.6281E-05	5.3413E-11	9285.7160	-3.8115E-05
661912. 12.667	1.41E-11	-7.1992E-06	2.8454E-05	1.1624E-11	9285.7153	-5.5811E-05
661912. 12.833	1.35E-11	-3.2314E-06	1.9344E-05	-1.0268E-11	9285.7147	-5.3503E-05
661912. 13.000	1.06E-11	-7.4720E-07	1.1367E-05	-1.8618E-11	9285.7144	-4.2218E-05
661912. 13.167	7.27E-12	5.6494E-07	5.4445E-06	-1.9001E-11	9285.7144	-2.8856E-05
661912. 13.333	4.30E-12	1.0751E-06	1.6179E-06	-1.5559E-11	9285.7144	-1.7064E-05
661912. 13.500	2.08E-12	1.1103E-06	-4.9230E-07	-1.0972E-11	9285.7144	-8.2586E-06
661912. 13.667	6.39E-13	9.1523E-07	-1.3920E-06	-6.7211E-12	9285.7144	-2.5383E-06
661912. 13.833	-1.61E-13	6.4891E-07	-1.5503E-06	-3.4382E-12	9285.7144	6.3897E-07
661912. 14.000	-5.07E-13	3.9980E-07	-1.3293E-06	-1.2372E-12	9285.7143	2.0133E-06
661912. 14.167	-5.73E-13	2.0629E-07	-9.7179E-07	3.4870E-14	9285.7143	2.2768E-06
661912. 14.333	-4.95E-13	7.5857E-08	-6.1813E-07	6.2705E-13	9285.7143	1.9671E-06
661912. 14.500	-3.64E-13	3.8504E-12	-3.3364E-07	7.8626E-13	9285.7143	1.4467E-06
661912. 14.667	-2.33E-13	-3.5663E-08	-1.3589E-07	7.1142E-13	9285.7143	9.2626E-07
661912. 14.833	-1.27E-13	-4.5571E-08	-1.6629E-08	5.4093E-13	9285.7143	5.0491E-07
661912. 15.000	-5.29E-14	-4.1417E-08	4.2961E-08	3.5835E-13	9285.7143	2.1017E-07
661912. 15.167	-7.68E-15	-3.1391E-08	6.3018E-08	2.0555E-13	9285.7143	3.0510E-08
661912. 15.333	1.56E-14	-2.0491E-08	6.0400E-08	9.6656E-14	9285.7143	-6.1934E-08
661912. 15.500	2.45E-14	-1.1295E-08	4.7118E-08	2.9943E-14	9285.7143	-9.7445E-08
661912. 15.667	2.56E-14	-4.7966E-09	3.0533E-08	-3.8302E-15	9285.7143	-1.0157E-07
661912. 15.833	2.33E-14	-1.1158E-09	1.4371E-08	-1.6239E-14	9285.7143	-9.2375E-08
661912. 16.000	2.02E-14	0.0000	0.0000	-1.8581E-14	9285.7143	-8.0076E-08
330956.						

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 3:

Pile-head deflection	=	.03218240	m
Computed slope at pile head	=	-.01355833	
Maximum bending moment	=	162.26567	kN- m
Maximum shear force	=	133.50000	kN
Depth of maximum bending moment	=	2.16666667	m
Depth of maximum shear force	=	0.00000	m
Number of iterations	=	28	
Number of zero deflection points	=	8	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 4

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Specified shear force at pile head = 178.000 kN
Specified moment at pile head = .000 m- kN
Specified axial load at pile head = 1170.000 kN

(Zero moment for this load indicates free-head conditions)

Depth X m	Deflect. y m	Moment M kN- m	Shear V kN	Slope S Rad.	Total Stress kN/ m**2	Soil Res. Es*h p F/L kN/ m
0.000	.058738	-1.9837E-11	178.0000	-.0224917	9285.7143	-74.0443
105.0490 .167	.054989	33.0242	165.3849	-.0224224	13714.7199	-77.3367
234.3993 .333	.051264	63.8731	152.2211	-.0222191	17851.9909	-80.6291
262.1381 .500	.047583	92.4300	138.6093	-.0218910	21681.8751	-82.7125
289.7135 .667	.043967	118.6137	124.7397	-.0214481	25193.4763	-83.7223
317.3700 .833	.040434	142.3746	110.7220	-.0209003	28380.1579	-84.4903
348.2683 1.000	.037000	163.6721	96.5969	-.0202580	31236.4505	-85.0116
382.9355 1.167	.033681	182.4742	82.4058	-.0195315	33758.0739	-85.2816
422.0075 1.333	.030489	198.7580	68.1910	-.0187313	35941.9587	-85.2957
466.2573 1.500	.027437	212.5097	54.2029	-.0178682	37786.2647	-82.5613
501.5186 1.667	.024533	223.7942	40.6945	-.0169524	39299.6685	-79.5396
540.3485 1.833	.021786	232.6860	27.6952	-.0159944	40492.1887	-76.4525
584.8670 2.000	.019202	239.2637	15.2156	-.0150038	41374.3496	-73.3015

Depth X (m)	Deflect. y (m)	Moment M (kN- m)	Shear V (kN)	Slope S (Rad.)	Total Stress (kN/ m**2)	Soil Res. p (kN/ m)	Es*h F/L (kN/ m)
							636.2323
2.167	.016785	243.6094	3.2666	-.0139904	41957.1681	-70.0871	695.9292
2.333	.014539	245.8088	-8.1414	-.0129632	42252.1418	-66.8094	5.8903
2.500	.012464	245.9512	-18.9978	-.0119311	42271.2400	-63.4673	8.6773
2.667	.010561	244.1293	-29.2916	-.0109025	42026.8979	-60.0583	947.7567
2.833	.008830	240.4393	-39.0113	-.0098855	41532.0152	-56.5781	1067.9391
3.000	.007266	234.9809	-48.1445	-.0088877	40799.9621	-53.0197	16.1039
3.167	.005867	227.8573	-56.6771	-.0079162	39844.5944	-49.3715	02.4627
3.333	.004628	219.1759	-64.5927	-.0069780	38680.2846	-45.6160	1642.9038
3.500	.003541	209.0479	-71.8711	-.0060792	37321.9768	-41.7240	1963.7121
3.667	.002601	197.5897	-78.4853	-.0052258	35785.2821	-37.6464	12.1492
3.833	.001799	184.9242	-84.3970	-.0044230	34086.6490	-33.2945	83.9842
4.000	.001127	171.1824	-89.5454	-.0036756	32243.6804	-28.4857	4213.1845
4.167	.000574	156.5092	-93.8151	-.0029878	30275.7995	-22.7518	6604.6785
4.333	.000131	141.0759	-96.8696	-.0023632	28205.9779	-13.9013	697.5042
4.500	-.000214	125.1410	-96.6645	-.0018045	26068.8815	16.3619	2766.4373
4.667	-.000471	109.5581	-93.5268	-.0013119	23979.0020	21.2909	7540.6822
4.833	-.000651	94.4770	-89.7757	-.0008837	21956.4124	23.7225	6074.2476
5.000	-.000765	79.9775	-85.7125	-.0005175	20011.8269	25.0362	53.5781
5.167	-.000823	66.1080	-81.4881	-.0002109	18151.7315	25.6565	193.1440
5.333	-.000835	52.0971	77.2016	3.8862E-05	16379.9592	25.7808	5143.1951
5.500	-.000810	40.3590	-71.3617	.0002346	14698.4237	44.2981	9109.7372
5.667	-.000757	29.0184	-64.0647	.0003802	13177.4855	43.2664	522.8573
5.833	-.000684	18.8558	-57.0621	.0004807	11814.5462	40.7641	936.8210
6.000	-.000597	9.8102	-50.5754	.0005408	10601.3992	37.0767	10350.6354
6.167	-.000503	1.7864	-44.7762	.0005652	9525.3006	32.5131	10763.6383
6.333	-.000409	-5.3356	-39.7835	.0005577	10001.2986	27.3991	1175.4816
6.500	-.000318	-11.6923	-31.5721	.0005220	10853.8113	71.1385	7339.5415
6.667	-.000235	-16.0632	-20.1476	.0004637	11440.0217	65.9554	46852.4970
6.833	-.000163	-18.5890	-9.6338	.0003910	11778.7590	60.2105	61583.9756
7.000	-.000104	-19.4270	-.1284270	.0003112	11891.1477	53.8535	6068.9270
7.167	-5.92E-05	-18.7532	8.2550	.0002311	11800.7786	46.7473	31589.

Depth X (m)	Deflect. y (m)	Moment M (kN- m)	Shear V (kN)	Slope S (Rad.)	Total Stress (kN/ m**2)	Soil Res. p (kN/ m)	Es*h F/L (kN/ m)
7.333	-2.73E-05	-16.7655	15.3593	.0001565	11534.1989	38.5050	235474.
7.500	-7.03E-06	-13.6944	22.3498	9.2614E-05	11122.3327	45.3802	1076250.
7.667	3.62E-06	-9.3517	24.1846	4.4244E-05	10539.9040	-23.3616	1076250.
7.833	7.72E-06	-5.6502	19.8969	1.2758E-05	10043.4798	-28.0911	606414.
8.000	7.87E-06	-2.7243	15.2038	-4.8182E-06	9651.0857	-28.2266	597730.
8.167	6.11E-06	-.5803520	9.[illegible]612	-1.1754E-05	9363.5477	-39.4843	1076250.
8.333	3.95E-06	.4673189	4.1439	-1.1991E-05	9348.3883	-25.5229	1076250.
8.500	2.12E-06	.8056367	.8776224	-9.3197E-06	9393.7615	-13.6728	1076250.
8.667	8.46E-07	.7634944	-.7169737	-6.0264E-06	9388.1096	-5.4623	1076250.
8.833	1.09E-07	.5689958	-1.2306	-3.2297E-06	9362.0246	-.7010622	1076250.
9.000	-2.31E-07	.3545575	-1.1649	-1.2914E-06	9333.2654	1.4897	1076250.
9.167	-3.22E-07	.1812083	-.8675198	-1.6689E-07	9310.0169	2.0786	1076250.
9.333	-2.86E-07	.0654493	-.5402306	3.5080E-07	9294.4920	1.8489	1076250.
9.500	-2.05E-07	.0009946	-.2758661	4.9025E-07	9285.8477	1.3235	1076250.
9.667	-1.23E-07	-.0266973	-.0994408	4.3631E-07	9289.2948	.7936111	1076250.
9.833	-5.95E-08	-.0323225	-.0012783	3.1244E-07	9290.0492	.3843397	1076250.
10.000	-1.88E-08	-.0272452	.0408410	1.8742E-07	9289.3683	.1210915	1076250.
10.167	2.95E-09	-.0187820	.0493427	9.0813E-08	9288.2332	-.0190712	1076250.
10.333	1.15E-08	-.0108331	.0415549	2.8656E-08	9287.1672	-.0743828	1076250.
10.500	1.25E-08	-.0049415	.0286268	-4.4516E-09	9286.3770	-.0807539	1076250.
10.667	1.00E-08	-.0012891	.0164972	-1.7528E-08	9285.8872	-.0648008	1076250.
10.833	6.66E-09	.0005644	.0075118	-1.9049E-08	9285.7900	-.0430241	1076250.
11.000	3.69E-09	.0012223	.0019434	-1.5299E-08	9285.8782	-.0237972	1076250.
11.167	1.56E-09	.0012182	-.0008807	-1.0177E-08	9285.8777	-.0100924	1076250.
11.333	2.93E-10	.0009327	-.0018794	-5.6629E-09	9285.8394	-.0018909	1076250.
11.500	-3.25E-10	.0005939	-.0018622	-2.4588E-09	9285.7939	.0020970	1076250.
11.667	-5.27E-10	.0003129	-.0014040	-5.5545E-10	9285.7563	.0034016	1076250.
11.833	-5.10E-10	.0001262	-.0008461	3.6612E-10	9285.7312	.0032926	1076250.
12.000	-4.05E-10	3.0751E-05	-.0004378	6.9545E-10	9285.7184	.0016074	661912.
12.167	-2.78E-10	-2.0035E-05	-.0002118	7.1794E-10	9285.7170	.0011043	661912.
12.333	-1.65E-10	-4.0128E-05	-6.5021E-05	5.9167E-10	9285.7197	.0006570	661912.
12.500	-8.08E-11	-4.1939E-05	1.6483E-05	4.1942E-10	9285.7199	.0003211	

Depth X (m)	Deflect. y (m)	Moment M (kN- m)	Shear V (kN)	Slope S (Rad.)	Total Stress (kN/ m**2)	Soil Res. p (kN/ m)	Es*h F/L (kN/ m)
							661912.
12.667	-2.56E-11	-3.4797E-05	5.1717E-05	2.5837E-10	9285.7190	.0001017	661912.
12.833	5.28E-12	-2.4801E-05	5.8448E-05	1.3328E-10	9285.7176	-2.0953E-05	661912.
13.000	1.88E-11	-1.5366E-05	5.0475E-05	4.8980E-11	9285.7163	-7.4720E-05	661912.
13.167	2.16E-11	-7.9949E-06	3.7099E-05	-5.1372E-14	9285.7154	-8.5793E-05	661912.
13.333	1.88E-11	-3.0000E-06	2.3729E-05	-2.3128E-11	9285.7147	-7.4652E-05	661912.
13.500	1.39E-11	-7.6324E-08	1.2910E-05	-2.9584E-11	9285.7143	-5.5176E-05	661912.
13.667	8.94E-12	1.3148E-06	5.3544E-06	-2.6985E-11	9285.7145	-3.5488E-05	661912.
13.833	4.90E-12	1.7190E-06	7.7604E-07	-2.0618E-11	9285.7145	-1.9453E-05	661912.
14.000	2.06E-12	1.5815E-06	-1.5278E-06	-1.3691E-11	9285.7145	-8.1935E-06	661912.
14.167	3.34E-13	1.2151E-06	-2.3213E-06	-7.8213E-12	9285.7144	-1.3284E-06	661912.
14.333	-5.44E-13	8.1077E-07	-2.2519E-06	-3.5694E-12	9285.7144	2.1605E-06	661912.
14.500	-8.55E-13	4.6582E-07	-1.7888E-06	-8.9005E-13	9285.7143	3.3968E-06	661912.
14.667	-8.41E-13	2.1484E-07	-1.2275E-06	5.3853E-13	9285.7143	3.3388E-06	661912.
14.833	-6.76E-13	5.6435E-08	-7.2564E-07	1.1079E-12	9285.7143	2.6839E-06	661912.
15.000	-4.71E-13	-2.7467E-08	-3.4597E-07	1.1687E-12	9285.7143	1.8722E-06	661912.
15.167	-2.86E-13	-5.9343E-08	-9.5227E-08	9.8650E-13	9285.7143	1.1367E-06	661912.
15.333	-1.43E-13	-5.9594E-08	4.6685E-08	7.3687E-13	9285.7143	5.6620E-07	661912.
15.500	-4.06E-14	-4.4069E-08	1.0731E-07	5.1930E-13	9285.7143	1.6125E-07	661912.
15.667	3.05E-14	-2.4028E-08	1.1064E-07	3.7638E-13	9285.7143	-1.2126E-07	661912.
15.833	8.49E-14	-7.3365E-09	7.2448E-08	3.1055E-13	9285.7143	-3.3701E-07	661912.
16.000	1.34E-13	0.0000	0.0000	2.9515E-13	9285.7143	-5.3237E-07	330956.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 4:

Pile-head deflection	=	.05873788	m
Computed slope at pile head	=	-.02249174	
Maximum bending moment	=	245.95123	kN- m
Maximum shear force	=	178.00000	kN
Depth of maximum bending moment	=	2.50000000	m
Depth of maximum shear force	=	0.00000	m
Number of iterations	=	32	
Number of zero deflection points	=	8	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 5

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Specified shear force at pile head = 222.500 kN
Specified moment at pile head = .000 m- kN
Specified axial load at pile head = 1170.000 kN

(Zero moment for this load indicates free-head conditions)

Depth X (m)	Deflect. y (m)	Moment M (kN- m)	Shear V (kN)	Slope S (Rad.)	Total Stress (kN/ m**2)	Soil Res. p (kN/ m)	Es*h F/L (kN/ m)
0.000	.111101	2.9755E-10	222.5000	-.0380113	9285.7143	-74.0442	55.5381
.167	.104766	43.4671	209.8849	-.0379201	15115.2706	-77.3366	123.0307
.333	.098461	84.7505	196.7211	-.0376509	20651.9462	-80.6290	136.4818
.500	.092216	123.7247	183.0086	-.0372134	25878.9436	-83.9214	151.6759
.667	.086057	160.2666	168.7474	-.0366174	30779.7189	-87.2138	168.9076
.833	.080010	194.2546	153.9374	-.0358733	35337.9950	-90.5062	188.5313
1.000	.074099	225.5696	138.5786	-.0349921	39537.7753	-93.7986	210.9760
1.167	.068346	254.0944	122.6711	-.0339854	43363.3567	-97.0910	236.7641
1.333	.062770	279.7143	106.2149	-.0328651	46799.3421	-100.3834	266.5357
1.500	.057391	302.3168	89.4628	-.0316435	49830.6537	-100.6427	292.2730
1.667	.052223	321.8762	72.6890	-.0303334	52453.8441	-100.6427	321.1976
1.833	.047280	338.3765	56.0536	-.0289477	54666.7663	-98.9817	348.9226
2.000	.042573	351.8503	39.8400	-.0274990	56473.7969	-95.5820	374.1850
2.167	.038113	362.3811	24.1981	-.0260000	57886.1219	-92.1204	402.8353
2.333	.033907	370.0563	9.1382	-.0244627	58915.4811	-88.5983	435.4998
2.500	.029959	374.9676	-5.3298	-.0228991	59574.1531	-85.0171	472.9622
2.667	.026274	377.2104	-19.1960	-.0213204	59874.9401	-81.3775	516.2154
2.833	.022852	376.8839	-32.4507	-.0197377	59831.1551	-77.6796	566.5337
3.000	.019695	374.0912	-45.0843	-.0181615	59456.6099	-73.9229	625.5790
3.167	.016798	368.9388	-57.0866	-.0166020	58765.6065	-70.1057	695.5573
3.333	.014161	361.5371	-68.4476	-.0150689	57772.9306	-66.2252	779.4593
3.500	.011775	351.9998	-79.1560	-.0135713	56493.8515	-62.2764	

881.4415						
3.667	.009637	340.4446	-89.2000	-.0121180	54944.1268	-58.2515
1007.4570						
3.833	.007736	326.9925	-98.5658	-.0107172	53140.0194	-54.1384
1166.3531						
4.000	.006064	311.7690	-107.2372	-.0093766	51098.3288	-49.9181
1371.9079						
4.167	.004611	294.9036	-115.1937	-.0081033	48836.4485	-45.5601
1646.9253						
4.333	.003363	276.5314	-122.4081	-.0069039	46372.4655	-41.0126
2032.4002						
4.500	.002309	256.7935	-128.8410	-.0057846	43725.3376	-36.1820
2611.3189						
4.667	.001435	235.8403	-134.4292	-.0047506	40915.2276	-30.8760
3585.9722						
4.833	.000726	213.8365	-139.0521	-.0038069	37964.2025	-24.5999
5649.2333						
5.000	.000166	190.9743	-142.3561	-.0029572	34898.0589	-15.0474
15100.2074						
5.167	-.000260	167.5378	-142.1542	-.0022048	31754.3934	17.4703
11199.5515						
5.333	-.000569	144.4494	-138.8083	-.0015500	28658.4198	22.6807
6645.2573						
5.500	-.000777	121.8729	-133.3795	-.0009910	25630.5834	42.4647
9112.8437						
5.667	-.000899	100.3761	-125.5653	-.0005246	22747.5658	51.3059
9509.7095						
5.833	-.000951	80.2224	-116.5736	-.0001455	20044.6636	56.5940
9913.1220						
6.000	-.000948	61.5750	-106.9663	.0001521	17543.7895	58.6936
10322.2131						
6.167	-.000901	44.5076	-97.2400	.0003747	15254.8124	58.0219
10735.2200						
6.333	-.000823	29.0155	-87.8178	.0005290	13177.1038	55.0451
11150.2473						
6.500	-.000724	15.0287	-75.9448	.0006215	11301.2746	87.4304
20114.0766						
6.667	-.000616	3.4582	-61.6636	.0006603	9749.5081	83.9436
22726.1605						
6.833	-.000504	-5.7834	-48.0131	.0006554	10061.3438	79.8629
26390.9008						
7.000	-.000397	-12.8018	-35.0886	.0006164	11002.6116	75.2313
31571.5172						
7.167	-.000299	-17.7199	-22.9800	.0005523	11662.2081	70.0712
39072.7298						
7.333	-.000213	-20.6772	-11.7755	.0004718	12058.8166	64.3833
50370.2034						
7.500	-.000142	-21.8291	-1.5654	.0003825	12213.3022	58.1379
68409.7976						
7.667	-8.55E-05	-21.3482	7.5501	.0002919	12148.8050	51.2484
99875.5101						
7.833	-4.43E-05	-19.4262	15.4447	.0002063	11891.0439	43.4861
163476.						
8.000	-1.67E-05	-16.2804	21.9092	.0001314	11469.1475	34.0884
339391.						
8.167	-5.35E-07	-12.1744	25.0378	7.1679E-05	10918.4712	3.4545
1076250.						
8.333	7.15E-06	-7.9624	23.0290	2.9415E-05	10353.5893	-27.5596
642160.						
8.500	9.27E-06	-4.5095	18.2819	3.2388E-06	9890.5036	-29.4055
528681.						
8.667	8.23E-06	-1.8697	13.4527	-1.0150E-05	9536.4700	-28.5458
577911.						

8.833	5.89E-06	-.0213325	7.9060	-1.4119E-05	9288.5753	-38.0138
1076250.						
9.000	3.53E-06	.7711336	2.8407	-1.2545E-05	9389.1342	-22.7701
1076250.						
9.167	1.71E-06	.9304663	.0257002	-8.9739E-06	9410.5029	-11.0101
1076250.						
9.333	5.35E-07	.7832002	-1.1796	-5.3772E-06	9390.7525	-3.4538
1076250.						
9.500	-8.74E-08	.5393555	-1.4204	-2.6014E-06	9358.0495	.5643741
1076250.						
9.667	-3.32E-07	.3107463	-1.1946	-8.1724E-07	9327.3897	2.1459
1076250.						
9.833	-3.60E-07	.1414899	-.8221073	1.3192E-07	9304.6901	2.3235
1076250.						
10.000	-2.88E-07	.0366591	-.4733247	5.0582E-07	9290.6308	1.8619
1076250.						
10.167	-1.91E-07	-.0164822	-.2152732	5.4817E-07	9287.9248	1.2347
1076250.						
10.333	-1.06E-07	-.0353125	-.0555490	4.3946E-07	9290.4502	.6819786
1076250.						
10.500	-4.47E-08	-.0351699	.0253472	2.9153E-07	9290.4311	.2887765
1076250.						
10.667	-8.43E-09	-.0269771	.0539504	1.6109E-07	9289.3323	.0544614
1076250.						
10.833	8.98E-09	-.0172493	.0536572	6.8272E-08	9288.0277	-.0579795
1076250.						
11.000	1.43E-08	-.0091180	.0411178	1.2932E-08	9286.9371	-.0924934
1076250.						
11.167	1.33E-08	-.0035484	.0262588	-1.3653E-08	9286.1902	-.0858151
1076250.						
11.333	9.77E-09	-.0003597	.0138487	-2.1855E-08	9285.7625	-.0631061
1076250.						
11.500	6.00E-09	.0010763	.0053588	-2.0351E-08	9285.8586	-.0387720
1076250.						
11.667	2.99E-09	.0014345	.0005195	-1.5081E-08	9285.9067	-.0193005
1076250.						
11.833	9.77E-10	.0012554	-.0016147	-9.4357E-09	9285.8826	-.0063096
1076250.						
12.000	-1.56E-10	.0008999	-.0020887	-4.9121E-09	9285.8350	.0006211
661912.						
12.167	-6.60E-10	.0005610	-.0018185	-1.8458E-09	9285.7895	.0026223
661912.						
12.333	-7.72E-10	.0002945	-.0013445	-5.0174E-11	9285.7538	.0030647
661912.						
12.500	-6.77E-10	.0001129	-.0008651	8.0486E-10	9285.7294	.0026887
661912.						
12.667	-5.03E-10	5.8376E-06	-.0004744	1.0540E-09	9285.7151	.0019992
661912.						
12.833	-3.26E-10	-4.5675E-05	-.0002000	9.7041E-10	9285.7204	.0012934
661912.						
13.000	-1.80E-10	-6.1222E-05	-3.2719E-05	7.4606E-10	9285.7225	.0007145
661912.						
13.167	-7.70E-11	-5.6872E-05	5.2303E-05	4.9820E-10	9285.7219	.0003057
661912.						
13.333	-1.38E-11	-4.3982E-05	8.2365E-05	2.8652E-10	9285.7202	5.4991E-05
661912.						
13.500	1.85E-11	-2.9529E-05	8.0817E-05	1.3224E-10	9285.7182	-7.3561E-05
661912.						
13.667	3.02E-11	-1.7095E-05	6.4682E-05	3.4384E-11	9285.7166	-.0001201
661912.						
13.833	3.00E-11	-7.9818E-06	4.4753E-05	-1.8247E-11	9285.7154	-.0001191
661912.						
14.000	2.42E-11	-2.1700E-06	2.6837E-05	-3.9554E-11	9285.7146	-9.5912E-05

661912.						
14.167	1.68E-11	9.7925E-07	1.3284E-05	-4.2053E-11	9285.7144	-6.6717E-05
661912.						
14.333	1.01E-11	2.2745E-06	4.3711E-06	-3.5224E-11	9285.7146	-4.0242E-05
661912.						
14.500	5.06E-12	2.4500E-06	-6.5620E-07	-2.5308E-11	9285.7146	-2.0086E-05
661912.						
14.667	1.70E-12	2.0656E-06	-2.8916E-06	-1.5831E-11	9285.7146	-6.7380E-06
661912.						
14.833	-2.19E-13	1.4923E-06	-3.3805E-06	-8.3633E-12	9285.7145	8.7097E-07
661912.						
15.000	-1.09E-12	9.4205E-07	-2.9468E-06	-3.2539E-12	9285.7144	4.3335E-06
661912.						
15.167	-1.30E-12	5.1136E-07	-2.1541E-06	-2.0347E-13	9285.7144	5.1786E-06
661912.						
15.333	-1.16E-12	2.2410E-07	-1.3390E-06	1.3401E-12	9285.7143	4.6029E-06
661912.						
15.500	-8.57E-13	6.4518E-08	-6.7168E-07	1.9459E-12	9285.7143	3.4045E-06
661912.						
15.667	-5.10E-13	-5.5056E-10	-2.1907E-07	2.0801E-12	9285.7143	2.0269E-06
661912.						
15.833	-1.64E-13	-9.3172E-09	4.0612E-09	2.0594E-12	9285.7143	6.5074E-07
661912.						
16.000	1.76E-13	0.0000	0.0000	2.0399E-12	9285.7143	-6.9948E-07
330956.						

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 5:

Pile-head deflection	=	.11110120	m
Computed slope at pile head	=	-.03801128	
Maximum bending moment	=	377.21037	kN- m
Maximum shear force	=	222.50000	kN
Depth of maximum bending moment	=	2.66666667	m
Depth of maximum shear force	=	0.00000	m
Number of iterations	=	48	
Number of zero deflection points	=	8	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 6

Pile-head boundary conditions are Shear and Moment (BC Type 1)
Specified shear force at pile head = 267.000 kN
Specified moment at pile head = .000 m- kN
Specified axial load at pile head = 1170.000 kN

(Zero moment for this load indicates free-head conditions)

Depth	Deflect.	Moment	Shear	Slope	Total	Soil Res.
Es*h						
X	y	M	V	S	Stress	p
F/L						
m	m	kN- m	kN	Rad.	kN/ m**2	kN/ m
kN/ m						

0.000	.233925	-5.5543E-10	267.0000	-.0690939	9285.7143	-74.0441
26.3774						
.167	.222409	56.9449	254.3850	-.0689743	16922.8293	-77.3365
57.9535						
.333	.210934	111.6950	241.2212	-.0686204	24265.5843	-80.6289
63.7079						
.500	.199536	164.1139	227.5086	-.0680415	31295.7035	-83.9213
70.0970						
.667	.188253	214.0674	213.2474	-.0672478	37995.1670	-87.2137
77.2131						
.833	.177120	261.4230	198.4374	-.0662498	44346.2255	-90.5061
85.1646						
1.000	.166170	306.0506	183.0787	-.0650588	50331.4150	-93.7985
94.0789						
1.167	.155434	347.8222	167.1712	-.0636864	55933.5708	-97.0909
104.1075						
1.333	.144941	386.6121	150.7150	-.0621450	61135.8420	-100.3833
115.4301						
1.500	.134719	422.2971	133.9629	-.0604473	65921.7047	-100.6426
124.5095						
1.667	.124792	454.8408	117.1891	-.0586063	70286.2756	-100.6426
134.4138						
1.833	.115183	484.2166	100.4153	-.0566354	74225.9821	-100.6426
145.6267						
2.000	.105914	510.4004	83.6416	-.0545479	77737.5995	-100.6426
158.3723						
2.167	.097001	533.3708	66.8678	-.0523572	80818.2533	-100.6426
172.9242						
2.333	.088461	553.1090	50.0940	-.0500769	83465.4219	-100.6426
189.6175						
2.500	.080308	569.5988	33.3203	-.0477205	85676.9385	-100.6426
208.8669						
2.667	.072554	582.8267	16.5465	-.0453018	87450.9928	-100.6426
231.1894						
2.833	.065208	592.7820	-.2272926	-.0428344	88786.1328	-100.6426
257.2356						
3.000	.058276	599.4564	-17.0011	-.0403322	89681.2654	-100.6427
287.8328						
3.167	.051764	602.8445	-33.7748	-.0378087	90135.6581	-100.6427
324.0447						
3.333	.045673	602.9435	-50.3157	-.0352780	90148.9389	-97.8476
357.0570						
3.500	.040004	599.8310	-66.2713	-.0327536	89731.5094	-93.6194
390.0376						
3.667	.034755	593.6270	-81.5172	-.0302488	88899.4632	-89.3913
428.3818						
3.833	.029922	584.4557	-96.0432	-.0277762	87669.4563	-84.9815
473.3579						
4.000	.025497	572.4453	-109.8389	-.0253481	86058.7000	-80.5670
526.6522						
4.167	.021472	557.7285	-122.8931	-.0229761	84084.9587	-76.0831
590.5568						
4.333	.017838	540.4416	-135.1936	-.0206712	81766.5520	-71.5228
668.2664						
4.500	.014582	520.7257	-146.7268	-.0184440	79122.3667	-66.8754
764.3739						
4.667	.011690	498.7259	-157.4768	-.0163044	76171.8805	-62.1250
885.7380						
4.833	.009147	474.5921	-167.4245	-.0142616	72935.2054	-57.2473
1043.1054						
5.000	.006936	448.4797	-176.5454	-.0123242	69433.1620	-52.2036

1254.4069						
5.167	.005039	420.5501	-184.8065	-.0105003	65687.4070	-46.9290
1552.2335						
5.333	.003436	390.9727	-192.1594	-.0087971	61720.5563	-41.3059
2003.6252						
5.500	.002107	359.9278	-204.9725	-.0072211	57557.1051	-112.4511
8897.0929						
5.667	.001029	325.4647	-219.2285	-.0057826	52935.1178	-58.6216
9495.7720						
5.833	.000179	289.1068	-225.0051	-.0044927	48059.0134	-10.6974
9960.5238						
6.000	-.000469	252.2151	-223.4694	-.0033565	43111.3198	29.1254
10357.8424						
6.167	-.000940	215.9261	-215.9993	-.0023740	38244.4423	60.5186
10731.5724						
6.333	-.001260	181.1413	-203.9598	-.0015406	33579.3090	83.9571
11105.5293						
6.500	-.001453	148.5403	-188.2923	-.0008487	29207.0637	104.0533
11932.1814						
6.667	-.001543	118.7082	-170.8195	-.0002878	25206.1513	105.6194
11409.2641						
6.833	-.001549	91.7127	-153.2071	.0001538	21585.6810	105.7295
11373.6736						
7.000	-.001492	67.5791	-135.6688	.0004882	18349.0263	104.7307
11702.2031						
7.167	-.001387	46.2994	-118.3715	.0007272	15495.1157	102.8368
12360.7109						
7.333	-.001249	27.8384	-101.4527	.0008828	13019.2300	100.1890
13366.8916						
7.500	-.001092	12.1376	-85.0299	.0009667	10913.5315	96.8838
14782.1480						
7.667	-.000927	-.8819643	-69.2073	.0009903	9403.9981	92.9886
16718.6860						
7.833	-.000762	-11.3177	-54.0791	.0009647	10803.5834	88.5493
19361.3618						
8.000	-.000605	-19.2846	-39.7338	.0009005	11872.0454	83.5943
23012.4534						
8.167	-.000462	-24.9135	-26.2564	.0008077	12626.9690	78.1347
28181.2869						
8.333	-.000336	-28.3517	-13.7316	.0006959	13088.0751	72.1620
35774.0490						
8.500	-.000230	-29.7621	-2.2483	.0005739	13277.2372	65.6377
47537.4538						
8.667	-.000145	-29.3250	8.0938	.0004499	13218.6060	58.4675
67259.4546						
8.833	-8.02E-05	-27.2397	17.1681	.0003312	12938.9412	50.4243
104853.						
9.000	-3.45E-05	-23.7314	24.7731	.0002242	12468.4361	40.8366
197404.						
9.167	-5.41E-06	-19.0694	31.0863	.0001344	11843.1935	34.9208
1076250.						
9.333	1.03E-05	-13.4218	31.4792	6.6205E-05	11085.7636	-30.2059
487759.						
9.500	1.67E-05	-8.6022	26.1248	1.9981E-05	10439.3891	-34.0473
340599.						
9.667	1.70E-05	-4.7213	20.4366	-7.9828E-06	9918.9095	-34.2102
335758.						
9.833	1.40E-05	-1.7869	14.8693	-2.1642E-05	9525.3580	-32.5980
388083.						
10.000	9.77E-06	.2435520	9.6701	-2.4881E-05	9318.3780	-29.7926
508364.						
10.167	5.71E-06	1.4462	4.1170	-2.1335E-05	9479.6699	-36.8449
1076250.						

10.333	2.66E-06	1.6242	-.3826133	-1.4891E-05	9503.5412	-17.1499
1076250.						
10.500	7.42E-07	1.3245	-2.2112	-8.7021E-06	9463.3441	-4.7925
1076250.						
10.667	-2.45E-07	.8905343	-2.4788	-4.0532E-06	9405.1475	1.5813
1076250.						
10.833	-6.09E-07	.4997964	-2.0193	-1.1352E-06	9352.7440	3.9320
1076250.						
11.000	-6.23E-07	.2178710	-1.3563	3.7109E-07	9314.9339	4.0247
1076250.						
11.167	-4.85E-07	.0475652	-.7597646	9.2819E-07	9292.0935	3.1332
1076250.						
11.333	-3.14E-07	-.0357459	-.3297635	9.5299E-07	9290.5083	2.0268
1076250.						
11.500	-1.68E-07	-.0627276	-.0707060	7.4632E-07	9294.1269	1.0819
1076250.						
11.667	-6.51E-08	-.0596056	.0544809	4.8956E-07	9293.7082	.4203550
1076250.						
11.833	-4.35E-09	-.0447583	.0918523	2.7052E-07	9291.7170	.0281025
1076250.						
12.000	2.51E-08	-.0290937	.0858943	1.1552E-07	9289.6162	-.0995995
661912.						
12.167	3.42E-08	-.0161719	.0662904	2.0518E-08	9287.8832	-.1356470
661912.						
12.333	3.19E-08	-.0070049	.0444230	-2.8126E-08	9286.6537	-.1267615
661912.						
12.500	2.48E-08	-.0013533	.0256585	-4.5668E-08	9285.8958	-.0984132
661912.						
12.667	1.67E-08	.0015658	.0119319	-4.5222E-08	9285.9243	-.0663050
661912.						
12.833	9.71E-09	.0026417	.0031943	-3.6391E-08	9286.0686	-.0385472
661912.						
13.000	4.56E-09	.0026447	-.0015288	-2.5296E-08	9286.0690	-.0181292
661912.						
13.167	1.27E-09	.0021420	-.0034612	-1.5250E-08	9286.0016	-.0050595
661912.						
13.333	-5.18E-10	.0014969	-.0037112	-7.6125E-09	9285.9150	.0020590
661912.						
13.500	-1.26E-09	.0009079	-.0031214	-2.5653E-09	9285.8360	.0050182
661912.						
13.667	-1.37E-09	.0004574	-.0022487	3.0018E-10	9285.7756	.0054550
661912.						
13.833	-1.16E-09	.0001582	-.0014090	1.5923E-09	9285.7355	.0046208
661912.						
14.000	-8.43E-10	-1.2848E-05	-.0007450	1.8973E-09	9285.7160	.0033471
661912.						
14.167	-5.31E-10	-9.0895E-05	-.0002903	1.6796E-09	9285.7265	.0021091
661912.						
14.333	-2.83E-10	-.0001103	-2.0927E-05	1.2573E-09	9285.7291	.0011237
661912.						
14.500	-1.12E-10	-9.8361E-05	.0001098	8.1944E-10	9285.7275	.0004447
661912.						
14.667	-9.80E-12	-7.4010E-05	.0001501	4.5766E-10	9285.7242	3.8901E-05
661912.						
14.833	4.06E-11	-4.8518E-05	.0001399	2.0050E-10	9285.7208	-.0001612
661912.						
15.000	5.70E-11	-2.7464E-05	.0001076	4.1030E-11	9285.7180	-.0002265
661912.						
15.167	5.43E-11	-1.2680E-05	7.0722E-05	-4.3226E-11	9285.7160	-.0002155
661912.						
15.333	4.26E-11	-3.8733E-06	3.8652E-05	-7.7970E-11	9285.7148	-.0001693
661912.						
15.500	2.83E-11	2.3406E-07	1.5184E-05	-8.5608E-11	9285.7143	-.0001123

661912.						
15.667	1.41E-11	1.2215E-06	1.1604E-06	-8.2553E-11	9285.7144	-5.5973E-05
661912.						
15.833	7.62E-13	6.5305E-07	-3.7564E-06	-7.8619E-11	9285.7144	-3.0275E-06
661912.						
16.000	-1.21E-11	0.0000	0.0000	-7.7248E-11	9285.7143	4.8104E-05
330956.						

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 6:

Pile-head deflection	=	.23392511	m
Computed slope at pile head	=	-.06909385	
Maximum bending moment	=	602.94354	kN- m
Maximum shear force	=	267.00000	kN
Depth of maximum bending moment	=	3.33333333	m
Depth of maximum shear force	=	0.00000	m
Number of iterations	=	66	
Number of zero deflection points	=	7	

Summary of Pile Response(s)

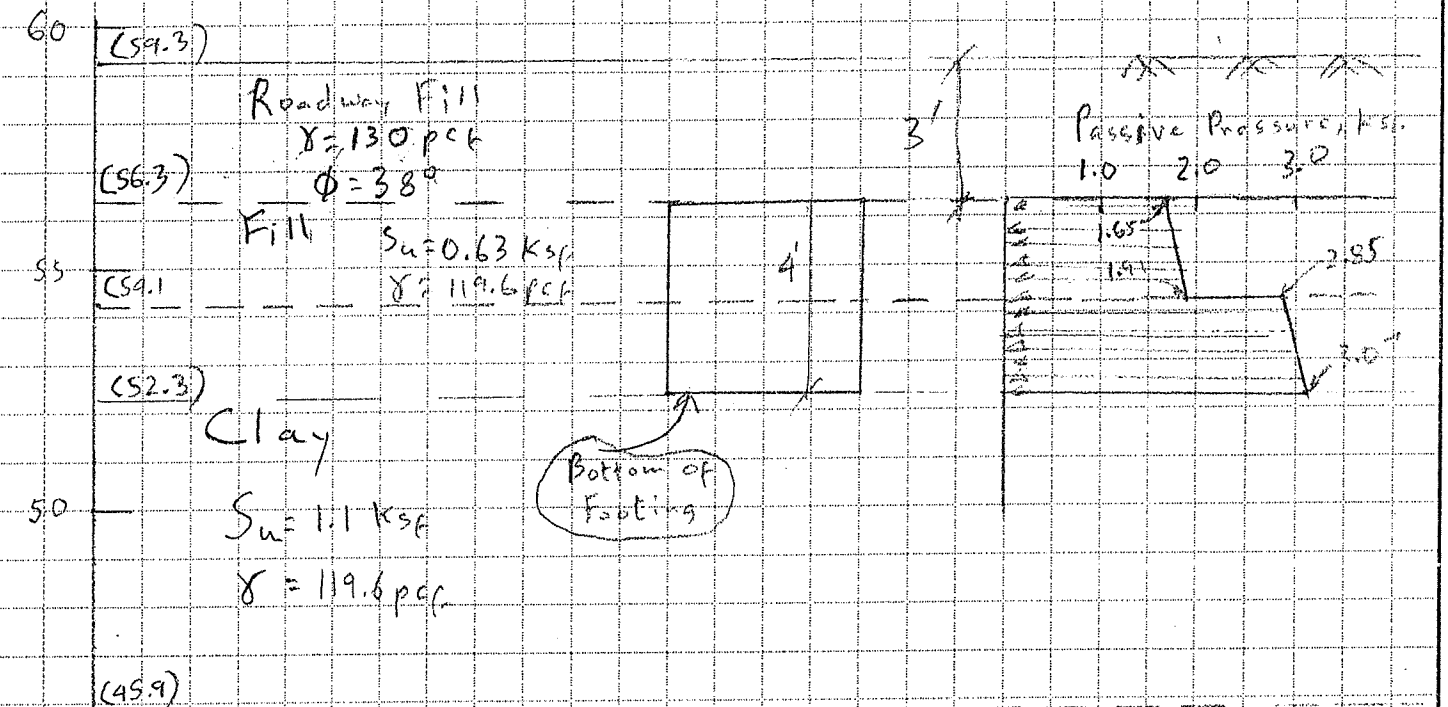
Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment, y = pile-head displacment m
Type 2 = Shear and Slope, M = Pile-head Moment kN- m
Type 3 = Shear and Rot. Stiffness, V = Pile-head Shear Force kN
Type 4 = Deflection and Moment, S = Pile-head Slope, radians
Type 5 = Deflection and Slope, R = Rot. Stiffness of Pile-head m- kN/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load kN	Pile-Head Deflection m	Maximum Moment m- kN	Maximum Shear kN
1	V= 44.500	M= 0.000	1170.0000	.0034892	35.5860	44.5000
1	V= 89.000	M= 0.000	1170.0000	.0141189	91.9046	89.0000
1	V= 133.500	M= 0.000	1170.0000	.0321824	162.2657	133.5000
1	V= 178.000	M= 0.000	1170.0000	.0587379	245.9512	178.0000
1	V= 222.500	M= 0.000	1170.0000	.1111012	377.2104	222.5000
1	V= 267.000	M= 0.000	1170.0000	.2339251	602.9435	267.0000

The analysis ended normally.

Century Boulevard Undercrossing – Passive Pressures on Footing



Passive Pressure: $(\gamma h + 2c)$

Top of Footing: $3 \times 0.130 + 2 \times 0.63 = 1.65$ Ksf (El 56.3)

El 54.1, $3 \times .130 + 2.2 \times .120 + 2 \times 0.63 = 1.91$ Ksf (above)

$3 \times .130 + 2.2 \times .120 + 2 \times 1.1 = 2.85$ Ksf (below)

Bottom of Footing: $3 \times .130 + 4 \times .120 + 2 \times 1.1 = 3.07$ Ksf

Note: The footing will be against undisturbed material.
For backup of design soil profile & properties, see page 3

$$\text{Avg. Pressure} = \frac{\frac{1.65+1.91}{2} \times 2.2 + \frac{(2.85+3.07)}{2} \times 1.5}{4}$$

$$= \frac{3.663+5.328}{4} \simeq 2.25 \text{ Ksf} \quad \therefore \text{ Static}$$
(110 kPa)

$$\frac{2.25}{0.65} \simeq 3.45 \text{ Ksf} \quad \therefore \text{ Seismic}$$
(165 kPa)

The above passive pressures are ultimate. The actual passive pressures mobilized may be computed using the curve in Sheet No. 4 from FEMA 356

5.1 SITE TOPOGRAPHY

Development of the freeway, bridges and underpassing has resulted in the placement of fill embankments. The original ground surface is relatively flat, ranging in elevation from about 17 to 19 meters. Vegetation in the vicinity of the proposed improvements consists of grasses and shrubs.

5.2 SUBSURFACE CONDITIONS

Construction of the roadway embankment resulted in the placement of approximately 1.7 m of fill on the north and south sides of the crossing. Results of the subsurface investigations indicate that the underlying native soils consist of alluvium to the maximum explored depth. The alluvium is composed of predominately stiff sandy and silty clay (consistencies vary from soft to hard) with layers of medium dense silty sand.

Based on the results of our current investigation, Caltrans standards, and on our previous experience with similar soils, generalized soil engineering parameters were developed for the purposes of this foundation evaluation and are tabulated below. A generalized geologic cross-section was also prepared, as is shown in Figure 3.

Table 2
Soil Parameters

Soil Type	Elevation of Top of the Layer (m)	Layer Thickness (m)	Unit Weight (kN/m^3) pcf	Cohesion (kPa)	Friction Angle (deg)
Embankment Fill	24.0	6	20.1 127.9	0	40
Fill	18.0 59.06	1.5	18.8 119.6	30 630 psf	0
Clay	16.5 54.13	2.5	18.8 119.6	52.5 1100 psf	0
Sand	14.0 45.9	2.5	18.8	0	33
Clay	11.5	13.5	18.1	143.5	0
Sandy Clay	-2.0	5.5	19.1	0	30
Hard Silt	-7.5	1.5	18.8	200	0

15.95m = 52.3 + 7 = 59.3

5.3 GROUNDWATER CONDITIONS

Groundwater was not encountered in the previous exploration, however groundwater was encountered at an elevation of about 4.0 meters during the subsurface investigations conducted in January of 2005 and at an elevation of about 4.4 meters during the subsurface investigations conducted in July of 2005. According to the groundwater measurements taken in January and March of 2006 at the piezometer constructed in Boring B-20, the groundwater was at the elevation of about 4.4 m and 4.7m respectively. The recommended design groundwater elevation is 5 m.

The moment capacity of a pile group shall be determined assuming a rigid pile cap. Lower-bound moment capacity shall be based on triangular distribution of axial pile loading and lower-bound axial capacity of the piles. Upper-bound moment capacity shall be based on a rectangular distribution of axial pile load using full, upper-bound axial capacity of the piles.

The lateral capacity of a pile group shall include the contributions of the piles (with an appropriate modification for group effects) and the passive resistance of the pile cap. The lateral capacity of the piles shall be calculated using the same method used to calculate the stiffness. The lateral capacity of the pile cap, due to passive pressure, shall be calculated using established principles of soil mechanics. Passive pressure mobilization shall be calculated using Figure 4-6.

C4.4.2.2.2 Capacity Parameters

The lateral capacity of a pile cap should be calculated in the same way that the capacity of a shallow foundation is computed, except that the contribution of base traction should be neglected. Section C4.4.2.1.5 provides a more detailed description of the calculation procedure.

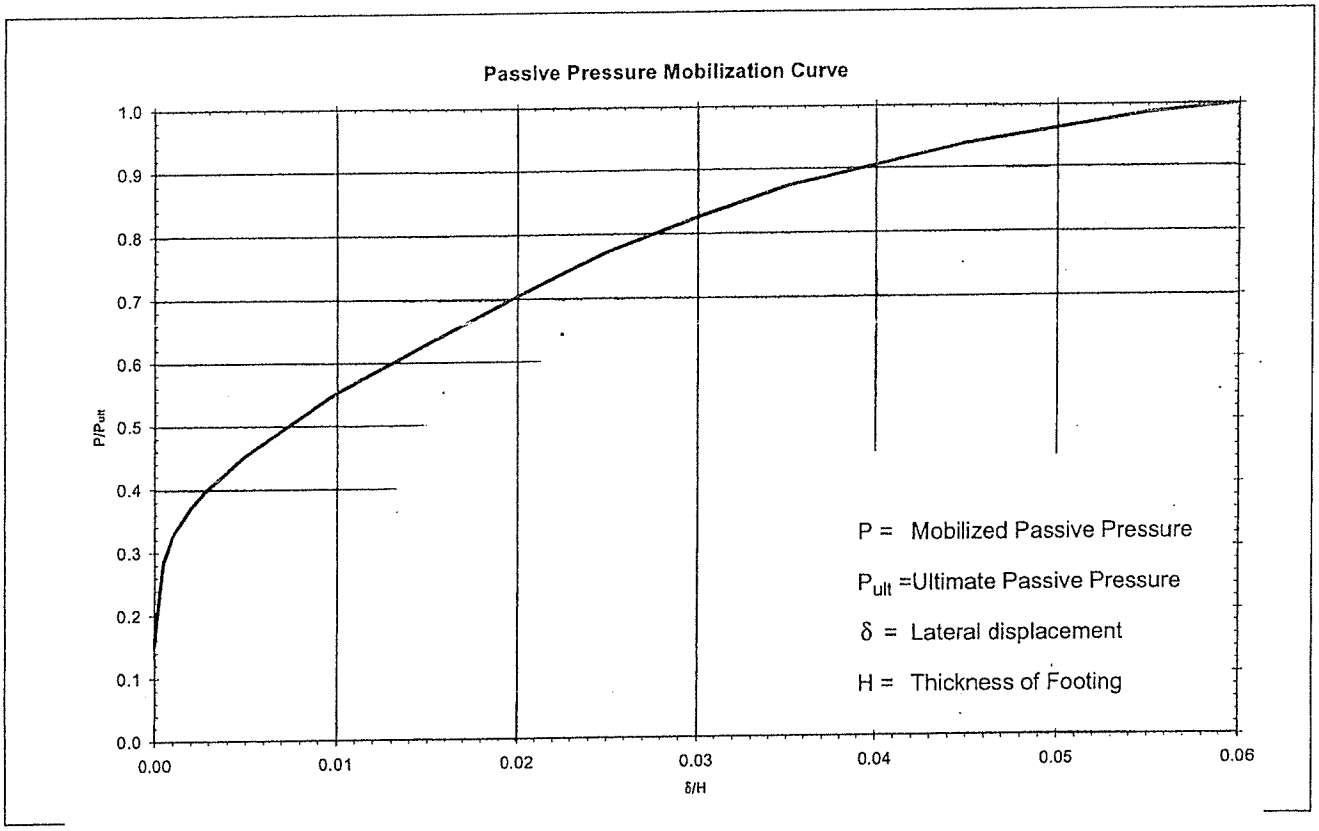


Figure 4-6 Passive Pressure Mobilization Curve

GEOTECHNICAL ENGINEERING INVESTIGATION
EAST CONTRA COSTA TRANSIT DEVELOPMENT (eBART) AT UTILITY CORRIDOR UNDERCROSSING
PITTSBURG, CALIFORNIA

PARIKH

Practicing in the Geosciences

GEOTECHNICAL ENGINEERING INVESTIGATION
EAST CONTRA COSTA TRANSIT DEVELOPMENT
(eBART) AT UTILITY CORRIDOR UNDERCROSSING
PITTSBURG, CALIFORNIA

For

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Job No. 205124.UTL

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GEOTECHNICAL ENGINEERING INVESTIGATION
EAST CONTRA COSTA TRANSIT DEVELOPMENT (eBART)
AT UTILITY CORRIDOR UNDERCROSSING
PITTSBURG, CALIFORNIA

INTRODUCTION

This report presents the results of our geotechnical engineering investigation for the proposed new bridge for eBART between the eastbound and westbound bridges on Highway 4 crossing at the Utility Corridor Undercrossing in Pittsburg, California. Our work was performed generally in accordance with the scope of work as per our agreement. The general location of the site and its vicinity are shown on the Project Location Map, Plate 1.

The geotechnical recommendations presented in this report are intended for design input and are not intended to use as specifications. These recommendations should not be used for direct bidding purposes.

PROPOSED CONSTRUCTION

A General Plan and a Foundation Plan for the project were provided to us by Beyaz and Patel, the Structural Engineer for the project. Per the plans, the eBART structure will consist of a single span cast-in-place, prestressed concrete box girder bridge, with walkways on either side. The structure will be 29.6 meters long and 9.6 meters wide. It will be constructed between the new eastbound and westbound highway bridges along Route 4 crossing the Utility Corridor to be constructed under a separate program and will be separated from the highway bridges by concrete traffic barriers. Two parallel railroad tracks with associated ballast and railroad ties will be installed on top of the box girder structure. The bridge abutments will be founded on 914 mm cast-in-drilled-hole (CIDH) piles with a nominal capacity of 2900 kN.

PURPOSE AND SCOPE

URS Consultants of Oakland, California performed a geotechnical investigation and prepared a foundation report (February, 2007) for Rte 4 widening (Utility Undercrossing (Widen), Br. No. 28-105). The purpose of their investigation was to evaluate the general soil conditions at the site of the two new highway bridges on either side of the eBART structure, to evaluate their

engineering properties, and to provide recommendations for foundation support of the two bridges. Since the two new highway bridges are located on either side of the proposed eBART structure, it was decided by Contra Costa County Traffic Authority and PGH Wong that this information should be used for the eBART structure between the two bridges to the extent possible; rather, we are directed to use this data for the eBART structure foundation report. No new field investigation or laboratory testing was performed specifically for this project. Therefore, pertinent information from the URS report, including methods of obtaining representative soil samples and logging soil materials encountered, two cone penetrometer tests (CPT, and laboratory testing of the collected samples have been included in the present report. Per contract conditions, we are not responsible for the information in the URS report regarding the results of their field investigation and laboratory testing.

The scope of work performed for this investigation included a review of the URS foundation report, review of other readily available soils and geologic literature, engineering analysis of the field and laboratory data, and preparation of this report. We have presented the descriptive log of the boreholes and CPT data from URS report in Appendix A.

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

Our recommendations in this report are based on the above information. Any major deviation should be reported to this office for consideration.

SITE CONDITIONS

Per the As-Built drawings, the Utilities Undercrossing, constructed in 1952, is a two-span, inverted U-frame structure. The structure is approximately 40 meters long and spans about 9.45 meters

under the roadway. The east and west walls are supported on 1.2-meter wide spread footings. The mid-span is supported on individual columns at 2.3 meters on center, supported on 0.91-meter wide spread footings. The bottoms of the footings are at an elevation of 59 feet and design-bearing capacity of 239 kiPa is noted.

FIELD EXPLORATION AND LABORATORY TESTING

This section of the report is primarily conveying what is included in the URS report. Per the URS foundation report, the two (2) exploratory borings and the two cone penetration test (CPT) soundings drilled as part of the field investigation for the Century Boulevard Undercrossing, 50 meters east of the project site, are considered applicable to the present project. The borings were drilled on January 4 and 10, 2005, and the CPT soundings were performed on July 21, 2005. The borings and the adjacent CPTs were located on Century Boulevard on either side of Route 4. An additional boring was drilled approximately 50 meters west of the project site, on January 12, 2005 from the top of the road embankment. The boring and CPT locations are shown on Plate 5. The boring and the CPT locations are also shown on the plan portion of the Log of Test Borings in Appendix A.

Soil Borings

The borings were drilled by Taber Consultants of West Sacramento, California, using a truck-mounted drill rig. Initial drilling for the two Century Boulevard borings (to depths of 6.1m and 13.7m) was performed using a solid stem auger. Subsequent drilling was performed using the rotary wash drilling method. The two borings for Century Boulevard were drilled to depths of about 27.9 m below the existing ground surface at an approximate elevation of 18.0. The remaining boring, located east of the project site, was drilled from the top of the embankment (approximate elevation 23.7) to a depth of 9.6 meters using a solid stem auger for the entire depth.

Selected samples were obtained at various depths generally at 1.5 m intervals to a depth of 15 meters and at 3 m intervals thereafter. Samples were obtained using 63 mm O.D. & 51 mm I.D. (Modified California) samplers fitted with brass liners for the clayey material and 51 mm O.D. & 35 mm I.D. (Standard Penetration Test) samplers for the granular material. The samplers were

driven in subsurface soils under the impact of a 63.5 kg safety hammer having a free fall of 762 mm. The blow counts are presented on the "Log of Test Borings". (When correlating standard penetration data in similar soils, the blow counts for the Modified California Sampler can be taken as roughly 1.2 times that for the Standard Penetration Test in similar soils). The samples were sealed and transported to the URS laboratory for further evaluation and testing. The field investigation was conducted under the supervision of a URS field engineer who logged the test borings and prepared the samples for subsequent laboratory testing and evaluation.

Cone Penetration Testing (CPT)

On July 21, 2005, Gregg Drilling & Testing of Martinez, California performed CPT work using a truck mounted CPT rig. The CPTs were conducted using a 20-ton capacity cone with a tip area of 15 square centimeters and a friction sleeve area of 225 square centimeters. The soil resistance exerted to the tip and side of the cone were recorded and correlated to soil type, classification and strength characteristics. Groundwater level was estimated from pore pressure measurements during CPT operation.

Laboratory Testing

Laboratory tests were performed on selected samples obtained during field exploration to determine the physical and engineering properties of the subsoils. Laboratory data of moisture contents, total density, grain size distribution, Atterberg Limits and unconfined compression strengths are presented on the Log of Test Borings. Other tests performed include an Unconsolidated Undrained (UU) triaxial test and three consolidation tests. A detailed description of laboratory testing performed is presented in Appendix B. Appendix B also includes Plasticity Charts for Atterberg Limits, grain size distribution curves, stress-strain curve for the UU test and the load-deformation curves for the consolidation tests.

Boring and CPT Logs

The log of test borings (LOTB) sheets, presented in the URS report is provided in Appendix A. Sheet 4 of 4 was not available and is therefore not included. The abrupt stratum changes shown on

these logs may be gradual and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations. CPT logs are also presented on the LOTB sheets at appropriate locations.

SUBSURFACE CONDITIONS

Embankment fill at the location of the Utility Crossing generally consisted of stiff clays to a depth of approximately 2.5 meters, as indicated in boring B-19. The borings and CPT data indicated that the underlying native soils were predominantly stiff to hard lean clays to a depth of approximately 32 meters below the top of the embankment. The clays were stiff near the surface, increasing in strength with depth; hard clays were encountered at a depth of approximately 20 meters in boring B-20 and 22 meters in B-21. Very stiff to hard silts and sandy silts occurred below the clay soils.

Groundwater was encountered during drilling at elevations ranging from 4.0 to 4.7 meters below. However, groundwater level may vary with passage of time due to seasonal groundwater fluctuation, surface and subsurface flows, ground surface run-off, and other factors that may not be present at the time of investigation. A design groundwater table at El 5.0 as suggested in the URS geotechnical report is found reasonable and has been used in this study.

In addition to the new borings and CPT soundings, we reviewed the boring in the LOTB sheet from the As-built drawings for the Standard Oil Road undercrossing, which is also presented in Appendix A. The boring indicates predominantly silty soils. The discrepancy between the two sets of boring may be attributed to changes in soil classification over the years – the borings were drilled in 1952.

GEOLOGY

General geologic features pertaining to the site were evaluated by reference to the "Geologic Map of Contra Costa County, Geologic Map of the San Francisco Bay Region" by Graymer, R. W. et. al., 2006 (USGS Scientific Investigations Map 2918). Based on the publication, the project site subsoils mainly consist of Pleistocene alluvium deposits. A geologic map is attached (Plate 2).

EARTHQUAKE CONSIDERATIONS

Seismic Sources

The project site is located in a seismically active part of Northern California. Many faults exist in the San Francisco Bay Area. These faults, which are capable of producing earthquakes, may cause strong ground shaking at the site. Maximum credible earthquake magnitudes for some of the faults in the area determined by Mualchin (1996) are summarized below. These maximum credible earthquakes represent the largest earthquakes that could occur on the given fault based on the current understanding of the regional tectonic structure.

SEISMIC DATA

Fault	Type	Estimated Nearest Distance From Project Site (Km)	Maximum Credible Earthquake
Antioch Fault	Strike-slip	4.6	6.75
Coast Ranges – Sierran Block Boundary Zone	Reverse	6.2	7.00
Greenville Fault	Strike-slip	8.3	7.25

Seismic Hazards/Liquefaction Impact

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction. Since no active faults pass through the site, the potential for fault rupture is relatively low. Based on available geological and seismic information, the possibility of the site to experience strong ground shaking may be considered significant.

Liquefaction is a phenomenon in which saturated soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged, cohesionless sands and silts of low relative density are the type of soils

which usually are susceptible to liquefaction - the susceptibility increases with decreasing relative density (reflected by the number of blows to drive a sampler), and decreasing fines content. Accepted procedures for the assessment for liquefaction potential for cohesionless soils have evolved over the years through research and field observations (Youd et al, 2001). Recent research and field observations have shown that clays of low plasticity are also potentially liquefiable, based on the moisture content and plasticity characteristics of the clay. Procedures for the assessment of liquefaction potential for clay soils have also been established and have received general acceptance. (Bray et. al., 2004). The liquefaction potential for the general area is found to be relatively low. The URS geotechnical report presents the results of their assessment of liquefaction potential, using the CPT information. The only potentially liquefiable layer identified is a 1-meter thick sand layer at a depth of 17 m below ground surface in CPT-1 on the north side of Route 4. Analyses further indicate negligible post liquefaction settlements. The consequences of potential liquefaction on the foundations of the eBART structure are thus considered inconsequential.

FINDINGS AND RECOMMENDATIONS

General

Based on the findings of the investigation, it is our opinion that the site is feasible for the planned bridge structure provided the recommendations presented in this report are incorporated into the final design and construction.

This report was prepared specifically for the proposed bridge structure according to the plans provided to us. Normal construction procedures were assumed throughout our analysis and represent one of the bases of recommendations presented herein. Our design criteria have been based upon the materials encountered at the site. Therefore, we should be notified in the event that these conditions are changed, so as to modify or amend our recommendations.

Foundations

Per the Foundation Plan for the project, 914 mm diameter cast-in-drilled-hole (CIDH) piles are planned for foundation support at the abutment locations. It may be noted that CIDH piles are recommended in the URS geotechnical report for the adjacent highway bridges across Utility Corridor Undercrossing due to access, noise and vibration considerations.

Estimation of the required pile tip elevations was made using the procedures recommended by FHWA Manual IF-99-025 (1999). Pile tip elevations are based only on skin friction; end bearing is neglected due to the difficulty of thorough cleaning of the pile bottom. Their analyses are included in Appendix C. The recommended specified pile tip elevations are shown in the pile data table below.

PILE DATA TABLE – 914 mm CIDH Piles

Location	Pile Type	Design Loading (Service)	Nominal Resistance		Cut-off Elev. (m)	Design Tip Elev. (m)	Specified Tip Elev. (m)
			Compression	Tension			
Abut 1	914 mm CIDH	N/A	2900 kN	0	21.457	1.7 (1); 5.0 (2)	1.6
Abut 2	914 mm CIDH	N/A	2900 kN	0	21.566	1.7 (1); 5.0 (2)	1.6
Design Tip Elevation is controlled by the following demands: (1) Compression; (2) Lateral Loads Cut off elevation provided by the Structural Designer							

Construction Considerations

Caltrans standard specification for "Cast-in-Place Concrete Piling" should be used for the construction of CIDH piles. Groundwater is expected during pile construction near the bottom of the pile. Access tubes should be provided to allow for construction quality control (Gamma-Gamma Logging). Due to the presence of granular material and groundwater, raveling or caving is expected which may require additional drilling and cleaning effort and may increase the concrete volume for the piles. It is prudent to make the contractor aware of these conditions so that he takes appropriate steps to comply with the standards and maintain the integrity of the CIDH piles. The use of temporary steel casing should be anticipated at all times to maintain the integrity

of the piles. It is also recommended that the specifications set certain criteria for qualifications and previous work experience requirements to pre-qualify the potential contractors. The intent is to help select qualified contractors to reduce construction issues.

Lateral Pile Capacity

Per instructions from the Structural Engineer, lateral load analyses were performed for the piles at the two abutments for loads up to 2224 kN (500 kips), using the LPILE program and appropriate soil properties for the site. A fixed head condition (no rotation) at the pile head was assumed for all the analyses per instructions from the Structural Engineert. Additionally, a group reduction factor of 0.6 was used to reflect a pile spacing of three times the pile 'diameter', consistent with recent discussions with Caltrans. Detailed output from the LPILE runs, including plots of deflection and bending moments along the lengths of the piles, are presented in Appendix C. A summary of the results is presented below.

Location	Pile Type	Lateral Load (kN)	Displacement at pile top (mm)	Maximum Bending Moment (kN-m)[1]
Abutments 1 and 2	914mm CIDH Plle	222.4	0.9	303.5
		444.8	4.1	800.0
		667.2	10.3	1411.6
		889.6	19.7	2115.1
		1112.0	32.5	2896.8
		1334.4	49.1	3746.5
		1556.8	69.2	4661.3
		1779.2	92.7	5634.3
		2001.6	119.0	6659.2
		2224.0	148.1	7729.1
Note: Maximum bending moment occurs at top of pile				

Generally, abutment piles are designed for service loads only, whereas, bent piles are governed by seismic loading conditions. A maximum deflection of 6.5mm is recommended at the top of the pile for service loads.

Seismic Design Criteria

The governing fault is the Coast Ranges Sierran Block (CRSB) Boundary Zone (Mw=7.00, style of faulting: Reverse) located at about 6 kilometers from the project site. The closest mapped fault on the seismic hazard map prepared by Mualchin (Caltrans 1996) is the Antioch Fault, but the California Geological Survey does not consider this fault active. It had previously been mapped in 1976 as an Alquist-Priolo fault rupture zone, but more recent studies resulted in the fault no longer being classified as active (Wills, 1991). Even if the Antioch Fault were considered active, the ground motions would be lower than those from the CRSB, due to the larger magnitude and reverse style faulting for the CRSB.

Recommended peak acceleration and Acceleration Response Spectra (ARS) curve based on Caltrans Seismic Design Criteria (SDC, v 1.4) are provided below. Recommended peak acceleration and ARS curve based on the AREMA Code for a 2400-year interval are also presented for reference purposes.

Caltrans SDC

Recommended Peak Rock Acceleration (PBA): 0.58g

A value of 0.48g is obtained using the fault distance and MCE noted above and the attenuation relationship per Sadigh (1997) correlating PBA to fault distance and MCE. The site falls between 0.4g and 0.5g contours on the Caltrans Seismic Hazard Map. The computed PBA (0.58g) is increased by 20%, also per Sadigh (1997), to account for the governing reverse fault effect (Coast Ranges – Sierran Block).

Soil Profile: Type D

Design ARS Curve (see Plate 4): Curve based on Caltrans SDC (v. 1.4, 6/2006) for different structural periods. The curve is based on (Governing Fault – Coast Ranges – Sierran Block; Mw = 7.00) Figure B.8, PBA = 0.58g. The curve for PBA=0.58g was obtained by interpolation of the 0.5g and 0.6g curves.

AREMA Code

Per AREMA Chapter 9, the 2400-year return interval represents the survivability state, described as

'a very rare or maximum credible event with a very low probability of being exceeded during the life of the structure'. The corresponding ARS curve shown on Plate 4 is based on a peak acceleration of 0.6g (established from Figure 9-1.3) and a site coefficient of 1.2, representative of the site subsurface conditions.

Lateral Earth Pressures

Recommended earth pressures for design of abutment retaining walls and wing walls:

Active Condition (flexible wall - wall free to rotate at least 0.4 percent of wall height
Structure Backfill: Equivalent Fluid Pressure (EFP) – 5.65 kN/m^3
Surcharge (dead or live load): 0.3 times surcharge load

At-Rest Condition (rigid wall - wall not free to rotate at least 0.4 percent of wall height
Structure Backfill: Equivalent Fluid Pressure (EFP) – 8.65 kN/m^3
Surcharge (dead or live load): 0.5 times surcharge load

Passive Resistance for Seismic Design of Abutment Wall
Height of wall – 1.7 meters or higher: 265 kN/m^2 (ultimate)
Height of wall – less than 1.7 meters: 265 X (H/1.7) kN/m^2 (ultimate)

Seismic increment of Lateral Earth Pressure (based on BART Facilities Standards)
$2.15H^2$ (kN) per meter of wall, acting at 0.6H above the base
(The earth pressures are based on Mononobe-Okabe formulation. The accelerations used are half of the corresponding peak acceleration per BART Facilities Standards)

Grading

All grading operations should be performed in accordance with the project specifications and Caltrans Standard Specifications for Earthwork (Section 19). A representative from our office or regulating agency should observe all excavated areas during grading and perform moisture and density tests on prepared subgrade and compacted fill material. Any fill material imported to the site should be non-expansive, relatively granular material having a Plasticity Index (PI) of less than 15. It should also be non-corrosive, free of deleterious material and should be reviewed by the Geotechnical Engineer.

Should there be any alterations of the proposed construction that will affect the stated bases of our recommendations, we should be informed so that we can review such changes and amend our recommendations or submit additional recommendations.

Engineered Fill. Engineered fill should be non-expansive and consist of relatively granular material having a PI of less than 15. In addition, In addition, the material should be consistent with the requirements of the pavement design.

Compaction of Fill and Subgrades. The project specific recommendations for required compaction as per Caltrans standards are as follows:

- 90% for subgrade preparation, general fill and backfilling after removing buried utilities and depressions caused due to construction activities, etc.
- 95% for all engineered fill for structural backfill of bridge abutments, footing subgrade, and for upper 6 inches of pavement subgrade and aggregate base of pavement sections.

Slope Ratio. For permanent fill slope, a maximum slope gradient of 2H:1V is recommended. The end slopes at the abutments should not be steeper than 1.5H:1V. For temporary slopes during construction, a slope ration of up to 1H:1V may be used under dry conditions and up to 1.5H:1V under submerged conditions. It should be noted that local irregularities such as loose layers and pockets might require flattening of the slope.

Our office should review the final grading plans relevant to the structure prior to grading to see that the intent of our recommendations is included in the plans.

Corrosion

The results of corrosion investigations performed under URS study are included in Appendix B. A summary of the corrosion test data is presented below.

Boring	Depth (m)	pH	Resistivity (ohms-cm)	Sulfate (ppm)	Chloride (ppm)
B-20	4	8.2	1200 * 1000 **	39	ND
B-21	2	7.6	4300 * 2300 **	---	---
ND – Not Detected; * - As Received; ** - Minimum					

Based on the data, the site subsoil is non-corrosive per Caltrans corrosion design guidelines, and standard Type II modified or Type I-P (MS) modified cement may be used for the concrete substructures. The minimum cement factor and cover thickness should be per Caltrans Bridge Design Specifications (Section 8.22).

Plan Review

We recommend that final plans for foundations be reviewed by this office prior to construction, so that the intent of our recommendations is included in the project plans and specifications. This also serves the purpose to further see that no misunderstandings or misinterpretations have occurred.

Construction Observation

To a degree, the performance of any structure is dependent upon construction procedures and quality. Hence, observation of foundation excavations, and pile installations should be carried out by the regulating agencies. If the subsurface conditions different from those forming the basis of our recommendations are encountered, this office should be informed in order to assess the need for design changes. Therefore, the recommendations presented in this report are contingent upon good quality control and these geotechnical observations during construction.

INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with

generally accepted geotechnical engineering principles and practices and are based on our site reconnaissance and the assumption that the subsurface conditions encountered in URS explorations do not deviate from observed conditions. All work done is in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

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

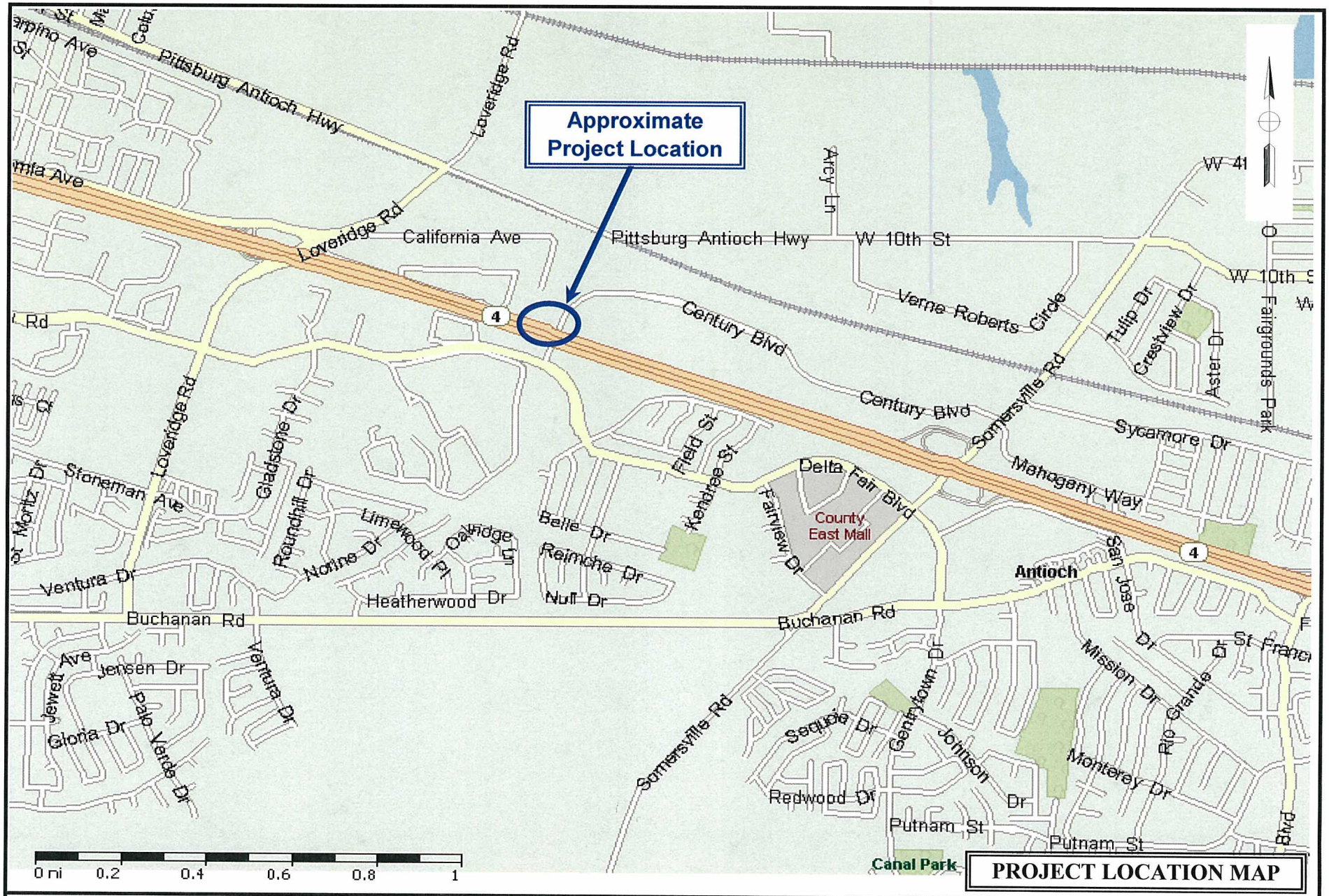
This report is issued with the understanding that it is the designer's responsibility to ensure that the information and recommendations contained herein are incorporated into the project and that necessary steps are also taken to see that the recommendations are carried out in the field.

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

Respectfully submitted,
PARIKH CONSULTANTS, INC.

Partha Sircar, Ph.D., P.E. C54619
Senior Engineer

Gary Parikh, G.E. 666
Project Manager

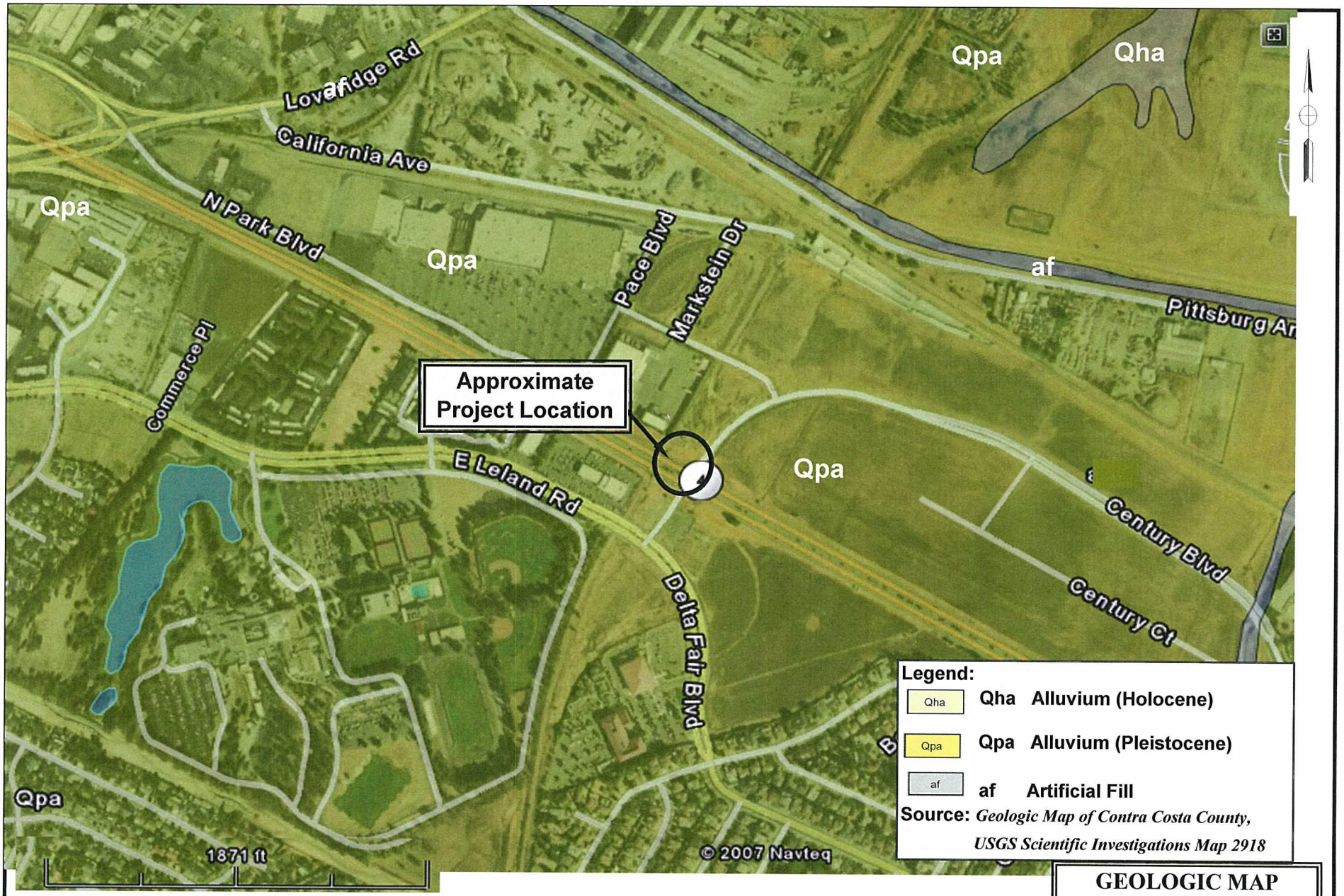


PROJECT LOCATION MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

EAST CONTRA COSTA COUNTY TRANSIT DEVELOPMENT (eBART)
AT UTILITIES UNDERCROSSING, PITTSBURG, CALIFORNIA

JOB NO.: 205124.10 | **PLATE 1**



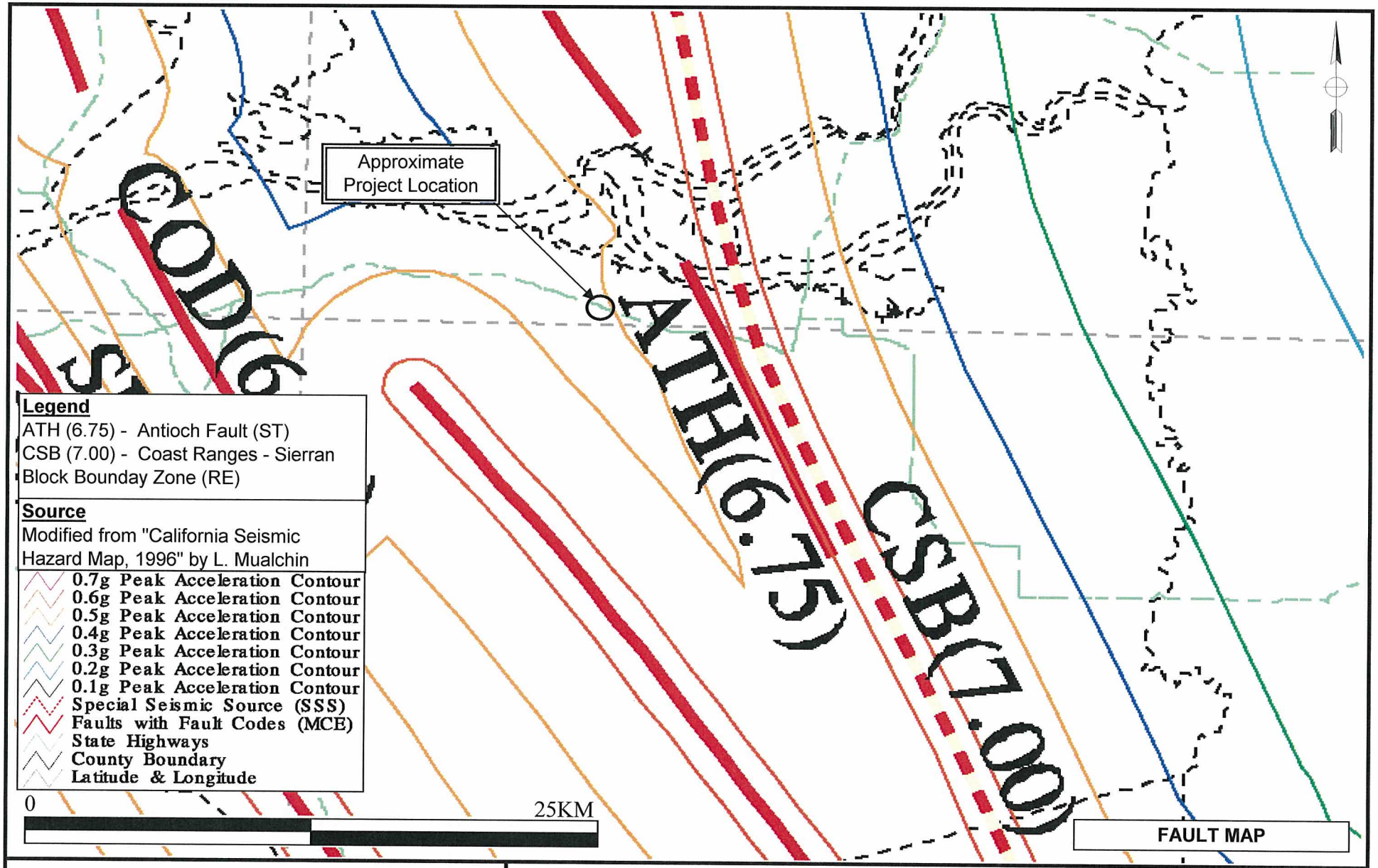
GEOLOGIC MAP

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

EAST CONTRA COSTA COUNTY TRANSIT DEVELOPMENT (eBART)
AT UTILITIES UNDERCROSSING, PITTSBURG, CALIFORNIA

JOB NO.: 205124.10

PLATE NO.: 2



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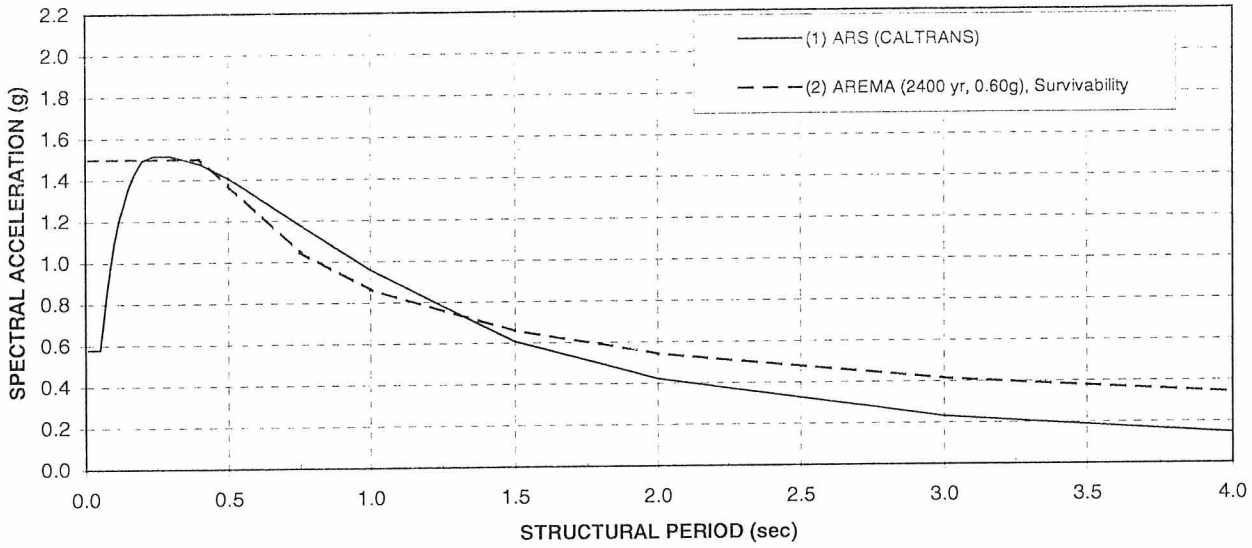
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

EAST CONTRA COSTA COUNTY TRANSIT DEVELOPMENT (eBART)
AT UTILITIES UNDERCROSSING, PITTSBURG, CALIFORNIA

JOB NO.: 205124.10

PLATE 3



(1) Caltrans SDC (v 1.4, June 2006), Figure B.8
Governing Fault: Coast Ranges - Sierran Block Boundary Zone (Mw=7.0, Soil Profile Type D, PBA= 0.58 g)
The PBA is obtained by incorporating the Mw and fault distance into the relationship per Sadigh (1997) and then increasing the PBA computed by 20% to account for the reverse fault effect.
The curve for PBA=0.58g was obtained by interpolation of the PBA=0.5g and PBA=0.6g curves

(2) AREMA (with MAX=2.5 AD)
Performance Criteria Limit State = Survivability
Use 2400-year standard return period (USA) and Base Acceleration Coefficient = 0.60 g
Site Coefficient = 1.2 (Soil Type 2), D (Damping Factor) = 1.0 (for 5%)
AREMA (with MAX=2.5 AD)

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER Philip Weymond No. 2596 Exp. 6/30/09 GEOTECHNICAL STATE OF CALIFORNIA

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PLEASANT HILL, CA 94523

URS
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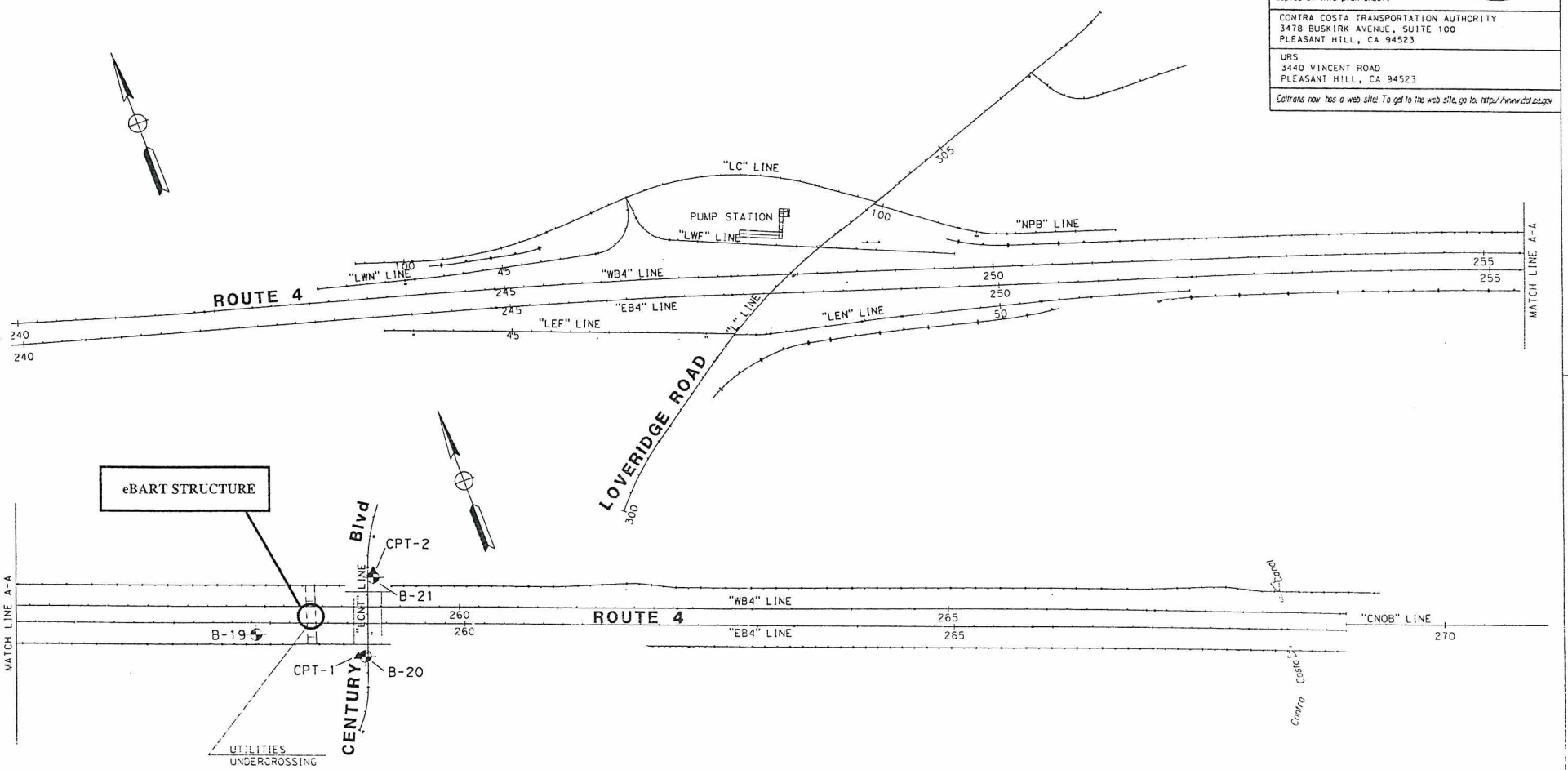
Caltrans Metric



(From URS Foundation Report)

UTILITIES UC (WIDEN) FOUNDATION REPORT
SITE AND BORING LOCATIONS

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

PLATE 5

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

DESIGN OVERSIGHT: SOTERO ANGELES

CALCULATED/DESIGNED BY: EAJ DATE: 06/06 REVISED BY

CHECKED BY: BR 06/06 DATE REVISED

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

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DGN FILE => ...\Hand-keymap-uti.dgn

CU 04275 EA 228591

APPENDIX A

(includes all plates in Appendix B and As-Built LOTB Sheet in Appendix A from URS Report)

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER _____ DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meyrand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

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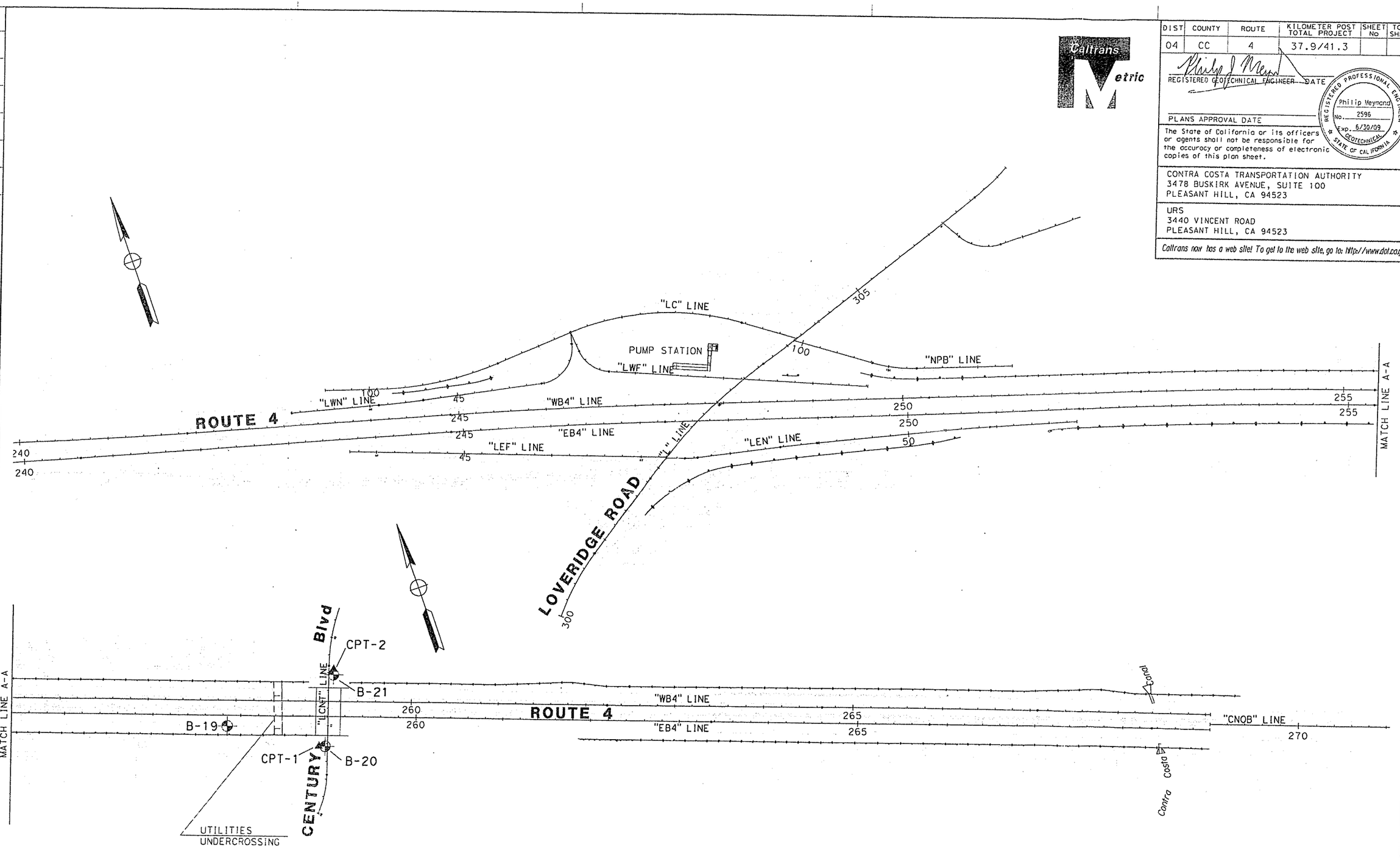
DATE	REVISED BY
EAJ 06/06	DATE REVISED
BR 06/06	

CALCULATED/ DESIGNED BY
CHECKED BY

DESIGN OVERSIGHT
SOTERO ANGELES

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans



UTILITIES UC (WIDEN) FOUNDATION REPORT
SITE AND BORING LOCATIONS

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

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CU 04275 EA 228501

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BENCH MARKS

BENCH MARK DATA
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EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

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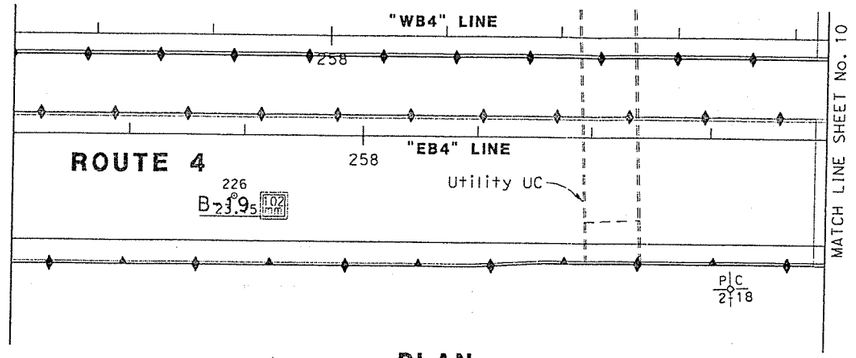
ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



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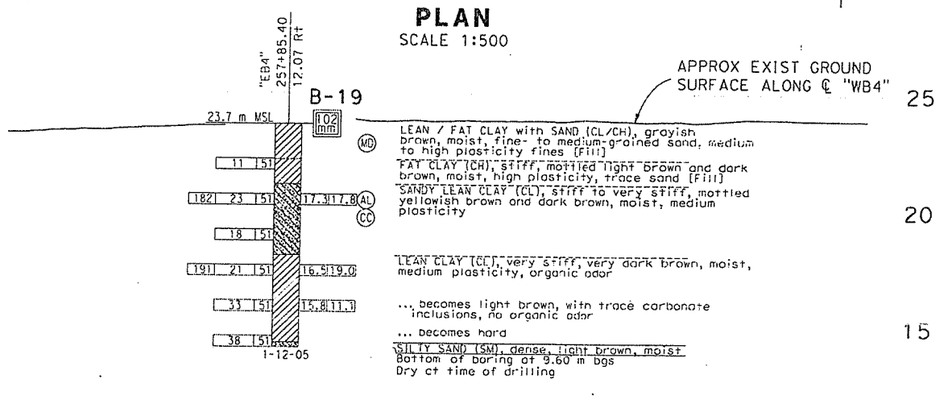

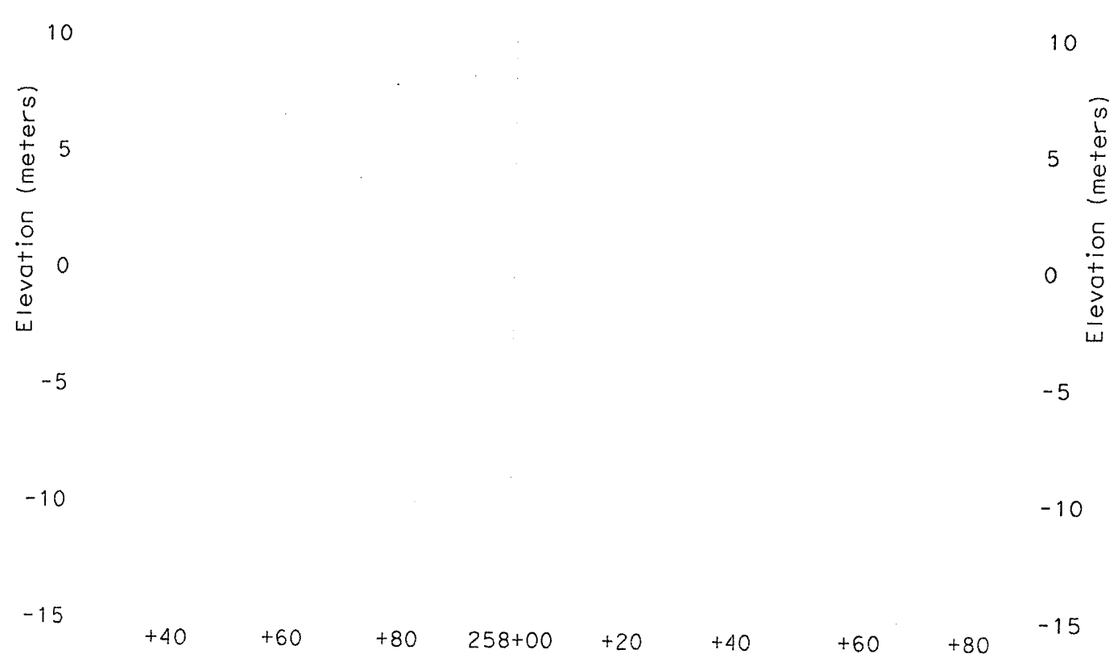

PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

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URS
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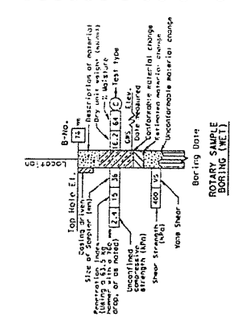
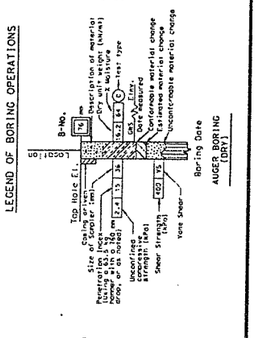
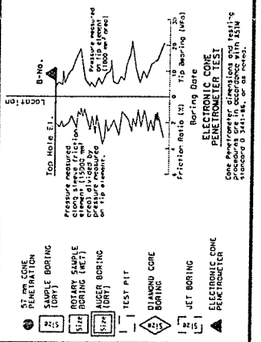
PLEASANT HILL, CA 94523

LEGEND OF BORING OPERATIONS

TEST TYPE
A Atterberg Limit
C Corrosivity Test
CN Consolidation
DS Direct Shear
HY Hydrometer
MD Moisture Density (Proctor)
P Pushed Sample
R Resistance R-value Test
SA Sieve Analysis
SE Swell/Settlement Test
U Unconsolidated Undrained Triaxial Compression
W Wash Sieve







ST 49 mm CONE PENETRATION TEST
SAMPLE BORING
ROTARY SAMPLE BORING (WET)
AUGER BORING (DRY)
TEST PIT
DIAMOND CORE BORING
JET BORING
ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS

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

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/ 0.3m)	Granular	SPT N-Value (Blows/ 0.3m)	Cohesive
0-4	Very Loose	1/2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
/50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO. 28-0105	UTILITIES UC (WIDEN)
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/04/05		PROJECT ENGINEER	KILOMETER POST 39.9(24.8)	LOG OF TEST BORINGS 1 OF 4

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

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CU 04275
EA 228591

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DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 10 OF 13

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BENCH MARKS

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ELEVATION=17.943 m

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No. BART-185

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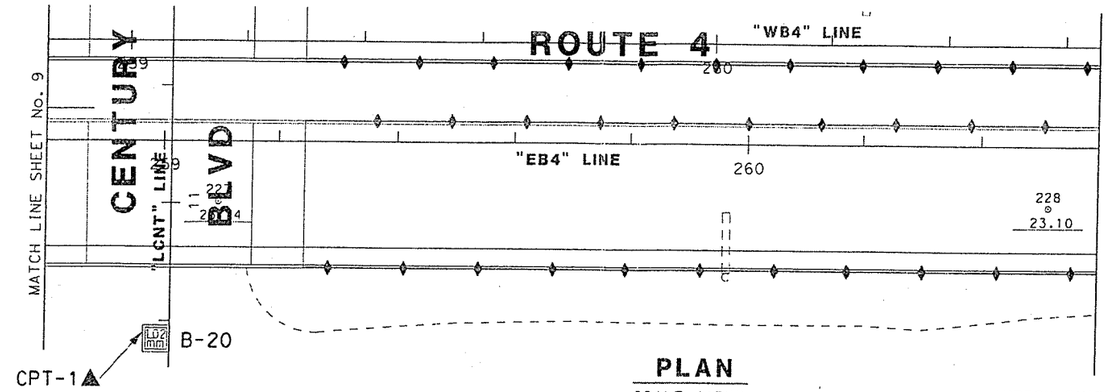
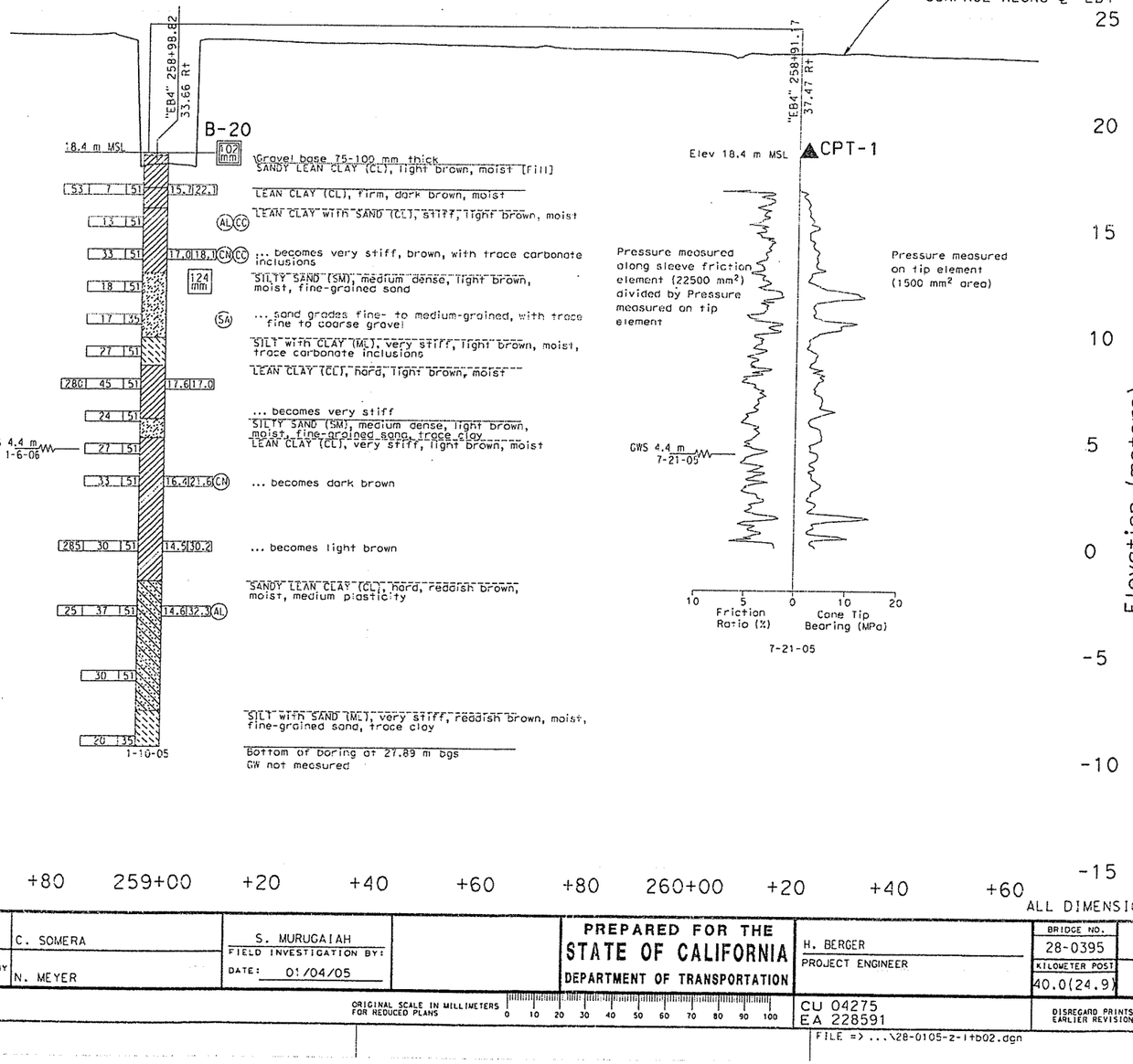
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.





PROFILE VIEW

Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

Philip Meyhand No. 2596 Exp. 6/30/09 REGISTERED PROFESSIONAL ENGINEER GEOTECHNICAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

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

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

LEGEND OF BORING OPERATIONS

TEST TYPE: Atterberg Limit; Corrosivity Test; Consolidation; Direct Shear; Imprometer; Mpa Density (CID Compaction Test); Resistance R-value; Sieve Analysis; Swell/Settlement Test; Unconsolidated Undrained Triaxial Compression Test; Vane Shear

57 mm CONE PENETRATION; SAMPLE BORING (SMP); ROTARY SAMPLE BORING (WET); AUGER BORING (DRY); TEST PIT; DIAMOND CORE BORING; JET BORING; ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS: GRAVEL; SAND; SILT; CLAY; SANDY CLAY or CLAYEY SAND; SANDY SILT or SILTY SAND; SILTY CLAY; CLAYEY SILT; PEAT and/or ORGANIC MATTER; FILL MATERIAL; DOUBLE; IGNEOUS ROCK; SEDIMENTARY ROCK; METAMORPHIC

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test	SPT N-Value (Blows/ 0.3m)	Granular	SPT N-Value (Blows/ 0.3m)	Cohesive
0-4		Very Loose	<2	Very Soft
5-10		Loose	2-4	Soft
11-30		Medium Dense	5-8	Firm
31-50		Dense	9-15	Stiff
>50		Very Dense	16-30	Very stiff
			>30	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO. 28-0395	UTILITIES UC (WIDEN)
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/04/05		PROJECT ENGINEER	KILOMETER POST 40.0(24.9)	LOG OF TEST BORINGS 2 OF 4

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228591

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/31/05; 2/28/06; 05/31/07; 03/28/07; 10/25/07

SHEET 11 OF 13

FILE => ...\28-0105-2-1tb02.dgn

USERNAME => Christine@RadiantPublishing TIME PLOTTED => 10/31/2007 6:17:01 PM

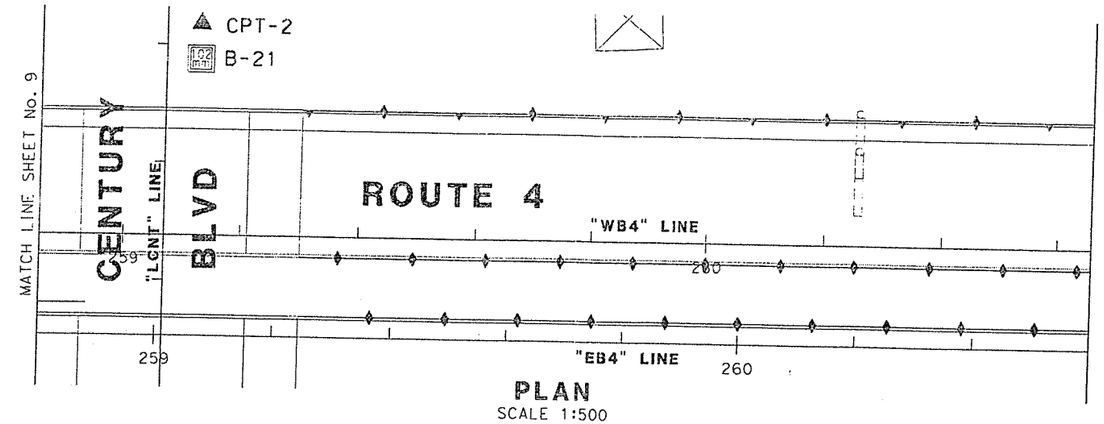
BENCH MARKS

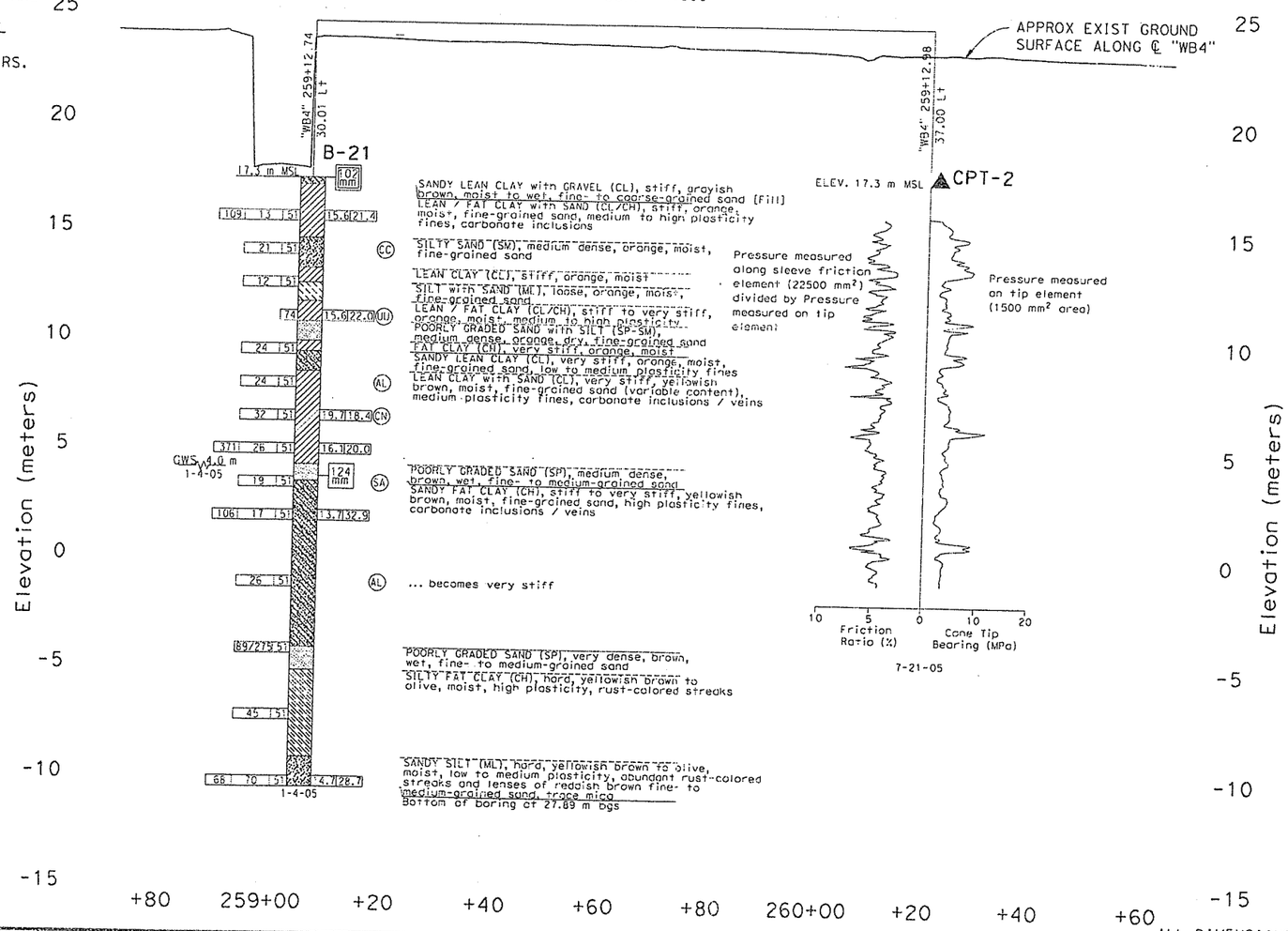
BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.





PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

DIST	COUNTY	ROUTE	KILOMETER TOTAL PROJECT	POST	SHEET No	TOTAL SHEETS
04	CC	4	37.9/4[illegible].3			

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Phillip Veymans — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

LEGEND OF BORING OPERATIONS

TEST TYPE
(A) Atterberg Limit (C) Corrosivity Test (CN) Consolidation (CR) Direct Shear (D) Dynamic Cone Penetrometer (E) Expansion Index (ECI) Expansion Index (Modified ASTM D4829) (M) Resistance R-Value (MD) Moisture Density Relationship (SA) Sieve Analysis (SR) Sieve/Hydrometer Test (UC) Unconsolidated Undrained Triaxial Compression Test (UU) Unconsolidated Undrained Triaxial Compression Test

ROTARY SAMPLE BORING (MET)
B-No. — Location — Top Hole El. — Sampling Method — Size of Sampler (mm) — Penetration Resistance (Blows per 0.3 m (1 ft) or as noted) — Recovery (%) — Sample No. — Type — Graphic Log — Description of material (Dry unit weight (kN/m³), Dry unit weight (pcf), Moisture content (%), Color, Unconsistency, Consistency, Structure, Bedding, Unweathered rock strength, Weathered rock or discontinuity spacing, Additional observations) — Unconfined Compressive Strength (kPa) — Shear Strength (kPa) — Vane Shear — Boring Date

AUGER BORING (DBY)
B-No. — Location — Top Hole El. — Sampling Method — Size of Auger — Penetration Resistance (Blows per 0.3 m (1 ft) or as noted) — Recovery (%) — Sample No. — Type — Graphic Log — Description of material (Dry unit weight (kN/m³), Dry unit weight (pcf), Moisture content (%), Color, Unconsistency, Consistency, Structure, Bedding, Unweathered rock strength, Weathered rock or discontinuity spacing, Additional observations) — Unconfined Compressive Strength (kPa) — Shear Strength (kPa) — Vane Shear — Boring Date

ELECTRONIC CONE PENETROMETER TEST
B-No. — Location — Top Hole El. — Pressure measured along sleeve friction element (15500 mm² area) divided by Pressure measured on tip element — Pressure measured on tip element (1500 mm² area) — Friction Ratio (%) — Tip Bearing (MPa) — Boring Date
Cone Penetrometer dimensions and testing procedures conform to ASTM standard D 5778, as revised.
ELECTRONIC CONE PENETROMETER

63.5 mm CONE PENETRATION — SAMPLE BORING (DBY) — ROTARY SAMPLE BORING (MET) — AUGER BORING (DBY) — TEST PIT — DIAMOND CORE BORING — JET BORING — ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS
GRAVEL — SAND — SILT — CLAY — SANDY CLAY or CLAYEY SAND — SANDY SILT or SILTY SAND — SILTY CLAY — CLAYEY SILT — PEAT and/or ORGANIC WATER — TILL MATERIAL — COBBLE — IGNEOUS ROCK — SEDIMENTARY ROCK — METAMORPHIC

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N Value (Blows/0.3m)	Granular	SPT N Value (Blows/0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	P. RESPESS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/04/05		PROJECT ENGINEER

BRIDGE NO. 28-0395 — KILOMETER POST 40.0(24.9)

UTILITIES UC (WIDEN)
LOG OF TEST BORINGS 3 OF 4

CU 04275
EA 228591

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/31/06 | 7/23/07 | 09/28/07 | 10/25/07

SHEET 12 OF 13

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

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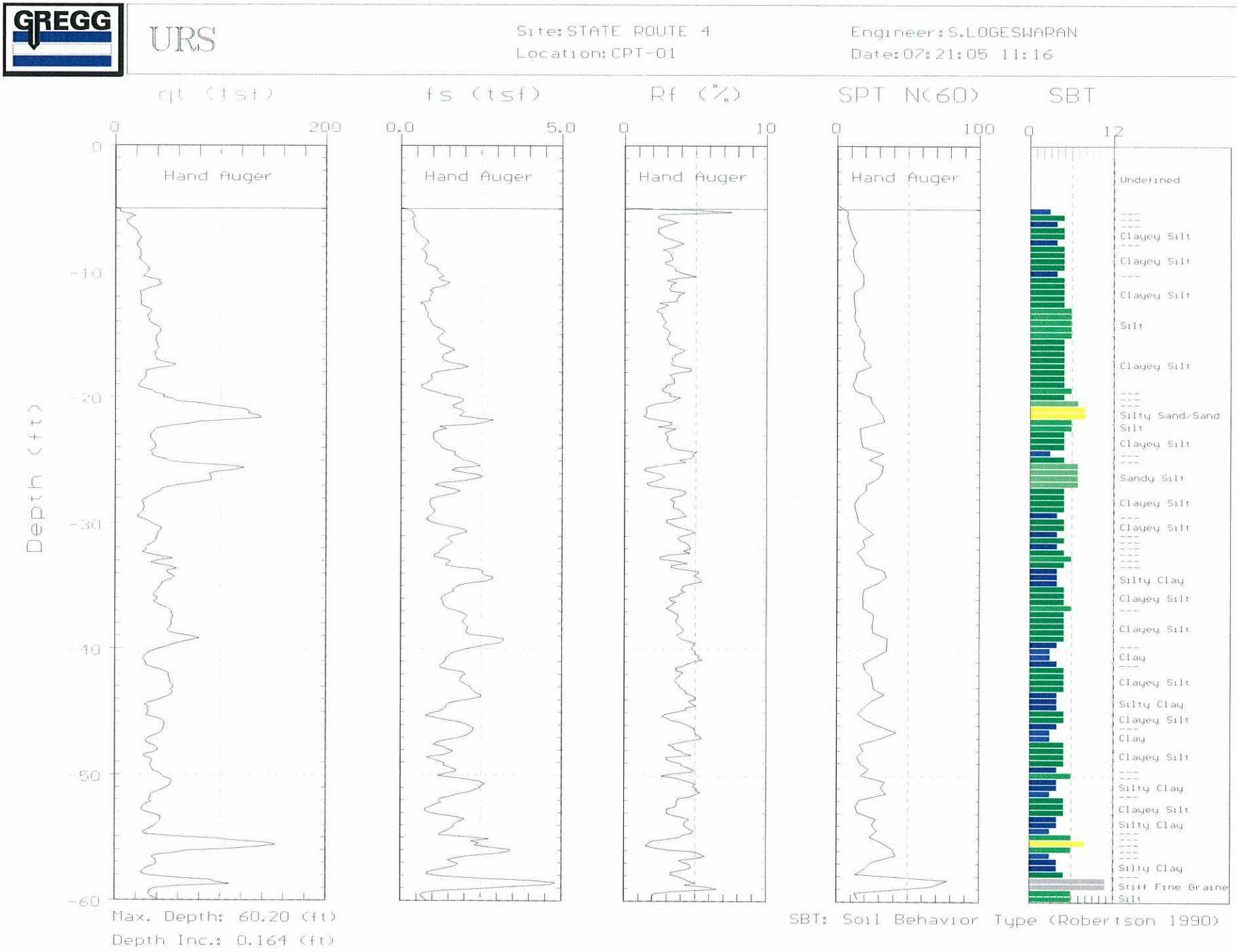
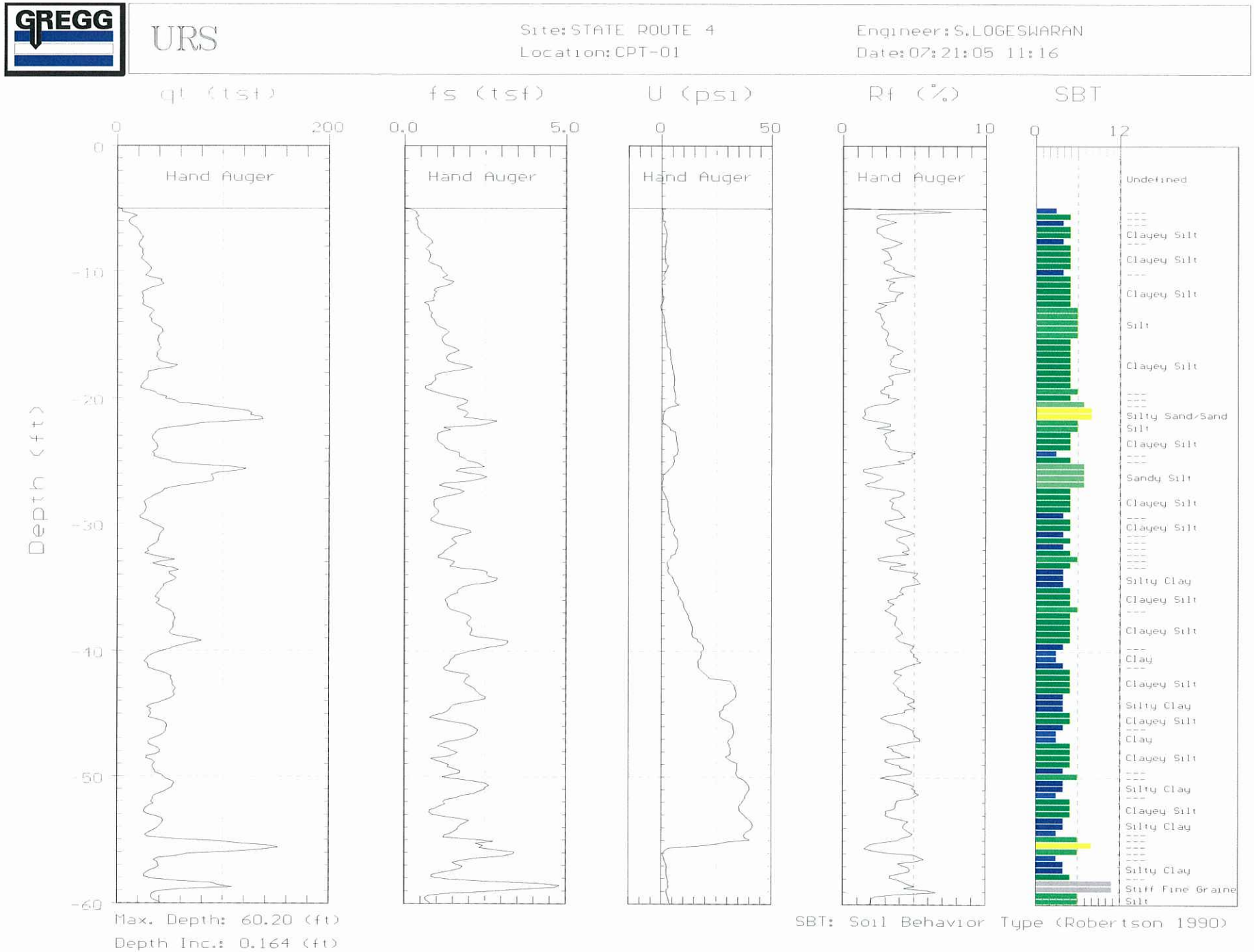
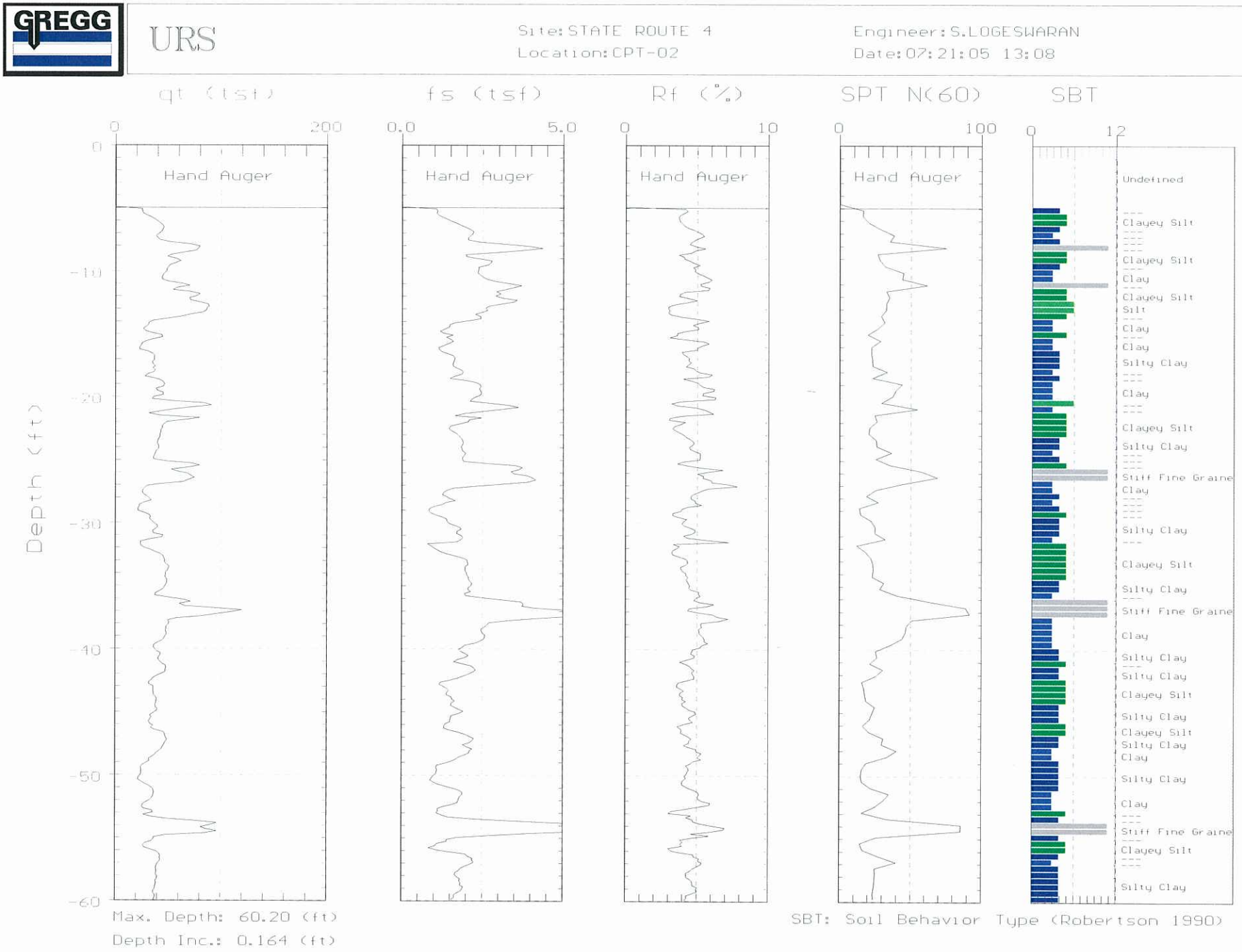
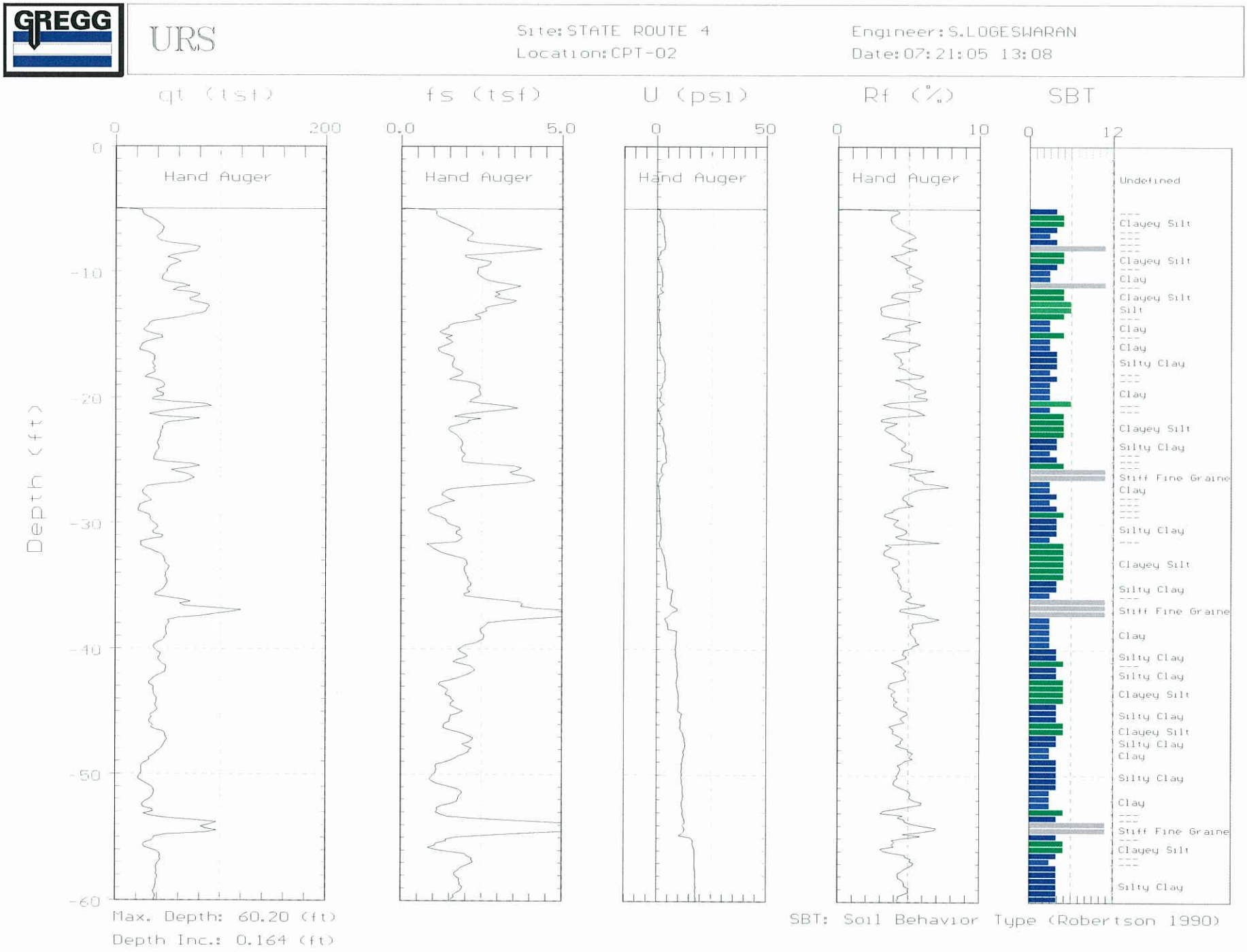

GREGG
URS
Site: STATE ROUTE 4
Location: CPT-01
Engineer: S.LOGESWARAN
Date: 07:21:05 11:16
qt (tsf)
fs (tsf)
Rf (%)
SPT N(60)
SBT
Hand Auger
Depth (ft)
Undefined
Clayey Silt
Silty Sand/Sand Silt
Sandy Silt
Silty Clay
Clay
Stiff Fine Grained Silt
Max. Depth: 60.20 (ft)
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson 1990)


GREGG
URS
Site: STATE ROUTE 4
Location: CPT-01
Engineer: S.LOGESWARAN
Date: 07:21:05 11:16
qt (tsf)
fs (tsf)
U (psi)
Rf (%)
SBT
Hand Auger
Depth (ft)
Undefined
Clayey Silt
Silt
Silty Sand/Sand Silt
Sandy Silt
Silty Clay
Clay
Stiff Fine Grained Silt
Max. Depth: 60.20 (ft)
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson 1990)

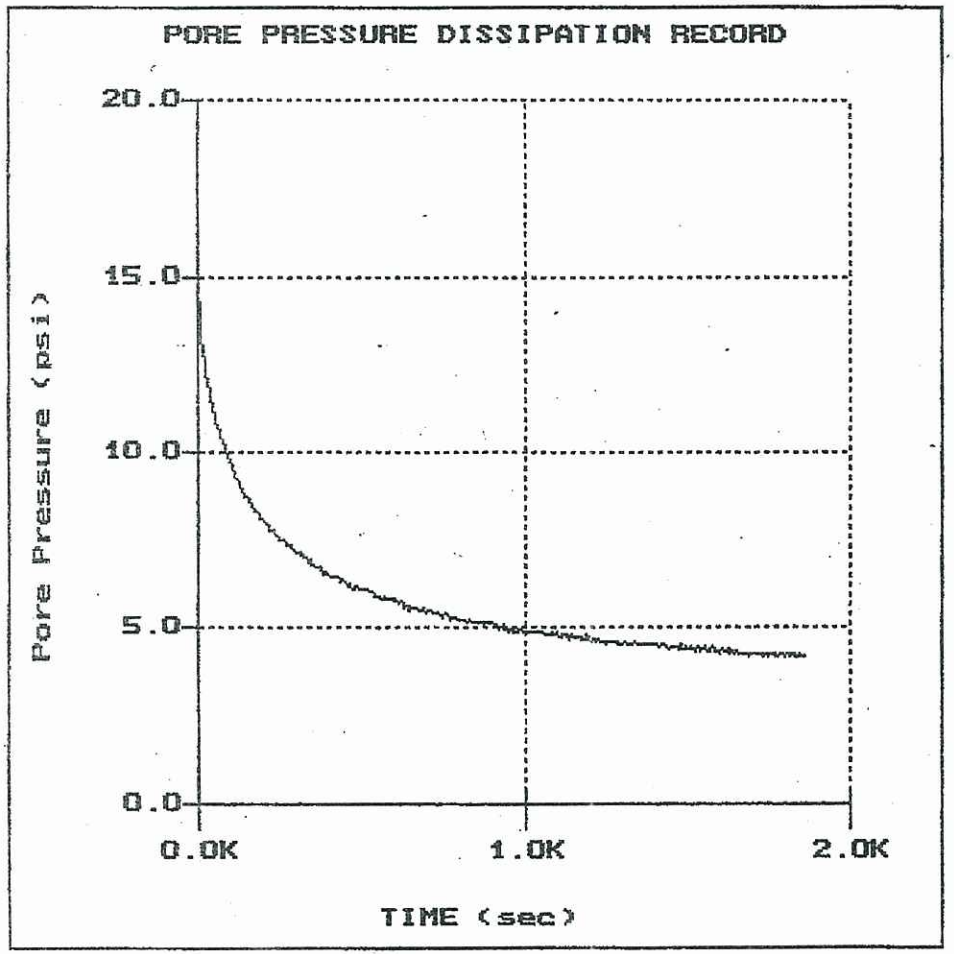

GREGG
URS
Site: STATE ROUTE 4
Location: CPT-02
Engineer: S.LOGESWARAN
Date: 07:21:05 13:08
qt (tsf)
fs (tsf)
Rf (%)
SPT N(60)
SBT
0
200
0.0
5.0
0
10
0
100
0
12
Hand Auger
Depth (ft)
0
-10
-20
-30
-40
-50
-60
Undefined
Clayey Silt
Clayey Silt
Clay
Clayey Silt
Silt
Clay
Clay
Silty Clay
Clay
Clayey Silt
Silty Clay
Stiff Fine Graine
Clay
Silty Clay
Clayey Silt
Silty Clay
Stiff Fine Graine
Clay
Silty Clay
Silty Clay
Clayey Silt
Silty Clay
Clayey Silt
Silty Clay
Clay
Silty Clay
Clay
Stiff Fine Graine
Clayey Silt
Silty Clay
Max. Depth: 60.20 (ft)
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson 1990)


GREGG
URS
Site: STATE ROUTE 4
Location: CPT-02
Engineer: S.LOGESWARAN
Date: 07:21:05 13:08
qt (tsf)
fs (tsf)
U (psi)
Rf (%)
SBT
0
200
0.0
5.0
50
10
12
Hand Auger
Depth (ft)
-10
-20
-30
-40
-50
-60
Undefined
Clayey Silt
Clay
Silt
Silty Clay
Stiff Fine Graine
Max. Depth: 60.20 (ft)
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson 1990)

URS

Site:STATE ROUTE 4
Location:CPT-01

Engineer:S.LOGESWARA
Date:07:21:05 11:16



File: 293C01.PPC
Depth (m): 16.90
(ft): 55.45
Duration : 1860.0s
U-min: 4.15 1840.0s
U-max: 14.93 0.0s

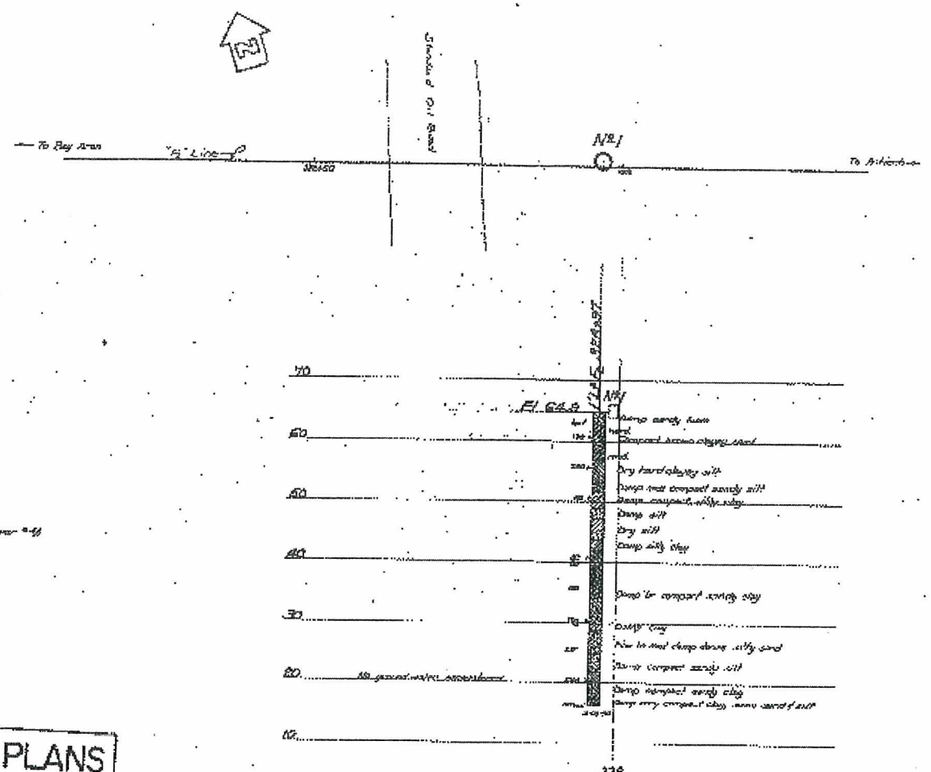
F-246(3)

187 140

NE cor. Sec. 5 T. 2 S. R. 2 W. M.D.B.&M.

Revised Mitigation

AUGUST 27, 1951



AS BUILT PLANS
Contract No. 52-041227
Date Completed
Document No. 4100252

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES					
As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.					
DIST.	COUNTY	ROUTE	KILOMETER POST-TOTAL PROJECT	Sheet No.	Total Sheets
04	CC		37.9/41.3		

Philip J. Meymand
REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER
Philip Meymand
No. 2596
Exp. 6/30/07
GEOTECHNICAL
STATE OF CALIFORNIA

UTILITIES UC (WIDEN)

LOG OF TEST BORINGS NO. 4 OF 4

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

CU: 04275
EA: 228591

BRIDGE No.	
28-0105	
Sheet	of
12	12

Revisions made to this Log of Test Borings from the original 1951 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from "EB4" Line
N-1	258+55.06	0.84 Rt

Notes:

1. See the General Plan and/or Foundation Plan for Metric Stationing.
2. Structure Design produced the data presented in the table above. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.

NOTE: 22mm per-foot wrap made using a 28 in. base circle with a 29 inch free full

No Change
THIS SEC OF PLANS HAS BEEN IDENTIFIED AS CONFORMING TO THE AS BUILT CONDITION AS REVISED BY ADDENDA
SIGNATURE [illegible] DATE 12-22-06

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

LEGEND OF BORING OPERATIONS

LEGEND OF EARTH MATERIALS

ABBREVIATIONS

NOTES

MICROFILMED

STANDARD OIL ROAD UNDERCROSSING

11 x 17
28-99
C-2548-4

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY SUPERVISION AND CONTROL OF WORK DONE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION OF THE DISCIPLINE OF FIELD WORKS.

DATE 8/21/27 SIGNATURE [illegible] NOTES [illegible]

Appendix B

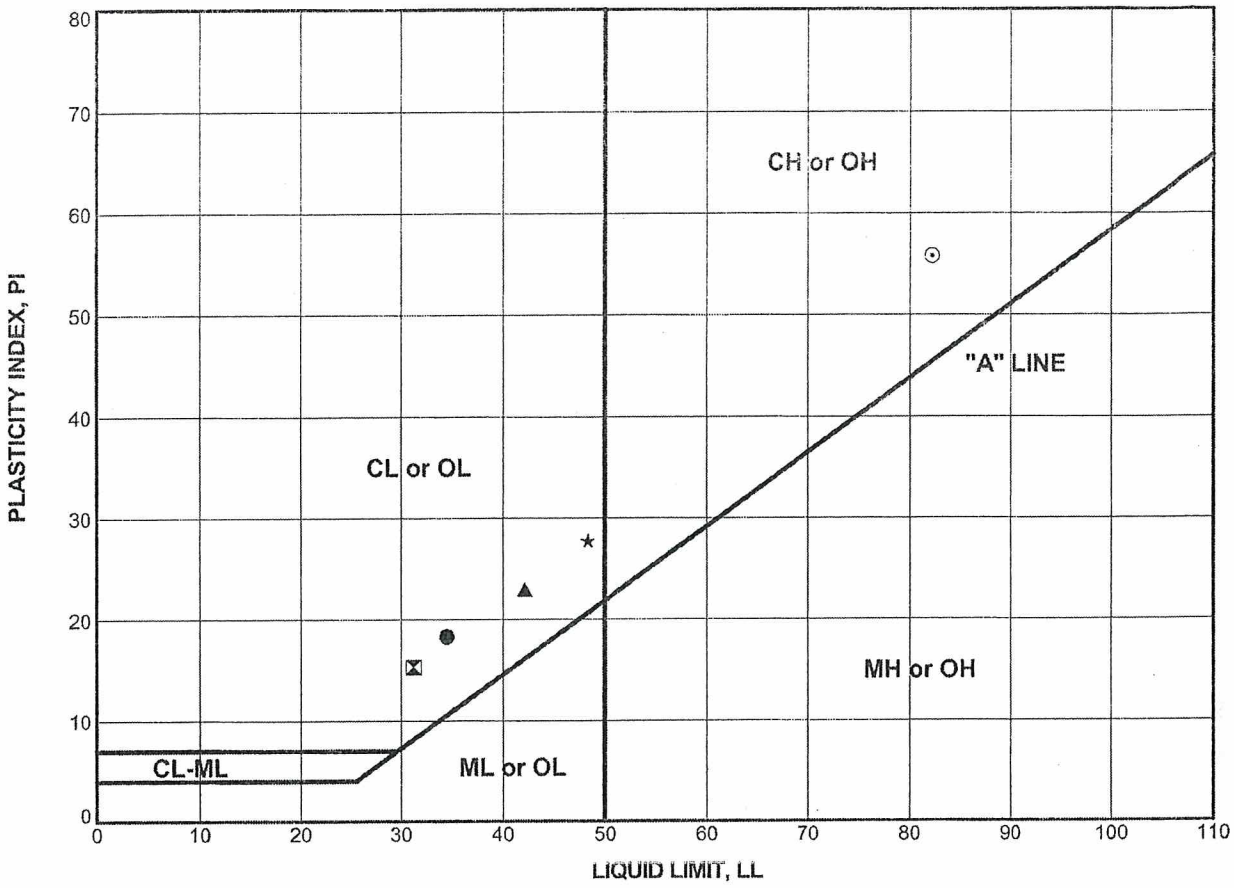
(Laboratory Tests (Appendix C) and Corrosion Tests (Appendix D) in URS Report)

TABLE C-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information			USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, kN/m^3	Sieve			Atterberg Limits			Unconfined Compressive Strength, kPa	UU Triaxial		Other Tests
Boring Number	Sample Number	Depth, meters				Gravel, %	Sand, %	<#200, %	LL	PL	PI		Peak Deviator Stress, kPa	Confining Pressure, kPa	
B-19	19-1	0.6-1.5	CL/CH												COMP
B-19	19-3A	3.0-3.7	CL												CORR
B-19	19-3-4	3.35	CL	17.8	17.3				34	16	18	182			
B-19	19-5-4	6.40	CL	19.0	16.5							191			
B-19	19-6-4	7.92	CL	11.1	15.8										
B-20	20-1-4	1.83	CL	22.1	15.7							53			
B-20	20-2-3	3.20	CL						31	16	15				CORR
B-20	20-3-3	4.72	CL	18.1	17.0										CONS
B-20	20-3-4	4.88	CL												CORR
B-20	20-5	7.77	SM			3	72	25							
B-20	20-7-4	10.97	CL	17.0	17.6							280			
B-20	20-10-4	15.54	CL	21.6	16.4										CONS
B-20	20-11-4	18.59	CL	30.2	14.5							285			
B-20	20-12-4	21.64	CL	32.3	14.6				42	19	23	25			
B-21	21-1-3	1.83	CL/CH	21.4	15.6							109			
B-21	21-2-2	3.20	SM												CORR
B-21	21-4	6.10	CL/CH	22.0	15.6								135	86	
B-21	21-6-3	9.45	CL						48	21	27				
B-21	21-7-3	10.97	CL	18.4	16.6										CONS
B-21	21-8-3	12.50	CL	20.0	16.1							371			
B-21	21-9-2	13.87	CH			1	30	70							
B-21	21-10-2	15.39	CH	32.9	13.7							106			
B-21	21-11-2	18.44	CH						82	26	56				
B-21	21-14-2	27.58	ML	28.7	14.7							68			

The laboratory tests were performed in general accordance with the following ASTM standards:

Water Content - ASTM Test Method D2216
Dry Unit Weight - ASTM Test Method D2937
Particle Size Distribution Analysis by Mechanical Sieving and Hydrometer - ASTM Test Method D422
Atterberg Limits - ASTM Test Method D4318
Unconfined Compressive Strength Test (UC, q_u in kPa) - ASTM Test Method D2166
Unconsolidated Undrained Triaxial Compression Test (UU Triaxial) - ASTM Test Method D2850
One-dimensional Consolidation Test (CONS) - ASTM Test Method D2435
One-dimensional Swell/Settlement Potential Test (SWELL) - ASTM Test Method D4546
Laboratory Compaction Test (COMP) - ASTM Test Method D1557-B
Corrosivity Suite of Chemical Tests (CORR) - Redox by ASTM Test Method D1498; pH by ASTM Test Method D4972; Resistivity by ASTM Test Method G57; Sulfate Content and Chloride Content by ASTM Test Method D4327



Boring Number	Sample Number	Depth (meters)	Test Symbol	Moisture Content (%)	LL	PL	PI	Classification
B-19	19-3-4	3.35	●	18	34	16	18	Sandy Lean Clay (CL)
B-20	20-2-3	3.20	⊠		31	16	15	Lean Clay with Sand (CL)
B-20	20-12-4	21.64	▲	32	42	19	23	Sandy Lean Clay (CL)
B-21	21-6-3	9.45	★		48	21	27	Lean Clay with Sand (CL)
B-21	21-11-2	18.44	⊙		82	26	56	Sandy Fat Clay (CH)

Report: ATTERBERG_PLOT_12 PTS; File: OAK_SR4PITTS.GPJ; 2/24/2005

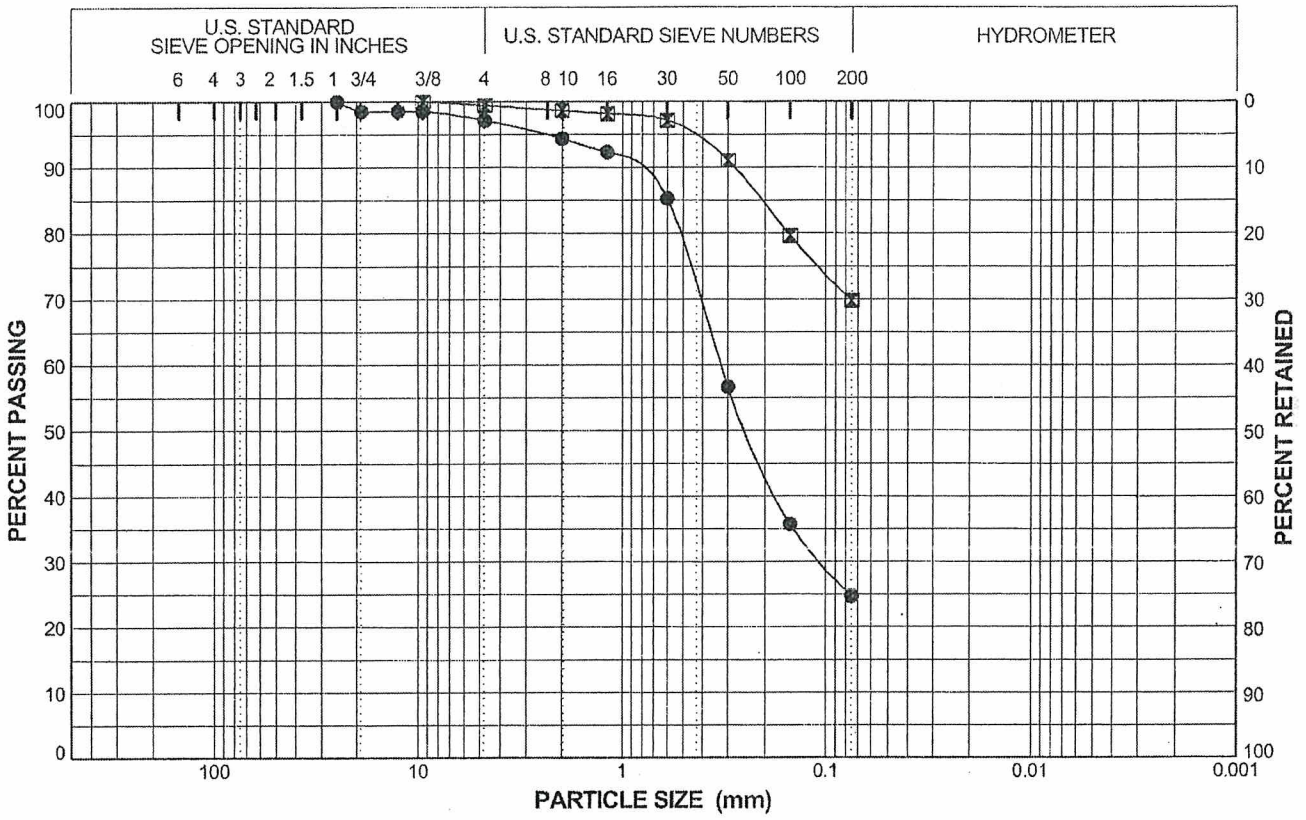
State Route 4 Loveridge to Somersville Road
Utility Crossing Bridge No. 28-105
26814910.24000

PLASTICITY CHART

URS

Figure C-1

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (meters)	Symbol	LL	PI	Classification
B-20	20-5	7.77	●			Silty Sand (SM)
B-21	21-9-2	13.87	⊠			Sandy Fat Clay (CH)

Report: SIEVE_5_CURVES_OAK; File: OAK_SR4PITTS.GPJ; 2/24/2005

State Route 4 Loveridge to Somersville Road
Utility Crossing Bridge No. 28-105
26814910.24000

PARTICLE SIZE DISTRIBUTION CURVES

Figure C-2

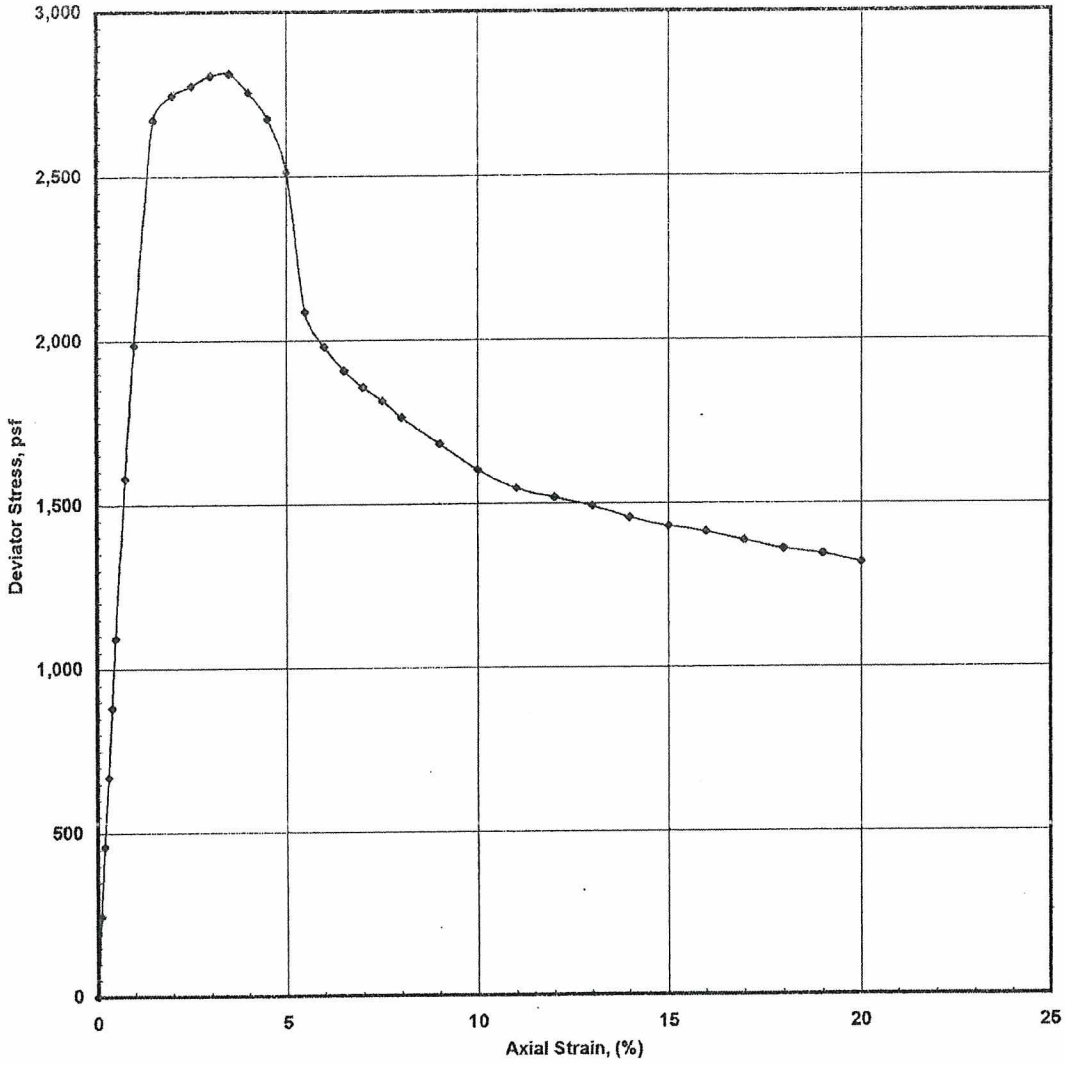
URS

URS

Unconsolidated Undrained Triaxial Test
ASTM D2850

Project Name:	SR 4 Loveridge to Somersville Rd.	Total Unit Weight, pcf:	121.2
Project Number:	26814910.24000	Dry Unit Weight, pcf:	99.3
Location:	Pittsburg, CA	Moisture Content, %:	22.04
Boring Number:	CB-21	Saturation, %:	87.7
Sample Number:	4	Void Ratio:	0.666
Depth, ft:	20-22	Confining Pressure, psf:	1,800
Date Tested:	01/21/05	Peak Deviator Stress, psf:	2,812
Description:	Brown sandy clay	Strain @ Failure, %:	3.50
Sample Diameter, in:	2.860	Sample Height, in:	5.945

Dial Reading, inches	Load Reading, pounds	Axial Strain, percent	Deviator Stress, psf
0.000	0.0	0.00	0.0
0.006	11.0	0.10	246
0.012	20.5	0.20	459
0.018	30.0	0.30	670
0.024	39.5	0.40	882
0.030	49.0	0.50	1093
0.045	71.0	0.75	1580
0.059	89.5	1.00	1986
0.089	121.0	1.50	2672
0.119	125.0	2.00	2746
0.149	127.0	2.50	2776
0.178	129.0	3.00	2805
0.208	130.0	3.50	2812
0.238	128.0	4.00	2754
0.268	125.0	4.50	2676
0.297	118.0	5.00	2513
0.327	98.5	5.50	2086
0.357	94.0	6.00	1981
0.386	91.0	6.50	1907
0.416	89.0	7.00	1855
0.446	87.5	7.50	1814
0.476	85.5	8.00	1763
0.535	82.5	9.00	1683
0.595	79.5	10.00	1604
0.654	77.5	11.00	1546
0.713	77.0	12.00	1519
0.773	76.5	13.00	1492
0.832	75.5	14.00	1455
0.892	75.0	15.00	1429
0.951	75.0	16.00	1412
1.011	74.5	17.00	1386
1.070	74.0	18.00	1360
1.130	74.0	19.00	1344
1.189	73.5	20.00	1318



Description: Brown sandy clay

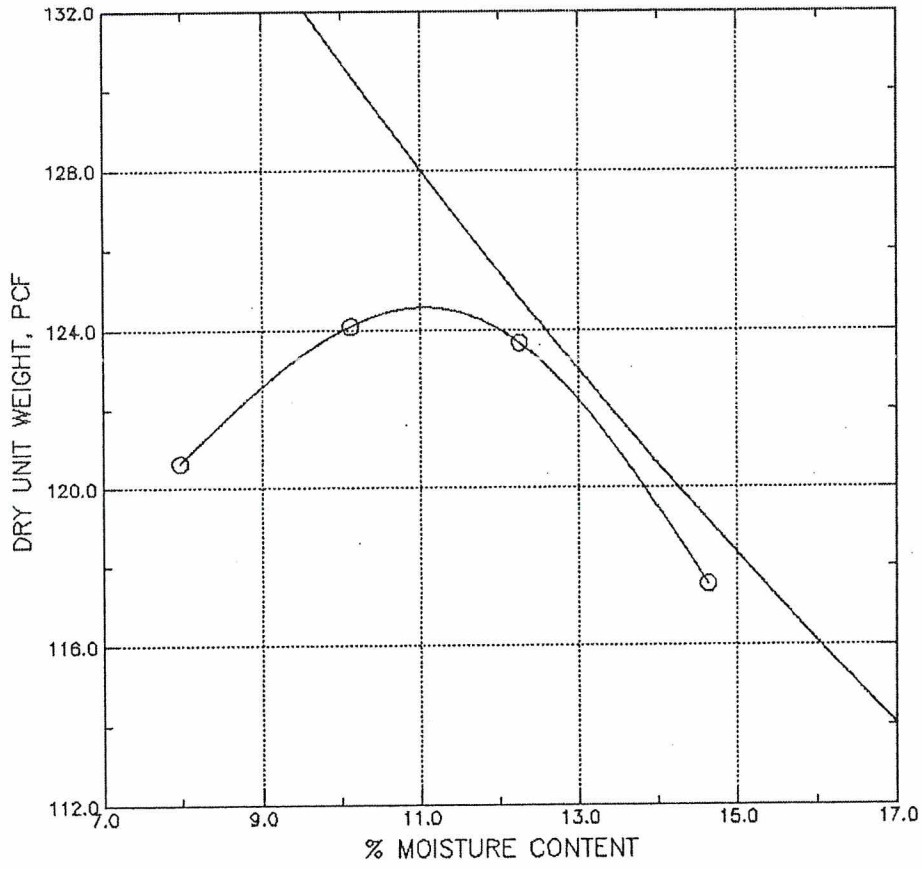
Boring Number	Sample Number	Sample Depth (feet)	Dry Unit Weight (pcf)	Initial Moisture Content (%)	Specific Gravity (assumed)	Void Ratio	Initial Saturation (%)	Height/ Diameter Ratio	Rate of Shearing (%/min)	Confining Pressure (psf)	Peak Deviator Stress (psf)	Peak Shear Stress (psf)
CB-21	4	20-22	99.3	22.0	2.65	0.666	87.7	2.08	0.75	1,800	2,812	1,406

Project Name: SR 4	**UNCONSOLIDATED UNDRAINED TRIAXIAL TEST STRESS VS. STRAIN ASTM D2850**	URS
Project Number: 26814910.24000		Figure No.
Location: Pittsburg, , CA		

URS

	Boring No. : B-19 Sample No. : 1 Tested by : S. Capps Filename : B19-01	Project : SR 4 Loveridge to Somersville Rd. Project No.: 26814910.24000 Location : Pittsburg, CA Date: Fri Feb 04 2005

COMPACTION



Sample Description	: Brown sandy clay
Compaction Test Designation	: ASTM D1557-B
Maximum Dry Density	: 124.6 PCF
Optimum Moisture Content	: 11.1 %

Figure 2

URS

Fri Feb 04 08:45:06 2005

GEOTECHNICAL LABORATORY TEST DATA

Project : SR 4 Loveridge to Somersville Rd.
Project No. : 26814910.24000
Boring No. : B-19
Sample No. : 1
Location : Pittsburg, CA
Soil Description : Brown sandy clay
Remarks :

Depth : 2.0-5.0 feet
Test Date : 02/04/2005
Test Method : ASTM D1557-B

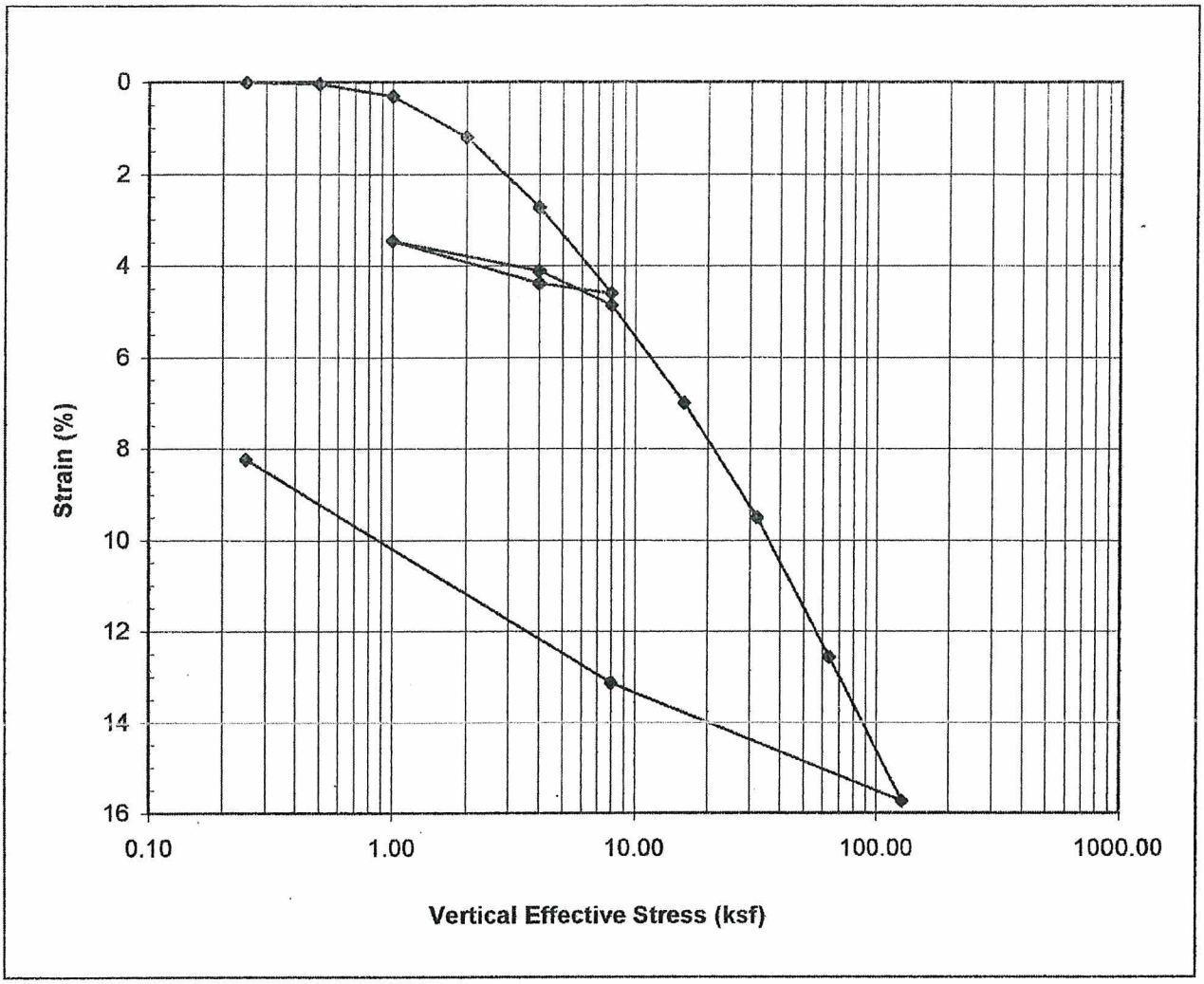
Filename : B19-01
Elevation : NA
Tested by : S. Capps
Checked by : R. Taraya

COMPACTION TEST

Mold ID : 4-1
Method Used : ASTM D1557-B
Volume of Mold : 0.03325 ft^3
Mass of Mold : 1856.6 gm
Specific Gravity : 2.65

Moisture Content ID	Mass of Container (gm)	Mass of Container + Moist Soil (gm)	Mass of Container + Dry Soil (gm)	Mass of Mold + Specimen (gm)	Moisture Content (%)	Dry Density (PCF)
	0.00	1960.10	1815.30	3821.30	8.0	120.6
	0.00	2059.80	1870.50	3917.40	10.1	124.1
	0.00	2092.10	1863.60	3950.40	12.3	123.7
	0.00	2031.30	1772.00	3888.70	14.6	117.5

Optimum Dry Density = 124.6 PCF
Optimum Moisture Content = 11.1 %



Boring: CB-20 Sample: 3-3 Depth, ft: 15.5

Description: Brown sandy clay

	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est.	Liquid Limit	Plasticity Index
Initial	18.05	128.0	108.5	0.611	82.7	0.9000	1.926	2.800	NA	NA
Final	17.07	138.4	118.2	0.478	99.9	0.8259				

Project: **SR 4**

Project #: **26814910**

Date: **01/20/05**

URS

Consolidation Test

Figure:

URS

Consolidation Test
ASTM D2435 Method A

Date: 01/20/05

Project Name: SR 4

Project Number: 26814910 .24000

Boring Number: CB-20 **Sample Number:** 3-3

Depth, ft: 15.5

Location: Pittsburg, CA

Load, Grams	Load, ksf	Load, tsf	Initial Dial, Inches	Frame Corr.	Dial Change	Final Dial, Inches	Change in Height, in.	Strain, Incre., %	Strain, Cum., %
250	0.25	0.13	0.3000	0.0009	0.0009	0.2991	0.0000	0.00	0.00
500	0.50	0.25	0.2991	0.0007	0.0010	0.2981	0.0003	0.03	0.03
1000	1	0.5	0.2981	0.0007	0.0032	0.2949	0.0025	0.28	0.31
2000	2	1	0.2949	0.0010	0.0090	0.2859	0.0080	0.89	1.20
4000	4	2	0.2859	0.0012	0.0149	0.2710	0.0137	1.52	2.72
8000	8	4	0.2710	0.0010	0.0179	0.2531	0.0169	1.88	4.60
4000	4	2	0.2531	0.0005	-0.0024	0.2555	-0.0019	-0.21	4.39
1000	1	0.50	0.2555	0.0010	-0.0094	0.2649	-0.0084	-0.93	3.46
4000	4	2	0.2649	0.0009	0.0068	0.2581	0.0059	0.66	4.11
8000	8	4	0.2581	0.0007	0.0074	0.2507	0.0067	0.74	4.86
16000	16	8	0.2507	0.0009	0.0202	0.2305	0.0193	2.14	7.00
32000	32	16	0.2305	0.0005	0.0231	0.2074	0.0226	2.51	9.51
64000	64	32	0.2074	0.0008	0.0283	0.1791	0.0275	3.06	12.57
128000	128	64	0.1791	0.0016	0.0301	0.1490	0.0285	3.17	15.73
8000	8	4	0.1490	0.0015	-0.0249	0.1739	-0.0234	-2.60	13.13
250	0.25	0.13	0.1739	0.0036	-0.0477	0.2216	-0.0441	-4.90	8.23
					Total	Change	0.0741		
					in	Height, in.			

URS

Consolidation Test
ASTM D2435 Method A

Frame 5

Project Name: SR 4

Project Number: 26814910.24000

Boring Number: CB-20

Depth, ft: 15.5

Location: Pittsburg, CA

Tested By: S. Capps

Date: 01/20/05

Sample Number: 3-3

Description: Brown sandy clay

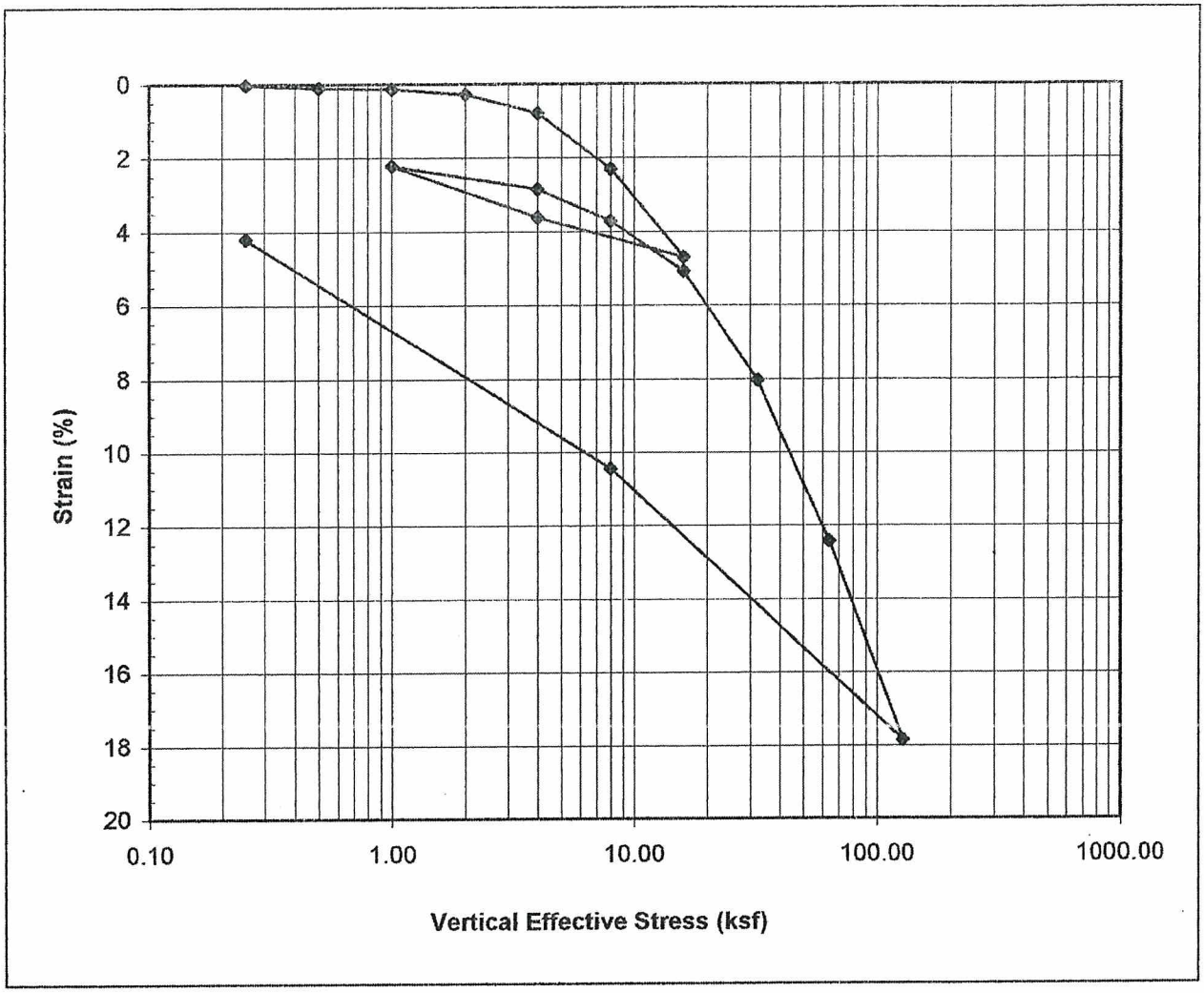
Liquid Limit: NA

Plastic Limit: NA

Plasticity Index: NA

Reviewed By: R. Taraya

Water Content Determination	Soil Adjacent to Sample	Sample at Start of Test	Sample at End of Test
Wet Soil + Tare, grams	315.8	297.5	296.77
Dry Soil + Tare, grams	283.48	284.02	284.02
Tare, grams	104.56	209.34	209.34
Weight of Water, grams	32.32	13.48	12.75
Weight of Dry Soil, grams	178.92	74.68	74.68
Water Content, %	18.06	18.05	17.07
Height of Gage Block, in:	0.7160	Dial Reading on Gage Block, in:	0.7450
Dial Reading on Sample, in:	0.9290		
Height of Sample, initial, in:	0.9000	Height of Sample, Final, in:	0.8259
Change in Height during Test, in:	0.0741	Estimated Specific Gravity:	2.80
Diameter of Ring, in:	1.926	Ring Number	R-7
Initial Area of Sample, cm^2:	18.80	Volume of Solids, Vs=Ws/Gs:	26.67
Volume of Sample, Initial, cm^3:	42.97	Volume of Sample, Final, cm^3	39.43
Volume of Voids, Initial, Vei, cm^3	16.30	Volume of Voids, Final, Vef, cm^3:	12.76
Volume of Water, Initial, Wwi, cm^3:	13.48	Volume of Water, Final, Wwf, cm^3:	12.75
Degree of Saturation, Initial, %	82.7	Degree of Saturation, Final, %	99.9
Total Unit Weight, Initial, pcf:	128.0	Total Unit Weight, Final, pcf:	138.4
Dry Unit Weight, Initial, pcf:	108.5	Dry Unit Weight, Final, pcf:	118.2
Initial Void Ratio:	0.6110	Final Void Ratio:	0.4784



Boring: CB-20 Sample: 10-4 Depth, ft: 51.0

Description: Brown sandy clay

	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est.	Liquid Limit	Plasticity Index
Initial	21.60	126.8	104.2	0.610	95.2	0.8940	1.939	2.690	NA	NA
Final	20.17	130.8	108.8	0.543	100.0	0.8565				

Project: **SR 4**
Project #: **26814910**
Date: **01/20/05**

URS

Consolidation Test

Figure:

URS

Consolidation Test
ASTM D2435 Method A

Date: 01/20/05

Project Name: SR 4

Project Number: 26814910 .24000

Boring Number: CB-20 **Sample Number:** 10-4

Depth, ft: 51.0

Location: Pittsburg, CA

Load, Grams	Load, ksf	Load, tsf	Initial Dial, Inches	Frame Corr.	Dial Change	Final Dial, Inches	Change in Height, in.	Strain, Incre., %	Strain, Cum., %
250	0.25	0.13	0.3000	0.0008	0.0010	0.2990	0.0002	0.02	0.02
500	0.50	0.25	0.2990	0.0006	0.0012	0.2978	0.0006	0.07	0.09
1000	1	0.50	0.2978	0.0007	0.0010	0.2968	0.0003	0.03	0.12
2000	2	1	0.2968	0.0009	0.0023	0.2945	0.0014	0.16	0.28
4000	4	2	0.2945	0.0010	0.0055	0.2890	0.0045	0.50	0.78
8000	8	4	0.2890	0.0014	0.0149	0.2741	0.0135	1.51	2.29
16000	16	8	0.2741	0.0015	0.0230	0.2511	0.0215	2.40	4.70
4000	4	2	0.2511	0.0024	-0.0120	0.2631	-0.0096	-1.07	3.62
1000	1	0.50	0.2631	0.0011	-0.0136	0.2767	-0.0125	-1.40	2.23
4000	4	2	0.2767	0.0010	0.0066	0.2701	0.0056	0.63	2.85
8000	8	4	0.2701	0.0013	0.0090	0.2611	0.0077	0.86	3.71
16000	16	8	0.2611	0.0013	0.0135	0.2476	0.0122	1.36	5.08
32000	32	16	0.2476	0.0011	0.0275	0.2201	0.0264	2.95	8.03
64000	64	32	0.2201	0.0013	0.0404	0.1797	0.0391	4.37	12.40
128000	128	64	0.1797	0.0020	0.0506	0.1291	0.0486	5.44	17.84
8000	8	4	0.1291	0.0035	-0.0697	0.1988	-0.0662	-7.40	10.44
250	0.25	0.13	0.1988	0.0041	-0.0599	0.2587	-0.0558	-6.24	4.19
					Total	Change	0.0375		
					in	Height, in.			

Consolidation Test
ASTM D2435 Method A

Frame 6

URS

Project Name: SR 4

Project Number: 26814910.24000

Boring Number: CB-20

Depth, ft: 51.0

Location: Pittsburg, CA

Tested By: S. Capps

Date: 01/20/05

Sample Number: 10-4

Description: Brown sandy clay

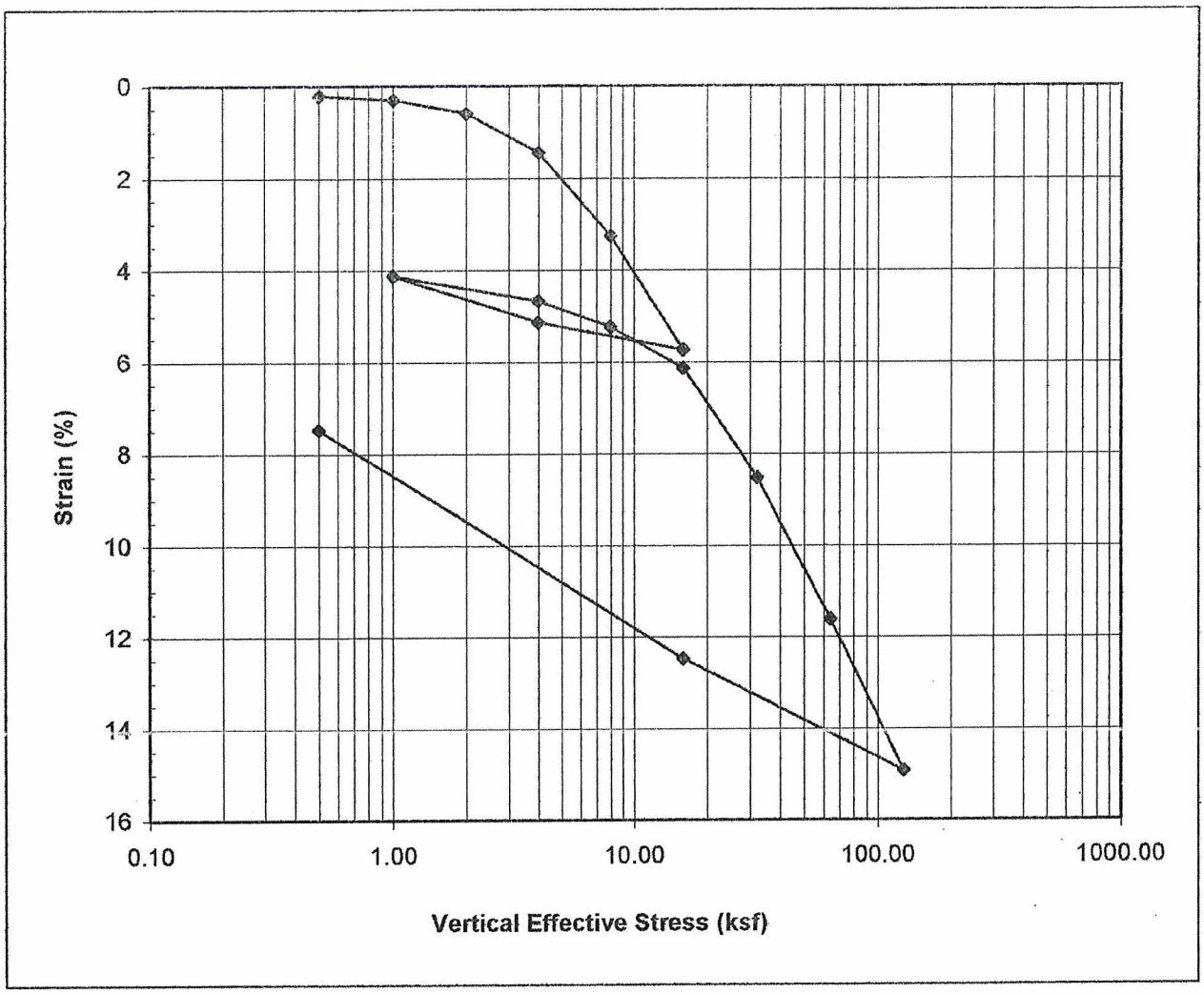
Liquid Limit: NA

Plastic Limit: NA

Plasticity Index: NA

Reviewed By: R. Taraya

Water Content Determination	Soil Adjacent to Sample	Sample at Start of Test	Sample at End of Test
Wet Soil + Tare, grams	339.57	307.42	306.39
Dry Soil + Tare, grams	298.31	291.81	291.81
Tare, grams	107.3	219.54	219.54
Weight of Water, grams	41.26	15.61	14.58
Weight of Dry Soil, grams	191.01	72.27	72.27
Water Content, %	21.60	21.60	20.17
Height of Gage Block, in:	0.7160	Dial Reading on Gage Block, in:	0.7280
Dial Reading on Sample, in:	0.9060		
Height of Sample, initial, in:	0.8940	Height of Sample, Final, in:	0.8565
Change in Height during Test, in:	0.0375	Estimated Specific Gravity:	2.69
Diameter of Ring, in:	1.939	Ring Number	R-8
Initial Area of Sample, cm^2:	19.05	Volume of Solids, Vs=Ws/Gs:	26.87
Volume of Sample, Initial, cm^3:	43.26	Volume of Sample, Final, cm^3	41.45
Volume of Voids, Initial, Vei, cm^3	16.39	Volume of Voids, Final, Vef, cm^3:	14.58
Volume of Water, Initial, Wwi, cm^3:	15.61	Volume of Water, Final, Wwf, cm^3:	14.58
Degree of Saturation, Initial, %	95.2	Degree of Saturation, Final, %	100.0
Total Unit Weight, Initial, pcf:	126.8	Total Unit Weight, Final, pcf:	130.8
Dry Unit Weight, Initial, pcf:	104.2	Dry Unit Weight, Final, pcf:	108.8
Initial Void Ratio:	0.6102	Final Void Ratio:	0.5427



Boring: CB-21 Sample: 7-3 Depth, ft: 36.0

Description: Brown sandy clay

	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est	Liquid Limit	Plasticity Index
Initial	18.41	125.4	105.9	0.585	84.7	0.8960	1.938	2.690	NA	NA
Final	17.33	134.3	114.5	0.466	100.0	0.8291				

Project: **SR 4**
Project #: **26814910**
Date: **01/20/05**

URS

Consolidation Test

Figure:

URS

Consolidation Test
ASTM D2435 Method A

Project Name: SR 4

Date: 01/20/05

Project Number: 26814910 .24000

Boring Number: CB-21 **Sample Number:** 7-3

Depth, ft: 36.0

Location: Pittsburg, CA

Load, Grams	Load, ksf	Load, tsf	Initial Dial, Inches	Frame Corr.	Dial Change	Final Dial, Inches	Change in Height, in.	Strain, Incre., %	Strain, Cum., %
500	0.50	0.25	0.3000	0.0008	0.0026	0.2974	0.0018	0.20	0.20
1000	1.00	0.50	0.2974	0.0004	0.0013	0.2961	0.0009	0.10	0.30
2000	2	1	0.2961	0.0006	0.0032	0.2929	0.0026	0.29	0.59
4000	4	2	0.2929	0.0003	0.0079	0.2850	0.0076	0.85	1.44
8000	8	4	0.2850	0.0008	0.0170	0.2680	0.0162	1.81	3.25
16000	16	8	0.2680	0.0007	0.0230	0.2450	0.0223	2.49	5.74
4000	4	2	0.2450	0.0008	-0.0062	0.2512	-0.0054	-0.60	5.13
1000	1	0.50	0.2512	0.0007	-0.0097	0.2609	-0.0090	-1.00	4.13
4000	4	2	0.2609	0.0001	0.0049	0.2560	0.0048	0.54	4.67
8000	8	4	0.2560	0.0007	0.0058	0.2502	0.0051	0.57	5.23
16000	16	8	0.2502	0.0008	0.0089	0.2413	0.0081	0.90	6.14
32000	32	16	0.2413	0.0009	0.0223	0.2190	0.0214	2.39	8.53
64000	64	32	0.2190	0.0014	0.0291	0.1899	0.0277	3.09	11.62
128000	128	64	0.1899	0.0020	0.0316	0.1583	0.0296	3.30	14.92
16000	16	8	0.1583	0.0030	-0.0249	0.1832	-0.0219	-2.44	12.48
500	0.50	0.25	0.1832	0.0018	-0.0467	0.2299	-0.0449	-5.01	7.47
					Total	Change	0.0669		
					in	Height, in.			

URS

Consolidation Test
ASTM D2435 Method A

Frame_7

Project Name: SR 4
Project Number: 26814910.24000
Boring Number: CB-21
Depth, ft: 36.0
Location: Pittsburg, CA

Date: 01/20/05
Sample Number: 7-3
Description: Brown sandy clay
Liquid Limit: NA
Plastic Limit: NA
Plasticity Index: NA

Tested By: S. Capps
Reviewed By: R. Taraya

Water Content Determination	Soil Adjacent to Sample	Sample at Start of Test	Sample at End of Test
Wet Soil + Tare, grams	331.5	314.86	314.06
Dry Soil + Tare, grams	294.4	301.32	301.32
Tare, grams	92.84	227.79	227.79
Weight of Water, grams	37.1	13.54	12.74
Weight of Dry Soil, grams	201.56	73.53	73.53
Water Content, %	18.41	18.41	17.33
Height of Gage Block; in:	0.7160	Dial Reading on Gage Block, in:	0.7470
Dial Reading on Sample, in:	0.9270		
Height of Sample, initial, in:	0.8960	Height of Sample, Final, in:	0.8291
Change in Height during Test, in:	0.0669	Estimated Specific Gravity:	2.69
Diameter of Ring, in:	1.938	Ring Number	R-6
Initial Area of Sample, cm^2:	19.03	Volume of Solids, Vs=Ws/Gs:	27.33
Volume of Sample, Initial, cm^3:	43.31	Volume of Sample, Final, cm^3	40.08
Volume of Voids, Initial, Vei, cm^3	15.98	Volume of Voids, Final, Vef, cm^3:	12.74
Volume of Water, Initial, Wwi, cm^3:	13.54	Volume of Water, Final, Wwf, cm^3:	12.74
Degree of Saturation, Initial, %	84.7	Degree of Saturation, Final, %	100.0
Total Unit Weight, Initial, pcf:	125.4	Total Unit Weight, Final, pcf:	134.3
Dry Unit Weight, Initial, pcf:	105.9	Dry Unit Weight, Final, pcf:	114.5
Initial Void Ratio:	0.5845	Final Void Ratio:	0.4662

STATE ROUTE 4 HIGHWAY WIDENING PROJECT
WEST OF LOVERIDGE ROAD, PITTSBURG, CA
TO SOMERSVILLE ROAD, ANTIOCH, CA

CENTURY BOULEVARD UNDERPASS
FOUNDATION INVESTIGATION REPORT

Prepared for:

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Prepared By:

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March 2006

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EXECUTIVE SUMMARY

V&A Consulting Engineers (V&A) was retained by URS Corporation to perform a Soil Corrosivity Investigation for the proposed State Route 4 Highway Widening Project Between Loveridge Road in Pittsburg, CA to Somersville Road in Antioch, CA. The objective of this investigation is to measure various soil parameters and evaluate the results to determine the corrosivity of the soil to the proposed underpass at Century Boulevard associated with the highway widening project. Corrosivity was determined at the underpass site to depths ranging from 0 to 6 meters below grade.

The California Department of Transportation, Division of Engineering Services, Materials Engineering and Testing Services, Corrosion Technology Branch has published "Corrosion Guidelines" (Guidelines) to define corrosive soil. The Guidelines consider soil to be corrosive to structural elements (steel reinforced concrete) if one or more of the following conditions exist for water or soil samples:

> ***"Chloride concentration is 500 ppm (mg/kg) or greater, sulfate concentration is 2,000 mg/kg or greater, or the pH is 5.5 or less."***

A wide variety of soluble salts is typically found in soils. Two soils having the same resistivity may have significantly different corrosion characteristics, depending on the specific ions available. The major constituents that accelerate corrosion are chlorides, sulfates and the acidity (pH) of the soil. Chloride ions tend to break down otherwise protective surface deposits, and can result in corrosion of reinforcing steel in concrete structures. Sulfates in soil can be highly aggressive to portland cement concrete by combining chemically with certain constituents of the concrete, principally tricalcium aluminate. This reaction is accompanied by expansion and eventual disruption of the concrete matrix. High concentrations of bicarbonates tend to decrease soil resistivities. Although bicarbonates are not aggressive to buried concrete, bicarbonates will lower the soil resistivity which can promote corrosion activity.

This report provides recommendations for corrosion control for the various structural foundation materials under consideration. This foundation investigation is in accordance with Caltrans Corrosion Guidelines dated September 2003 (Guidelines). The materials considered as part of this investigation include buried reinforced concrete, prestressed concrete piles, and steel pipe piles.

Acidity, as indicated by the pH of the soil, is another important factor of soil. The lower the pH (the more acidic the environment), the higher the corrosivity will be with respect to buried metallic and concrete structures. As pH increases above 7 (the neutral value), conditions become increasingly more alkaline and passive to buried structures.

Evaluation of the soil environment is reported in terms of potential damage to the structures due to corrosion. Soil resistivity measurements were conducted in the field during the initial stages of the work. In addition, soil samples collected by URS during the geotechnical investigation were forwarded to Sequoia Analytical Laboratory in Sacramento, CA, for testing. The soil borings were analyzed for 'as-received' resistivity, minimum resistivity, and pH. The soil borings with a minimum resistivity of 1,000 ohm-cm or less were analyzed for water soluble chloride ion concentration and water soluble sulfate ion concentration.

Based on the results of the corrosion analyses, the soil is determined to be *non-corrosive* in accordance with the Guidelines.

The pH of the soil samples analyzed ranged from 7.6 to 8.2 and the soil is considered to be *non-corrosive* in accordance with the Guidelines.

The water soluble chloride ion concentration is below the detection level of 15 milligrams per kilogram (mg/kg), and the water soluble sulfate ion concentration of the soil sample tested is 39 mg/kg. The chloride ion and sulfate ion concentrations are determined to be *non-corrosive* in accordance with the Guidelines.

CONCLUSIONS

- Soil samples were obtained for corrosion analysis at boring locations B-20 and B-21. Based on the results of the corrosion analyses, the site is considered non-corrosive.
- The proposed structure is not within 300 m (1000 ft.) of salt or brackish water.
- The in-situ resistivity measured at the Century Boulevard Underpass site is considered to be non-corrosive to steel pipe piles in accordance with the Guidelines.
- The chloride ion concentration is less than 15 mg/kg for Soil Samples B-20 and B-21 and is considered to be non-corrosive to buried reinforced concrete, cast in place piles, and prestressed concrete piles in accordance with the Guidelines.
- The sulfate ion concentration is less than 50 mg/kg for Soil Samples B-20 and B-21 and is considered to be non-corrosive to buried reinforced concrete, cast in place piles, and prestressed concrete piles in accordance with the Guidelines.
- The pH of the soil is greater than 7.0 for Soil Samples B-20 and B-21 and is considered to be non-corrosive to buried reinforced concrete, cast in place piles, and prestressed concrete piles in accordance with the Guidelines.

RECOMMENDATIONS

Based on the test data and review of the project requirements, specific recommendations for each structural foundation material alternative are listed below:

Buried Reinforced Concrete Structures, Prestressed Concrete Piles and Cast in Place Concrete Piles

Buried concrete structures should be constructed of durable concrete as described in Section 8.22 of the Caltrans Bridge Design Specifications and ACI Standards 201.2R and 222R. These recommendations include, but are not limited to, the following:

- The water/cement ratio should not exceed 0.50.
- A concrete cover of a minimum of 5.1 centimeters should be applied over all steel reinforcement.
- Salt-free sand and potable water should be used.
- Type II modified cement should be used.
- The concrete should be allowed to cure according to the manufacturer's recommendations.

Steel Pipe Piles

A conservative approach for the design of pipe piles would be to assume that corrosion will occur at a rate of 0.025 millimeters per year between grade and a depth 1 meter below the water table, in accordance with the Guidelines. It is important to note that structural considerations for pipe piles may require increases in metal wall thickness to withstand both installation and structural loadings, as they have not been considered in this analysis.

TEST METHODS

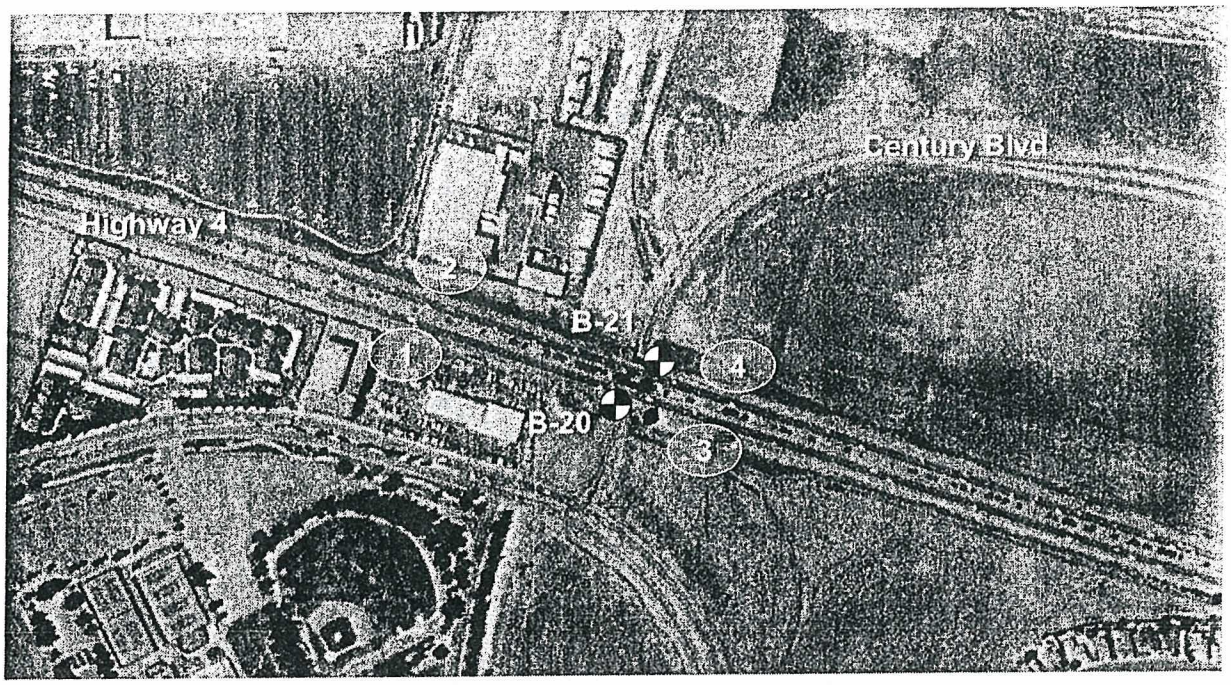
In attempting to predict corrosion problems associated with a particular type of structure prior to installation, it is necessary to investigate the soil conditions the structure will encounter. Since corrosion is an electrochemical process accompanied by current flow, the electrochemical characteristics of a soil are of primary importance when evaluating corrosivity. Test methods utilized during this investigation reflect the most practical methods of evaluating corrosivity.

Soil Resistivity

In-situ resistivity of the soil was measured at four locations at the Century Boulevard Underpass site. Figure 1 shows the project vicinity map. Figure 2 shows the in-situ soil resistivity and soil boring locations.

Figure 1 - Vicinity and Project Site Map[1]

[1] Map courtesy of the USGS and the TerraServer Team



In-Situ Soil Resistivity Location, See Table 1 (Typical of 4)
Soil Sample Location, See Table 2 (Typical of 2)

Figure 2 - Soil Resistivity Testing and Soil Sample Locations[2]

In-situ soil resistivity was measured using the Wenner 4-Electrode Method, with a Model 400 Soil Resistance Meter, manufactured by Nilsson Electrical Laboratory, Inc. The Wenner Method involves the use of four metal probes or electrodes, driven into the ground along a straight line, equidistant from each other, as shown in Figure 3.

[2] Map courtesy of the USGS and the TerraServer Team

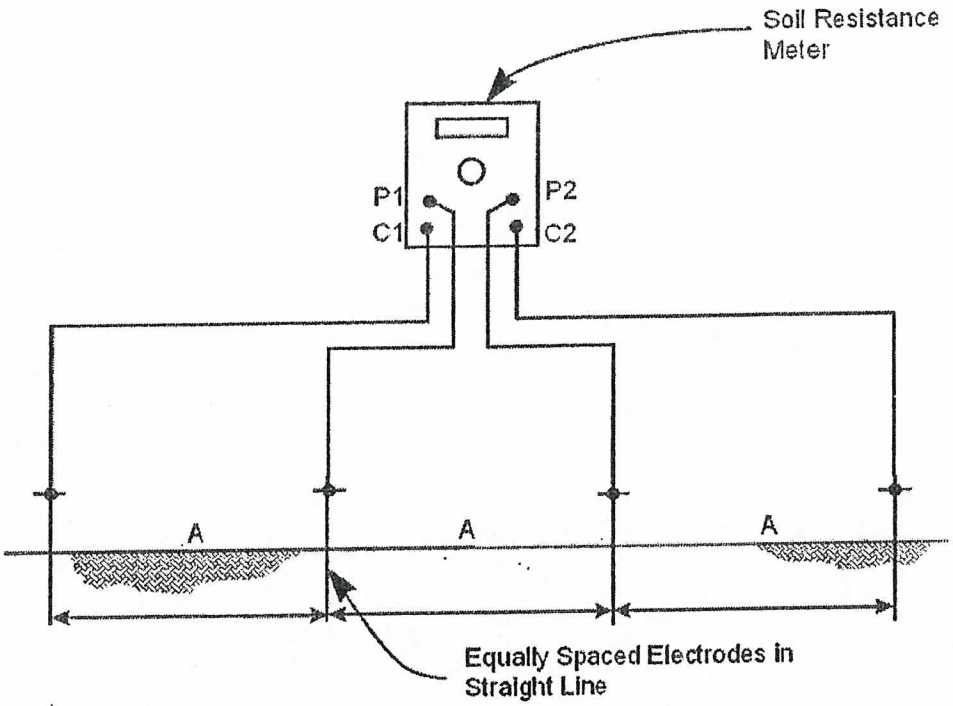


Figure 3 - Soil Resistivity Measurement Using the Wenner 4-Electrode Method

An alternating current from the Soil Resistance Meter causes a current to flow through the soil between the outside electrodes, C1 and C2. Due to the resistance of the soil, the current creates a voltage gradient, which is proportional to the average resistance of the soil mass to a depth equal to the distance between electrodes. The voltage drop is then measured across pins, P1 and P2. Resistivity of the soil is then computed from the instrument reading according to the following formula:

$$\rho = 2 \cdot \pi \cdot A \cdot R$$

Where:

ρ	=	soil resistivity (ohm-cm)
A	=	distance between electrodes (cm)
R	=	soil resistance, instrument reading (ohms)
π	=	3.14 (approx.)

Soil resistivity measurements were conducted with electrodes spaced at 1.5, 3, 4.5, and 6 meters. The resistivity values obtained represent the average resistivity of the soil to a depth equal to the electrode spacing. An additional method of calculating the soil resistivity using the data from the 4-Electrode Method is the Barnes-Layer Resistivity Calculation. The Barnes Layer Calculation is used to determine the resistivity of the soil for each soil layer. While the 4-Electrode Method at 3-meter

electrode spacing will consider all 3 meters of soil below the surface, the Barnes-Layer method will consider the resistivity of only the layer of soil between 1.5 and 3 meters below the surface. This method assumes the soil layers are a uniform thickness and parallel to the surface.

$$\rho_{b-a} = KR_{b-a}$$

and

$$\frac{1}{R_{b-a}} = \frac{1}{R_a} - \frac{1}{R_b}$$

Where:

ρ_{b-a}	=	Soil resistivity of layer depth b-a (ohm-cm)
a	=	Soil depth to top of layer (cm)
b	=	Soil depth to bottom of layer (cm)
R_a	=	Soil resistance read at depth a (ohms)
R_b	=	Soil resistance read at depth b (ohms)
R_{b-a}	=	Resistance of soil layer from a to b (cm)
K	=	Layer constant (cm)
	=	2π (b-a)

Soil resistance is measured at electrode spacings of 1.5, 3, 4.5, and 6 meters. Barnes Layer resistivity is calculated for layers 0 to 1.5, 1.5 to 3, 3 to 4.5, and 4.5 to 6 meters below grade. The results of both methods are listed on Table 1.

To supplement the resistivity data obtained during field testing, two soil samples from the Century Boulevard Underpass site were obtained from URS for analysis of minimum soil resistivity using a soil box, as shown in Figure 4.

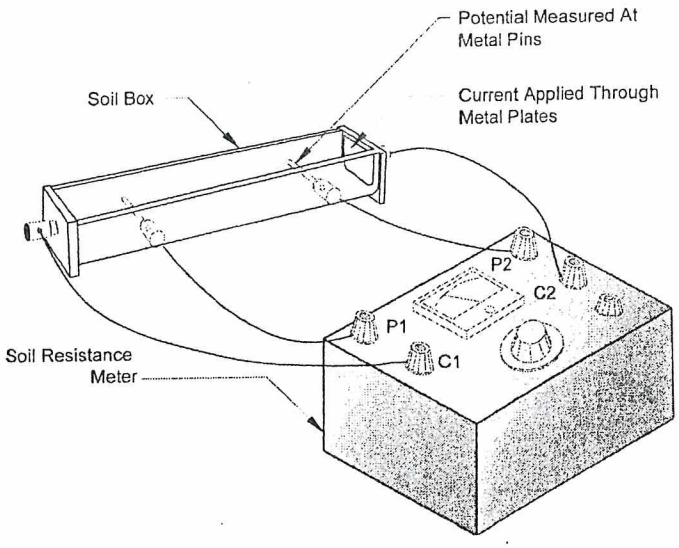


Figure 4 - Soil Resistivity Measurement Using the Soil Box Method

The soil box apparatus consists of a small plastic box with metal end plates. Dirt from the soil sample is tightly packed into the box and current is passed through the soil sample. The current causes a voltage drop across the soil sample and soil resistivity is determined using the above referenced Soil Resistance Meter.

The soil samples were placed in the soil box and the soil resistivity was measured in the "as-received" state. Distilled water was added to the soil sample in 10-mL increments and the resistivity was measured after each watering. As the soil sample became more saturated, the soil resistivity decreased until the minimum soil resistivity was reached.

Laboratory Analysis of Soil

The soil samples have a minimum resistivity greater than or equal to 1,000 ohm-cm and were forwarded to CERCO Analytical Laboratory in Pleasanton, CA, for testing. Both samples were tested for pH, and Soil Sample B-20 with a minimum resistivity of 1,000 ohm-cm was also tested for water soluble chloride and water soluble sulfate ion concentration.

TEST RESULTS

Data obtained during this investigation has been summarized in tabular form for analysis and presentation. Table 1 lists the results of the in-situ soil resistivity measurements conducted at the site. Table 2 lists the "as-received" and minimum soil resistivity for each sample collected as well as

the chemical analysis of the sample. The locations of the soil samples and the in-situ resistivity test locations are shown on Figure 2.

In-Situ Soil Resistivity

Table 1 - In-Situ Soil Resistivity Data

Site*	Depth (meters)	Resistivity (ohm-cm)	Layer Resistivity (ohm-cm)	Layer (meters)
1	1.5	1,053	1,053	0 – 1.5
	3.0	823	676	1.5 – 3.0
	4.5	747	630	3.0 – 4.5
	6.0	728	676	4.5 – 6.0
2	1.5	1,149	1,149	0 – 1.5
	3.0	785	596	1.5 – 3.0
	4.5	1,034	2,827	3.0 – 4.5
	6.0	1,187	2,137	4.5 – 6.0
3	1.5	1,436	1,436	0 – 1.5
	3.0	1,111	906	1.5 – 3.0
	4.5	948	733	3.0 – 4.5
	6.0	651	336	4.5 – 6.0
4	1.5	1,053	1,053	0 – 1.5
	3.0	938	846	1.5 – 3.0
	4.5	891	808	3.0 – 4.5
	6.0	728	470	4.5 – 6.0

Since corrosion is a natural electrochemical process accompanied by the flow of electrical current, it is important to understand how easily current will travel through the soil surrounding the steel or steel reinforced concrete structure. Resistivity is a measure of the ability of a soil to conduct an electric current. Soil resistivity is primarily dependent on the chemical and moisture content of the soil. As the concentration of chemical constituents increases, the soil resistivity will decrease. Additional moisture generally decreases the soil resistivity up to the point where the maximum solubility for the dissolved ionic chemicals is achieved. Beyond the maximum solubility, an increase in moisture generally increases the resistivity as the chemicals become more and more diluted. Since corrosion rate depends on current flow through the soil to and from the metal, soil corrosivity normally increases as soil resistivity decreases.

Based upon analysis of the in-situ soil resistivity results for the Century Boulevard Underpass site, shown in Table 1, the soil is determined to be *non-corrosive* to a depth of 6 meters below grade to the buried reinforced concrete, cast in place concrete piles, and prestressed concrete piles, in accordance with the Guidelines.

Soil samples were obtained for corrosion analyses at the following locations:

Laboratory Analysis of Soil Samples

Table 2 - Soil Resistivity and Chemical Data

Item No.	Boring No.	Station	Sample No.	Depth (meters)	Soil Resistivity (ohm-cm)		Chemical Data		
					As-Received	Minimum	pH	Sulfate (mg/kg)	Chloride (mg/kg)
1	B - 20	259	2	4	1,200	1,000	8.2	39	ND
2	B - 21	259	2	2	4,300	2,300	7.6	--	--

ND – Not Detected. Below the detection level of 15 mg/kg.

Based on the results of the corrosion analyses, the site is considered to be *non-corrosive.*

APPENDIX C

CAST-IN-DRILLED-HOLE PILE CAPACITY
Design per O'Neil and Reese (1999)

eBART AT UTILITY CORRIDOR (NEAR CENTURY BLVD)
PROJECT NO. 205124.10

PILE DIA, B (ft) = 3

SIDE MOBILIZATION
FACTOR (CLAY) = 1
FACTOR (SAND) = 1

INCREAMENTS (FT)= 5

SOIL GROUPS
1. GRAVELS, SANDS AND NONPLASTIC SILTS
2. CLAYS AND PLASTIC SILTS
3. IGM (COHESIONLESS MATERIAL)

SOIL TYPES
GRAVEL, SAND, NSILT, CLAY, PSILT

F.S. FOR COMPRESSION = 1

F.S. FOR UPLIFT = 1

PERIMETER OF THE PILE (ft) = 9.42 SQ. FT.
AREA OF THE PILE TIP 7.07 SQ. FT.

DEPTH FROM	TO	SOIL GROUP	TYPE	γ' (pcf)	Δσ' (psf)	σ' (psf)	BLOW COUNT	CONSISTENCY	SHEAR STRENGTH PARAMETERS α	c(psf)	β	ϕ (°)	ULTIMATE COMPRESSION (PER SECTION) (Ton)	ULTIMATE COMPRESSION CAPACITY (Ton)	ULTIMATE UPLIFT (PER SECTION) (Ton)	ULTIMATE UPLIFT CAPACITY (Ton)
FTG																
0	5	2	CLAY	125	625	313	15	STIFF	0.55	1875			24.30	24.30	17.01	17.01
5	10	2	CLAY	125	625	938	15	STIFF	0.55	1875			24.30	48.60	17.01	34.02
10	16	2	CLAY	125	750	1625	15	STIFF	0.55	1875			29.16	77.75	20.41	54.43
16	21	2	CLAY	125	625	2313	8.8	STIFF	0.55	1100			14.25	92.01	9.98	64.41
21	26	2	CLAY	125	625	2938	8.8	STIFF	0.55	1100			14.25	106.26	9.98	74.39
26	31	2	CLAY	125	625	3563	8.8	STIFF	0.55	1100			14.25	120.52	9.98	84.36
31	39	2	CLAY	125	1000	4375	8.8	STIFF	0.55	1100			22.81	143.33	15.97	100.33
39	44	2	CLAY	125	625	5188	24	V.STIFF	0.55	3000			38.88	182.20	27.21	127.54
44	49	2	CLAY	68	340	5670	24	V.STIFF	0.55	3000			38.88	221.08	27.21	154.76
49	54	2	CLAY	68	340	6010	24	V.STIFF	0.55	3000			38.88	259.96	27.21	181.97
54	57	2	CLAY	68	204	6282	24	V.STIFF	0.55	3000			23.33	283.29	16.33	198.30
57	62	2	CLAY	68	340	6554	16	STIFF	0.55	2000			25.92	309.20	18.14	216.44
62	67	2	CLAY	68	340	6894	16	STIFF	0.55	2000			25.92	335.12	18.14	234.59
67	72	2	CLAY	68	340	7234	16	STIFF	0.55	2000			25.92	361.04	18.14	252.73
72	77	2	CLAY	68	340	7574	16	STIFF	0.55	2000			25.92	386.96	18.14	270.87
77	82	2	CLAY	68	340	7914	16	STIFF	0.55	2000			25.92	412.88	18.14	289.01
82	87	2	CLAY	68	340	8254	16	STIFF	0.55	2000			25.92	438.79	18.14	307.16
87	92	2	CLAY	68	340	8594	16	STIFF	0.55	2000			25.92	464.71	18.14	325.30

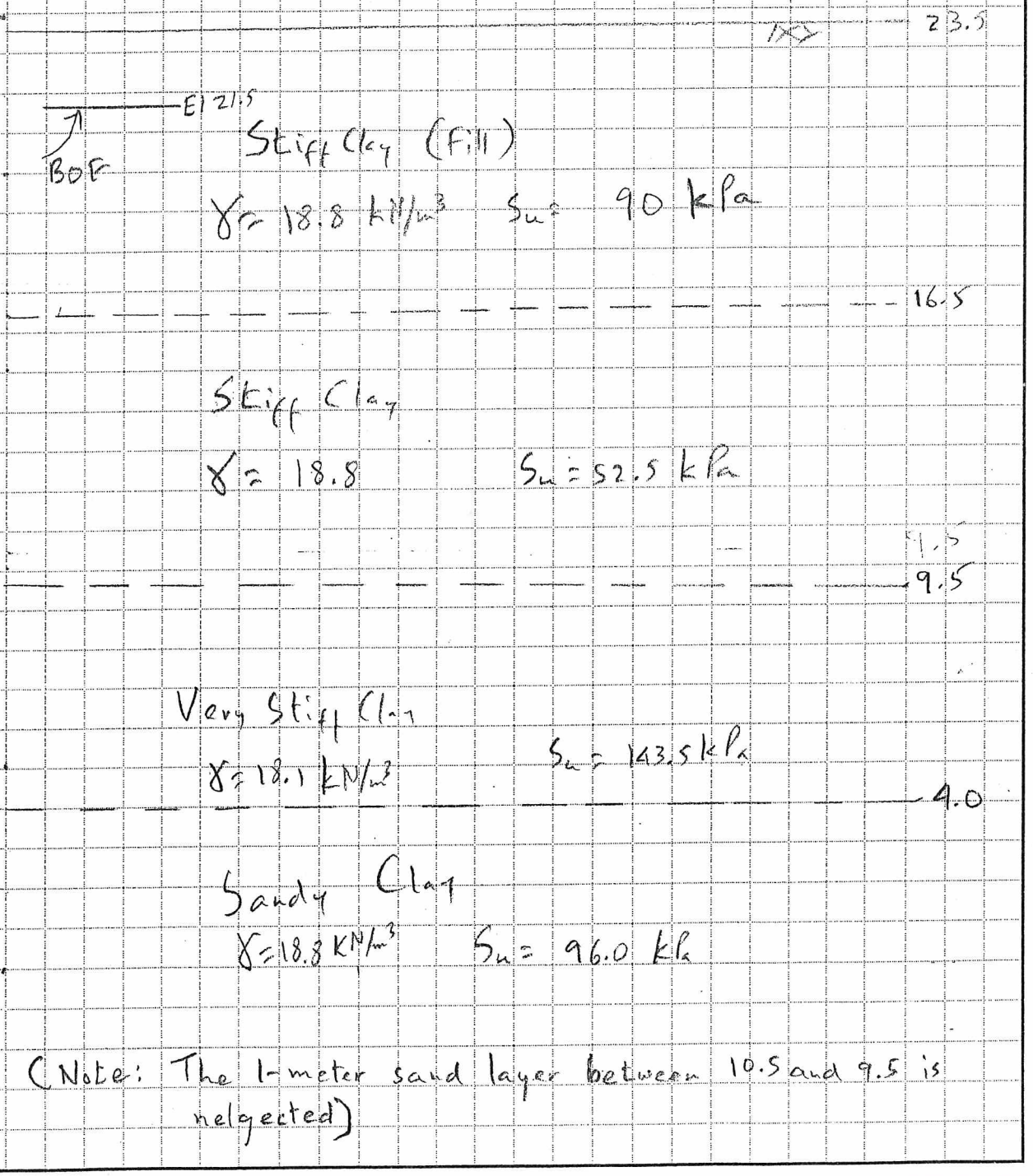
Use 65-ft (19.8 meters) pile length to provide ultimate compression capacity of 326 Tons (2900 kN).
Use shaft friction for design; neglect end bearing of 36" dia. CIDH pile.
Top of Pile @ El 21.5; Pile Tip @ 21.5 - 19.8 = 1.7-meter (elevation)
(See design soil profile on next page)

PARIKH
Practicing in the Geosciences

JOB 20512.9.10
SHEET NO ____ OF ____
CALCULATED BY Partha Sircar DATE 12/10/07
CHECKED BY ____ DATE ____
SCALE ____

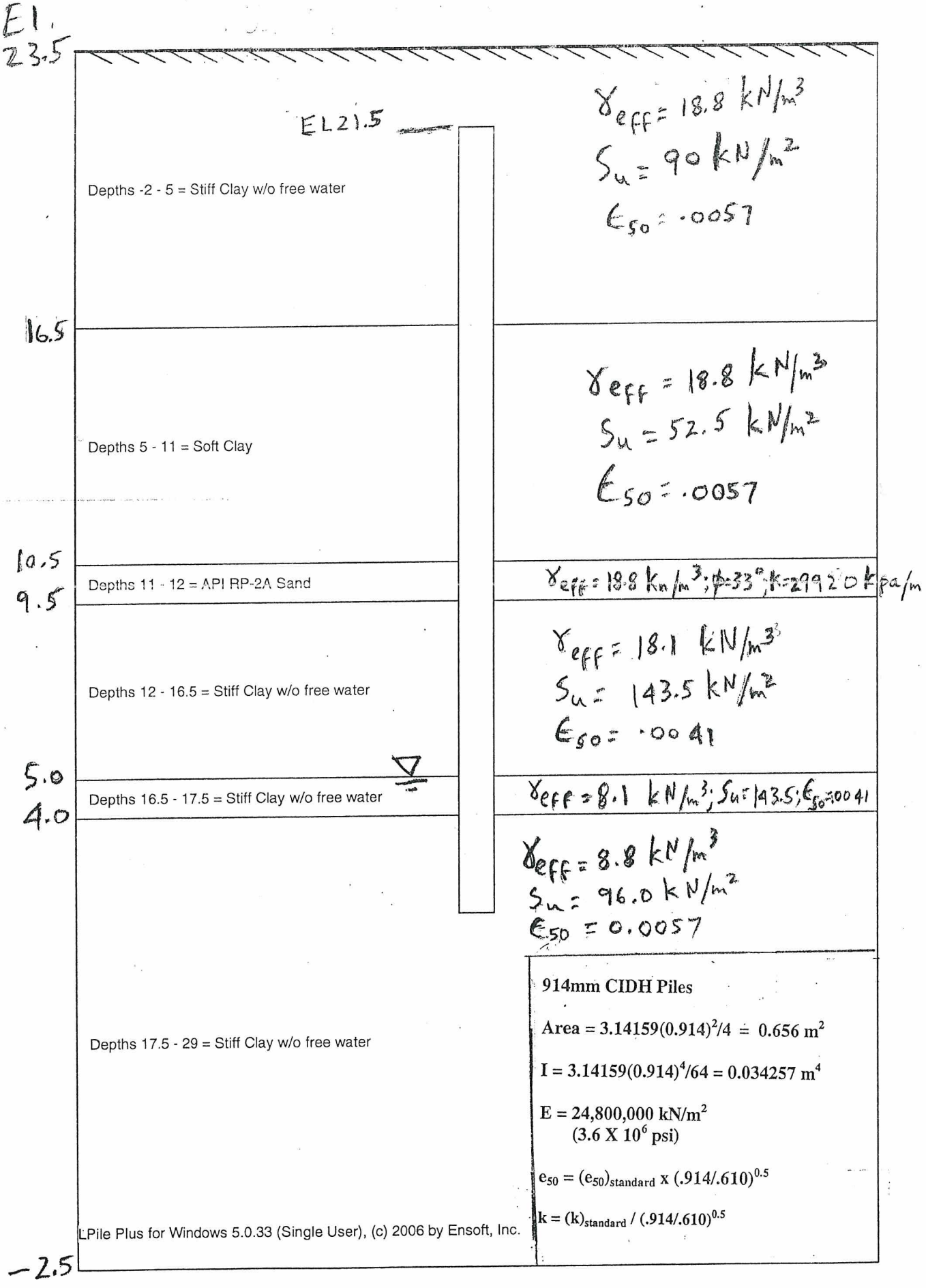
BART @ Utilities Corridor Undercrossing

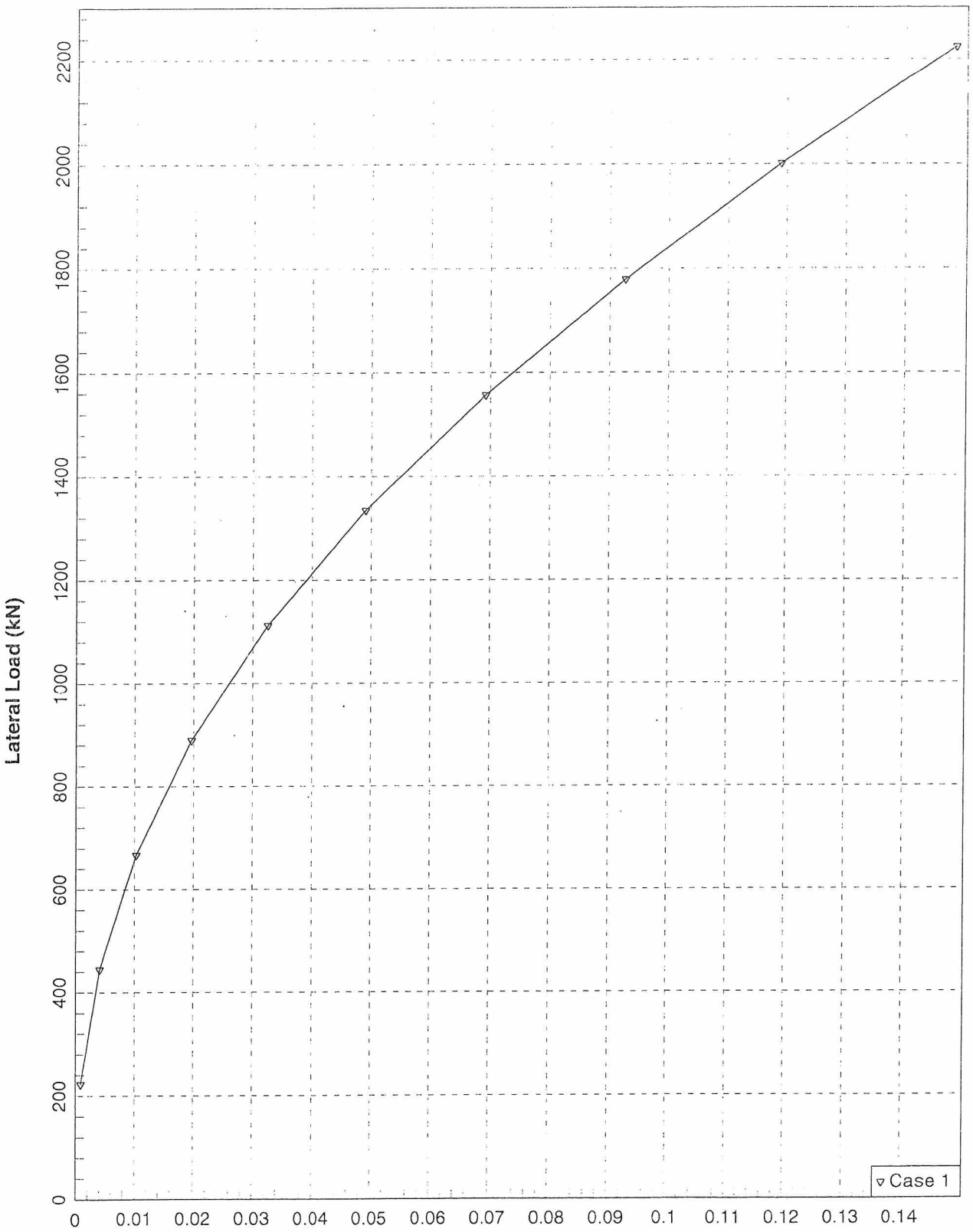
DESIGN SOIL PROFILE FOR CIDH Pile Capacity



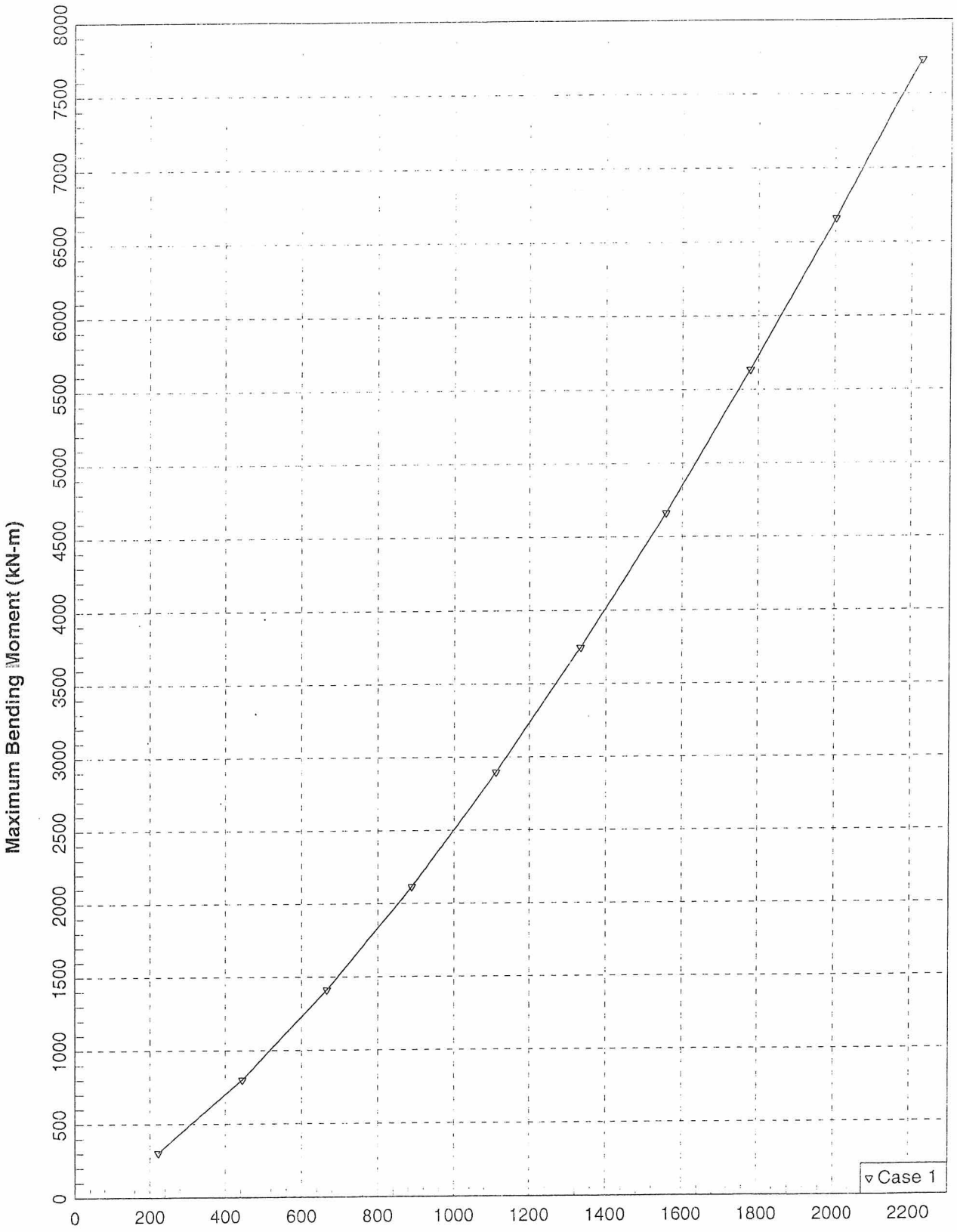
(Note: The 1-meter sand layer between 10.5 and 9.5 is neglected)

LPILE Runs – 914mm CIDH Piles
eBART – Utility Undercrossing
Job No. 205124.10



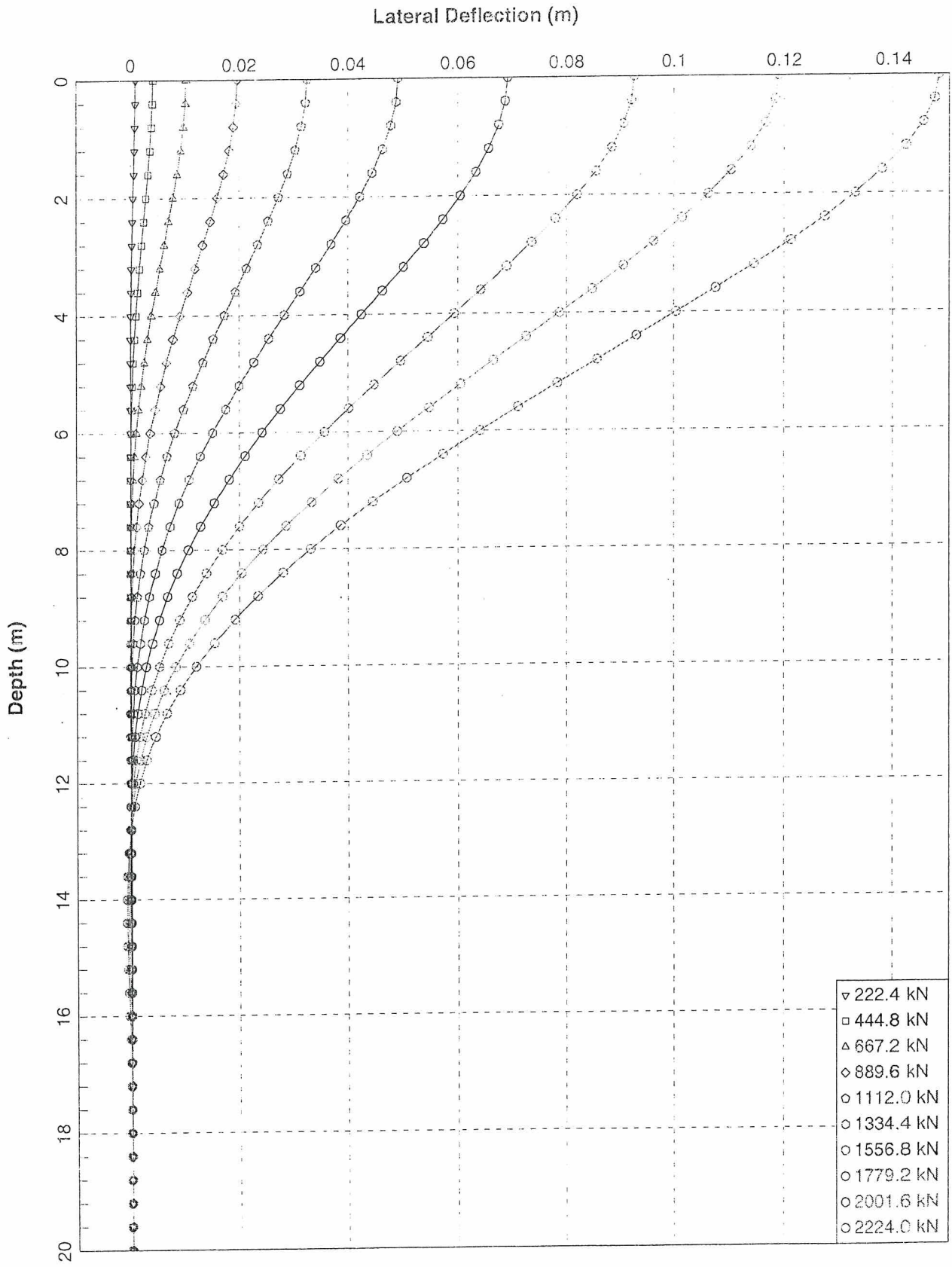


Utilities Undercrossing - 914mm CIDH Pile - Fixed Head

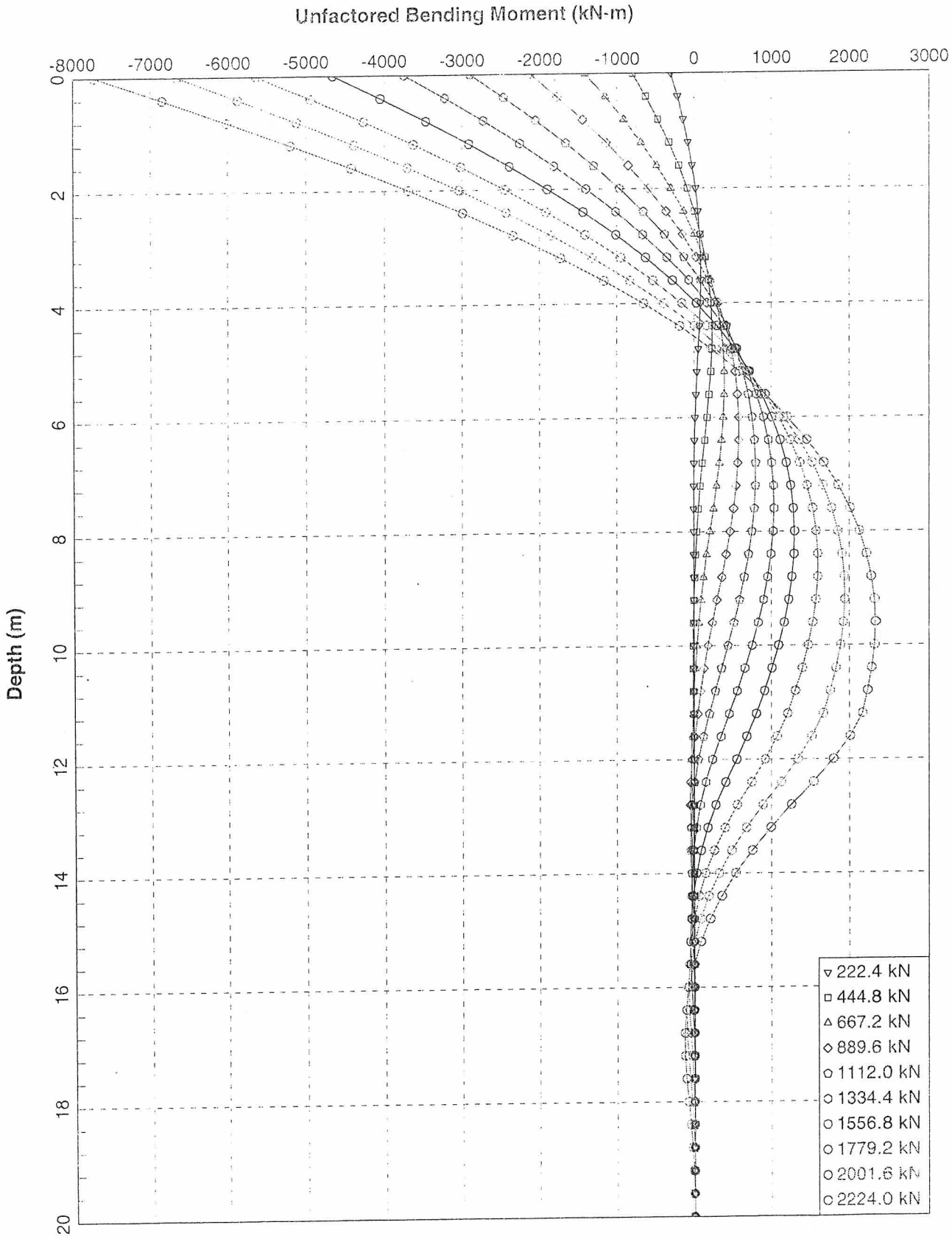


Lateral Load (kN)

Utilities Undercrossing - 914CIDH Pile - Fixed Head



Utilities Undercrossing - 914mm CIDH Pile - Fixed Head



Utilities Undercrossing - 914mm CIDH Pile - Fixed Head

LPILE Plus for Windows, Version 5.0 (5.0.33)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method

(c) 1985-2007 by Ensoft, Inc.
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This program is licensed to:

Partha Sircar
Parikh Consultants

Path to file locations: S:\Ongoing Projects\2005\205124.10 eBART\Utility Undercrossing\LPILE Runs\
Name of input data file: Run No. 1.lpd
Name of output file: Run No. 1.lpo
Name of plot output file: Run No. 1.lpp
Name of runtime file: Run No. 1.lpr

Time and Date of Analysis

Date: December 10, 2007 Time: 16:33:38

Problem Title

Utilities Undercrossing - 914 mm CIDH Pile - 1

Program Options

Units Used in Computations - SI Units: Meters, Kilopascals

Basic Program Options:

Analysis Type 1:
- Computation of Lateral Pile Response Using User-specified Constant EI

Computation Options:
- Only internally-generated p-y curves used in analysis
- Analysis uses p-y multipliers for group action
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No additional p-y curves to be computed at user-specified depths

Solution Control Parameters:
- Number of pile increments = 50

- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 2.5400E-07 m
- Maximum allowable deflection = 2.5400E+00 m

Printing Options:
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (spacing of output points) = 1

Pile Structural Properties and Geometry

Pile Length = 20.00 m
Depth of ground surface below top of pile = -2.00 m
Slope angle of ground surface = .00 deg.

Structural properties of pile defined using 2 points

Point No.	Depth X m	Pile Diameter m	Moment of Inertia m**4	Pile Area Sq. m	Modulus of Elasticity kN/Sq. m
1	0.0000	.91400000	.0342570	.6560000	24800000.
2	20.0000	.91400000	.0342570	.6560000	24800000.

Soil and Rock Layering Information

The soil profile is modelled using 6 layers

Layer 1 is stiff clay without free water
Distance from top of pile to top of layer = -2.000 m
Distance from top of pile to bottom of layer = 5.000 m

Layer 2 is soft clay, p-y criteria by Matlock, 1970
Distance from top of pile to top of layer = 5.000 m
Distance from top of pile to bottom of layer = 11.000 m

Layer 3 is sand, p-y criteria by API RP-2A, 1987
Distance from top of pile to top of layer = 11.000 m
Distance from top of pile to bottom of layer = 12.000 m
p-y subgrade modulus k for top of soil layer = 29920.000 kN/ m**3
p-y subgrade modulus k for bottom of layer = 29920.000 kN/ m**3

Layer 4 is stiff clay without free water
Distance from top of pile to top of layer = 12.000 m
Distance from top of pile to bottom of layer = 16.500 m

Layer 5 is stiff clay without free water
Distance from top of pile to top of layer = 16.500 m
Distance from top of pile to bottom of layer = 17.500 m

Layer 6 is stiff clay without free water
Distance from top of pile to top of layer = 17.500 m
Distance from top of pile to bottom of layer = 29.000 m

(Depth of lowest layer extends 9.00 m below pile tip)

Effective Unit Weight of Soil vs. Depth

Distribution of effective unit weight of soil with depth is defined using 12 points

Point No.	Depth X m	Eff. Unit Weight kN/ m**3
1	-2.00	18.80000
2	5.00	18.80000
3	5.00	18.80000
4	11.00	18.80000
5	11.00	18.80000
6	12.00	18.80000
7	12.00	18.10000
8	16.50	18.10000
9	16.50	8.10000
10	17.50	8.10000
11	17.50	8.80000
12	29.00	8.80000

Shear Strength of Soils

Distribution of shear strength parameters with depth defined using 12 points

Point No.	Depth X m	Cohesion c kN/ m**2	Angle of Friction Deg.	E50 or k_rm	RQD %
1	-2.000	90.00000	.00	.00570	.0
2	5.000	90.00000	.00	.00570	.0
3	5.000	52.50000	.00	.00570	.0
4	11.000	52.50000	.00	------	------
5	11.000	.00000	33.00	------	------
6	12.000	.00000	33.00	.00410	.0
7	12.000	143.50000	.00	.00410	.0
8	16.500	143.50000	.00	.00410	.0
9	16.500	143.50000	.00	.00410	.0
10	17.500	143.50000	.00	.00570	.0
11	17.500	96.00000	.00	.00570	.0
12	29.000	96.00000	.00		

Notes:

(1) Cohesion = uniaxial compressive strength for rock materials.
(2) Values of E50 are reported for clay strata.
(3) Default values will be generated for E50 when input values are 0.
(4) RQD and k_rm are reported only for weak rock strata.

p-y Modification Factors

Distribution of p-y multipliers with depth defined using 2 points

Point No.	Depth X m	p-mult	y-mult
1	.000	.6000	1.0000
2	20.000	.6000	1.0000

Loading Type

Static loading criteria was used for computation of p-y curves

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load Case Number 1

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head = 222.400 kN
Slope at pile head = .000 m/ m
Axial load at pile head = 2900.000 kN

(Zero slope for this load indicates fixed-head condition)

Load Case Number 2

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head = 444.800 kN
Slope at pile head = .000 m/ m
Axial load at pile head = 2900.000 kN

(Zero slope for this load indicates fixed-head condition)

Load Case Number 3

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head = 667.200 kN
Slope at pile head = .000 m/ m
Axial load at pile head = 2900.000 kN

(Zero slope for this load indicates fixed-head condition)

Load Case Number 4

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head = 889.600 kN
Slope at pile head = .000 m/ m
Axial load at pile head = 2900.000 kN

(Zero slope for this load indicates fixed-head condition)

Load Case Number 5

Pile-head boundary conditions are Shear and Slope (BC Type 2)

Shear force at pile head = 1112.000 kN
Slope at pile head = .000 m/ m
Axial load at pile head = 2900.000 kN

(Zero slope for this load indicates fixed-head condition)

Load Case Number 6

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head = 1334.400 kN
Slope at pile head = .000 m/ m
Axial load at pile head = 2900.000 kN

(Zero slope for this load indicates fixed-head condition)

Load Case Number 7

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head = 1556.800 kN
Slope at pile head = .000 m/ m
Axial load at pile head = 2900.000 kN

(Zero slope for this load indicates fixed-head condition)

Load Case Number 8

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head = 1779.200 kN
Slope at pile head = .000 m/ m
Axial load at pile head = 2900.000 kN

(Zero slope for this load indicates fixed-head condition)

Load Case Number 9

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head = 2001.600 kN
Slope at pile head = .000 m/ m
Axial load at pile head = 2900.000 kN

(Zero slope for this load indicates fixed-head condition)

Load Case Number 10

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Shear force at pile head = 2224.000 kN
Slope at pile head = .000 m/ m
Axial load at pile head = 2900.000 kN

(Zero slope for this load indicates fixed-head condition)

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 1

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head = 222.400 kN
Specified slope at pile head = 0.000E+00 m/ m
Specified axial load at pile head = 2900.000 kN

(Zero slope for this load indicates fixed-head conditions)

Depth Es*h / F/L	Deflect. X	Moment y	Shear M	Slope V	Total S	Soil Res. Stress	p
	m	m	kN- m	kN	Rad.	kN/ m**2	kN/ m
kN/ m							
0.000	.000911	-303.4595	222.4000	0.0000	8468.9846	-57.2550	
12366.6585							
.400	.000883	-218.9970	198.8276	-.0001230	7342.2266	-60.5071	
27466.1440							
.800	.000813	-144.1121	174.0862	-.0002085	6343.2361	-63.0997	
31052.0221							
1.200	.000716	-79.2444	148.5185	-.0002621	5477.8792	-64.7389	
36173.7279							
1.600	.000604	-24.6917	122.4694	-.0002855	4750.1270	-65.5067	
43383.1643							
2.000	.000487	19.3935	96.2944	-.0002868	4679.4473	-65.3682	
53641.0558							
2.400	.000375	53.0091	70.3663	-.0002697	5127.8914	-64.2720	
68635.8857							
2.800	.000272	76.3123	45.0830	-.0002393	5438.7637	-62.1448	
91500.5301							
3.200	.000183	89.6306	20.8790	-.0002002	5616.4348	-58.8753	
128588.							
3.600	.000111	93.4800	-1.7498	-.0001571	5667.7863	-54.2683	
194690.							
4.000	5.75E-05	88.5953	-22.1817	-.0001142	5602.6233	-47.8913	
333412.							
4.400	2.01E-05	75.9997	-39.4170	-7.5499E-05	5434.5931	-38.2850	
761892.							
4.800	-2.94E-06	57.2369	-44.9873	-4.4133E-05	5184.2915	10.4334	
1418044.							
5.200	-1.52E-05	40.1122	-38.8783	-2.1216E-05	4955.8424	20.1116	
529022.							
5.600	-1.99E-05	26.1835	-31.8706	-5.6092E-06	4770.0284	14.9270	
299801.							
6.000	-1.97E-05	14.6288	-25.9113	3.9985E-06	4615.8846	14.8692	
302005.							
6.400	-1.67E-05	5.4452	-18.5156	8.7241E-06	4493.3719	22.1093	
529022.							
6.800	-1.27E-05	-.2039616	-10.7306	9.9580E-06	4423.4526	16.8159	
529022.							
7.200	-8.75E-06	-3.1624	-5.0528	9.1655E-06	4462.9196	11.5733	
529022.							
7.600	-5.38E-06	-4.2674	-1.3144	7.4164E-06	4477.6608	7.1184	
529022.							
8.000	-2.82E-06	-4.2312	.8545352	5.4157E-06	4477.1770	3.7264	
529022.							
8.400	-1.05E-06	-3.5964	1.8775	3.5730E-06	4468.7086	1.3883	
529022.							
8.800	4.08E-08	-2.7375	2.1443	2.0820E-06	4457.2506	-.0539971	
529022.							
9.200	6.16E-07	-1.8857	1.9707	9.9360E-07	4445.8879	-.8144774	
529022.							
9.600	8.36E-07	-1.1633	1.5867	2.7583E-07	4436.2500	-1.1053	
529022.							
10.000	8.37E-07	-.6170013	1.1444	-1.4326E-07	4428.9627	-1.1063	
529022.							
10.400	7.21E-07	-.2474170	.7323865	-3.4676E-07	4424.0323	-.9536878	

529022.							
10.800	5.59E-07	-.0302876	.3937626	-4.1213E-07	4421.1358	-.7394317	
529022.							
11.200	3.91E-07	.0685492	.2360180	-4.0313E-07	4421.6462	-.0492912	
50375.8635							
11.600	2.37E-07	.1594621	.2198608	-3.4945E-07	4422.8590	-.0314952	
53248.1835							
12.000	1.12E-07	.2452486	.0617906	-2.5418E-07	4424.0034	-.7588557	
2714382.							
12.400	3.33E-08	.2094842	-.1351079	-1.4713E-07	4423.5263	-.2256367	
2714382.							
12.800	-5.87E-09	.1375036	-.1722628	-6.5442E-08	4422.5661	.0398620	
2714382.							
13.200	-1.91E-08	.0718258	-.1383641	-1.6163E-08	4421.6899	.1296316	
2714382.							
13.600	-1.88E-08	.0268498	-.0869162	7.0663E-09	4421.0899	.1276080	
2714382.							
14.000	-1.34E-08	.0022764	-.0431405	1.3923E-08	4420.7621	.0912705	
2714382.							
14.400	-7.67E-09	-.0076949	-.0144816	1.2647E-08	4420.8344	.0520237	
2714382.							
14.800	-3.33E-09	-.0093382	.0004453	8.6376E-09	4420.8563	.0226110	
2714382.							
15.200	-7.56E-10	-.0073587	.0059940	4.7069E-09	4420.8299	.0051325	
2714382.							
15.600	4.33E-10	-.0045540	.0064322	1.9025E-09	4420.7925	-.0029416	
2714382.							
16.000	7.66E-10	-.0022174	.0048047	3.0846E-10	4420.7613	-.0051958	
2714382.							
16.400	6.80E-10	-.0007109	.0028423	-3.8091E-10	4420.7412	-.0046162	
2714382.							
16.800	4.61E-10	5.7309E-05	.0012934	-5.3478E-10	4420.7325	-.0031280	
2714382.							
17.200	2.52E-10	.0003251	.0003252	-4.4477E-10	4420.7360	-.0017130	
2714382.							
17.600	1.05E-10	.0003185	-.0001053	-2.9326E-10	4420.7360	-.0004395	
1672313.							
18.000	1.78E-11	.0002415	-.0002081	-1.6141E-10	4420.7349	-7.4522E-05	
1672313.							
18.400	-2.40E-11	.0001525	-.0002029	-6.8665E-11	4420.7337	.0001003	
1672313.							
18.800	-3.71E-11	7.9355E-05	-.0001518	-1.4094E-11	4420.7328	.0001551	
1672313.							
19.200	-3.53E-11	3.1034E-05	-9.1297E-05	1.1893E-11	4420.7321	.0001475	
1672313.							
19.600	-2.76E-11	6.2898E-06	-3.8732E-05	2.0679E-11	4420.7318	.0001154	
1672313.							
20.000	-1.87E-11	0.0000	0.0000	2.2160E-11	4420.7317	7.8301E-05	
836156.							

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 1.

Pile-head deflection = .00091122 m
Computed slope at pile head = 0.00000
Maximum bending moment = -303.45952 kN- m
Maximum shear force = 222.40000 kN
Depth of maximum bending moment = 0.00000 m
Depth of maximum shear force = 0.00000 m

Number of iterations = 17
Number of zero deflection points = 5

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 2

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head = 444.800 kN
Specified slope at pile head = 0.000E+00 m/ m
Specified axial load at pile head = 2900.000 kN

(Zero slope for this load indicates fixed-head conditions)

Depth Es*h / F/L	Deflect. X	Moment y	Shear M	Slope V	Total S	Soil Res. Stress	p
	m	m	kN- m	kN	Rad.	kN/ m**2	kN/ m
kN/ m							
0.000	.004136	-799.9976	444.8000	-1.0842E-18	15092.9717	-83.5847	
4042.0826							
.400	.004060	-628.5460	410.3276	-.0003363	12805.7481	-88.7775	
8745.6990							
.800	.003867	-470.9554	373.9306	-.0005951	10703.4364	-93.2075	
9642.0995							
1.200	.003584	-328.0208	335.9167	-.0007832	8796.6405	-96.8619	
10809.6099							
1.600	.003240	-200.4050	296.6007	-.0009076	7094.2019	-99.7182	
12310.4628							
2.000	.002858	-88.6346	256.3075	-.0009757	5603.1471	-101.7478	
14239.4558							
2.400	.002460	6.9046	215.3744	-.0009949	4512.8410	-102.9176	
16737.4160							
2.800	.002062	85.9731	174.1528	-.0009730	5567.6424	-103.1906	
20014.9458							
3.200	.001681	148.4842	133.0096	-.0009178	6401.5619	-102.5251	
24394.0397							
3.600	.001328	194.5102	92.3300	-.0008371	7015.5644	-100.8733	
30383.6303							
4.000	.001011	224.2903	52.5201	-.0007385	7412.8403	-98.1759	
38824.9832							
4.400	.000737	238.2397	14.0145	-.0006296	7598.9301	-94.3521	
51195.6976							
4.800	.000508	236.9626	-22.7105	-.0005178	7581.8938	-89.2730	
70325.1999							
5.200	.000323	221.2725	-48.1221	-.0004099	7372.5818	-37.7851	
46794.9248							
5.600	.000180	199.4159	-61.8967	-.0003108	7081.0072	-31.0880	
69135.1746							
6.000	7.43E-05	172.4763	-72.7455	-.0002233	6721.6236	-23.1559	
124648.							
6.400	1.23E-06	141.7375	-77.7021	-.0001493	6311.5582	-1.6268	
529022.							
6.800	-4.52E-05	110.6611	-74.1062	-8.9910E-05	5896.9878	19.6061	
173681.							
7.200	-7.07E-05	82.6612	-65.6312	-4.4400E-05	5523.4595	22.7687	

128822.						
7.600	-8.07E-05	58.2591	-56.3187	-1.1225E-05	5197.9278	23.7938
127975.						
8.000	-7.97E-05	37.6322	-46.8207	1.1349E-05	4922.7584	23.6961
118959.						
8.400	-7.16E-05	20.7762	-37.5082	2.5099E-05	4697.8929	22.8665
127754.						
8.800	-5.96E-05	7.5674	-28.6328	3.1771E-05	4521.6836	21.5109
144370.						
9.200	-4.62E-05	-2.2037	-20.3791	3.3034E-05	4430.1303	19.7575
171142.						
9.600	-3.32E-05	-8.8225	-12.8835	3.0440E-05	4538.2931	17.6951
213373.						
10.000	-2.18E-05	-12.5852	-6.2713	2.5403E-05	4588.6223	15.3909
282068.						
10.400	-1.28E-05	-13.8885	.2057008	1.9172E-05	4606.0087	16.9943
529022.						
10.800	-6.49E-06	-12.4651	5.3210	1.2967E-05	4587.0203	8.5820
529022.						
11.200	-2.48E-06	-9.6618	7.0997	7.7581E-06	4549.6232	.3118193
50375.8627						
11.600	-2.82E-07	-6.8033	7.1696	3.8820E-06	4511.4902	.0376064
53248.1835						
12.000	6.30E-07	-3.9351	6.3225	1.3541E-06	4473.2273	-4.2730
2714382.						
12.400	8.01E-07	-1.7484	4.3812	1.6104E-08	4444.0561	-5.4339
2714382.						
12.800	6.43E-07	-.4301981	2.4223	-4.9677E-07	4426.4707	-4.3604
2714382.						
13.200	4.03E-07	.1905892	1.0028	-5.5317E-07	4423.2742	-2.7371
2714382.						
13.600	2.00E-07	.3733399	.1839351	-4.2042E-07	4425.7122	-1.3573
2714382.						
14.000	6.70E-08	.3387126	-.1784775	-2.5279E-07	4425.2502	-.4547249
2714382.						
14.400	-2.21E-09	.2311444	-.2664196	-1.1864E-07	4423.8153	.0150142
2714382.						
14.800	-2.79E-08	.1258522	-.2255464	-3.4600E-08	4422.4106	.1893514
2714382.						
15.200	-2.99E-08	.0507875	-.1471062	6.9831E-09	4421.4092	.2028498
2714382.						
15.600	-2.23E-08	.0081510	-.0762479	2.0858E-08	4420.8404	.1514419
2714382.						
16.000	-1.32E-08	-.0102592	-.0280361	2.0362E-08	4420.8686	.0896170
2714382.						
16.400	-6.03E-09	-.0143251	-.0019320	1.4574E-08	4420.9228	.0409033
2714382.						
16.800	-1.55E-09	-.0118386	.0083480	8.4150E-09	4420.8896	.0104970
2714382.						
17.200	7.04E-10	-.0076661	.0094915	3.8233E-09	4420.8340	-.0047797
2714382.						
17.600	1.51E-09	-.0042543	.0072714	1.0171E-09	4420.7885	-.0063205
1672313.						
18.000	1.52E-09	-.0018513	.0047380	-4.2020E-10	4420.7564	-.0063467
1672313.						
18.400	1.18E-09	-.0004629	.0024856	-9.6500E-10	4420.7379	-.0049151
1672313.						
18.800	7.46E-10	.0001394	.0008788	-1.0412E-09	4420.7336	-.0031191
1672313.						
19.200	3.43E-10	.0002426	-3.1614E-05	-9.5124E-10	4420.7349	-.0014329
1672313.						
19.600	-1.49E-11	.0001163	-.0003057	-8.6676E-10	4420.7333	6.2413E-05
1672313.						

20.000	-3.51E-10	0.0000	0.0000	-8.3937E-10	4420.7317	.0014661
836156.						

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 2:

Pile-head deflection	=	.00413573	m
Computed slope at pile head	=	-1.084202E-18	
Maximum bending moment	=	-799.99765	kN- m
Maximum shear force	=	444.80000	kN
Depth of maximum bending moment	=	0.00000	m
Depth of maximum shear force	=	0.00000	m
Number of iterations	=	18	
Number of zero deflection points	=	5	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 3

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head = 667.200 kN
Specified slope at pile head = 0.000E+00 m/ m
Specified axial load at pile head = 2900.000 kN

(Zero slope for this load indicates fixed-head conditions)

Depth	Deflect.	Moment	Shear	Slope	Total	Soil Res.
Es*h						
X	y	M	V	S	Stress	p
F/L						
m	m	kN- m	kN	Rad.	kN/ m**2	kN/ m
kN/ m						
0.000	.010277	-1411.5820	667.2000	2.3852E-17	23251.7150	-104.9419
2042.2912						
.400	.010144	-1152.7119	623.8894	-.0006037	19798.2999	-111.6111
4401.0835						
.800	.009794	-911.0700	578.0503	-.0010895	16574.7148	-117.5845
4802.3299						
1.200	.009272	-687.7440	529.9652	-.0014659	13595.4705	-122.8411
5299.2407						
1.600	.008621	-483.6970	479.9257	-.0017417	10873.4140	-127.3563
5908.9535						
2.000	.007879	-299.7628	428.2338	-.0019261	8419.6696	-131.1032
6655.8019						
2.400	.007080	-136.6414	375.2023	-.0020288	6243.5749	-134.0542
7573.2923						
2.800	.006256	5.1059	321.1552	-.0020598	4488.8462	-136.1816
8707.3097						
3.200	.005433	125.0614	266.4273	-.0020292	6089.0933	-137.4578
10121.0856						
3.600	.004633	222.9553	211.3647	-.0019472	7395.0317	-137.8551
11902.9227						
4.000	.003875	298.6707	156.3246	-.0018244	8405.1002	-137.3454

14178.4929						
4.400	.003173	352.2477	101.6759	-.0016712	9119.8351	-135.8978
17131.1977						
4.800	.002538	383.8886	47.8015	-.0014979	9541.9359	-133.4743
21037.7963						
5.200	.001975	393.9640	7.2888	-.0013148	9676.3449	-69.0893
13994.2463						
5.600	.001486	392.7699	-19.0973	-.0011296	9660.4157	-62.8413
16915.8430						
6.000	.001071	381.3067	-42.9348	-.0009473	9507.4928	-56.3459
21041.6427						
6.400	.000728	360.6199	-64.1127	-.0007727	9231.5240	-49.5437
27218.1440						
6.800	.000453	331.8092	-82.4807	-.0006097	8847.1789	-42.2964
37349.3999						
7.200	.000240	296.0498	-97.7891	-.0004619	8370.1365	-34.2453
56991.5641						
7.600	8.35E-05	254.6495	-109.4542	-.0003322	7817.8421	-24.0804
115382.						
8.000	-2.54E-05	209.2577	-111.0368	-.0002230	7212.2937	16.1676
254264.						
8.400	-9.49E-05	166.3374	-102.7810	-.0001346	6639.7297	25.1114
105799.						
8.800	-.000133	127.3447	-92.1366	-6.5469E-05	6119.5530	28.1105
84467.2234						
9.200	-.000147	92.7800	-80.6989	-1.3649E-05	5658.4489	29.0779
78954.1863						
9.600	-.000144	62.8172	-69.1111	2.2980E-05	5258.7343	28.8616
80149.6860						
10.000	-.000129	37.4379	-57.7756	4.6581E-05	4920.1658	27.8156
86295.9971						
10.400	-.000107	16.4886	-46.9882	5.9276E-05	4640.6956	26.1214
97857.3896						
10.800	-8.15E-05	-.2902135	-36.9892	6.3090E-05	4424.6033	23.8736
117156.						
11.200	-5.63E-05	-13.2491	-30.7964	5.9902E-05	4297.4796	7.0905
50375.4598						
11.600	-3.36E-05	-25.0663	-28.4841	5.0882E-05	4155.1249	4.4713
53248.0455						
12.000	-1.56E-05	-36.1544	-6.4237	3.6470E-05	4903.0440	105.8306
2714382.						
12.400	-4.41E-06	-30.2899	20.7302	2.0829E-05	4824.8090	29.9388
2714382.						
12.800	1.07E-06	-19.6186	25.2694	9.0795E-06	4682.4503	-7.2426
2714382.						
13.200	2.85E-06	-10.0954	19.9506	2.0844E-06	4555.4077	-19.3515
2714382.						
13.600	2.73E-06	-3.6629	12.3686	-1.1544E-06	4469.5964	-18.5585
2714382.						
14.000	1.93E-06	-.1978147	6.0401	-2.0633E-06	4423.3706	-13.0843
2714382.						
14.400	1.08E-06	1.1739	1.9517	-1.8335E-06	4436.3921	-7.3573
2714382.						
14.800	4.61E-07	1.3678	-.1458356	-1.2352E-06	4438.9790	-3.1306
2714382.						
15.200	9.61E-08	1.0601	-.9023310	-6.6359E-07	4434.8739	-.6519097
2714382.						
15.600	-6.95E-08	.6475056	-.9383270	-2.6160E-07	4429.3697	.4719298
2714382.						
16.000	-1.13E-07	.3100558	-.6902892	-3.6179E-08	4424.8680	.7682590
2714382.						
16.400	-9.85E-08	.0953581	-.4029699	5.9260E-08	4422.0038	.6683377
2714382.						

16.800	-6.58E-08	-.0124576	-.1799925	7.8776E-08	4420.8979	.4465490
2714382.						
17.200	-3.55E-08	-.0488187	-.0425465	6.4351E-08	4421.3830	.2406811
2714382.						
17.600	-1.43E-08	-.0466441	.0175670	4.1878E-08	4421.3540	.0598864
1672313.						
18.000	-1.97E-09	-.0348623	.0311876	2.2690E-08	4421.1968	.0082167
1672313.						
18.400	3.83E-09	-.0217467	.0296302	9.3637E-09	4421.0218	-.0160037
1672313.						
18.800	5.53E-09	-.0111798	.0218092	1.6124E-09	4420.8808	-.0231015
1672313.						
19.200	5.12E-09	-.0043031	.0129095	-2.0324E-09	4420.7891	-.0213967
1672313.						
19.600	3.90E-09	-.0008475	.0053695	-3.2449E-09	4420.7430	-.0163037
1672313.						
20.000	2.52E-09	0.0000	0.0000	-3.4445E-09	4420.7317	-.0105435
836156.						

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 3:

Pile-head deflection	=	.01027688	m
Computed slope at pile head	=	2.3852E-17	
Maximum bending moment	=	-1411.5820	kN- m
Maximum shear force	=	667.20000	kN
Depth of maximum bending moment	=	0.00000	m
Depth of maximum shear force	=	0.00000	m
Number of iterations	=	25	
Number of zero deflection points	=	4	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 4

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head = 889.600 kN
Specified slope at pile head = 0.000E+00 m/ m
Specified axial load at pile head = 2900.000 kN

(Zero slope for this load indicates fixed-head conditions)

Depth	Deflect.	Moment	Shear	Slope	Total	Soil Res.
Es*h						
X	y	M	V	S	Stress	p
F/L						
m	m	kN- m	kN	Rad.	kN/ m**2	kN/ m
kN/ m						
0.000	.019669	-2115.1235	889.6000	4.3368E-18	32637.1962	-123.4309
1255.0999						
.400	.019470	-1768.5803	838.6402	-.0009143	28014.1934	-131.3682
2698.9509						
.800	.018937	-1442.0902	784.6355	-.0016701	23658.7043	-138.6551

2928.7230 1.200	.018133	-1136.9973	727.8514	-.0022773	19588.6612	-145.2654
3204.3643 1.600	.017115	-854.5258	668.5640	-.0027461	15820.3963	-151.1718
3332.9841 2.000	.015937	-595.7752	607.0603	-.0030875	12368.5747	-156.3467
3324.2240 2.400	.014645	-361.7146	543.6383	-.0033129	9246.1272	-160.7633
4390.7980 2.800	.013286	-153.1786	478.6066	-.0034341	6464.1863	-164.3953
4349.3354 3.200	.011898	29.1378	412.2840	-.0034633	4809.4398	-167.2176
5621.6184 3.600	.010516	184.6835	344.9992	-.0034130	6884.4718	-169.2061
6436.3850 4.000	.009168	313.0553	277.0905	-.0032958	8596.9955	-170.3374
7431.9867 4.400	.007879	414.0022	208.9055	-.0031246	9943.6608	-170.5876
8660.4142 4.800	.006668	487.4289	140.8020	-.0029124	10923.1984	-169.9300
10193.6368 5.200	.005549	533.4006	87.3180	-.0026721	11536.4763	-97.4901
7027.5728 5.600	.004530	563.4826	49.5965	-.0024139	11937.7809	-91.1173
8045.0014 6.000	.003618	578.6781	14.4659	-.0021450	12140.4937	-84.5360
9346.4627 6.400	.002814	580.0318	-17.9908	-.0018723	12158.5521	-77.7471
11050.0546 6.800	.002120	568.6291	-47.6885	-.0016018	12006.4368	-70.7418
13347.0118 7.200	.001533	545.5972	-74.5356	-.0013395	11699.1835	-63.4936
16568.3830 7.600	.001048	512.1083	-98.4229	-.0010905	11252.4307	-55.9428
21343.1203 8.000	.000660	469.3889	-119.2027	-.0008595	10682.5394	-47.9563
29044.5320 8.400	.000361	418.7402	-136.6351	-.0006504	10006.8676	-39.2057
43458.4347 8.800	.000140	361.5898	-150.1970	-.0004667	9244.4622	-28.6038
81653.3757 9.200	-1.25E-05	299.6653	-152.6081	-.0003110	8418.3688	16.5483
529022. 9.600	-.000109	240.2249	-144.0425	-.0001839	7625.4136	26.2800
96695.6647 10.000	-.000160	184.8581	-132.8118	-8.3878E-05	6886.8015	29.8735
74837.9400 10.400	-.000176	134.1701	-120.6674	-8.7744E-06	6210.6062	30.8485
70184.2947 10.800	-.000167	88.3445	-108.4366	4.3608E-05	5599.2778	30.3055
72723.1099 11.200	-.000141	47.3196	-98.8260	7.5545E-05	5051.9915	17.7475
50373.3352 11.600	-.000106	9.1085	-92.4477	8.8829E-05	4542.2416	14.1441
53246.8031 12.000	-6.99E-05	-26.8446	-68.8053	8.4654E-05	4778.8481	104.0679
595831. 12.400	-3.85E-05	-46.1322	-30.0553	6.7474E-05	5036.1507	89.6823
931029. 12.800	-1.59E-05	-51.0454	9.4398	4.4597E-05	5101.6945	107.7930
2714382. 13.200	-2.85E-06	-38.6838	34.8697	2.3474E-05	4936.7870	19.3566
2714382. 13.600	2.89E-06	-23.2041	34.8126	8.9049E-06	4730.2819	-19.6421
2714382. 14.000	4.27E-06	-10.8544	25.0870	8.8712E-07	4565.5330	-28.3860
2714382. 14.400	3.60E-06	-3.1365	14.3982	-2.4065E-06	4462.5743	-24.4581
2714382. 14.800	2.35E-06	.6697291	6.3222	-2.9872E-06	4429.6661	-15.9216
2714382. 15.200	1.21E-06	1.9282	1.4897	-2.3757E-06	4446.4543	-8.2410
2714382. 15.600	4.46E-07	1.8670	-.7634377	-1.4822E-06	4445.6383	-3.0247
2714382. 16.000	2.86E-08	1.3209	-1.4073	-7.3176E-07	4438.3526	-.1944350
2714382. 16.400	-1.40E-07	.7428994	-1.2566	-2.4592E-07	4430.6422	.9478183
2714382. 16.800	-1.68E-07	.3181737	-.8288958	3.3995E-09	4424.9496	1.1406
2714382. 17.200	-1.37E-07	.0717749	-.4248994	9.4727E-08	4421.6892	.9293600
2714382. 17.600	-9.23E-08	-.0239655	-.1618469	1.0598E-07	4421.0514	.3859022
1672313. 18.000	-5.22E-08	-.0579485	-.0410462	8.6699E-08	4421.5048	.2181015
1672313. 18.400	-2.29E-08	-.0570036	.0217596	5.9638E-08	4421.4922	.0959274
1672313. 18.800	-4.46E-09	-.0406792	.0446722	3.6642E-08	4421.2744	.0186359
1672313. 19.200	6.37E-09	-.0213508	.0430742	2.2039E-08	4421.0165	-.0266261
1672313. 19.600	1.32E-08	-.0062709	.0267376	1.5537E-08	4420.8154	-.0550772
1672313. 20.000	1.88E-08	0.0000	0.0000	1.4061E-08	4420.7317	-.0785907
836156.						

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 4:

Pile-head deflection	=	.01966869	m
Computed slope at pile head	=	4.336809E-18	
Maximum bending moment	=	-2115.12347	kN- m
Maximum shear force	=	889.60000	kN
Depth of maximum bending moment	=	0.00000	m
Depth of maximum shear force	=	0.00000	m
Number of iterations	=	28	
Number of zero deflection points	=	4	

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 5

Pile-head boundary conditions are Shear and Slope (BC Type 2)

Specified shear force at pile head	=	1112.000	kN
Specified slope at pile head	=	0.000E+00	m/ m
Specified axial load at pile head	=	2900.000	kN

(Zero slope for this load indicates fixed-head conditions)

Depth Es*h X F/L m	Deflect. y m	Moment M kN- m	Shear V kN	Slope S Rad.	Total Stress kN/ m**2	Soil Res. p kN/ m
0.000	.032532	-2896.7516	1112.0000	2.6021E-17	43064.3808	-139.9771
860.5409 .400	.032260	-2462.3587	1054.1958	-.0012616	37269.4325	-149.0439
1848.0580 .800	.031523	-2050.4681	992.8884	-.0023240	31774.6712	-157.4931
1998.4494 1.200	.030400	-1662.6564	928.3307	-.0031981	26601.1322	-165.2951
2174.9068 1.600	.028965	-1300.3839	860.7877	-.0038956	21768.2940	-172.4202
2381.1171 2.000	.027284	-964.9884	790.5357	-.0044289	17294.0044	-178.8399
2621.9123 2.400	.025421	-657.6803	717.8623	-.0048109	13194.4097	-184.5266
2903.4776 2.800	.023435	-379.5372	643.0663	-.0050551	9483.8867	-189.4538
3233.6682 3.200	.021377	-131.4995	566.4561	-.0051754	6174.9791	-193.5967
3622.4583 3.600	.019295	85.6346	488.3505	-.0051862	5563.1268	-196.9315
4082.5726 4.000	.017228	271.2129	409.0771	-.0051022	8038.8039	-199.4354
4630.3792 4.400	.015213	424.7334	328.9729	-.0049384	10086.8193	-201.0858
5287.1771 4.800	.013278	545.8482	248.3839	-.0047099	11702.5316	-201.8588
6081.1134 5.200	.011445	634.3674	183.1929	-.0044320	12883.4086	-124.0966
4337.0704 5.600	.009732	702.6848	134.8600	-.0041173	13794.7850	-117.5678
4832.1526 6.000	.008151	751.8075	89.1818	-.0037749	14450.0987	-110.8230
5438.2421 6.400	.006712	782.7879	46.2423	-.0034136	14863.3881	-103.8745
6190.1611 6.800	.005421	796.7209	6.1211	-.0030418	15049.2586	-96.7314
7138.1801 7.200	.004279	794.7417	-31.1048	-.0026671	15022.8557	-89.3984
8357.2876 7.600	.003287	778.0247	-65.3594	-.0022969	14799.8455	-81.8743
9963.9753 8.000	.002441	747.7829	-96.5638	-.0019377	14396.4099	-74.1480
12148.7987 8.400	.001737	705.2691	-124.6316	-.0015956	13829.2604	-66.1910
15245.4706 8.800	.001165	651.7795	-149.4580	-.0012761	13115.6908	-57.9409
19896.5757 9.200	.000716	588.6633	-170.8981	-.0009841	12273.7002	-49.2596
27528.5936 9.600	.000378	517.3442	-188.7103	-.0007238	11322.2784	-39.8017
42169.5637 10.000	.000137	439.3742	-202.3456	-.0004985	10282.1324	-28.3748
82996.8243						

10.400	-2.13E-05	356.6243	-204.9710	-.0003111	9178.2204	15.2481
286490. 10.800	-.000112	276.1193	-196.6108	-.0001622	8104.2565	26.5529
94690.1872 11.200	-.000151	199.7119	-187.4959	-5.0176E-05	7084.9568	19.0213
50372.9585 11.600	-.000152	126.2389	-179.6368	2.6556E-05	6104.8021	20.2743
53245.3466 12.000	-.000130	55.9409	-151.2841	6.9444E-05	5167.0023	121.4891
374392. 12.400	-9.68E-05	5.0506	-104.4092	8.3802E-05	4488.1078	112.8855
466692. 12.800	-6.28E-05	-27.7809	-61.5707	7.8451E-05	4791.3379	101.3067
645704. 13.200	-3.40E-05	-44.3880	-23.9274	6.1461E-05	5012.8833	86.9099
1022680. 13.600	-1.36E-05	-47.0654	11.8964	3.9932E-05	5048.5999	92.2092
2714382. 14.000	-2.05E-06	-34.9636	33.1168	2.0622E-05	4887.1574	13.8927
2714382. 14.400	2.91E-06	-20.6198	31.9473	7.5366E-06	4695.8067	-19.7403
2714382. 14.800	3.98E-06	-9.4232	22.5949	4.6406E-07	4546.4406	-27.0214
2714382. 15.200	3.28E-06	-2.5449	12.7387	-2.3534E-06	4454.6818	-22.2596
2714382. 15.600	2.10E-06	.7732223	5.4377	-2.7705E-06	4431.0468	-14.2454
2714382. 16.000	1.06E-06	1.8117	1.1448	-2.1619E-06	4444.9001	-7.2194
2714382. 16.400	3.70E-07	1.6940	-.8008695	-1.3367E-06	4443.3308	-2.5087
2714382. 16.800	-5.45E-09	1.1741	-1.2952	-6.6147E-07	4436.3944	.0370117
2714382. 17.200	-1.59E-07	.6594080	-1.0714	-2.2984E-07	4429.5284	1.0823
2714382. 17.600	-1.89E-07	.3175328	-.6965960	1.4067E-10	4424.9677	.7915419
1672313. 18.000	-1.59E-07	.1021308	-.4050278	9.8935E-08	4422.0942	.6662994
1672313. 18.400	-1.10E-07	-.0067190	-.1796394	1.2140E-07	4420.8213	.4606426
1672313. 18.800	-6.23E-08	-.0418623	-.0354556	1.0996E-07	4421.2902	.2602762
1672313. 19.200	-2.22E-08	-.0353386	.0351737	9.1785E-08	4421.2031	.0928707
1672313. 19.600	1.12E-08	-.0139363	.0444058	8.0185E-08	4420.9176	-.0467104
1672313. 20.000	4.19E-08	0.0000	0.0000	7.6904E-08	4420.7317	-.1753186
836156.						

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 5:

Pile-head deflection	=	.03253235	m
Computed slope at pile head	=	2.602085E-17	
Maximum bending moment	=	-2896.75161	kN- m
Maximum shear force	=	1112.00000	kN
Depth of maximum bending moment	=	0.00000	m

Depth of maximum shear force = 0.00000 m
Number of iterations = 29
Number of zero deflection points = 4

Computed values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 6

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head = 1334.400 kN
Specified slope at pile head = 0.000E+00 m/ m
Specified axial load at pile head = 2900.000 kN

(Zero slope for this load indicates fixed-head conditions)

Depth Es*h X F/L m	Deflect. y m	Moment M kN- m	Shear V kN	Slope S Rad.	Total Stress kN/ m**2	Soil Res. p kN/ m
0.000	.049087	-3746.4824	1334.4000	6.9389E-17	54400.0783	-155.1381
632.0975 .400	.048734	-3224.1104	1270.3250	-.0016410	47431.4582	-165.2368
1356.2351 .800	.047774	-2726.4154	1202.3289	-.0030418	40792.0379	-174.7438
1463.0869 1.200	.046301	-2255.1903	1130.6548	-.0042145	34505.7358	-183.6267
1586.3892 1.600	.044402	-1812.1139	1055.5586	-.0051720	28594.9453	-191.8546
1728.3269 2.000	.042163	-1398.7444	977.3081	-.0059279	23080.4568	-199.3975
1891.6857 2.400	.039660	-1016.5147	896.1831	-.0064965	17981.3820	-206.2274
2079.9499 2.800	.036966	-666.7261	812.4742	-.0068927	13315.0840	-212.3173
2297.4483 3.200	.034146	-350.5442	726.4823	-.0071322	9097.1097	-217.6421
2549.5558 3.600	.031260	-68.9935	638.5183	-.0072310	5341.1286	-222.1780
2842.9688 4.000	.028361	177.0463	548.9023	-.0072055	6782.5899	-225.9022
3186.0839 4.400	.025496	386.8451	457.9633	-.0070728	9581.3771	-228.7926
3589.5264 4.800	.022703	559.8259	366.0396	-.0068499	11888.9985	-230.8263
4066.9065 5.200	.020016	695.5686	289.9721	-.0065544	13699.8529	-149.5112
2987.8891 5.600	.017459	807.0097	231.4989	-.0062007	15186.5146	-142.8544
3272.8422 6.000	.015055	895.1533	175.7339	-.0058000	16362.3802	-135.9708
3612.6170 6.400	.012819	961.0527	122.7644	-.0053630	17241.5005	-128.8766
4021.2945 6.800	.010765	1005.8069	72.6718	-.0049000	17838.5375	-121.5866
4517.9680						

7.200	.008899	1030.5580	25.5316	-.0044206	18168.7252	-114.1141
5129.0461 7.600	.007228	1036.4880	-18.5853	-.0039340	18247.8331	-106.4707
5891.9157 8.000	.005752	1024.8166	-59.6126	-.0034487	18092.1324	-98.6656
6860.9856 8.400	.004469	996.7989	-97.4063	-.0029728	17718.3677	-90.7053
8118.1006 8.800	.003374	953.7241	-132.1462	-.0025136	17143.7341	-82.5919
9791.4717 9.200	.002438	896.9136	-163.5286	-.0020780	16385.8632	-74.3200
12092.4574 9.600	.001712	827.7221	-191.5668	-.0016720	15462.8243	-65.8714
15393.5054 10.000	.001121	747.5391	-216.1814	-.0013011	14393.1563	-57.2013
20413.9691 10.400	.000671	657.7956	-237.2626	-.0009703	13195.9477	-48.2047
28745.8644 10.800	.000345	559.9801	-254.6251	-.0006836	11891.0557	-38.6081
44815.4570 11.200	.000124	455.6814	-268.4670	-.0004445	10499.6765	-15.6012
50373.9105 11.600	-1.10E-05	348.6377	-268.2941	-.0002552	9071.6770	1.4658
53248.1686 12.000	-8.02E-05	241.6381	-246.4578	-.0001162	7644.2662	107.7155
536921. 12.400	-.000104	151.7410	-201.9288	-2.3699E-05	6445.0086	114.9295
442143. 12.800	-9.91E-05	80.1498	-156.2294	3.0991E-05	5489.9571	113.5676
458277. 13.200	-7.92E-05	26.6856	-112.0427	5.6142E-05	4776.7266	107.3662
542377. 13.600	-5.42E-05	-9.6146	-71.0365	6.0160E-05	4548.9936	97.6645
720606. 14.000	-3.11E-05	-30.2832	-34.5106	5.0768E-05	4824.7198	84.9649
1094430. 14.400	-1.36E-05	-37.3409	.9374418	3.4848E-05	4918.8717	92.2755
2714382. 14.800	-3.17E-06	-29.6141	23.7014	1.9086E-05	4815.7937	21.5442
2714382. 15.200	1.67E-06	-18.4241	25.7422	7.7777E-06	4666.5148	-11.3403
2714382. 15.600	3.05E-06	-9.0384	19.3383	1.3127E-06	4541.3070	-20.6789
2714382. 16.000	2.72E-06	-2.9564	11.5093	-1.5111E-06	4460.1715	-18.4665
2714382. 16.400	1.84E-06	.1725086	5.3208	-2.1664E-06	4423.0330	-12.4757
2714382. 16.800	9.88E-07	1.3052	1.4846	-1.8185E-06	4438.1440	-6.7055
2714382. 17.200	3.84E-07	1.3644	-.3771944	-1.1901E-06	4438.9329	-2.6033
2714382. 17.600	3.61E-08	1.0062	-.9280144	-6.3201E-07	4434.1553	-.1508061
1672313. 18.000	-1.22E-07	.6234302	-.8561797	-2.4837E-07	4429.0485	.5099793
1672313. 18.400	-1.63E-07	.3218745	-.6182044	-2.5833E-08	4425.0256	.6798972
1672313. 18.800	-1.43E-07	.1289266	-.3629486	8.0291E-08	4422.4516	.5963821
1672313. 19.200	-9.84E-08	.0313294	-.1614012	1.1802E-07	4421.1497	.4113546
1672313. 19.600	-4.82E-08	-.0004682	-.0387984	1.2528E-07	4420.7380	.2016594

1672313. 20.000	1.83E-09	0.0000	0.0000	1.2517E-07	4420.7317	-.0076672
836156.						

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 6:

Pile-head deflection = .04908676 m
Computed slope at pile head = 6.938894E-17
Maximum bending moment = -3746.48244 kN- m
Maximum shear force = 1334.40000 kN
Depth of maximum bending moment = 0.00000 m
Depth of maximum shear force = 0.00000 m
Number of iterations = 30
Number of zero deflection points = 4

Computed values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 7

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head = 1556.800 kN
Specified slope at pile head = 0.000E+00 m/ m
Specified axial load at pile head = 2900.000 kN

(Zero slope for this load indicates fixed-head conditions)

Depth Es*h X F/L m	Deflect. y m	Moment M kN- m	Shear V kN	Slope S Rad.	Total Stress kN/ m**2	Soil Res. p kN/ m
0.000	.069231	-4661.2739	1556.8000	-5.2042E-17	66603.7071	-169.0642
488.4082 .400	.068792	-4050.8062	1486.9656	-.0020509	58459.8602	-180.1079
1047.2638 .800	.067590	-3466.9433	1412.8283	-.0038207	50670.9315	-190.5786
1127.8511 1.200	.065735	-2911.6795	1334.6242	-.0053223	43263.5243	-200.4419
1219.6925 1.600	.063332	-2386.8962	1252.6028	-.0065697	36262.7370	-209.6652
1324.2262 2.000	.060480	-1894.3537	1167.0263	-.0075775	29692.0796	-218.2171
1443.2467 2.400	.057270	-1435.6954	1078.1692	-.0083614	23573.3947	-226.0683
1578.9615 2.800	.053790	-1012.4218	986.3174	-.0089378	17926.7818	-233.1907
1734.0709 3.200	.050120	-625.9058	891.7677	-.0093234	12770.5274	-239.5579
1911.8783 3.600	.046332	-277.3772	794.8272	-.0095361	8121.0380	-245.1448
2116.4376						

4.000	.042491	32.0797	695.8128	-.0095938	4848.6853	-249.9272
2352.7525 4.400	.038657	301.5307	595.0510	-.0095153	8443.2532	-253.8814
2627.0491 4.800	.034879	530.1960	492.8781	-.0093195	11493.7259	-256.9833
2947.1579 5.200	.031201	717.4544	406.8102	-.0090258	13991.8166	-173.3562
2222.4498 5.600	.027658	876.5840	338.8330	-.0086505	16114.6591	-166.5296
2408.3973 6.000	.024280	1008.5901	273.6362	-.0082067	17875.6651	-159.4543
2626.8715 6.400	.021093	1114.5326	211.3161	-.0077069	19288.9746	-152.1464
2885.2819 6.800	.018115	1195.5230	151.9627	-.0071631	20369.4142	-144.6205
3193.3964 7.200	.015362	1252.7212	95.6607	-.0065868	21132.4574	-136.8893
3564.2985 7.600	.012846	1287.3329	42.4901	-.0059888	21594.1895	-128.9640
4015.8431 8.000	.010571	1300.6073	-7.4735	-.0053796	21771.2743	-120.8537
4572.9334 8.400	.008542	1293.8348	-54.1572	-.0047688	21680.9262	-112.5649
5271.2114 8.800	.006756	1268.3452	-97.4903	-.0041656	21340.8867	-104.1005
6163.2869 9.200	.005209	1225.5068	-137.4021	-.0035786	20769.4082	-95.4585
7329.7900 9.600	.003893	1166.7258	-173.8196	-.0030154	19985.2490	-86.6287
8900.2346 10.000	.002797	1093.4469	-206.6627	-.0024833	19007.6842	-77.5870
11095.6456 10.400	.001907	1007.1569	-235.8368	-.0019888	17856.5469	-68.2837
14325.3313 10.800	.001206	909.3915	-261.2166	-.0015376	16552.3231	-58.6151
19441.7181 11.200	.000677	801.7510	-289.9605	-.0011348	15116.3623	-85.1049
50317.6831 11.600	.000298	680.0559	-314.9168	-.0007860	13492.9076	-39.6763
53237.3236 12.000	4.78E-05	551.6411	-341.7919	-.0004960	11779.8108	-94.6993
793249. 12.400	-9.87E-05	407.7731	-338.0481	-.0002702	9860.5635	113.4183
459586. 12.800	-.000168	281.8294	-289.4365	-.0001078	8180.4314	129.6397
307963. 13.200	-.000185	176.4741	-236.9631	6.0749E-08	6774.9560	132.7271
287013. 13.600	-.000168	92.2588	-184.4903	6.3324E-05	5651.4949	129.6370
308045. 14.000	-.000134	28.7350	-134.0582	9.1807E-05	4804.0658	122.5234
364876. 14.400	-9.49E-05	-15.2008	-87.0880	9.4993E-05	4623.5154	112.3275
473510. 14.800	-5.83E-05	-41.1558	-44.7311	8.1726E-05	4969.7645	99.4570
682107. 15.200	-2.95E-05	-51.1753	-8.0641	5.9990E-05	5103.4272	83.8782
1137009. 15.600	-1.03E-05	-47.7463	22.7329	3.6703E-05	5057.6830	70.1066
2714382. 16.000	-1.46E-07	-33.0741	36.9523	1.7677E-05	4861.9516	.9904363
2714382. 16.400	3.81E-06	-18.2254	31.9790	5.6004E-06	4663.8651	-25.8571

2714382. 16.800	4.33E-06	-7.5039	20.9250	-4.5663E-07	4520.8367	-29.4127
2714382. 17.200	3.45E-06	-1.4844	10.3668	-2.5726E-06	4440.5336	-23.3782
2714382. 17.600	2.28E-06	.7955130	3.7879	-2.7348E-06	4431.3441	-9.5166
1672313. 18.000	1.26E-06	1.5523	.8332902	-2.1820E-06	4441.4399	-5.2564
1672313. 18.400	5.31E-07	1.4672	-.6616846	-1.4712E-06	4440.3048	-2.2185
1672313. 18.800	8.03E-08	1.0264	-1.1725	-8.8420E-07	4434.4237	-.3357333
1672313. 19.200	-1.77E-07	.5312403	-1.0919	-5.1752E-07	4427.8186	.7388699
1672313. 19.600	-3.34E-07	.1540468	-.6650834	-3.3620E-07	4422.7867	1.3952
1672313. 20.000	-4.62E-07	0.0000	0.0000	-3.1994E-07	4420.7317	1.9302

836156.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 7:

Pile-head deflection	=	.06923072 m
Computed slope at pile head	=	-5.204170E-17
Maximum bending moment	=	-4661.27393 kN- m
Maximum shear force	=	1556.80000 kN
Depth of maximum bending moment	=	0.00000 m
Depth of maximum shear force	=	0.00000 m
Number of iterations	=	31
Number of zero deflection points	=	3

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 8

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head = 1779.200 kN
Specified slope at pile head = 0.000E+00 m/ m
Specified axial load at pile head = 2900.000 kN

(Zero slope for this load indicates fixed-head conditions)

Depth Es*h F/L	Deflect. x y	Moment M	Shear V	Slope S	Total Stress	Soil Res. p
	m m	kN- m	kN	Rad.	kN/ m**2	kN/ m
kN/ m						
0.000	.092670	-5634.2900	1779.2000	2.4286E-16	79584.0717	-181.8492
392.4672 .400	.092139	-4935.6194	1704.0786	-.0024883	70263.5680	-193.7579
841.1531						

.800	.090679	-4265.2543	1624.3056	-.0046543	61320.6713	-205.1068
904.7587 1.200	.088416	-3625.3769	1540.1123	-.0065118	52784.4895	-215.8595
976.5657 1.600	.085470	-3018.0570	1451.7441	-.0080758	44682.6359	-225.9816
1057.5991 2.000	.081955	-2445.2458	1359.4598	-.0093619	37041.1404	-235.4402
1149.1173 2.400	.077980	-1908.7696	1263.5308	-.0103869	29884.3653	-244.2043
1252.6439 2.800	.073646	-1410.3235	1164.2411	-.0111683	23234.9261	-252.2444
1370.0442 3.200	.069046	-951.4664	1061.8857	-.0117242	17113.6157	-259.5324
1503.5434 3.600	.064266	-533.6147	956.7710	-.0120739	11539.3329	-266.0411
1655.8687 4.000	.059386	-158.0382	849.2139	-.0122367	6529.0149	-271.7445
1830.3468 4.400	.054477	174.1455	739.5417	-.0122329	6743.8913	-276.6164
2031.0732 4.800	.049600	461.9755	628.0924	-.0120831	10583.6412	-280.6304
2263.1421 5.200	.044810	704.6523	532.8486	-.0118085	13821.0319	-195.5882
1745.9183 5.600	.040153	915.6501	456.0183	-.0114271	16635.8145	-188.5632
1878.4311 6.000	.035669	1095.9777	382.0528	-.0109535	19041.4460	-181.2644
2032.7529 6.400	.031391	1246.7044	311.0586	-.0104020	21052.1919	-173.7066
2213.4883 6.800	.027347	1368.9572	243.1367	-.0097862	22683.0857	-165.9029
2426.6206 7.200	.023562	1463.9179	178.3832	-.0091193	23949.8933	-157.8646
2680.0359 7.600	.020052	1532.8207	116.8902	-.0084139	24869.0801	-149.6007
2984.3035 8.000	.016830	1576.9503	58.7465	-.0076818	25457.7832	-141.1179
3353.8694 8.400	.013906	1597.6397	4.0389	-.0069345	25733.7870	-132.4199
3808.9377 8.800	.011283	1596.2693	-47.1464	-.0061826	25715.5062	-123.5067
4378.5475 9.200	.008960	1574.2661	-94.7223	-.0054362	25421.9759	-114.3727
5105.8280 9.600	.006934	1533.1035	-138.5979	-.0047047	24872.8521	-105.0051
6057.4619 10.000	.005196	1474.3027	-178.6747	-.0039967	24088.4298	-95.3789
7341.8829 10.400	.003737	1399.4361	-214.8403	-.0033202	23089.6839	-85.4493
9147.3458 10.800	.002540	1310.1333	-246.9573	-.0026823	21898.3541	-75.1354
11831.0605 11.200	.001591	1208.0933	-301.7969	-.0020895	20537.1057	-199.0629
50056.1746 11.600	.000869	1073.5434	-364.6972	-.0015524	18742.1646	-115.4386
53156.1072 12.000	.000349	919.9370	-418.8969	-.0010831	16693.0033	-155.5596
178386. 12.400	2.21E-06	740.9387	-453.0041	-.0006921	14305.1048	-14.9765
2714382. 12.800	-.000205	559.1394	-428.7634	-.0003860	11879.8412	136.1800
265897. 13.200	-.000307	398.8236	-371.4020	-.0001605	9741.1737	150.6266

196495. 13.600	-.000333	262.3902	-310.5170	-4.8674E-06	7921.1060	153.7987
184587. 14.000	-.000311	150.4213	-249.5366	9.2313E-05	6427.4028	151.1032
194645. 14.400	-.000259	62.5468	-190.4233	.0001424	5255.1266	144.4634
222739. 14.800	-.000197	-2.2478	-134.5744	.0001566	4450.7184	134.7810
274278. 15.200	-.000134	-45.4762	-83.1188	.0001454	5027.3997	122.4972
365349. 15.600	-8.02E-05	-69.0802	-37.0727	.0001184	5342.2851	107.7331
537096. 16.000	-3.94E-05	-75.4092	2.5068	8.4426E-05	5426.7157	90.1644
916250. 16.400	-1.27E-05	-67.2707	37.7660	5.0838E-05	5318.1451	86.1319
2714382. 16.800	1.31E-06	-45.3143	53.2173	2.4334E-05	5025.2396	-8.8757
2714382. 17.200	6.77E-06	-24.7533	42.2478	7.8393E-06	4750.9488	-45.9718
2714382. 17.600	7.58E-06	-11.5342	26.7159	-7.0325E-07	4574.6024	-31.6877
1672313. 18.000	6.21E-06	-3.3789	15.1842	-4.2140E-06	4465.8080	-25.9708
1672313. 18.400	4.21E-06	.6228676	6.4713	-4.8628E-06	4429.0410	-17.5935
1672313. 18.800	2.32E-06	1.8094	1.0113	-4.2902E-06	4444.8695	-9.7066
1672313. 19.200	7.76E-07	1.4419	-1.5789	-3.5248E-06	4439.9666	-3.2443
1672313. 19.600	-4.98E-07	.5544619	-1.8112	-3.0549E-06	4428.1284	2.0827
1672313. 20.000	-1.67E-06	0.0000	0.0000	-2.9244E-06	4420.7317	6.9732

836156.

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 8:

Pile-head deflection	=	.09266976 m
Computed slope at pile head	=	2.428613E-16
Maximum bending moment	=	-5634.29002 kN- m
Maximum shear force	=	1779.20000 kN
Depth of maximum bending moment	=	0.00000 m
Depth of maximum shear force	=	0.00000 m
Number of iterations	=	29
Number of zero deflection points	=	3

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 9

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head = 2001.600 kN
Specified slope at pile head = 0.000E+00 m/ m

Specified axial load at pile head = 2900.000 kN

(Zero slope for this load indicates fixed-head conditions)

Depth Es*h F/L	Deflect. x y	Moment M	Shear V	Slope S	Total Stress	Soil Res. p
	m m	kN- m	kN	Rad.	kN/ m**2	kN/ m
kN/ m						
0.000	.119049	-6659.1973	2001.6000	1.7347E-17	93256.6821	-193.6015
325.2456 .400	.118422	-5872.2269	1921.6190	-.0029501	82758.2305	-206.3036
696.8401 .800	.116689	-5115.0580	1836.6674	-.0055366	72657.3400	-218.4545
748.8413 1.200	.113993	-4390.0481	1746.9732	-.0077742	62985.4628	-230.0162
807.1234 1.600	.110470	-3699.4432	1652.7795	-.0096786	53772.5592	-240.9523
872.4625 2.000	.106250	-3045.3702	1554.3433	-.0112664	45047.0035	-251.2285
945.7997 2.400	.101457	-2429.8305	1451.9352	-.0125553	36835.4953	-260.8121
1028.2677 2.800	.096206	-1854.6937	1345.8385	-.0135639	29162.9750	-269.6717
1121.2265 3.200	.090606	-1321.6914	1236.3487	-.0143117	22052.5434	-277.7772
1226.3117 3.600	.084757	-832.4116	1123.7734	-.0148188	15525.3847	-285.0995
1345.4975 4.000	.078751	-388.2931	1008.4315	-.0151062	9600.6929	-291.6100
1481.1808 4.400	.072672	9.3799	890.6534	-.0151954	4545.8631	-297.2803
1636.2929 4.800	.066594	359.4830	770.7812	-.0151085	9216.3563	-302.0810
1814.4532 5.200	.060585	661.0567	667.1102	-.0148683	13239.4523	-216.2740
1427.9088 5.600	.054700	927.6656	582.0491	-.0144943	16796.1050	-209.0314
1528.5730 6.000	.048989	1160.3228	499.9451	-.0140028	19859.8308	-201.4886
1645.1611 6.400	.043498	1360.1080	420.9156	-.0134094	22565.0344	-193.6592
1780.8744 6.800	.038262	1528.1650	345.0728	-.0127295	24806.9717	-185.5547
1939.8397 7.200	.033314	1665.6987	272.5250	-.0119776	26641.7170	-177.1844
2127.4484 7.600	.028680	1773.9731	203.3771	-.0111679	28086.1342	-168.5551
2350.8567 8.000	.024380	1854.3098	137.7319	-.0103137	29157.8532	-159.6710
2619.7395 8.400	.020429	1908.0864	75.6911	-.0094280	29875.2514	-150.5328
2947.4622 8.800	.016837	1936.7356	17.3571	-.0085229	30257.4421	-141.1370
3352.9656 9.200	.013610	1941.7452	-37.1652	-.0076098	30324.2713	-131.4746
3863.9177 9.600	.010749	1924.6583	-87.7658	-.0066996	30096.3268	-121.5287
4522.2491 10.000	.008251	1887.0757	-134.3258	-.0058023	29594.9620	-111.2711

5394.4559						
10.400	.006108	1830.6591	-176.7112	-.0049271	28842.3450	-100.6561
6592.2454						
10.800	.004309	1757.1577	-214.7640	-.0040825	27861.5441	-89.6080
8119.0548						
11.200	.002842	1668.3193	-302.8326	-.0032761	26676.6768	-350.7348
49372.4895						
11.600	.001688	1522.4722	-417.6343	-.0025250	24731.0269	-223.2737
52902.4234						
12.000	.000822	1340.0697	-500.8320	-.0018511	22297.7167	-192.7149
58827.3569						
12.400	.000207	1126.1011	-566.6942	-.0012705	19443.3019	-136.5962
263538.						
12.800	-.000195	889.6620	-567.1186	-.0007960	16289.1241	134.4740
276069.						
13.200	-.000429	674.2528	-507.4524	-.0004278	13415.4930	163.9572
152617.						
13.600	-.000537	484.6926	-440.0247	-.0001550	10886.6951	173.2812
129051.						
14.000	-.000553	322.5926	-370.4512	3.5058E-05	8724.2266	174.5861
126181.						
14.400	-.000509	188.2502	-301.3391	.0001553	6932.0538	170.9745
134348.						
14.800	-.000429	81.1610	-234.3773	.0002187	5503.4467	163.8347
152690.						
15.200	-.000334	.2409412	-170.8332	.0002379	4423.9459	153.8837
184263.						
15.600	-.000239	-56.0575	-111.7542	.0002248	5168.5580	141.5095
236962.						
16.000	-.000154	-89.6838	-58.0818	.0001905	5617.1446	126.8524
328961.						
16.400	-8.65E-05	-102.9648	-10.7558	.0001451	5794.3169	109.7775
507583.						
16.800	-3.82E-05	-98.6251	29.0932	9.7645E-05	5736.4241	89.4677
937691.						
17.200	-8.39E-06	-79.9167	58.3794	5.5614E-05	5486.8480	66.9631
2714382.						
17.600	6.33E-06	-52.0506	64.4826	2.4547E-05	5115.1046	-26.4472
1672313.						
18.000	1.12E-05	-28.3876	49.7919	5.6109E-06	4799.4322	-47.0060
1672313.						
18.400	1.08E-05	-12.2301	31.3480	-3.9510E-06	4583.8853	-45.2135
1672313.						
18.800	8.08E-06	-3.3000	15.5471	-7.6070E-06	4464.7554	-33.7913
1672313.						
19.200	4.73E-06	.2252012	4.8346	-8.3309E-06	4423.7360	-19.7709
1672313.						
19.600	1.42E-06	.5869790	-.3051065	-8.1397E-06	4428.5622	-5.9277
1672313.						
20.000	-1.78E-06	0.0000	0.0000	-8.0015E-06	4420.7317	7.4533
836156.						

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 9:

Pile-head deflection	=	.11904940 m
Computed slope at pile head	=	1.734723E-17
Maximum bending moment	=	-6659.19727 kN- m
Maximum shear force	=	2001.60000 kN

1606.5709						
7.200	.044542	1858.4521	376.2124	-.0151201	29213.1130	-195.1968
1752.9245						
7.600	.038669	2010.3531	299.9310	-.0142093	31239.5236	-186.2103
1926.1998						
8.000	.033175	2131.3624	227.3015	-.0132343	32853.8296	-176.9367
2133.4038						
8.400	.028082	2222.8979	158.4393	-.0122093	34074.9434	-167.3747
2384.1266						
8.800	.023407	2286.4393	93.4606	-.0111477	34922.6077	-157.5188
2691.8088						
9.200	.019163	2323.5290	32.4852	-.0100625	35417.3965	-147.3580
3075.8277						
9.600	.015357	2335.7724	-24.3612	-.0089656	35580.7274	-136.8738
3565.0775						
10.000	.011991	2324.8402	-76.9434	-.0078684	35434.8892	-126.0376
4204.4495						
10.400	.009062	2292.4724	-125.1122	-.0067815	35003.0910	-114.8060
5067.3427						
10.800	.006566	2240.4835	-168.6958	-.0057143	34309.5417	-103.1123
6281.8672						
11.200	.004491	2170.7730	-297.0024	-.0046759	33379.5800	-538.4205
47956.0783						
11.600	.002825	2013.7297	-478.5509	-.0036908	31284.5683	-369.3222
52293.3389						
12.000	.001538	1796.4949	-597.5008	-.0027938	28386.5835	-225.4270
58616.9370						
12.400	.000590	1542.2107	-678.0655	-.0020079	24994.3460	-177.3968
120281.						
12.800	-6.80E-05	1258.7008	-692.8722	-.0013485	21212.2267	103.3634
608211.						
13.200	-.000489	991.0415	-638.3483	-.0008189	17641.5611	169.2562
138494.						
13.600	-.000723	749.9219	-567.1655	-.0004090	14424.9444	186.6578
103258.						
14.000	-.000816	538.2580	-491.3559	-.0001058	11601.2764	192.3900
94300.8659						
14.400	-.000808	357.0826	-414.4990	.0001050	9184.3342	191.8947
95033.5262						
14.800	-.000732	206.4152	-338.6727	.0002377	7174.3809	187.2365
102306.						
15.200	-.000628	85.5930	-265.3369	.0003064	5562.5714	179.4426
116225.						
15.600	-.000487	-6.5652	-195.6297	.0003250	4508.3132	169.0937
138900.						
16.000	-.000358	-71.6648	-130.5049	.0003066	5376.7638	156.5304
175106.						
16.400	-.000242	-111.6803	-70.8128	.0002634	5910.5853	141.9301
234905.						
16.800	-.000147	-128.9261	-17.3655	.0002068	6140.6498	125.3062
341370.						
17.200	-7.63E-05	-126.0525	28.9712	.0001468	6102.3147	106.3774
558012.						
17.600	-2.94E-05	-106.0896	60.5780	9.2108E-05	5836.0033	51.6564
702298.						
18.000	-2.57E-06	-77.8038	73.0565	4.8618E-05	5458.6607	10.7362
1672313.						
18.400	9.63E-06	-47.7577	67.1493	1.9259E-05	5057.8354	-40.2720
1672313.						
18.800	1.28E-05	-24.1290	48.3595	2.3358E-06	4742.6208	-53.6773
1672313.						
19.200	1.15E-05	-9.0755	28.0071	-5.4809E-06	4541.8022	-48.0844
1672313.						

Depth of maximum bending moment	=			0.00000	m	
Depth of maximum shear force	=			0.00000	m	
Number of iterations	=			28		
Number of zero deflection points	=			3		

Computed Values of Load Distribution and Deflection
for Lateral Loading for Load Case Number 10

Pile-head boundary conditions are Shear and Slope (BC Type 2)
Specified shear force at pile head = 2224.000 kN
Specified slope at pile head = 0.000E+00 m/ m
Specified axial load at pile head = 2900.000 kN

(Zero slope for this load indicates fixed-head conditions)

Depth Es*h X F/L m	Deflect. y m	Moment M kN- m	Shear V kN	Slope S Rad.	Total Stress kN/ m**2	Soil Res. p kN/ m
0.000	.148110	-7729.0890	2224.0000	-1.7347E-16	107529.	-204.4668
276.1010 .400	.147382	-6853.7357	2139.5264	-.0034330	95851.8905	-217.9012
591.3901 .800	.145364	-6009.5034	2049.7881	-.0064611	84589.5450	-230.7901
635.0690 1.200	.142213	-5198.9153	1955.0114	-.0090997	73776.0257	-243.0937
683.7433 1.600	.138084	-4424.3829	1855.4378	-.0113652	63443.5000	-254.7743
738.0271 2.000	.133121	-3688.1979	1751.3237	-.0132750	53622.5428	-265.7959
798.6576 2.400	.127464	-2992.5259	1642.9398	-.0148477	44342.0429	-276.1239
866.5157 2.800	.121243	-2339.3994	1530.5699	-.0161029	35629.1136	-285.7254
942.6526 3.200	.114582	-1730.7113	1414.5111	-.0170611	27509.0075	-294.5684
1028.3263 3.600	.107594	-1168.2089	1295.0731	-.0177435	20005.0345	-302.6217
1125.0474 4.000	.100387	-653.4879	1172.5778	-.0181723	13138.4823	-309.8545
1234.6413 4.400	.093056	-187.9868	1047.3597	-.0183704	6928.5391	-316.2359
1359.3296 4.800	.085691	227.0193	919.7658	-.0183613	7449.2461	-321.7340
1501.8412 5.200	.078367	590.4239	808.2896	-.0181688	12297.1873	-235.6467
1202.7787 5.600	.071155	915.8027	715.5235	-.0178142	16637.8498	-228.1842
1282.7357 6.000	.064116	1204.1717	625.8073	-.0173152	20484.7910	-220.3967
1374.9863 6.400	.057303	1456.6197	539.2686	-.0166888	23852.5320	-212.2965
1481.9133 6.800	.050765	1674.3046	456.0305	-.0159517	26756.5231	-203.8940

19.600	8.45E-06	-1.7106	11.3211	-8.0201E-06	4443.5514	-35.3456
1672313.						
20.000	5.09E-06	0.0000	0.0000	-8.4228E-06	4420.7317	-21.2601
836156.						

Output Verification:

Computed forces and moments are within specified convergence limits.

Output Summary for Load Case No. 10:

Pile-head deflection	=	.14811018 m
Computed slope at pile head	=	-1.734723E-16
Maximum bending moment	=	-7729.08898 kN- m
Maximum shear force	=	2224.00000 kN
Depth of maximum bending moment	=	0.00000 m
Depth of maximum shear force	=	0.00000 m
Number of iterations	=	28
Number of zero deflection points	=	2

Summary of Pile Response(s)

Definition of Symbols for Pile-Head Loading Conditions:

Type 1 = Shear and Moment, Y = pile-head displacment m
Type 2 = Shear and Slope, M = Pile-head Moment kN- m
Type 3 = Shear and Rot. Stiffness, V = Pile-head Shear Force kN
Type 4 = Deflection and Moment, S = Pile-head Slope, radians
Type 5 = Deflection and Slope, R = Rot. Stiffness of Pile-head m- kN/rad

Load Type	Pile-Head Condition 1	Pile-Head Condition 2	Axial Load kN	Pile-Head Deflection m	Maximum Moment m- kN	Maximum Shear kN
2	V= 222.400	S= 0.000	2900.0000	.0009112	-303.4595	222.4000
2	V= 444.800	S= 0.000	2900.0000	.0041357	-799.9976	444.8000
2	V= 667.200	S= 0.000	2900.0000	.0102769	-1411.5820	667.2000
2	V= 889.600	S= 0.000	2900.0000	.0196687	-2115.1235	889.6000
2	V= 1112.000	S= 0.000	2900.0000	.0325323	-2896.7516	1112.0000
2	V= 1334.400	S= 0.000	2900.0000	.0490868	-3746.4824	1334.4000
2	V= 1556.800	S= 0.000	2900.0000	.0692307	-4661.2739	1556.8000
2	V= 1779.200	S= 0.000	2900.0000	.0926698	-5634.2900	1779.2000
2	V= 2001.600	S= 0.000	2900.0000	.1190494	-6659.1973	2001.6000
2	V= 2224.000	S= 0.000	2900.0000	.1481102	-7729.0890	2224.0000

The analysis ended normally.

CONTRA COSTA TRANSPORTATION AUTHORITY

California Department of Transportation

#3

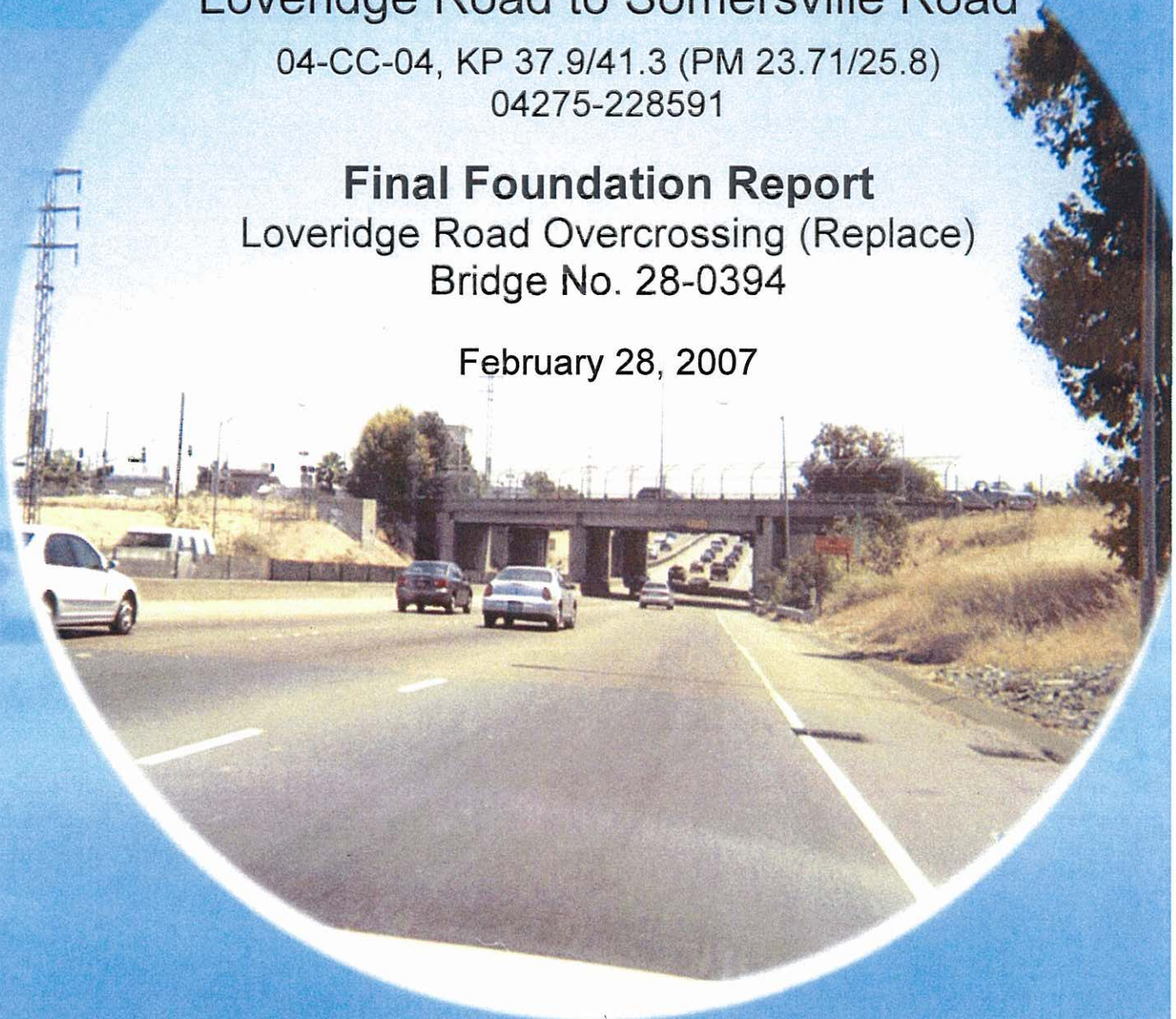
SR4 (East) Widening Project
Loveridge Road to Somersville Road

04-CC-04, KP 37.9/41.3 (PM 23.71/25.8)
04275-228591

Final Foundation Report

Loveridge Road Overcrossing (Replace)
Bridge No. 28-0394

February 28, 2007



URS

URS

February 28, 2007
Project No. 26814911

Ms. Susan Miller
Project Director
Contra Costa Transportation Authority
3478 Buskirk Avenue, Suite 100
Pleasant Hill, CA 94523

Subject: **SR4 (East) Widening Project**
Loveridge Road to Somersville Road
Foundation Report: Loveridge Road Overcrossing (replace)

Dear Ms. Miller,

URS is pleased to provide you with this Foundation Report for the Loveridge Road Overcrossing (Bridge No. 28-0394) replace project located in Antioch, California.

This report has been prepared in accordance with Caltrans guidelines for foundation reports, and replaces our foundation report (95% Submittal) for this structure dated August 8, 2006.

It has been our pleasure to be of service to Contra Costa Transportation Authority on this project. If you should have any questions, please contact the undersigned.

Sincerely,
URS CORPORATION

Philip Meymand, Ph.D., G.E.
Project Manager

Said Salah-Mars, Ph.D., P.E.
Engineering Department Manager

REGISTERED PROFESSIONAL ENGINEER
PHILIP J. MEYMAND
No. GE2596
Exp. 6-30-07
GEOTECHNICAL
STATE OF CALIFORNIA

Enclosure

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The proposed State Route (SR) 4 (East) Widening Project - Loveridge Road to Somerville Road would widen SR4 from its current four lanes to an eight-lane facility from west of Loveridge Road (KP 37.9) to the Somersville Road Interchange (KP 41.3). This Project is part of Contra Costa Transportation Authority's (CCTA's) overall plan to continue the widening of SR4 further into East County and is consistent with the Phase 1 Implementation Plan recommendation made in the SR4 (east) Railroad Ave. to SR 160 Major Investment Study (MIS).

The proposed project will widen the freeway from two to four lanes providing three mixed-flow and one High Occupancy Vehicle (HOV) lanes in each direction. From SR 242 to west of Loveridge Road, the above improvements have either been completed, or are under construction. The improvements will conform to the existing four lane facility just before the Somersville Road overcrossing. Some of the significant features of this project include:

- Widening and reconstruction of the Loveridge Road interchange. The existing Loveridge Road Overcrossing and Camp Stoneman Road Underpass will be removed.
- Reconstruction of the eastbound diagonal on- and off-ramps at the Loveridge Interchange.
- Improvements at the intersection of Loveridge Road with California Avenue/ North Park Boulevard to accommodate the projected traffic volumes and increase public safety.
- Reconstruction of the Century Boulevard undercrossing structure.
- Provisions in the freeway median and at the Loveridge Interchange to accommodate a future mass transit extension.
- Reconstruction of the storm water pump station located in the northwest corner of the Loveridge Interchange to accommodate new construction features.
- Construction of a number of retaining and sound walls.

The subject of this foundation report (FR) is the Loveridge Road overcrossing structure located in Antioch, California. Figure 1 shows the site location plan for this structure.

1.1 PURPOSE AND SCOPE OF THIS STUDY

The purpose of this FR is to document existing foundation conditions and make foundation recommendations for the proposed structure.

1.2 PROJECT SCOPE OF WORK

The scope of work for this study includes:

- Site reconnaissance
- Geotechnical field exploration and laboratory testing program
- Review of as-built bridge drawings, logs of test borings (LOTBs), geologic maps, foundation report, and other existing information
- Preparation of this FR, which includes:

- Description of site geology and evaluation of geologic hazards;
- Assessment of subsurface conditions based on available information;
- Development of seismic design criteria;
- Foundation recommendations for the proposed structure; and
- Construction considerations.

2.1 HISTORY AND SUPERSTRUCTURE

The Loveridge Overcrossing structures consist of two two-span steel girder bridges: an easterly Camp Stoneman Road Underpass and a westerly Loveridge Road Overcrossing Structure, both constructed in 1953 and widened in 1971. The Loveridge Road interchange will be widened and reconstructed to accommodate two left turns, two through traveled lanes, shoulders sufficient for bicycles, and a sidewalk in each direction of travel. The existing Loveridge Road Overcrossing and Camp Stoneman Road Underpass will be removed. At the Loveridge Interchange, the eastbound diagonal on-and off-ramps will be reconstructed but the eastbound loop on-ramp will be eliminated. The westbound on- and off-ramps will be reconstructed at their current location maintaining the existing buttonhook configuration.

2.2 EXISTING FOUNDATIONS

We infer from available (but incomplete) as-built plans for the original 1953 bridge that it is founded on 406 mm octagonal pre-cast concrete piles with a design load of 285 kN. The abutments and bents were widened in 1971 at the center divide utilizing spread footings with a design bearing pressure of 287 kPa.

The complete pile length contributes to uplift and lateral resistance. The existing foundation details for the structure are summarized in Tables 1.1 and 1.2. Since the structure will be removed, the lateral capacities of the foundations were not calculated.

Table 1.1 - Existing Deep Foundation Information

Location	Pile Type	Design Loading (kN)	Level	Avg. Pile Tip Elevation (m)
Abut 1	406 mm Precast Concrete Piles	285	1	8.60
			2	5.50
			3	3.30
Bent 2	406 mm Precast Concrete Piles	285	1	
Abut 3	406 mm Precast Concrete Piles	285	1	7.20
			2	4.00
			3	2.00

Table 1.2 - Existing Shallow Foundation Information

Support Location	Minimum Width (m)	Avg. Bottom of Footing Elevation (m)	Allowable Bearing Capacity (kPa)
Abut 1	0.90	8.2	320
Bent 2	1.80	8.2	320
Abut 3	0.90	8.2	320

2.3 PROPOSED STRUCTURE

The proposed bridge structure consists of a 3-span cast-in-place pre-stressed concrete box girder. The abutments will 5-6 m tall and supported on piles. Bent 2 will be located between the eastbound and westbound SR4 lanes and bent 3 will be located between SR4 and the proposed ramp structure.

3.1 REGIONAL GEOLOGY

The SR4 project is located near the boundary between the Central Valley and the Coast Range physiographic province, at the northern end of the Diablo Range. The Coast Ranges are characterized by north to northwest trending elongated mountain ranges and intervening valleys. The Franciscan Complex underlies the core of the Diablo Range, which is in fault contact with the Great Valley sediments of the Central Valley province to the east. Younger sedimentary deposits from Paleocene to Pleistocene in age (65 million to 0.1 million years old) are widely distributed along the margin of the Diablo range and along the foothills through which the SR 4 alignment crosses and skirts around (Graymer, et al, 2002). These sedimentary rocks are in turn locally overlain by more recent alluvium and alluvial fan deposits and by bay mud deposits along the Sacramento River margin.

3.2 SEISMOTECTONIC SETTING

The SR 4 project lies within a domain of north-northwest oriented right-lateral strike-slip faulting, the San Andreas fault system, that accommodates the majority of the plate motion between the Pacific and North American plates. In addition to the right-lateral strike-slip deformation, a component of compression oriented normal to the plate boundary is manifest as a series of folds and thrust faults, including the Coast Range-Sierran Block Boundary zone, oriented parallel and sub-parallel to the faults of the San Andreas system. In contrast, regional compression in the Mount Diablo region, within which the SR 4 project is situated, has a more northerly orientation, which has resulted in a series of folds and thrusts that are at a distinct oblique angle to the main strike-slip faults.

The San Francisco Bay area is a region of relatively high seismic activity. This historical seismicity is associated with the active faults of the San Andreas system. During historical times there have been almost 8,000 earthquakes of Richter local magnitude (M_L) 2.0 or larger, of which 14 earthquakes were **M** 6.0 or greater. These include the 1836 M_L 6¼ event on the San Andreas fault; the 1868 M_L 6.8 event on the southern Hayward fault; the 1889 **M** 6¼ Collinsville earthquake, possibly on the Pittsburg-Kirby Hills fault; the 1898 M_L 6.7 'Mare Island' earthquake; the 1906 **M** 7.9 'Great San Francisco Earthquake' on the San Andreas fault; a 1911 M_L 6.6 event on the southern Calaveras fault; and the 1989 **M** 7.0 Loma Prieta event, located on a fault paralleling the Santa Cruz Mountains segment of the San Andreas fault.

3.3 SITE GEOLOGY

The sediments in the project area are a combination of surficial deposits of Holocene to Pleistocene (recent to 2 million years old) alluvium, alluvial fan and terrace deposits consisting of medium dense to dense sandy gravel or gravelly sand that generally grades finer, and medium dense sand that fines upward to sandy or silty clay (USGS, OFR 97-98).

4.1 PREVIOUS FIELD EXPLORATIONS

Prior to construction of the bridge, a subsurface investigation was performed at the site in June 1950 and October 1950. Subsurface information was obtained from one borehole (B-1) and two test holes (TH 1 & 2). Boring B-1 encountered alluvium consisting of silty clay to the maximum explored depth of 11 m. Test hole TH1 encountered alluvium consisting of silty clay and clayey silt with a layer of silty sand to the maximum explored depth of 11.5 m. No samples were recovered from Test hole TH2. Groundwater was not encountered at the time of drilling. A subsequent investigation was performed in December 1952. Subsurface information was obtained from one rotary wash boring (B-1) and two cone penetration tests (B-2 & B-3) in December 1952. Boring B-1 encountered alluvium consisting of silty clay to the maximum explored depth of 9.2 m. Another subsurface investigation was performed in July 1970, prior to the widening of Loveridge Road. Subsurface information was obtained from one rotary wash boring (B-4) in July 1970. Boring B-4 encountered alluvium consisting of silty clay and clayey silt with a layer of silty sand to the maximum explored depth of 22 m. Groundwater was encountered at the depth of about 9.8 m (elevation 5.9 m) in B-4 at the time of drilling. The LOTBs obtained from the subsurface investigations described above are provided in Appendix A.

4.2 CURRENT FIELD EXPLORATIONS

The current field investigation for the proposed reconstruction of the Loveridge Road Overcrossing was performed between January 05 and 25, 2005, and included drilling two rotary-wash borings (B-9 & B-10). Boring B-9 was located on the median near the intersection of Loveridge Road and California Avenue. Boring B-10 was located near the entrance to eastbound SR4 from Loveridge Road. The boring locations were surveyed and the approximate locations are shown on Figure 2. Boring B-7 located near the intersection of Loveridge Road and California Avenue and drilled for the pumping plant structure was also included in the current analysis given its proximity to the subject site.

Taber Consultants from West Sacramento, California performed the drilling of the rotary wash borings. Ms. Shobhna Upadhyaya and Mr. Sathish Murugaiah of our firm supervised the drilling and logged the borings in general accordance with the Caltrans Soil & Rock Logging Classification Manual (1996).

Both borings were drilled using a truck-mounted Diedrich D-120 drill rig equipped with a 63.5 kg automatic trip hammer. Borings B-9 and B-10 were advanced to depths of 3 m and 15.2 m, respectively, using a 102 mm solid-stem auger, and subsequently advanced to a depth of about 27.9 m by the rotary wash method using a 124 mm diameter drag bit.

The borings were generally sampled at 1.5 m intervals. A Modified California split-spoon drive sampler (50.8 mm fitted with four 101.6 mm-long, 49 mm ID, brass liners) was used to sample in clayey material. A 0.6 m long split barrel SPT drive sampler (35 mm -ID) was used to sample granular materials. As noted above, the samplers were driven using a 63.5 kg safety hammer dropping 762 mm. All samples were carefully sealed, labeled, and transported to our Geotechnical laboratory in Pleasant Hill, California for review and testing.

Boring B-7 encountered about 1.2 m of fill consisting of fat clay. Below the fill, alluvium consisting predominantly of stiff to hard silty lean clay and stiff to very stiff fat clay with medium dense silty sand and sandy silt layers was encountered to the maximum explored depth of 15.7 m. Groundwater was encountered in the boring at a depth of about 10.7 m at the time of drilling.

Boring B-9 encountered about 3.4 m of fill consisting of fat clay. Below the fill, alluvium consisting predominantly of lean and fat clay with consistency increasing with depth from medium stiff to hard with layers of medium dense silty and clayey sand and silt was encountered to the maximum explored depth of 27.9 m. Groundwater was not encountered in the boring prior to switching to the rotary wash drilling method at a depth of about 3.0 m.

Boring B-10 encountered about 2.6 m of fill consisting of fat clay. Below the fill, alluvium consisting predominantly of very stiff lean and fat clay with layers of medium dense silty sand and very dense poorly graded sand was encountered to the maximum explored depth of 27.9 m. Groundwater was encountered in the boring at a depth of about 13.1 m at the time of drilling.

On completion of the drilling, a piezometer was constructed in Boring B-10 and the ground surface was restored to its initial elevation. On completion of the drilling, Borings B-7 and B-9 were backfilled with cement grout, and the ground surface was restored to its initial elevation. Excess drill cuttings and fluid from the boring were contained in 55-gallon drums and were hauled off for disposal.

The Log of Test Borings (LOTBs) obtained from the current subsurface investigation are provided in Appendix B.

4.3 LABORATORY TESTING

Laboratory soil tests were performed on soil samples recovered from field exploration to evaluate their engineering properties. The tests were performed in accordance with the ASTM Standards for Testing. The following tests were performed:

- Moisture content (ASTM D2216)
- Dry density (ASTM D2937)
- Particle-size (sieve) analysis (ASTM D-422 and D-1140)
- Unconfined compressive strength (ASTM D2166)
- Atterberg limits (ASTM D4318)
- One-dimensional swell/settlement potential (ASTM Test Method D4546)
- Unconsolidated undrained triaxial (UU) (ASTM Test Method D2850)

Results of the laboratory tests are presented in Appendix C, and on the LOTBs of the corresponding sample depths.

5.1 SITE TOPOGRAPHY

Development of the freeway, bridges, and on-ramps and off-ramps has resulted in the placement of fill embankments and cuts along the alignment. The original ground surface is relatively flat, ranging in elevation from about 15 to 16.5 meters. Vegetation in the vicinity of the proposed improvements consists of grasses and shrubs. The structures in the vicinity of the proposed improvement consist of a Motel, office buildings and other structures.

5.2 SUBSURFACE CONDITIONS

Construction of the roadway embankment resulted in the placement of approximately 1.7 m of fill on the north and south sides of the crossing. Results of the subsurface investigations indicate that the underlying native soils consist of alluvium to the maximum explored depth. The alluvium is composed of predominately stiff sandy, silty clay and fat clay (consistencies vary from soft to hard), with layers of medium dense silty sand. A 4 m thick layer of very dense silty/poorly graded sand was encountered at about 24 m below the ground surface.

Based on the results of our current investigation, Caltrans standards, and on our previous experience with similar soils, two generalized soil profiles were developed for the purposes of this foundation evaluation. These profiles are shown in Figures 3-1 and 3-2, and the engineering parameters are shown below in Table 2-1 and 2-2.

Table 2-1
Soil Parameters - Abutment 1

Soil Type	Elevation of Top of the Layer (m)	Layer Thickness (m)	Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (deg)
Clay	11.0	1.7	19.2	100	0
Sand	9.3	2.3	15.5	0	33
Clay	7.0	3.8	19.2	100	0
Clay	3.2	8.3	18.3	100	0
Sand	-5.1	4.6	18.0	0	35
Sand	-9.7	1.7	18.0	0	36

Table 2-2
Soil Parameters - Bent 2, Bent 3, and Abutment 4

Soil Type	Elevation of Top of the Layer (m)	Layer Thickness (m)	Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (deg)
Clay	9.9	2.8	18.0	50	0
Sand	7.1	0.8	18.0	0	33
Clay	6.3	8.3	18.0	50	0
Clay	-2.0	4.7	20.0	90	0
Clay	-6.7	4.5	20.0	120	0
Sand	-11.2	1.6	18.0	0	36

5.3 GROUNDWATER CONDITIONS

Groundwater was not encountered during the 1951 field exploration. However, Groundwater was encountered at elevation 5.9 m and 3.4 m during the subsequent field investigations conducted in 1971 and 2005, respectively. According to the groundwater measurements taken in January of 2006 in the piezometer constructed in Boring B-10, groundwater was at the elevation of about 4.1 meters. We recommend a groundwater elevation of 5 m for design purposes.

6.1 SEISMIC DESIGN METHODOLOGY

The seismic design methodology adopted for this project is based on the following current Caltrans standards:

1) Seismic Design Criteria (SDC), v 1.4, June 2006

2) Guidelines for Structures Foundation Reports, v 2.0, dated March 2006

3) California Seismic Hazard Map (Mualchin, 1996)

6.2 PEAK BEDROCK ACCELERATION

The closest faults to the Loveridge Road Overcrossing are the Coast Ranges Sierran Block boundary zone (CRSB), the Antioch, and the Greenville faults. The faults are designated with the Maximum Credible Earthquake (MCE) magnitudes of 7.0, 6.75, and 7.25, respectively by the California Seismic Hazard Map (Mualchin, 1996). The locations of these faults and associated peak bedrock acceleration (PBA) contours were obtained from the California Seismic Hazard Map and transferred to a topographical map showing the Century Boulevard undercrossing. The closest mapped fault on the California Seismic Hazard Map is the Antioch fault, but the California Geological Survey does not consider this fault to be active. It had previously been mapped in 1976 as an Alquist-Priolo fault rupture zone, but more recent studies resulted in the fault no longer being classified as active (Wills, 1991). Even if the Antioch fault were considered active, the ground motions would be lower than those from the CRSB due to the larger magnitude and reverse style of faulting for the CRSB. The site is located within the 0.5 g PBA contour.

Table 3 – Seismic Source Parameters

Fault	Type	MCE	Distance (km)	Near Field Effects?	Fault Type Effects?	PBA (g)
CRSB	Reverse	7.0	6.25	Y	Y	0.5
Greenville	Strike-slip	7.25	7.5	Y	N	-
Antioch	Strike-slip	6.75	5.5	Y	N	-

6.3 SITE SOIL PROFILE

Boring logs from the previous and current field explorations for the Loveridge Road Overcrossing were reviewed. The weighted average of the recorded SPT blow counts over the depth of exploration (to a maximum depth of approximately 27 m) was used to determine the average standard penetration resistance value (N), which was found to be 21 (uncorrected). Although the depth of exploration did not reach a depth of 30 m, our understanding of the regional geology indicates the soils become stiffer and denser with depth. The standard penetration resistance was used to classify the soil profile based on the guidelines given in SDC Table B.1. Accordingly, this site is classified as a stiff soil site or Soil Profile Type D.

6.4 FAULT TYPE AND NEAR-FIELD SPECTRAL ACCELERATION INCREASES

The technical report that accompanies the California Seismic Hazard Map (Mualchin, 1996) indicates that the controlling fault, CRSB, has 'reverse' mode of fault displacement. To verify the PBA estimated using the seismic hazard map, PBA was also determined using the attenuation relationship presented by Sadigh et al. (1997) considering the reverse style of faulting for CRSB as recommended by Caltrans Guidelines for Structures Foundation Reports, v 2.0 (2006). We recommend using the PBA of 0.6 g as calculated using the Sadigh et al. (1997) for this study.

In addition, since the project site is less than 15 km from the nearest active fault, design spectral accelerations should be modified to account for near-fault effects as follows:

Period (sec)	Increase in Spectral Acceleration (%)
< 0.5	0
0.5 – 1.0	0 – 20 (determined by linear interpolation)
≥1	20

This does not include adjustments for bridges with fundamental periods of vibration greater than 1.5 seconds. Since the fundamental period of vibration of the structure is less than 1.5 seconds, no modification is required for long-period structures

6.5 DESIGN ACCELERATION RESPONSE SPECTRUM

Based on Caltrans SDC (Version 1.4), the design seismic response spectrum can be estimated with spectral acceleration values generated by:

- Soil Profile Type D
- Maximum Credible Earthquake (MCE) Magnitude 7.25 ± 0.25
- Peak bedrock acceleration 0.6 g (includes ARS increase for fault type)
- ARS increase for near-field effect

The Design Acceleration Response Spectrum (ARS) corresponding to Soil Type D, magnitude of controlling event 7.25 ± 0.25, and a PBA of 0.6 g was obtained from SDC Figure B.8 and modified to account for near field effects as described above. The Design Acceleration Response Spectrum is attached as Figure 4, and the spectral values are provided in Table 4.

Table 4 – Spectral acceleration values (PBA = 0.6 g, M = 7.0, Soil Type D)

T (Sec)	S_a* (g)	S_a** (g)	S_a*** (g)
0.00	0.60	0.60	0.60
0.01	0.60	0.60	0.60
0.02	0.60	0.60	0.60
0.03	0.60	0.60	0.60
0.04	0.60	0.60	0.60
0.05	0.60	0.60	0.60
0.10	1.14	1.14	1.14
0.13	1.34	1.34	1.34
0.15	1.43	1.43	1.43
0.20	1.55	1.55	1.55
0.25	1.57	1.57	1.57
0.30	1.57	1.57	1.57
0.35	1.56	1.56	1.56
0.38	1.55	1.55	1.55
0.50	1.47	1.47	1.47
0.63	1.35	1.42	1.42
0.75	1.23	1.35	1.35
0.88	1.12	1.29	1.29
1.00	1.00	1.20	1.20
1.13	0.89	1.07	1.06
1.25	0.80	0.96	0.95
1.38	0.70	0.84	0.85
1.50	0.64	0.77	0.77
1.63	0.58	0.69	0.70
1.75	0.53	0.63	0.63
1.88	0.50	0.59	0.58
2.00	0.45	0.54	0.53
2.13	0.41	0.49	0.49
2.25	0.38	0.45	0.45
2.38	0.35	0.42	0.42
2.50	0.32	0.39	0.39
2.63	0.31	0.37	0.36
2.75	0.28	0.34	0.34
2.88	0.27	0.32	0.31
3.00	0.25	0.30	0.29
3.13	0.23	0.28	0.27
3.25	0.21	0.26	0.26
3.38	0.20	0.24	0.24
3.50	0.20	0.24	0.23
3.63	0.18	0.22	0.22
3.75	0.17	0.21	0.20
3.88	0.16	0.20	0.19
4.00	0.15	0.18	0.17

*From SDC **Modified for Near-field effects ***Modified to obtain a smooth curve

7.1 LIQUEFACTION

Liquefaction is a phenomenon in which a sudden increase in pore pressure due to strong earthquake shaking causes relatively loose, cohesionless soils below the water table to undergo temporary but substantial loss of shear strength. Liquefaction can result in loss of foundation bearing capacity, differential settlements, and lateral spreading.

Based on a review of the liquefaction susceptibility map of the San Francisco Bay region (Knudsen et al., 2000), the alluvium underlying the SR 4 Loveridge Road Undercrossing is classified as having a "low" liquefaction susceptibility.

Liquefaction analysis was performed for the submerged sand layers encountered in boring B-9 between depths of 26 and 28 m bgs and in boring B-10 between depths of 21.5 and 28 m bgs using NCEER (1998) procedures. Liquefaction potential is predicted at depths where the earthquake loading exceeds the soil resistance, or when the factor of safety against liquefaction, expressed as:

FS_L = (cyclic shear stress required to cause liquefaction) / (equivalent cyclic shear stress induced by earthquake) ..

is less than 1. The California Geological Survey recommends that liquefaction potential be considered if the factor of safety is less than 1.3.

From the boring logs, the recorded blow counts were standardized by correcting them as appropriate for overburden pressure, sampler type, rod length, borehole diameter, hammer type, and fines content. Based on the discussion in Section 6.2, the design earthquake used to evaluate liquefaction potential has a peak ground acceleration of 0.6g, with a maximum magnitude of 7.0. The design groundwater depth was used for calculating liquefaction potential.

Dissipation of excess pore water pressure generated by ground shaking produces volume changes within the liquefied soil layer, which could manifest at the ground surface as settlement. An evaluation of the post-liquefaction settlement at the site following a major seismic event was performed using the method proposed by Tokimatsu and Seed (1987), which was originally developed for clean sands. It is commonly understood that an elevated fines content in sand will reduce the observed standard penetration test (SPT) blowcounts, denoted as N_{60} blowcounts for a given relative density and therefore a correction to the N_{60} blowcounts was applied based upon the fines content. The volumetric strains were estimated from the computed clean sand equivalent blow count and the magnitude scaled cyclic stress ratio. Based on our analysis of the soil boring data, post liquefaction settlements on the order of 15 mm were estimated for the liquefiable zones. The results of the liquefaction analysis are shown in Appendix E.

These settlements are associated with liquefaction of sand zones that do not appear to be areally extensive and occur at a depth greater than 20 m from the ground surface. Given the depth and limited extent of the soils susceptible to liquefaction, surface expression of liquefaction during a seismic event is anticipated to be limited to negligible localized settlement. Based upon this information, large sand boils that could impact the support of the proposed structures are not anticipated to occur.

7.2 FAULT RUPTURE

No active faults have been mapped underlying the SR 4 alignment between Loveridge Road and Sommersville Road. The project site is not with a Alquist-Priolo special studies zones (CGS, 2003). The potential for surface fault rupture at the site is therefore considered to be low.

7.3 LANDSLIDES AND SLOPE FAILURE

Due to the relatively flat topography at the site, landsliding is not considered a hazard. Slumping or distress of the embankment fill slopes at the site was not noted during the site reconnaissance.

7.4 GROUND SUBSIDENCE/HEAVE

Due to the relatively dense/stiff character of the underlying alluvium, the potential for ground subsidence and heave is considered to be low.

7.5 FLOOD

FEMA flood zone maps (http://www.esri.com/hazards) indicate that the site is located outside of the 100- and 500-year flood plain. Therefore the potential for flooding hazard is considered to be very small.

7.6 SCOUR

Because the proposed structure supports are located outside waterways, scour is not an issue for foundation design.

7.7 CORROSION

As part of our study, near surface soil samples were collected at two locations on the subject site. The samples were analyzed for corrosivity by V&A Consulting Engineers, Inc. The results of that testing are presented in Appendix F. The soil samples were analyzed for pH, resistivity, chlorides and sulphates. The results of the sulfate, chloride, pH and resistivity testing indicate the near surface site soil is considered noncorrosive to buried concrete, reinforced concrete and mortar coated steel pipe.

7.8 EROSION

The Rincon clay soils, which cover part of the project area, are classified as having a moderately severe hazard of erosion (USDA, 1977).

8.1 DESIGN ASSUMPTIONS

The generalized geologic profile with soil stratigraphy, soil engineering parameters, and estimated groundwater level is presented as Figure 3. This generalized soil profile was the basis for developing foundation recommendations for the proposed widening.

8.2 FOUNDATION ALTERNATIVES

Driven precast concrete piles – Driven precast concrete piles are a suitable foundation alternative from the technical standpoint, but have certain constructability disadvantages. Precast concrete piles offer advantages in shallow groundwater and caving soil conditions, and are generally more economical that other pile types. However, as noted in Caltrans Memo To Designers 21-19, a larger work area is required to install driven piles than for CIDH piles (diameter < 24 in), which may be a determining factor at the Loveridge Road OC. Driven piles have greater noise and vibration impacts, but those considerations may not be pertinent to this project.

Cast-in-drilled-hole (CIDH) piles – CIDH piles have the advantages of easy penetration into dense/hard soil zones, the availability of larger diameters for increased lateral capacity (such as for retrofit applications), and adaptability of length to variable subsurface conditions. The presence of shallow groundwater or caving soils can complicate the use of CIDH piles. From the constructability standpoint, CIDH piling rigs are more economical to mobilize than pile driving rigs, can work in limited access conditions, and have significantly lower noise and vibration impacts during pile installation than driving operations.

Driven pipe piles or cast-in-steel-shell (CISS) piles – Driven pipe piles are technically feasible for support of the bridge abutments and bents, but have the same constructability limitations as driven precast concrete piles. While pipe piles or CISS piles can adjust pile diameter and wall thickness to obtain increased lateral stiffness, they have a disadvantage owing to the high cost of steel.

8.3 PROPOSED FOUNDATIONS

Driven precast concrete piles are the recommended foundation system for this structure. Details for the proposed driven precast concrete pile foundation alternative are summarized in Table 5.

Driven pile capacities were computed using the program Driven 1.2 (2001). End bearing was neglected for pile tips in clay. Driven data is provided in Appendix E.

Pile driving should satisfy the field acceptance criteria currently used by Caltrans. The following Gates formula can be used verify the ultimate capacity.

$$Q_u = [7\sqrt{E_r}\log(10N_b)] - 550$$

where,

E_r = Rated Energy (Joules)

Q_u = Ultimate Capacity (kN)

N_b = Number of blows per 25 mm of penetration

Table 5 – Proposed Foundation Data Table

Location	Pile Type	Design Loading (kN)	Nominal Capacity (kN)		Design Tip Elevations (m)*	Specified Tip Elevations (m)
			Compression	Tension		
Abut 1R B.O.F+=9.200	Class 625 Alt "X" (355 mm)	625	1250	0	-3.2(1) 5.2(3)	-3.2
Abut 1R B.O.F=10.450	Class 625 Alt "X" (355 mm)	625	1250	0	-0.5(1) 5.4(3)	-0.5
Abut 1R B.O.F=11.650	Class 625 Alt "X" (355 mm)	625	1250	0	1.2(1) 6.1(3)	1.2
Abut 1R B.O.F=12.900	Class 625 Alt "X" (355 mm)	625	1250	0	2.9(1) 8.9(3)	2.9
Abut 1L B.O.F=9.500	Class 625 Alt "X" (355 mm)	625	1250	0	-3.0(1) 5.5(3)	-3.0
Abut 1L B.O.F=10.750	Class 625 Alt "X" (355 mm)	625	1250	0	-0.1(1) 5.8(3)	-0.1
Abut 1L B.O.F=11.950	Class 625 Alt "X" (355 mm)	625	1250	0	1.7(1) 6.5(3)	1.7
Abut 1L B.O.F=13.200	Class 625 Alt "X" (355 mm)	625	1250	0	3.4(1) 7.7(3)	3.4
Bent 2 B.O.F=7.450	760 mm CIDH (900 kN)	N/A	1900	0	-12.8(1) -12.6(3)	-12.8
Bent 2 B.O.F=7.100	760 mm CIDH (900 kN)	N/A	1950	0	-12.8(1) -12.6(3)	-12.8
Bent 3 B.O.F=7.150	760 mm CIDH (900 kN)	N/A	1650	0	-12.8(1) -12.6(3)	-12.8
Bent 3 B.O.F=7.150	760 mm CIDH (900 kN)	N/A	1750	0	-12.8(1) -12.6(3)	-12.8
Abut 4R B.O.F=7.050	Class 625 Alt "X" (355 mm)	625	1250	0	-9.3(1) 2.0(3)	-9.3
Abut 4L B.O.F=7.250	Class 625 Alt "X" (355 mm)	625	1250	0	-9.2(1) 2.2(3)	-9.2
Abut 4L B.O.F=8.500	Class 625 Alt "X" (355 mm)	625	1250	0	-8.5(1) 0.5(3)	-8.5
Abut 4L B.O.F=9.700	Class 625 Alt "X" (355 mm)	625	1250	0	-6.3(1) 3.7(3)	-6.3
Abut 4L B.O.F=10.950	Class 625 Alt "X" (355 mm)	625	1250	0	-5.3(1) 4.9(3)	-5.3
Abut 4L B.O.F=12.150	Class 625 Alt "X" (355 mm)	625	1250	0	-4.2(1) 6.1(3)	-4.2

* Design tip elevation is controlled by the following demands:

(1) Compression, (2) Tension, (3) Lateral Loads

+ B.O.F = Bottom of footing elevation in meters

Also presented in Table 5 are the design tip elevations for lateral loads, which are service loads of 135kN/Pile and 165 kN/Pile at abutments 1 and 4, respectively, and seismic loads of 444kN/Pile and 417kN/PIle at bents 2 and 3, respectively. The computer program LPILE Plus 4.0M was utilized to analyze the individual pile response at abutments 1 and 4 to applied lateral and axial loads with a series of nonlinear springs that are internally generated by the program as a function of user-specified soil properties. The piles were modeled according to Caltrans Standard plan B2-8. In addition, the piles were modeled with free head conditions. LPile data is included in Appendix E. The computer program Group 7.0 was utilized to analyze the pile group response to applied lateral load and axial loads with a series of non linear springs that are internally generated by the program as a function of user-specified soil properties for the free head CIDH piles used in bents 2 and 3.

For computing the lateral resistance of piles arrayed in groups at abutment 1 and abutment 4, a group efficiency factor should be applied for pile lateral resistance in the direction of loading. For pile spacing of 5 diameters or greater, an efficiency factor of 100% shall be applied; for pile spacing of 4 diameters, an efficiency factor of 80% shall be applied; and for pile spacing of 3 diameters, an efficiency factor of 60% shall be applied.

For abutments constructed with compacted structural backfill, passive resistance may be developed by the abutment walls. To estimate resistance to lateral loads according to Caltrans Seismic Design Criteria (V1.4), an equivalent fluid unit weight of 140 kN/m^3 (up to a maximum pressure of 269 kPa) can be used to calculate the ultimate passive pressure; however, resistance offered by the upper 0.30 m of soil should be neglected when computing passive soil resistance.

8.4 APPROACH FILL EMBANKMENT

Approach embankments will be constructed at the north and south ends of the Loveridge Road Overcrossing.

The existing approach embankments at the Loveridge Road will be extended to accommodate the proposed widening. The proposed new widening will add two lanes to the outside of the existing structure. The planned approach embankments will be approximately 2 m high. The approach embankment will have side slopes ranging from 1.5H:1V (horizontal:vertical) to 4H:1V on different sides.

Structure approach embankment material is expected to be imported from off-site sources. Native soils and existing fill materials (less any surficial debris or organic material) are expected to be suitable for incorporation into new embankment fills but it should be noted that local borrow sources have not been evaluated in this study. In general, all embankment materials should conform to Caltrans Standard Specifications.

Planned embankment slopes are anticipated to be generally 1V : 2 H or flatter. Such slopes are expected to be appropriately stable. Overside run-off should be controlled by use of curbs and/or dikes. Slopes should be vegetated to minimized erosion potential. Where new fill is to be placed onto existing fill slopes or natural slopes exceeding 1V: 5H it should be placed on discrete benches cut fully into existing fill below any loose/soft or otherwise unsuitable materials.

We estimate long-term consolidation settlements for the proposed extension of the embankments will be on the order of 5 cm. We estimate differential settlements between the bridge and embankment will be less than 1 cm. We anticipate that both north and south embankment

extensions will be constructed in one phase, and that a sufficient waiting period will occur prior to the construction of the foundation system and the bridge in order to reduce net differential settlement between the existing and widened structure. We recommend that a 120 day waiting period be implemented after embankment construction prior to bridge construction to minimize the effects of differential settlement. We expect that the 50% of the settlement will be completed during the 120 day waiting period. The progress of fill settlement may be monitored using settlement monuments. As a result of this, in our opinion, downdrag on the piles will be negligible. Depending upon construction staging, wick drains and/or surcharge loading may be employed to accelerate the rate of settlement.

Grading is expected to be performed in accordance with the latest edition of Caltrans Standard Specifications, including Section 19. Within 50 m of proposed bridge abutments, all fill should conform to structure approach embankment material and should be placed to at least 95% relative compaction (CTM 216) per Caltrans Standard Specifications. All other embankment fill at least 0.8 m below finished grade should be placed to at least 90% relative compaction (CTM 216). Expansive soil shall be excluded from the embankment zone shown in the attached Figure 5.

8.5 CONSTRUCTION CONSIDERATIONS

Potential construction considerations are expected to include:

- Physical conflicts: resolve potential conflicts with locations of new bridge supports and all existing facilities such as utilities.
- Loading conflicts: resolve potential conflicts with loading imposed on existing facilities by new bridge foundations or approaches.
- CIDH piles are expected to encounter ground water. Contractor should use temporary casings or drilling slurry to prevent caving into drill hole.
- Settlement of approach fills.
- Jetting or predrilling for prestressed precast concrete driven piles installation shall not be permitted except where piles are to be installed through embankment to be constructed. At these locations, piles shall be predrilled through embankment material in accordance with Sec 49-1.06 of the standard specifications.

The opinions, conclusions and recommendations presented herein are based on subsurface information developed by URS and others. The recommendations presented in this report are based on the assumption that the soil and geologic conditions do not deviate substantially from those anticipated by the information contained in the existing logs of test borings. If any variations are encountered during construction, the Geotechnical Professional should be contacted so that supplemental recommendations can be made.

If existing facilities, utilities, soils/bedrock conditions, road/structure distress, slope distress or groundwater/seepage conditions other than those noted in this report are present on the site, then their presence was not known, or was not considered in the preparation of this report. Locating utilities and evaluating potential utility interference is outside the scope of this report. Individuals utilizing this report shall inform URS Corporation if they are aware of any additional facilities or site conditions so that their presence and impact upon the project (or vice-versa) can be properly evaluated and recommendations modified to address geotechnical issues as necessary.

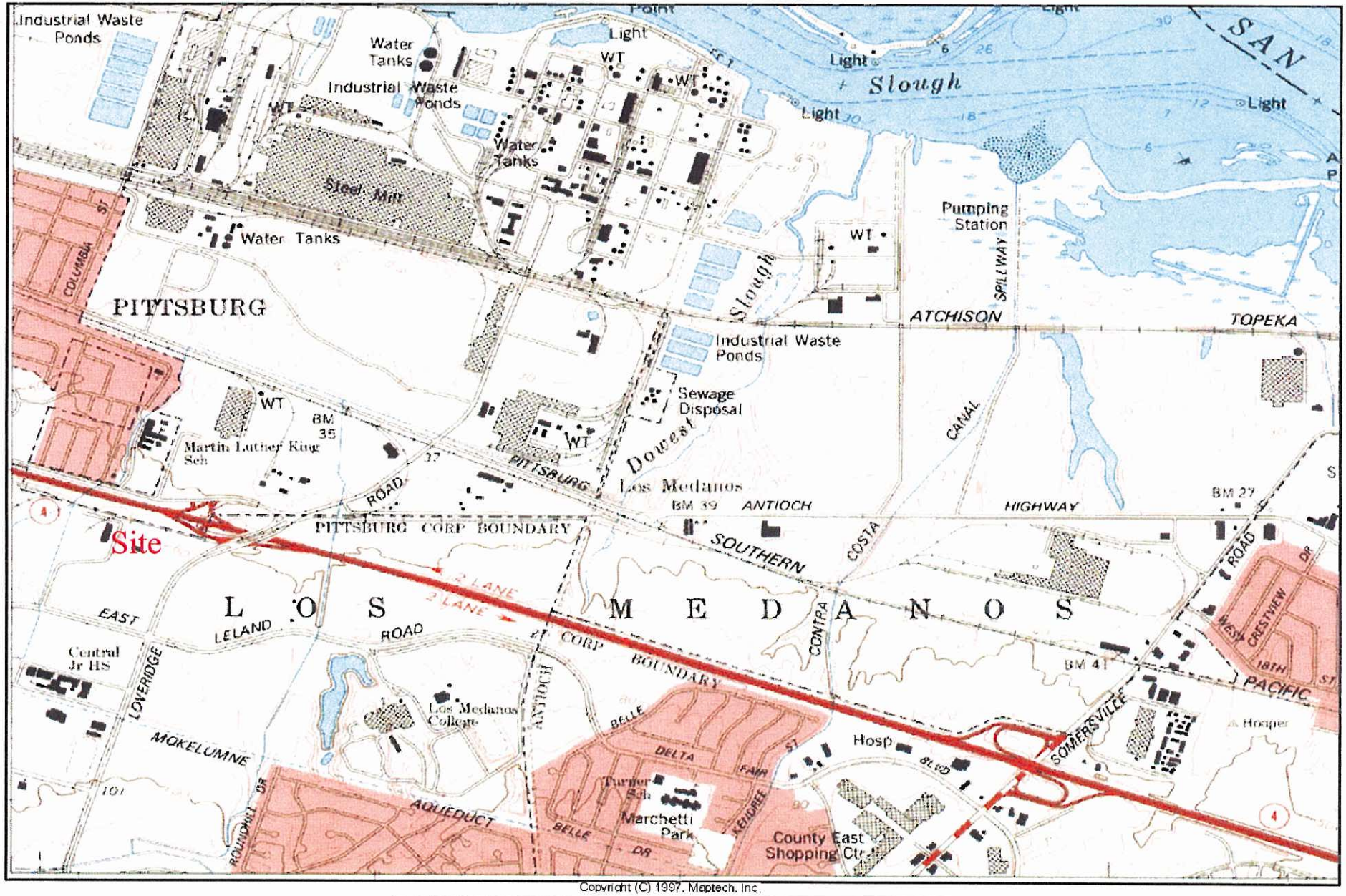
The Geotechnical Professional shall be given the opportunity to review the final specifications and drawings to verify that those documents are consistent with the intent of the geotechnical recommendations.

Geotechnical issues may arise during construction that were not apparent at the time this report was prepared. The Geotechnical Professional should be retained during construction to review the soil conditions encountered and the construction procedures used. All earthwork, pile and wall installation and testing should be completed under the direct observation of the Geotechnical Professional.

Specific review and investigation for environmental issues and subsurface environmental contamination were beyond the scope of our services.

The opinions and recommendations presented in this report were developed with the standard of care commonly used by other professionals practicing at the same time, within the same locality and under the same limitations. No other warranties are included, either express or implied, as to the professional advice included in this report.

Figures



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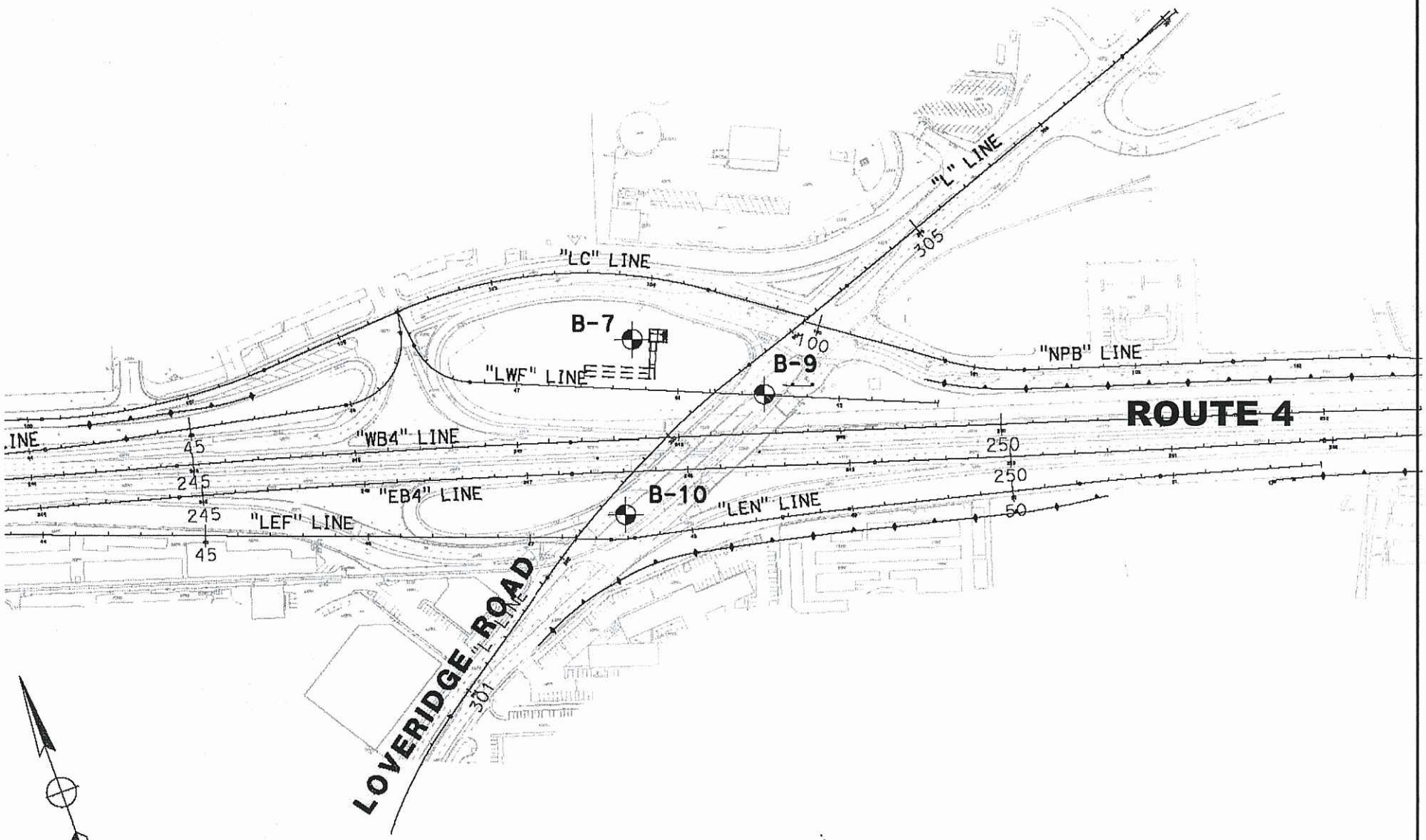
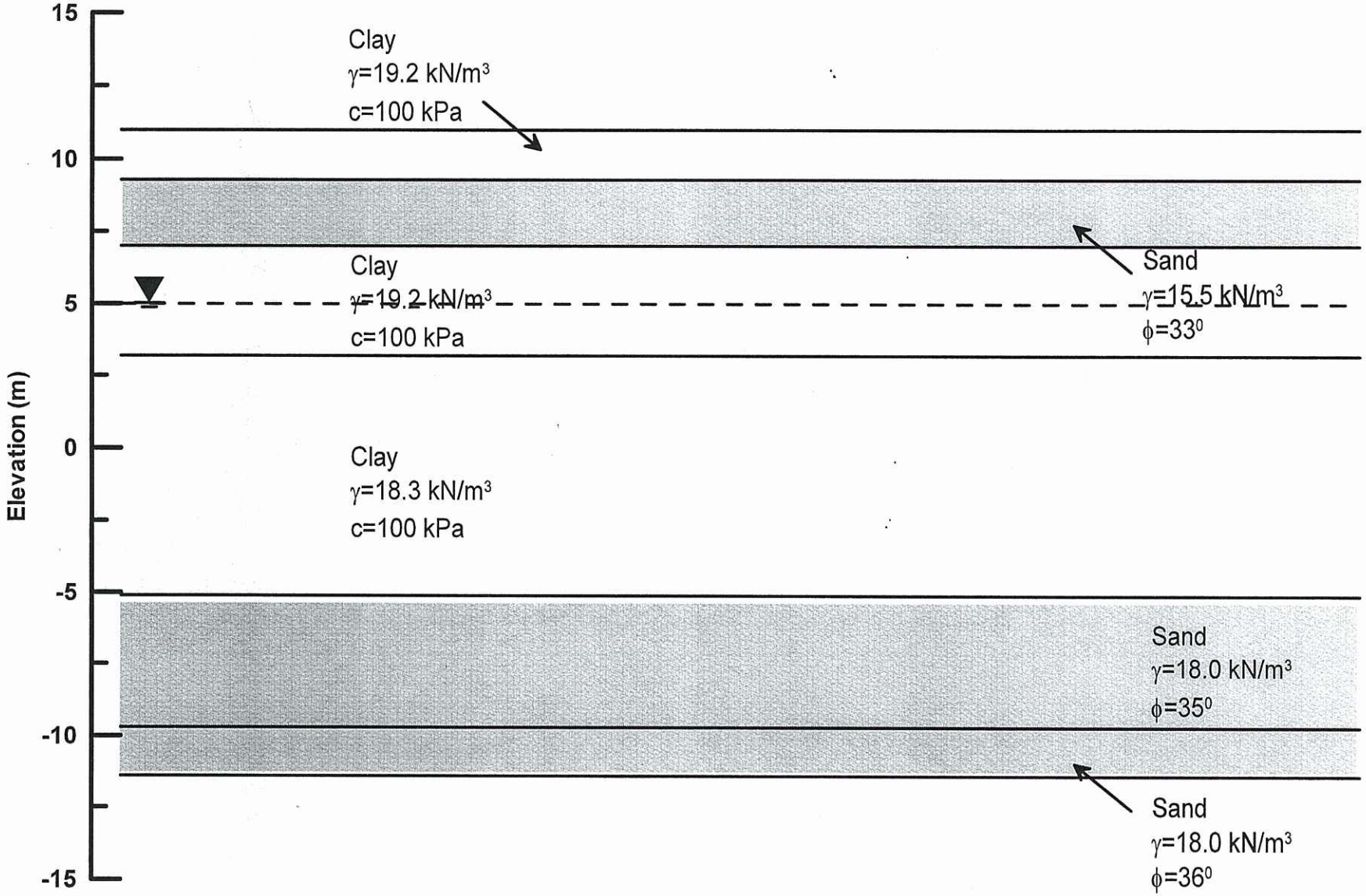
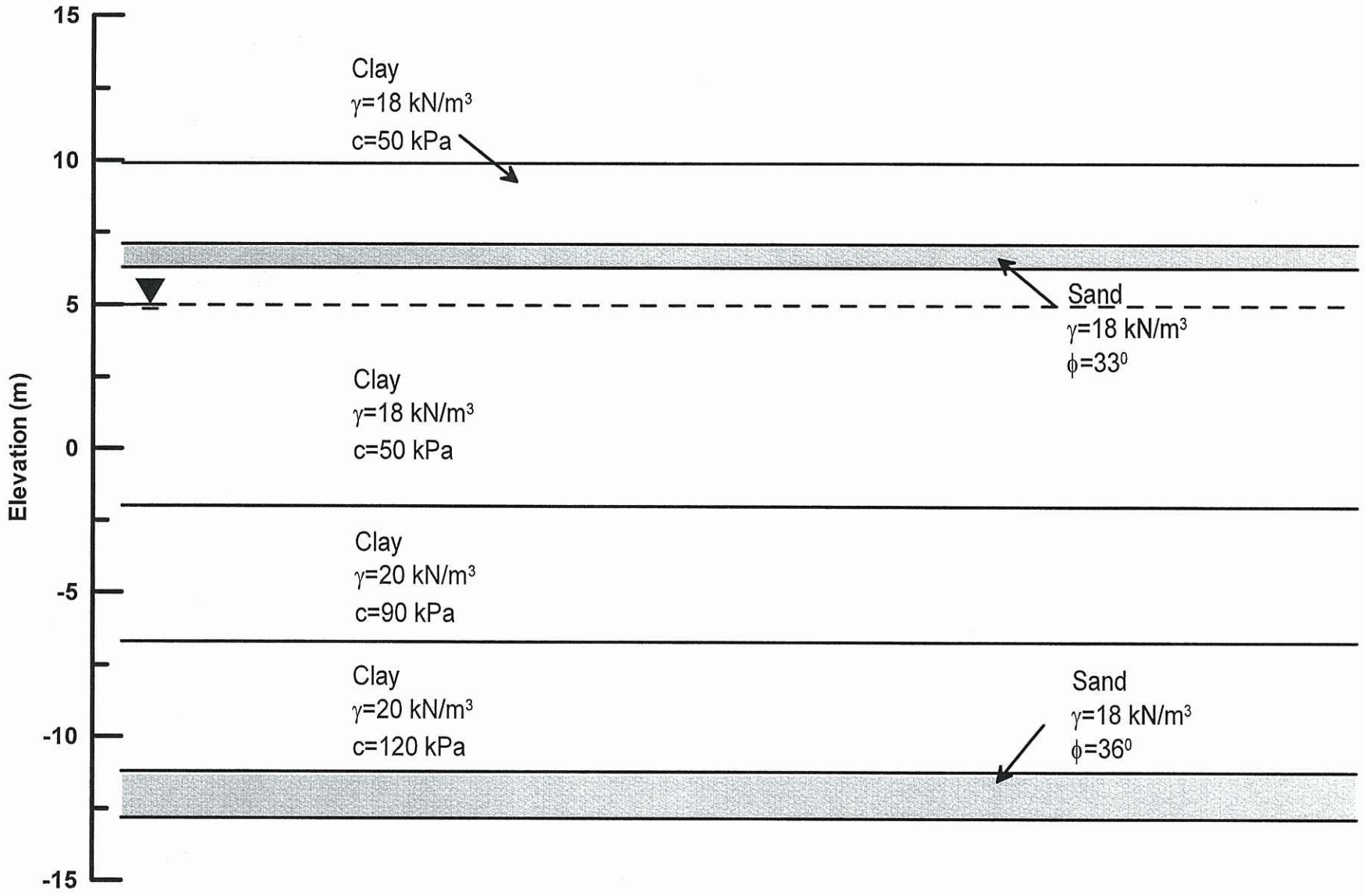
Project No. 26814910	SR 4 (EAST) WIDENING PROJECT LOVERIDGE TO SOMERSVILLE ROAD, Pittsburg CA	**Site Location Plan**	FIGURE 1
	URS		



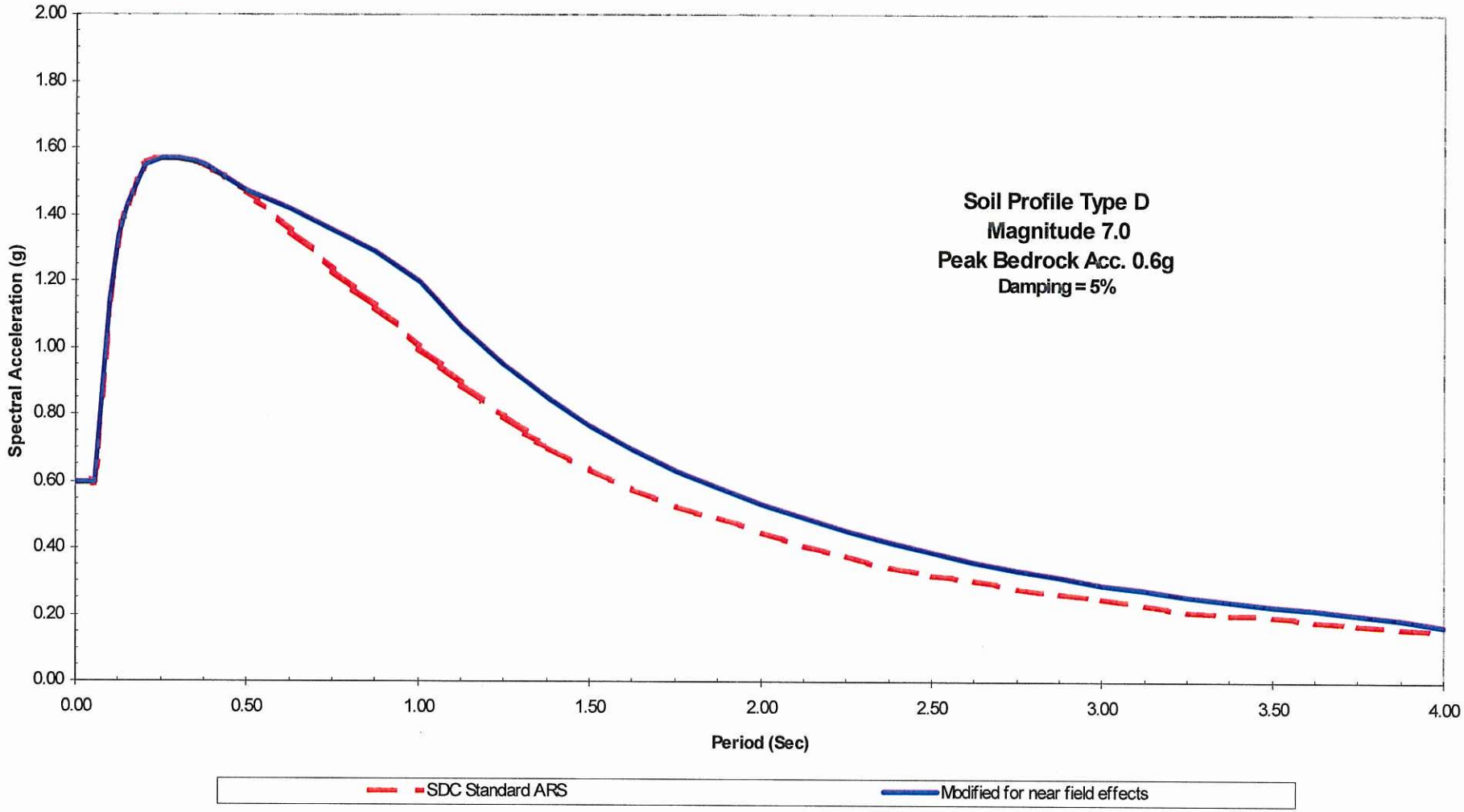
Project No. 26814910	SR 4 (EAST) WIDENING PROJECT LOVERIDGE TO SOMERSVILLE ROAD, Pittsburg CA URS	**Boring Locations** **Loveridge Road Overcrossing**	FIGURE 2



Project No. 26814910	SR 4 (EAST) WIDENING PROJECT LOVERIDGE TO SOMERSVILLE ROAD, Pittsburg, CA URS	**Generalized Geologic Cross Section** **LOVERIDGE ROAD OVERCROSSING** **Abutment 1.**	FIGURE 3-1



Project No. 26814910	SR 4 (EAST) WIDENING PROJECT LOVERIDGE TO SOMERSVILLE ROAD, Pittsburg, CA	**Generalized Geologic Cross Section** LOVERIDGE ROAD OVERCROSSING Bent 2, Bent 3, and Abutment 4.	FIGURE 3-2
	URS		



Project No. 26814910	SR 4 (EAST) WIDENING PROJECT LOVERIDGE TO SOMERSVILLE ROAD, Pittsburg CA	**Acceleration Response Spectrum**	FIGURE 4
	URS		

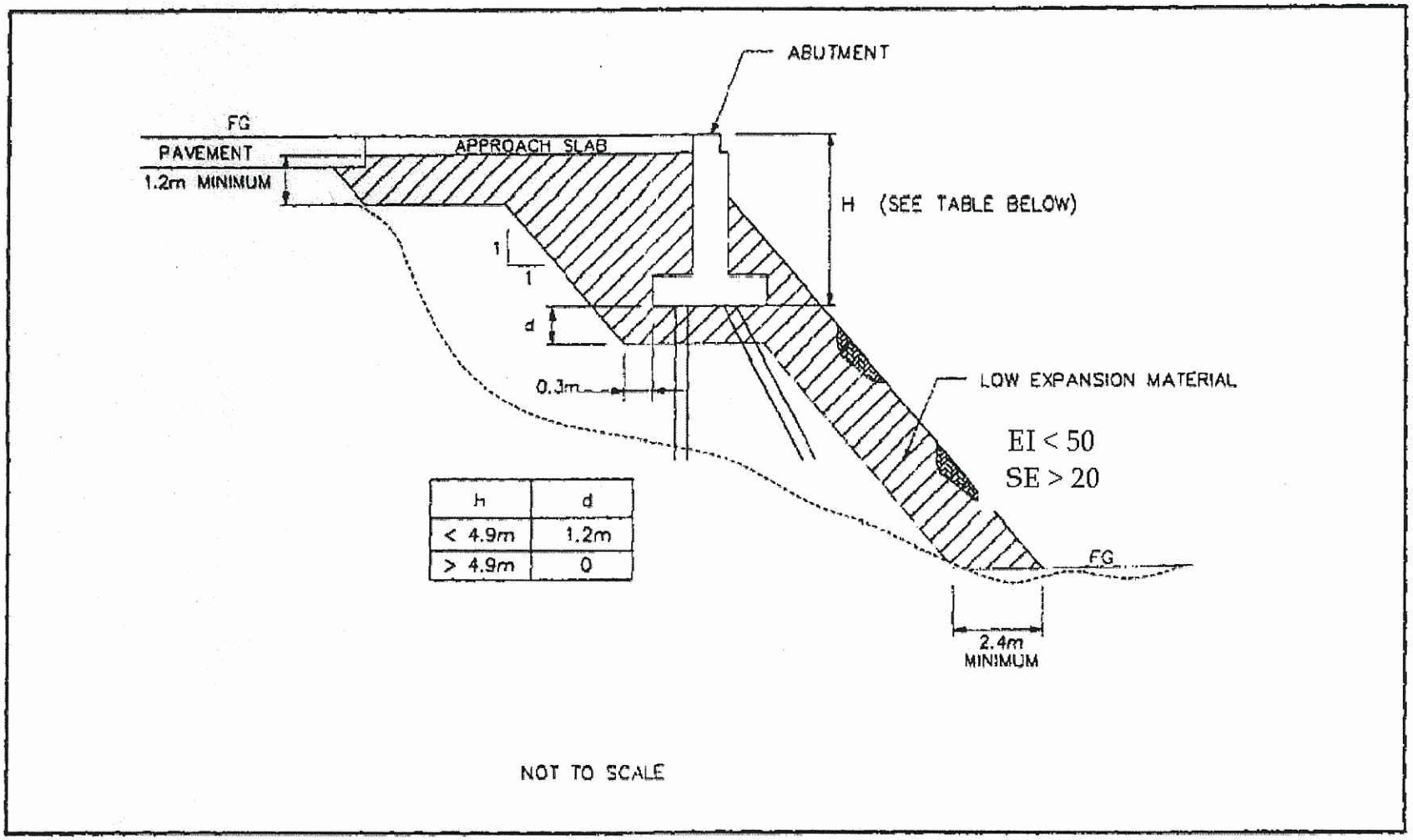


Figure 5.4. of Guidelines for Structures Foundation Reports, March 2006, Caltrans

Project No. 26814910	SR 4 (EAST) WIDENING PROJECT LOVERIDGE TO SOMERSVILLE ROAD, Pittsburg, CA	**Expansive Soil Exclusion Zone in Bridge Abutment**	FIGURE 5
	URS	**LOVERIDGE ROAD OVERCROSSING**	

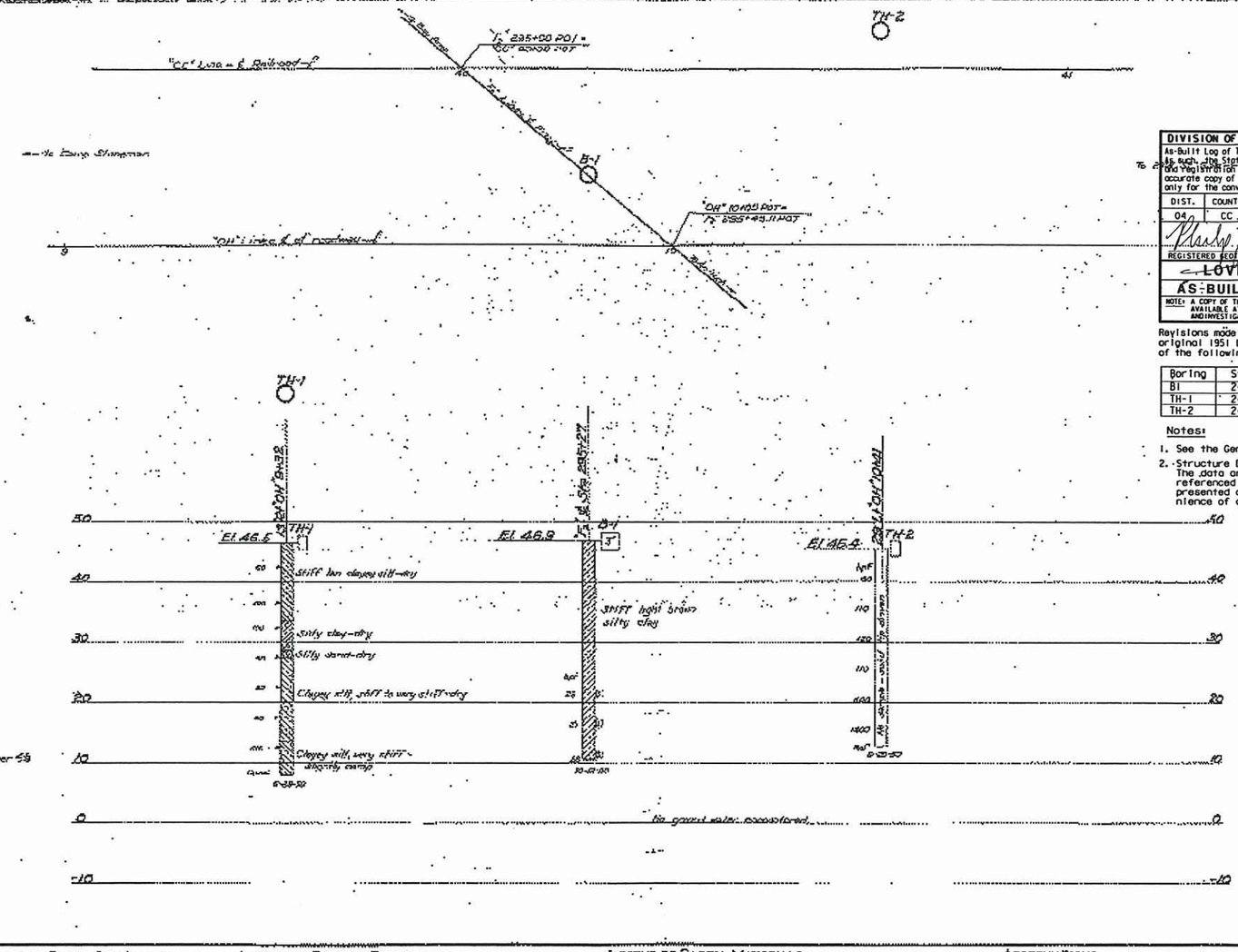
Appendix A

Logs Of Test Borings From Previous Subsurface Investigations

F-246(3)

EA 103120

Filed for record at the request of Caltrans
Dec 29 44
August 27, 1981



DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

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

DIST.	COUNTY	ROUTE	KILOMETER POST-TOTAL PROJECT	Sheet No.	Total Sheets
04	CC		37.9/41.3		

Philip Meymand
REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER
Philip Meymand
No. 2596
Exp. 6/30/07
GEOTECHNICAL
STATE OF CALIFORNIA

LOVERIDGE ROAD OC (REPLACE)

AS-BUILT LOG OF TEST BORINGS NO. 1

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

CU: 04275
EA: 228501

BRIDGE No. 28-0394

Sheet ___ of ___

Revisions made to this Log of Test Borings from the original 1951 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from "EB4" Line
B1	248+27.95	0
TH-1	248+19.96	6.09 Rt
TH-2	248+37.47	25.03 Lt

Notes:

1. See the General Plan and/or Foundation Plan for Metric Stationing.
2. Structure Design produced the data presented in the table above. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.

AS BUILT PLANS
Contract No. 12-4C27
Date Completed
Document No. 4000254V2

Note: Blows per foot were recorded as follows:
TH-1 & 2: Using a 63.5 kg hand hammer with a 18" free fall.
B-1: Using a 140 lb hammer with a 30" free fall

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

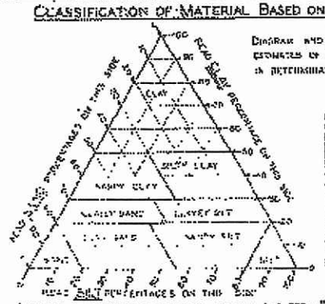


DIAGRAM AND TABLE SHOWING THE BASIS FOR ESTIMATES OF UNIFIED SOIL CLASSIFICATION USED IN DETERMINATION OF CLASS NAMES.

GROUPING USED IN TRIANGULAR CLASSIFICATION

CLASS NAME	PERCENTAGE BY SIZES PRESENT		
	SAND	SILT	CLAY
SAND	80-100	0-20	0-20
SILTY SAND	65-80	0-35	0-20
SILT	0-20	80-100	0-20
CLAYEY SAND	65-80	0-20	20-35
CLAYEY SILT	0-35	65-80	20-35
SANDY CLAY	30-70	0-30	30-70
SILTY CLAY	0-30	50-70	30-50
CLAY	0-30	0-30	50-100

IF GRAVEL IS PRESENT IN APPRECIABLE AMOUNTS THE TERM "GRAVELLY" MAY BE ADDED TO THE CLASS NAME, VIZ. "GRAVELLY SAND". THE TERMS "COARSE", "MEDIUM" AND "FINE" WHEN USED TO DESCRIBE GRAVEL, SAND AND SILT REFER TO STANDARD GRADE SIZE LIMITS.

LEGEND OF BORING OPERATIONS

- Rock or any boring
- 1" Sampler boring
- Rotary wash boring
- 1" Closed sampler driven
- Core boring
- 2½" Pitcher sampler driven
- 2½" Sampler driven
- 2"OD Auger boring
- 3"OD-2½" Auger boring
- Casing driven
- Wet boring
- (S) Sample taken

The appropriate boring symbol designating the method of operation are shown at the upper right-hand corner of the test-hole log. Where more than one boring operation symbols are shown at the point of change.

LEGEND OF EARTH MATERIALS

- Gravel – G
- Sand – S
- Silt – Si
- Clay – C
- Silty Sand – Si S
- Clayey Sand – C S
- Sandy Silt – S Si
- Clayey Silt – C Si
- Sandy Clay – S C
- Silty Clay – Si C
- Peat and Organic Clay – O
- Sandstone – Ss
- Shale – Sh
- Broken Rock (Fragments) – Br
- Rock – R

ABBREVIATIONS

EL 60.4	Elevation of ground at test hole
∇	Drilled with rotary – wet hole encountered
∇	Rolled pipe
M	Moisture as % dry weight
∇	Elevation of ground water encountered

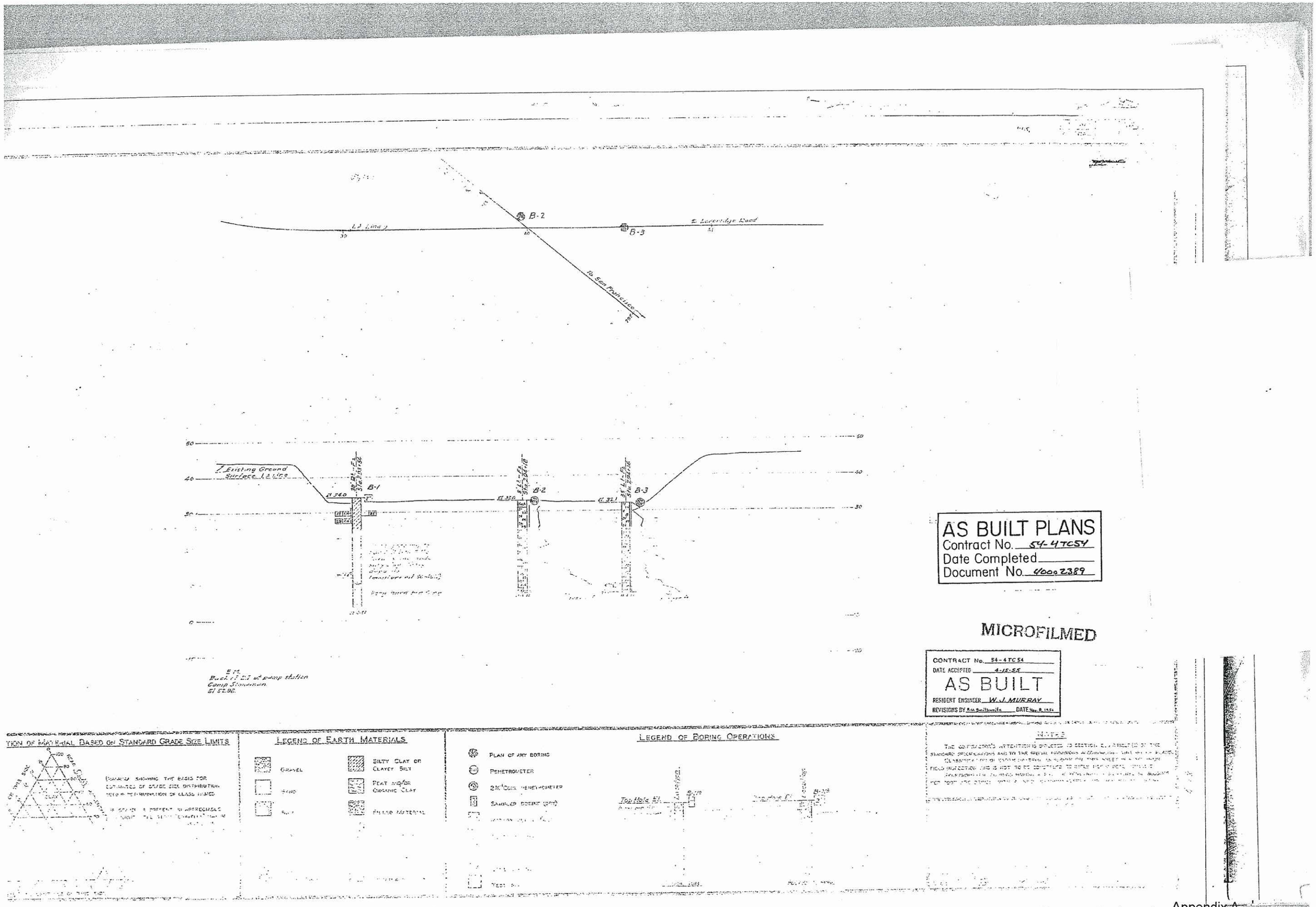
NOTES

THE CONTRACTOR'S ATTENTION IS DIRECTED TO SECTION 2, ARTICLE (c) OF THE STANDARD SPECIFICATIONS AND TO THE SPECIAL PROVISIONS ACCOMPANYING THE SET OF PLANS.

CLASSIFICATION OF EARTH MATERIAL AS SHOWN ON THIS SHEET IS BASED UPON FIELD INSPECTION AND IS NOT TO BE CONSTRUED TO IMPLY MECHANICAL ANALYSIS.

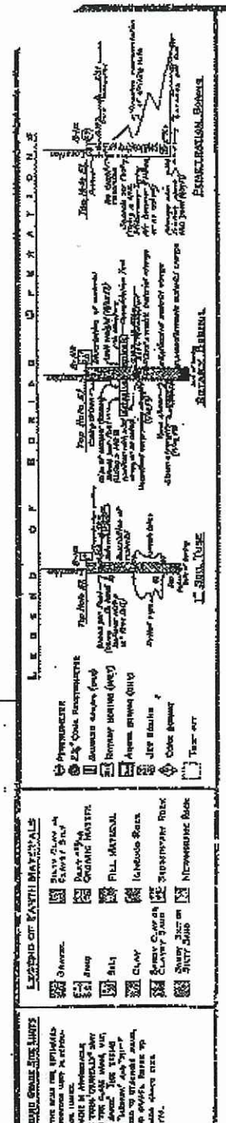
MICROFILMED

CAMP STONEMAN ROAD UNDERPASS
LOG OF TEST BORINGS
1"=10'
28-96
C-2380-22


B-2
B-3
To San Francisco
Existing Ground Surface
B-1
B-2
B-3
Camp Stoneman
El 52.90
AS BUILT PLANS
Contract No. 54-4TC54
Date Completed
Document No. 40002389
MICROFILMED
CONTRACT No. 54-4TC54
DATE ACCEPTED 4-15-55
AS BUILT
RESIDENT ENGINEER W. J. MURRAY
REVISIONS BY
DATE
TION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS
LEGEND OF EARTH MATERIALS
GRAVEL
SILTY CLAY OR CLAYEY SILT
PEAT AND/OR ORGANIC CLAY
FILLED MATERIAL
LEGEND OF BORING OPERATIONS
PLAN OF ANY BORING
PENETROMETER
SAMPLER BORING
NOTES

DIST.	COUNTY	ROUTE	POST MILE / TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	CC	4	28.0/28.6	30	30

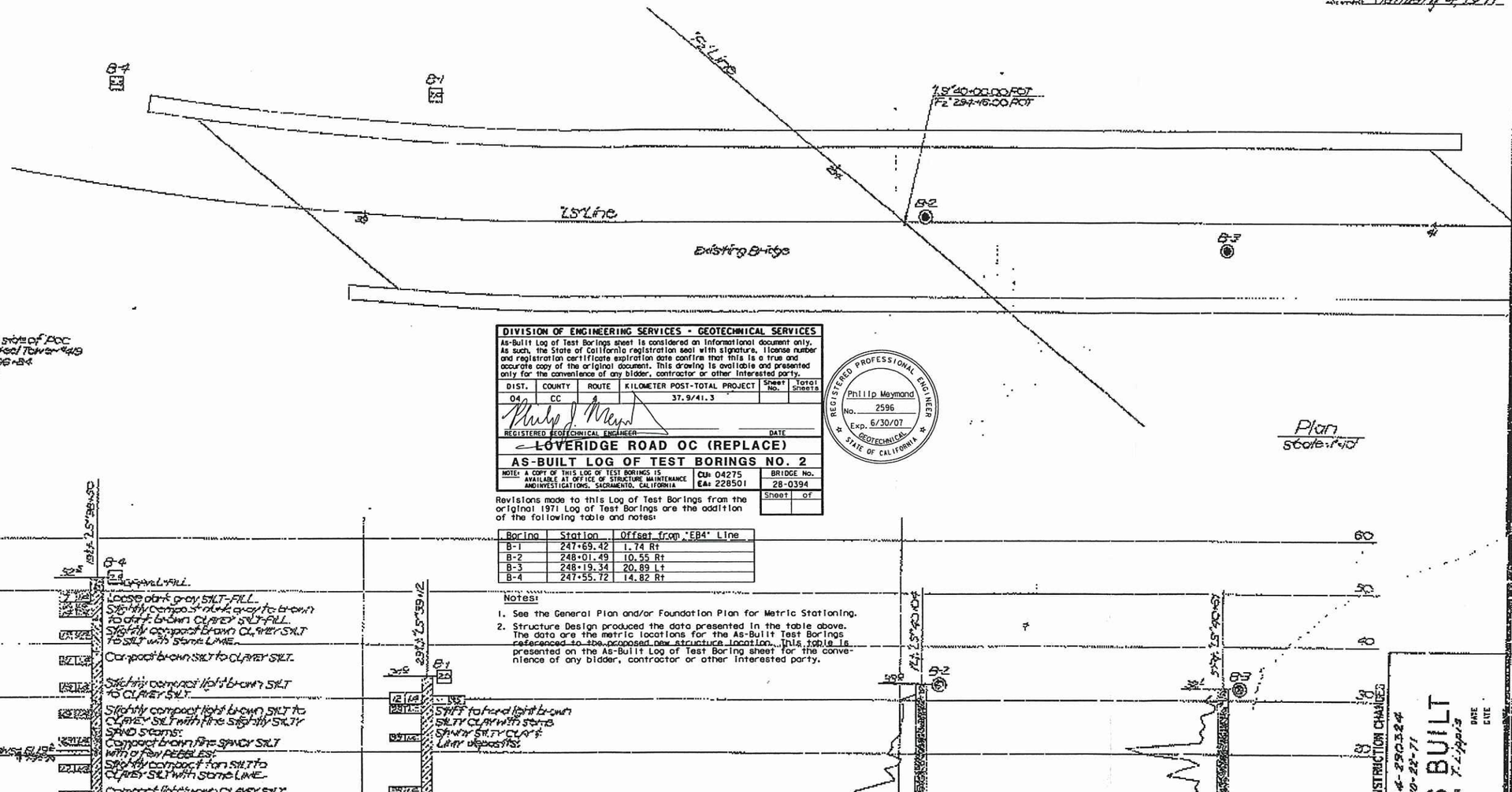
Before Me: Carl Gibbs, PE
DATE SIGNED: January 4, 1971



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

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

EM #29
Concrete slope protection
Both sides of steel Tower #49
Both 12' 29+84
Elev. 48.41



DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

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

DIST.	COUNTY	ROUTE	KILOMETER POST-TOTAL PROJECT	Sheet No.	Total Sheets
04	CC		37.9/41.3		

Philip J. Meymand
REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER
Philip Meymand
No. 2596
Exp. 6/30/07
GEOTECHNICAL
STATE OF CALIFORNIA

LOVERIDGE ROAD OC (REPLACE)

AS-BUILT LOG OF TEST BORINGS NO. 2

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

CU: 04275
EA: 228501

BRIDGE No. 28-0394

Sheet of

Revisions made to this Log of Test Borings from the original 1971 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from "EB4" Line
B-1	247+69.42	1.74 Rt
B-2	248+01.49	10.55 Rt
B-3	248+19.34	20.89 Lt
B-4	247+55.72	14.82 Rt

Notes:

1. See the General Plan and/or Foundation Plan for Metric Stationing.
2. Structure Design produced the data presented in the table above. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.

NO CONSTRUCTION CHANGES
CONTRACT NO. 04-259324
DATE ACCEPTED 10-22-71
AS BUILT
RESIDENT ENGINEER T. Lyons — DATE
REVISIONS BY — DATE
DESIGNATED BY — DATE
R.E.

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

LOVERIDGE ROAD OVERCROSSING
(WIDEN)
LOG OF TEST BORINGS

BRIDGE NO.	POST MILE	DRAWING NO.	SHEET	OF
28-109	28.3		3	

REVISION DATES — PRELIMINARY STATE ONLY

WO 250321
CU 04205
RR231057

Disregard prior boring section notation dates

30

Appendix B

Logs Of Test Borings From Current Subsurface Investigations

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

Phillip Meymond No. 2596 Exp. 6/30/07 REGISTERED PROFESSIONAL ENGINEER GEOTECHNICAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

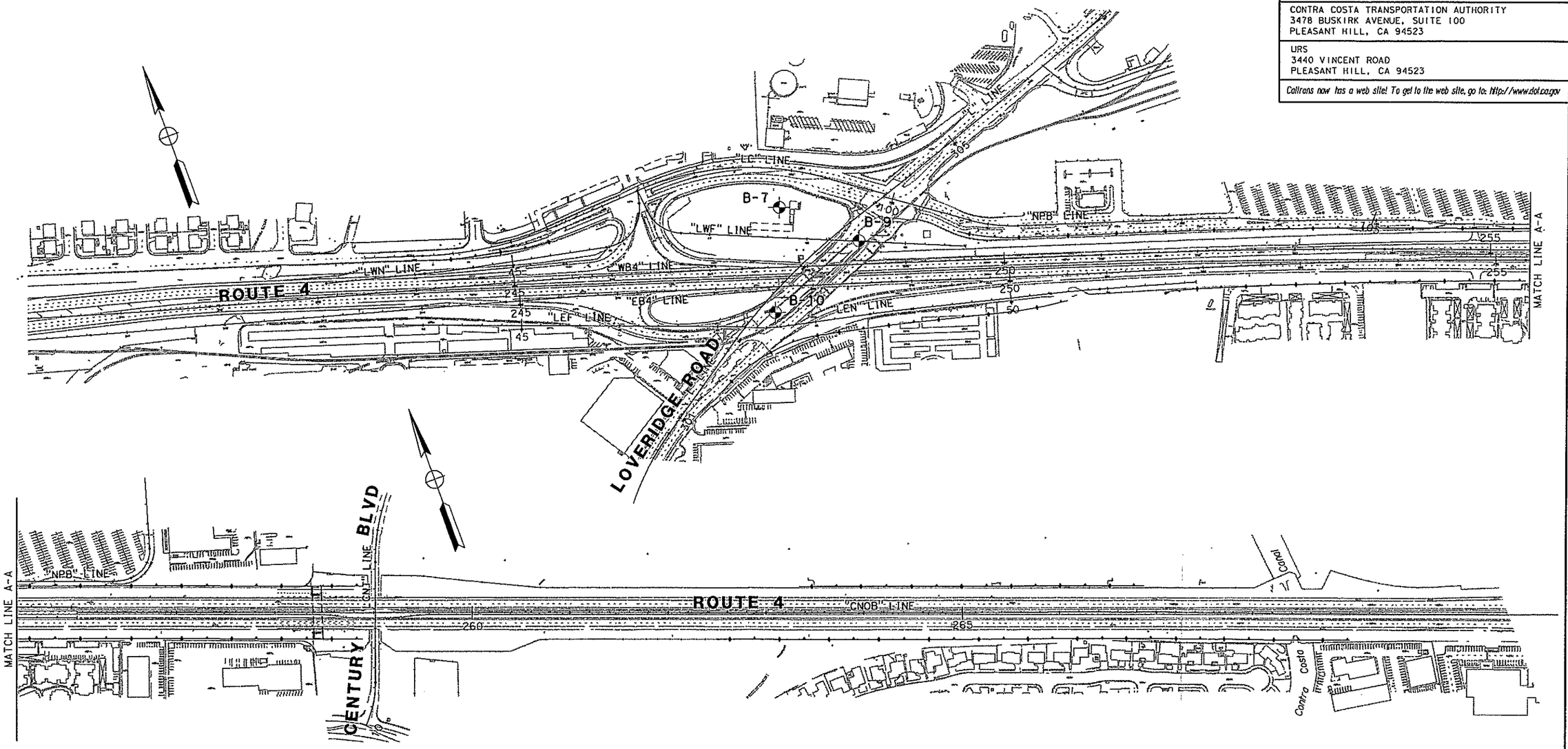
Caltrans now has a web site! To get to the web site, go to: http://www.dot.ca.gov

DATE	REVISED BY
06/06	EAJ
06/06	BR

CALCULATED/DESIGNED BY
CHECKED BY
DATE REVISED

DESIGN OVERSIGHT
SOTERO ANGELES

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans



LOVERIDGE OC FOUNDATION REPORT
SITE AND BORING LOCATIONS

ALL DIMENSIONS ARE IN
METERS UNLESS OTHERWISE SHOWN

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => cesomer0
DGN FILE => ...\lotb-keymap-loveridge.dgn

CU 04275

EA 228594

LAST REVISION 00-00-00
DATE PLOTTED => 1/31/2007
TIME PLOTTED => 4:47:08 PM

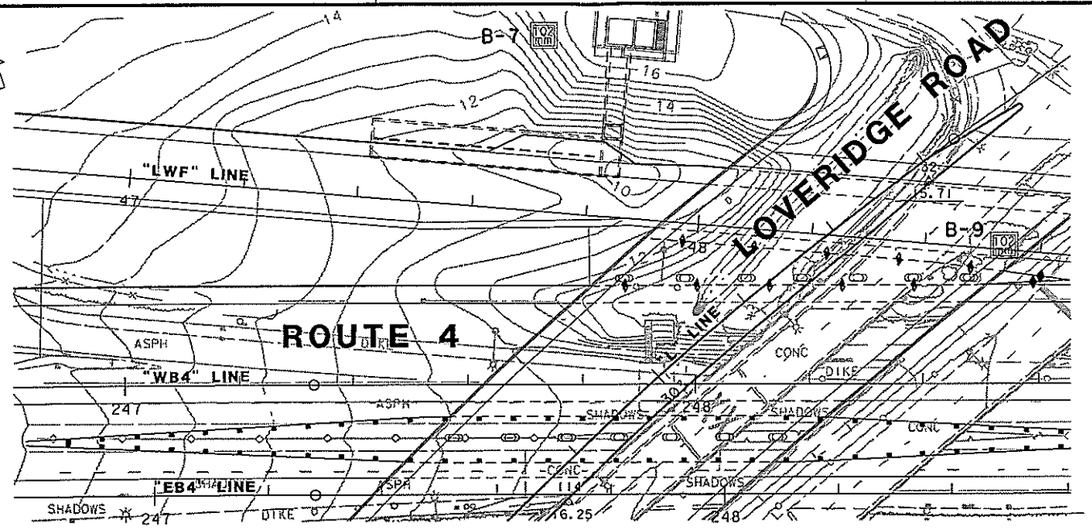
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
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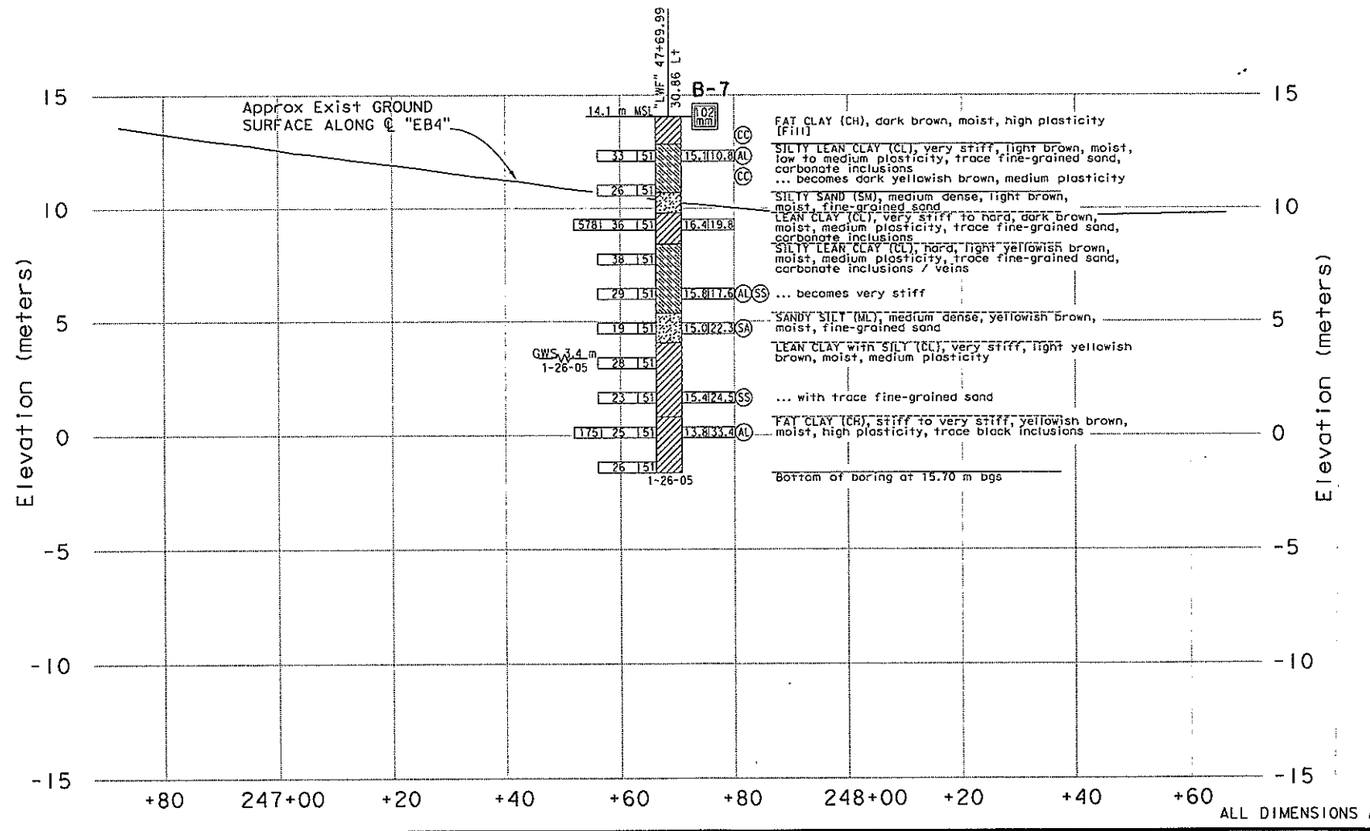

PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:
AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

Phillip Meymand No. 2596 Exp. 6/30/07 GEOTECHNICAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

LEGEND OF BORING OPERATIONS

TEST TYPE
Atterberg Limits
Corrosivity Test
Consolidation
Direct Shear
Hydrometer
Mx Density, Mod Proctor, & CBR
Resistance R-value Test
Sieve Analysis
Swell/Settlement Potential
Unconfined Unconsolidated Undrained Triaxial Test
Vane Shear

ROTARY SAMPLE BORING (RB#)
AUGER BORING (AB#)
ELECTRONIC CONE PENETROMETER TEST
57 mm CORE PENETRATION
SAMPLE BORING (SB#)
ROTARY SAMPLE BORING (RB#)
AUGER BORING (AB#)
TEST PIT
DIAMOND CORE BORING
JET BORING
ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS
GRAVEL
SAND
SILT
CLAY
CLAYEY SILT
POSS ORGANIC MATTER
FILL MATERIAL
COBBLE
BOULDER
IGNEOUS ROCK
SANDY CLAY or CLAYEY SAND
SANDY SILT or SILTY SAND
SEDIMENTARY ROCK
METAMORPHIC
SILTY CLAY

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-value (Blows/0.30m)	Granular	SPT N-value (Blows/0.30m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO. 28-0394	LOVERIDGE ROAD OC (REPLACE)
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/26/05		PROJECT ENGINEER	KILOMETER POST 38.8	LOG OF TEST BORINGS NO. 1

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)
ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100
CU 04275
EA 228501
FILE => ...\28-0394-z-1tb01.dgn
DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES (PRELIMINARY STAGE ONLY) 10/17/05 01/20/06 02/16/07
SHEET 34 OF 38

USERNAME => casomer0 DATE PLOTTED => 1/31/2007 TIME PLOTTED => 4:56:58 PM

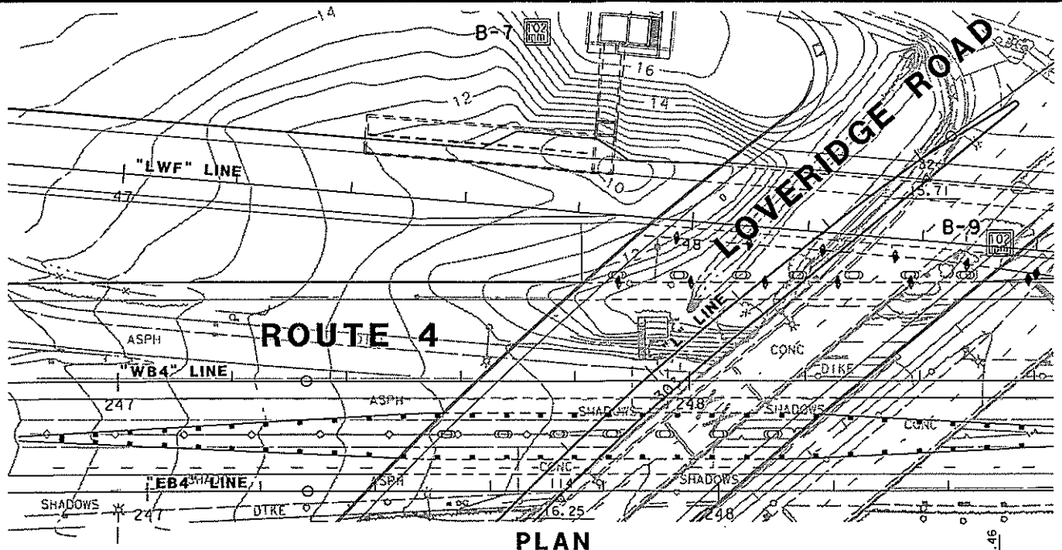
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



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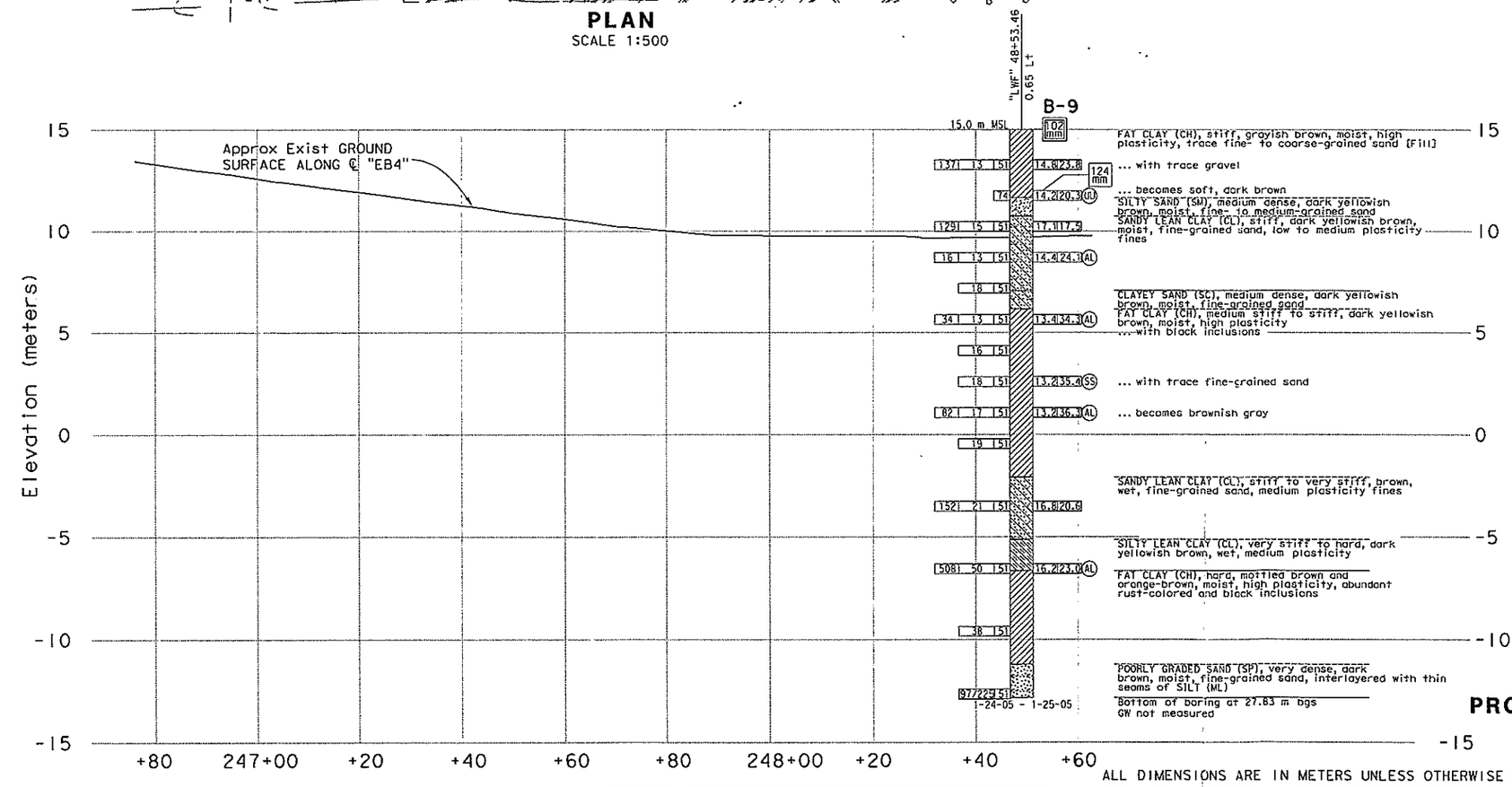
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:
AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER ____ DATE

Phillip Meymond No. 2596 Exp. 6/30/07 GEOTECHNICAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

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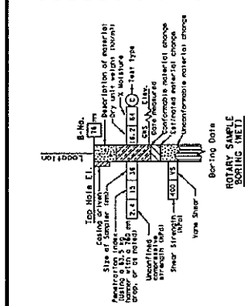
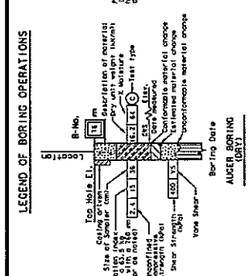
CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

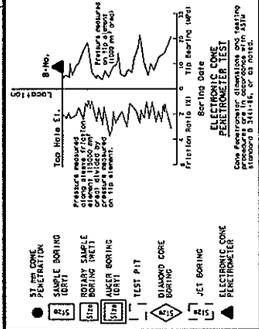
URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

LEGEND OF BORING OPERATIONS

TEST TYPE: Atterberg Limits; Corrosivity Test; Consolidation; Direct Shear; Hydrometer; Max. Density, ELAB Compaction Test; Resistance R-Value; Sieve Analysis; Soil/Settlement Test; Unconsolidated Undrained Triaxial Compression Test; Vane Shear







51 mm CONE PENETRATION
SAMPLE BORING (DRY)
ROTARY SAMPLE BORING (WET)
AUGER BORING (DRY)
TEST PIT
DIAMOND CORE BORING
JET BORING
ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS

GRAVEL; SAND; SILT; CLAY; SANDY CLAY or CLAYEY SAND; SANDY SILT or SILTY SAND; SILTY CLAY; CLAYEY SILT; PEAT or ORGANIC MATTER; FILL MATERIAL; COBBLE; IGNEOUS ROCK; SEDIMENTARY ROCK; METAMORPHIC

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/0.30m)	Granular	SPT N-Value (Blows/0.30m)	Cohesive
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>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO. 28-0394	LOVERIDGE ROAD OC (REPLACE)
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/25/05		PROJECT ENGINEER	KILOMETER POST 38.8	LOG OF TEST BORINGS NO. 2

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228501

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/17/05; 01/26/06; 02/15/07

SHEET 35 OF 38

FILE => ...\28-0394-z-ltb02.dgn

USERNAME => cesomer0 DATE PLOTTED => 1/31/2007 TIME PLOTTED => 4:57:02 PM

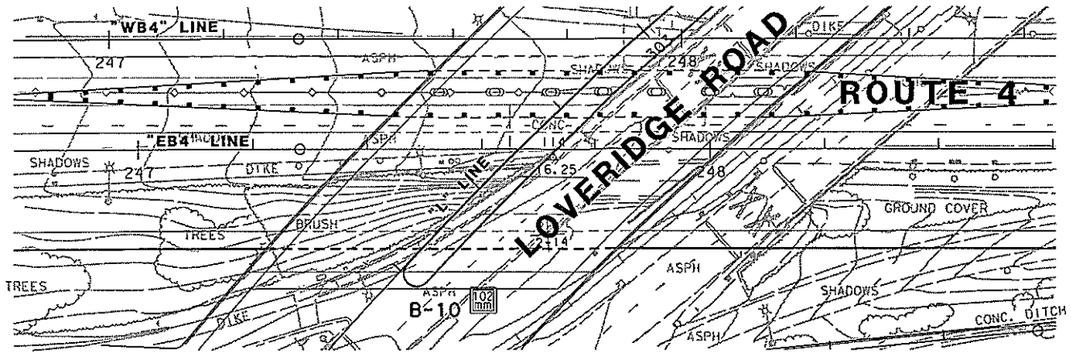
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



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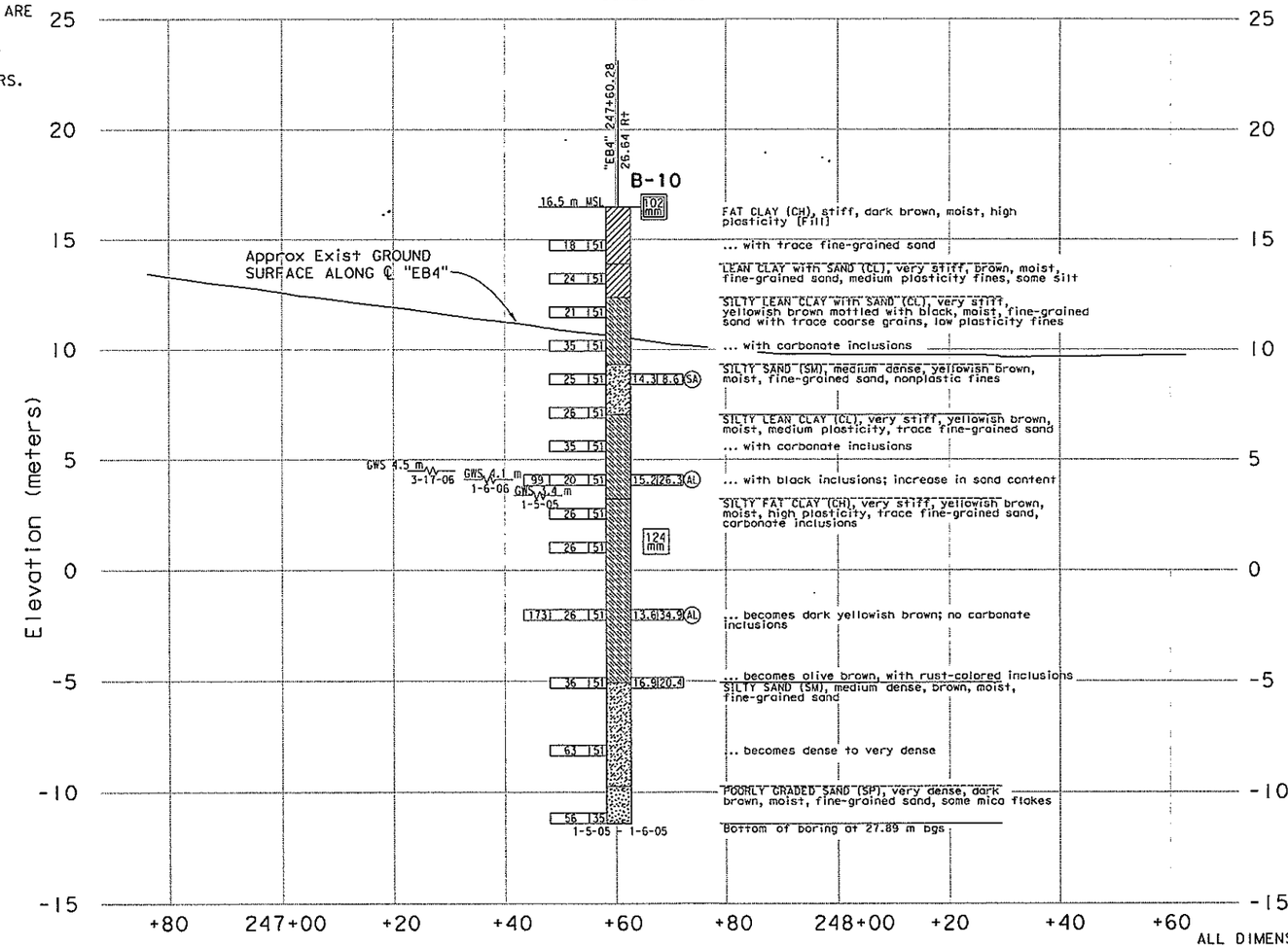
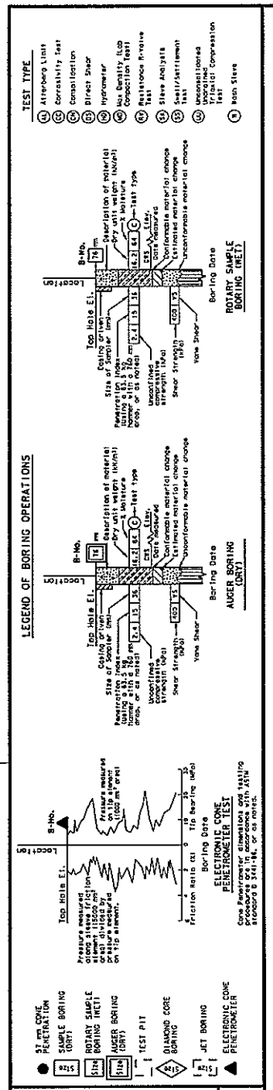


PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN



NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. UPADHYAYA	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO. 28-0394	LOVERIDGE ROAD OC (REPLACE)
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/06/05		PROJECT ENGINEER	KILOMETER POST 38.8	LOG OF TEST BORINGS NO. 3

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)
ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100
CU 04275
EA 228501
FILE => ...\28-0394-z-ltb03.dgn
DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES (PRELIMINARY STAGE ONLY): 10/17/05 01/26/06 02/15/07
SHEET 36 OF 38
USERNAME => cesomerO DATE PLOTTED => 1/31/2007 TIME PLOTTED => 5:54:16 PM

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

Caltrans Metrie

Philip J. Meyer
REGISTERED GEOTECHNICAL ENGINEER DATE

REGISTERED PROFESSIONAL ENGINEER — Phillip Meymand — No. 2596 — Exp. 6/30/07 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

Appendix C
Laboratory Test Results

TABLE C-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information			USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, kN/m³	Sieve			Atterberg Limits			Unconfined Compressive Strength, kPa	UU Triaxial		Other Tests
Boring Number	Sample Number	Depth, meters				Gravel, %	Sand, %	<#200, %	LL	PL	PI		Peak Deviator Stress, kPa	Confining Pressure, kPa	
B-7	7-1	0.6-1.5	CH												CORR
B-7	7-2-3	1.83	CL	10.8	15.1				39	18	21				
B-7	7-3A	2.4-3.0	CL												CORR
B-7	7-4-3	4.88	CL	19.8	16.4							578			
B-7	7-6-2	7.77	CL	17.6	15.8				42	18	24				SWELL
B-7	7-7-2	9.30	ML	22.3	15.0	0	43	57							
B-7	7-9-3	12.50	CL	24.5	15.4										SWELL
B-7	7-11-2	15.39	CH	33.4	13.8				87	27	60	175			

The laboratory tests were performed in general accordance with the following ASTM standards:

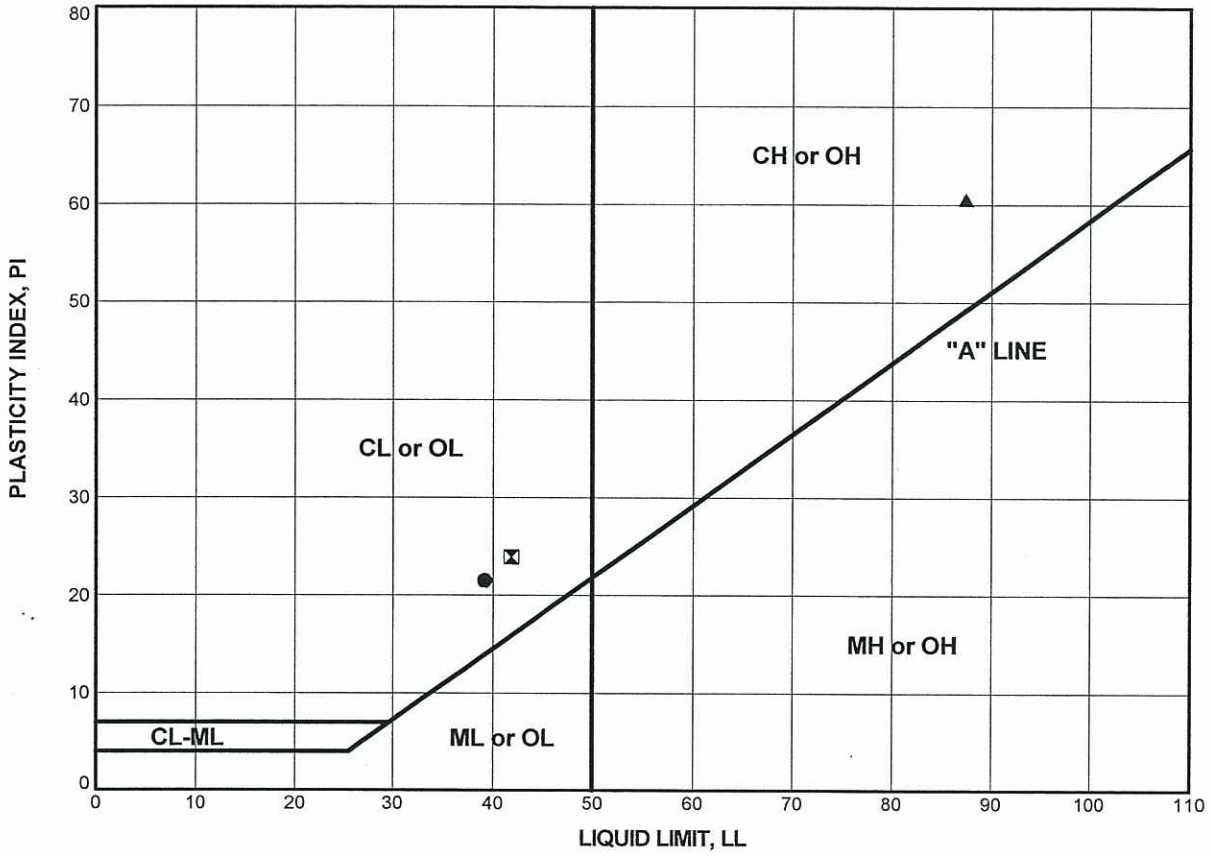
Water Content - ASTM Test Method D2216
Dry Unit Weight - ASTM Test Method D2937
Particle Size Distribution Analysis by Mechanical Sieving and Hydrometer - ASTM Test Method D422
Atterberg Limits - ASTM Test Method D4318
Unconfined Compressive Strength Test (UC, q_u in kPa) - ASTM Test Method D2166
Unconsolidated Undrained Triaxial Compression Test (UU Triaxial) - ASTM Test Method D2850
One-dimensional Consolidation Test (CONS) - ASTM Test Method D2435
One-dimensional Swell/Settlement Potential Test (SWELL) - ASTM Test Method D4546
Laboratory Compaction Test (COMP) - ASTM Test Method D1557-B
Corrosivity Suite of Chemical Tests (CORR) - Redox by ASTM Test Method D1498; pH by ASTM Test Method D4972; Resistivity by ASTM Test Method G57; Sulfate Content and Chloride Content by ASTM Test Method D4327

TABLE C-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information			USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, kN/m³	Sieve			Atterberg Limits			Unconfined Compressive Strength, kPa	UU Triaxial		Other Tests
Boring Number	Sample Number	Depth, meters				Gravel, %	Sand, %	<#200, %	LL	PL	PI		Peak Deviator Stress, kPa	Confining Pressure, kPa	
B-9	9-2-3	1.83	CH	23.8	14.8							137			
B-9	9-3	3.35	SM	20.3	14.2								45	62	
B-9	9-4-3	4.88	CL	17.5	17.1							129			
B-9	9-5-3	6.40	CL	24.1	14.4				31	17	14	16			
B-9	9-7-2	9.30	CH	34.3	13.4				52	21	31	34			
B-9	9-9-2	12.34	CH	35.4	13.2										SWELL
B-9	9-10-2	13.87	CH	36.3	13.2				87	27	60	82			
B-9	9-12-3	18.59	CL	20.6	16.8							152			
B-9	9-13-3	21.64	CH	23.0	16.2				51	24	27	508			
B-10	10-6-3	7.92	SM	8.6	14.3	0	72	28							
B-10	10-9-3	12.50	CL	26.3	15.2				40	18	22	99			
B-10	10-12-2	18.44	CH	34.9	13.6				98	28	70	173			
B-10	10-13-3	21.64	SM	20.4	16.9										

The laboratory tests were performed in general accordance with the following ASTM standards:

Water Content - ASTM Test Method D2216
Dry Unit Weight - ASTM Test Method D2937
Particle Size Distribution Analysis by Mechanical Sieving - ASTM Test Method D422
Atterberg Limits - ASTM Test Method D4318
Unconfined Compressive Strength Test (UC, q_u in kPa) - ASTM Test Method D2166
Unconsolidated Undrained Triaxial Compression Test (UU Triaxial) - ASTM Test Method D2850
One-dimensional Consolidation Test (CONS) - ASTM Test Method 2435
One-dimensional Swell/Settlement Potential Test (SWELL) - ASTM Test Method 4546



Boring Number	Sample Number	Depth (meters)	Test Symbol	Moisture Content (%)	LL	PL	PI	Classification
B-7	7-2-3	1.83	●	11	39	18	21	Silty Lean Clay (CL)
B-7	7-6-2	7.77	⊠	18	42	18	24	Silty Lean Clay (CL)
B-7	7-11-2	15.39	▲	33	87	27	60	Fat Clay (CH)

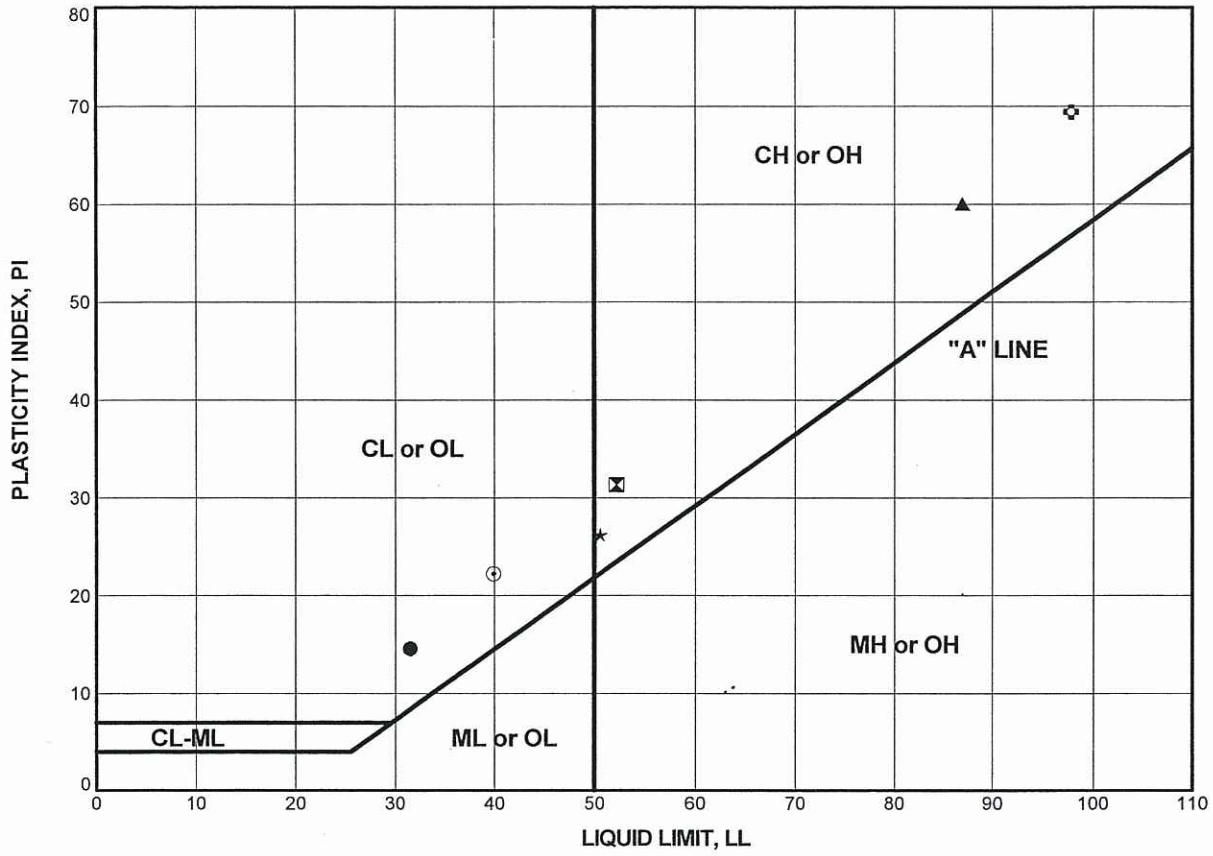
Report: ATTERBERG_PLOT_12.PTS; File: OAK_SR4PITTS.GPJ; 2/23/2005

State Route 4 Loveridge to Somersville Road
Loveridge Road Overcrossing
26814910.24000

PLASTICITY CHART

URS

Figure C-1



Boring Number	Sample Number	Depth (meters)	Test Symbol	Moisture Content (%)	LL	PL	PI	Classification
B-9	9-5-3	6.40	●	24	31	17	14	Sandy Lean Clay (CL)
B-9	9-7-2	9.30	⊠	34	52	21	31	Fat Clay (CH)
B-9	9-10-2	13.87	▲	36	87	27	60	Fat Clay (CH)
B-9	9-13-3	21.64	★	23	51	24	27	Fat Clay (CH)
B-10	10-9-3	12.50	⊙	26	40	18	22	Silty Lean Clay (CL)
B-10	10-12-2	18.44	✿	35	98	28	70	Silty Fat Clay (CH)

Report: ATTERBERG_PLOT_12 PTS; File: OAK_SR4PITTS.GPJ; 2/19/2005 B-10P

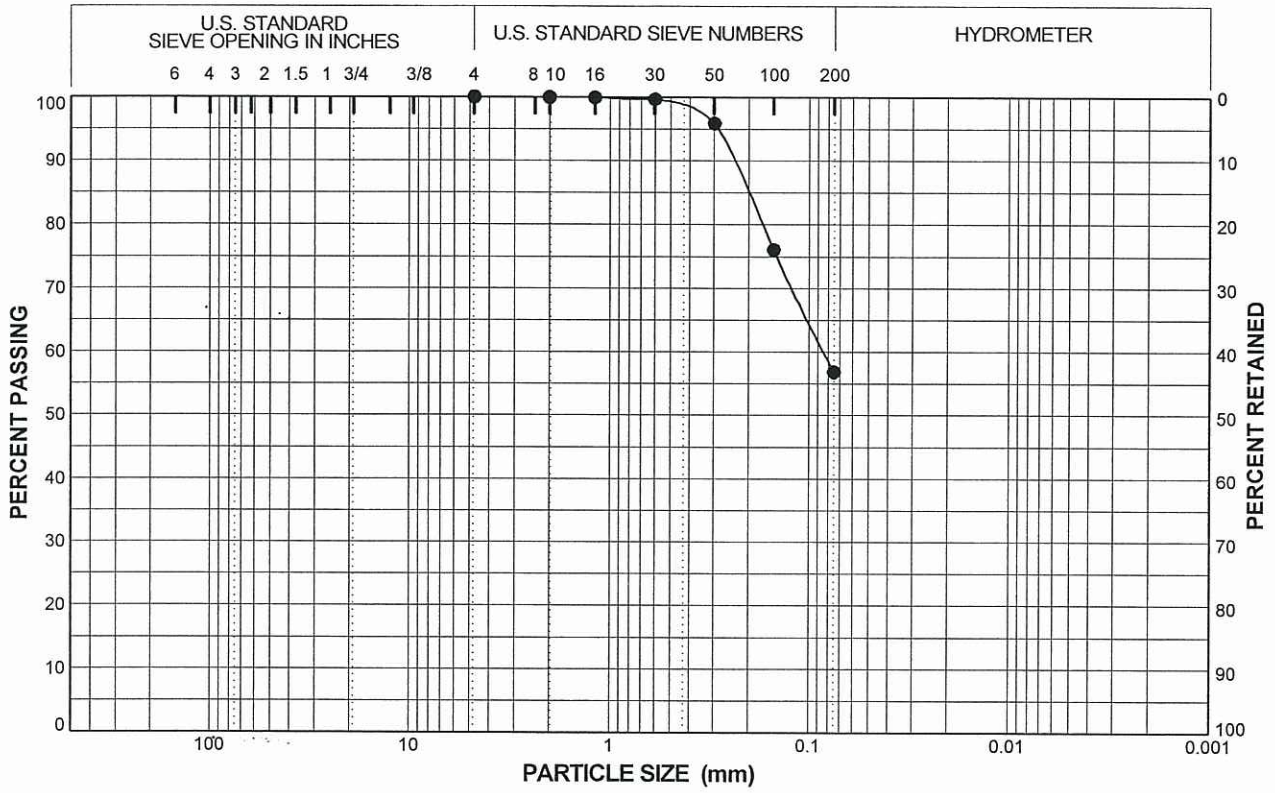
State Route 4 Loveridge to Somersville Road
Loveridge Road Overcrossing
26814910.24000

PLASTICITY CHART

URS

Figure C-2

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (meters)	Symbol	LL	PI	Classification
B-7	7-7-2	9.30	●			Sandy Silt (ML)

Report: SIEVE_5_CURVES_OAK; File: OAK_SR4PITTS.GPJ; 2/23/2005

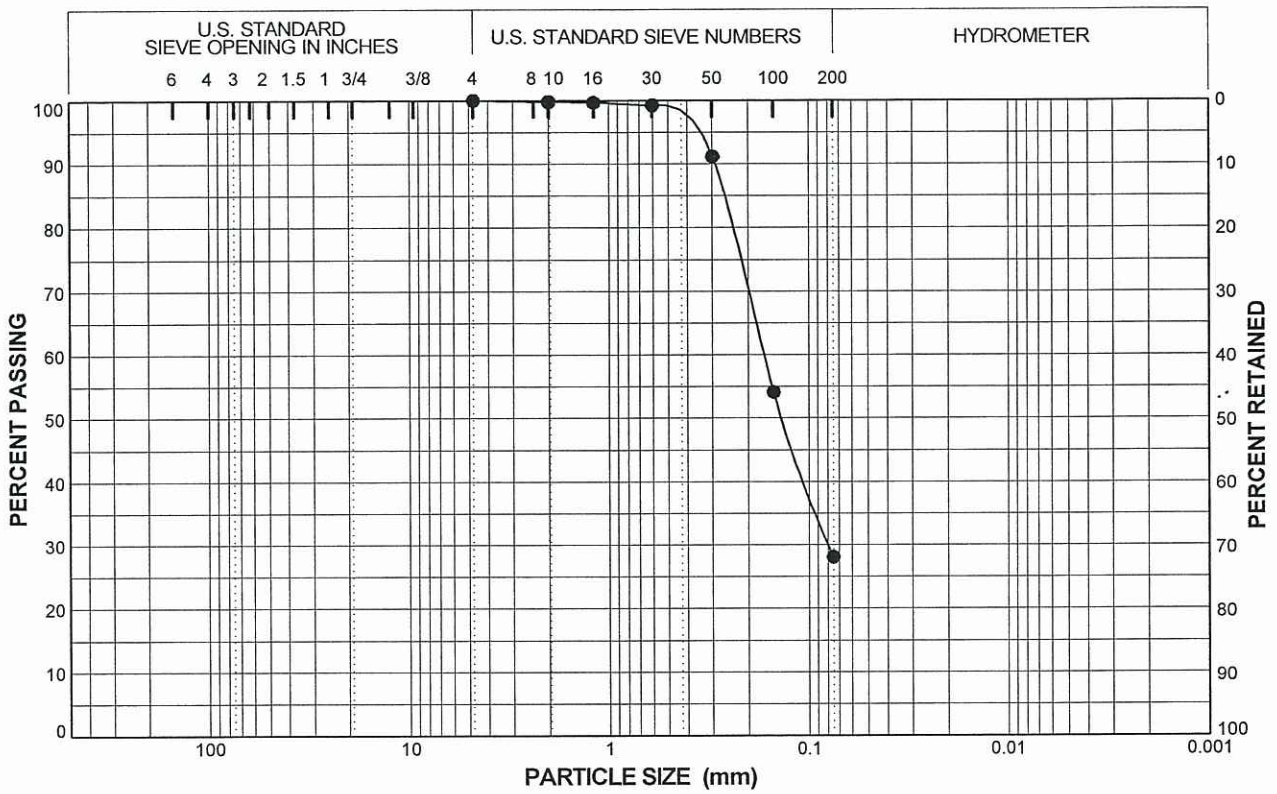
State Route 4 Loveridge to Somersville Road
Loveridge Road Overcrossing
26814910.24000

PARTICLE SIZE DISTRIBUTION CURVES

Figure C-3

URS

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (meters)	Symbol	LL	PI	Classification
B-10	10-6-3	7.92	●			Silty Sand (SM)

Report: SIEVE_5_CURVES_OAK; File: OAK_SR4PITTS.GPJ; 2/19/2005 B-10P

State Route 4 Loveridge to Somersville Road
Loveridge Road Overcrossing
26814910.24000

PARTICLE SIZE DISTRIBUTION CURVES

Figure C-3

URS

URS

ASTM D2166
Unconfined Compressive Strength

Request # 3

Project Name: SR 4 Loveridge to Somersville Rd.

Project Number: 26814910.24000

Location: Pittsburg, CA

Boring/ Sample Number	Moisture Content %	Total Unit Weight pcf	Dry Unit Weight pcf	Unconfined Compressive Strength, psf	Strain at Failure	Sample Description
B7-2-3	10.81	106.7	96.3	NA	NA	Brown fine sandy silty clay
B7-4-3	19.76	124.7	104.1	12074	4.8%	Brown silty clay with calcareous nodules
B7-7-2	22.33	116.6	95.3	NA	NA	Brown sandy silt
B7-11-2	33.45	117.3	87.9	3649	5.8%	Light brown silty clay
B9-2-3	23.80	117.0	94.5	2859	6.8%	Dark brown clay
B9-4-3	17.53	127.9	108.8	2688	5.1%	Brown sandy clay
B9-5-3	24.12	113.9	91.8	331	1.7%	Brown clayey sand/sandy clay
B9-7-2	34.34	114.2	85.0	707	10.0%	Brown fine sandy silty clay

URS

ASTM D2166
Unconfined Compressive Strength

Project Name: SR 4 Loveridge to Somersville Rd.

Request # 3

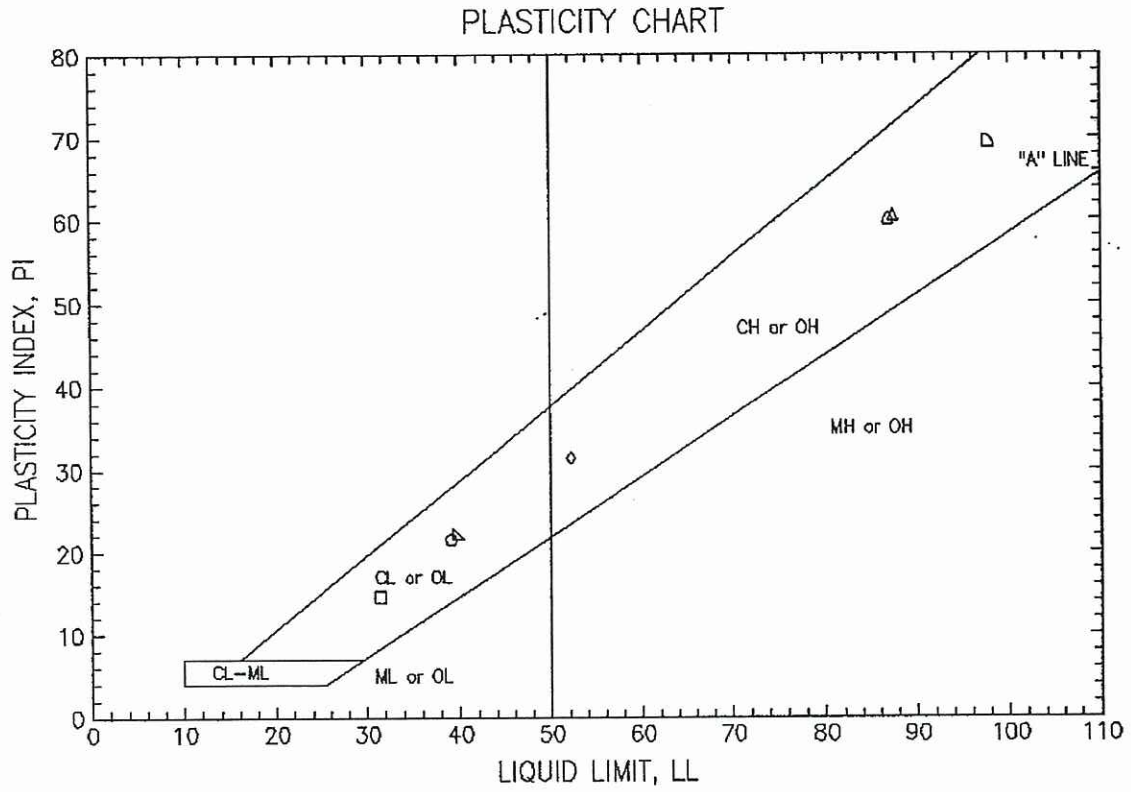
Project Number: 26814910.24000

Location: Pittsburg, CA

Boring/ Sample Number	Moisture Content %	Total Unit Weight pcf	Dry Unit Weight pcf	Unconfined Compressive Strength, psf	Strain at Failure	Sample Description
B9-10-2	36.30	114.8	84.2	1717	10.0%	Gray clay
B9-12-3	20.58	128.9	106.9	3181	10.0%	Brown silty clay
B9-13-3	22.95	126.6	103.0	10620	5.3%	Brown clay
B10-6-3	8.60	98.8	90.9	NA	NA	Light brown silty sand
B10-9-3	26.29	122.3	96.8	2070	10.0%	Light brown sandy silty clay
B10-12-2	34.88	116.4	86.3	3609	2.5%	Light brown silty clay
B10-13-3	20.35	129.4	107.5	NA	NA	Brown sandy silty clay

URS

Project : SR 4 Loveridge to Somersville Rd.
Project No. : 26814910.24000
Location : Pittsburg, CA
Date : Wed Feb 09 2005



Symbol	Boring No.	Sample No.	Liquid Limit	Plastic Limit	Plasticity Index
○	B-7	2-3	39.11	17.58	21.53
△	B-7	11-2	87.41	26.89	60.52
□	B-9	5-3	31.49	16.91	14.58
◇	B-9	7-2	52.21	20.84	31.36
▷	B-9	10-2	86.91	26.87	60.04
◩	B-10	9-3	39.86	17.62	22.25
▷	B-10	12-2	97.79	28.39	69.40

Figure 1

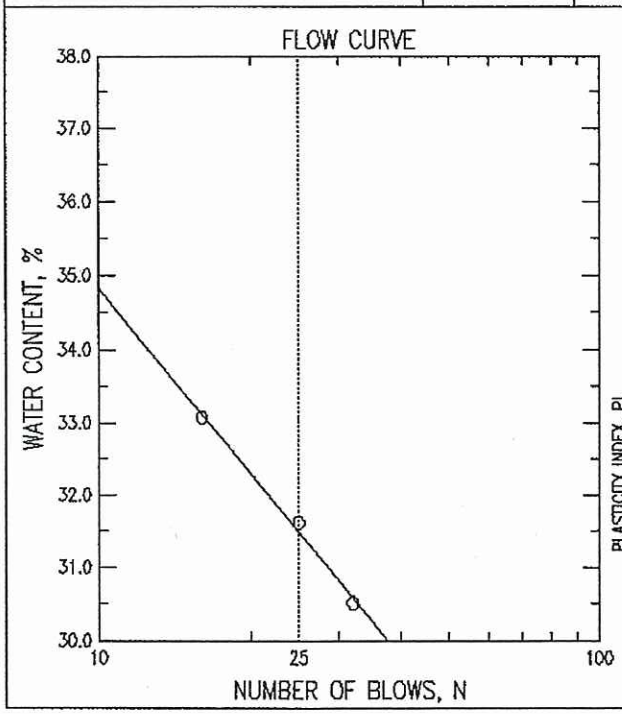
URS

ATTERBERG LIMITS

PROJECT	PROJECT NUMBER	TESTED BY	BORING NUMBER
SR 4 Loveridge to Somersville Rd.	26814910.24000	R. Taraya	B-9
LOCATION		CHECKED BY	SAMPLE NUMBER
Pittsburg, CA		S. Capps	S-3
SAMPLE DESCRIPTION		DATE	FILENAME
Brown clayey sand/sandy clay		Wed Feb 09 2005	B9-S-03

LIQUID LIMIT DETERMINATIONS					
CONTAINER NUMBER	85	78	80		
WT. WET SOIL + TARE	25.22	26.23	26		
WT. DRY SOIL + TARE	21.84	22.68	22.24		
WT. WATER	3.38	3.55	3.76		
TARE WT.	10.76	11.45	10.87		
WT. DRY SOIL	11.08	11.23	11.37		
WATER CONTENT, W_N (%)	30.51	31.61	33.07		
NUMBER OF BLOWS, N	32	25	16		
ONE-POINT LIQUID LIMIT, LL	31.43	31.61	31.33		

PLASTIC LIMIT DETERMINATIONS					
CONTAINER NUMBER	33				
WT. WET SOIL + TARE	34.88				
WT. DRY SOIL + TARE	31.38				
WT. WATER	3.5				
TARE WT.	10.68				
WT. DRY SOIL	20.7				
WATER CONTENT (%)	16.91				



SUMMARY OF RESULTS	
NATURAL WATER CONTENT, W (%)	24.1
LIQUID LIMIT, LL	31.5
PLASTIC LIMIT, PL	16.9
PLASTICITY INDEX, PI	14.6
LIQUIDITY INDEX, LI*	0.50

*LI = (W - PL)/PI

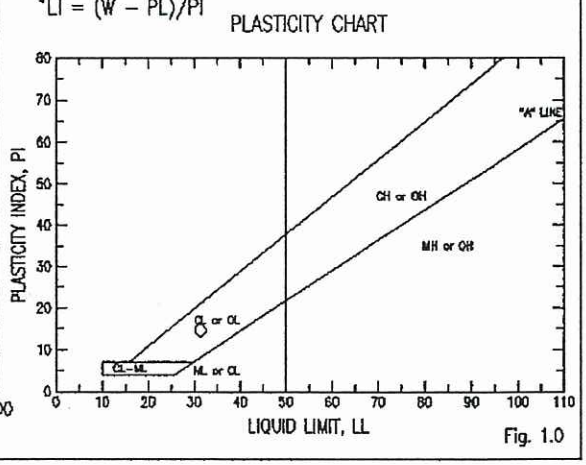


Fig. 1.0

URS

Wed Feb 09 10:04:55 2005

GEOTECHNICAL LABORATORY TEST DATA

Project : SR 4 Loveridge to Somersville Rd.
Project No. : 26814910.24000
Boring No. : B-9
Sample No. : 5-3
Location : Pittsburg, CA
Soil Description : Brown clayey sand/sandy clay
Remarks :

Depth : 21.0 feet
Test Date : 02/08/2005
Test Method : ASTM D4318

Filename : B9-5-03
Elevation : NA
Tested by : R. Taraya
Checked by : S. Capps

Natural Moisture Content

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Moisture Content (%)
1) B9-5-3	0.00	149.77	120.66	24.13

Average Moisture Content = 24.13

Plastic Limit

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Moisture Content (%)
1) 33	10.68	34.88	31.38	16.91

Plastic Limit = 16.91

Liquid Limit

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Number of Drops	Moisture Content (%)
1) 85	10.76	25.22	21.84	32	30.51
2) 78	11.45	26.23	22.68	25	31.61
3) 80	10.87	26.00	22.24	16	33.07

Liquid Limit = 31.49
Plastic Index = 14.58

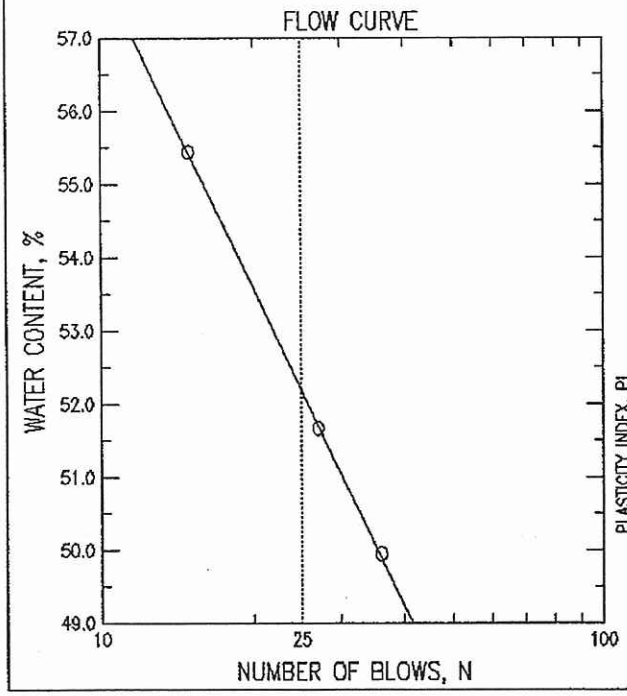
URS

ATTERBERG LIMITS

PROJECT	PROJECT NUMBER	TESTED BY	BORING NUMBER
SR 4 Loveridge to Somersville Rd.	26814910.24000	R. Taraya	B-9
LOCATION Pittsburg, CA		CHECKED BY S. Capps	SAMPLE NUMBER 7-2
SAMPLE DESCRIPTION Brown fine sandy silty clay		DATE Wed Feb 09 2005	FILENAME B9-7-02

LIQUID LIMIT DETERMINATIONS					
CONTAINER NUMBER	31	87	66		
WT. WET SOIL + TARE	25.01	24.51	24.29		
WT. DRY SOIL + TARE	20.57	19.86	19.45		
WT. WATER	4.44	4.65	4.84		
TARE WT.	11.68	10.86	10.72		
WT. DRY SOIL	8.89	9	8.73		
WATER CONTENT, W_N (%)	49.94	51.67	55.44		
NUMBER OF BLOWS, N	36	27	15		
ONE-POINT LIQUID LIMIT, LL	52.20	52.15	52.12		

PLASTIC LIMIT DETERMINATIONS					
CONTAINER NUMBER	41				
WT. WET SOIL + TARE	34.63				
WT. DRY SOIL + TARE	30.67				
WT. WATER	3.96				
TARE WT.	11.67				
WT. DRY SOIL	19				
WATER CONTENT (%)	20.84				



SUMMARY OF RESULTS	
NATURAL WATER CONTENT, W (%)	34.3
LIQUID LIMIT, LL	52.2
PLASTIC LIMIT, PL	20.8
PLASTICITY INDEX, PI	31.4
LIQUIDITY INDEX, LI*	0.43

*LI = (W – PL)/PI

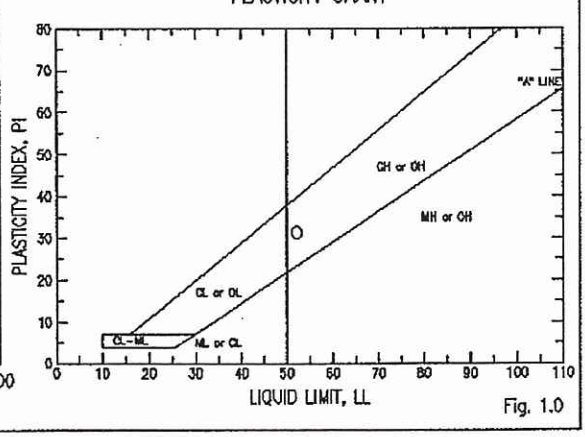


Fig. 1.0

URS

Wed Feb 09 10:08:13 2005 Page : 1

GEOTECHNICAL LABORATORY TEST DATA

Project : SR 4 Loveridge to Somersville Rd.
Project No. : 26814910.24000
Boring No. : B-9
Sample No. : 7-2
Location : Pittsburg, CA
Soil Description : Brown fine sandy silty clay
Remarks :

Depth : 30.5 feet
Test Date : 02/08/2005
Test Method : ASTM D4318

Filename : B9-7-02
Elevation : NA
Tested by : R. Taraya
Checked by : S. Capps

Natural Moisture Content

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Moisture Content (%)
1) B9-7-2	0.00	216.18	160.92	34.34

Average Moisture Content = 34.34

Plastic Limit

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Moisture Content (%)
1) 41	11.67	34.63	30.67	20.84

Plastic Limit = 20.84

Liquid Limit

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Number of Drops	Moisture Content (%)
1) 31	11.68	25.01	20.57	36	49.94
2) 87	10.86	24.51	19.86	27	51.67
3) 66	10.72	24.29	19.45	15	55.44

Liquid Limit = 52.21
Plastic Index = 31.36

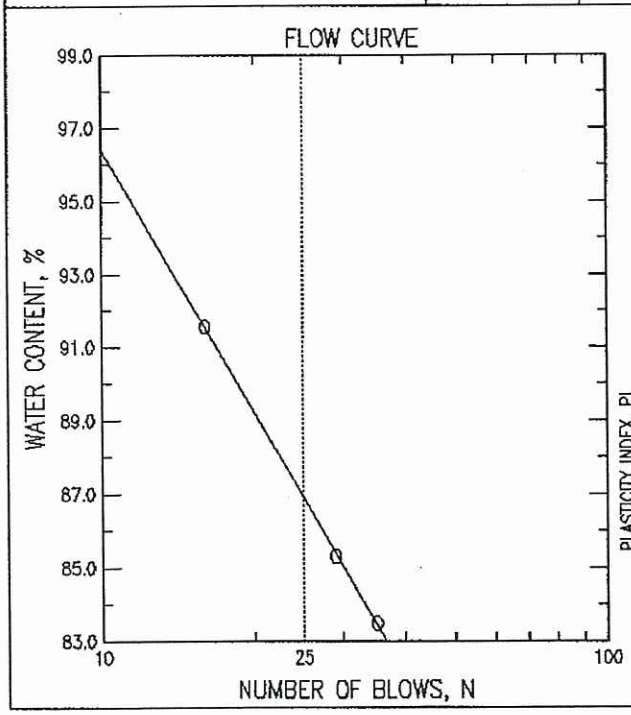
URS

ATTERBERG LIMITS

PROJECT	PROJECT NUMBER	TESTED BY	BORING NUMBER
SR 4 Loveridge to Somersville Rd.	26814910.24000	R. Taraya	B-9
LOCATION		CHECKED BY	SAMPLE NUMBER
Pittsburg, CA		S. Capps	10-2
SAMPLE DESCRIPTION		DATE	FILENAME
Gray clay		Wed Feb 09 2005	B9-10-02

LIQUID LIMIT DETERMINATIONS					
CONTAINER NUMBER	35	42	46		
WT. WET SOIL + TARE	23.23	23.74	25.54		
WT. DRY SOIL + TARE	17.52	17.88	18.93		
WT. WATER	5.71	5.86	6.61		
TARE WT.	10.68	11.01	11.71		
WT. DRY SOIL	6.84	6.87	7.22		
WATER CONTENT, W_N (%)	83.48	85.30	91.55		
NUMBER OF BLOWS, N	35	29	16		
ONE-POINT LIQUID LIMIT, LL	86.95	86.84	86.74		

PLASTIC LIMIT DETERMINATIONS					
CONTAINER NUMBER	83				
WT. WET SOIL + TARE	35.37				
WT. DRY SOIL + TARE	30.35				
WT. WATER	5.02				
TARE WT.	11.67				
WT. DRY SOIL	18.68				
WATER CONTENT (%)	26.87				



SUMMARY OF RESULTS	
NATURAL WATER CONTENT, W (%)	36.3
LIQUID LIMIT, LL	86.9
PLASTIC LIMIT, PL	26.9
PLASTICITY INDEX, PI	60.0
LIQUIDITY INDEX, LI*	0.16

*LI = (W - PL)/PI

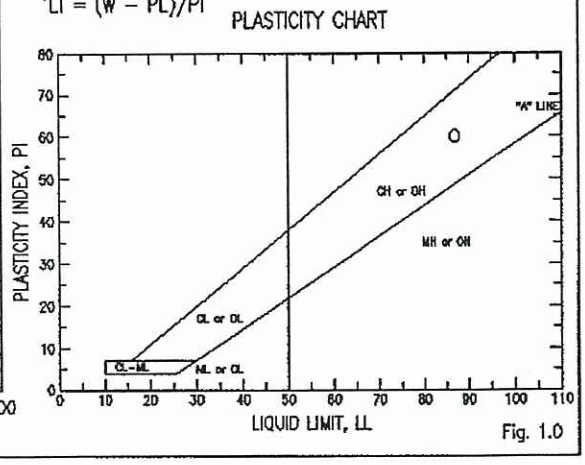


Fig. 1.0

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Wed Feb 09 10:30:58 2005

GEOTECHNICAL LABORATORY TEST DATA

Project : SR 4 Loveridge to Somersville Rd.
Project No. : 26814910.24000
Boring No. : B-9
Sample No. : 10-2
Location : Pittsburg, CA
Soil Description : Gray clay
Remarks :

Depth : 45.5 feet
Test Date : 02/08/2005
Test Method : ASTM D4318

Filename : B9-10-02
Elevation : NA
Tested by : R. Taraya
Checked by : S. Capps

Natural Moisture Content

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Moisture Content (%)
1) B9-10-2	0.00	274.58	201.46	36.30

Average Moisture Content = 36.30

Plastic Limit

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Moisture Content (%)
1) 83	11.67	35.37	30.35	26.87

Plastic Limit = 26.87

Liquid Limit

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Number of Drops	Moisture Content (%)
1) 35	10.68	23.23	17.52	35	83.48
2) 42	11.01	23.74	17.88	29	85.30
3) 46	11.71	25.54	18.93	16	91.55

Liquid Limit = 86.91
Plastic Index = 60.04

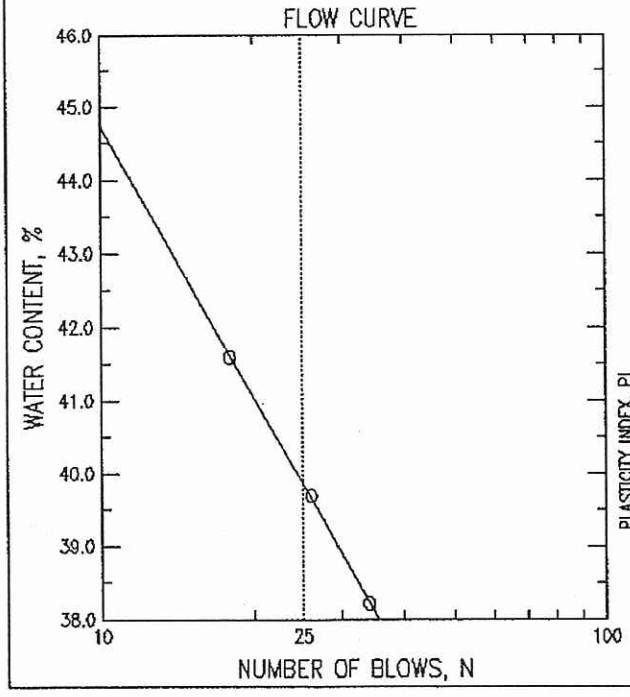
URS

ATTERBERG LIMITS

PROJECT	PROJECT NUMBER	TESTED BY	BORING NUMBER
SR 4 Loveridge to Somersville Rd.	26814910.24000	R. Taraya	B-10
LOCATION		CHECKED BY	SAMPLE NUMBER
Pittsburg, CA		S. Capps	9-3
SAMPLE DESCRIPTION		DATE	FILENAME
Light brown sandy silty clay		Wed Feb 09 2005	B10-9-03

LIQUID LIMIT DETERMINATIONS					
CONTAINER NUMBER	82	32	10		
WT. WET SOIL + TARE	26.12	25.88	27.31		
WT. DRY SOIL + TARE	21.89	21.55	22.71		
WT. WATER	4.23	4.33	4.6		
TARE WT.	10.82	10.64	11.65		
WT. DRY SOIL	11.07	10.91	11.06		
WATER CONTENT, W_N (%)	38.21	39.69	41.59		
NUMBER OF BLOWS, N	34	26	18		
ONE-POINT LIQUID LIMIT, LL	39.66	39.88	39.97		

PLASTIC LIMIT DETERMINATIONS					
CONTAINER NUMBER	62				
WT. WET SOIL + TARE	38.54				
WT. DRY SOIL + TARE	34.43				
WT. WATER	4.11				
TARE WT.	11.1				
WT. DRY SOIL	23.33				
WATER CONTENT (%)	17.62				



SUMMARY OF RESULTS	
NATURAL WATER CONTENT, W (%)	26.3
LIQUID LIMIT, LL	39.9
PLASTIC LIMIT, PL	17.6
PLASTICITY INDEX, PI	22.2
LIQUIDITY INDEX, LI*	0.39

*LI = (W - PL)/PI

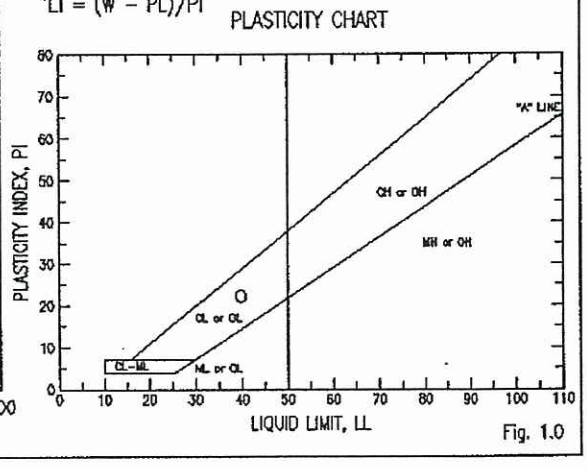


Fig. 1.0

URS

Wed Feb 09 10:34:24 2005 Page : 1

GEOTECHNICAL LABORATORY TEST DATA

Project : SR 4 Loveridge to Somersville Rd.
Project No. : 26814910.24000
Boring No. : B-10
Sample No. : 9-3
Location : Pittsburg, CA
Soil Description : Light brown sandy silty clay
Remarks :

Depth : 41.0 feet
Test Date : 02/08/2005
Test Method : ASTM D4318

Filename : B10-9-03
Elevation : NA
Tested by : R. Taraya
Checked by : S. Capps

Natural Moisture Content

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Moisture Content (%)
1) B10-9-3	0.00	279.19	221.07	26.29

Average Moisture Content = 26.29

Plastic Limit

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Moisture Content (%)
1) 62	11.10	38.54	34.43	17.62

Plastic Limit = 17.62

Liquid Limit

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Number of Drops	Moisture Content (%)
1) 82	10.82	26.12	21.89	34	38.21
2) 32	10.64	25.88	21.55	26	39.69
3) 10	11.65	27.31	22.71	18	41.59

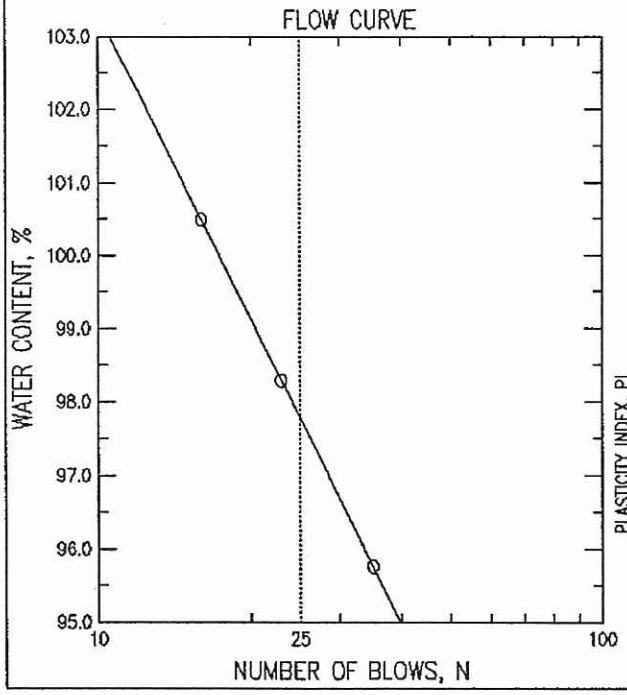
Liquid Limit = 39.86
Plastic Index = 22.25

URS

ATTERBERG LIMITS

PROJECT	PROJECT NUMBER	TESTED BY	BORING NUMBER
SR 4 Loveridge to Somersville Rd.	26814910.24000	R. Taraya	B-10
LOCATION		CHECKED BY	SAMPLE NUMBER
Pittsburg, CA		S. Capps	12-2
SAMPLE DESCRIPTION		DATE	FILENAME
Light brown silty clay		Wed Feb 09 2005	B10-12-2

LIQUID LIMIT DETERMINATIONS					
CONTAINER NUMBER	30	34	36		
WT. WET SOIL + TARE	24.86	23.77	23.84		
WT. DRY SOIL + TARE	18.09	17.47	17.71		
WT. WATER	6.77	6.3	6.13		
TARE WT.	11.02	11.06	11.61		
WT. DRY SOIL	7.07	6.41	6.1		
WATER CONTENT, W_N (%)	95.76	98.28	100.49		
NUMBER OF BLOWS, N	35	23	16		
ONE-POINT LIQUID LIMIT, LL	99.74	97.30	95.21		
PLASTIC LIMIT DETERMINATIONS					
CONTAINER NUMBER	67				
WT. WET SOIL + TARE	29.85				
WT. DRY SOIL + TARE	25.66				
WT. WATER	4.19				
TARE WT.	10.9				
WT. DRY SOIL	14.76				
WATER CONTENT (%)	28.39				



SUMMARY OF RESULTS	
NATURAL WATER CONTENT, W (%)	34.9
LIQUID LIMIT, LL	97.8
PLASTIC LIMIT, PL	28.4
PLASTICITY INDEX, PI	69.4
LIQUIDITY INDEX, LI*	0.09

*LI = (W - PL)/PI

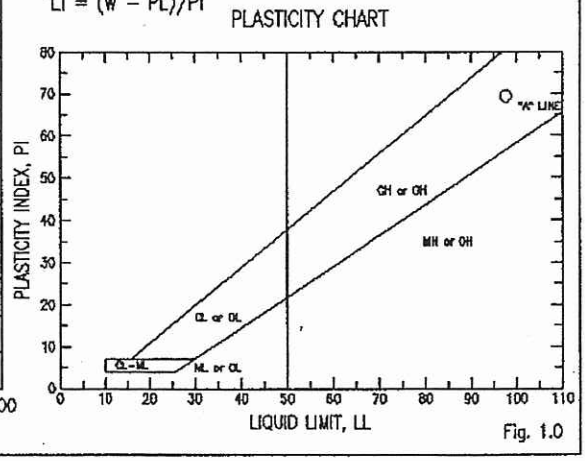


Fig. 1.0

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Wed Feb 09 10:39:00 2005 Page : 1

GEOTECHNICAL LABORATORY TEST DATA

Project : SR 4 Loveridge to Somersville Rd.
Project No. : 26814910.24000
Boring No. : B-10
Sample No. : 12-2
Location : Pittsburg, CA
Soil Description : Light brown silty clay
Remarks :

Depth : 60.5 feet
Test Date : 02/08/2005
Test Method : ASTM D4318

Filename : B10-12-2
Elevation : NA
Tested by : R. Taraya
Checked by : S. Capps

Natural Moisture Content

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Moisture Content (%)
1) B10-12-2	0.00	292.89	217.15	34.88

Average Moisture Content = 34.88

Plastic Limit

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Moisture Content (%)
1) 67	10.90	29.85	25.66	28.39

Plastic Limit = 28.39

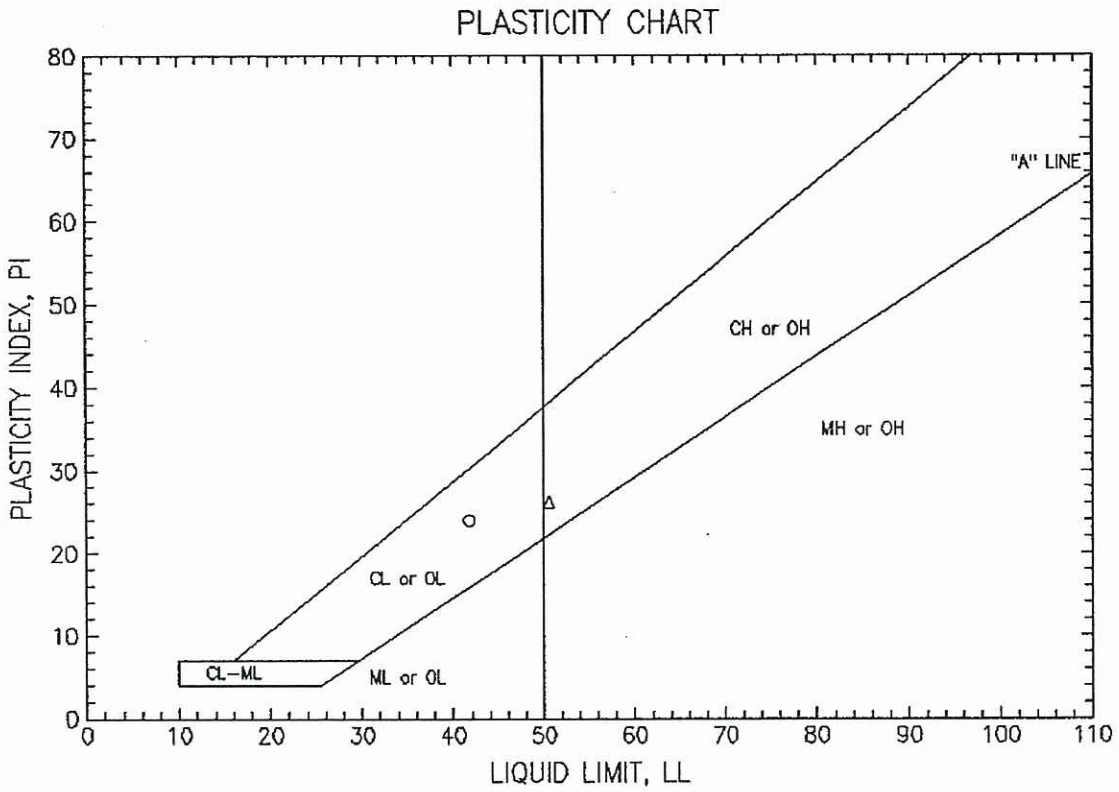
Liquid Limit

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Number of Drops	Moisture Content (%)
1) 30	11.02	24.86	18.09	35	95.76
2) 34	11.06	23.77	17.47	23	98.28
3) 36	11.61	23.84	17.71	16	100.49

Liquid Limit = 97.79
Plastic Index = 69.40

URS

Project : SR 4 Loveridge to Somersville Rd.
Project No. : 26814910.24000
Location : Pittsburg, CA
Date : Fri Feb 11 2005



Symbol	Boring No.	Sample No.	Liquid Limit	Plastic Limit	Plasticity Index
O	B-7	6-2	41.77	17.81	23.96
Δ	B-9	13-3	50.57	24.33	26.24

Figure 1

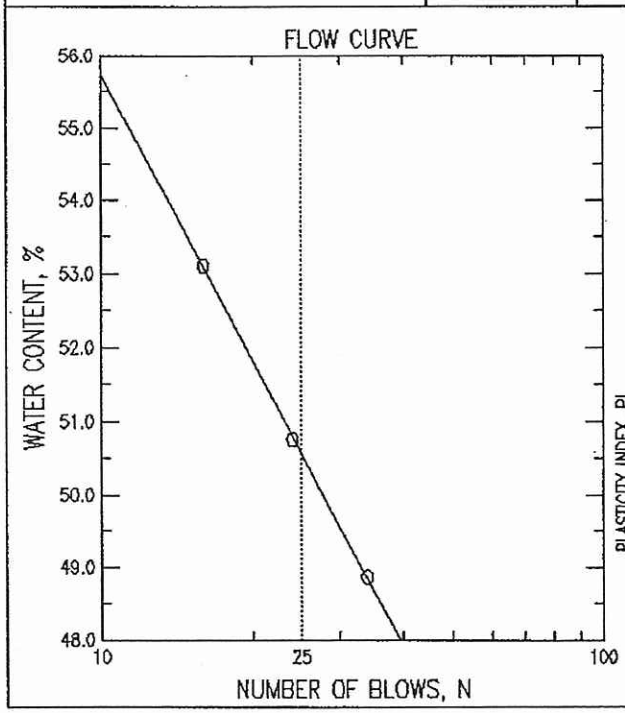
URS

ATTERBERG LIMITS

PROJECT	PROJECT NUMBER	TESTED BY	BORING NUMBER
SR 4 Loveridge to Somersville Rd.	26814910.24000	R. Taraya	B-9
LOCATION Pittsburg, CA		CHECKED BY S. Capps	SAMPLE NUMBER 13-3
SAMPLE DESCRIPTION Brown clay		DATE Fri Feb 11 2005	FILENAME B9-13-03

LIQUID LIMIT DETERMINATIONS					
CONTAINER NUMBER	73	84	74		
WT. WET SOIL + TARE	23.97	24.98	24.67		
WT. DRY SOIL + TARE	19.89	20.28	19.96		
WT. WATER	4.08	4.7	4.71		
TARE WT.	11.54	11.02	11.09		
WT. DRY SOIL	8.35	9.26	8.87		
WATER CONTENT, W_N (%)	48.86	50.76	53.10		
NUMBER OF BLOWS, N	34	24	16		
ONE-POINT LIQUID LIMIT, LL	50.71	50.51	50.31		

PLASTIC LIMIT DETERMINATIONS					
CONTAINER NUMBER	31				
WT. WET SOIL + TARE	32.68				
WT. DRY SOIL + TARE	28.57				
WT. WATER	4.11				
TARE WT.	11.68				
WT. DRY SOIL	16.89				
WATER CONTENT (%)	24.33				



SUMMARY OF RESULTS	
NATURAL WATER CONTENT, W (%)	23.0
LIQUID LIMIT, LL	50.6
PLASTIC LIMIT, PL	24.3
PLASTICITY INDEX, PI	26.2
LIQUIDITY INDEX, LI*	-0.05

*LI = (W - PL)/PI

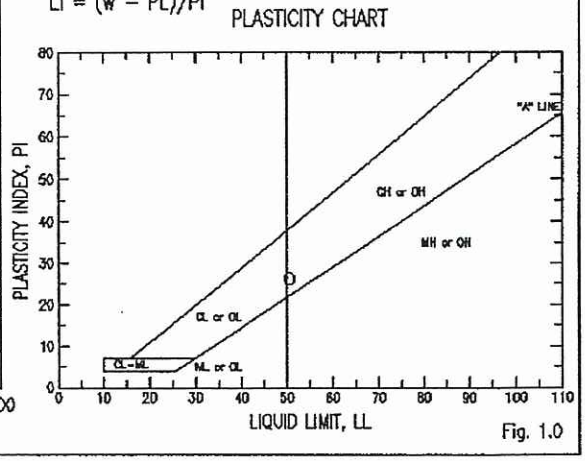


Fig. 1.0

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Fri Feb 11 09:40:40 2005

GEOTECHNICAL LABORATORY TEST DATA

Project : SR 4 Loveridge to Somersville Rd.
Project No. : 26814910.24000
Boring No. : B-9
Sample No. : 13-3
Location : Pittsburg, CA
Soil Description : Brown clay
Remarks :

Depth : 71.0 feet
Test Date : 02/10/2005
Test Method : ASTM D4318

Filename : B9-13-03
Elevation : NA
Tested by : R. Taraya
Checked by : S. Capps

Natural Moisture Content

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Moisture Content (%)
1) B9-13-3	0.00	290.72	236.45	22.95

Average Moisture Content = 22.95

Plastic Limit

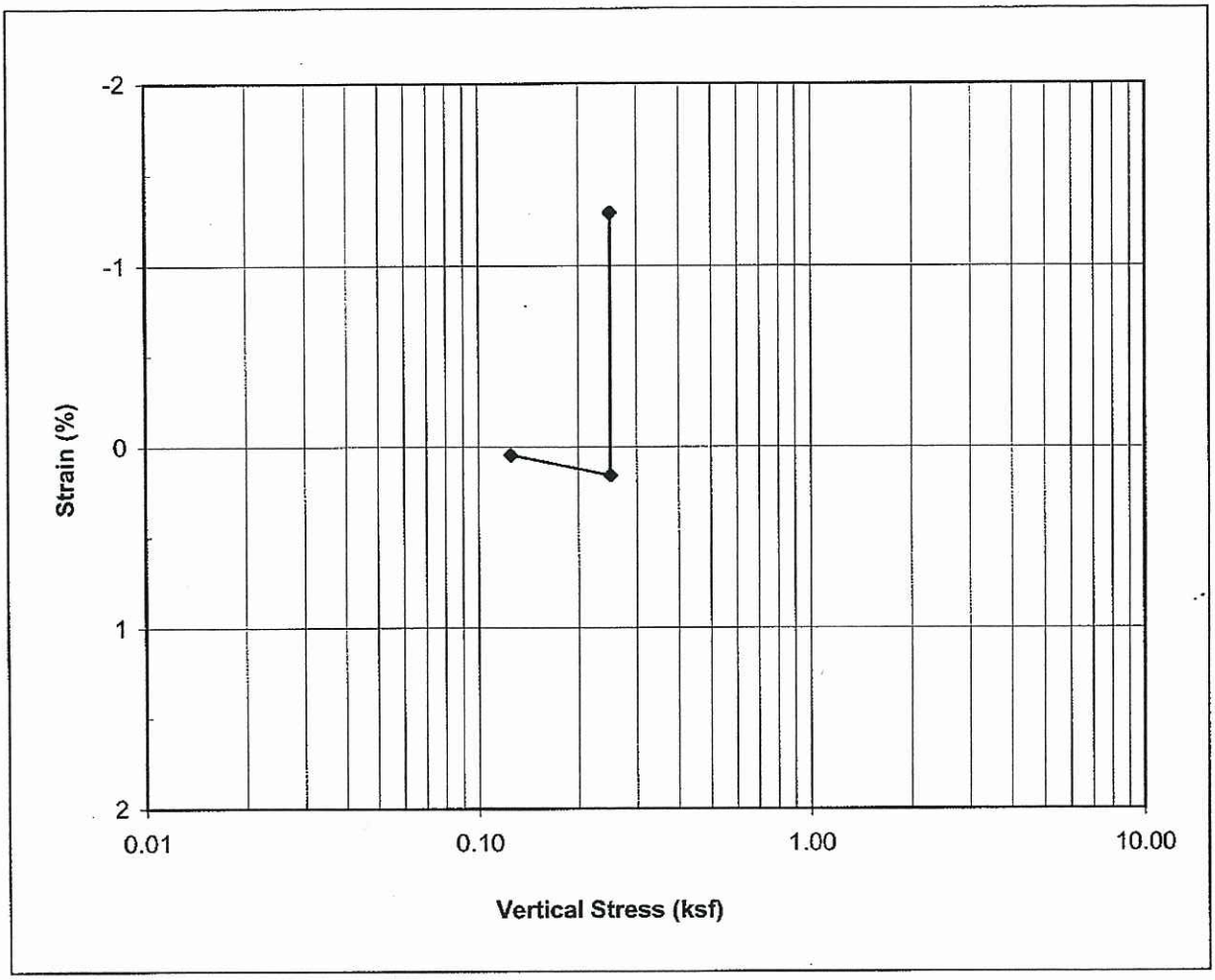
Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Moisture Content (%)
1) 31	11.68	32.68	28.57	24.33

Plastic Limit = 24.33

Liquid Limit

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Number of Drops	Moisture Content (%)
1) 73	11.54	23.97	19.89	34	48.86
2) 84	11.02	24.98	20.28	24	50.76
3) 74	11.09	24.67	19.96	16	53.10

Liquid Limit = 50.57
Plastic Index = 26.24



Boring: B-9 Sample: 9-2 Depth, ft: 40.5

Description: Brown fine sandy clay

	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est.	Liquid Limit	Plasticity Index
Initial	35.42	113.7	83.9	1.007	95.0	0.4415	1.938	2.700	NA	NA
Final	38.24	114.6	82.9	1.033	100.0	0.4472				

Project: **SR 4**
Project #: **26814910**
Date: **02/10/05**

Swell/Settlement Test

Figure:

Swell/Settlement Test
ASTM D4546

Project Name: SR 4 Date: 02/10/05

Project Number: 26814910 .24000

Boring Number: B-9 **Sample Number:** 9-2

Depth, ft: 40.5

Location: Pittsburg, CA

Load, Grams	Load, ksf	Load, tsf	Initial Dial, Inches	Frame Corr.	Dial Change	Final Dial, Inches	Change in Height, in.	Strain, Incre., %	Strain, Cum., %
125	0.13	0.063	0.1500	0.0003	0.0005	0.1495	0.0002	0.05	0.05
250	0.25	0.125	0.1495	0.0005	0.0010	0.1485	0.0005	0.11	0.16
250	0.25	0.125	0.1485	0.0000	-0.0064	0.1549	-0.0064	-1.45	-1.29
					Total	Change	-0.0057		
					in	Height, in.			

Swell/Settlement Test
ASTM D4546

Frame 7

Project Name: SR 4 **Date:** 02/10/05

Project Number: 26814910.24000

Boring Number: B-9 **Sample Number:** 9-2

Depth, ft: 40.5 **Description:** Brown fine sandy clay

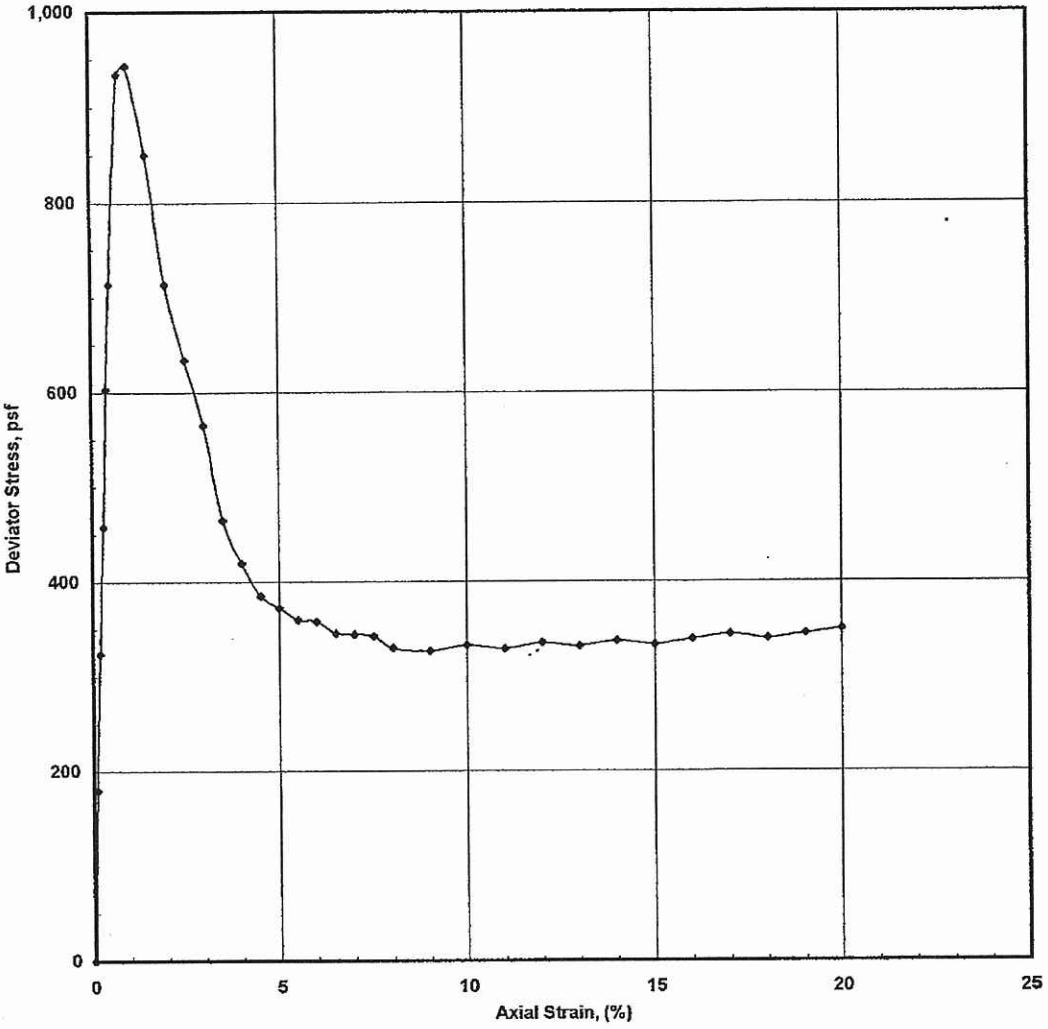
Location: Pittsburg, CA **Liquid Limit:** NA

Plastic Limit: NA

Plasticity Index: NA

Tested By: S. Capps **Reviewed By:** R. Taraya

Water Content Determination	Soil Adjacent to Sample	Sample at Start of Test	Sample at End of Test
Wet Soil + Tare, grams	171.57	266.74	267.55
Dry Soil + Tare, grams	149.38	256.57	256.57
Tare, grams	86.69	227.86	227.86
Weight of Water, grams	22.19	10.17	10.98
Weight of Dry Soil, grams	62.69	28.71	28.71
Water Content, %	35.40	35.42	38.24
Height of Gage Block, in:	0.7160	Dial Reading on Gage Block, in:	0.4965
Dial Reading on Sample, in:	0.2220		
Height of Sample, initial, in:	0.4415	Height of Sample, Final, in:	0.4472
Change in Height during Test, in:	-0.0057	Estimated Specific Gravity:	2.70
Diameter of Ring, In:	1.938	Ring Number	R-6
Initial Area of Sample, cm^2:	19.03	Volume of Solids, Vs=Ws/Gs:	10.63
Volume of Sample, Initial, cm^3:	21.34	Volume of Sample, Final, cm^3	21.62
Volume of Voids, Initial, Vei, cm^3	10.71	Volume of Voids, Final, Vef, cm^3:	10.98
Volume of Water, Initial, Wwi, cm^3:	10.17	Volume of Water, Final, Wwf, cm^3:	10.98
Degree of Saturation, Initial, %	95.0	Degree of Saturation, Final, %	100.0
Total Unit Weight, Initial, pcf:	113.7	Total Unit Weight, Final, pcf:	114.6
Dry Unit Weight, Initial, pcf:	83.9	Dry Unit Weight, Final, pcf:	82.9
Initial Void Ratio:	1.0071	Final Void Ratio:	1.0330



Description: Brown clayey silty sand

Boring Number	Sample Number	Sample Depth (feet)	Dry Unit Weight (pcf)	Initial Moisture Content (%)	Specific Gravity (assumed)	Void Ratio	Initial Saturation (%)	Height/ Diameter Ratio	Rate of Shearing (%/min)	Confining Pressure (psf)	Peak Deviator Stress (psf)	Peak Shear Stress (psf)
B-9	3	11.0	90.6	20.3	2.65	0.825	65.1	2.08	0.75	1,300	943	472

Project Name: SR 4	**UNCONSOLIDATED UNDRAINED TRIAXIAL TEST STRESS VS. STRAIN ASTM D2850**	URS
Project Number: 26814910.24000		Figure No.
Location: Pittsburg, , CA		

URS

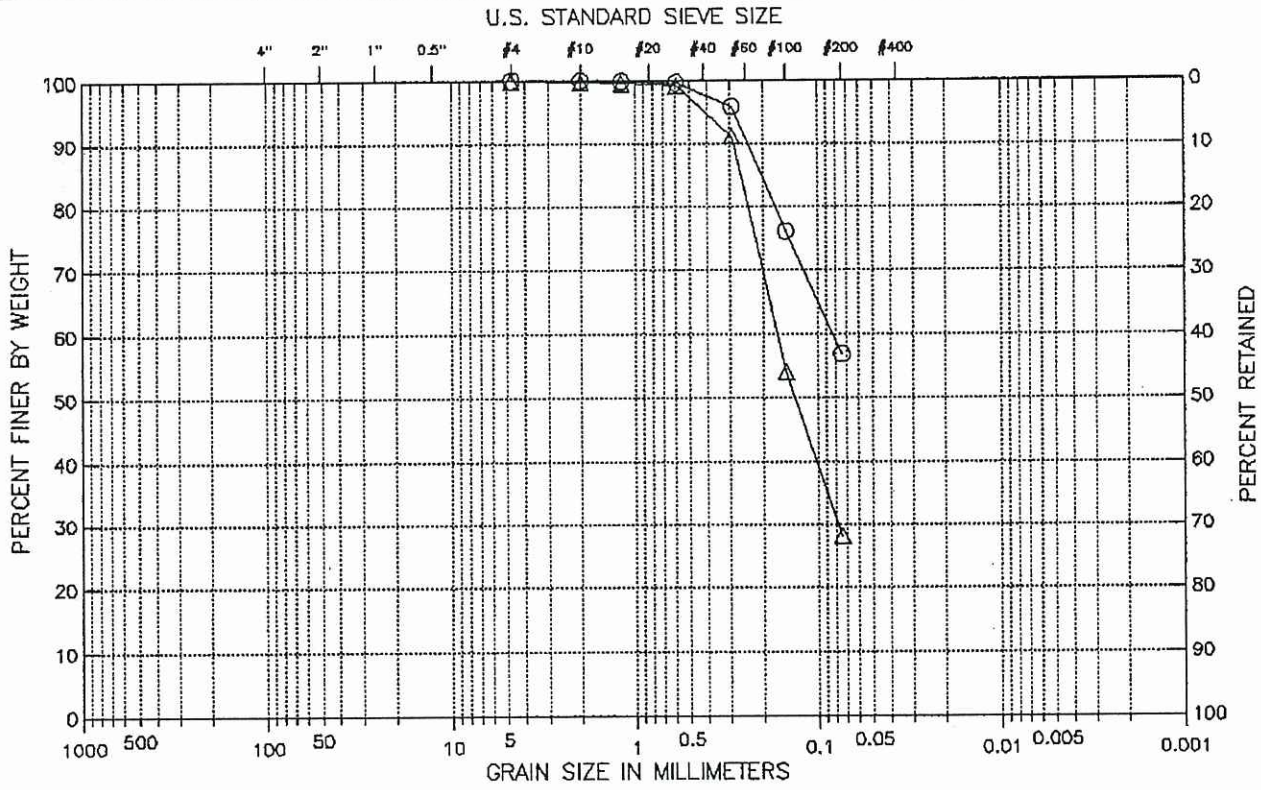
Unconsolidated Undrained Triaxial Test
ASTM D2850

Project Name:	SR 4 Loveridge to Somersville Rd.
Project Number:	26814910.24000
Location:	Pittsburg, CA
Boring Number:	B-9
Sample Number:	3
Depth, ft:	11.0
Date Tested:	02/07/05
Description:	Brown clayey silty sand
Sample Diameter, in:	2.860

Total Unit Weight, pcf:	109.0
Dry Unit Weight, pcf:	90.6
Moisture Content, %:	20.28
Saturation, %:	65.1
Void Ratio:	0.825
Confining Pressure, psf:	1,300
Peak Deviator Stress, psf:	943
Strain @ Failure, %:	1.00
Sample Height, in:	5.945

Dial Reading, inches	Load Reading, pounds	Axial Strain, percent	Deviator Stress, psf
0.000	0.0	0.00	0.0
0.006	8.0	0.10	179
0.012	14.5	0.20	324
0.018	20.5	0.30	458
0.024	27.0	0.40	603
0.030	32.0	0.50	714
0.045	42.0	0.75	934
0.059	42.5	1.00	943
0.089	38.5	1.50	850
0.119	32.5	2.00	714
0.149	29.0	2.50	634
0.178	26.0	3.00	565
0.208	21.5	3.50	465
0.238	19.5	4.00	420
0.268	18.0	4.50	385
0.297	17.5	5.00	373
0.327	17.0	5.50	360
0.357	17.0	6.00	358
0.386	16.5	6.50	346
0.416	16.5	7.00	344
0.446	16.5	7.50	342
0.476	16.0	8.00	330
0.535	16.0	9.00	326
0.595	16.5	10.00	333
0.654	16.5	11.00	329
0.713	17.0	12.00	335
0.773	17.0	13.00	332
0.832	17.5	14.00	337
0.892	17.5	15.00	333
0.951	18.0	16.00	339
1.011	18.5	17.00	344
1.070	18.5	18.00	340
1.130	19.0	19.00	345
1.189	19.5	20.00	350

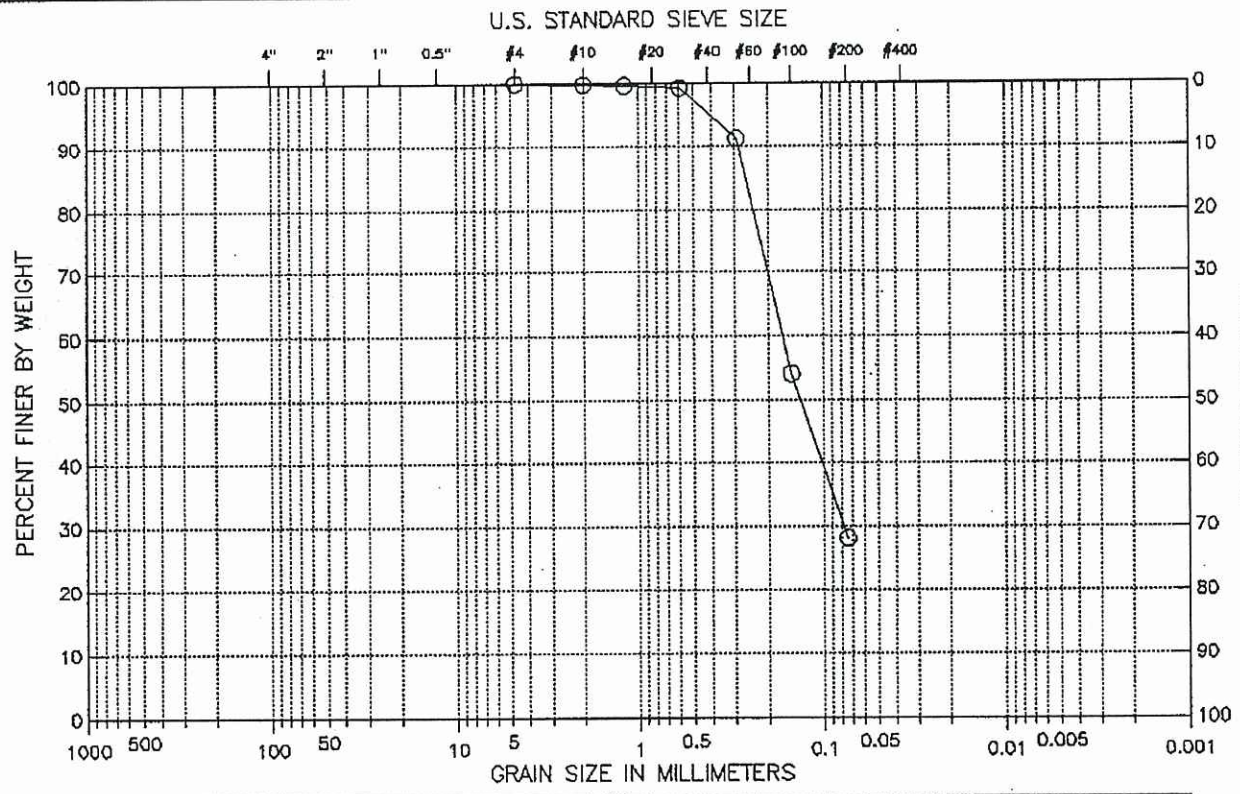
Project : SR 4 Loveridge to Somersville Rd.
Project No.: 26814910.24000
Location: Pittsburg, CA
Date : Tue Feb 08 2005



Symbol	Boring No.	Sample No.	Depth	Filename	Classification	/ Description
⊖	B-7	7-2	30.5 feet	B7-7-02	ML	Sandy silt
△	B-10	6-3	26.0 feet	B10-6-03	SM	Silty sand

Figure 1

	Boring No. : B-10 Sample No: 6-3 Tested by : R. Taraya Filename : B10-6-03	Project : SR 4 Loveridge to Somersville Rd. Project No.: 26814910.24000 Location: Pittsburg, CA Date : Tue Feb 08 2005



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Classification :
(SM) Silty sand
Visual Description :
Light brown silty sand

Remarks :
Depth: 26.0 feet

Figure 1

URS

Tue Feb 08 10:08:39 2005

GEOTECHNICAL LABORATORY TEST DATA

Project : SR 4 Loveridge to Somersville Rd.
Project No. : 26814910.24000
Boring No. : B-10
Sample No. : 6-3
Location : Pittsburg, CA
Soil Description : Light brown silty sand
Remarks : Depth: 26.0 feet

Depth : 26.0 feet
Test Date : 02/08/2005
Test Method : ASTM D422

Filename : B10-6-03
Elevation : NA
Tested by : R. Taraya
Checked by : S. Capps

COARSE SIEVE SET

Sieve Mesh	Sieve Openings Inches	Millimeters	Weight Retained (gm)	Cumulative Weight Retained (gm)	Percent Finer (%)
#4	0.187	4.75	0.00	0.00	100
#10	0.079	2.00	0.56	0.56	100
#16	0.047	1.19	0.36	0.92	100
#30	0.023	0.60	1.21	2.13	99
#50	0.012	0.30	22.39	24.52	91
#100	0.006	0.15	102.94	127.46	54
#200	0.003	0.07	72.32	199.78	28

Total Dry Weight of Sample = 277.81

D85 : 0.2633 mm
D60 : 0.1661 mm
D50 : 0.1334 mm
D30 : 0.0779 mm
D15 : N/A
D10 : N/A

Soil Classification
ASTM Group Symbol : SM
ASTM Group Name : Silty sand
AASHTO Group Symbol : A-2-4(0)
AASHTO Group Name : Silty Gravel and Sand

Appendix D
Corrosivity Test Results

STATE ROUTE 4 WIDENING PROJECT
WEST OF LOVERIDGE ROAD, PITTSBURG, CA
TO SOMERSVILLE ROAD, ANTIOCH, CA

LOVERIDGE ROAD OVERCROSSING
FOUNDATION INVESTIGATION REPORT

Prepared for:

URS CORPORATION
1333 Broadway, Suite 800
Oakland, CA 94612

Prepared By:

V&A CONSULTING ENGINEERS INC.
Lake Merritt Plaza
1999 Harrison Street, Suite 975
Oakland, CA 94612

March 2006

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EXECUTIVE SUMMARY

V&A Consulting Engineers (V&A) was retained by URS Corporation to perform a soil corrosivity investigation for the proposed State Route 4 Highway Widening Project between Loveridge Road in Pittsburg, CA and Somersville Road in Antioch, CA. The objective of this investigation is to measure various soil parameters and evaluate the results to determine the corrosivity of the soil at the proposed Loveridge Road overpass. Corrosivity was determined at the Loveridge Road overpass site to depths ranging from 0 to 6 meters (0 to 20 feet) below grade.

This report provides recommendations for corrosion control for the various structural foundation materials under consideration. This foundation investigation is in accordance with Caltrans Corrosion Guidelines dated September 2003 (Guidelines). The materials considered as part of this investigation include buried reinforced concrete, prestressed concrete piles, cast in place concrete piles and steel pipe piles.

The California Department of Transportation, Division of Engineering Services, Materials Engineering and Testing Services, Corrosion Technology Branch has published Corrosion Guidelines (Guidelines) to define corrosive soil. The Guidelines consider soil to be corrosive to structural elements (steel piles and steel reinforced concrete) if one or more of the following conditions exist for representative water or soil samples:

> ***"Chloride concentration is 500 ppm (mg/kg) or greater, sulfate concentration is 2,000 (mg/kg) or greater or the pH is 5.5 or less."***

Evaluation of the soil environment is reported in terms of potential damage to the structures due to corrosion. Soil resistivity measurements were conducted in the field during the initial stages of this project. In addition, soil samples collected by URS during the geotechnical investigation were provided to V&A to perform laboratory testing for chemical analysis. The soil samples were analyzed for 'as-received' resistivity, minimum resistivity, pH, water soluble chloride ion concentration and water soluble sulfate ion concentration.

The water soluble chloride ion concentration in the soil borings analyzed ranges from below the detection level of 10 milligrams per kilogram (mg/kg) to a maximum of 48 mg/kg. The water soluble sulfate ion concentration in the soil borings analyzed ranges from below the detection level of 10 mg/kg to a maximum of 210 mg/kg.

The pH of the soil samples analyzed ranges from 8.0 to 8.5.

The results of the corrosivity analysis indicate that the soils are considered to be *non-corrosive,* in accordance with the Guidelines.

CONCLUSIONS

- The chloride ion concentration in the soil borings analyzed is less than 50 mg/kg.
- The sulfate ion concentration in the soil borings analyzed is less than 210 mg/kg.
- The pH in the soil borings analyzed is greater than 8.0.
- The soil is considered to be *non-corrosive* to buried reinforced concrete, cast in place piles, steel pipe piles and prestressed concrete piles in accordance with the Guidelines.

RECOMMENDATIONS

Based on the test data and review of the project requirements, specific recommendations for each structural foundation material alternative are listed below:

Buried Reinforced Concrete Structures, Prestressed Concrete Piles and Cast in Place Concrete Piles

Buried concrete structures should be constructed of durable concrete as described in Section 8.22 of the Caltrans Bridge Design Specifications and ACI Standards 201.2R and 222R. These recommendations include, but are not limited to, the following:

- The water/cement ratio should not exceed 0.50.
- A concrete cover of a minimum of 5 centimeters should be applied over all steel reinforcement.
- Salt-free sand and potable water free of organic matter, oil and salts should be used in the concrete mix. Chloride ion concentration shall not exceed 50 ppm and sulfate ion concentration shall not exceed 50 ppm.

Steel Pipe Piles

- The soil is classified as *non-corrosive*, as indicated by the Guidelines and a sacrificial corrosion allowance is not required.

Metallic Pipelines and Metallic Electrical Conduit

- Underground pressurized metallic pipelines and metallic electrical conduit associated with the new overpass may require a combination of coatings or cathodic protection for

corrosion protection. Specific recommendations will be based on the critical nature of each structure.

TEST METHODS

In attempting to predict corrosion problems associated with a particular type of structure prior to installation, it is necessary to investigate the soil conditions the structure will encounter. Since corrosion is an electrochemical process accompanied by current flow, the electrochemical characteristics of a soil are of primary importance when evaluating corrosivity.

In-Situ Soil Resistivity

In-situ resistivity of the soil was measured at two locations at the Loveridge Road Overpass site. Figure 1 shows the project vicinity map. Figure 2 shows the in-situ soil resistivity and soil boring locations.

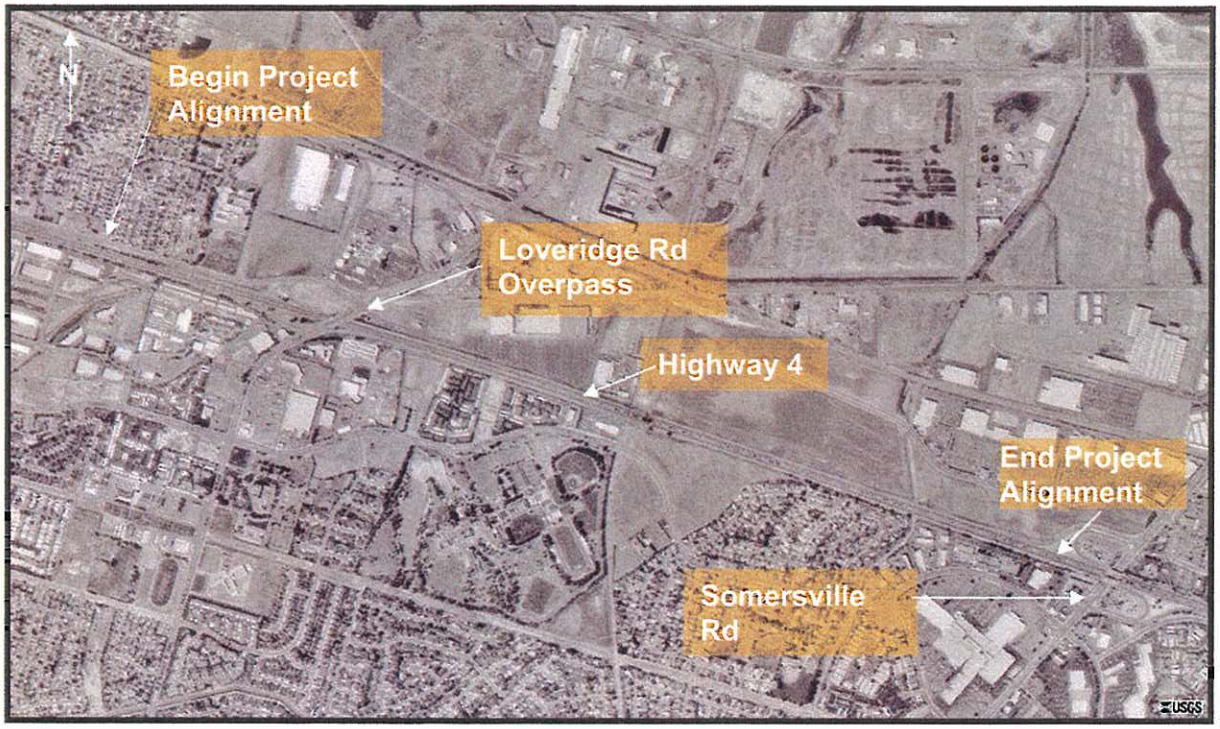

Figure 1 - Vicinity and Project Site Map[1]

[1] Map courtesy of the USGS TerraServer Team

Figure 2 - Soil Resistivity Testing and Soil Sample Locations[2]

In-situ soil resistivity was measured using the Wenner 4-Electrode Method, with a Model 400 Soil Resistance Meter, manufactured by Nilsson Electrical Laboratory, Inc. The Wenner 4-Electrode Method involves the use of four metal probes or electrodes, driven into the ground along a straight line, equidistant from each other, as shown in Figure 3.

[2] Map courtesy of the USGS TerraServer Team

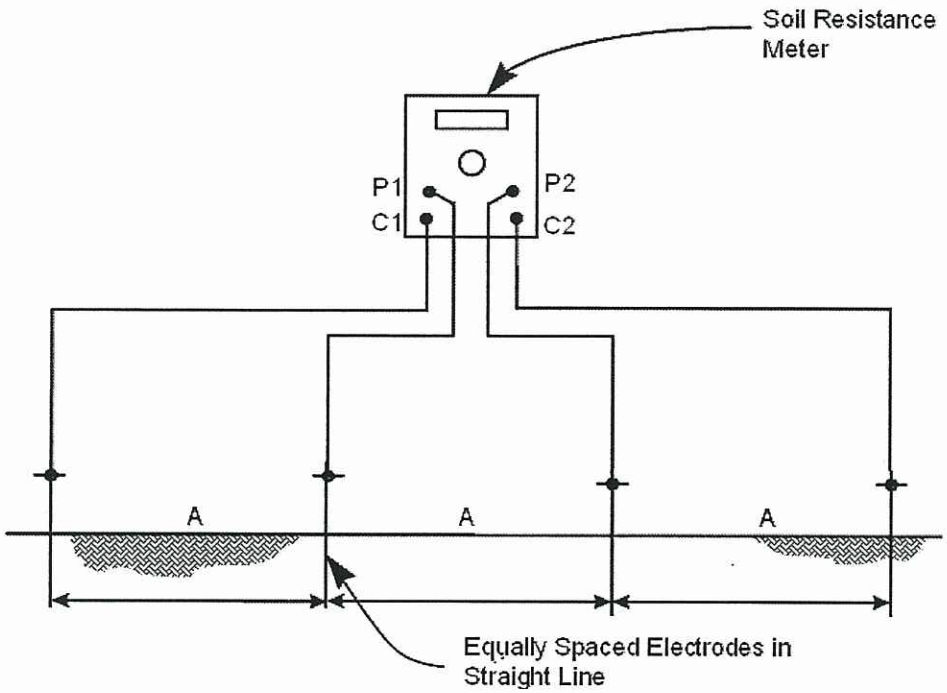

Figure 3 - Soil Resistivity Measurement Using the Wenner 4-Electrode Method

An alternating current from the Soil Resistance Meter causes a current to flow through the soil between the outside electrodes, C1 and C2. Due to the resistance of the soil, the current creates a voltage gradient, which is proportional to the average resistance of the soil mass to a depth equal to the distance between electrodes. The voltage drop is then measured across pins, P1 and P2. Resistivity of the soil is then computed from the instrument reading according to the following formula:

$$\rho = 2 \cdot \pi \cdot A \cdot R$$

Where:

ρ	=	soil resistivity (ohm-cm)
A	=	distance between electrodes (cm)
R	=	soil resistance, instrument reading (ohms)
π	=	3.14 (approx.)

Soil resistance is measured with electrodes spaced 1.5, 3, 4.5, and 6 meters apart. The resistivity is calculated using the above formula and the values obtained represent the average resistivity of the soil to a depth equal to the electrode spacing. An additional method of calculating the soil resistivity using the data from the Wenner 4-Electrode Method is the Barnes-Layer Resistivity Calculation. The Barnes Layer Calculation is used to determine the resistivity of the soil for each soil layer. While the

Wenner 4-Electrode Method at 3-meter electrode spacing will consider all 3 meters of soil below the surface, the Barnes-Layer method will consider the resistivity of only the layer of soil between 1.5 and 3 meters of soil below the surface. This method assumes the soil layers are a uniform thickness and parallel to the surface.

$$\rho_{b-a} = KR_{b-a} \qquad \text{and} \qquad \frac{1}{R_{b-a}} = \frac{1}{R_a} - \frac{1}{R_b}$$

Where:

ρ_{b-a}	=	Soil resistivity of layer depth b-a (ohm-cm)
a	=	Soil depth to top of layer (cm)
b	=	Soil depth to bottom of layer (cm)
R_a	=	Soil resistance read at depth a (ohms)
R_b	=	Soil resistance read at depth b (ohms)
R_{b-a}	=	Resistance of soil layer from a to b (cm)
K	=	2 π (b-a)

Barnes Layer resistivity is calculated for layers 0 to 1.5, 1.5 to 3, 3 to 4.5, and 4.5 to 6 meters below grade. The results of both methods are listed in Table 1.

Laboratory Analysis of Soil Samples

To supplement the in-situ resistivity data, soil borings were obtained from the geotechnical investigation. Minimum soil resistivity of the selected soil borings was measured using a soil box, as shown in Figure 4.

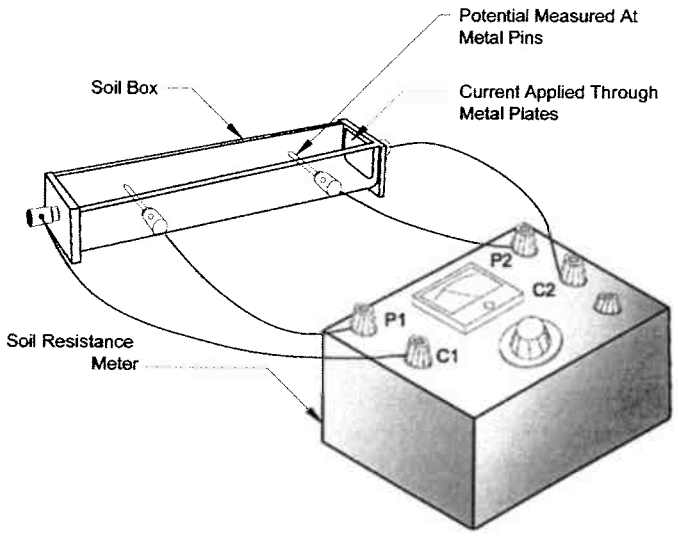

Figure 4 – Minimum Soil Resistivity Measurement Using the Soil Box Method

The soil box apparatus consists of a small plastic box with metal end plates. The soil sample is tightly packed into the box and current is passed through the soil sample. The current causes a voltage drop across the soil sample and soil resistivity is determined using the above referenced Soil Resistance Meter.

Soil samples were placed in the soil box and the soil resistivity was measured in the "as-received" state. Distilled water was added to the soil sample in 10-mL increments and the resistivity was measured after each watering. As the soil sample became more saturated, the soil resistivity decreased until the minimum soil resistivity was reached. The soil samples that had a minimum resistivity less than 1,000 ohm-cm were forwarded to Sequoia Analytical Laboratory in Sacramento and analyzed for water soluble chloride ion concentration, water soluble sulfate ion concentration and pH.

TEST RESULTS AND DISCUSSION

Data obtained during this investigation has been summarized in tabular form for analysis and presentation. Table 1 lists the results of the in-situ soil resistivity measurements conducted at the site. Table 2 lists the "as-received" and minimum soil resistivity for each sample collected as well as the chemical analysis of the sample. The locations of the soil samples and the in-situ resistivity test locations are shown on Figure 2.

In-Situ Soil Resistivity

Table 1 - In-Situ Soil Resistivity Data

Site*	Depth (meters)	Resistivity (ohm-cm)	Layer Resistivity (ohm-cm)	Layer (meters)
1	1.5	970	970	0 – 1.5
	3	1100	1,300	1.5 – 3
	4.5	1000	840	3 – 4.5
	6	1000	970	4.5 – 6
2	1.5	910	910	0 – 1.5
	3	919	930	1.5 – 3
	4.5	950	1,000	3 – 4.5
	6	920	840	4.5 – 6

* - See Figure 2

Corrosion of a metal is an electrochemical process and is accompanied by the flow of electric current. Resistivity is a measure of the ability of a soil to conduct an electric current and is an important parameter in consideration of corrosion data. Soil resistivity is primarily dependent upon the chemical content and moisture content of the soil mass. The greater the amount of chemical constituents present in the soil, the lower the resistivity will be. As moisture content increases, resistivity decreases until maximum solubility of dissolved chemicals is attained. Beyond this point, an increase in moisture content results in dilution of the chemical concentration and resistivity increases. The corrosion rate of steel in soil normally increases as resistivity decreases. Therefore, in any particular group of soils, maximum corrosion will generally occur in the lowest resistivity areas.

Laboratory Analysis of Soil Samples

Table 2 – Minimum Soil Resistivity and Chemical Data

Item No.	Boring No.	Sample No.	Depth (meters)	Soil Resistivity (ohm-cm)		Chemical Data		
				As-Received	Minimum	pH	Sulfate (mg/kg)	Chloride (mg/kg)
1	B - 7	1A	1.2 – 1.5	740	630	8.0	54	ND
2	B - 7	3A	2.4 – 3	2,300	740	8.5	210	48
3	B - 11	2A	1.2 – 1.5	710	700	8.5	ND	ND

ND – Not Detected, below the detection level of 10 mg/kg.

mg/kg – milligrams per kilogram

A wide variety of soluble salts is typically found in soils. Two soils having the same resistivity may have significantly different corrosion characteristics, depending on the specific ions available. The major constituents that accelerate corrosion are chlorides, sulfates and the acidity (pH) of the soil. Chloride ions tend to break down otherwise protective surface deposits, and can result in corrosion of reinforcing steel in concrete structures. Sulfates in soil can be highly aggressive to Portland cement concrete by combining chemically with certain constituents of the concrete, principally tricalcium aluminate. This reaction is accompanied by expansion and eventual disruption of the concrete matrix. High concentrations of bicarbonates tend to decrease soil resistivities. Although bicarbonates are not aggressive to concrete, lower resistivity environments can promote corrosion activity.

Acidity, as indicated by the pH value, is another important factor of soil. The lower the pH (the more acidic the environment), the more corrosive the soil will be with respect to buried metallic and

concrete structures. When in contact with portland cement concrete, acid will attack the exposed surface and be neutralized by the alkalinity of the concrete. As pH increases above 7 (the neutral value), conditions become increasingly more alkaline and passive to buried structures.

Appendix E
Analysis And Calculations

```
Loveridge Road OC Abutment 1 L BOF 9.500 355 mm 625 kN Driven Piles (Abutment)
[GENERIC SOIL HEADER : BETA4]

[UNIT SYSTEM: METRIC]
[NUMBER SOIL LAYERS:  6]
[SOIL LAYER:  1]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   100.0000]
     [ADHESION GRAPH: GENERAL]
     [USER DEFINED:   0.0000]
     [THICKNESS:  1.7000]
     [UNIT WEIGHT:  19.2000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  2]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  2.3000]
     [UNIT WEIGHT:  15.5000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  3]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   100.0000]
     [ADHESION GRAPH: GRAPH1]
     [USER DEFINED:   0.0000]
     [THICKNESS:  3.8000]
     [UNIT WEIGHT:  19.2000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  4]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   100.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  8.3000]
     [UNIT WEIGHT:  18.3000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  5]
     [SOIL TYPE: COHESIONLESS]
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          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 35.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  4.6000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  6]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  1.7000]
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     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[END GENERIC SOIL HEADER]
[PROJECT INFORMATION]

[PROJECT NAME: SR4]
[PROJECT CLIENT: Caltrans @ CCCTA]
[PROJECT MANAGER: Philip Meymand]
[COMPUTED BY: Sathish]
[DATE: 08/17/2005]
[WATER TABLE - DRILLING:  7.0000]
[WATER TABLE - RESTDRIV:  7.0000]
[WATER TABLE - DESIGN:  7.0000]
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     [DEPTH:  0.0000]
     [NOR]
[SCOURABLE SOILS: FALSE]
     [PIER:  0.0000]
     [CHANNEL DEGRADATION:  0.0000]
[PILE TYPE: CONCRETE PILE]
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     [SQUARE SIDE: 355.6000]

[END PROJECT INFORMATION]

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Loveridge Road OC Abutment 1 L BOF 10.750 355 mm 625 kN Driven Piles
[GENERIC SOIL HEADER : BETA4]

[UNIT SYSTEM: METRIC]
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     [THICKNESS:  6.2500]
     [UNIT WEIGHT:  19.2000]
     [SENSITIVITY:  1.0000]

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          [ANGLE: 33.00]
          [CORRECTION: TRUE]
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               [DEPTH:  0.0000  N:  1]
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     [UNIT WEIGHT:  15.5000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  3]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   100.0000]
     [ADHESION GRAPH: GRAPH1]
     [USER DEFINED:   0.0000]
     [THICKNESS:  3.8000]
     [UNIT WEIGHT:  19.2000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  4]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   100.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  8.3000]
     [UNIT WEIGHT:  18.3000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  5]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 35.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 35.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  4.6000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  6]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
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[END GENERIC SOIL HEADER]
[PROJECT INFORMATION]

[PROJECT NAME: SR4]
[PROJECT CLIENT: Caltrans / CCCTA]
[PROJECT MANAGER: Philip Meymand]
[COMPUTED BY: Sathish]
[DATE: 01/31/2006]
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[PILE TYPE: CONCRETE PILE]
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[END PROJECT INFORMATION]

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[UNIT SYSTEM: METRIC]
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     [SHEAR STRENGTH:   100.0000]
     [ADHESION GRAPH: GENERAL]
     [USER DEFINED:   0.0000]
     [THICKNESS:  7.6500]
     [UNIT WEIGHT:  19.2000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  2]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
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          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  2.3000]
     [UNIT WEIGHT:  15.5000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  3]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   100.0000]
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     [USER DEFINED:   0.0000]
     [THICKNESS:  3.8000]
     [UNIT WEIGHT:  19.2000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  4]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   100.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  8.3000]
     [UNIT WEIGHT:  18.3000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  5]
     [SOIL TYPE: COHESIONLESS]
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          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 35.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  4.6000]
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[SOIL LAYER:  6]
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          [CORRECTION: TRUE]
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          [NUMBER VALUES: 1:FALSE]
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     [THICKNESS:  1.7000]
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     [UNIT WEIGHT:  18.0000]
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[END GENERIC SOIL HEADER]
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[PROJECT NAME: SR4]
[PROJECT CLIENT: Caltrans / CCCTA]
[PROJECT MANAGER: Philip Meymand]
[COMPUTED BY: Sathish]
[DATE: 01/31/2006]
[WATER TABLE - DRILLING: 11.9500]
[WATER TABLE - RESTDRIV: 11.9500]
[WATER TABLE - DESIGN: 11.9500]
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[SCOURABLE SOILS: FALSE]
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     [CHANNEL DEGRADATION:  0.0000]
[PILE TYPE: CONCRETE PILE]
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[END PROJECT INFORMATION]

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[UNIT SYSTEM: METRIC]
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     [ADHESION GRAPH: GENERAL]
     [USER DEFINED:   0.0000]
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     [SENSITIVITY:  1.0000]

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          [CORRECTION: TRUE]
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     [THICKNESS:  2.3000]
     [UNIT WEIGHT:  15.5000]
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[SOIL LAYER:  3]
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     [SHEAR STRENGTH:   100.0000]
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     [USER DEFINED:   0.0000]
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     [SENSITIVITY:  1.0000]

[SOIL LAYER:  4]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   100.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  8.3000]
     [UNIT WEIGHT:  18.3000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  5]
     [SOIL TYPE: COHESIONLESS]
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          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
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[SOIL LAYER:  6]
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          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
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     [SENSITIVITY:  1.0000]

[END GENERIC SOIL HEADER]
[PROJECT INFORMATION]

[PROJECT NAME: SR4]
[PROJECT CLIENT: Caltrans / CCCTA]
[PROJECT MANAGER: Philip Meymand]
[COMPUTED BY: Sathish]
[DATE: 01/31/2006]
[WATER TABLE - DRILLING: 13.3000]
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[WATER TABLE - DESIGN: 13.3000]
[SOFT COMPRESSIBLE SOILS: FALSE]
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Loveridge Road OC Abutment 1 L BOF 9.500 355 mm 625 kN Driven Piles
[GENERIC SOIL HEADER : BETA4]

[UNIT SYSTEM: METRIC]
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     [SOIL TYPE: COHESIVE]
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     [ADHESION GRAPH: GENERAL]
     [USER DEFINED:    0.0000]
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     [THICKNESS:  2.3000]
     [UNIT WEIGHT:  15.5000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  3]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    100.0000]
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     [USER DEFINED:    0.0000]
     [THICKNESS:  3.8000]
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     [SENSITIVITY:  1.0000]

[SOIL LAYER:  4]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    100.0000]
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     [THICKNESS:  8.3000]
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[SOIL LAYER:  5]
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     [THICKNESS:  1.7000]
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     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[END GENERIC SOIL HEADER]
[PROJECT INFORMATION]

[PROJECT NAME: SR4]
[PROJECT CLIENT: Caltrans / CCCTA]
[PROJECT MANAGER: Philip Meymand]
[COMPUTED BY: Sathish]
[DATE: 01/31/2006]
[WATER TABLE - DRILLING:  6.2000]
[WATER TABLE - RESTDRIV:  6.2000]
[WATER TABLE - DESIGN:  6.2000]
[SOFT COMPRESSIBLE SOILS: FALSE]
     [DEPTH:  0.0000]
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[SCOURABLE SOILS: FALSE]
     [PIER:  0.0000]
     [CHANNEL DEGRADATION:  0.0000]
[PILE TYPE: CONCRETE PILE]
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     [TIP DIAMETER:  0.0000]
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[END PROJECT INFORMATION]

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Loveridge Road OC Abutment 1 R BOF 9.200 355 mm 625 kN Driven Piles (Abutment)
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     [ADHESION GRAPH: GENERAL]
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     [UNIT WEIGHT:  19.2000]
     [SENSITIVITY:  1.0000]

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     [USER DEFINED:    0.0000]
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     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    100.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:    0.0000]
     [THICKNESS:  8.3000]
     [UNIT WEIGHT:  18.3000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  5]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 35.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 35.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  4.6000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  6]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  1.7000]
```

```
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[END GENERIC SOIL HEADER]
[PROJECT INFORMATION]

[PROJECT NAME: SR4]
[PROJECT CLIENT: Caltrans @ CCCTA]
[PROJECT MANAGER: Philip Meymand]
[COMPUTED BY: Sathish]
[DATE: 08/17/2005]
[WATER TABLE - DRILLING:  6.7000]
[WATER TABLE - RESTDRIV:  6.7000]
[WATER TABLE - DESIGN:  6.7000]
[SOFT COMPRESSIBLE SOILS: FALSE]
     [DEPTH:  0.0000]
     [NOR]
[SCOURABLE SOILS: FALSE]
     [PIER:  0.0000]
     [CHANNEL DEGRADATION:  0.0000]
[PILE TYPE: CONCRETE PILE]
     [DEPTH:  1.5000]
     [SHAPE: SQUARE]
     [TIP DIAMETER:  0.0000]
     [SQUARE SIDE: 355.6000]

[END PROJECT INFORMATION]

[END OF FILE]
```

```
Loveridge Road OC Abutment 1 R BOF 10.450 355 mm 625 kN Driven Piles
[GENERIC SOIL HEADER : BETA4]

[UNIT SYSTEM: METRIC]
[NUMBER SOIL LAYERS:  6]
[SOIL LAYER:  1]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   100.0000]
     [ADHESION GRAPH: GENERAL]
     [USER DEFINED:   0.0000]
     [THICKNESS:  5.8500]
     [UNIT WEIGHT:  19.2000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  2]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  2.3000]
     [UNIT WEIGHT:  15.5000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  3]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   100.0000]
     [ADHESION GRAPH: GRAPH1]
     [USER DEFINED:   0.0000]
     [THICKNESS:  3.8000]
     [UNIT WEIGHT:  19.2000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  4]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   100.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  8.3000]
     [UNIT WEIGHT:  18.3000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  5]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 35.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 35.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  4.6000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  6]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  1.7000]
```

```
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[END GENERIC SOIL HEADER]
[PROJECT INFORMATION]

[PROJECT NAME: SR4]
[PROJECT CLIENT: Caltrans / CCCTA]
[PROJECT MANAGER: Philip Meymand]
[COMPUTED BY: Sathish]
[DATE: 01/31/2006]
[WATER TABLE - DRILLING: 10.1500]
[WATER TABLE - RESTDRIV: 10.1500]
[WATER TABLE - DESIGN: 10.1500]
[SOFT COMPRESSIBLE SOILS: FALSE]
     [DEPTH:  0.0000]
     [NOR]
[SCOURABLE SOILS: FALSE]
     [PIER:  0.0000]
     [CHANNEL DEGRADATION:  0.0000]
[PILE TYPE: CONCRETE PILE]
     [DEPTH:  4.7000]
     [SHAPE: SQUARE]
     [TIP DIAMETER:  0.0000]
     [SQUARE SIDE: 355.6000]

[END PROJECT INFORMATION]

[END OF FILE]
```

```
Loveridge Road OC Abutment 1 R BOF 11.650 355 mm 625 kN Driven Piles
[GENERIC SOIL HEADER : BETA4]

[UNIT SYSTEM: METRIC]
[NUMBER SOIL LAYERS:  6]
[SOIL LAYER:  1]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   100.0000]
     [ADHESION GRAPH: GENERAL]
     [USER DEFINED:   0.0000]
     [THICKNESS:  7.0500]
     [UNIT WEIGHT:  19.2000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  2]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  2.3000]
     [UNIT WEIGHT:  15.5000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  3]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   100.0000]
     [ADHESION GRAPH: GRAPH1]
     [USER DEFINED:   0.0000]
     [THICKNESS:  3.8000]
     [UNIT WEIGHT:  19.2000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  4]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   100.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  8.3000]
     [UNIT WEIGHT:  18.3000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  5]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 35.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 35.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  4.6000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  6]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  1.7000]
```

```
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[END GENERIC SOIL HEADER]
[PROJECT INFORMATION]

[PROJECT NAME: SR4]
[PROJECT CLIENT: Caltrans / CCCTA]
[PROJECT MANAGER: Philip Meymand]
[COMPUTED BY: Sathish]
[DATE: 01/31/2006]
[WATER TABLE - DRILLING: 11.3500]
[WATER TABLE - RESTDRIV: 11.3500]
[WATER TABLE - DESIGN: 11.3500]
[SOFT COMPRESSIBLE SOILS: FALSE]
     [DEPTH:  0.0000]
     [NOR]
[SCOURABLE SOILS: FALSE]
     [PIER:  0.0000]
     [CHANNEL DEGRADATION:  0.0000]
[PILE TYPE: CONCRETE PILE]
     [DEPTH:  4.7000]
     [SHAPE: SQUARE]
     [TIP DIAMETER:  0.0000]
     [SQUARE SIDE: 355.6000]

[END PROJECT INFORMATION]

[END OF FILE]
```

```
Loveridge Road OC Abutment 1 R BOF 12.900 355 mm 625 kN Driven Piles
[GENERIC SOIL HEADER : BETA4]

[UNIT SYSTEM: METRIC]
[NUMBER SOIL LAYERS:  6]
[SOIL LAYER:  1]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   100.0000]
     [ADHESION GRAPH: GENERAL]
     [USER DEFINED:   0.0000]
     [THICKNESS:  8.3000]
     [UNIT WEIGHT:  19.2000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  2]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  2.3000]
     [UNIT WEIGHT:  15.5000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  3]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   100.0000]
     [ADHESION GRAPH: GRAPH1]
     [USER DEFINED:   0.0000]
     [THICKNESS:  3.8000]
     [UNIT WEIGHT:  19.2000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  4]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   100.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  8.3000]
     [UNIT WEIGHT:  18.3000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  5]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 35.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 35.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  4.6000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  6]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  1.7000]
```

```
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[END GENERIC SOIL HEADER]
[PROJECT INFORMATION]

[PROJECT NAME: SR4]
[PROJECT CLIENT: Caltrans / CCCTA]
[PROJECT MANAGER: Philip Meymand]
[COMPUTED BY: Sathish]
[DATE: 01/31/2006]
[WATER TABLE - DRILLING: 12.6000]
[WATER TABLE - RESTDRIV: 12.6000]
[WATER TABLE - DESIGN: 12.6000]
[SOFT COMPRESSIBLE SOILS: FALSE]
     [DEPTH:  0.0000]
     [NOR]
[SCOURABLE SOILS: FALSE]
     [PIER:  0.0000]
     [CHANNEL DEGRADATION:  0.0000]
[PILE TYPE: CONCRETE PILE]
     [DEPTH:  4.7000]
     [SHAPE: SQUARE]
     [TIP DIAMETER:  0.0000]
     [SQUARE SIDE: 355.6000]

[END PROJECT INFORMATION]

[END OF FILE]
```

```
Loveridge Road OC Abutment 1 R BOF 9.200 355 mm 625 kN Driven Piles
[GENERIC SOIL HEADER : BETA4]

[UNIT SYSTEM: METRIC]
[NUMBER SOIL LAYERS:  6]
[SOIL LAYER:  1]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   100.0000]
     [ADHESION GRAPH: GENERAL]
     [USER DEFINED:   0.0000]
     [THICKNESS:  1.7000]
     [UNIT WEIGHT:  19.2000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  2]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  2.3000]
     [UNIT WEIGHT:  15.5000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  3]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   100.0000]
     [ADHESION GRAPH: GRAPH1]
     [USER DEFINED:   0.0000]
     [THICKNESS:  3.8000]
     [UNIT WEIGHT:  19.2000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  4]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   100.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  8.3000]
     [UNIT WEIGHT:  18.3000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  5]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 35.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 35.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  4.6000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  6]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  1.7000]
```

```
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[END GENERIC SOIL HEADER]
[PROJECT INFORMATION]

[PROJECT NAME: SR4]
[PROJECT CLIENT: Caltrans / CCCTA]
[PROJECT MANAGER: Philip Meymand]
[COMPUTED BY: Sathish]
[DATE: 01/31/2006]
[WATER TABLE - DRILLING:  6.0000]
[WATER TABLE - RESTDRIV:  6.0000]
[WATER TABLE - DESIGN:  6.0000]
[SOFT COMPRESSIBLE SOILS: FALSE]
     [DEPTH:  0.0000]
     [NOR]
[SCOURABLE SOILS: FALSE]
     [PIER:  0.0000]
     [CHANNEL DEGRADATION:  0.0000]
[PILE TYPE: CONCRETE PILE]
     [DEPTH:  1.8000]
     [SHAPE: SQUARE]
     [TIP DIAMETER:  0.0000]
     [SQUARE SIDE: 355.6000]

[END PROJECT INFORMATION]

[END OF FILE]
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```
Loveridge Road OC Abutment 4 L BOF 7.250 355 mm 625 kN Driven Piles (Abutment)
[GENERIC SOIL HEADER : BETA4]

[UNIT SYSTEM: METRIC]
[NUMBER SOIL LAYERS:  6]
[SOIL LAYER:  1]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    50.0000]
     [ADHESION GRAPH: GENERAL]
     [USER DEFINED:   0.0000]
     [THICKNESS:  1.6600]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  2]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 32.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 32.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  0.8000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  3]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    70.0000]
     [ADHESION GRAPH: GRAPH1]
     [USER DEFINED:   0.0000]
     [THICKNESS:  8.4000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  4]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    90.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  4.6000]
     [UNIT WEIGHT:  20.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  5]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   120.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  4.5000]
     [UNIT WEIGHT:  20.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  6]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  1.6000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[END GENERIC SOIL HEADER]
[PROJECT INFORMATION]
```

```
[PROJECT NAME: SR4]
[PROJECT CLIENT: Caltrans @ CCCTA]
[PROJECT MANAGER: Philip Meymand]
[COMPUTED BY: Sathish]
[DATE: 08/17/2005]
[WATER TABLE - DRILLING:  4.7600]
[WATER TABLE - RESTDRIV:  4.7600]
[WATER TABLE - DESIGN:  4.7600]
[SOFT COMPRESSIBLE SOILS: FALSE]
     [DEPTH:  0.0000]
     [NOR]
[SCOURABLE SOILS: FALSE]
     [PIER:  0.0000]
     [CHANNEL DEGRADATION:  0.0000]
[PILE TYPE: CONCRETE PILE]
     [DEPTH:  1.5100]
     [SHAPE: SQUARE]
     [TIP DIAMETER:  0.0000]
     [SQUARE SIDE: 355.6000]

[END PROJECT INFORMATION]

[END OF FILE]
```

```
Loveridge Road OC Abutment 4 L BOF 10.950 355 mm 625 kN Driven Piles
[GENERIC SOIL HEADER : BETA4]

[UNIT SYSTEM: METRIC]
[NUMBER SOIL LAYERS:  6]
[SOIL LAYER:  1]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    50.0000]
     [ADHESION GRAPH: GENERAL]
     [USER DEFINED:   0.0000]
     [THICKNESS:  9.4500]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  2]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  0.8000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  3]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    50.0000]
     [ADHESION GRAPH: GRAPH1]
     [USER DEFINED:   0.0000]
     [THICKNESS:  8.3000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  4]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    90.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  4.7000]
     [UNIT WEIGHT:  20.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  5]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   120.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  4.5000]
     [UNIT WEIGHT:  20.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  6]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  1.6000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[END GENERIC SOIL HEADER]
[PROJECT INFORMATION]
```

```
[PROJECT NAME: SR4]
[PROJECT CLIENT: Caltrans @ CCCTA]
[PROJECT MANAGER: Philip Meymand]
[COMPUTED BY: Sathish]
[DATE: 01/31/2006]
[WATER TABLE - DRILLING: 11.5500]
[WATER TABLE - RESTDRIV: 11.5500]
[WATER TABLE - DESIGN: 11.5500]
[SOFT COMPRESSIBLE SOILS: FALSE]
     [DEPTH:  0.0000]
     [NOR]
[SCOURABLE SOILS: FALSE]
     [PIER:  0.0000]
     [CHANNEL DEGRADATION:  0.0000]
[PILE TYPE: CONCRETE PILE]
     [DEPTH:  5.6000]
     [SHAPE: SQUARE]
     [TIP DIAMETER:  0.0000]
     [SQUARE SIDE: 355.6000]

[END PROJECT INFORMATION]

[END OF FILE]
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```
Loveridge Road OC Abutment 4 L BOF 12.150 355 mm 625 kN Driven Piles
[GENERIC SOIL HEADER : BETA4]

[UNIT SYSTEM: METRIC]
[NUMBER SOIL LAYERS:  6]
[SOIL LAYER:  1]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    50.0000]
     [ADHESION GRAPH: GENERAL]
     [USER DEFINED:   0.0000]
     [THICKNESS: 10.5500]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  2]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  0.8000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  3]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    50.0000]
     [ADHESION GRAPH: GRAPH1]
     [USER DEFINED:   0.0000]
     [THICKNESS:  8.3000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  4]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    90.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  4.7000]
     [UNIT WEIGHT:  20.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  5]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   120.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  4.5000]
     [UNIT WEIGHT:  20.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  6]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  1.6000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[END GENERIC SOIL HEADER]
[PROJECT INFORMATION]
```

```
[PROJECT NAME: SR4]
[PROJECT CLIENT: Caltrans @ CCCTA]
[PROJECT MANAGER: Philip Meymand]
[COMPUTED BY: Sathish]
[DATE: 01/31/2006]
[WATER TABLE - DRILLING: 12.6500]
[WATER TABLE - RESTDRIV: 12.6500]
[WATER TABLE - DESIGN: 12.6500]
[SOFT COMPRESSIBLE SOILS: FALSE]
     [DEPTH:  0.0000]
     [NOR]
[SCOURABLE SOILS: FALSE]
     [PIER:  0.0000]
     [CHANNEL DEGRADATION:  0.0000]
[PILE TYPE: CONCRETE PILE]
     [DEPTH:  5.5000]
     [SHAPE: SQUARE]
     [TIP DIAMETER:  0.0000]
     [SQUARE SIDE: 355.6000]

[END PROJECT INFORMATION]

[END OF FILE]
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```
Loveridge Road OC Abutment 4 L BOF 7.250 355 mm 625 kN Driven Piles
[GENERIC SOIL HEADER : BETA4]

[UNIT SYSTEM: METRIC]
[NUMBER SOIL LAYERS:  6]
[SOIL LAYER:  1]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    50.0000]
     [ADHESION GRAPH: GENERAL]
     [USER DEFINED:   0.0000]
     [THICKNESS:  3.1500]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  2]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  0.8000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  3]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    50.0000]
     [ADHESION GRAPH: GRAPH1]
     [USER DEFINED:   0.0000]
     [THICKNESS:  8.3000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  4]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    90.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  4.7000]
     [UNIT WEIGHT:  20.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  5]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   120.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  4.5000]
     [UNIT WEIGHT:  20.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  6]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  1.6000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[END GENERIC SOIL HEADER]
[PROJECT INFORMATION]
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```
[PROJECT NAME: SR4]
[PROJECT CLIENT: Caltrans @ CCCTA]
[PROJECT MANAGER: Philip Meymand]
[COMPUTED BY: Sathish]
[DATE: 01/31/2006]
[WATER TABLE - DRILLING:  5.2500]
[WATER TABLE - RESTDRIV:  5.2500]
[WATER TABLE - DESIGN:  5.2500]
[SOFT COMPRESSIBLE SOILS: FALSE]
     [DEPTH:  0.0000]
     [NOR]
[SCOURABLE SOILS: FALSE]
     [PIER:  0.0000]
     [CHANNEL DEGRADATION:  0.0000]
[PILE TYPE: CONCRETE PILE]
     [DEPTH:  3.0000]
     [SHAPE: SQUARE]
     [TIP DIAMETER:  0.0000]
     [SQUARE SIDE: 355.6000]

[END PROJECT INFORMATION]

[END OF FILE]
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```
Loveridge Road OC Abutment 4 L BOF 8.500 355 mm 625 kN Driven Piles
[GENERIC SOIL HEADER : BETA4]

[UNIT SYSTEM: METRIC]
[NUMBER SOIL LAYERS:  6]
[SOIL LAYER:  1]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    50.0000]
     [ADHESION GRAPH: GENERAL]
     [USER DEFINED:   0.0000]
     [THICKNESS:  7.0000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  2]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  0.8000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  3]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    50.0000]
     [ADHESION GRAPH: GRAPH1]
     [USER DEFINED:   0.0000]
     [THICKNESS:  8.3000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  4]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    90.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  4.7000]
     [UNIT WEIGHT:  20.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  5]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   120.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  4.5000]
     [UNIT WEIGHT:  20.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  6]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  1.6000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[END GENERIC SOIL HEADER]
[PROJECT INFORMATION]
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[PROJECT NAME: SR4]
[PROJECT CLIENT: Caltrans @ CCCTA]
[PROJECT MANAGER: Philip Meymand]
[COMPUTED BY: Sathish]
[DATE: 01/31/2006]
[WATER TABLE - DRILLING:  9.1000]
[WATER TABLE - RESTDRIV:  9.1000]
[WATER TABLE - DESIGN:  9.1000]
[SOFT COMPRESSIBLE SOILS: FALSE]
     [DEPTH:  0.0000]
     [NOR]
[SCOURABLE SOILS: FALSE]
     [PIER:  0.0000]
     [CHANNEL DEGRADATION:  0.0000]
[PILE TYPE: CONCRETE PILE]
     [DEPTH:  5.6000]
     [SHAPE: SQUARE]
     [TIP DIAMETER:  0.0000]
     [SQUARE SIDE: 355.6000]

[END PROJECT INFORMATION]

[END OF FILE]
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```
Loveridge Road OC Abutment 4 L BOF 9.700 355 mm 625 kN Driven Piles
[GENERIC SOIL HEADER : BETA4]

[UNIT SYSTEM: METRIC]
[NUMBER SOIL LAYERS:  6]
[SOIL LAYER:  1]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    50.0000]
     [ADHESION GRAPH: GENERAL]
     [USER DEFINED:   0.0000]
     [THICKNESS:  8.2000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  2]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  0.8000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  3]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    50.0000]
     [ADHESION GRAPH: GRAPH1]
     [USER DEFINED:   0.0000]
     [THICKNESS:  8.3000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  4]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    90.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  4.7000]
     [UNIT WEIGHT:  20.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  5]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   120.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  4.5000]
     [UNIT WEIGHT:  20.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  6]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  1.6000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[END GENERIC SOIL HEADER]
[PROJECT INFORMATION]
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[PROJECT NAME: SR4]
[PROJECT CLIENT: Caltrans @ CCCTA]
[PROJECT MANAGER: Philip Meymand]
[COMPUTED BY: Sathish]
[DATE: 01/31/2006]
[WATER TABLE - DRILLING: 10.3000]
[WATER TABLE - RESTDRIV: 10.3000]
[WATER TABLE - DESIGN: 10.3000]
[SOFT COMPRESSIBLE SOILS: FALSE]
     [DEPTH:  0.0000]
     [NOR]
[SCOURABLE SOILS: FALSE]
     [PIER:  0.0000]
     [CHANNEL DEGRADATION:  0.0000]
[PILE TYPE: CONCRETE PILE]
     [DEPTH:  5.6000]
     [SHAPE: SQUARE]
     [TIP DIAMETER:  0.0000]
     [SQUARE SIDE: 355.6000]

[END PROJECT INFORMATION]

[END OF FILE]
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Loveridge Road OC Abutment 4 R BOF 7.050 355 mm 625 kN Driven Piles (Abutment)
[GENERIC SOIL HEADER : BETA4]

[UNIT SYSTEM: METRIC]
[NUMBER SOIL LAYERS: 6]
[SOIL LAYER: 1]
[SOIL TYPE: COHESIVE]
[SHEAR STRENGTH: 50.0000]
[ADHESION GRAPH: GENERAL]
[USER DEFINED: 0.0000]
[THICKNESS: 1.4600]
[UNIT WEIGHT: 18.0000]
[SENSITIVITY: 1.0000]

[SOIL LAYER: 2]
[SOIL TYPE: COHESIONLESS]
[ANGLE: 32.00]
[CORRECTION: TRUE]
[NUMBER VALUES: 1:FALSE]
[DEPTH: 0.0000 N: 1]
[ANGLE: 32.00]
[CORRECTION: TRUE]
[NUMBER VALUES: 1:FALSE]
[DEPTH: 0.0000 N: 1]
[THICKNESS: 0.8000]
[UNIT WEIGHT: 18.0000]
[SENSITIVITY: 1.0000]

[SOIL LAYER: 3]
[SOIL TYPE: COHESIVE]
[SHEAR STRENGTH: 70.0000]
[ADHESION GRAPH: GRAPH1]
[USER DEFINED: 0.0000]
[THICKNESS: 8.4000]
[UNIT WEIGHT: 18.0000]
[SENSITIVITY: 1.0000]

[SOIL LAYER: 4]
[SOIL TYPE: COHESIVE]
[SHEAR STRENGTH: 90.0000]
[ADHESION GRAPH: GRAPH3]
[USER DEFINED: 0.0000]
[THICKNESS: 4.6000]
[UNIT WEIGHT: 20.0000]
[SENSITIVITY: 1.0000]

[SOIL LAYER: 5]
[SOIL TYPE: COHESIVE]
[SHEAR STRENGTH: 120.0000]
[ADHESION GRAPH: GRAPH3]
[USER DEFINED: 0.0000]
[THICKNESS: 4.5000]
[UNIT WEIGHT: 20.0000]
[SENSITIVITY: 1.0000]

[SOIL LAYER: 6]
[SOIL TYPE: COHESIONLESS]
[ANGLE: 36.00]
[CORRECTION: TRUE]
[NUMBER VALUES: 1:FALSE]
[DEPTH: 0.0000 N: 1]
[ANGLE: 36.00]
[CORRECTION: TRUE]
[NUMBER VALUES: 1:FALSE]
[DEPTH: 0.0000 N: 1]
[THICKNESS: 1.6000]
[UNIT WEIGHT: 18.0000]
[SENSITIVITY: 1.0000]

[END GENERIC SOIL HEADER]
[PROJECT INFORMATION]

```
[PROJECT NAME: SR4]
[PROJECT CLIENT: Caltrans @ CCCTA]
[PROJECT MANAGER: Philip Meymand]
[COMPUTED BY: Sathish]
[DATE: 08/17/2005]
[WATER TABLE - DRILLING:  4.5600]
[WATER TABLE - RESTDRIV:  4.5600]
[WATER TABLE - DESIGN:  4.5600]
[SOFT COMPRESSIBLE SOILS: FALSE]
     [DEPTH:  0.0000]
     [NOR]
[SCOURABLE SOILS: FALSE]
     [PIER:  0.0000]
     [CHANNEL DEGRADATION:  0.0000]
[PILE TYPE: CONCRETE PILE]
     [DEPTH:  1.5100]
     [SHAPE: SQUARE]
     [TIP DIAMETER:  0.0000]
     [SQUARE SIDE: 355.6000]

[END PROJECT INFORMATION]

[END OF FILE]
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```
Loveridge Road OC Abutment 4 R BOF 7.050 355 mm 625 kN Driven Piles
[GENERIC SOIL HEADER : BETA4]

[UNIT SYSTEM: METRIC]
[NUMBER SOIL LAYERS:  6]
[SOIL LAYER:  1]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    50.0000]
     [ADHESION GRAPH: GENERAL]
     [USER DEFINED:   0.0000]
     [THICKNESS:  3.1500]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  2]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 33.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  0.8000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  3]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    50.0000]
     [ADHESION GRAPH: GRAPH1]
     [USER DEFINED:   0.0000]
     [THICKNESS:  8.3000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  4]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:    90.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  4.7000]
     [UNIT WEIGHT:  20.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  5]
     [SOIL TYPE: COHESIVE]
     [SHEAR STRENGTH:   120.0000]
     [ADHESION GRAPH: GRAPH3]
     [USER DEFINED:   0.0000]
     [THICKNESS:  4.5000]
     [UNIT WEIGHT:  20.0000]
     [SENSITIVITY:  1.0000]

[SOIL LAYER:  6]
     [SOIL TYPE: COHESIONLESS]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
          [ANGLE: 36.00]
          [CORRECTION: TRUE]
          [NUMBER VALUES: 1:FALSE]
               [DEPTH:  0.0000  N:  1]
     [THICKNESS:  1.6000]
     [UNIT WEIGHT:  18.0000]
     [SENSITIVITY:  1.0000]

[END GENERIC SOIL HEADER]
[PROJECT INFORMATION]
```

```
[PROJECT NAME: SR4]
[PROJECT CLIENT: Caltrans @ CCCTA]
[PROJECT MANAGER: Philip Meymand]
[COMPUTED BY: Sathish]
[DATE: 01/31/2006]
[WATER TABLE - DRILLING:  5.2500]
[WATER TABLE - RESTDRIV:  5.2500]
[WATER TABLE - DESIGN:  5.2500]
[SOFT COMPRESSIBLE SOILS: FALSE]
     [DEPTH:  0.0000]
     [NOR]
[SCOURABLE SOILS: FALSE]
     [PIER:  0.0000]
     [CHANNEL DEGRADATION:  0.0000]
[PILE TYPE: CONCRETE PILE]
     [DEPTH:  3.2000]
     [SHAPE: SQUARE]
     [TIP DIAMETER:  0.0000]
     [SQUARE SIDE: 355.6000]

[END PROJECT INFORMATION]

[END OF FILE]
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AB1L950: Abutment 1 Leftwing BOF = 9.500 m, Axial Capacity check for Group (Less then 3D center to center spacing)

No of Piles	12	Perimeter of the Single Pile (m)	1.422	Perimeter / Pile for Group (m)	1.190	Perimeter of Concrete / Pile (m)	0.415	Perimeter of Soil/ Pile (m)	0.775

Depth (m)	Soil Type	Effective Stress at Midpoint (kPa)	Sliding Friction Angle	Adhesion (kPa)	Skin Friction (kN)	Strength	K_δ	Skin Friction from Concrete Area (kN)	Skin Friction from Soil Area (kN)	Total Skin Friction (kN)
0.01	Cohesive	-	-	0	0	0		0.00	0.00	0.00
1.69	Cohesive	-	-	0	0	0		0.00	0.00	0.00
1.7	Cohesive	-	-	64.32	0	0		0.00	0.00	0.00
1.89	Cohesive	-	-	64.32	17.38	100		5.07	14.73	19.80
1.91	Cohesionless	36.56	27.78	-	18.66	33	1.56	5.44	15.21	20.65
4.19	Cohesionless	126.1	27.78	-	140.21	33	1.56	40.89	204.56	245.45
4.21	Cohesive	-	-	100	142.33	100		41.51	206.11	247.62
7.21	Cohesive	-	-	100	569.04	100		165.97	438.65	604.62
7.99	Cohesive	-	-	99.57	677.67	100		197.65	499.11	696.76
8.01	Cohesive	-	-	64.82	679.91	100		198.31	500.66	698.96
11.01	Cohesive	-	-	64.82	956.51	100		278.98	733.20	1012.18
14.01	Cohesive	-	-	69.79	1275.57	100		372.04	965.74	1337.78
16.29	Cohesive	-	-	74.41	1556.32	100		453.93	1142.47	1596.39
16.31	Cohesionless	198.03	29.46	-	1559.98	35	1.81	454.99	1145.66	1600.65
19.31	Cohesionless	210.33	29.46	-	2313.75	35	1.81	674.84	1653.43	2328.27
20.89	Cohesionless	216.81	29.46	-	2746.17	35	1.81	800.97	1929.09	2730.06
20.91	Cohesionless	235.74	30.3	-	2752.28	36	2.08	802.75	1933.56	2736.31
22.59	Cohesionless	242.63	30.3	-	3322.74	36	2.08	969.13	2319.85	3288.98

AB4L725: Abutment 4 Leftwing BOF = 7.250 m, Axial Capacity check for Group (Less then 3D center to center spacing)

No of Piles	15	Perimeter of the Single Pile (m)	1.422	Perimeter / Pile for Group (m)	1.152	Perimeter of Concrete / Pile (m)	0.379	Perimeter of Soil/ Pile (m)	0.773

Depth (m)	Soil Type	Effective Stress at Midpoint (kPa)	Sliding Friction Angle	Adhesion (kPa)	Skin Friction (kN)	Strength	K_δ	Skin Friction from Concrete Area (kN)	Skin Friction from Soil Area (kN)	Total Skin Friction (kN)
0.01	Cohesive	-	-	0	0	0		0.00	0.00	0.00
2.99	Cohesive	-	-	0	0	0		0.00	0.00	0.00
3	Cohesive	-	-	46.76	0	0		0.00	0.00	0.00
3.01	Cohesive	-	-	46.76	0.67	50		0.18	0.39	0.57
3.14	Cohesive	-	-	46.76	9.31	50		2.48	5.41	7.89
3.16	Cohesionless	126.1	27.78	-	10.53	33	1.56	2.81	7.06	9.87
3.94	Cohesionless	133.12	27.78	-	59.46	33	1.56	15.86	75.23	91.09
3.96	Cohesive	-	-	50	60.87	50		16.23	76.00	92.24
6.96	Cohesive	-	-	50	274.22	50		73.13	191.91	265.03
9.96	Cohesive	-	-	50	487.57	50		130.02	307.81	437.83
12.24	Cohesive	-	-	49.39	642.5	50		171.33	395.90	567.23
12.26	Cohesive	-	-	65.72	644.07	90		171.75	397.29	569.04
15.26	Cohesive	-	-	65.72	924.48	90		246.53	605.92	852.45
16.94	Cohesive	-	-	67.7	1094.75	90		291.93	722.75	1014.68
16.96	Cohesive	-	-	52.92	1096.58	120		292.42	724.60	1017.03
19.96	Cohesive	-	-	52.92	1322.39	120		352.64	1002.77	1355.41
21.44	Cohesive	-	-	55.63	1451.07	120		386.95	1140.00	1526.96
21.46	Cohesionless	315.07	30.3	-	1455.49	36	2.08	388.13	1145.96	1534.09
23.04	Cohesionless	321.54	30.3	-	2013.23	36	2.08	536.86	1625.89	2162.75

AB4L850: Abutment 4 Leftwing BOF = 8.500 m, Axial Capacity check for Group (Less then 3D center to center spacing)

No of Piles	10	Perimeter of the Single Pile (m)	1.422	Perimeter / Pile for Group (m)	1.164	Perimeter of Concrete / Pile (m)	0.498	Perimeter of Soil/ Pile (m)	0.666

Depth (m)	Soil Type	Effective Stress at Midpoint (kPa)	Sliding Friction Angle	Adhesion (kPa)	Skin Friction (kN)	Strength	K_δ	Skin Friction from Concrete Area (kN)	Skin Friction from Soil Area (kN)	Total Skin Friction (kN)
0.01	Cohesive	-	-	0	0	0		0	0	0
3.01	Cohesive	-	-	0	0	0		0	0	0
5.59	Cohesive	-	-	0	0	0		0	0	0
5.6	Cohesive	-	-	46.76	0	0		0	0	0
6.01	Cohesive	-	-	46.76	27.27	50		9.54	13.66	23.20
6.99	Cohesive	-	-	46.76	92.44	50		32.35	46.30	78.65
7.01	Cohesionless	126.1	27.78	-	94.35	33	1.56	33.02	47.73	80.75
7.79	Cohesionless	133.12	27.78	-	196.34	33	1.56	68.72	106.49	175.21
7.81	Cohesive	-	-	50	198.43	50		69.45	107.16	176.61
10.81	Cohesive	-	-	50	411.78	50		144.12	207.08	351.21
13.81	Cohesive	-	-	50	625.13	50		218.80	307.01	525.80
16.09	Cohesive	-	-	49.39	780.06	50		273.02	382.95	655.97
16.11	Cohesive	-	-	65.72	781.63	90		273.57	384.15	657.72
19.11	Cohesive	-	-	65.72	1062.04	90		371.71	564.01	935.73
20.79	Cohesive	-	-	67.7	1232.31	90		431.31	664.74	1096.05
20.81	Cohesive	-	-	52.92	1234.14	120		431.95	666.34	1098.28
23.81	Cohesive	-	-	52.92	1459.94	120		510.98	906.15	1417.13
25.29	Cohesive	-	-	55.63	1588.63	120		556.02	1024.46	1580.48
25.31	Cohesionless	315.07	30.3	-	1594.02	36	2.08	557.91	1029.60	1587.50
26.89	Cohesionless	321.54	30.3	-	2304.97	36	2.08	806.74	1443.36	2250.10

Axial capacities for 30 inch diameter drilled piers at Loverdige OC

Bent 2_BOF = 7.10m

Note: Required pile length: Add 1D to length (Column E)

	m	ft
Ground surface elevation/Top of soil elevation (feet)	9.9	32.48
Pile capacities computed from (feet)	7.1	23.29
GWT elevation (feet)	5	16.40

alpha method for undrained and beta method for drained1

Diameter 2.500 feet Load 432 kips
30.000 inches

												Cohesive Soil					Cohesionless Soil												For Plot	
Patm (psi)	Patm (ksf)	Elevation (m)	Elevation (ft)	Depth (m)	Depth (ft)	Depth (in)	Su (Kpa)	Su (ksf)	Su (psi)	Su/pa	Coh (0) / Non Coh (1)	α	α (2)	f max (ksf)	f max (psi)	N60	β	β (2)	Unit Wt (kN/m3)	Unit Wt. (pcf)	σ (psf)	u (psf)	σ' (psf)	f max (ksf)	ΔRsu (kips)	Rsu (kips)	Pile Tip Elevation (ft)	Pile Length (ft)	Rsu (kN)	Pile Length (m)
14.696	2.118	9.90	32.47	0.01	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	0.95	0.00	0.95	0.00	0.00	0.00	30	2.50	0.00	0.76
14.696	2.118	9.85	32.31	0.17	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	18.73	0.00	18.73	0.00	0.00	0.00	30	2.50	0.00	0.76
14.696	2.118	9.80	32.14	0.34	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	38.50	0.00	38.50	0.01	0.00	0.00	30	2.50	0.06	0.76
14.696	2.118	9.75	31.98	0.50	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	57.28	0.00	57.28	0.01	0.00	0.00	29	2.50	0.00	0.76
14.696	2.118	9.70	31.82	0.66	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	76.05	0.00	76.05	0.02	0.00	0.00	29	2.50	0.00	0.76
14.696	2.118	9.65	31.65	0.83	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	94.83	0.00	94.83	0.02	0.00	0.00	29	2.50	0.00	0.76
14.696	2.118	9.60	31.48	0.99	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	113.60	0.00	113.60	0.03	0.00	0.00	29	2.50	0.00	0.76
14.696	2.118	9.55	31.32	1.15	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	132.37	0.00	132.37	0.03	0.00	0.00	29	2.50	0.00	0.76
14.696	2.118	9.50	31.16	1.32	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	151.15	0.00	151.15	0.04	0.00	0.00	29	2.50	0.00	0.76
14.696	2.118	9.45	31.00	1.48	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	169.92	0.00	169.92	0.04	0.00	0.00	28	2.50	0.00	0.76
14.696	2.118	9.40	30.83	1.65	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	188.70	0.00	188.70	0.05	0.00	0.00	28	2.50	0.00	0.76
14.696	2.118	9.35	30.67	1.81	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	207.47	0.00	207.47	0.05	0.00	0.00	28	2.50	0.00	0.76
14.696	2.118	9.30	30.50	1.98	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	226.25	0.00	226.25	0.06	0.00	0.00	28	2.50	0.00	0.79
14.696	2.118	9.25	30.34	2.14	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	245.02	0.00	245.02	0.06	0.00	0.00	28	2.50	0.00	0.76
14.696	2.118	9.20	30.18	2.30	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	263.80	0.00	263.80	0.07	0.00	0.00	28	2.50	0.00	0.76
14.696	2.118	9.15	30.01	2.47	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	282.57	0.00	282.57	0.07	0.00	0.00	28	2.50	0.00	0.76
14.696	2.118	9.10	29.85	2.63	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	301.35	0.00	301.35	0.08	0.00	0.00	27	2.50	0.00	0.76
14.696	2.118	9.05	29.69	2.80	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	320.12	0.00	320.12	0.08	0.00	0.00	27	2.50	0.00	0.76
14.696	2.118	9.00	29.52	2.96	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	338.90	0.00	338.90	0.08	0.00	0.00	27	2.50	0.00	0.76
14.696	2.118	8.95	29.36	3.12	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	357.67	0.00	357.67	0.08	0.00	0.00	27	2.50	0.00	0.76
14.696	2.118	8.90	29.19	3.29	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	376.45	0.00	376.45	0.09	0.00	0.00	27	2.50	0.00	0.76
14.696	2.118	8.85	29.03	3.45	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	395.22	0.00	395.22	0.10	0.00	0.00	27	2.50	0.00	0.76
14.696	2.118	8.80	28.86	3.62	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	414.00	0.00	414.00	0.10	0.00	0.00	26	2.50	0.00	0.76
14.696	2.118	8.75	28.70	3.78	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	432.77	0.00	432.77	0.11	0.00	0.00	26	2.50	0.00	0.76
14.696	2.118	8.70	28.54	3.94	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	451.55	0.00	451.55	0.11	0.00	0.00	26	2.50	0.00	0.76
14.696	2.118	8.65	28.37	4.11	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	470.32	0.00	470.32	0.12	0.00	0.00	26	2.50	0.00	0.76
14.696	2.118	8.60	28.21	4.27	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	489.09	0.00	489.09	0.12	0.00	0.00	26	2.50	0.00	0.76
14.696	2.118	8.55	28.04	4.44	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	507.87	0.00	507.87	0.13	0.00	0.00	26	2.50	0.00	0.76
14.696	2.118	8.50	27.88	4.60	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	526.64	0.00	526.64	0.13	0.00	0.00	26	2.50	0.00	0.76
14.696	2.118	8.45	27.72	4.76	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	545.42	0.00	545.42	0.14	0.00	0.00	25	2.50	0.00	0.76
14.696	2.118	8.40	27.55	4.93	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	564.19	0.00	564.19	0.14	0.00	0.00	25	2.50	0.00	0.76
14.696	2.118	8.35	27.39	5.09	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	582.97	0.00	582.97	0.15	0.00	0.00	25	2.50	0.00	0.76
14.696	2.118	8.30	27.22	5.26	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	601.74	0.00	601.74	0.16	0.00	0.00	25	2.50	0.00	0.76
14.696	2.118	8.25	27.06	5.42	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	620.52	0.00	620.52	0.16	0.00	0.00	25	2.50	0.00	0.76
14.696	2.118	8.20	26.90	5.58	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	639.29	0.00	639.29	0.16	0.00	0.00	24	2.50	0.00	0.76
14.696	2.118	8.15	26.73	5.75	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	658.07	0.00	658.07	0.16	0.00	0.00	24	2.50	0.00	0.76
14.696	2.118	8.10	26.57	5.91	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	676.84	0.00	676.84	0.17	0.00	0.00	24	2.50	0.00	0.76
14.696	2.118	8.05	26.40	6.08	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	695.62	0.00	695.62	0.17	0.00	0.00	24	2.50	0.00	0.76
14.696	2.118	8.00	26.24	6.24	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	714.39	0.00	714.39	0.18	0.00	0.00	24	2.50	0.00	0.76
14.696	2.118	7.95	26.08	6.40	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	733.17	0.00	733.17	0.18	0.00	0.00	24	2.50	0.00	0.76
14.696	2.118	7.90	25.91	6.57	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	751.94	0.00	751.94	0.19	0.00	0.00	23	2.50	0.00	0.76
14.696	2.118	7.85	25.75	6.73	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	770.72	0.00	770.72	0.19	0.00	0.00	23	2.50	0.00	0.76
14.696	2.118	7.80	25.59	6.90	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	789.49	0.00	789.49	0.20	0.00	0.00	23	2.50	0.00	0.76
14.696	2.118	7.75	25.42	7.06	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	808.26	0.00	808.26	0.20	0.00	0.00	23	2.50	0.00	0.76
14.696	2.118	7.70	25.26	7.22	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	827.04	0.00	827.04	0.21	0.00	0.00	23	2.50	0.00	0.76
14.696	2.118	7.65	25.09	7.39	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	845.81	0.00	845.81	0.21	0.00	0.00	23	2.50	0.00	0.76
14.696	2.118	7.60	24.93	7.55	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	864.59	0.00	864.59	0.22	0.00	0.00	22	2.50	0.00	0.76
14.696	2.118	7.55	24.77	7.72	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	883.36	0.00	883.36	0.22	0.00	0.00	22	2.50	0.00	0.76
14.696	2.118	7.50	24.60	7.88	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	902.14	0.00	902.14	0.23	0.00	0.00	22	2.50	0.00	0.76
14.696	2.118	7.45	24.44	8.04	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	920.91	0.00	920.91	0.23	0.00	0.00	22	2.50	0.00	0.76
14.696	2.118	7.40	24.27	8.21	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	939.69	0.00	939.69	0.23	0.00	0.00	22	2.50	0.00	0.76
14.696	2.118	7.35	24.11	8.37	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	958.46	0.00	958.46	0.24	0.00	0.00	22	2.50	0.00	0.76
14.696	2.118	7.30	23.94	8.54	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	977.24	0.00	977.24	0.24	0.00	0.00	21	2.50	0.00	0.76
14.696	2.118	7.25	23.78	8.70	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	996.01	0.00	996.01	0.25	0.00	0.00	21	2.50	0.00	0.76
14.696	2.118	7.20	23.62	8.86	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1014.79	0.00	1014.79	0.25	0.00	0.00	21	2.50	0.00	0.76
14.696	2.118	7.15	23.45	9.03	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1033.56	0.00	1033.56	0.26	0.00	0.00	21	2.50	0.00	0.76
14.696	2.118	7.10	23.29	9.19	0.01	0.071559055		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.09	1.09	18.00	114.48	1052.34	0.00	1052.34	1.15	0.05	0.05	21	2.51	0.24	0.76
14.696	2.118	7.05	23.12	9.35	0.17	2.039559055		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.09	1.09	18.00	114.48	1071.11	0.00	1071.11	1.16	1.50	1.56	21	2.67	6.91	0.81
14.696	2.118	7.00	22.96	9.52	0.33	4.007559055		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.08	1.08	18.00	114.48	1089.89	0.00	1089.89	1.18	1.52	3.07	20	2.83	13.67	0.86
14.696	2.118	6.95	22.80	9.68	0.50	5.975559055		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.08	1.08	18.00	114.48	1108.66	0.00	1108.66	1.20	1.54	4.61	20	3.00	20.52	0.91
14.696	2.118	6.90	22.63	9.85	0.66	7.943559055		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.08	1.08	18.00	114.48	1127.44	0.00	1127.44	1.21	1.56	6.18	20	3.16	27.47	0.96
14.696	2.118	6.85	22.47	10.01	0.83	9.911559055		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.07	1.07	18.00	114.48	1146.21	0.00	1146.21	1.23	1.58	7.76	20	3.33	34.51	1.01
14.696	2.118	6.80	22.30	10.18	0.99	11.87955906		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.07	1.07	18.00	114.48	1164.98	0.00	1164.98	1.24	1.60	9.36	20	3.49	41.64	1.06
14.696	2.118	6.75	22.14	10.34	1.16	13.84755906		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.07	1.07	18.00	114.48	1183.76	0.00	1183.76	1.26	1.62	10.99	20	3.66	48.88	1.11
14.696	2.118	6.70	21.98	10.50	1.32	15.81555906		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.06	1.06	18.00	114.48	1202.53	0.00	1202.53	1.28	1.64	12.63	19	3.82	56.16	1.16
14.696	2.118	6.65	21.81	10.67	1.48	17.78355906		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.06	1.06	18.00	114.48	1221.31	0.00	1221.31	1.29	1.66	14.29	19	3.98	63.56	1.21
14.696	2.118	6.60	21.65	10.83	1.65	19.75155906		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.05	1.05	18.00	114.48	1240.08	0.00	1240.08	1.31	1.68	15.98	19	4.15	71.08	1.26
14.696	2.118	6.55	21.48	11.00	1.81	21.71955906		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.05	1.05	18.00	114.48	1258.86	0.00	1258.86	1.32	1.70	17.68	19	4.31	78.66	1.31
14.696	2.118	6.50	21.32	11.16	1.97	23.68755906		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.05	1.05	18.00	114.48	1277.63	0.00	1277.63	1.34	1.72	19.41	19	4.47	86.33	1.36
14.696	2.118	6.45	21.16	11.32	2.14	25.65555906		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.04	1.04	18.00	114.48	1296.41	0.00	1296.41	1.35	1.74	21.16	18	4.64	94.09	1.41
14.696	2.118	6.40	20.99	11.49	2.30	27.62355906		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.04	1.04	18.00	114.48	1315.18	0.00	1315.18	1.37	1.76	22.92	18	4.80	101.94	1.46
14.696	2.118	6.35	20.83	11.65	2.47	29.59155906		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.04	1.04	18.00	114.48	1333.96	0.00	1333.96	1.39	1.78	24.70	18	4.97	109.88	1.51
14.696	2.118	6.30	20.66	11.82	2.63	31.55955906	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1352.73	0.00	1352.73	0.34	0.74	25.44	18	5.13	113.17	1.56
14.696	2.118	6.25	20.50	11.98	2.79	33.52755906	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1371.51	0.00	1371.51	0.34	0.74	26.18	18	5.29	116.46	1.61
14.696	2.118	6.20	20.34	12.14	2.96	35.49555906	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1390.28	0.00	1390.28	0.35	0.74	26.92	18	5.46	119.75	1.66
14.696	2.118	6.15	20.17	12.31	3.12	37.46355906	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1409.06	0.00	1409.06	0.35	0.74	27.66	18	5.62	123.04	1.71
14.696	2.118	6.10	20.01	12.47	3.28	39.43155906	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1427.83	0.00	1427.83	0.36	0.74	28.40	18	5.79	126.33	1.76
14.696	2.118	6.05	19.84	12.64	3.45	41.39955906	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1446.61	0.00	1446.61	0.36	0.74	29.14	17	5.95	129.62	1.81
14.696	2.118	6.00	19.68	12.80	3.61	43.36755906	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1465.38	0.00	1465.38	0.37	0.74	29.88	17	6.11	132.91	1.86
14.696	2.118	5.95	19.52	12.96	3.78	45.33555906	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1484.16	0.00	1484.16	0.37	0.74	30.62	17	6.28	136.20	1.91
14.696	2.118	5.90	19.35	13.13	3.94	47.30355906	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1502.93	0.00	1502.93	0.38	0.74	31.36	17	6.44	139.50	1.96
14.696	2.118	5.85	19.19	13.29	4.11	49.27155906	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1521.70	0.00	1521.70	0.38	0.74	32.10	17	6.61	142.79	2.01
14.696	2.118	5.80	19.02	13.46	4.27	51.23955906	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1540.48	0.00	1540.48	0.39	0.74	32.84	17	6.77	146.08	2.06
14.696	2.118	5.75	18.86	13.62	4.43	53.20755906	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1559.25	0.00	1559.25	0.39	0.74	33.58	16	6.93	149.37	2.11
14.696	2.118	5.70	18.70	13.78	4.60	55.17555906	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1578.03	0.00	1578.03	0.39	0.74	34.32	16	7.10	152.66	2.16
14.696	2.118	5.65	18.53	13.95	4.76	57.14355906	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1596.80	0.00	1596.80	0.40	0.74	35.06	16	7.26	155.95	2.21
15.696	2.260	5.60	18.37	14.11	4.93	59.11155906	50	1.04	7.25	0.462	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1615.58	0.00	1615.58	0.40	0.74	35.80	16	7.43	159.24	2.26
16.696	2.404	5.55	18.20	14.28	5.09	61.07955906	50	1.04	7.25	0.434	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1634.35	0.00	1634.35	0.41	0.74	36.54	16	7.59	162.53	2.31
17.696	2.548	5.50	18.04	14.44	5.26	63.04755906	50	1.04	7.25	0.410	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1653.13	0.00	1653.13	0.41	0.74	37.28	16	7.76	165.82	2.36
18.696	2.692	5.45	17.88	14.60	5.42	65.01555906	50	1.04	7.25	0.388	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1671.90	0.00	1671.90	0.42	0.74	38.02	16	7.92	169.11	2.41
19.696	2.836	5.40	17.71	14.77	5.58	66.98355906	50	1.04	7.25	0.368	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1690.68	0.00	1690.68	0.42	0.74	38.76	16	8.08	172.40	2.46
20.696	2.980	5.35	17.55	14.93	5.75	68.95155906	50	1.04	7.25	0.350	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1709.45	0.00	1709.45	0.43	0.74	39.50	15	8.25	175.69	2.51
21.696	3.124	5.30	17.38	15.10	5.91	70.91955906	50	1.04	7.25	0.334	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1728.23	0.00	1728.23	0.43	0.74	40.24	15	8.41	178.98	2.56
22.696	3.268	5.25	17.22	15.26	6.07	72.88755906	50	1.04	7.25	0.320	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1747.00	0.00	1747.00	0.44	0.74	40.98	15	8.57	182.27	2.61
23.696	3.412	5.20	17.06	15.42	6.24	74.85555906	50	1.04	7.25	0.306	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1765.78	0.00	1765.78	0.44	0.74	41.72	15	8.74	185.56	2.66
24.696	3.556	5.15	16.89	15.59	6.40	76.82355906	50	1.04	7.25	0.294	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1784.55	0.00	1784.55	0.45	0.74	42.46	14	8.90	188.86	2.71
25.696	3.700	5.10	16.73	15.75	6.57	78.79155906	50	1.04	7.25	0.282	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1803.33	0.00	1803.33	0.45	0.74	43.20	14	9.07	192.15	2.76
26.696	3.844	5.05	16.56	15.92	6.73	80.75955906	50	1.04	7.25	0.272	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1822.10	0.00	1822.10	0.46	0.74	43.94	14	9.23	195.44	2.81
27.696	3.988	5.00	16.40	16.08	6.89	82.72755906	50	1.04	7.25	0.262	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1840.87	0.26	1840.61	0.46	0.74	44.68	14	9.39	198.73	2.86
28.696	4.132	4.95	16.24	16.24	7.06	84.69555906	50	1.04	7.25	0.253	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1859.65	10.50	1849.15	0.46	0.74	45.42	14	9.55	202.02	2.91
29.696	4.276	4.90	16.07	16.41	7.22	86.66355906	50	1.04	7.25	0.244	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1878.42	20.73	1857.69	0.46	0.74	46.16	14	9.72	205.31	2.96
30.696	4.420	4.85	15.91	16.57	7.39	88.63155906	50	1.04	7.25	0.236	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1897.20	30.96	1866.24	0.47	0.74	46.90	13	9.88	208.60	3.01
31.696	4.564	4.80	15.74	16.74	7.55	90.59955906	50	1.04	7.25	0.229	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1915.97	41.20	1874.78	0.47	0.74	47.63	13	10.05	211.89	3.06
32.696	4.708	4.75	15.58	16.90	7.71	92.56755906	50	1.04	7.25	0.222	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1934.75	51.43	1883.32	0.47	0.74	48.37	13	10.21	215.18	3.11
33.696	4.852	4.70	15.42	17.06	7.88	94.53555906	50	1.04	7.25	0.215	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1953.52	61.66	1891.86	0.47	0.74	49.11	13	10.38	218.47	3.16
34.696	4.996	4.65	15.25	17.23	8.04	96.50355906	50	1.04	7.25	0.209	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1972.30	71.90	1900.40	0.48	0.74	49.85	13	10.54	221.76	3.21
35.696	5.140	4.60	15.09	17.39	8.21	98.47155906	50	1.04	7.25	0.203	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1991.07	82.13	1908.94	0.48	0.74	50.59	13	10.71	225.05	3.26
36.696	5.284	4.55	14.92	17.56	8.37	100.4395591	50	1.04	7.25	0.198	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2009.85	92.36	1917.48	0.48	0.74	51.33	12	10.87	228.34	3.31
37.696	5.428	4.50	14.76	17.72	8.53	102.4075591	50	1.04	7.25	0.192	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2028.62	102.60	1926.02	0.48	0.74	52.07	12	11.03	231.63	3.36
38.696	5.572	4.45	14.60	17.88	8.70	104.3755591	50	1.04	7.25	0.187	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2047.40	112.83	1934.56	0.48	0.74	52.81	12	11.20	234.93	3.41
39.696	5.716	4.40	14.43	18.05	8.86	106.3435591	50	1.04	7.25	0.183	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2066.17	123.07	1943.11	0.48	0.74	53.55	12	11.36	238.22	3.46
40.696	5.860	4.35	14.27	18.21	9.03	108.3115591	50	1.04	7.25	0.178	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2084.95	133.30	1951.65	0.49	0.74	54.29	12	11.53	241.51	3.51
41.696	6.004	4.30	14.10	18.38	9.19	110.2795591	50	1.04	7.25	0.174	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2103.72	143.53	1960.19	0.49	0.74	55.03	12	11.69	244.80	3.56
42.696	6.148	4.25	13.94	18.54	9.35	112.2475591	50	1.04	7.25	0.170	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2122.50	153.77	1968.73	0.49	0.74	55.77	11	11.85	248.09	3.61
43.696	6.292	4.20	13.78	18.70	9.52	114.2155591	50	1.04	7.25	0.166	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2141.27	164.00	1977.27	0.49	0.74	56.51	11	12.02	251.38	3.66
44.696	6.436	4.15	13.61	18.87	9.68	116.1835591	50	1.04	7.25	0.162	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2160.04	174.23	1985.81	0.50	0.74	57.25	11	12.18	254.67	3.71
45.696	6.580	4.10	13.45	19.03	9.85	118.1515591	50	1.04	7.25	0.159	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2178.82	184.47	1994.35	0.50	0.74	57.99	11	12.35	257.96	3.76
46.696	6.724	4.05	13.28	19.20	10.01	120.1195591	50	1.04	7.25	0.155	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2197.59	194.70	2002.89	0.50	0.74	58.73	11	12.51	261.25	3.81
47.696	6.868	4.00	13.12	19.36	10.17	122.0875591	50	1.04	7.25	0.152	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2216.37	204.93	2011.43	0.50	0.74	59.47	11	12.67	264.54	3.86
48.696	7.012	3.95	12.95	19.52	10.34	124.0555591	50	1.04	7.25	0.149	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2235.14	215.17	2019.98	0.50	0.74	60.21	10	12.84	267.83	3.91
49.696	7.156	3.90	12.79	19.69	10.50	126.0235591	50	1.04	7.25	0.146	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2253.92	225.40	2028.52	0.51	0.74	60.95	10	13.00	271.12	3.96
50.696	7.300	3.85	12.63	19.85	10.67	127.9915591	50	1.04	7.25	0.143	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2272.69	235.63	2037.06	0.51	0.74	61.69	10	13.17	274.41	4.01
51.696	7.444	3.80	12.46	20.02	10.83	129.9595591	50	1.04	7.25	0.140	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2291.47	245.87	2045.60	0.51	0.74	62.43	10	13.33	277.70	4.06
52.696	7.588	3.75	12.30	20.18	10.99	131.9275591	50	1.04	7.25	0.138	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2310.24	256.10	2054.14	0.51	0.74	63.17	10	13.49	280.99	4.11
53.696	7.732	3.70	12.14	20.34	11.16	133.8955591	50	1.04	7.25	0.135	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2329.02	266.34	2062.68	0.52	0.74	63.91	10	13.66	284.29	4.16
54.696	7.876	3.65	11.97	20.51	11.32	135.8635591	50	1.04	7.25	0.133	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2347.79	276.57	2071.22	0.52	0.74	64.65	9	13.82	287.58	4.21
55.696	8.020	3.60	11.81	20.67	11.49	137.8315591	50	1.04	7.25	0.130	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2366.57	286.80	2079.76	0.52	0.74	65.39	9	13.99	290.87	4.26
56.696	8.164	3.55	11.64	20.84	11.65	139.7995591	50	1.04	7.25	0.128	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2385.34	297.04	2088.30	0.52	0.74	66.13	9	14.15	294.16	4.31
57.696	8.308	3.50	11.48	21.00	11.81	141.7675591	50	1.04	7.25	0.126	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2404.12	307.27	2096.85	0.52	0.74	66.87	9	14.31	297.45	4.36
58.696	8.452	3.45	11.32	21.16	11.98	143.7355591	50	1.04	7.25	0.124	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2422.89	317.50	2105.39	0.53	0.74	67.61	9	14.48	300.74	4.41
59.696	8.596	3.40	11.15	21.33	12.14	145.7035591	50	1.04	7.25	0.121	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2441.67	327.74	2113.93	0.53	0.74	68.35	9	14.64	304.03	4.46
60.696	8.740	3.35	10.99	21.49	12.31	147.6715591	50	1.04	7.25	0.119	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2460.44	337.97	2122.47	0.53	0.74	69.09	8	14.81	307.32	4.51
61.696	8.884	3.30	10.82	21.66	12.47	149.6395591	50	1.04	7.25	0.118	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2479.21	348.20	2131.01	0.53	0.74	69.83	8	14.97	310.61	4.56
62.696	9.028	3.25	10.66	21.82	12.63	151.6075591	50	1.04	7.25	0.116	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2497.99	358.44	2139.55	0.53	0.74	70.57	8	15.13	313.90	4.61
63.696	9.172	3.20	10.50	21.98	12.80	153.5755591	50	1.04	7.25	0.114	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2516.76	368.67	2148.09	0.54	0.74	71.31	8	15.30	317.19	4.66
64.696	9.316	3.15	10.33	22.15	12.96	155.5435591	50	1.04	7.25	0.112	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2535.54	378.91	2156.63	0.54	0.74	72.05	8	15.46	320.48	4.71
65.696	9.460	3.10	10.17	22.31	13.13	157.5115591	50	1.04	7.25	0.110	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2554.31	389.14	2165.17	0.54	0.74	72.79	8	15.63	323.77	4.76
66.696	9.604	3.05	10.00	22.48	13.29	159.4795591	50	1.04	7.25	0.109	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2573.09	399.37	2173.72	0.54	0.74	73.53	8	15.79	327.06	4.81

67.696	9.748	3.00	9.84	22.64	13.46	161.4475591	50	1.04	7.25	0.107	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2591.86	409.61	2182.26	0.55	0.74	74.27	7	15.95	330.36	4.86
68.696	9.892	2.95	9.68	22.80	13.62	163.4155591	50	1.04	7.25	0.106	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2610.64	419.84	2190.80	0.55	0.74	75.01	7	16.12	333.65	4.91
69.696	10.036	2.90	9.51	22.97	13.78	165.3835591	50	1.04	7.25	0.104	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2629.41	430.07	2199.34	0.55	0.74	75.75	7	16.28	336.94	4.96
70.696	10.180	2.85	9.35	23.13	13.95	167.3515591	50	1.04	7.25	0.103	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2648.19	440.31	2207.88	0.55	0.74	76.49	7	16.45	340.23	5.01
71.696	10.324	2.80	9.18	23.30	14.11	169.3195591	50	1.04	7.25	0.101	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2666.96	450.54	2216.42	0.55	0.74	77.23	7	16.61	343.52	5.06
72.696	10.468	2.75	9.02	23.46	14.27	171.2875591	50	1.04	7.25	0.100	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2685.74	460.77	2224.96	0.56	0.74	77.97	7	16.77	346.81	5.11
73.696	10.612	2.70	8.86	23.62	14.44	173.2555591	50	1.04	7.25	0.098	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2704.51	471.01	2233.50	0.56	0.74	78.71	6	16.94	350.10	5.16
74.696	10.756	2.65	8.69	23.78	14.60	175.2235591	50	1.04	7.25	0.097	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2723.29	481.24	2242.05	0.56	0.74	79.45	6	17.10	353.39	5.21
75.696	10.900	2.60	8.53	23.95	14.77	177.1915591	50	1.04	7.25	0.096	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2742.06	491.47	2250.59	0.56	0.74	80.19	6	17.27	356.68	5.26
76.696	11.044	2.55	8.36	24.12	14.93	179.1595591	50	1.04	7.25	0.095	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2760.84	501.71	2259.13	0.56	0.74	80.92	6	17.43	359.97	5.31
77.696	11.188	2.50	8.20	24.28	15.09	181.1275591	50	1.04	7.25	0.093	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2779.61	511.94	2267.67	0.57	0.74	81.66	6	17.59	363.26	5.36
78.696	11.332	2.45	8.04	24.44	15.26	183.0955591	50	1.04	7.25	0.092	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2798.39	522.18	2276.21	0.57	0.74	82.40	6	17.76	366.55	5.41
79.696	11.476	2.40	7.87	24.61	15.42	185.0635591	50	1.04	7.25	0.091	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2817.16	532.41	2284.75	0.57	0.74	83.14	5	17.92	369.84	5.46
80.696	11.620	2.35	7.71	24.77	15.59	187.0315591	50	1.04	7.25	0.090	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2835.93	542.64	2293.29	0.57	0.74	83.88	5	18.09	373.13	5.51
81.696	11.764	2.30	7.54	24.94	15.75	188.9995591	50	1.04	7.25	0.089	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2854.71	552.88	2301.83	0.58	0.74	84.62	5	18.25	376.43	5.56
82.696	11.908	2.25	7.38	25.10	15.91	190.9675591	50	1.04	7.25	0.088	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2873.49	563.11	2310.37	0.58	0.74	85.36	5	18.41	379.72	5.61
83.696	12.052	2.20	7.22	25.26	16.08	192.9355591	50	1.04	7.25	0.087	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2892.26	573.34	2318.92	0.58	0.74	86.10	5	18.58	383.01	5.66
84.696	12.196	2.15	7.05	25.43	16.24	194.9035591	50	1.04	7.25	0.086	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2911.03	583.58	2327.46	0.58	0.74	86.84	5	18.74	386.30	5.71
85.696	12.340	2.10	6.89	25.59	16.41	196.8715591	50	1.04	7.25	0.085	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2929.81	593.81	2336.00	0.58	0.74	87.58	4	18.91	389.59	5.76
86.696	12.484	2.05	6.72	25.76	16.57	198.8395591	50	1.04	7.25	0.084	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2948.58	604.04	2344.54	0.59	0.74	88.32	4	19.07	392.88	5.81
87.696	12.628	2.00	6.56	25.92	16.73	200.8075591	50	1.04	7.25	0.083	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2967.36	614.28	2353.08	0.59	0.74	89.06	4	19.23	396.17	5.86
88.696	12.772	1.95	6.40	26.08	16.90	202.7755591	50	1.04	7.25	0.082	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2986.13	624.51	2361.62	0.59	0.74	89.80	4	19.40	399.46	5.91
89.696	12.916	1.90	6.23	26.25	17.06	204.7435591	50	1.04	7.25	0.081	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3004.91	634.75	2370.16	0.59	0.74	90.54	4	19.56	402.75	5.96
90.696	13.060	1.85	6.07	26.41	17.23	206.7115591	50	1.04	7.25	0.080	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3023.68	644.98	2378.70	0.59	0.74	91.28	4	19.73	406.04	6.01
91.696	13.204	1.80	5.90	26.58	17.39	208.6795591	50	1.04	7.25	0.079	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3042.46	655.21	2387.24	0.60	0.74	92.02	3	19.89	409.33	6.06
92.696	13.348	1.75	5.74	26.74	17.55	210.6475591	50	1.04	7.25	0.078	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3061.23	665.45	2395.78	0.60	0.74	92.76	3	20.06	412.62	6.11
93.696	13.492	1.70	5.58	26.90	17.72	212.6155591	50	1.04	7.25	0.077	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3080.01	675.68	2404.33	0.60	0.74	93.50	3	20.22	415.91	6.16
94.696	13.636	1.65	5.41	27.07	17.88	214.5835591	50	1.04	7.25	0.077	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3098.78	685.91	2412.87	0.60	0.74	94.24	3	20.38	419.20	6.21
95.696	13.780	1.60	5.25	27.23	18.05	216.5515591	50	1.04	7.25	0.076	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3117.56	696.15	2421.41	0.61	0.74	94.98	3	20.55	422.49	6.26
96.696	13.924	1.55	5.08	27.40	18.21	218.5195591	50	1.04	7.25	0.075	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3136.33	706.38	2429.95	0.61	0.74	95.72	3	20.71	425.79	6.31
97.696	14.068	1.50	4.92	27.56	18.37	220.4875591	50	1.04	7.25	0.074	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3155.10	716.61	2438.49	0.61	0.74	96.46	2	20.87	429.08	6.36
98.696	14.212	1.45	4.76	27.72	18.54	222.4555591	50	1.04	7.25	0.073	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3173.88	726.85	2447.03	0.61	0.74	97.20	2	21.04	432.37	6.41
99.696	14.356	1.40	4.59	27.89	18.70	224.4235591	50	1.04	7.25	0.073	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3192.65	737.08	2455.57	0.61	0.74	97.94	2	21.20	435.66	6.46
100.696	14.500	1.35	4.43	28.05	18.87	226.3915591	50	1.04	7.25	0.072	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3211.43	747.31	2464.11	0.62	0.74	98.68	2	21.37	438.95	6.51
101.696	14.644	1.30	4.26	28.22	19.03	228.3595591	50	1.04	7.25	0.071	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3230.20	757.55	2472.65	0.62	0.74	99.42	2	21.53	442.24	6.56
102.696	14.788	1.25	4.10	28.38	19.19	230.3275591	50	1.04	7.25	0.071	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3248.98	767.78	2481.20	0.62	0.74	100.16	2	21.69	445.53	6.61
103.696	14.932	1.20	3.94	28.54	19.36	232.2955591	50	1.04	7.25	0.070	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3267.75	778.02	2489.74	0.62	0.74	100.90	1	21.86	448.82	6.66
104.696	15.076	1.15	3.77	28.71	19.52	234.2635591	50	1.04	7.25	0.069	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3286.53	788.25	2498.28	0.62	0.74	101.64	1	22.02	452.11	6.71
105.696	15.220	1.10	3.61	28.87	19.68	236.2315591	50	1.04	7.25	0.069	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3305.30	798.48	2506.82	0.63	0.74	102.38	1	22.19	455.40	6.76
106.696	15.364	1.05	3.44	29.04	19.85	238.1995591	50	1.04	7.25	0.068	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3324.08	808.72	2515.36	0.63	0.74	103.12	1	22.35	458.69	6.81
107.696	15.508	1.00	3.28	29.20	20.01	240.1675591	50	1.04	7.25	0.067	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3342.85	818.95	2523.90	0.63	0.74	103.86	1	22.51	461.98	6.86
108.696	15.652	0.95	3.12	29.36	20.18	242.1355591	50	1.04	7.25	0.067	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3361.63	829.18	2532.44	0.63	0.74	104.60	1	22.68	465.27	6.91
109.696	15.796	0.90	2.95	29.53	20.34	244.1035591	50	1.04	7.25	0.066	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3380.40	839.42	2540.98	0.64	0.74	105.34	0	22.84	468.56	6.96
110.696	15.940	0.85	2.79	29.69	20.51	246.0715591	50	1.04	7.25	0.066	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3399.18	849.65	2549.53	0.64	0.74	106.08	0	23.01	471.85	7.01
111.696	16.084	0.80	2.62	29.85	20.67	248.0395591	50	1.04	7.25	0.065	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3417.95	859.88	2558.07	0.64	0.74	106.82	0	23.17	475.15	7.06
112.696	16.228	0.75	2.46	30.02	20.83	250.0075591	50	1.04	7.25	0.064	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3436.73	870.12	2566.61	0.64	0.74	107.56	0	23.33	478.44	7.11
113.696	16.372	0.70	2.30	30.18	21.00	251.9755591	50	1.04	7.25	0.064	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3455.50	880.35	2575.15	0.64	0.74	108.30	0	23.50	481.73	7.16
114.696	16.516	0.65	2.13	30.35	21.16	253.9435591	50	1.04	7.25	0.063	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3474.28	890.59	2583.69	0.65	0.74	109.04	0	23.66	485.02	7.21
115.696	16.660	0.60	1.97	30.51	21.33	255.9115591	50	1.04	7.25	0.063	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3493.05	900.82	2592.23	0.65	0.74	109.78	-1	23.83	488.31	7.26
116.696	16.804	0.55	1.80	30.68	21.49	257.8795591	50	1.04	7.25	0.062	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3511.82	911.05	2600.77	0.65	0.74	110.52	-1	23.99	491.60	7.31
117.696	16.948	0.50	1.64	30.84	21.65	259.8475591	50	1.04	7.25	0.062	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3530.60	921.29	2609.31	0.65	0.74	111.26	-1	24.15	494.89	7.36
118.696	17.092	0.45	1.48	31.00	21.82	261.8155591	50	1.04	7.25	0.061	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3549.37	931.52	2617.86	0.65	0.74	112.00	-1	24.32	498.18	7.41
119.696	17.236	0.40	1.31	31.17	21.98	263.7835591	50	1.04	7.25	0.061	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3568.15	941.75	2626.40	0.66	0.74	112.74	-1	24.48	501.47	7.46
120.696	17.380	0.35	1.15	31.33	22.15	265.7515591	50	1.04	7.25	0.060	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3586.92	951.99	2634.94	0.66	0.74	113.48	-1	24.65	504.76	7.51
121.696	17.524	0.30	0.98	31.50	22.31	267.7195591	50	1.04	7.25	0.060	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3605.70	962.22	2643.48	0.66	0.74	114.21	-2	24.81	508.05	7.56
122.696	17.668	0.25	0.82	31.66	22.47	269.6875591	50	1.04	7.25	0.059	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3624.47	972.45	2652.02	0.66	0.74	114.95	-2	24.97	511.34	7.61
123.696	17.812	0.20	0.66	31.82	22.64	271.6555591	50	1.04	7.25	0.059	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3643.25	982.69	2660.56	0.67	0.74	115.69	-2	25.14	514.63	7.66
124.696	17.956	0.15	0.49	31.99	22.80	273.6235591	50	1.04	7.25	0.058	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3662.02	992.92	2669.10	0.67	0.74	116.43	-2	25.30	517.92	7.71
125.696	18.100	0.10	0.33	32.15	22.97	275.5915591	50	1.04	7.25	0.058	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3680.80	1003.16	2677.64	0.67	0.74	117.17	-2	25.47	521.22	7.76
126.696	18.244	0.05	0.16	32.32	23.13	277.5595591	50	1.04	7.25	0.057	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3699.57	1013.39	2686.18	0.67	0.74	117.91	-2	25.63	524.51	7.81
127.696	18.388	0.00	0.00	32.48	23.29	279.5275591	50	1.04	7.25	0.057	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3718.35	1023.62	2694.72	0.67	0.74	118.65	-3	25.79	527.80	7.86
128.696	18.532	-0.05	-0.16	32.64	23.46	281.4955591	50	1.04	7.25	0.056	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3737.12	1033.86	2703.27	0.68	0.74	119.39	-3	25.96	531.09	7.91
129.696	18.676	-0.10	-0.33	32.81	23.62	283.4635591	50	1.04	7.25	0.056	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3755.90	1044.09	2711.81	0.68	0.74	120.13	-3	26.12	534.38	7.96
130.696	18.820	-0.15	-0.49	32.97	23.79	285.4315591	50	1.04	7.25	0.056	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3774.67	1054.32	2720.35	0.68	0.74	120.87	-3	26.29	537.67	8.01
131.696	18.964	-0.20	-0.66	33.14	23.95	287.3995591	50	1.04	7.25	0.055	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3793.45	1064.56	2728.89	0.68	0.74	121.61	-3	26.45	540.96	8.06
132.696	19.108	-0.25	-0.82	33.30	24.11	289.3675591	50	1.04	7.25	0.055	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3812.22	1074.79	2737.43	0.68	0.74	122.35	-3	26.61	544.25	8.11
133.696	19.252	-0.30	-0.98	33.46	24.28	291.3355591	50	1.04	7.25	0.054	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3830.99	1085.02	2745.97	0.69	0.74	123.09	-3	26.78	547.54	8.16
134.696	19.396	-0.35	-1.15	33.63	24.44	293.3035591	50	1.04	7.25	0.054	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3849.77	1095.26	2754.51	0.69	0.74	123.83	-4	26.94	550.83	8.21
135.696	19.540	-0.40	-1.31	33.79	24.61	295.2715591	50	1.04	7.25	0.053	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3868.54	1105.49	2763.05	0.69	0.74	124.57	-4	27.11	554.12	8.26
136.696	19.684	-0.45	-1.48	33.96	24.77	297.2395591	50	1.04	7.25	0.053	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3887.32	1115.72	2771.59	0.69	0.74	125.31	-4	27.27	557.41	8.31
137.696	19.828	-0.50	-1.64	34.12	24.93	299.2075591	50	1.04	7.25	0.053	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3906.09	1125.96	2780.14	0.70	0.74	126.05	-4	27.43	560.70	8.36
138.696	19.972	-0.55	-1.80	34.28	25.10	301.1755591	50	1.04	7.25	0.052	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3924.87	1136.19	2788.68	0.70	0.74	126.79	-4	27.60	563.99	8.41
139.696	20.116	-0.60	-1.97	34.45	25.26	303.1435591	50	1.04	7.25	0.052	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3943.64	1146.43	2797.22	0.70	0.74	127.53	-4	27.76	567.29	8.46
140.696	20.260	-0.65	-2.13	34.61	25.43	305.1115591	50	1.04	7.25	0.052	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3962.42	1156.66	2805.76	0.70	0.74	128.27	-5	27.93	570.58	8.51
141.696	20.404	-0.70	-2.30	34.78	25.59	307.0795591	50	1.04	7.25	0.051	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3981.19	1166.89	2814.30	0.70	0.74	129.01	-5	28.09	573.87	8.56
142.696	20.548	-0.75	-2.46	34.94	25.75	309.0475591	50	1.04	7.25	0.051	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3999.97	1177.13	2822.84	0.71	0.74	129.75	-5	28.25	577.16	8.61
143.696	20.692	-0.80	-2.62	35.10	25.92	311.0155591	50	1.04	7.25	0.050	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4018.74	1187.36	2831.38	0.71	0.74	130.49	-5	28.42	580.45	8.66
144.696	20.836	-0.85	-2.79	35.27	26.08	312.9835591	50	1.04	7.25	0.050	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4037.52	1197.59	2839.92	0.71	0.74	131.23	-5	28.58	583.74	8.71
145.696	20.980	-0.90	-2.95	35.43	26.25	314.9515591	50	1.04	7.25	0.050	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4056.29	1207.83	2848.46	0.71	0.74	131.97	-5	28.75	587.03	8.76
146.696	21.124	-0.95	-3.12	35.60	26.41	316.9195591	50	1.04	7.25	0.049	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4075.07	1218.06	2857.01	0.71	0.74	132.71	-6	28.91	590.32	8.81
147.696	21.268	-1.00	-3.28	35.76	26.57	318.8875591	50	1.04	7.25	0.049	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4093.84	1228.29	2865.55	0.72	0.74	133.45	-6	29.07	593.61	8.86
148.696	21.412	-1.05	-3.44	35.92	26.74	320.8555591	50	1.04	7.25	0.049	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4112.62	1238.53	2874.09	0.72	0.74	134.19	-6	29.24	596.90	8.91
149.696	21.556	-1.10	-3.61	36.09	26.90	322.8235591	50	1.04	7.25	0.048	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4131.39	1248.76	2882.63	0.72	0.74	134.93	-6	29.40	600.19	8.96
150.696	21.700	-1.15	-3.77	36.25	27.07	324.7915591	50	1.04	7.25	0.048	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4150.17	1258.99	2891.17	0.72	0.74	135.67	-6	29.57	603.48	9.01
151.696	21.844	-1.20	-3.94	36.42	27.23	326.7595591	50	1.04	7.25	0.048	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4168.94	1269.23	2899.71	0.72	0.74	136.41	-6	29.73	606.77	9.06
152.696	21.988	-1.25	-4.10	36.58	27.39	328.7275591	50	1.04	7.25	0.047	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4187.71	1279.46	2908.25	0.73	0.74	137.15	-7	29.89	610.06	9.11
153.696	22.132	-1.30	-4.26	36.74	27.56	330.6955591	50	1.04	7.25	0.047	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4206.49	1289.70	2916.79	0.73	0.74	137.89	-7	30.06	613.36	9.16
154.696	22.276	-1.35	-4.43	36.91	27.72	332.6635591	50	1.04	7.25	0.047	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4225.26	1299.93	2925.33	0.73	0.74	138.63	-7	30.22	616.65	9.21
155.696	22.420	-1.40	-4.59	37.07	27.89	334.6315591	50	1.04	7.25	0.047	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4244.04	1310.16	2933.88	0.73	0.74	139.37	-7	30.39	619.94	9.26
156.696	22.564	-1.45	-4.76	37.24	28.05	336.5995591	50	1.04	7.25	0.046	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4262.81	1320.40	2942.42	0.74	0.74	140.11	-7	30.55	623.23	9.31
157.696	22.708	-1.50	-4.92	37.40	28.21	338.5675591	50	1.04	7.25	0.046	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4281.59	1330.63	2950.96	0.74	0.74	140.85	-7	30.71	626.52	9.36
158.696	22.852	-1.55	-5.08	37.56	28.38	340.5355591	50	1.04	7.25	0.046	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4300.36	1340.86	2959.50	0.74	0.74	141.59	-8	30.88	629.81	9.41
159.696	22.996	-1.60	-5.25	37.73	28.54	342.5035591	50	1.04	7.25	0.045	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4319.14	1351.10	2968.04	0.74	0.74	142.33	-8	31.04	633.10	9.46
160.696	23.140	-1.65	-5.41	37.89	28.71	344.4715591	50	1.04	7.25	0.045	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4337.91	1361.33	2976.58	0.74	0.74	143.07	-8	31.21	636.39	9.51
161.696	23.284	-1.70	-5.58	38.06	28.87	346.4395591	50	1.04	7.25	0.045	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4356.69	1371.56	2985.12	0.75	0.74	143.81	-8	31.37	639.68	9.56
162.696	23.428	-1.75	-5.74	38.22	29.03	348.4075591	50	1.04	7.25	0.045	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4375.46	1381.80	2993.66	0.75	0.74	144.55	-8	31.53	642.97	9.61
163.696	23.572	-1.80	-5.90	38.38	29.20	350.3755591	50	1.04	7.25	0.044	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4394.24	1392.03	3002.20	0.75	0.74	145.29	-8	31.70	646.26	9.66
164.696	23.716	-1.85	-6.07	38.55	29.36	352.3435591	50	1.04	7.25	0.044	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4413.01	1402.27	3010.75	0.75	0.74	146.03	-9	31.86	649.55	9.71
165.696	23.860	-1.90	-6.23	38.71	29.53	354.3115591	50	1.04	7.25	0.044	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4431.79	1412.50	3019.29	0.75	0.74	146.77	-9	32.03	652.84	9.76
166.696	24.004	-1.95	-6.40	38.88	29.69	356.2795591	50	1.04	7.25	0.044	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4450.56	1422.73	3027.83	0.76	0.74	147.50	-9	32.19	656.13	9.81
167.696	24.148	-2.00	-6.56	39.04	29.85	358.2475591	90	1.88	13.05	0.078	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4471.42	1432.97	3038.46	0.76	1.33	148.84	-9	32.36	662.06	9.86
168.696	24.292	-2.05	-6.72	39.20	30.02	360.2155591	90	1.88	13.05	0.077	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4492.28	1443.20	3049.08	0.76	1.33	150.17	-9	32.52	667.98	9.91
169.696	24.436	-2.10	-6.89	39.37	30.18	362.1835591	90	1.88	13.05	0.077	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4513.14	1453.43	3059.71	0.76	1.33	151.50	-9	32.68	673.90	9.96
170.696	24.580	-2.15	-7.05	39.53	30.35	364.1515591	90	1.88	13.05	0.076	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4534.00	1463.67	3070.34	0.77	1.33	152.83	-10	32.85	679.83	10.01
171.696	24.724	-2.20	-7.22	39.70	30.51	366.1195591	90	1.88	13.05	0.076	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4554.86	1473.90	3080.96	0.77	1.33	154.16	-10	33.01	685.75	10.06
172.696	24.868	-2.25	-7.38	39.86	30.67	368.0875591	90	1.88	13.05	0.076	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4575.73	1484.13	3091.59	0.77	1.33	155.49	-10	33.17	691.67	10.11
173.696	25.012	-2.30	-7.54	40.02	30.84	370.0555591	90	1.88	13.05	0.075	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4596.59	1494.37	3102.22	0.78	1.33	156.83	-10	33.34	697.60	10.16
174.696	25.156	-2.35	-7.71	40.19	31.00	372.0235591	90	1.88	13.05	0.075	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4617.45	1504.60	3112.85	0.78	1.33	158.16	-10	33.50	703.52	10.21
175.696	25.300	-2.40	-7.87	40.35	31.17	373.9915591	90	1.88	13.05	0.074	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4638.31	1514.83	3123.47	0.78	1.33	159.49	-10	33.67	709.44	10.26
176.696	25.444	-2.45	-8.04	40.52	31.33	375.9595591	90	1.88	13.05	0.074	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4659.17	1525.07	3134.10	0.78	1.33	160.82	-11	33.83	715.37	10.31
177.696	25.588	-2.50	-8.20	40.68	31.49	377.9275591	90	1.88	13.05	0.073	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4680.03	1535.30	3144.73	0.79	1.33	162.15	-11	33.99	721.29	10.36
178.696	25.732	-2.55	-8.36	40.84	31.66	379.8955591	90	1.88	13.05	0.073	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4700.89	1545.54	3155.36	0.79	1.33	163.48	-11	34.16	727.21	10.41
179.696	25.876	-2.60	-8.53	41.01	31.82	381.8635591	90	1.88	13.05	0.073	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4721.75	1555.77	3165.98	0.79	1.33	164.82	-11	34.32	733.14	10.46
180.696	26.020	-2.65	-8.69	41.17	31.99	383.8315591	90	1.88	13.05	0.072	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4742.61	1566.00	3176.61	0.79	1.33	166.15	-11	34.49	739.06	10.51
181.696	26.164	-2.70	-8.86	41.34	32.15	385.7995591	90	1.88	13.05	0.072	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4763.47	1576.24	3187.24	0.80	1.33	167.48	-11	34.65	744.98	10.56
182.696	26.308	-2.75	-9.02	41.50	32.31	387.7675591	90	1.88	13.05	0.071	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4784.33	1586.47	3197.86	0.80	1.33	168.81	-12	34.81	750.91	10.61
183.696	26.452	-2.80	-9.18	41.66	32.48	389.7355591	90	1.88	13.05	0.071	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4805.19	1596.70	3208.49	0.80	1.33	170.14	-12	34.98	756.83	10.66
184.696	26.596	-2.85	-9.35	41.83	32.64	391.7035591	90	1.88	13.05	0.071	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4826.05	1606.94	3219.12	0.80	1.33	171.47	-12	35.14	762.75	10.71
185.696	26.740	-2.90	-9.51	41.99	32.81	393.6715591	90	1.88	13.05	0.070	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4846.92	1617.17	3229.74	0.81	1.33	172.81	-12	35.31	768.68	10.76
186.696	26.884	-2.95	-9.68	42.16	32.97	395.6395591	90	1.88	13.05	0.070	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4867.78	1627.40	3240.37	0.81	1.33	174.14	-12	35.47	774.60	10.81
187.696	27.028	-3.00	-9.84	42.32	33.13	397.6075591	90	1.88	13.05	0.070	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4888.64	1637.64	3251.00	0.81	1.33	175.47	-12	35.63	780.52	10.86
188.696	27.172	-3.05	-10.00	42.48	33.30	399.5755591	90	1.88	13.05	0.069	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4909.50	1647.87	3261.63	0.82	1.33	176.80	-13	35.80	786.45	10.91
189.696	27.316	-3.10	-10.17	42.65	33.46	401.5435591	90	1.88	13.05	0.069	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4930.36	1658.11	3272.25	0.82	1.33	178.13	-13	35.96	792.37	10.96
190.696	27.460	-3.15	-10.33	42.81	33.63	403.5115591	90	1.88	13.05	0.068	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4951.22	1668.34	3282.88	0.82	1.33	179.46	-13	36.13	798.29	11.01
191.696	27.604	-3.20	-10.50	42.98	33.79	405.4795591	90	1.88	13.05	0.068	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4972.08	1678.57	3293.51	0.82	1.33	180.79	-13	36.29	804.22	11.06
192.696	27.748	-3.25	-10.66	43.14	33.95	407.4475591	90	1.88	13.05	0.068	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	4992.94	1688.81	3304.14	0.83	1.33	182.13	-13	36.45	810.14	11.11
193.696	27.892	-3.30	-10.82	43.30	34.12	409.4155591	90	1.88	13.05	0.067	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5013.80	1699.04	3314.76	0.83	1.33	183.46	-13	36.62	816.06	11.16
194.696	28.036	-3.35	-10.99	43.47	34.28	411.3835591	90	1.88	13.05	0.067	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5034.66	1709.27	3325.39	0.83	1.33	184.79	-13	36.78	821.98	11.21
195.696	28.180	-3.40	-11.15	43.63	34.45	413.3515591	90	1.88	13.05	0.067	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5055.52	1719.51	3336.02	0.83	1.33	186.12	-14	36.95	827.91	11.26
196.696	28.324	-3.45	-11.32	43.80	34.61	415.3195591	90	1.88	13.05	0.066	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5076.38	1729.74	3346.64	0.84	1.33	187.45	-14	37.11	833.83	11.31
197.696	28.468	-3.50	-11.48	43.96	34.77	417.2875591	90	1.88	13.05	0.066	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5097.25	1739.97	3357.27	0.84	1.33	188.78	-14	37.27	839.75	11.36
198.696	28.612	-3.55	-11.64	44.12	34.94	419.2555591	90	1.88	13.05	0.066	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5118.11	1750.21	3367.90	0.84	1.33	190.12	-14	37.44	845.68	11.41
199.696	28.756	-3.60	-11.81	44.29	35.10	421.2235591	90	1.88	13.05	0.065	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5138.97	1760.44	3378.53	0.84	1.33	191.45	-14	37.60	851.60	11.46
200.696	28.900	-3.65	-11.97	44.45	35.27	423.1915591	90	1.88	13.05	0.065	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5159.83	1770.67	3389.15	0.85	1.33	192.78	-14	37.77	857.52	11.51
201.696	29.044	-3.70	-12.14	44.62	35.43	425.1595591	90	1.88	13.05	0.065	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5180.69	1780.91	3399.78	0.85	1.33	194.11	-15	37.93	863.45	11.56
202.696	29.188	-3.75	-12.30	44.78	35.59	427.1275591	90	1.88	13.05	0.064	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5201.55	1791.14	3410.41	0.85	1.33	195.44	-15	38.09	869.37	11.61
203.696	29.332	-3.80	-12.46	44.94	35.76	429.0955591	90	1.88	13.05	0.064	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5222.41	1801.38	3421.03	0.86	1.33	196.77	-15	38.26	875.29	11.66
204.696	29.476	-3.85	-12.63	45.11	35.92	431.0635591	90	1.88	13.05	0.064	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5243.27	1811.61	3431.66	0.86	1.33	198.11	-15	38.42	881.22	11.71
205.696	29.620	-3.90	-12.79	45.27	36.09	433.0315591	90	1.88	13.05	0.063	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5264.13	1821.84	3442.29	0.86	1.33	199.44	-15	38.59	887.14	11.76
206.696	29.764	-3.95	-12.96	45.44	36.25	434.9995591	90	1.88	13.05	0.063	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5284.99	1832.08	3452.92	0.86	1.33	200.77	-15	38.75	893.06	11.81
207.696	29.908	-4.00	-13.12	45.60	36.41	436.9675591	90	1.88	13.05	0.063	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5305.85	1842.31	3463.54	0.87	1.33	202.10	-16	38.91	898.99	11.86
208.696	30.052	-4.05	-13.28	45.76	36.58	438.9355591	90	1.88	13.05	0.063	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5326.71	1852.54	3474.17	0.87	1.33	203.43	-16	39.08	904.91	11.91
209.696	30.196	-4.10	-13.45	45.93	36.74	440.9035591	90	1.88	13.05	0.062	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5347.57	1862.78	3484.80	0.87	1.33	204.76	-16	39.24	910.83	11.96
210.696	30.340	-4.15	-13.61	46.09	36.91	442.8715591	90	1.88	13.05	0.062	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5368.44	1873.01	3495.42	0.87	1.33	206.10	-16	39.41	916.76	12.01
211.696	30.484	-4.20	-13.78	46.26	37.07	444.8395591	90	1.88	13.05	0.062	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5389.30	1883.24	3506.05	0.88	1.33	207.43	-16	39.57	922.68	12.06
212.696	30.628	-4.25	-13.94	46.42	37.23	446.8075591	90	1.88	13.05	0.061	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5410.16	1893.48	3516.68	0.88	1.33	208.76	-16	39.73	928.60	12.11
213.696	30.772	-4.30	-14.10	46.58	37.40	448.7755591	90	1.88	13.05	0.061	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5431.02	1903.71	3527.31	0.88	1.33	210.09	-17	39.90	934.53	12.16
214.696	30.916	-4.35	-14.27	46.75	37.56	450.7435591	90	1.88	13.05	0.061	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5451.88	1913.95	3537.93	0.88	1.33	211.42	-17	40.06	940.45	12.21
215.696	31.060	-4.40	-14.43	46.91	37.73	452.7115591	90	1.88	13.05	0.061	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5472.74	1924.18	3548.56	0.89	1.33	212.75	-17	40.23	946.37	12.26
216.696	31.204	-4.45	-14.60	47.08	37.89	454.6795591	90	1.88	13.05	0.060	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5493.60	1934.41	3559.19	0.89	1.33	214.08	-17	40.39	952.30	12.31
217.696	31.348	-4.50	-14.76	47.24	38.05	456.6475591	90	1.88	13.05	0.060	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5514.46	1944.65	3569.82	0.89	1.33	215.42	-17	40.55	958.22	12.36
218.696	31.492	-4.55	-14.92	47.40	38.22	458.6155591	90	1.88	13.05	0.060	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5535.32	1954.88	3580.44	0.90	1.33	216.75	-17	40.72	964.14	12.41
219.696	31.636	-4.60	-15.09	47.57	38.38	460.5835591	90	1.88	13.05	0.059	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5556.18	1965.11	3591.07	0.90	1.33	218.08	-18	40.88	970.07	12.46
220.696	31.780	-4.65	-15.25	47.73	38.55	462.5515591	90	1.88	13.05	0.059	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5577.04	1975.35	3601.70	0.90	1.33	219.41	-18	41.05	975.99	12.51
221.696	31.924	-4.70	-15.42	47.90	38.71	464.5195591	90	1.88	13.05	0.059	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5597.90	1985.58	3612.32	0.90	1.33	220.74	-18	41.21	981.91	12.56
222.696	32.068	-4.75	-15.58	48.06	38.87	466.4875591	90	1.88	13.05	0.059	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5618.77	1995.81	3622.95	0.91	1.33	222.07	-18	41.37	987.84	12.61
223.696	32.212	-4.80	-15.74	48.22	39.04	468.4555591	90	1.88	13.05	0.058	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5639.63	2006.05	3633.58	0.91	1.33	223.41	-18	41.54	993.76	12.66
224.696	32.356	-4.85	-15.91	48.39	39.20	470.4235591	90	1.88	13.05	0.058	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5660.49	2016.28	3644.21	0.91	1.33	224.74	-18	41.70	999.68	12.71
225.696	32.500	-4.90	-16.07	48.55	39.37	472.3915591	90	1.88	13.05	0.058	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5681.35	2026.51	3654.83	0.91	1.33	226.07	-19	41.87	1005.61	12.76
226.696	32.644	-4.95	-16.24	48.72	39.53	474.3595591	90	1.88	13.05	0.058	0	0.55	0.55	1.034	7.16	0.00	0.25	20.00	127.20	5702.21	2036.75	3665.46	0.92	1.33	227.40	-19	42.03	1011.53	12.81

227.696	32.788	-5.00	-16.40	48.88	39.69	476.3275591	90	1.88	13.05	0.057	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5723.07	2046.98	3676.09	0.82	1.33	228.73	-16	42.18	1017.46	12.86
228.696	32.932	-5.05	-16.56	49.04	39.86	478.2955591	90	1.88	13.05	0.057	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5743.93	2057.22	3686.71	0.82	1.33	230.06	-16	42.36	1023.38	12.91
229.696	33.076	-5.10	-16.73	49.21	40.02	480.2635591	90	1.88	13.05	0.057	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5764.78	2067.45	3697.34	0.82	1.33	231.40	-16	42.52	1029.30	12.96
230.696	33.220	-5.15	-16.89	49.37	40.18	482.2315591	90	1.88	13.05	0.057	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5785.65	2077.68	3707.97	0.93	1.33	232.73	-18	42.69	1035.22	13.01
231.696	33.364	-5.20	-17.06	49.54	40.35	484.1995591	90	1.88	13.05	0.056	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5806.51	2087.92	3718.60	0.93	1.33	234.06	-20	42.85	1041.14	13.06
232.696	33.508	-5.25	-17.22	49.70	40.51	486.1675591	90	1.88	13.05	0.056	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5827.37	2098.15	3729.22	0.93	1.33	235.39	-20	43.01	1047.07	13.11
233.696	33.652	-5.30	-17.38	49.86	40.68	488.1355591	90	1.88	13.05	0.056	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5848.23	2108.38	3739.85	0.93	1.33	236.72	-20	43.18	1052.99	13.16
234.696	33.796	-5.35	-17.55	50.03	40.84	490.1035591	90	1.88	13.05	0.056	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5869.09	2118.62	3750.48	0.94	1.33	238.05	-20	43.34	1058.91	13.21
235.696	33.940	-5.40	-17.71	50.19	41.01	492.0715591	90	1.88	13.05	0.055	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5889.96	2128.85	3761.10	0.94	1.33	239.39	-20	43.51	1064.84	13.26
236.696	34.084	-5.45	-17.88	50.35	41.17	494.0395591	90	1.88	13.05	0.055	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5910.82	2139.08	3771.73	0.94	1.33	240.72	-20	43.67	1070.76	13.31
237.696	34.228	-5.50	-18.04	50.52	41.33	496.0075591	90	1.88	13.05	0.055	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5931.66	2149.32	3782.36	0.95	1.33	242.05	-21	43.83	1076.68	13.36
238.696	34.372	-5.55	-18.20	50.68	41.50	497.9755591	90	1.88	13.05	0.055	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5952.54	2159.55	3792.98	0.95	1.33	243.38	-21	44.00	1082.61	13.41
239.696	34.516	-5.60	-18.37	50.85	41.66	499.9435591	90	1.88	13.05	0.054	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5973.40	2169.79	3803.61	0.95	1.33	244.71	-21	44.16	1088.53	13.46
240.696	34.660	-5.65	-18.53	51.01	41.83	501.9115591	90	1.88	13.05	0.054	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5994.26	2180.02	3814.24	0.95	1.33	246.04	-21	44.33	1094.46	13.51
241.696	34.804	-5.70	-18.70	51.18	41.99	503.8795591	90	1.88	13.05	0.054	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6015.12	2190.25	3824.87	0.96	1.33	247.37	-21	44.49	1100.38	13.56
242.696	34.948	-5.75	-18.86	51.34	42.15	505.8475591	90	1.88	13.05	0.054	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6035.98	2200.49	3835.50	0.96	1.33	248.71	-21	44.65	1106.30	13.61
243.696	35.092	-5.80	-19.02	51.50	42.32	507.8155591	90	1.88	13.05	0.054	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6056.84	2210.72	3846.12	0.96	1.33	250.04	-22	44.82	1112.22	13.66
244.696	35.236	-5.85	-19.19	51.67	42.48	509.7835591	90	1.88	13.05	0.053	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6077.70	2220.96	3856.75	0.96	1.33	251.37	-22	44.98	1118.15	13.71
245.696	35.380	-5.90	-19.35	51.83	42.65	511.7515591	90	1.88	13.05	0.053	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6098.56	2231.19	3867.38	0.97	1.33	252.70	-22	45.15	1124.07	13.76
246.696	35.524	-5.95	-19.52	52.00	42.81	513.7195591	90	1.88	13.05	0.053	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6119.42	2241.42	3878.00	0.97	1.33	254.03	-22	45.31	1129.99	13.81
247.696	35.668	-6.00	-19.68	52.16	42.97	515.6875591	90	1.88	13.05	0.053	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6140.29	2251.66	3888.63	0.97	1.33	255.36	-22	45.47	1135.92	13.86
248.696	35.812	-6.05	-19.84	52.32	43.14	517.6555591	90	1.88	13.05	0.052	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6161.16	2261.89	3899.26	0.97	1.33	256.70	-22	45.64	1141.84	13.91
249.696	35.956	-6.10	-20.01	52.49	43.30	519.6235591	90	1.88	13.05	0.052	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6182.01	2272.12	3909.89	0.98	1.33	258.03	-23	45.80	1147.76	13.96
250.696	36.100	-6.15	-20.17	52.65	43.47	521.5915591	90	1.88	13.05	0.052	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6202.87	2282.36	3920.51	0.98	1.33	259.36	-23	45.97	1153.68	14.01
251.696	36.244	-6.20	-20.34	52.82	43.63	523.5595591	90	1.88	13.05	0.052	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6223.73	2292.59	3931.14	0.98	1.33	260.69	-23	46.13	1159.61	14.06
252.696	36.388	-6.25	-20.50	52.98	43.79	525.5275591	90	1.88	13.05	0.052	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6244.59	2302.82	3941.77	0.99	1.33	262.02	-23	46.29	1165.53	14.11
253.696	36.532	-6.30	-20.66	53.14	43.96	527.4955591	90	1.88	13.05	0.051	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6265.45	2313.06	3952.39	0.99	1.33	263.35	-23	46.46	1171.46	14.16
254.696	36.676	-6.35	-20.83	53.31	44.12	529.4635591	90	1.88	13.05	0.051	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6286.31	2323.29	3963.02	0.99	1.33	264.69	-23	46.62	1177.38	14.21
255.696	36.820	-6.40	-20.99	53.47	44.29	531.4315591	90	1.88	13.05	0.051	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6307.17	2333.52	3973.65	0.99	1.33	266.02	-23	46.79	1183.30	14.26
256.696	36.964	-6.45	-21.16	53.64	44.45	533.3995591	90	1.88	13.05	0.051	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6328.03	2343.76	3984.28	1.00	1.33	267.35	-24	46.95	1189.23	14.31
257.696	37.108	-6.50	-21.32	53.80	44.61	535.3675591	90	1.88	13.05	0.051	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6348.89	2353.99	3994.90	1.00	1.33	268.68	-24	47.11	1195.15	14.36
258.696	37.252	-6.55	-21.48	53.96	44.78	537.3355591	90	1.88	13.05	0.050	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6369.76	2364.22	4005.53	1.00	1.33	270.01	-24	47.28	1201.07	14.41
259.696	37.396	-6.60	-21.65	54.13	44.94	539.3035591	90	1.88	13.05	0.050	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6390.61	2374.46	4016.16	1.00	1.33	271.34	-24	47.44	1207.00	14.46
260.696	37.540	-6.65	-21.81	54.29	45.11	541.2715591	90	1.88	13.05	0.050	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6411.46	2384.69	4026.78	1.01	1.33	272.66	-24	47.61	1212.92	14.51
261.696	37.684	-6.70	-21.98	54.46	45.27	543.2395591	120	2.51	17.40	0.067	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6432.34	2394.92	4037.41	1.01	1.78	274.45	-24	47.77	1220.82	14.56
262.696	37.828	-6.75	-22.14	54.62	45.43	545.2075591	120	2.51	17.40	0.066	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6453.20	2405.16	4048.04	1.01	1.78	276.23	-25	47.93	1228.71	14.61
263.696	37.972	-6.80	-22.30	54.78	45.60	547.1755591	120	2.51	17.40	0.066	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6474.06	2415.39	4058.67	1.01	1.78	278.00	-25	48.10	1236.61	14.66
264.696	38.116	-6.85	-22.47	54.95	45.76	549.1435591	120	2.51	17.40	0.066	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6494.92	2425.63	4069.29	1.02	1.78	279.78	-25	48.26	1244.51	14.71
265.696	38.260	-6.90	-22.63	55.11	45.93	551.1115591	120	2.51	17.40	0.066	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6515.78	2435.86	4079.92	1.02	1.78	281.56	-25	48.43	1252.41	14.76
266.696	38.404	-6.95	-22.80	55.28	46.09	553.0795591	120	2.51	17.40	0.065	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6536.64	2446.09	4090.55	1.02	1.78	283.33	-26	48.59	1260.31	14.81
267.696	38.548	-7.00	-22.96	55.44	46.25	555.0475591	120	2.51	17.40	0.065	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6557.50	2456.33	4101.18	1.03	1.78	285.10	-26	48.75	1268.20	14.86
268.696	38.692	-7.05	-23.12	55.60	46.42	557.0155591	120	2.51	17.40	0.065	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6578.36	2466.56	4111.80	1.03	1.78	286.88	-26	48.92	1276.10	14.91
269.696	38.836	-7.10	-23.29	55.77	46.58	558.9835591	120	2.51	17.40	0.065	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6599.22	2476.79	4122.43	1.03	1.78	288.65	-26	49.08	1284.00	14.96
270.696	38.980	-7.15	-23.45	55.93	46.75	560.9515591	120	2.51	17.40	0.064	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6620.08	2487.03	4133.06	1.03	1.78	290.43	-26	49.25	1291.90	15.01
271.696	39.124	-7.20	-23.62	56.10	46.91	562.9195591	120	2.51	17.40	0.064	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6640.94	2497.26	4143.68	1.04	1.78	292.21	-26	49.41	1299.79	15.06
272.696	39.268	-7.25	-23.78	56.26	47.07	564.8875591	120	2.51	17.40	0.064	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6661.81	2507.49	4154.31	1.04	1.78	293.98	-26	49.57	1307.69	15.11
273.696	39.412	-7.30	-23.94	56.42	47.24	566.8555591	120	2.51	17.40	0.064	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6682.67	2517.73	4164.94	1.04	1.78	295.76	-26	49.74	1315.59	15.16
274.696	39.556	-7.35	-24.11	56.59	47.40	568.8235591	120	2.51	17.40	0.063	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6703.53	2527.96	4175.57	1.04	1.78	297.53	-27	49.90	1323.49	15.21
275.696	39.700	-7.40	-24.27	56.75	47.57	570.7915591	120	2.51	17.40	0.063	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6724.39	2538.10	4186.10	1.05	1.78	299.31	-27	50.07	1331.38	15.26
276.696	39.844	-7.45	-24.44	56.92	47.73	572.7595591	120	2.51	17.40	0.063	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6745.25	2548.43	4196.82	1.05	1.78	301.08	-27	50.23	1339.28	15.31
277.696	39.988	-7.50	-24.60	57.08	47.89	574.7275591	120	2.51	17.40	0.063	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6766.11	2558.66	4207.45	1.05	1.78	302.86	-27	50.39	1347.18	15.36
278.696	40.132	-7.55	-24.76	57.24	48.06	576.6955591	120	2.51	17.40	0.062	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6786.97	2568.90	4218.07	1.06	1.78	304.63	-27	50.56	1355.08	15.41
279.696	40.276	-7.60	-24.93	57.41	48.22	578.6635591	120	2.51	17.40	0.062	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6807.83	2579.13	4228.70	1.06	1.78	306.41	-27	50.72	1362.97	15.46
280.696	40.420	-7.65	-25.09	57.57	48.39	580.6315591	120	2.51	17.40	0.062	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6828.69	2589.36	4239.33	1.06	1.78	308.18	-28	50.89	1370.87	15.51
281.696	40.564	-7.70	-25.26	57.74	48.55	582.5995591	120	2.51	17.40	0.062	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6849.55	2599.60	4249.96	1.06	1.78	309.96	-28	51.05	1378.77	15.56
282.696	40.708	-7.75	-25.42	57.90	48.71	584.5675591	120	2.51	17.40	0.062	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6870.41	2609.83	4260.58	1.07	1.78	311.74	-28	51.21	1386.67	15.61
283.696	40.852	-7.80	-25.58	58.06	48.88	586.5355591	120	2.51	17.40	0.061	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6891.27	2620.06	4271.21	1.07	1.78	313.51	-28	51.38	1394.57	15.66
284.696	40.996	-7.85	-25.75	58.23	49.04	588.5035591	120	2.51	17.40	0.061	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6912.13	2630.30	4281.84	1.07	1.78	315.29	-28	51.54	1402.46	15.71
285.696	41.140	-7.90	-25.91	58.39	49.21	590.4715591	120	2.51	17.40	0.061	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6933.00	2640.53	4292.48	1.07	1.78	317.06	-28	51.71	1410.36	15.76
286.696	41.284	-7.95	-26.08	58.56	49.37	592.4395591	120	2.51	17.40	0.061	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6953.86	2650.76	4303.09	1.08	1.78	318.84	-29	51.87	1418.26	15.81
287.696	41.428	-8.00	-26.24	58.72	49.53	594.4075591	120	2.51	17.40	0.060	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6974.72	2661.00	4313.72	1.08	1.78	320.61	-29	52.03	1426.16	15.86
288.696	41.572	-8.05	-26.40	58.88	49.70	596.3755591	120	2.51	17.40	0.060	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6995.58	2671.23	4324.35	1.08	1.78	322.39	-29	52.20	1434.06	15.91
289.696	41.716	-8.10	-26.57	59.05	49.86	598.3435591	120	2.51	17.40	0.060	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7016.44	2681.47	4334.97	1.08	1.78	324.16	-29	52.36	1441.95	15.96
290.696	41.860	-8.15	-26.73	59.21	50.03	600.3115591	120	2.51	17.40	0.060	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7037.30	2691.70	4345.60	1.09	1.78	325.94	-29	52.53	1449.86	16.01
291.696	42.004	-8.20	-26.90	59.38	50.19	602.2795591	120	2.51	17.40	0.060	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7058.16	2701.93	4356.23	1.09	1.78	327.71	-29	52.69	1457.76	16.06
292.696	42.148	-8.25	-27.06	59.54	50.35	604.2475591	120	2.51	17.40	0.059	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7079.02	2712.17	4366.86	1.09	1.78	329.49	-30	52.85	1465.64	16.11
293.696	42.292	-8.30	-27.22	59.70	50.52	606.2155591	120	2.51	17.40	0.059	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7099.88	2722.40	4377.48	1.09	1.78	331.27	-30	53.02	1473.54	16.16
294.696	42.436	-8.35	-27.39	59.87	50.68	608.1835591	120	2.51	17.40	0.059	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7120.74	2732.63	4388.11	1.10	1.78	333.04	-30	53.18	1481.44	16.21
295.696	42.580	-8.40	-27.55	60.03	50.85	610.1515591	120	2.51	17.40	0.059	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7141.60	2742.87	4398.74	1.10	1.78	334.82	-30	53.35	1489.34	16.26
296.696	42.724	-8.45	-27.72	60.20	51.01	612.1195591	120	2.51	17.40	0.059	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7162.46	2753.10	4409.36	1.10	1.78	336.59	-30	53.51	1497.24	16.31
297.696	42.868	-8.50	-27.88	60.36	51.17	614.0875591	120	2.51	17.40	0.058	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7183.33	2763.33	4419.99	1.10	1.78	338.37	-30	53.67	1505.13	16.36
298.696	43.012	-8.55	-28.04	60.52	51.34	616.0555591	120	2.51	17.40	0.058	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7204.19	2773.57	4430.62	1.11	1.78	340.14	-31	53.84	1513.03	16.41
299.696	43.156	-8.60	-28.21	60.69	51.50	618.0235591	120	2.51	17.40	0.058	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7225.05	2783.80	4441.25	1.11	1.78	341.92	-31	54.00	1520.93	16.46
300.696	43.300	-8.65	-28.37	60.85	51.67	619.9915591	120	2.51	17.40	0.058	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7245.91	2794.03	4451.87	1.11	1.78	343.69	-31	54.17	1528.83	16.51
301.696	43.444	-8.70	-28.54	61.02	51.83	621.9595591	120	2.51	17.40	0.058	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7266.77	2804.27	4462.50	1.12	1.78	345.47	-31	54.33	1536.72	16.56
302.696	43.588	-8.75	-28.70	61.18	51.99	623.9275591	120	2.51	17.40	0.057	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7287.63	2814.50	4473.13	1.12	1.78	347.24	-31	54.49	1544.62	16.61
303.696	43.732	-8.80	-28.86	61.34	52.16	625.8955591	120	2.51	17.40	0.057	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7308.49	2824.74	4483.76	1.12	1.78	349.02	-31	54.66	1552.52	16.66
304.696	43.876	-8.85	-29.03	61.51	52.32	627.8635591	120	2.51	17.40	0.057	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7329.33	2834.97	4494.38	1.12	1.78	350.80	-32	54.82	1560.42	16.71
305.696	44.020	-8.90	-29.19	61.67	52.49	629.8315591	120	2.51	17.40	0.057	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7350.21	2845.20	4505.01	1.13	1.78	352.57	-32	54.99	1568.31	16.76
306.696	44.164	-8.95	-29.36	61.84	52.65	631.7995591	120	2.51	17.40	0.057	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7371.07	2855.44	4515.64	1.13	1.78	354.35	-32	55.15	1576.21	16.81
307.696	44.308	-9.00	-29.52	62.00	52.81	633.7675591	120	2.51	17.40	0.057	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7391.93	2865.67	4526.26	1.13	1.78	356.12	-32	55.31	1584.11	16.86
308.696	44.452	-9.05	-29.68	62.16	52.98	635.7355591	120	2.51	17.40	0.056	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7412.79	2875.90	4536.89	1.13	1.78	357.90	-32	55.48	1592.01	16.91
309.696	44.596	-9.10	-29.85	62.33	53.14	637.7035591	120	2.51	17.40	0.056	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7433.65	2886.14	4547.52	1.14	1.78	359.67	-32	55.64	1599.90	16.96
310.696	44.740	-9.15	-30.01	62.49	53.31	639.6715591	120	2.51	17.40	0.056	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7454.52	2896.37	4558.14	1.14	1.78	361.45	-33	55.81	1607.80	17.01
311.696	44.884	-9.20	-30.18	62.66	53.47	641.6395591	120	2.51	17.40	0.056	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7475.38	2906.60	4568.77	1.14	1.78	363.22	-33	55.97	1615.70	17.00
312.696	45.028	-9.25	-30.34	62.82	53.63	643.6075591	120	2.51	17.40	0.056	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7496.24	2916.84	4579.40	1.14	1.79	365.00	-33	56.13	1623.60	17.11
313.696	45.172	-9.30	-30.50	62.98	53.80	645.5755591	120	2.51	17.40	0.055	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7517.10	2927.07	4590.03	1.15	1.78	366.77	-33	56.30	1631.50	17.16
314.696	45.316	-9.35	-30.67	63.15	53.96	647.5435591	120	2.51	17.40	0.055	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7537.96	2937.31	4600.65	1.15	1.78	368.55	-33	56.46	1639.39	17.21
315.696	45.460	-9.40	-30.83	63.31	54.13	649.5115591	120	2.51	17.40	0.055	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7558.82	2947.54	4611.28	1.16	1.78	370.33	-33	56.63	1647.29	17.26
316.696	45.604	-9.45	-31.00	63.48	54.29	651.4795591	120	2.51	17.40	0.055	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7579.68	2957.77	4621.91	1.16	1.78	372.10	-33	56.78	1655.19	17.31
317.696	45.748	-9.50	-31.16	63.64	54.45	653.4475591	120	2.51	17.40	0.055	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7600.54	2968.01	4632.54	1.16	1.78	373.88	-34	56.95	1663.09	17.36
318.696	45.892	-9.55	-31.32	63.80	54.62	655.4155591	120	2.51	17.40	0.055	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7621.40	2978.24	4643.16	1.16	1.78	375.65	-34	57.12	1670.98	17.41
319.696	46.036	-9.60	-31.49	63.97	54.78	657.3835591	120	2.51	17.40	0.054	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7642.26	2988.47	4653.79	1.16	1.78	377.43	-34	57.28	1678.88	17.46
320.696	46.180	-9.65	-31.65	64.13	54.95	659.3515591	120	2.51	17.40	0.054	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7663.12	2998.71	4664.42	1.17	1.78	379.20	-34	57.45	1686.78	17.51
321.696	46.324	-9.70	-31.82	64.30	55.11	661.3195591	120	2.51	17.40	0.054	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7683.98	3008.94	4675.04	1.17	1.78	380.98	-34	57.61	1694.68	17.56
322.696	46.468	-9.75	-31.98	64.46	55.27	663.2875591	120	2.51	17.40	0.054	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7704.86	3019.17	4685.67	1.17	1.78	382.75	-34	57.77	1702.57	17.61
323.696	46.612	-9.80	-32.14	64.62	55.44	665.2555591	120	2.51	17.40	0.054	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7725.71	3029.41	4696.30	1.17	1.78	384.53	-35	57.94	1710.47	17.66
324.696	46.756	-9.85	-32.31	64.79	55.60	667.2235591	120	2.51	17.40	0.054	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7746.57	3039.64	4706.93	1.18	1.78	386.30	-35	58.10	1718.37	17.71
325.696	46.900	-9.90	-32.47	64.95	55.77	669.1915591	120	2.51	17.40	0.053	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7767.43	3049.87	4717.56	1.18	1.78	388.08	-35	58.27	1726.27	17.76
326.696	47.044	-9.95	-32.64	65.12	55.93	671.1595591	120	2.51	17.40	0.053	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7788.29	3060.11	4728.18	1.18	1.78	389.86	-35	58.43	1734.16	17.81
327.696	47.188	-10.00	-32.80	65.28	56.09	673.1275591	120	2.51	17.40	0.053	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7809.16	3070.34	4738.81	1.18	1.78	391.63	-35	58.59	1742.06	17.86
328.696	47.332	-10.05	-32.96	65.44	56.26	675.0955591	120	2.51	17.40	0.053	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7830.01	3080.58	4749.43	1.19	1.78	393.41	-35	58.76	1749.96	17.91
329.696	47.476	-10.10	-33.13	65.61	56.42	677.0635591	120	2.51	17.40	0.053	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7850.87	3090.81	4760.06	1.19	1.78	395.18	-36	58.92	1757.86	17.96
330.696	47.620	-10.15	-33.29	65.77	56.59	679.0315591	120	2.51	17.40	0.053	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7871.73	3101.04	4770.69	1.19	1.78	396.96	-36	59.09	1765.76	18.01
331.696	47.764	-10.20	-33.46	65.94	56.75	680.9995591	120	2.51	17.40	0.052	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7892.59	3111.28	4781.32	1.20	1.78	398.73	-36	59.25	1773.65	18.06
332.696	47.908	-10.25	-33.62	66.10	56.91	682.9675591	120	2.51	17.40	0.052	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7913.45	3121.51	4791.94	1.20	1.78	400.51	-36	59.41	1781.55	18.11
333.696	48.052	-10.30	-33.78	66.26	57.08	684.9355591	120	2.51	17.40	0.052	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7934.31	3131.74	4802.57	1.20	1.78	402.28	-36	59.58	1789.45	18.16
334.696	48.196	-10.35	-33.95	66.43	57.24	686.9035591	120	2.51	17.40	0.052	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7955.17	3141.98	4813.20	1.20	1.78	404.06	-36	59.74	1797.35	18.21
335.696	48.340	-10.40	-34.11	66.59	57.41	688.8715591	120	2.51	17.40	0.052	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7976.04	3152.21	4823.82	1.21	1.78	405.83	-37	59.91	1805.24	18.26
336.696	48.484	-10.45	-34.28	66.76	57.57	690.8395591	120	2.51	17.40	0.052	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7996.90	3162.44	4834.45	1.21	1.78	407.61	-37	60.07	1813.14	18.31
337.696	48.628	-10.50	-34.44	66.92	57.73	692.8075591	120	2.51	17.40	0.052	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8017.76	3172.68	4845.08	1.21	1.78	409.39	-37	60.23	1821.04	18.36
338.696	48.772	-10.55	-34.60	67.08	57.90	694.7755591	120	2.51	17.40	0.051	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8038.62	3182.91	4855.71	1.21	1.78	411.16	-37	60.40	1828.94	18.41
339.696	48.916	-10.60	-34.77	67.25	58.06	696.7435591	120	2.51	17.40	0.051	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8059.48	3193.15	4866.33	1.22	1.79	412.94	-37	60.56	1836.83	18.46
340.696	49.060	-10.65	-34.93	67.41	58.23	698.7115591	120	2.51	17.40	0.051	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8080.34	3203.38	4876.96	1.22	1.78	414.71	-37	60.73	1844.73	18.51
341.696	49.204	-10.70	-35.10	67.58	58.39	700.6795591	120	2.51	17.40	0.051	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8101.20	3213.61	4887.59	1.22	1.78	416.49	-38	60.89	1852.63	18.56
342.696	49.348	-10.75	-35.26	67.74	58.55	702.6475591	120	2.51	17.40	0.051	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8122.06	3223.85	4898.22	1.22	1.78	418.26	-38	61.06	1860.53	18.61
343.696	49.492	-10.80	-35.42	67.90	58.72	704.6155591	120	2.51	17.40	0.051	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8142.92	3234.08	4908.84	1.23	1.78	420.04	-38	61.22	1868.43	18.66
344.696	49.636	-10.85	-35.59	68.07	58.88	706.5835591	120	2.51	17.40	0.050	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8163.78	3244.31	4918.47	1.23	1.78	421.81	-38	61.38	1876.32	18.71
345.696	49.780	-10.90	-35.75	68.23	59.05	708.5515591	120	2.51	17.40	0.050	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8184.64	3254.55	4930.10	1.23	1.78	423.59	-38	61.55	1884.22	18.76
346.696	49.924	-10.95	-35.92	68.40	59.21	710.5195591	120	2.51	17.40	0.050	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8205.50	3264.78	4940.72	1.24	1.78	425.37	-38	61.71	1892.12	18.81
347.696	50.068	-11.00	-36.08	68.56	59.37	712.4875591	120	2.51	17.40	0.050	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8226.37	3275.01	4951.35	1.24	1.78	427.14	-39	61.87	1900.02	18.86
348.696	50.212	-11.05	-36.24	68.72	59.54	714.4555591	120	2.51	17.40	0.050	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8247.23	3285.25	4961.98	1.24	1.78	428.92	-39	62.04	1907.91	18.91
349.696	50.356	-11.10	-36.41	68.89	59.70	716.4235591	120	2.51	17.40	0.050	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8268.09	3295.48	4972.61	1.24	1.78	430.69	-39	62.20	1915.81	18.96
350.696	50.500	-11.15	-36.57	69.05	59.87	718.3915591	120	2.51	17.40	0.050	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8288.95	3305.71	4983.23	1.25	1.78	432.47	-39	62.37	1923.71	19.01
351.696	50.644	-11.20	-36.74	69.22	60.03	720.3595591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	18.00	114.48	8307.72	3315.96	4991.77	1.87	2.41	434.86	-39	62.53	1934.42	19.06
352.696	50.788	-11.25	-36.90	69.38	60.19	722.3275591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	18.00	114.48	8326.50	3326.18	5000.32	1.87	2.40	437.26	-39	62.69	1945.12	19.11
353.696	50.932	-11.30	-37.06	69.54	60.36	724.2955591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	18.00	114.48	8345.27	3336.42	5008.86	1.86	2.40	439.66	-40	62.86	1955.80	19.16
354.696	51.076	-11.35	-37.23	69.71	60.52	726.2635591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	18.00	114.48	8364.05	3346.65	5017.40	1.86	2.40	442.06	-40	63.02	1966.46	19.21
355.696	51.220	-11.40	-37.39	69.87	60.69	728.2315591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	18.00	114.48	8382.82	3356.88	5025.94	1.86	2.39	444.47	-40	63.10	1977.09	19.26
356.696	51.364	-11.45	-37.56	70.04	60.85	730.1995591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	18.00	114.48	8401.60	3367.12	5034.48	1.85	2.39	446.85	-40	63.36	1987.71	19.31
357.696	51.508	-11.50	-37.72	70.20	61.01	732.1675591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	18.00	114.48	8420.37	3377.35	5043.02	1.85	2.38	449.24	-40	63.51	1998.30	19.36
358.696	51.652	-11.55	-37.88	70.36	61.18	734.1355591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	18.00	114.48	8439.16	3387.58	5051.56	1.85	2.38	451.61	-40	63.68	2008.86	19.41
359.696	51.796	-11.60	-38.05	70.53	61.34	736.1035591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	18.00	114.48	8457.92	3397.82	5060.10	1.84	2.37	453.99	-41	63.84	2019.43	19.46
360.696	51.940	-11.65	-38.21	70.69	61.51	738.0715591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	18.00	114.48	8476.69	3408.05	5068.64	1.84	2.37	456.36	-41	64.01	2029.97	19.51
361.696	52.084	-11.70	-38.38	70.86	61.67	740.0395591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	18.00	114.48	8495.47	3418.28	5077.19	1.84	2.36	458.72	-41	64.17	2040.46	19.56
362.696	52.228	-11.75	-38.54	71.02	61.83	742.0075591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	18.00	114.48	8514.24	3428.52	5085.73	1.83	2.36	461.08	-41	64.33	2050.97	19.61
363.696	52.372	-11.80	-38.70	71.18	62.00	743.9755591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	18.00	114.48	8533.02	3438.76	5094.27	1.83	2.36	463.43	-41	64.50	2061.44	19.66
364.696	52.516	-11.85	-38.87	71.35	62.16	745.9435591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	18.00	114.48	8551.79	3448.99	5102.81	1.82	2.35	465.78	-41	64.66	2071.90	19.71
365.696	52.660	-11.90	-39.03	71.51	62.33	747.9115591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	18.00	114.48	8570.57	3459.22	5111.36	1.82	2.34	468.13	-42	64.83	2082.33	19.76
366.696	52.804	-11.95	-39.20	71.68	62.49	749.8795591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	18.00	114.48	8589.34	3469.45	5119.89	1.82	2.34	470.47	-42	64.99	2092.74	19.81
367.696	52.948	-12.00	-39.36	71.84	62.65	751.8475591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	18.00	114.48	8608.12	3479.69	5128.43	1.81	2.34	472.80	-42	65.15	2103.12	19.86
368.696	53.092	-12.05	-39.52	72.00	62.82	753.8155591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	18.00	114.48	8626.89	3489.92	5136.97	1.81	2.33	475.13	-42	65.32	2113.49	19.91
369.696	53.236	-12.10	-39.69	72.17	62.98	755.7835591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	18.00	114.48	8645.67	3500.15	5145.51	1.81	2.33	477.46	-42	65.48	2123.84	19.96
370.696	53.380	-12.15	-39.85	72.33	63.13	757.7515591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	18.00	114.48	8664.44	3510.39	5154.06	1.80	2.32	479.78	-42	65.65	2134.16	20.01
371.696	53.524	-12.20	-40.02	72.50	63.31	759.7195591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	18.00	114.48	8683.22	3520.62	5162.60	1.80	2.32	482.09	-43	65.81	2144.46	20.06
372.696	53.668	-12.25	-40.18	72.66	63.47	761.6875591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	18.00	114.48	8701.99	3530.85	5171.14	1.79	2.31	484.41	-43	65.97	2154.76	20.11
373.696	53.812	-12.30	-40.34	72.82	63.64	763.6555591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	18.00	114.48	8720.77	3541.09	5179.68	1.79	2.31	486.71	-43	66.14	2165.01	20.10
374.696	53.956	-12.35	-40.51	72.99	63.80	765.6235591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	18.00	114.48	8739.54	3551.32	5188.22	1.79	2.30	489.01	-43	66.30	2175.24	20.21
375.696	54.100	-12.40	-40.67	73.15	63.97	767.5915591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	18.00	114.48	8758.32	3561.56	5196.76	1.78	2.30	491.31	-43	66.47	2185.46	20.26
376.696	54.244	-12.45	-40.84	73.32	64.13	769.5595591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	18.00	114.48	8777.09	3571.79	5205.30	1.78	2.29	493.60	-43	66.63	2195.66	20.31
377.696	54.388	-12.50	-41.00	73.48	64.29	771.5275591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	18.00	114.48	8795.87	3582.02	5213.84	1.78	2.29	495.89	-44	66.79	2205.83	20.36
378.696	54.532	-12.55	-41.16	73.64	64.46	773.4955591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	18.00	114.48	8814.64	3592.26	5222.38	1.77	2.28	498.17	-44	66.96	2215.98	20.41
379.696	54.676	-12.60	-41.33	73.81	64.62	775.4635591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	18.00	114.48	8833.41	3602.49	5230.93	1.77	2.28	500.45	-44	67.12	2226.11	20.46
380.696	54.820	-12.65	-41.49	73.97	64.79	777.4315591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	18.00	114.48	8852.19	3612.72	5239.47	1.76	2.27	502.72	-44	67.29	2236.21	20.51
381.696	54.964	-12.70	-41.66	74.14	64.95	779.3995591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	18.00	114.48	8870.96	3622.96	5248.01	1.76	2.27	504.99	-44	67.45	2246.30	20.56
382.696	55.108	-12.75	-41.82	74.30	65.11	781.3675591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.33	0.33	18.00	114.48	8889.74	3633.19	5256.56	1.76	2.26	507.25	-44	67.61	2256.36	20.61
383.696	55.252	-12.80	-41.98	74.46	65.28	783.3355591		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.33	0.33	18.00	114.48	8908.51	3643.42	5265.09	1.76	2.26	509.51	-44	67.78	2266.40	20.66
																									FOS	1.18				

Axial capacities for 30 inch diameter drilled piers at Loverdige OC   Bent 2_BOF = 7.45m   Note: Required pile length: Add 1D to length (Column E)

		m	ft
Ground surface elevation/Top of soil elevation (feet)		9.9	32.48
Pile capacities computed from (feet)		7.45	24.44
GWT elevation (feet)		5	18.40

pha method for undrained and beta method for drained

Diameter 2.500 feet Load 426 kips
30.000 inches

Patm (psi)	Patm (ksf)	Elevation (m)	Elevation (ft)	Depth (m)	Depth (ft)	Depth (in)	Su (Kpa)	Su (ksf)	Su (psi)	Su/pa	Coh (0) / Non Coh (1)	α	α (2)	f_{max} (ksf)	f_{max} (psi)	N60	β	β (2)	Unit Wt (kN/m3)	Unit Wt. (pcf)	σ (psf)	u (psf)	σ' (psf)	q_{max} (ksf)	ΔR_{s} (kips)	R_{s} (kips)	Pile Tip Elevation (ft)	Pile Length (ft)	R_{s} (kN)	Pile Length (m)
							Cohesive Soil										Cohesionless Soil												For Plot	
14.696	2.118	9.90	32.47	0.01	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	0.95	0.00	0.95	0.00	0.00	0.00	30	2.50	0.00	0.76
14.696	2.118	9.85	32.31	0.17	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	19.73	0.00	19.73	0.00	0.00	0.00	30	2.50	0.00	0.76
14.696	2.118	9.80	32.14	0.34	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	38.50	0.00	38.50	0.01	0.00	0.00	30	2.50	0.00	0.76
14.696	2.118	9.75	31.98	0.50	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	57.28	0.00	57.28	0.01	0.00	0.00	29	2.50	0.00	0.76
14.696	2.118	9.70	31.82	0.66	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	76.05	0.00	76.05	0.02	0.00	0.00	29	2.50	0.00	0.76
14.696	2.118	9.65	31.65	0.83	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	94.83	0.00	94.83	0.02	0.00	0.00	29	2.50	0.00	0.76
14.696	2.118	9.60	31.49	0.99	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	113.60	0.00	113.60	0.03	0.00	0.00	29	2.50	0.00	0.76
14.696	2.118	9.55	31.32	1.16	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	132.37	0.00	132.37	0.03	0.00	0.00	29	2.50	0.00	0.76
14.696	2.118	9.50	31.16	1.32	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	151.15	0.00	151.15	0.04	0.00	0.00	29	2.50	0.00	0.76
14.696	2.118	9.45	31.00	1.48	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	169.92	0.00	169.92	0.04	0.00	0.00	28	2.50	0.00	0.76
14.696	2.118	9.40	30.83	1.65	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	188.70	0.00	188.70	0.05	0.00	0.00	28	2.50	0.00	0.76
14.696	2.118	9.35	30.67	1.81	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	207.47	0.00	207.47	0.05	0.00	0.00	28	2.50	0.00	0.76
14.696	2.118	9.30	30.50	1.98	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	226.25	0.00	226.25	0.06	0.00	0.00	28	2.50	0.00	0.76
14.696	2.118	9.25	30.34	2.14	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	245.02	0.00	245.02	0.06	0.00	0.00	28	2.50	0.00	0.76
14.696	2.118	9.20	30.18	2.30	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	263.80	0.00	263.80	0.07	0.00	0.00	28	2.50	0.00	0.76
14.696	2.118	9.15	30.01	2.47	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	282.57	0.00	282.57	0.07	0.00	0.00	28	2.50	0.00	0.76
14.696	2.118	9.10	29.85	2.63	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	301.35	0.00	301.35	0.08	0.00	0.00	27	2.50	0.00	0.76
14.696	2.118	9.05	29.68	2.80	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	320.12	0.00	320.12	0.08	0.00	0.00	27	2.50	0.00	0.76
14.696	2.118	9.00	29.52	2.96	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	338.90	0.00	338.90	0.08	0.00	0.00	27	2.50	0.00	0.76
14.696	2.118	8.95	29.36	3.12	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	357.67	0.00	357.67	0.09	0.00	0.00	27	2.50	0.00	0.76
14.696	2.118	8.90	29.19	3.29	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	376.45	0.00	376.45	0.09	0.00	0.00	27	2.50	0.00	0.76
14.696	2.118	8.85	29.03	3.45	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	395.22	0.00	395.22	0.10	0.00	0.00	27	2.50	0.00	0.76
14.696	2.118	8.80	28.86	3.62	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	414.00	0.00	414.00	0.10	0.00	0.00	26	2.50	0.00	0.76
14.696	2.118	8.75	28.70	3.78	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	432.77	0.00	432.77	0.11	0.00	0.00	26	2.50	0.00	0.76
14.696	2.118	8.70	28.54	3.94	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	451.55	0.00	451.55	0.11	0.00	0.00	26	2.50	0.00	0.76
14.696	2.118	8.65	28.37	4.11	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	470.32	0.00	470.32	0.12	0.00	0.00	26	2.50	0.00	0.76
14.696	2.118	8.60	28.21	4.27	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	489.09	0.00	489.09	0.12	0.00	0.00	26	2.50	0.00	0.76
14.696	2.118	8.55	28.04	4.44	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	507.87	0.00	507.87	0.13	0.00	0.00	26	2.50	0.00	0.76
14.696	2.118	8.50	27.88	4.60	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	526.64	0.00	526.64	0.13	0.00	0.00	25	2.50	0.00	0.76
14.696	2.118	8.45	27.72	4.76	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	545.42	0.00	545.42	0.14	0.00	0.00	25	2.50	0.00	0.76
14.696	2.118	8.40	27.55	4.93	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	564.19	0.00	564.19	0.14	0.00	0.00	25	2.50	0.00	0.76
14.696	2.118	8.35	27.39	5.09	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	582.97	0.00	582.97	0.15	0.00	0.00	25	2.50	0.00	0.76
14.696	2.118	8.30	27.22	5.26	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	601.74	0.00	601.74	0.15	0.00	0.00	25	2.50	0.00	0.76
14.696	2.118	8.25	27.06	5.42	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	620.52	0.00	620.52	0.16	0.00	0.00	25	2.50	0.00	0.76
14.696	2.118	8.20	26.90	5.58	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	639.29	0.00	639.29	0.16	0.00	0.00	24	2.50	0.00	0.76
14.696	2.118	8.15	26.73	5.75	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	658.07	0.00	658.07	0.16	0.00	0.00	24	2.50	0.00	0.76
14.696	2.118	8.10	26.57	5.91	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	676.84	0.00	676.84	0.17	0.00	0.00	24	2.50	0.00	0.76
14.696	2.118	8.05	26.40	6.08	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	695.62	0.00	695.62	0.17	0.00	0.00	24	2.50	0.00	0.76
14.696	2.118	8.00	26.24	6.24	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	714.39	0.00	714.39	0.18	0.00	0.00	24	2.50	0.00	0.76
14.696	2.118	7.95	26.08	6.40	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	733.17	0.00	733.17	0.18	0.00	0.00	24	2.50	0.00	0.76
14.696	2.118	7.90	25.91	6.57	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	751.94	0.00	751.94	0.19	0.00	0.00	23	2.50	0.00	0.76
14.696	2.118	7.85	25.75	6.73	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	770.72	0.00	770.72	0.19	0.00	0.00	23	2.50	0.00	0.76
14.696	2.118	7.80	25.58	6.90	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	789.49	0.00	789.49	0.20	0.00	0.00	23	2.50	0.00	0.76
14.696	2.118	7.75	25.42	7.06	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	808.26	0.00	808.26	0.20	0.00	0.00	23	2.50	0.00	0.76
14.696	2.118	7.70	25.26	7.22	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	827.04	0.00	827.04	0.21	0.00	0.00	23	2.50	0.00	0.76
14.696	2.118	7.65	25.09	7.39	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	845.81	0.00	845.81	0.21	0.00	0.00	23	2.50	0.00	0.76
14.696	2.118	7.60	24.93	7.55	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	864.59	0.00	864.59	0.22	0.00	0.00	22	2.50	0.00	0.76
14.696	2.118	7.55	24.76	7.72	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	883.36	0.00	883.36	0.22	0.00	0.00	22	2.50	0.00	0.76
14.696	2.118	7.50	24.60	7.88	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	902.14	0.00	902.14	0.23	0.00	0.00	22	2.50	0.00	0.76
14.696	2.118	7.45	24.44	8.04	0.01	0.075066614	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	920.91	0.00	920.91	0.23	0.03	0.03	22	2.51	0.13	0.76
14.696	2.118	7.40	24.27	8.21	0.17	2.043066614	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	939.69	0.00	939.69	0.23	0.74	0.77	22	2.67	3.42	0.81
14.696	2.118	7.35	24.11	8.37	0.33	4.011066614	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	958.46	0.00	958.46	0.24	0.74	1.51	22	2.83	6.71	0.86
14.696	2.118	7.30	23.94	8.54	0.50	5.979066614	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	977.24	0.00	977.24	0.24	0.74	2.25	21	3.00	10.00	0.91
14.696	2.118	7.25	23.78	8.70	0.66	7.947066614	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	996.01	0.00	996.01	0.25	0.74	2.99	21	3.16	13.29	0.96
14.696	2.118	7.20	23.62	8.86	0.83	9.915066614	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1014.79	0.00	1014.79	0.25	0.74	3.73	21	3.33	16.58	1.01
14.696	2.118	7.15	23.45	9.03	0.99	11.88306661	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1033.56	0.00	1033.56	0.26	0.74	4.47	21	3.49	19.87	1.06
14.696	2.118	7.10	23.29	9.19	1.15	13.85106661		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.09	1.09	18.00	114.48	1052.34	0.00	1052.34	1.15	1.46	5.94	21	3.65	26.44	1.11
14.696	2.118	7.05	23.12	9.36	1.32	15.81906661		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.09	1.09	18.00	114.48	1071.11	0.00	1071.11	1.16	1.50	7.44	21	3.82	33.11	1.16
14.696	2.118	7.00	22.96	9.52	1.48	17.78706661		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.08	1.08	18.00	114.48	1089.89	0.00	1089.89	1.18	1.52	8.96	20	3.98	39.87	1.21
14.696	2.118	6.95	22.80	9.68	1.65	19.75506661		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.08	1.08	18.00	114.48	1108.66	0.00	1108.66	1.20	1.54	10.50	20	4.15	46.72	1.26
14.696	2.118	6.90	22.63	9.85	1.81	21.72306661		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.08	1.08	18.00	114.48	1127.44	0.00	1127.44	1.21	1.56	12.07	20	4.31	53.67	1.31
14.696	2.118	6.85	22.47	10.01	1.97	23.69106661		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.07	1.07	18.00	114.48	1146.21	0.00	1146.21	1.23	1.58	13.65	20	4.47	60.71	1.36
14.696	2.118	6.80	22.30	10.18	2.14	25.65906661		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.07	1.07	18.00	114.48	1164.99	0.00	1164.99	1.24	1.60	15.25	20	4.64	67.84	1.41
14.696	2.118	6.75	22.14	10.34	2.30	27.62706661		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.07	1.07	18.00	114.48	1183.76	0.00	1183.76	1.26	1.62	16.88	20	4.80	75.07	1.46
14.696	2.118	6.70	21.98	10.50	2.47	29.59506661		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.06	1.06	18.00	114.48	1202.53	0.00	1202.53	1.28	1.64	18.52	19	4.97	82.38	1.51
14.696	2.118	6.65	21.81	10.67	2.63	31.56306661		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.06	1.06	18.00	114.48	1221.31	0.00	1221.31	1.29	1.66	20.18	19	5.13	89.79	1.56
14.696	2.118	6.60	21.65	10.83	2.79	33.53106661		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.06	1.06	18.00	114.48	1240.08	0.00	1240.08	1.31	1.68	21.87	19	5.29	97.25	1.61
14.696	2.118	6.55	21.48	11.00	2.96	35.49906661		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.05	1.05	18.00	114.48	1258.86	0.00	1258.86	1.32	1.70	23.57	19	5.46	104.86	1.66
14.696	2.118	6.50	21.32	11.16	3.12	37.46706661		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.05	1.05	18.00	114.48	1277.63	0.00	1277.63	1.34	1.72	25.30	19	5.62	112.54	1.71
14.696	2.118	6.45	21.16	11.32	3.29	39.43506661		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.04	1.04	18.00	114.48	1296.41	0.00	1296.41	1.35	1.74	27.04	19	5.79	120.30	1.76
14.696	2.118	6.40	20.99	11.49	3.45	41.40306661		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.04	1.04	18.00	114.48	1315.18	0.00	1315.18	1.37	1.76	28.81	18	5.95	128.16	1.81
14.696	2.118	6.35	20.83	11.65	3.61	43.37106661		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.04	1.04	18.00	114.48	1333.96	0.00	1333.96	1.39	1.78	30.59	18	6.11	136.08	1.86
14.696	2.118	6.30	20.66	11.82	3.78	45.33906661	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1352.73	0.00	1352.73	0.34	0.74	31.33	18	6.28	139.37	1.91
14.696	2.118	6.25	20.50	11.98	3.94	47.30706661	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1371.51	0.00	1371.51	0.34	0.74	32.07	18	6.44	142.66	1.96
14.696	2.118	6.20	20.34	12.14	4.11	49.27506661	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1390.28	0.00	1390.28	0.35	0.74	32.81	18	6.61	145.95	2.01
14.696	2.118	6.15	20.17	12.31	4.27	51.24306661	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1409.06	0.00	1409.06	0.35	0.74	33.55	18	6.77	149.24	2.06
14.696	2.118	6.10	20.01	12.47	4.43	53.21106661	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1427.83	0.00	1427.83	0.36	0.74	34.29	18	6.93	152.53	2.11
14.696	2.118	6.05	19.84	12.64	4.60	55.17906661	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1446.61	0.00	1446.61	0.36	0.74	35.03	17	7.10	155.83	2.16
14.696	2.118	6.00	19.68	12.80	4.76	57.14706661	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1465.38	0.00	1465.38	0.37	0.74	35.77	17	7.26	159.12	2.21
14.696	2.118	5.95	19.52	12.96	4.93	59.11506661	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1484.15	0.00	1484.15	0.37	0.74	36.51	17	7.43	162.41	2.26
14.696	2.118	5.90	19.35	13.13	5.09	61.08306661	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1502.93	0.00	1502.93	0.38	0.74	37.25	17	7.59	165.70	2.31
14.696	2.118	5.85	19.19	13.29	5.25	63.05106661	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1521.70	0.00	1521.70	0.38	0.74	37.99	17	7.76	168.99	2.36
14.696	2.118	5.80	19.02	13.46	5.42	65.01906661	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1540.48	0.00	1540.48	0.39	0.74	38.73	17	7.92	172.28	2.41
14.696	2.118	5.75	18.86	13.62	5.58	66.98706661	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1559.25	0.00	1559.25	0.39	0.74	39.47	16	8.08	175.57	2.46
14.696	2.118	5.70	18.70	13.78	5.75	68.95506661	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1578.03	0.00	1578.03	0.39	0.74	40.21	16	8.25	178.86	2.51
14.696	2.118	5.65	18.53	13.95	5.91	70.92306661	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1596.80	0.00	1596.80	0.40	0.74	40.95	16	8.41	182.15	2.56
15.696	2.260	5.60	18.37	14.11	6.07	72.89106661	50	1.04	7.25	0.462	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1615.58	0.00	1615.58	0.40	0.74	41.69	16	8.57	185.44	2.61
16.696	2.404	5.55	18.20	14.28	6.24	74.85906661	50	1.04	7.25	0.434	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1634.35	0.00	1634.35	0.41	0.74	42.43	16	8.74	188.73	2.66
17.696	2.548	5.50	18.04	14.44	6.40	76.82706661	50	1.04	7.25	0.410	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1653.13	0.00	1653.13	0.41	0.74	43.17	16	8.90	192.02	2.71
18.696	2.692	5.45	17.88	14.60	6.57	78.79506661	50	1.04	7.25	0.388	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1671.90	0.00	1671.90	0.42	0.74	43.91	15	9.07	195.31	2.76
19.696	2.836	5.40	17.71	14.77	6.73	80.76306661	50	1.04	7.25	0.368	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1690.68	0.00	1690.68	0.42	0.74	44.65	15	9.23	198.60	2.81
20.696	2.980	5.35	17.55	14.93	6.89	82.73106661	50	1.04	7.25	0.350	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1709.46	0.00	1709.46	0.43	0.74	45.39	15	9.39	201.89	2.86
21.696	3.124	5.30	17.38	15.10	7.06	84.69906661	50	1.04	7.25	0.334	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1728.23	0.00	1728.23	0.43	0.74	46.13	15	9.56	205.19	2.91
22.696	3.268	5.25	17.22	15.26	7.22	86.66706661	50	1.04	7.25	0.320	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1747.00	0.00	1747.00	0.44	0.74	46.87	15	9.72	208.48	2.96
23.696	3.412	5.20	17.06	15.42	7.39	88.63506661	50	1.04	7.25	0.306	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1765.78	0.00	1765.78	0.44	0.74	47.61	15	9.89	211.77	3.01
24.696	3.556	5.15	16.89	15.59	7.55	90.60306661	50	1.04	7.25	0.294	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1784.55	0.00	1784.55	0.45	0.74	48.35	14	10.05	215.06	3.06
25.696	3.700	5.10	16.73	15.75	7.71	92.57106661	50	1.04	7.25	0.282	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1803.33	0.00	1803.33	0.45	0.74	49.09	14	10.21	218.35	3.11
26.696	3.844	5.05	16.56	15.92	7.88	94.53906661	50	1.04	7.25	0.272	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1822.10	0.00	1822.10	0.46	0.74	49.83	14	10.38	221.64	3.16
27.696	3.988	5.00	16.40	16.08	8.04	96.50706661	50	1.04	7.25	0.262	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1840.87	0.25	1840.61	0.46	0.74	50.57	14	10.54	224.93	3.21
28.696	4.132	4.95	16.24	16.24	8.21	98.47506661	50	1.04	7.25	0.253	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1859.65	10.50	1849.15	0.46	0.74	51.31	14	10.71	228.22	3.26
29.696	4.276	4.90	16.07	16.41	8.37	100.4430666	50	1.04	7.25	0.244	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1878.42	20.73	1857.69	0.46	0.74	52.05	14	10.87	231.51	3.31
30.696	4.420	4.85	15.91	16.57	8.53	102.4110666	50	1.04	7.25	0.236	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1897.20	30.96	1866.24	0.47	0.74	52.79	13	11.03	234.80	3.36
31.696	4.564	4.80	15.74	16.74	8.70	104.3790666	50	1.04	7.25	0.229	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1915.97	41.20	1874.78	0.47	0.74	53.53	13	11.20	238.09	3.41
32.696	4.708	4.75	15.58	16.90	8.86	106.3470666	50	1.04	7.25	0.222	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1934.75	51.43	1883.32	0.47	0.74	54.27	13	11.36	241.38	3.46
33.696	4.852	4.70	15.42	17.06	9.03	108.3150666	50	1.04	7.25	0.216	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1953.52	61.66	1891.86	0.47	0.74	55.00	13	11.53	244.67	3.51
34.696	4.996	4.65	15.25	17.23	9.19	110.2830666	50	1.04	7.25	0.209	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1972.30	71.90	1900.40	0.48	0.74	55.74	13	11.69	247.96	3.56
35.696	5.140	4.60	15.09	17.39	9.35	112.2510666	50	1.04	7.25	0.203	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1991.07	82.13	1908.94	0.48	0.74	56.48	13	11.85	251.25	3.61
36.696	5.284	4.55	14.92	17.56	9.52	114.2190666	50	1.04	7.25	0.196	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2009.85	92.36	1917.48	0.48	0.74	57.22	12	12.02	254.55	3.66
37.696	5.428	4.50	14.76	17.72	9.68	116.1870666	50	1.04	7.25	0.192	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2028.62	102.60	1926.02	0.48	0.74	57.96	12	12.18	257.84	3.71
38.696	5.572	4.45	14.60	17.88	9.85	118.1550666	50	1.04	7.25	0.187	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2047.40	112.83	1934.56	0.48	0.74	58.70	12	12.35	261.13	3.76
39.696	5.716	4.40	14.43	18.05	10.01	120.1230666	50	1.04	7.25	0.183	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2066.17	123.07	1943.11	0.49	0.74	59.44	12	12.51	264.42	3.81
40.696	5.860	4.35	14.27	18.21	10.17	122.0910666	50	1.04	7.25	0.178	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2084.95	133.30	1951.65	0.49	0.74	60.18	12	12.67	267.71	3.86
41.696	6.004	4.30	14.10	18.38	10.34	124.0590666	50	1.04	7.25	0.174	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2103.72	143.53	1960.19	0.49	0.74	60.92	12	12.84	271.00	3.91
42.696	6.148	4.25	13.94	18.54	10.50	126.0270666	50	1.04	7.25	0.170	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2122.50	153.77	1968.73	0.49	0.74	61.66	11	13.00	274.29	3.96
43.696	6.292	4.20	13.78	18.70	10.67	127.9950666	50	1.04	7.25	0.166	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2141.27	164.00	1977.27	0.49	0.74	62.40	11	13.17	277.58	4.01
44.696	6.436	4.15	13.61	18.87	10.83	129.9630666	50	1.04	7.25	0.162	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2160.04	174.23	1985.81	0.50	0.74	63.14	11	13.33	280.87	4.06
45.696	6.580	4.10	13.45	19.03	10.99	131.9310666	50	1.04	7.25	0.159	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2178.82	184.47	1994.35	0.50	0.74	63.88	11	13.49	284.16	4.11
46.696	6.724	4.05	13.28	19.20	11.16	133.8990666	50	1.04	7.25	0.155	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2197.59	194.70	2002.89	0.50	0.74	64.62	11	13.66	287.45	4.16
47.696	6.868	4.00	13.12	19.36	11.32	135.8670666	50	1.04	7.25	0.152	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2216.37	204.93	2011.43	0.50	0.74	65.36	11	13.82	290.74	4.21
48.696	7.012	3.95	12.96	19.52	11.49	137.8350666	50	1.04	7.25	0.149	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2235.14	215.17	2019.98	0.50	0.74	66.10	10	13.99	294.03	4.26
49.696	7.156	3.90	12.79	19.69	11.65	139.8030666	50	1.04	7.25	0.146	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2253.92	225.40	2028.52	0.51	0.74	66.84	10	14.15	297.33	4.31
50.696	7.300	3.85	12.63	19.85	11.81	141.7710666	50	1.04	7.25	0.143	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2272.69	235.63	2037.06	0.51	0.74	67.58	10	14.31	300.62	4.36
51.696	7.444	3.80	12.46	20.02	11.98	143.7390666	50	1.04	7.25	0.140	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2291.47	245.87	2045.60	0.51	0.74	68.32	10	14.48	303.91	4.41
52.696	7.588	3.75	12.30	20.18	12.14	145.7070666	50	1.04	7.25	0.138	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2310.24	256.10	2054.14	0.51	0.74	69.06	10	14.64	307.20	4.46
53.696	7.732	3.70	12.14	20.34	12.31	147.6750666	50	1.04	7.25	0.135	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2329.02	266.34	2062.68	0.52	0.74	69.80	10	14.81	310.49	4.51
54.696	7.876	3.65	11.97	20.51	12.47	149.6430666	50	1.04	7.25	0.133	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2347.79	276.57	2071.22	0.52	0.74	70.54	9	14.97	313.78	4.56
55.696	8.020	3.60	11.81	20.67	12.63	151.6110666	50	1.04	7.25	0.130	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2366.57	286.80	2079.76	0.52	0.74	71.28	9	15.13	317.07	4.61
56.696	8.164	3.55	11.64	20.84	12.80	153.5790666	50	1.04	7.25	0.128	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2385.34	297.04	2088.30	0.52	0.74	72.02	9	15.30	320.36	4.66
57.696	8.308	3.50	11.48	21.00	12.96	155.5470666	50	1.04	7.25	0.126	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2404.12	307.27	2096.85	0.52	0.74	72.76	9	15.46	323.65	4.71
58.696	8.452	3.45	11.32	21.16	13.13	157.5150666	50	1.04	7.25	0.124	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2422.89	317.50	2105.39	0.53	0.74	73.50	9	15.63	326.94	4.76
59.696	8.596	3.40	11.15	21.33	13.29	159.4830666	50	1.04	7.25	0.121	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2441.67	327.74	2113.93	0.53	0.74	74.24	9	15.79	330.23	4.81
60.696	8.740	3.35	10.99	21.49	13.45	161.4510666	50	1.04	7.25	0.119	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2460.44	337.97	2122.47	0.53	0.74	74.98	8	15.95	333.52	4.86
61.696	8.884	3.30	10.82	21.65	13.62	163.4190666	50	1.04	7.25	0.118	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2479.21	348.20	2131.01	0.53	0.74	75.72	8	16.12	336.81	4.91
62.696	9.028	3.25	10.66	21.82	13.78	165.3870666	50	1.04	7.25	0.116	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2497.99	358.44	2139.55	0.53	0.74	76.46	8	16.28	340.10	4.96
63.696	9.172	3.20	10.50	21.98	13.95	167.3550666	50	1.04	7.25	0.114	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2516.76	368.67	2148.09	0.54	0.74	77.20	8	16.45	343.39	5.01
64.696	9.316	3.15	10.33	22.15	14.11	169.3230666	50	1.04	7.25	0.112	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2535.54	378.91	2156.63	0.54	0.74	77.94	8	16.61	346.69	5.06
65.696	9.460	3.10	10.17	22.31	14.27	171.2910666	50	1.04	7.25	0.110	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2554.31	389.14	2165.17	0.54	0.74	78.68	8	16.77	349.98	5.11
66.696	9.604	3.05	10.00	22.48	14.44	173.2590666	50	1.04	7.25	0.109	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2573.09	399.37	2173.72	0.54	0.74	79.42	8	16.94	353.27	5.16

67.698	9.748	3.00	9.84	22.64	14.50	175.2270866	50	1.04	7.25	0.107	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	2591.66	409.01	2182.26	0.55	0.74	80.10	7	17.10	356.66	5.21
68.698	9.892	2.95	9.68	22.80	14.77	177.1950866	50	1.04	7.25	0.106	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	2610.64	419.64	2190.80	0.55	0.74	80.80	7	17.27	359.86	5.26
69.698	10.036	2.90	9.51	22.97	14.83	179.1630866	50	1.04	7.25	0.104	0	0.56	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2629.41	430.07	2199.34	0.55	0.74	81.64	7	17.43	363.14	5.31
70.698	10.180	2.85	9.35	23.13	15.09	181.1310866	50	1.04	7.25	0.103	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2648.19	440.31	2207.88	0.55	0.74	82.38	7	17.59	366.43	5.36
71.698	10.324	2.80	9.18	23.30	15.26	183.0990866	50	1.04	7.25	0.101	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2666.96	450.54	2216.42	0.55	0.74	83.12	7	17.76	369.72	5.41
72.698	10.468	2.75	9.02	23.46	15.42	185.0670866	50	1.04	7.25	0.100	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	2685.74	460.77	2224.96	0.56	0.74	83.86	7	17.92	373.01	5.46
73.698	10.612	2.70	8.86	23.62	15.59	187.0350866	50	1.04	7.25	0.098	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2704.51	471.01	2233.50	0.56	0.74	84.60	6	18.09	376.30	5.51
74.698	10.756	2.65	8.69	23.79	15.75	189.0030866	50	1.04	7.25	0.097	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	2723.29	481.24	2242.05	0.56	0.74	85.34	6	18.25	379.59	5.56
75.698	10.900	2.60	8.53	23.95	15.91	190.9710866	50	1.04	7.25	0.096	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	2742.06	491.47	2250.59	0.56	0.74	86.08	6	18.41	382.88	5.61
76.698	11.044	2.55	8.36	24.12	16.08	192.9390866	50	1.04	7.25	0.095	0	0.55	0.56	0.574	3.99	0.00	0.25	18.00	114.48	2760.84	501.71	2259.13	0.56	0.74	86.82	6	18.58	386.17	5.66
77.698	11.188	2.50	8.20	24.28	16.24	194.9070866	50	1.04	7.25	0.093	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2779.61	511.94	2267.67	0.57	0.74	87.56	6	18.74	389.46	5.71
78.698	11.332	2.45	8.04	24.44	16.41	196.8750866	50	1.04	7.25	0.092	0	0.55	0.56	0.574	3.99	0.00	0.25	18.00	114.48	2798.39	522.18	2276.21	0.57	0.74	88.28	6	18.91	392.75	5.76
79.698	11.476	2.40	7.87	24.61	16.57	198.8430866	50	1.04	7.25	0.091	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2817.16	532.41	2284.75	0.57	0.74	89.03	6	19.07	396.05	5.81
80.698	11.620	2.35	7.71	24.77	16.73	200.8110866	50	1.04	7.25	0.090	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2835.93	542.64	2293.29	0.57	0.74	89.77	6	19.23	399.34	5.86
81.698	11.764	2.30	7.54	24.94	16.90	202.7790866	50	1.04	7.25	0.089	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2854.71	552.88	2301.83	0.58	0.74	90.51	6	19.40	402.63	5.91
82.698	11.908	2.25	7.38	25.10	17.06	204.7470866	50	1.04	7.25	0.088	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	2873.48	563.11	2310.37	0.58	0.74	91.25	6	19.56	405.92	5.96
83.698	12.052	2.20	7.22	25.26	17.23	206.7150866	50	1.04	7.25	0.087	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2892.26	573.34	2318.92	0.58	0.74	91.99	6	19.73	409.21	6.01
84.698	12.196	2.15	7.05	25.43	17.39	208.6830866	50	1.04	7.25	0.086	0	0.55	0.56	0.574	3.99	0.00	0.25	18.00	114.48	2911.03	583.58	2327.46	0.56	0.74	92.73	5	19.89	412.50	6.06
85.698	12.340	2.10	6.89	25.59	17.55	210.6510866	50	1.04	7.25	0.085	0	0.55	0.56	0.574	3.99	0.00	0.25	18.00	114.48	2929.81	593.81	2336.00	0.58	0.74	93.47	4	20.05	415.79	6.11
86.698	12.484	2.05	6.72	25.76	17.72	212.6190866	50	1.04	7.25	0.084	0	0.56	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2948.58	604.04	2344.54	0.59	0.74	94.21	4	20.22	419.08	6.16
87.698	12.628	2.00	6.56	25.92	17.88	214.5870866	50	1.04	7.25	0.083	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	2967.36	614.28	2353.08	0.59	0.74	94.95	4	20.38	422.37	6.21
88.698	12.772	1.95	6.40	26.08	18.05	216.5550866	50	1.04	7.25	0.082	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2986.13	624.51	2361.62	0.59	0.74	95.69	4	20.55	425.66	6.26
89.698	12.916	1.90	6.23	26.25	18.21	218.5230866	50	1.04	7.25	0.081	0	0.56	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3004.91	634.75	2370.16	0.59	0.74	96.43	4	20.71	428.95	6.31
90.698	13.060	1.85	6.07	26.41	18.37	220.4910866	50	1.04	7.25	0.080	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3023.68	644.98	2378.70	0.59	0.74	97.17	4	20.87	432.24	6.36
91.698	13.204	1.80	5.90	26.58	18.54	222.4590866	50	1.04	7.25	0.079	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3042.46	655.21	2387.24	0.60	0.74	97.91	3	21.04	435.53	6.41
92.698	13.348	1.75	5.74	26.74	18.70	224.4270866	50	1.04	7.25	0.078	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3061.23	665.45	2395.79	0.60	0.74	98.65	3	21.20	438.82	6.46
93.698	13.492	1.70	5.58	26.90	18.87	226.3950866	50	1.04	7.25	0.077	0	0.55	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3080.01	675.68	2404.33	0.60	0.74	99.39	3	21.37	442.12	6.51
94.698	13.636	1.65	5.41	27.07	19.03	228.3630866	50	1.04	7.25	0.077	0	0.56	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3098.78	685.91	2412.87	0.60	0.74	100.13	3	21.53	445.41	6.56
95.698	13.780	1.60	5.25	27.23	19.19	230.3310866	50	1.04	7.25	0.076	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3117.56	696.15	2421.41	0.61	0.74	100.87	3	21.69	448.70	6.61
96.698	13.924	1.55	5.08	27.40	19.36	232.2990866	50	1.04	7.25	0.075	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3136.33	706.38	2429.95	0.61	0.74	101.61	3	21.86	451.99	6.66
97.698	14.068	1.50	4.92	27.56	19.52	234.2670866	50	1.04	7.25	0.074	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3155.10	716.61	2438.49	0.61	0.74	102.35	2	22.02	455.28	6.71
98.698	14.212	1.45	4.76	27.72	19.69	236.2350866	50	1.04	7.25	0.073	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3173.88	726.85	2447.03	0.61	0.74	103.09	2	22.18	458.57	6.76
99.698	14.356	1.40	4.59	27.89	19.85	238.2030866	50	1.04	7.25	0.073	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3192.65	737.08	2455.57	0.61	0.74	103.83	2	22.35	461.86	6.81
100.698	14.500	1.35	4.43	28.05	20.01	240.1710866	50	1.04	7.25	0.072	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3211.43	747.31	2464.11	0.62	0.74	104.57	2	22.51	465.15	6.86
101.698	14.644	1.30	4.26	28.22	20.18	242.1390866	50	1.04	7.25	0.071	0	0.56	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3230.20	757.55	2472.66	0.62	0.74	105.31	2	22.68	468.44	6.91
102.698	14.788	1.25	4.10	28.38	20.34	244.1070866	50	1.04	7.25	0.071	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3248.98	767.78	2481.20	0.62	0.74	106.05	2	22.84	471.73	6.96
103.698	14.932	1.20	3.94	28.54	20.51	246.0750866	50	1.04	7.25	0.070	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3267.75	778.02	2489.74	0.62	0.74	106.79	1	23.01	475.02	7.01
104.698	15.076	1.15	3.77	28.71	20.67	248.0430866	50	1.04	7.25	0.069	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3286.53	788.25	2498.28	0.62	0.74	107.53	1	23.17	478.31	7.06
105.698	15.220	1.10	3.61	28.87	20.83	250.0110866	50	1.04	7.25	0.069	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3305.30	798.48	2506.82	0.63	0.74	108.27	1	23.33	481.60	7.11
106.698	15.364	1.05	3.44	29.04	21.00	251.9790866	50	1.04	7.25	0.068	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3324.08	808.72	2515.36	0.63	0.74	109.01	1	23.50	484.89	7.16
107.698	15.508	1.00	3.28	29.20	21.16	253.9470866	50	1.04	7.25	0.067	0	0.55	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3342.85	818.95	2523.90	0.63	0.74	109.75	1	23.66	488.18	7.21
108.698	15.652	0.95	3.12	29.36	21.33	255.9150866	50	1.04	7.25	0.067	0	0.56	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3361.63	829.18	2532.44	0.63	0.74	110.49	1	23.83	491.46	7.26
109.698	15.796	0.90	2.95	29.53	21.49	257.8830866	50	1.04	7.25	0.066	0	0.56	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3380.40	839.42	2540.98	0.64	0.74	111.23	0	23.99	494.77	7.31
110.698	15.940	0.85	2.79	29.69	21.65	259.8510866	50	1.04	7.25	0.066	0	0.56	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3399.18	849.65	2549.53	0.64	0.74	111.97	0	24.16	498.06	7.36
111.698	16.084	0.80	2.62	29.86	21.82	261.8190866	50	1.04	7.25	0.065	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3417.95	859.88	2558.07	0.64	0.74	112.71	0	24.32	501.35	7.41
112.698	16.228	0.75	2.46	30.02	21.98	263.7870866	50	1.04	7.25	0.064	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3436.73	870.12	2566.61	0.64	0.74	113.45	0	24.48	504.64	7.46
113.698	16.372	0.70	2.30	30.18	22.15	265.7550866	50	1.04	7.25	0.064	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3455.50	880.35	2575.15	0.64	0.74	114.19	0	24.65	507.93	7.51
114.698	16.516	0.65	2.13	30.35	22.31	267.7230866	50	1.04	7.25	0.063	0	0.55	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3474.28	890.59	2583.69	0.65	0.74	114.93	0	24.81	511.22	7.56
115.698	16.660	0.60	1.97	30.51	22.47	269.6910866	50	1.04	7.25	0.063	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3493.05	900.82	2592.23	0.65	0.74	115.67	-1	24.97	514.51	7.61
116.698	16.804	0.55	1.80	30.68	22.64	271.6590866	50	1.04	7.25	0.062	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3511.82	911.06	2600.77	0.65	0.74	116.41	-1	25.14	517.80	7.66
117.698	16.948	0.50	1.64	30.84	22.80	273.6270866	50	1.04	7.25	0.062	0	0.56	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3530.60	921.29	2609.31	0.65	0.74	117.15	-1	25.30	521.09	7.71
118.698	17.092	0.45	1.48	31.00	22.97	275.5950866	50	1.04	7.25	0.061	0	0.56	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3549.37	931.52	2617.86	0.66	0.74	117.89	-1	25.47	524.38	7.76
119.698	17.236	0.40	1.31	31.17	23.13	277.5630866	50	1.04	7.25	0.061	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3568.15	941.75	2626.40	0.66	0.74	118.63	-1	25.63	527.67	7.81
120.698	17.380	0.35	1.15	31.33	23.29	279.5310866	50	1.04	7.25	0.060	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3586.92	951.99	2634.94	0.66	0.74	119.37	-1	25.79	530.96	7.86
121.698	17.524	0.30	0.98	31.50	23.46	281.4990866	50	1.04	7.25	0.060	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3605.70	962.22	2643.48	0.66	0.74	120.11	-2	25.96	534.25	7.91
122.698	17.668	0.25	0.82	31.66	23.62	283.4670866	50	1.04	7.25	0.059	0	0.56	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3624.47	972.46	2652.02	0.66	0.74	120.85	-2	26.12	537.55	7.96
123.698	17.812	0.20	0.66	31.82	23.79	285.4350866	50	1.04	7.25	0.059	0	0.55	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3643.25	982.69	2660.56	0.67	0.74	121.59	-2	26.29	540.84	8.01
124.698	17.956	0.15	0.49	31.99	23.95	287.4030866	50	1.04	7.25	0.058	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3662.02	992.92	2669.10	0.67	0.74	122.33	-2	26.45	544.13	8.06
125.698	18.100	0.10	0.33	32.15	24.11	289.3710866	50	1.04	7.25	0.058	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3680.80	1003.16	2677.64	0.67	0.74	123.07	-2	26.61	547.42	8.11
126.698	18.244	0.05	0.16	32.32	24.28	291.3390866	50	1.04	7.25	0.057	0	0.56	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3699.57	1013.39	2686.18	0.67	0.74	123.80	-2	26.78	550.71	8.16
127.698	18.388	0.00	0.00	32.48	24.44	293.3070866	50	1.04	7.25	0.057	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3718.35	1023.62	2694.72	0.67	0.74	124.54	-3	26.94	554.00	8.21
128.698	18.532	-0.05	-0.16	32.64	24.61	295.2750866	50	1.04	7.25	0.056	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3737.12	1033.86	2703.27	0.68	0.74	125.28	-3	27.11	557.29	8.26
129.698	18.676	-0.10	-0.33	32.81	24.77	297.2430866	50	1.04	7.25	0.056	0	0.55	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3755.90	1044.09	2711.81	0.68	0.74	126.02	-3	27.27	560.58	8.31
130.698	18.820	-0.15	-0.49	32.97	24.93	299.2110866	50	1.04	7.25	0.055	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3774.67	1054.32	2720.35	0.68	0.74	126.76	-3	27.43	563.87	8.36
131.698	18.964	-0.20	-0.66	33.14	25.10	301.1790866	50	1.04	7.25	0.055	0	0.55	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3793.45	1064.56	2728.89	0.68	0.74	127.50	-3	27.60	567.16	8.41
132.698	19.108	-0.25	-0.82	33.30	25.26	303.1470866	50	1.04	7.25	0.055	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3812.22	1074.79	2737.43	0.68	0.74	128.24	-3	27.76	570.45	8.46
133.698	19.252	-0.30	-0.98	33.46	25.43	305.1150866	50	1.04	7.25	0.054	0	0.56	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3830.99	1085.02	2745.97	0.69	0.74	128.98	-3	27.93	573.74	8.51
134.698	19.396	-0.35	-1.15	33.63	25.59	307.0830866	50	1.04	7.25	0.054	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3849.77	1095.26	2754.51	0.69	0.74	129.72	-4	28.09	577.03	8.56
135.698	19.540	-0.40	-1.31	33.79	25.75	309.0510866	50	1.04	7.25	0.053	0	0.56	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3868.54	1105.49	2763.05	0.69	0.74	130.46	-4	28.25	580.32	8.61
136.698	19.684	-0.45	-1.48	33.96	25.92	311.0190866	50	1.04	7.25	0.053	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3887.32	1115.72	2771.59	0.69	0.74	131.20	-4	28.42	583.62	8.66
137.698	19.828	-0.50	-1.64	34.12	26.08	312.9870866	50	1.04	7.25	0.053	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3906.09	1125.96	2780.14	0.70	0.74	131.94	-4	28.58	586.91	8.71
138.698	19.972	-0.55	-1.80	34.28	26.25	314.9550866	50	1.04	7.25	0.052	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3924.87	1136.19	2788.68	0.70	0.74	132.68	-4	28.75	590.20	8.76
139.698	20.116	-0.60	-1.97	34.45	26.41	316.9230866	50	1.04	7.25	0.052	0	0.55	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3943.64	1146.43	2797.22	0.70	0.74	133.42	-4	28.91	593.49	8.81
140.698	20.260	-0.65	-2.13	34.61	26.57	318.8910866	50	1.04	7.25	0.052	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3962.42	1156.66	2805.76	0.70	0.74	134.16	-5	29.07	596.78	8.86
141.698	20.404	-0.70	-2.30	34.78	26.74	320.8590866	50	1.04	7.25	0.051	0	0.55	0.56	0.574	3.99	0.00	0.20	18.00	114.48	3981.19	1166.89	2814.30	0.70	0.74	134.90	-5	29.24	600.07	8.91
142.698	20.548	-0.75	-2.46	34.94	26.90	322.8270866	50	1.04	7.25	0.051	0	0.55	0.56	0.574	3.99	0.00	0.25	18.00	114.48	3999.97	1177.13	2822.84	0.71	0.74	135.64	-5	29.40	603.36	8.96
143.698	20.692	-0.80	-2.62	35.10	27.07	324.7950866	50	1.04	7.25	0.050	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	4018.74	1187.36	2831.38	0.71	0.74	136.38	-5	29.57	606.65	9.01
144.698	20.836	-0.85	-2.79	35.27	27.23	326.7630866	50	1.04	7.25	0.050	0	0.55	0.56	0.574	3.99	0.00	0.25	18.00	114.48	4037.52	1197.59	2839.92	0.71	0.74	137.12	-5	29.73	609.94	9.06
145.698	20.980	-0.90	-2.95	35.43	27.39	328.7310866	50	1.04	7.25	0.050	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	4056.29	1207.83	2848.46	0.71	0.74	137.86	-6	29.89	613.23	9.11
146.698	21.124	-0.95	-3.12	35.60	27.56	330.6990866	50	1.04	7.25	0.049	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	4075.07	1218.06	2857.01	0.71	0.74	138.60	-6	30.06	616.52	9.16
147.698	21.268	-1.00	-3.28	35.76	27.72	332.6670866	50	1.04	7.25	0.049	0	0.55	0.56	0.574	3.99	0.00	0.25	18.00	114.48	4093.84	1228.29	2865.55	0.72	0.74	139.34	-6	30.22	619.81	9.21
148.698	21.412	-1.05	-3.44	35.92	27.89	334.6350866	50	1.04	7.25	0.049	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	4112.62	1238.53	2874.09	0.72	0.74	140.08	-6	30.39	623.10	9.26
149.698	21.556	-1.10	-3.61	36.09	28.05	336.6030866	50	1.04	7.25	0.048	0	0.55	0.56	0.574	3.99	0.00	0.25	18.00	114.48	4131.39	1248.76	2882.63	0.72	0.74	140.82	-6	30.55	626.39	9.31
150.698	21.700	-1.15	-3.77	36.25	28.21	338.5710866	50	1.04	7.25	0.048	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	4150.17	1258.99	2891.17	0.72	0.74	141.56	-6	30.71	629.69	9.36
151.698	21.844	-1.20	-3.94	36.42	28.38	340.5390866	50	1.04	7.25	0.048	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4168.94	1269.23	2899.71	0.72	0.74	142.30	-6	30.88	632.98	9.41
152.698	21.988	-1.25	-4.10	36.58	28.54	342.5070866	50	1.04	7.25	0.047	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	4187.71	1279.46	2908.25	0.73	0.74	143.04	-7	31.04	636.27	9.46
153.698	22.132	-1.30	-4.26	36.74	28.71	344.4750866	50	1.04	7.25	0.047	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4206.49	1289.70	2916.79	0.73	0.74	143.78	-7	31.21	639.56	9.51
154.698	22.276	-1.35	-4.43	36.91	28.87	346.4430866	50	1.04	7.25	0.047	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	4225.26	1299.93	2925.33	0.73	0.74	144.52	-7	31.37	642.85	9.56
155.698	22.420	-1.40	-4.59	37.07	29.03	348.4110866	50	1.04	7.25	0.047	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4244.04	1310.16	2933.88	0.73	0.74	145.26	-7	31.53	646.14	9.61
156.698	22.564	-1.45	-4.76	37.24	29.20	350.3790866	50	1.04	7.25	0.046	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	4262.81	1320.40	2942.42	0.74	0.74	146.00	-7	31.70	649.43	9.66
157.698	22.708	-1.50	-4.92	37.40	29.36	352.3470866	50	1.04	7.25	0.046	0	0.56	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4281.59	1330.63	2950.96	0.74	0.74	146.74	-7	31.86	652.72	9.71
158.698	22.852	-1.55	-5.08	37.56	29.53	354.3150866	50	1.04	7.25	0.046	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	4300.36	1340.86	2959.50	0.74	0.74	147.48	-8	32.03	656.01	9.76
159.698	22.996	-1.60	-5.25	37.73	29.69	356.2830866	50	1.04	7.25	0.045	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	4319.14	1351.10	2968.04	0.74	0.74	148.22	-8	32.19	659.30	9.81
160.698	23.140	-1.65	-5.41	37.89	29.85	358.2510866	50	1.04	7.25	0.045	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	4337.91	1361.33	2976.58	0.74	0.74	148.96	-8	32.35	662.59	9.86
161.698	23.284	-1.70	-5.58	38.06	30.02	360.2190866	50	1.04	7.25	0.045	0	0.56	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4356.69	1371.56	2985.12	0.75	0.74	149.70	-8	32.52	665.88	9.91
162.698	23.428	-1.75	-5.74	38.22	30.18	362.1870866	50	1.04	7.25	0.045	0	0.56	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4375.46	1381.80	2993.66	0.75	0.74	150.44	-8	32.68	669.17	9.96
163.698	23.572	-1.80	-5.90	38.38	30.35	364.1550866	50	1.04	7.25	0.044	0	0.55	0.56	0.574	3.99	0.00	0.25	18.00	114.48	4394.24	1392.03	3002.20	0.75	0.74	151.18	-8	32.85	672.46	10.01
164.698	23.716	-1.85	-6.07	38.55	30.51	366.1230866	50	1.04	7.25	0.044	0	0.55	0.56	0.574	3.99	0.00	0.25	18.00	114.48	4413.01	1402.27	3010.75	0.75	0.74	151.92	-9	33.01	675.75	10.06
165.698	23.860	-1.90	-6.23	38.71	30.67	368.0910866	50	1.04	7.25	0.044	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4431.79	1412.50	3019.29	0.75	0.74	152.66	-9	33.17	679.05	10.11
166.698	24.004	-1.95	-6.40	38.88	30.84	370.0590866	50	1.04	7.25	0.044	0	0.56	0.56	0.574	3.99	0.00	0.25	18.00	114.48	4450.56	1422.73	3027.83	0.76	0.74	153.40	-9	33.34	682.34	10.16
167.698	24.148	-2.00	-6.56	39.04	31.00	372.0270866	90	1.88	13.05	0.078	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4471.42	1432.97	3038.46	0.76	1.33	154.73	-9	33.50	688.26	10.21
168.698	24.292	-2.05	-6.72	39.20	31.17	373.9950866	90	1.88	13.05	0.077	0	0.55	0.56	1.034	7.18	0.00	0.25	20.00	127.20	4492.28	1443.20	3049.08	0.76	1.33	156.06	-9	33.67	694.16	10.26
169.698	24.436	-2.10	-6.89	39.37	31.33	375.9630866	90	1.88	13.05	0.077	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4513.14	1453.43	3059.71	0.76	1.33	157.39	-9	33.83	700.11	10.31
170.698	24.580	-2.15	-7.05	39.53	31.49	377.9310866	90	1.88	13.05	0.076	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4534.00	1463.67	3070.34	0.77	1.33	158.72	-10	33.99	706.03	10.36
171.698	24.724	-2.20	-7.22	39.70	31.66	379.8990866	90	1.88	13.05	0.076	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	4554.86	1473.90	3080.96	0.77	1.33	160.05	-10	34.16	711.96	10.41
172.698	24.868	-2.25	-7.38	39.86	31.82	381.8670866	90	1.88	13.05	0.076	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4575.73	1484.13	3091.59	0.77	1.33	161.38	-10	34.32	717.88	10.46
173.698	25.012	-2.30	-7.54	40.02	31.98	383.8350866	90	1.88	13.05	0.075	0	0.55	0.56	1.034	7.18	0.00	0.25	20.00	127.20	4596.59	1494.57	3102.22	0.78	1.33	162.72	-10	34.49	723.80	10.51
174.698	25.156	-2.35	-7.71	40.19	32.15	385.8030866	90	1.88	13.05	0.075	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4617.45	1504.60	3112.85	0.78	1.33	164.05	-10	34.65	729.72	10.56
175.698	25.300	-2.40	-7.87	40.35	32.31	387.7710866	90	1.88	13.05	0.074	0	0.56	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4638.31	1514.63	3123.47	0.78	1.33	165.38	-10	34.81	735.65	10.61
176.698	25.444	-2.45	-8.04	40.52	32.48	389.7390866	90	1.88	13.05	0.074	0	0.55	0.56	1.034	7.18	0.00	0.25	20.00	127.20	4659.17	1525.07	3134.10	0.78	1.33	166.71	-11	34.98	741.57	10.66
177.698	25.588	-2.50	-8.20	40.68	32.64	391.7070866	90	1.88	13.05	0.073	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	4680.03	1535.30	3144.73	0.79	1.33	168.04	-11	35.14	747.49	10.71
178.698	25.732	-2.55	-8.36	40.84	32.81	393.6750866	90	1.88	13.05	0.073	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	4700.89	1545.54	3155.35	0.79	1.33	169.37	-11	35.31	753.42	10.76
179.698	25.876	-2.60	-8.53	41.01	32.97	395.6430866	90	1.88	13.05	0.073	0	0.55	0.56	1.034	7.18	0.00	0.25	20.00	127.20	4721.75	1555.77	3165.98	0.79	1.33	170.71	-11	35.47	759.34	10.81
180.698	26.020	-2.65	-8.69	41.17	33.13	397.6110866	90	1.88	13.05	0.072	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	4742.61	1566.00	3176.61	0.79	1.33	172.04	-11	35.63	765.26	10.86
181.698	26.164	-2.70	-8.86	41.34	33.30	399.5790866	90	1.88	13.05	0.072	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4763.47	1576.24	3187.24	0.80	1.33	173.37	-11	35.80	771.18	10.91
182.698	26.308	-2.75	-9.02	41.50	33.46	401.5470866	90	1.88	13.05	0.071	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	4784.33	1586.47	3197.86	0.80	1.33	174.70	-12	35.96	777.11	10.96
183.698	26.452	-2.80	-9.18	41.66	33.63	403.5150866	90	1.88	13.05	0.071	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	4805.19	1596.70	3208.49	0.80	1.33	176.03	-12	36.13	783.03	11.01
184.698	26.596	-2.85	-9.35	41.83	33.79	405.4830866	90	1.88	13.05	0.071	0	0.55	0.56	1.034	7.18	0.00	0.25	20.00	127.20	4826.05	1606.94	3219.12	0.80	1.33	177.36	-12	36.29	788.95	11.06
185.698	26.740	-2.90	-9.51	41.99	33.95	407.4510866	90	1.88	13.05	0.070	0	0.55	0.56	1.034	7.18	0.00	0.25	20.00	127.20	4846.92	1617.17	3229.74	0.81	1.33	178.70	-12	36.45	794.88	11.11
186.698	26.884	-2.95	-9.68	42.16	34.12	409.4190866	90	1.88	13.05	0.070	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4867.78	1627.40	3240.37	0.81	1.33	180.03	-12	36.62	800.80	11.16
187.698	27.028	-3.00	-9.84	42.32	34.28	411.3870866	90	1.88	13.05	0.070	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	4888.64	1637.64	3251.00	0.81	1.33	181.36	-12	36.78	806.72	11.21
188.698	27.172	-3.05	-10.00	42.48	34.45	413.3550866	90	1.88	13.05	0.069	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	4909.50	1647.87	3261.63	0.82	1.33	182.69	-13	36.95	812.65	11.26
189.698	27.316	-3.10	-10.17	42.65	34.61	415.3230866	90	1.88	13.05	0.069	0	0.55	0.56	1.034	7.18	0.00	0.25	20.00	127.20	4930.36	1658.11	3272.25	0.82	1.33	184.02	-13	37.11	818.57	11.31
190.698	27.460	-3.15	-10.33	42.81	34.77	417.2910866	90	1.88	13.05	0.068	0	0.55	0.56	1.034	7.18	0.00	0.25	20.00	127.20	4951.22	1668.34	3282.88	0.82	1.33	185.35	-13	37.27	824.49	11.36
191.698	27.604	-3.20	-10.50	42.98	34.94	419.2590866	90	1.88	13.05	0.068	0	0.55	0.56	1.034	7.18	0.00	0.25	20.00	127.20	4972.08	1678.57	3293.51	0.82	1.33	186.69	-13	37.44	830.42	11.41
192.698	27.748	-3.25	-10.66	43.14	35.10	421.2270866	90	1.88	13.05	0.068	0	0.56	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4992.94	1688.81	3304.14	0.83	1.33	188.02	-13	37.60	836.34	11.46
193.698	27.892	-3.30	-10.82	43.30	35.27	423.1950866	90	1.88	13.05	0.067	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5013.80	1699.04	3314.76	0.83	1.33	189.35	-13	37.77	842.26	11.51
194.698	28.036	-3.35	-10.99	43.47	35.43	425.1630866	90	1.88	13.05	0.067	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5034.66	1709.27	3325.39	0.83	1.33	190.68	-13	37.93	848.19	11.56
195.698	28.180	-3.40	-11.15	43.63	35.59	427.1310866	90	1.88	13.05	0.067	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5055.52	1719.51	3336.02	0.83	1.33	192.01	-14	38.09	854.11	11.61
196.698	28.324	-3.45	-11.32	43.80	35.76	429.0990866	90	1.88	13.05	0.066	0	0.56	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5076.38	1729.74	3346.64	0.84	1.33	193.34	-14	38.26	860.03	11.66
197.698	28.468	-3.50	-11.48	43.96	35.92	431.0670866	90	1.88	13.05	0.066	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5097.25	1739.97	3357.27	0.84	1.33	194.67	-14	38.42	865.96	11.71
198.698	28.612	-3.55	-11.64	44.12	36.09	433.0350866	90	1.88	13.05	0.066	0	0.55	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5118.11	1750.21	3367.90	0.84	1.33	196.01	-14	38.59	871.88	11.76
199.698	28.756	-3.60	-11.81	44.29	36.25	435.0030866	90	1.88	13.05	0.065	0	0.55	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5138.97	1760.44	3378.53	0.84	1.33	197.34	-14	38.75	877.80	11.81
200.698	28.900	-3.65	-11.97	44.45	36.41	436.9710866	90	1.88	13.05	0.065	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5159.83	1770.67	3389.15	0.85	1.33	198.67	-14	38.91	883.73	11.86
201.698	29.044	-3.70	-12.14	44.62	36.58	438.9390866	90	1.88	13.05	0.065	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5180.69	1780.91	3399.78	0.85	1.33	200.00	-15	39.08	889.65	11.91
202.698	29.188	-3.75	-12.30	44.78	36.74	440.9070866	90	1.88	13.05	0.064	0	0.55	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5201.55	1791.14	3410.41	0.85	1.33	201.33	-15	39.24	895.57	11.96
203.698	29.332	-3.80	-12.46	44.94	36.91	442.8750866	90	1.88	13.05	0.064	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5222.41	1801.38	3421.03	0.86	1.33	202.66	-15	39.41	901.50	12.01
204.698	29.476	-3.85	-12.63	45.11	37.07	444.8430866	90	1.88	13.05	0.064	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5243.27	1811.61	3431.66	0.86	1.33	204.00	-15	39.57	907.42	12.06
205.698	29.620	-3.90	-12.79	45.27	37.23	446.8110866	90	1.88	13.05	0.063	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5264.13	1821.84	3442.29	0.86	1.33	205.33	-15	39.73	913.34	12.11
206.698	29.764	-3.95	-12.96	45.44	37.40	448.7790866	90	1.88	13.05	0.063	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5284.99	1832.08	3452.92	0.86	1.33	206.66	-15	39.90	919.27	12.16
207.698	29.908	-4.00	-13.12	45.60	37.56	450.7470866	90	1.88	13.05	0.063	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5305.85	1842.31	3463.54	0.87	1.33	207.99	-16	40.06	925.19	12.21
208.698	30.052	-4.05	-13.28	45.76	37.73	452.7150866	90	1.88	13.05	0.063	0	0.56	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5326.71	1852.54	3474.17	0.87	1.33	209.32	-16	40.23	931.11	12.26
209.698	30.196	-4.10	-13.45	45.93	37.89	454.6830866	90	1.88	13.05	0.062	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5347.57	1862.78	3484.80	0.87	1.33	210.65	-16	40.39	937.04	12.31
210.698	30.340	-4.15	-13.61	46.09	38.05	456.6510866	90	1.88	13.05	0.062	0	0.56	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5368.44	1873.01	3495.42	0.87	1.33	211.99	-16	40.55	942.96	12.36
211.698	30.484	-4.20	-13.78	46.26	38.22	458.6190866	90	1.88	13.05	0.062	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5389.30	1883.24	3506.05	0.88	1.33	213.32	-16	40.72	948.88	12.41
212.698	30.628	-4.25	-13.94	46.42	38.38	460.5870866	90	1.88	13.05	0.061	0	0.55	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5410.16	1893.48	3516.68	0.88	1.33	214.65	-16	40.88	954.81	12.46
213.698	30.772	-4.30	-14.10	46.58	38.55	462.5550866	90	1.88	13.05	0.061	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5431.02	1903.71	3527.31	0.88	1.33	215.98	-17	41.05	960.73	12.51
214.698	30.916	-4.35	-14.27	46.75	38.71	464.5230866	90	1.88	13.05	0.061	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5451.88	1913.95	3537.93	0.88	1.33	217.31	-17	41.21	966.65	12.56
215.698	31.060	-4.40	-14.43	46.91	38.87	466.4910866	90	1.88	13.05	0.061	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5472.74	1924.18	3548.56	0.89	1.33	218.64	-17	41.37	972.58	12.61
216.698	31.204	-4.45	-14.60	47.08	39.04	468.4590866	90	1.88	13.05	0.060	0	0.56	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5493.60	1934.41	3559.19	0.89	1.33	219.98	-17	41.54	978.50	12.66
217.698	31.348	-4.50	-14.76	47.24	39.20	470.4270866	90	1.88	13.05	0.060	0	0.55	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5514.46	1944.65	3569.82	0.89	1.33	221.31	-17	41.70	984.42	12.71
218.698	31.492	-4.55	-14.92	47.40	39.37	472.3950866	90	1.88	13.05	0.060	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5535.32	1954.88	3580.44	0.90	1.33	222.64	-17	41.87	990.35	12.76
219.698	31.636	-4.60	-15.09	47.57	39.53	474.3630866	90	1.88	13.05	0.059	0	0.55	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5556.18	1965.11	3591.07	0.90	1.33	223.97	-18	42.03	996.27	12.81
220.698	31.780	-4.65	-15.25	47.73	39.69	476.3310866	90	1.88	13.05	0.059	0	0.56	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5577.04	1975.35	3601.70	0.90	1.33	225.30	-18	42.19	1002.19	12.86
221.698	31.924	-4.70	-15.42	47.90	39.86	478.2990866	90	1.88	13.05	0.059	0	0.55	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5597.90	1985.58	3612.32	0.90	1.33	226.63	-18	42.36	1008.11	12.91
222.698	32.068	-4.75	-15.58	48.06	40.02	480.2670866	90	1.88	13.05	0.059	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5618.77	1995.81	3622.95	0.91	1.33	227.96	-18	42.52	1014.04	12.96
223.698	32.212	-4.80	-15.74	48.22	40.19	482.2350866	90	1.88	13.05	0.058	0	0.55	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5639.63	2006.05	3633.58	0.91	1.33	229.30	-18	42.69	1019.96	13.01
224.698	32.356	-4.85	-15.91	48.39	40.35	484.2030866	90	1.88	13.05	0.058	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5660.49	2016.28	3644.21	0.91	1.33	230.63	-18	42.85	1025.88	13.06
225.698	32.500	-4.90	-16.07	48.55	40.51	486.1710866	90	1.88	13.05	0.058	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5681.35	2026.51	3654.83	0.91	1.33	231.96	-19	43.01	1031.81	13.11
226.698	32.644	-4.95	-16.24	48.72	40.68	488.1390866	90	1.88	13.05	0.058	0	0.56	0.56	1.034	7.18	0.00	0.25	20.00	127.20	5702.21	2036.74	3665.46	0.92	1.33	233.29	-19	43.18	1037.73	13.16

227.696	32.788	-5.00	-16.40	48.88	40.84	490.1070866	90	1.88	13.05	0.057	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5723.07	2046.96	3676.09	0.92	1.33	234.62	-19	43.34	1043.65	13.21
228.696	32.932	-5.05	-16.56	49.04	41.01	492.0750866	90	1.88	13.05	0.057	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5743.93	2057.22	3686.71	0.92	1.33	235.95	-19	43.51	1049.58	13.26
229.696	33.076	-5.10	-16.73	49.21	41.17	494.0430866	90	1.88	13.05	0.057	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5764.79	2067.46	3697.34	0.92	1.33	237.29	-19	43.67	1055.50	13.31
230.696	33.220	-5.15	-16.89	49.37	41.33	496.0110866	90	1.88	13.05	0.057	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5785.65	2077.69	3707.97	0.93	1.33	238.62	-19	43.83	1061.42	13.36
231.696	33.364	-5.20	-17.06	49.54	41.50	497.9790866	90	1.88	13.05	0.056	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5806.51	2087.92	3718.60	0.93	1.33	239.96	-20	44.00	1067.35	13.41
232.696	33.508	-5.25	-17.22	49.70	41.66	499.9470866	90	1.88	13.05	0.056	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5827.37	2098.16	3729.22	0.93	1.33	241.28	-20	44.16	1073.27	13.46
233.696	33.652	-5.30	-17.38	49.86	41.83	501.9150866	90	1.88	13.05	0.056	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5848.23	2108.39	3739.85	0.93	1.33	242.61	-20	44.33	1079.18	13.51
234.696	33.796	-5.35	-17.55	50.03	41.99	503.8830866	90	1.88	13.05	0.056	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5869.09	2118.62	3750.48	0.94	1.33	243.94	-20	44.49	1085.12	13.56
235.696	33.940	-5.40	-17.71	50.19	42.15	505.8510866	90	1.88	13.05	0.055	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5889.96	2128.85	3761.10	0.94	1.33	245.28	-20	44.65	1091.04	13.61
236.696	34.084	-5.45	-17.88	50.36	42.32	507.8190866	90	1.88	13.05	0.055	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5910.82	2139.08	3771.73	0.94	1.33	246.61	-20	44.82	1096.96	13.66
237.696	34.228	-5.50	-18.04	50.52	42.48	509.7870866	90	1.88	13.05	0.055	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5931.68	2149.32	3782.36	0.95	1.33	247.94	-21	44.98	1102.89	13.71
238.696	34.372	-5.55	-18.20	50.68	42.65	511.7550866	90	1.88	13.05	0.055	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5952.54	2159.55	3792.99	0.95	1.33	249.27	-21	45.15	1108.81	13.76
239.696	34.516	-5.60	-18.37	50.85	42.81	513.7230866	90	1.88	13.05	0.054	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5973.40	2169.78	3803.61	0.95	1.33	250.60	-21	45.31	1114.73	13.81
240.696	34.660	-5.65	-18.53	51.01	42.97	515.6910866	90	1.88	13.05	0.054	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	5994.26	2180.02	3814.24	0.95	1.33	251.93	-21	45.47	1120.66	13.86
241.696	34.804	-5.70	-18.70	51.18	43.14	517.6590866	90	1.88	13.05	0.054	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6015.12	2190.25	3824.87	0.96	1.33	253.27	-21	45.64	1126.58	13.91
242.696	34.948	-5.75	-18.86	51.34	43.30	519.6270866	90	1.88	13.05	0.054	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6035.98	2200.48	3835.50	0.96	1.33	254.60	-21	45.80	1132.50	13.96
243.696	35.092	-5.80	-19.02	51.50	43.47	521.5950866	90	1.88	13.05	0.054	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6056.84	2210.12	3846.12	0.96	1.33	255.93	-22	45.97	1138.43	14.01
244.696	35.236	-5.85	-19.19	51.67	43.63	523.5630866	90	1.88	13.05	0.053	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6077.70	2220.95	3856.75	0.96	1.33	257.26	-22	46.13	1144.36	14.06
245.696	35.380	-5.90	-19.35	51.83	43.79	525.5310866	90	1.88	13.05	0.053	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6098.56	2231.10	3867.38	0.97	1.33	258.59	-22	46.29	1150.27	14.11
246.696	35.524	-5.95	-19.52	52.00	43.96	527.4990866	90	1.88	13.05	0.053	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6119.42	2241.42	3878.00	0.97	1.33	259.92	-22	46.46	1156.20	14.16
247.696	35.668	-6.00	-19.68	52.16	44.12	529.4670866	90	1.88	13.05	0.053	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6140.29	2251.66	3888.63	0.97	1.33	261.25	-22	46.62	1162.12	14.21
248.696	35.812	-6.05	-19.84	52.32	44.29	531.4350866	90	1.88	13.05	0.052	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6161.16	2261.89	3899.25	0.97	1.33	262.59	-22	46.79	1168.04	14.26
249.696	35.956	-6.10	-20.01	52.49	44.45	533.4030866	90	1.88	13.05	0.052	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6182.01	2272.12	3909.89	0.98	1.33	263.92	-23	46.95	1173.97	14.31
250.696	36.100	-6.15	-20.17	52.65	44.61	535.3710866	90	1.88	13.05	0.052	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6202.87	2282.35	3920.51	0.98	1.33	265.25	-23	47.11	1179.89	14.36
251.696	36.244	-6.20	-20.34	52.82	44.78	537.3390866	90	1.88	13.05	0.052	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6223.73	2292.59	3931.14	0.98	1.33	266.58	-23	47.28	1185.81	14.41
252.696	36.388	-6.25	-20.50	52.98	44.94	539.3070866	90	1.88	13.05	0.052	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6244.59	2302.82	3941.77	0.98	1.33	267.91	-23	47.44	1191.74	14.46
253.696	36.532	-6.30	-20.66	53.14	45.11	541.2750866	90	1.88	13.05	0.051	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6265.45	2313.06	3952.39	0.99	1.33	269.24	-23	47.61	1197.66	14.51
254.696	36.676	-6.35	-20.83	53.31	45.27	543.2430866	90	1.88	13.05	0.051	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6286.31	2323.29	3963.02	0.99	1.33	270.58	-23	47.77	1203.58	14.56
255.696	36.820	-6.40	-20.99	53.47	45.43	545.2110866	90	1.88	13.05	0.051	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6307.17	2333.52	3973.65	0.99	1.33	271.91	-23	47.93	1209.51	14.61
256.696	36.964	-6.45	-21.16	53.64	45.60	547.1790866	90	1.88	13.05	0.051	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6328.03	2343.76	3984.28	1.00	1.33	273.24	-24	48.10	1215.43	14.66
257.696	37.108	-6.50	-21.32	53.80	45.76	549.1470866	90	1.88	13.05	0.051	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6348.89	2353.99	3994.90	1.00	1.33	274.57	-24	48.26	1221.36	14.71
258.696	37.252	-6.55	-21.48	53.96	45.93	551.1150866	90	1.88	13.05	0.050	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6369.78	2364.22	4005.53	1.00	1.33	275.90	-24	48.43	1227.27	14.76
259.696	37.396	-6.60	-21.65	54.13	46.09	553.0830866	90	1.88	13.05	0.050	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6390.61	2374.46	4016.16	1.00	1.33	277.23	-24	48.59	1233.20	14.81
260.696	37.540	-6.65	-21.81	54.29	46.25	555.0510866	90	1.88	13.05	0.050	0	0.55	0.55	1.034	7.18		0.00	0.25	20.00	127.20	6411.46	2384.69	4026.78	1.01	1.33	278.57	-24	48.76	1239.12	14.86
261.696	37.684	-6.70	-21.98	54.46	46.42	557.0190866	120	2.51	17.40	0.067	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6432.34	2394.92	4037.41	1.01	1.78	280.34	-24	48.92	1247.02	14.91
262.696	37.828	-6.75	-22.14	54.62	46.58	558.9870866	120	2.51	17.40	0.066	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6453.20	2405.16	4048.04	1.01	1.78	282.12	-25	49.08	1254.92	14.96
263.696	37.972	-6.80	-22.30	54.78	46.75	560.9550866	120	2.51	17.40	0.066	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6474.06	2415.39	4058.67	1.01	1.78	283.89	-25	49.25	1262.81	15.01
264.696	38.116	-6.85	-22.47	54.95	46.91	562.9230866	120	2.51	17.40	0.066	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6494.92	2425.63	4069.29	1.02	1.78	285.67	-25	49.41	1270.71	15.06
265.696	38.260	-6.90	-22.63	55.11	47.07	564.8910866	120	2.51	17.40	0.066	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6515.78	2435.86	4079.92	1.02	1.78	287.44	-25	49.57	1278.61	15.11
266.696	38.404	-6.95	-22.80	55.28	47.24	566.8590866	120	2.51	17.40	0.065	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6536.64	2446.09	4090.55	1.02	1.78	289.22	-25	49.74	1286.51	15.16
267.696	38.548	-7.00	-22.96	55.44	47.40	568.8270866	120	2.51	17.40	0.065	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6557.50	2456.33	4101.18	1.03	1.78	290.99	-26	49.90	1294.41	15.21
268.696	38.692	-7.05	-23.12	55.60	47.57	570.7950866	120	2.51	17.40	0.065	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6578.36	2466.56	4111.80	1.03	1.78	292.77	-26	50.07	1302.30	15.26
269.696	38.836	-7.10	-23.29	55.77	47.73	572.7630866	120	2.51	17.40	0.065	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6599.22	2476.79	4122.43	1.03	1.78	294.54	-26	50.23	1310.20	15.31
270.696	38.980	-7.15	-23.45	55.93	47.89	574.7310866	120	2.51	17.40	0.064	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6620.08	2487.03	4133.06	1.03	1.78	296.32	-26	50.39	1318.10	15.36
271.696	39.124	-7.20	-23.62	56.10	48.06	576.6990866	120	2.51	17.40	0.064	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6640.94	2497.25	4143.68	1.04	1.78	298.10	-26	50.56	1326.00	15.41
272.696	39.268	-7.25	-23.78	56.26	48.22	578.6670866	120	2.51	17.40	0.064	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6661.81	2507.49	4154.31	1.04	1.78	299.87	-26	50.72	1333.89	15.46
273.696	39.412	-7.30	-23.94	56.42	48.39	580.6350866	120	2.51	17.40	0.064	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6682.67	2517.73	4164.94	1.04	1.78	301.65	-26	50.88	1341.79	15.51
274.696	39.556	-7.35	-24.11	56.59	48.55	582.6030866	120	2.51	17.40	0.063	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6703.53	2527.96	4175.57	1.04	1.78	303.42	-27	51.05	1349.69	15.56
275.696	39.700	-7.40	-24.27	56.75	48.71	584.5710866	120	2.51	17.40	0.063	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6724.39	2538.19	4186.19	1.05	1.78	305.20	-27	51.21	1357.59	15.61
276.696	39.844	-7.45	-24.44	56.92	48.88	586.5390866	120	2.51	17.40	0.063	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6745.25	2548.43	4196.82	1.05	1.78	306.97	-27	51.38	1365.48	15.66
277.696	39.988	-7.50	-24.60	57.08	49.04	588.5070866	120	2.51	17.40	0.063	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6766.11	2558.66	4207.45	1.05	1.78	308.75	-27	51.54	1373.38	15.71
278.696	40.132	-7.55	-24.76	57.24	49.21	590.4750866	120	2.51	17.40	0.062	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6786.97	2568.90	4218.07	1.05	1.78	310.52	-27	51.71	1381.28	15.76
279.696	40.276	-7.60	-24.93	57.41	49.37	592.4430866	120	2.51	17.40	0.062	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6807.83	2579.13	4228.70	1.06	1.78	312.30	-27	51.87	1389.18	15.81
280.696	40.420	-7.65	-25.09	57.57	49.53	594.4110866	120	2.51	17.40	0.062	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6828.69	2589.36	4239.33	1.06	1.78	314.07	-28	52.03	1397.07	15.86
281.696	40.564	-7.70	-25.26	57.74	49.70	596.3790866	120	2.51	17.40	0.062	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6849.55	2599.60	4249.96	1.06	1.78	315.85	-28	52.20	1404.97	15.91
282.696	40.708	-7.75	-25.42	57.90	49.86	598.3470866	120	2.51	17.40	0.062	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6870.41	2609.83	4260.58	1.07	1.78	317.63	-28	52.36	1412.87	15.96
283.696	40.852	-7.80	-25.58	58.06	50.03	600.3150866	120	2.51	17.40	0.061	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6891.27	2620.06	4271.21	1.07	1.78	319.40	-28	52.53	1420.77	16.01
284.696	40.996	-7.85	-25.75	58.23	50.19	602.2830866	120	2.51	17.40	0.061	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6912.13	2630.30	4281.84	1.07	1.78	321.18	-28	52.69	1428.67	16.06
285.696	41.140	-7.90	-25.91	58.39	50.35	604.2510866	120	2.51	17.40	0.061	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6933.00	2640.53	4292.46	1.07	1.78	322.95	-28	52.85	1436.56	16.11
286.696	41.284	-7.95	-26.08	58.56	50.52	606.2190866	120	2.51	17.40	0.061	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6953.86	2650.76	4303.09	1.08	1.78	324.73	-29	53.02	1444.46	16.16
287.696	41.428	-8.00	-26.24	58.72	50.68	608.1870866	120	2.51	17.40	0.060	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6974.72	2661.00	4313.72	1.08	1.78	326.50	-29	53.18	1452.36	16.21
288.696	41.572	-8.05	-26.40	58.88	50.85	610.1550866	120	2.51	17.40	0.060	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6995.58	2671.23	4324.36	1.08	1.78	328.28	-29	53.35	1460.26	16.26
289.696	41.716	-8.10	-26.57	59.05	51.01	612.1230866	120	2.51	17.40	0.060	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7016.44	2681.47	4334.97	1.08	1.78	330.05	-29	53.51	1468.15	16.31
290.696	41.860	-8.15	-26.73	59.21	51.17	614.0910866	120	2.51	17.40	0.060	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7037.30	2691.70	4345.60	1.09	1.78	331.83	-29	53.67	1476.05	16.36
291.696	42.004	-8.20	-26.90	59.38	51.34	616.0590866	120	2.51	17.40	0.060	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7058.16	2701.93	4356.23	1.09	1.78	333.60	-29	53.84	1483.95	16.41
292.696	42.148	-8.25	-27.06	59.54	51.50	618.0270866	120	2.51	17.40	0.059	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7079.02	2712.17	4366.86	1.09	1.78	335.38	-30	54.00	1491.85	16.46
293.696	42.292	-8.30	-27.22	59.70	51.67	619.9950866	120	2.51	17.40	0.059	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7099.88	2722.40	4377.48	1.09	1.78	337.16	-30	54.17	1499.74	16.51
294.696	42.436	-8.35	-27.38	59.87	51.83	621.9630866	120	2.51	17.40	0.059	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7120.74	2732.63	4388.11	1.10	1.78	338.93	-30	54.33	1507.64	16.56
295.696	42.580	-8.40	-27.55	60.03	51.99	623.9310866	120	2.51	17.40	0.059	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7141.60	2742.87	4398.74	1.10	1.78	340.71	-30	54.49	1515.54	16.61
296.696	42.724	-8.45	-27.72	60.20	52.16	625.8990866	120	2.51	17.40	0.059	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7162.46	2753.10	4409.36	1.10	1.78	342.48	-30	54.66	1523.44	16.66
297.696	42.868	-8.50	-27.88	60.36	52.32	627.8670866	120	2.51	17.40	0.058	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7183.33	2763.33	4419.99	1.10	1.78	344.26	-30	54.82	1531.33	16.71
298.696	43.012	-8.55	-28.04	60.52	52.49	629.8350866	120	2.51	17.40	0.058	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7204.19	2773.57	4430.62	1.11	1.78	346.03	-31	54.99	1539.23	16.76
299.696	43.156	-8.60	-28.21	60.69	52.65	631.8030866	120	2.51	17.40	0.058	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7225.05	2783.80	4441.25	1.11	1.78	347.81	-31	55.15	1547.13	16.81
300.696	43.300	-8.65	-28.37	60.85	52.81	633.7710866	120	2.51	17.40	0.058	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7245.91	2794.03	4451.87	1.11	1.78	349.58	-31	55.31	1555.03	16.86
301.696	43.444	-8.70	-28.54	61.02	52.98	635.7390866	120	2.51	17.40	0.058	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7266.77	2804.27	4462.50	1.12	1.78	351.36	-31	55.48	1562.93	16.91
302.696	43.588	-8.75	-28.70	61.18	53.14	637.7070866	120	2.51	17.40	0.057	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7287.63	2814.50	4473.13	1.12	1.78	353.14	-31	55.64	1570.82	16.96
303.696	43.732	-8.80	-28.86	61.34	53.31	639.6750866	120	2.51	17.40	0.057	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7308.49	2824.74	4483.75	1.12	1.78	354.91	-31	55.81	1578.72	17.01
304.696	43.876	-8.85	-29.03	61.51	53.47	641.6430866	120	2.51	17.40	0.057	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7329.35	2834.97	4494.38	1.12	1.78	356.69	-32	55.97	1586.62	17.06
305.696	44.020	-8.90	-29.19	61.67	53.63	643.6110866	120	2.51	17.40	0.057	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7350.21	2845.20	4505.01	1.13	1.78	358.46	-32	56.13	1594.52	17.11
306.696	44.164	-8.95	-29.36	61.84	53.80	645.5790866	120	2.51	17.40	0.057	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7371.07	2855.44	4515.64	1.13	1.78	360.24	-32	56.30	1602.41	17.16
307.696	44.308	-9.00	-29.52	62.00	53.96	647.5470866	120	2.51	17.40	0.057	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7391.93	2865.67	4526.26	1.13	1.78	362.01	-32	56.46	1610.31	17.21
308.696	44.452	-9.05	-29.68	62.16	54.13	649.5150866	120	2.51	17.40	0.056	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7412.79	2875.90	4536.89	1.13	1.78	363.79	-32	56.63	1618.21	17.26
309.696	44.596	-9.10	-29.85	62.33	54.29	651.4830866	120	2.51	17.40	0.056	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7433.65	2886.14	4547.52	1.14	1.78	365.56	-32	56.79	1626.11	17.31
310.696	44.740	-9.15	-30.01	62.49	54.45	653.4510866	120	2.51	17.40	0.056	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7454.52	2896.37	4558.14	1.14	1.78	367.34	-33	56.95	1634.00	17.36
311.696	44.884	-9.20	-30.18	62.66	54.62	655.4190866	120	2.51	17.40	0.056	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7475.36	2906.60	4568.77	1.14	1.78	369.11	-33	57.12	1641.90	17.41
312.696	45.028	-9.25	-30.34	62.82	54.78	657.3870866	120	2.51	17.40	0.056	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7496.24	2916.84	4579.40	1.14	1.78	370.89	-33	57.28	1649.80	17.46
313.696	45.172	-9.30	-30.50	62.98	54.95	659.3550866	120	2.51	17.40	0.055	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7517.10	2927.07	4590.03	1.15	1.78	372.67	-33	57.45	1657.70	17.51
314.696	45.316	-9.35	-30.67	63.15	55.11	661.3230866	120	2.51	17.40	0.055	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7537.96	2937.31	4600.65	1.15	1.78	374.44	-33	57.61	1665.60	17.56
315.696	45.460	-9.40	-30.83	63.31	55.27	663.2910866	120	2.51	17.40	0.055	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7558.82	2947.54	4611.28	1.15	1.78	376.22	-33	57.77	1673.49	17.61
316.696	45.604	-9.45	-31.00	63.48	55.44	665.2590866	120	2.51	17.40	0.055	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7579.68	2957.77	4621.91	1.16	1.78	377.99	-33	57.94	1681.39	17.66
317.696	45.748	-9.50	-31.16	63.64	55.60	667.2270866	120	2.51	17.40	0.055	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7600.54	2968.01	4632.54	1.16	1.78	379.77	-34	58.10	1689.29	17.71
318.696	45.892	-9.55	-31.32	63.80	55.77	669.1950866	120	2.51	17.40	0.055	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7621.40	2978.24	4643.16	1.16	1.78	381.54	-34	58.27	1697.19	17.76
319.696	46.036	-9.60	-31.49	63.97	55.93	671.1630866	120	2.51	17.40	0.054	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7642.26	2988.47	4653.79	1.16	1.78	383.32	-34	58.43	1705.08	17.81
320.696	46.180	-9.65	-31.65	64.13	56.09	673.1310866	120	2.51	17.40	0.054	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7663.12	2998.71	4664.42	1.17	1.78	385.09	-34	58.59	1712.98	17.86
321.696	46.324	-9.70	-31.82	64.30	56.26	675.0990866	120	2.51	17.40	0.054	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7683.98	3008.94	4675.04	1.17	1.78	386.87	-34	58.76	1720.88	17.91
322.696	46.468	-9.75	-31.98	64.46	56.42	677.0670866	120	2.51	17.40	0.054	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7704.85	3019.17	4685.67	1.17	1.78	388.64	-34	58.92	1728.78	17.96
323.696	46.612	-9.80	-32.14	64.62	56.59	679.0350866	120	2.51	17.40	0.054	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7725.71	3029.41	4696.30	1.17	1.78	390.42	-35	59.09	1736.67	18.01
324.696	46.756	-9.85	-32.31	64.79	56.75	681.0030866	120	2.51	17.40	0.054	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7746.57	3039.64	4706.93	1.18	1.78	392.20	-35	59.25	1744.57	18.06
325.696	46.900	-9.90	-32.47	64.95	56.91	682.9710866	120	2.51	17.40	0.053	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7767.43	3049.87	4717.55	1.18	1.78	393.97	-35	59.41	1752.47	18.11
326.696	47.044	-9.95	-32.64	65.12	57.08	684.9390866	120	2.51	17.40	0.053	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7788.29	3060.11	4728.18	1.18	1.78	395.75	-35	59.58	1760.37	18.16
327.696	47.188	-10.00	-32.80	65.28	57.24	686.9070866	120	2.51	17.40	0.053	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7809.15	3070.34	4738.81	1.18	1.78	397.52	-35	59.74	1768.26	18.21
328.696	47.332	-10.05	-32.96	65.44	57.41	688.8750866	120	2.51	17.40	0.053	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7830.01	3080.58	4749.43	1.19	1.78	399.30	-36	59.91	1776.16	18.26
329.696	47.476	-10.10	-33.13	65.61	57.57	690.8430866	120	2.51	17.40	0.053	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7850.87	3090.81	4760.06	1.19	1.78	401.07	-36	60.07	1784.06	18.31
330.696	47.620	-10.15	-33.29	65.77	57.73	692.8110866	120	2.51	17.40	0.053	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7871.73	3101.04	4770.69	1.19	1.78	402.85	-36	60.23	1791.96	18.36
331.696	47.764	-10.20	-33.46	65.94	57.90	694.7790866	120	2.51	17.40	0.052	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7892.59	3111.28	4781.32	1.20	1.78	404.62	-36	60.40	1799.86	18.41
332.696	47.908	-10.25	-33.62	66.10	58.06	696.7470866	120	2.51	17.40	0.052	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7913.45	3121.51	4791.94	1.20	1.78	406.40	-36	60.56	1807.75	18.46
333.696	48.052	-10.30	-33.78	66.26	58.23	698.7150866	120	2.51	17.40	0.052	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7934.31	3131.74	4802.57	1.20	1.78	408.17	-36	60.73	1815.65	18.51
334.696	48.196	-10.35	-33.95	66.43	58.39	700.6830866	120	2.51	17.40	0.052	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7955.17	3141.98	4813.20	1.20	1.78	409.95	-36	60.89	1823.55	18.56
335.696	48.340	-10.40	-34.11	66.59	58.55	702.6510866	120	2.51	17.40	0.052	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7976.04	3152.21	4823.82	1.21	1.78	411.73	-37	61.06	1831.45	18.61
336.696	48.484	-10.45	-34.28	66.76	58.72	704.6190866	120	2.51	17.40	0.052	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7996.90	3162.44	4834.45	1.21	1.78	413.50	-37	61.22	1839.34	18.66
337.696	48.628	-10.50	-34.44	66.92	58.88	706.5870866	120	2.51	17.40	0.052	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8017.76	3172.68	4845.08	1.21	1.78	415.28	-37	61.38	1847.24	18.71
338.696	48.772	-10.55	-34.60	67.08	59.05	708.5550866	120	2.51	17.40	0.051	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8038.62	3182.91	4855.71	1.21	1.78	417.05	-37	61.55	1855.14	18.76
339.696	48.916	-10.60	-34.77	67.25	59.21	710.5230866	120	2.51	17.40	0.051	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8059.48	3193.15	4866.33	1.22	1.78	418.83	-37	61.71	1863.04	18.81
340.696	49.060	-10.65	-34.93	67.41	59.37	712.4910866	120	2.51	17.40	0.051	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8080.34	3203.38	4876.96	1.22	1.78	420.60	-37	61.87	1870.93	18.86
341.696	49.204	-10.70	-35.10	67.58	59.54	714.4590866	120	2.51	17.40	0.051	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8101.20	3213.61	4887.59	1.22	1.78	422.38	-38	62.04	1878.83	18.91
342.696	49.348	-10.75	-35.26	67.74	59.70	716.4270866	120	2.51	17.40	0.051	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8122.06	3223.85	4898.22	1.22	1.78	424.16	-38	62.20	1886.73	18.96
343.696	49.492	-10.80	-35.42	67.90	59.87	718.3950866	120	2.51	17.40	0.051	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8142.92	3234.08	4908.84	1.23	1.78	425.93	-38	62.37	1894.63	19.01
344.696	49.636	-10.85	-35.59	68.07	60.03	720.3630866	120	2.51	17.40	0.050	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8163.78	3244.31	4919.47	1.23	1.78	427.70	-38	62.53	1902.53	19.06
345.696	49.780	-10.90	-35.75	68.23	60.19	722.3310866	120	2.51	17.40	0.050	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8184.64	3254.55	4930.10	1.23	1.78	429.48	-38	62.69	1910.42	19.11
346.696	49.924	-10.95	-35.92	68.40	60.36	724.2990866	120	2.51	17.40	0.050	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8205.50	3264.78	4940.72	1.24	1.78	431.26	-38	62.86	1918.32	19.16
347.696	50.068	-11.00	-36.08	68.56	60.52	726.2670866	120	2.51	17.40	0.050	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8226.37	3275.01	4951.35	1.24	1.78	433.03	-39	63.02	1926.22	19.21
348.696	50.212	-11.05	-36.24	68.72	60.69	728.2350866	120	2.51	17.40	0.050	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8247.23	3285.25	4961.98	1.24	1.78	434.81	-39	63.19	1934.12	19.26
349.696	50.356	-11.10	-36.41	68.89	60.85	730.2030866	120	2.51	17.40	0.050	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8268.09	3295.48	4972.61	1.24	1.78	436.58	-39	63.35	1942.01	19.31
350.696	50.500	-11.15	-36.57	69.05	61.01	732.1710866	120	2.51	17.40	0.050	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8288.95	3305.71	4983.23	1.25	1.78	438.36	-39	63.51	1949.91	19.36
351.696	50.644	-11.20	-36.74	69.22	61.18	734.1390866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	18.00	114.48	8307.72	3315.95	4991.77	1.87	2.41	440.77	-39	63.68	1960.63	19.41
352.696	50.788	-11.25	-36.90	69.38	61.34	736.1070866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	18.00	114.48	8326.50	3326.18	5000.32	1.87	2.40	443.17	-39	63.84	1971.32	19.46
353.696	50.932	-11.30	-37.06	69.54	61.51	738.0750866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	18.00	114.48	8345.27	3336.42	5008.86	1.86	2.40	445.57	-40	64.01	1982.00	19.51
354.696	51.076	-11.35	-37.23	69.71	61.67	740.0430866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	18.00	114.48	8364.05	3346.65	5017.40	1.86	2.40	447.97	-40	64.17	1992.68	19.56
355.696	51.220	-11.40	-37.39	69.87	61.83	742.0110866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	18.00	114.48	8382.82	3356.88	5025.94	1.86	2.39	450.36	-40	64.33	2003.29	19.61
356.696	51.364	-11.45	-37.56	70.04	62.00	743.9790866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	18.00	114.48	8401.60	3367.12	5034.48	1.85	2.39	452.74	-40	64.50	2013.91	19.66
357.696	51.508	-11.50	-37.72	70.20	62.16	745.9470866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	18.00	114.48	8420.37	3377.35	5043.02	1.85	2.38	455.13	-40	64.66	2024.50	19.71
358.696	51.652	-11.55	-37.88	70.36	62.33	747.9150866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	18.00	114.48	8439.15	3387.58	5051.56	1.85	2.38	457.50	-40	64.83	2035.08	19.76
359.696	51.796	-11.60	-38.05	70.53	62.49	749.8830866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	18.00	114.48	8457.92	3397.82	5060.10	1.84	2.37	459.88	-41	64.99	2045.63	19.81
360.696	51.940	-11.65	-38.21	70.69	62.65	751.8510866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	18.00	114.48	8476.69	3408.05	5068.64	1.84	2.37	462.24	-41	65.16	2056.17	19.86
361.696	52.084	-11.70	-38.38	70.86	62.82	753.8190866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	18.00	114.48	8495.47	3418.28	5077.19	1.84	2.36	464.61	-41	65.32	2066.68	19.91
362.696	52.228	-11.75	-38.54	71.02	62.98	755.7870866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	18.00	114.48	8514.24	3428.52	5085.73	1.83	2.36	466.97	-41	65.48	2077.17	19.96
363.696	52.372	-11.80	-38.70	71.18	63.15	757.7550866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	18.00	114.48	8533.02	3438.75	5094.27	1.83	2.36	469.32	-41	65.65	2087.66	20.01
364.696	52.516	-11.85	-38.87	71.35	63.31	759.7230866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	18.00	114.48	8551.79	3448.99	5102.81	1.82	2.35	471.67	-41	65.81	2098.10	20.06
365.696	52.660	-11.90	-39.03	71.51	63.47	761.6910866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	18.00	114.48	8570.57	3459.22	5111.35	1.82	2.34	474.02	-42	65.97	2108.53	20.11
366.696	52.804	-11.95	-39.20	71.68	63.64	763.6590866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	18.00	114.48	8589.34	3469.45	5119.89	1.82	2.34	476.36	-42	66.14	2118.94	20.16
367.696	52.948	-12.00	-39.36	71.84	63.80	765.6270866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	18.00	114.48	8608.12	3479.69	5128.43	1.81	2.34	478.69	-42	66.30	2129.33	20.21
368.696	53.092	-12.05	-39.52	72.00	63.97	767.5950866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	18.00	114.48	8626.89	3489.92	5136.97	1.81	2.33	481.02	-42	66.47	2139.69	20.26
369.696	53.236	-12.10	-39.69	72.17	64.13	769.5630866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	18.00	114.48	8645.67	3500.15	5145.51	1.81	2.33	483.35	-42	66.63	2150.04	20.31
370.696	53.380	-12.15	-39.85	72.33	64.29	771.5310866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	18.00	114.48	8664.44	3510.39	5154.06	1.80	2.32	485.67	-42	66.79	2160.36	20.36
371.696	53.524	-12.20	-40.02	72.50	64.46	773.4990866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	18.00	114.48	8683.22	3520.62	5162.60	1.80	2.32	487.99	-43	66.96	2170.67	20.41
372.696	53.668	-12.25	-40.18	72.66	64.62	775.4670866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	18.00	114.48	8701.99	3530.85	5171.14	1.79	2.31	490.30	-43	67.12	2180.95	20.46
373.696	53.812	-12.30	-40.34	72.82	64.79	777.4350866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	18.00	114.48	8720.77	3541.09	5179.68	1.79	2.31	492.60	-43	67.29	2191.21	20.51
374.696	53.956	-12.35	-40.51	72.99	64.95	779.4030866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	18.00	114.48	8739.54	3551.32	5188.22	1.79	2.30	494.90	-43	67.45	2201.45	20.56
375.696	54.100	-12.40	-40.67	73.15	65.11	781.3710866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	18.00	114.48	8758.32	3561.55	5196.76	1.78	2.30	497.20	-43	67.61	2211.68	20.61
376.696	54.244	-12.45	-40.84	73.32	65.28	783.3390866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	18.00	114.48	8777.09	3571.79	5205.30	1.78	2.29	499.49	-43	67.78	2221.88	20.66
377.696	54.388	-12.50	-41.00	73.48	65.44	785.3070866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	18.00	114.48	8795.87	3582.02	5213.84	1.78	2.29	501.78	-44	67.94	2232.03	20.71
378.696	54.532	-12.55	-41.16	73.64	65.61	787.2750866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	18.00	114.48	8814.64	3592.26	5222.38	1.77	2.28	504.06	-44	68.11	2242.18	20.76
379.696	54.676	-12.60	-41.33	73.81	65.77	789.2430866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	18.00	114.48	8833.41	3602.49	5230.93	1.77	2.28	506.34	-44	68.27	2252.31	20.81
380.696	54.820	-12.65	-41.49	73.97	65.93	791.2110866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	18.00	114.48	8852.19	3612.72	5239.47	1.76	2.27	508.61	-44	68.43	2262.42	20.86
381.696	54.964	-12.70	-41.66	74.14	66.10	793.1790866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	18.00	114.48	8870.96	3622.96	5248.01	1.76	2.27	510.88	-44	68.60	2272.50	20.91
382.696	55.108	-12.75	-41.82	74.30	66.26	795.1470866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.33	0.33	18.00	114.48	8889.74	3633.19	5256.55	1.76	2.26	513.14	-44	68.76	2282.56	20.96
383.696	55.252	-12.80	-41.98	74.46	66.43	797.1150866		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.33	0.33	18.00	114.48	8908.51	3643.42	5265.09	1.75	2.26	515.40	-44	68.93	2292.60	21.01
																								FOS	1.21					

Axial capacities for 36 inch diameter drilled piers at Loverdige OC | Bent 5_BOF = 7.15m | Note: Required pile length: Add 1D to length (Column E)

	m	ft
Ground surface elevation/Top of soil elevation (feet)	0.8	32.48
Pile capacities computed from (feet)	7.15	23.48
GWT elevation (feet)	6	18.40

lpha method for undrained and beta method for drained

Diameter 2.500 feet Load 385 kips
30.000 inches

Patm (psi)	Patm (ksf)	Elevation (m)	Elevation (ft)	Depth (ft)	Depth (ft)	Depth (in)	Su (Kpa)	Su (ksf)	Su (psi)	Su/pa	Coh (0) / Non Coh (1)	α	α (2)	f_{max} (ksf)	f_{max} (psi)	N60	β	β (2)	Unit Wt. (kN/m3)	Unit Wt. (pcf)	σ (psf)	u (psf)	σ' (psf)	f_{max} (ksf)	ΔR_s (kips)	R_s (kips)	Pile Tip Elevation (ft)	Pile Length (ft)	R_s (kN)	Pile Length (m)
												Cohesive Soil							Cohesionless Soil										For Plot	
14.696	2.110	0.90	32.47	0.01	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	0.95	0.00	0.95	0.00	0.00	0.00	30	2.50	0.00	0.78
14.696	2.110	0.85	32.31	0.17	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	10.00	114.48	10.73	0.00	18.73	0.00	0.00	0.00	30	2.50	0.00	0.78
14.696	2.110	0.80	32.14	0.34	0.00	0	50	1.04	7.25	0.493	0	0.56	0.00	0.000	0.00		0.00	0.25	10.00	114.48	38.50	0.00	38.50	0.01	0.00	0.00	30	2.50	0.00	0.78
14.699	2.118	8.75	31.98	0.50	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	67.28	0.00	57.28	0.01	0.00	0.00	28	2.50	0.00	0.78
14.696	2.118	0.70	31.82	0.66	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	10.00	114.48	76.06	0.00	78.05	0.02	0.00	0.00	29	2.50	0.00	0.70
14.696	2.110	8.65	31.65	0.83	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	16.00	114.48	04.83	0.00	84.83	0.02	0.00	0.00	29	2.50	0.00	0.78
14.696	2.110	0.60	31.40	0.99	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	113.60	0.00	113.60	0.03	0.00	0.00	29	2.50	0.00	0.78
14.696	2.110	0.55	31.32	1.10	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	132.37	0.00	132.37	0.03	0.00	0.00	29	2.50	0.00	0.78
14.696	2.110	9.50	31.10	1.32	0.00	0	50	1.04	7.25	0.493	0	0.56	0.00	0.000	0.00		0.00	0.25	10.00	114.48	151.10	0.00	151.15	0.04	0.00	0.00	29	2.50	0.00	0.78
14.696	2.118	0.45	31.00	1.48	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	10.00	114.48	169.82	0.00	169.92	0.04	0.00	0.00	28	2.50	0.00	0.78
14.696	2.118	8.40	30.63	1.65	0.00	0	50	1.04	7.25	0.493	0	0.56	0.00	0.000	0.06		0.00	0.25	18.00	114.48	188.70	0.00	188.70	0.05	0.00	0.00	28	2.50	0.00	0.70
14.696	2.110	9.35	30.87	1.61	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	10.00	114.48	207.47	0.00	207.47	0.05	0.00	0.00	28	2.50	0.00	0.78
14.696	2.118	0.30	30.50	1.98	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	226.25	0.00	226.25	0.06	0.00	0.00	28	2.50	0.00	0.78
14.696	2.110	9.25	30.34	2.14	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	246.02	0.00	245.02	0.06	0.00	0.00	28	2.50	0.00	0.78
14.696	2.110	0.20	30.18	2.30	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	263.80	0.00	263.80	0.07	0.00	0.00	28	2.50	0.00	0.78
14.696	2.110	0.15	30.01	2.47	0.00	0	50	1.04	7.25	0.493	0	0.56	0.00	0.000	0.06		0.00	0.25	10.00	114.48	282.07	0.00	282.67	0.07	0.00	0.00	28	2.50	0.00	0.78
14.696	2.110	9.10	29.55	2.63	0.00	0	50	1.04	7.25	0.493	0	0.65	0.00	0.000	0.00		0.00	0.25	18.00	114.48	301.36	0.00	301.35	0.06	0.00	0.00	27	2.50	0.00	0.78
14.696	2.110	9.05	29.66	2.80	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.06		0.00	0.25	18.00	114.48	320.12	0.00	320.12	0.06	0.00	0.00	27	2.50	0.00	0.78
14.696	2.110	0.00	29.52	2.96	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	338.90	0.00	338.90	0.08	0.00	0.00	27	2.50	0.00	0.70
14.696	2.110	8.95	29.36	3.12	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	10.80	114.48	357.67	0.00	357.07	0.09	0.00	0.00	27	2.50	0.00	0.78
14.696	2.110	8.90	29.10	3.29	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	376.46	0.00	378.46	0.09	0.00	0.00	27	2.50	0.00	0.78
14.696	2.110	0.85	29.03	3.40	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	395.22	0.00	395.22	0.10	0.00	0.00	27	2.50	0.00	0.78
14.696	2.110	8.80	28.86	3.62	0.00	0	50	1.04	7.25	0.493	8	0.56	0.00	0.000	0.00		0.00	0.25	18.00	114.48	414.00	0.00	414.00	0.10	0.00	0.00	26	2.50	0.00	0.78
14.696	2.118	0.75	28.70	3.78	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	10.00	114.48	432.77	0.00	432.77	0.11	0.00	0.00	26	2.50	0.00	0.78
14.696	2.110	8.70	28.54	3.94	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	10.00	114.48	451.55	0.00	451.55	0.11	0.00	0.00	26	2.50	0.00	0.78
14.696	2.118	0.65	28.37	4.11	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.900	0.00		0.00	0.25	18.00	114.48	470.32	0.00	470.32	0.12	0.00	0.00	28	2.50	0.00	0.78
14.696	2.110	6.80	28.21	4.27	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	489.09	0.00	488.00	0.12	0.00	0.00	28	2.50	0.00	0.78
14.696	2.110	8.56	28.04	4.44	0.00	0	50	1.04	7.25	0.493	0	0.56	0.00	0.900	0.00		0.00	0.25	18.00	114.48	507.87	0.00	507.87	0.15	0.00	0.00	26	2.50	0.00	0.78
14.696	2.110	8.50	27.86	4.60	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	526.64	0.00	526.64	0.13	0.00	9.00	25	2.50	0.00	0.78
14.696	2.110	0.45	27.72	4.70	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.40	640.42	0.00	545.42	0.14	0.00	0.00	25	2.50	0.00	0.78
14.696	2.110	8.40	27.55	4.93	0.00	0	50	1.04	7.25	0.493	0	0.55	0.00	0.000	0.00		0.00	0.25	18.00	114.48	584.18	0.00	564.10	0.14	0.00	0.00	28	2.50	0.00	0.70
14.696	2.118	0.35	27.39	6.09	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	502.97	0.00	582.97	0.16	0.00	0.00	25	2.50	0.00	0.78
14.696	2.110	8.30	27.22	6.26	0.00	0	50	1.04	7.26	0.493	0	0.55	0.56	0.574	3.99		0.00	0.25	10.00	114.48	501.74	0.00	601.74	0.16	0.00	0.00	25	2.50	0.00	0.78
14.696	2.110	8.25	27.08	5.42	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.674	3.99		0.00	0.25	18.00	114.48	620.52	0.00	620.52	0.10	0.00	0.00	25	2.50	0.00	0.76
14.696	2.110	8.20	26.90	5.58	0.00	0	50	1.04	7.25	0.493	0	0.55	0.56	0.574	3.99		0.00	0.25	18.00	114.48	639.29	0.00	639.29	0.10	0.00	0.00	24	2.50	0.00	0.78
14.696	2.118	8.10	26.73	3.76	0.00	0	50	1.04	7.26	0.493	0	0.56	0.55	0.574	3.99		0.00	0.25	18.00	114.48	658.07	0.00	668.07	0.10	0.00	0.00	24	2.50	0.00	0.76
14.696	2.110	8.10	26.57	3.01	0.00	0	50	1.04	7.25	0.493	0	0.56	0.55	0.574	3.99		0.00	0.25	18.00	114.48	670.84	0.00	076.84	0.17	0.00	0.00	24	2.50	0.00	0.78
14.696	2.110	0.05	26.40	8.08	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.674	3.98		0.00	0.25	18.00	114.48	695.82	0.00	695.82	0.17	0.00	0.00	24	2.50	0.00	0.78
14.696	2.110	0.00	26.24	8.24	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.674	3.99		8.00	0.25	10.00	114.48	714.39	0.00	714.39	0.18	0.00	0.00	24	2.50	0.00	0.76
14.696	2.110	7.95	26.08	0.40	0.00	0	50	1.04	7.25	0.493	0	0.56	0.56	0.574	3.89		0.00	0.25	18.00	114.48	733.17	0.00	733.17	0.10	0.00	0.00	24	2.50	0.00	0.78
14.696	2.118	7.80	25.91	0.57	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	761.94	0.00	751.94	0.10	0.00	0.00	23	2.50	0.00	0.78
14.696	2.110	7.85	25.75	8.73	0.00	0	50	1.04	7.25	0.493	0	0.55	0.56	0.574	3.99		0.00	0.25	18.00	114.48	770.72	0.00	770.72	0.10	0.00	0.00	23	2.50	0.00	0.76
14.696	2.110	7.90	25.66	0.90	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.674	3.99		0.00	0.25	18.00	114.48	789.49	0.00	789.49	0.20	0.00	0.00	23	2.50	8.00	0.70
14.696	2.110	7.75	25.42	7.06	0.00	0	50	1.04	7.25	0.493	0	0.56	0.56	0.674	3.99		8.00	0.25	18.00	114.48	808.26	0.00	808.25	0.20	0.00	0.00	23	2.50	0.00	0.78
14.696	2.110	7.70	26.25	7.22	0.00	0	50	1.04	7.25	0.493	0	0.56	0.55	0.574	3.99		0.00	0.25	18.00	114.48	827.04	0.00	827.04	0.21	0.00	0.00	23	2.50	0.00	0.78
14.696	2.110	7.65	25.09	7.39	0.00	0	50	1.04	7.25	0.493	0	0.56	0.55	0.674	3.99		0.00	-0.25	18.00	114.48	646.81	0.00	845.61	0.21	0.00	0.00	23	2.50	0.00	0.76
14.696	2.110	7.60	24.93	7.56	0.00	0	50	1.04	7.25	0.493	0	0.55	0.56	0.574	3.99		8.00	0.25	16.00	114.48	864.69	0.00	864.69	0.22	0.00	0.00	22	2.50	0.00	0.76
14.696	2.110	7.55	24.70	7.72	0.00	0	50	1.04	7.25	0.493	0	0.56	0.55	0.674	3.99		0.00	0.25	18.00	114.48	883.36	0.00	883.36	0.22	0.00	0.00	22	2.50	0.00	0.78
14.696	2.110	7.50	24.50	7.88	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.674	3.99		0.00	0.25	18.00	114.48	902.14	0.00	902.14	0.23	0.00	0.90	22	2.50	0.00	0.78
14.696	2.110	7.45	24.44	0.04	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	10.00	114.48	920.91	0.00	920.91	0.23	0.00	0.00	22	2.50	0.00	0.76
14.696	2.110	7.40	24.27	0.21	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	939.69	0.00	939.69	0.23	0.00	0.00	22	2.50	0.00	0.78
14.696	2.110	7.35	24.11	0.37	0.00	0	50	1.04	7.25	0.493	0	0.55	0.55	0.674	3.99		0.00	0.25	18.00	114.48	958.46	0.00	958.46	0.24	0.00	0.00	22	2.50	0.00	0.76
14.696	2.110	7.30	23.04	0.54	0.00	0	50	1.04	7.25	0.493	0	0.56	0.55	0.574	3.89		0.00	0.25	18.00	114.40	977.24	0.00	977.24	0.24	0.00	0.00	21	2.50	9.00	0.70
14.696	2.110	7.25	23.70	8.70	0.00	0	50	1.04	7.25	0.493	0	0.55	0.65	0.574	3.99		0.00	0.25	10.00	114.48	996.01	0.00	996.01	0.25	0.00	0.00	21	2.50	0.00	0.78
14.696	2.110	7.20	23.62	8.86	0.00	0	50	1.04	7.25	0.493	0	0.55	0.65	0.674	3.99		0.00	0.25	18.00	114.48	1014.79	0.00	1014.79	0.25	0.00	0.00	21	2.50	0.00	0.76
14.699	2.118	7.15	23.48	0.03	0.01	0.072062992	50	1.04	7.25	0.493	0	0.55	0.55	0.674	3.99		0.00	0.25	10.00	114.48	1033.56	0.00	1033.56	0.25	0.03	0.03	21	2.51	0.12	0.70
14.696	2.118	7.10	23.29	0.18	0.17	2.040062992		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.09	1.00	10.00	114.48	1052.34	0.00	1052.34	1.16	1.48	1.50	21	2.07	0.69	0.81
14.696	2.110	7.05	23.12	9.36	0.33	4.006062992		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.09	1.09	10.00	114.48	1071.11	0.00	1071.11	1.10	1.50	3.00	21	2.83	13.36	0.86
14.696	2.118	7.00	22.96	0.52	0.50	5.076062992		0.00	0.00	0.000	1	0.55	0.56	0.000	0.00	20	1.08	1.08	18.00	114.48	1089.89	0.00	1089.89	1.18	1.62	4.52	20	3.00	20.12	0.91
14.696	2.118	0.95	22.80	0.68	0.68	7.944062992		0.00	0.00	0.000	1	0.55	0.56	0.000	0.00	20	1.06	1.08	10.00	114.48	1108.66	0.00	1108.66	1.20	1.54	0.06	20	3.10	26.07	0.96
14.696	2.118	8.90	22.53	0.85	0.63	0.012062992		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.08	1.08	18.00	114.48	1127.44	0.00	1127.44	1.21	1.56	7.63	20	3.33	33.92	1.01
14.696	2.110	8.85	22.47	10.01	0.99	11.88006299		8.00	8.00	0.000	1	0.56	0.55	0.000	0.00	20	1.87	1.07	10.00	114.48	1148.21	0.00	1148.21	1.23	1.58	8.21	20	3.49	40.96	1.06
14.696	2.116	8.80	22.30	10.10	1.15	13.84006299		0.00	0.00	0.000	1	0.55	0.56	0.000	0.00	20	1.07	1.07	18.00	114.48	1164.98	0.00	1164.96	1.24	1.80	10.81	20	3.65	48.09	1.11
14.696	2.118	0.75	22.14	10.34	1.32	10.61606299		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.07	1.07	18.00	114.48	1163.76	0.00	1183.76	1.20	1.82	12.44	20	3.82	66.32	1.10
14.696	2.118	8.70	21.98	10.50	1.48	17.78406298		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.06	1.06	18.00	114.48	1202.53	0.00	1202.53	1.28	1.64	14.06	10	3.98	62.63	1.21
14.696	2.110	6.65	21.61	10.67	1.65	10.75206299		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.06	1.08	10.00	114.48	1221.31	0.00	1221.31	1.29	1.86	15.74	10	4.15	70.04	1.26
14.696	2.110	6.60	21.65	10.83	1.81	21.72006299		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.05	1.05	16.00	114.48	1240.08	0.00	1240.08	1.31	1.68	17.43	19	4.31	77.53	1.31
14.696	2.110	0.55	21.48	11.00	1.97	23.68806299		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	20	1.05	1.06	10.00	114.48	1258.86	0.00	1256.86	1.32	1.70	10.13	19	4.47	65.11	1.36
14.696	2.110	8.50	21.32	11.18	2.14	25.65606299		0.00	0.00	0.900	1	8.55	0.56	0.000	0.00	20	1.06	1.06	10.00	114.48	1277.63	0.00	1277.63	1.34	1.72	20.86	10	4.84	92.79	1.41
14.696	2.118	0.45	21.10	11.32	2.30	27.62406299		0.00	0.00	0.000	1	0.56	0.55	0.000	0.00	20	1.04	1.04	18.00	114.48	1296.41	0.00	.1296.41	1.35	1.74	22.60	10	4.80	100.56	1.46
14.696	2.110	0.40	20.99	11.40	2.47	29.59206299		0.00	0.00	0.000	1	0.56	0.56	0.000	0.00	20	1.04	1.04	18.00	114.48	1315.10	0.00	1315.10	1.37	1.76	24.37	10	4.97	108.40	1.51
14.696	2.110	0.35	20.63	11.65	2.63	31.58006299		0.00	0.00	0.000	1	0.55	0.58	0.000	0.00	20	1.04	1.04	18.00	114.48	1333.95	0.00	1333.96	1.39	1.76	26.16	18	8.13	118.33	1.56
14.696	2.116	0.30	20.66	11.82	2.70	33.52806299	50	1.04	7.25	0.493	0	0.55	0.55	0.674	3.99		0.00	0.25	16.00	114.48	1352.73	0.00	1352.73	0.34	0.74	28.69	10	5.29	110.62	1.61
14.696	2.116	0.28	20.50	11.98	2.86	35.49806299	50	1.04	7.25	0.493	0	0.56	0.55	0.574	3.98		0.00	0.25	18.00	114.48	1371.61	0.00	1371.51	0.34	0.74	27.63	18	8.48	122.91	1.66
14.696	2.116	8.20	20.34	12.14	3.12	37.46406299	50	1.04	7.25	0.493	0	0.55	0.55	0.074	3.99		0.08	0.25	18.00	114.48	1390.28	0.00	1390.28	0.35	0.74	28.37	18	8.62	126.20	1.71
14.696	2.110	0.16	20.17	12.31	3.29	39.43206299	50	1.04	7.25	0.493	0	0.55	0.65	0.674	3.99		0.00	0.25	18.00	114.46	1409.06	0.00	1409.06	0.35	0.74	29.11	16	6.79	129.49	1.76
14.696	2.110	0.10	20.01	12.47	3.45	41.40006299	50	1.04	7.25	0.483	0	0.55	0.55	0.674	3.99		0.00	0.25	18.00	114.48	1427.63	0.00	1427.63	0.36	0.74	29.85	18	8.95	132.79	1.81
14.696	2.116	0.05	19.64	12.64	3.01	43.36806299	50	1.04	7.25	0.493	0	0.55	0.55	0.674	3.99		0.00	0.25	18.00	114.48	1449.61	0.00	1446.81	0.38	0.74	30.59	17	0.11	136.06	1.86
14.696	2.118	0.00	19.68	12.60	3.78	45.33606299	50	1.04	7.25	0.493	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1465.36	0.00	1466.38	0.37	0.74	31.33	17	0.25	139.37	1.91
14.696	2.118	6.95	19.52	12.96	3.94	47.30406299	50	1.04	7.25	0.493	0	0.56	0.55	0.674	3.99		0.00	0.28	18.00	114.48	1484.13	0.00	1484.15	0.37	0.74	32.07	17	8.44	142.68	1.96
14.696	2.118	8.90	18.35	13.13	4.11	49.27206299	50	1.04	7.25	0.493	0	0.55	0.56	0.574	3.99		0.00	0.25	18.00	114.48	1502.93	0.00	1502.93	0.38	0.74	32.81	17	0.01	145.95	2.01
14.696	2.118	6.85	18.10	13.29	4.27	61.24006299	50	1.04	7.25	0.493	0	0.55	0.56	0.574	3.99		0.00	0.25	18.00	114.45	1621.70	0.00	1521.70	0.38	0.74	33.56	17	0.77	149.24	2.06
14.696	2.110	3.80	18.02	13.46	4.43	53.20806299	50	1.04	7.25	0.493	0	0.55	0.65	0.374	3.99		0.00	0.25	18.00	114.48	1640.48	0.00	1540.48	0.39	0.74	34.29	17	0.93	162.53	2.11
14.696	2.110	5.70	18.86	13.62	4.60	56.17606299	50	1.04	7.25	0.493	0	0.55	0.55	0.074	3.99		0.00	0.25	18.00	114.48	1659.25	0.00	1659.25	0.39	0.74	35.03	18	7.10	156.82	2.10
14.696	2.118	5.70	18.70	13.78	4.70	57.14406299	50	1.04	7.20	0.493	0	0.55	0.66	0.574	3.99		0.00	0.25	10.00	114.48	1678.03	0.00	1378.03	0.39	0.74	36.77	16	7.25	159.11	2.21
14.696	2.110	5.85	18.53	13.95	4.93	59.11206299	50	1.04	7.25	0.493	0	0.56	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1596.90	0.00	1598.90	0.40	0.74	36.51	10	7.43	182.40	2.26
15.696	2.260	3.60	18.37	14.11	5.09	81.08006299	50	1.04	7.25	0.462	0	0.65	0.65	0.574	3.99		0.00	0.25	18.00	114.48	1813.58	0.00	1615.58	0.40	0.74	37.25	16	7.59	165.69	2.31
16.696	2.404	5.55	10.20	14.28	0.26	83.04806299	50	1.04	7.25	0.434	0	0.55	0.56	0.574	3.99		0.00	0.25	10.00	114.48	1634.36	0.00	1634.35	0.41	0.74	37.99	10	7.76	168.96	2.36
17.696	2.548	6.50	18.04	14.44	5.42	65.01606299	50	1.04	7.25	0.410	0	0.55	0.56	0.574	3.99		0.00	0.25	18.00	114.48	1653.13	0.00	1663.13	0.41	0.74	38.73	10	7.92	172.27	2.41
18.696	2.692	5.46	17.88	14.60	0.58	66.98406299	30	1.04	7.25	0.388	0	0.56	0.56	8.574	3.99		0.00	0.25	18.00	114.48	1671.90	0.00	1671.90	0.42	0.74	39.47	10	8.06	175.56	2.46
10.696	2.836	3.40	17.71	14.77	5.75	66.95206299	50	1.04	7.25	0.368	0	0.56	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1690.56	0.00	1690.66	0.42	0.74	40.21	10	0.25	176.86	2.51
20.696	2.980	5.35	17.55	14.93	0.01	70.92006299	50	1.04	7.26	0.350	0	0.56	0.65	0.574	3.99		0.00	0.25	18.00	114.48	1709.45	0.00	1709.40	0.43	0.74	40.95	10	8.41	182.10	2.56
21.696	3.124	0.30	17.38	16.10	6.07	72.88806299	50	1.04	7.25	8.334	0	0.56	0.56	0.574	3.99		0.00	0.25	18.00	114.48	1728.23	0.00	1728.23	0.43	0.74	41.99	15	8.57	186.44	2.61
22.696	3.268	5.25	17.22	15.28	6.24	74.85606299	50	1.04	7.25	0.320	0	0.56	0.55	0.574	3.99		0.00	0.25	10.80	114.48	1747.00	0.00	1747.00	0.44	0.74	42.43	16	6.74	186.73	2.66
23.696	3.412	0.20	17.06	10.42	0.40	70.62406299	50	1.04	7.25	0.306	0	0.56	0.56	0.574	3.99		0.00	0.25	18.00	114.48	1765.70	0.00	1766.76	0.44	0.74	43.17	10	8.90	192.02	2.71
24.696	3.556	8.16	18.89	16.59	8.57	78.79206299	50	1.04	7.25	0.294	0	0.55	0.56	0.574	3.99		0.00	0.25	10.00	114.48	1784.56	0.00	1784.55	0.45	0.74	43.91	14	0.07	196.31	2.76
25.696	3.700	3.10	18.73	13.73	0.73	80.76006299	50	1.04	7.25	0.282	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1803.33	0.00	1803.33	0.43	0.74	44.65	14	0.23	195.60	2.81
26.696	3.844	6.05	18.56	16.92	8.99	82.72806299	50	1.04	7.25	0.272	0	0.56	0.56	0.574	3.99		0.00	0.25	18.00	114.40	1822.10	0.00	1822.10	0.48	0.74	45.39	14	9.39	201.89	2.86
27.696	3.988	5.00	18.40	18.08	7.08	84.69606299	50	1.04	7.25	0.262	0	0.55	0.56	0.674	3.99		0.00	0.25	10.00	114.48	1840.87	0.28	1840.61	0.48	0.74	46.13	14	9.56	205.18	2.91
28.696	4.132	4.95	10.24	10.24	7.22	86.66406299	50	1.04	7.25	0.253	0	0.56	0.55	0.574	3.98		0.00	0.25	18.00	114.48	1859.65	10.50	1849.15	0.48	0.74	46.87	14	9.72	208.47	2.96
29.696	4.276	4.90	16.07	18.41	7.39	88.63206299	50	1.04	7.25	0.244	0	0.55	0.56	0.574	3.99		0.00	0.25	10.00	114.48	1878.42	20.73	1867.69	0.48	0.74	47.61	14	9.89	211.76	3.01
30.696	4.420	4.85	13.91	16.57	7.56	80.60006299	50	1.04	7.25	0.236	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1897.20	30.86	1866.24	0.47	0.74	48.35	13	10.06	215.05	3.06
31.696	4.564	4.80	13.74	16.74	7.71	82.56806299	50	1.04	7.25	0.229	0	0.55	0.55	0.674	3.99		0.00	0.25	18.00	114.48	1015.97	41.20	1674.76	0.47	0.74	49.09	13	10.21	218.34	3.11
32.696	4.708	4.75	15.58	18.90	7.88	94.53606299	50	1.04	7.25	0.222	0	0.56	0.55	0.674	3.99		0.00	0.25	18.00	114.48	1934.75	51.43	1883.32	0.47	0.74	49.83	13	10.38	221.63	3.16
33.696	4.852	4.70	13.42	17.06	8.04	96.50406299	50	1.04	7.25	0.215	0	0.55	0.65	0.674	3.99		0.00	0.25	10.00	114.48	1953.52	01.66	1891.86	0.47	0.74	50.57	13	10.54	224.92	3.21
34.696	4.996	4.65	13.25	17.23	8.21	98.47206299	50	1.04	7.25	0.209	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	1072.30	71.90	1900.40	0.48	0.74	01.30	13	10.71	228.22	3.26
35.696	0.140	4.60	13.09	17.39	8.37	100.440063	50	1.04	7.25	0.203	0	0.55	0.56	0.574	3.99		0.00	0.25	16.00	114.48	1991.07	82.13	1908.94	0.48	0.74	52.04	13	10.87	231.61	3.31
36.696	5.284	4.55	14.92	17.56	8.53	102.408063	50	1.04	7.25	0.198	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2009.85	92.36	1917.48	0.48	0.74	62.78	12	11.03	234.80	3.36
37.696	8.428	4.50	14.76	17.72	0.70	104.378063	50	1.04	7.25	0.192	0	0.55	8.55	0.674	3.99		0.00	0.25	18.00	114.48	2028.62	102.80	1926.02	0.48	0.74	53.52	12	11.20	238.09	3.41
38.696	5.572	4.45	14.60	17.88	8.86	106.344063	50	1.04	7.25	0.187	0	0.55	0.55	0.574	3.99		0.00	0.26	18.00	114.48	2047.40	112.83	1934.56	0.48	0.74	64.26	12	11.36	241.38	3.46
39.696	0.710	4.40	14.43	18.05	8.03	108.312063	50	1.04	7.25	0.183	0	0.55	0.65	0.574	3.99		0.00	0.25	16.80	114.48	2086.17	123.07	1043.11	0.49	0.74	65.00	12	11.53	244.67	3.61
40.696	8.860	4.35	14.27	18.21	0.10	110.280063	50	1.04	7.25	0.176	0	0.66	0.56	0.574	3.99		0.00	0.25	10.00	114.48	2084.95	133.30	1951.86	0.49	0.74	66.74	12	11.69	247.96	6.56
41.696	6.004	4.30	14.10	16.38	0.35	112.248063	50	1.04	7.25	0.174	0	0.55	8.56	0.674	3.99		0.00	0.25	18.00	114.48	2103.72	143.53	1960.10	0.40	0.74	66.48	12	11.85	251.25	3.01
42.696	8.148	4.25	13.94	10.84	0.52	114.216063	50	1.04	7.25	0.170	0	0.56	0.65	0.874	3.99		0.00	0.25	18.00	114.48	2122.60	153.77	1968.73	0.40	0.74	07.22	11	12.02	254.84	3.66
43.696	6.292	4.20	13.78	16.70	3.66	116.184063	50	1.04	7.25	0.166	0	0.55	0.56	0.574	3.99		0.00	0.25	18.00	114.48	2141.27	164.00	1977.27	0.49	0.74	67.96	11	12.18	257.83	3.71
44.696	0.436	4.15	13.61	16.87	0.85	118.152063	50	1.04	7.25	0.162	0	0.55	0.55	0.074	3.99		0.00	0.25	16.00	114.48	2160.04	174.23	1985.61	0.50	0.74	58.70	11	12.35	261.12	3.76
45.696	6.580	4.10	13.45	10.03	10.01	120.120063	50	1.04	7.25	0.159	0	0.55	0.65	0.674	3.99		0.00	0.25	18.00	114.48	2178.82	184.47	1994.35	0.50	0.74	59.44	11	12.51	264.41	3.61
46.696	8.724	4.05	13.28	10.20	10.17	122.088063	50	1.04	7.25	0.155	0	0.56	0.55	0.674	3.99		0.00	0.25	18.00	114.48	2107.69	104.70	2002.89	0.50	0.74	60.10	11	12.67	267.70	3.86
47.696	0.868	4.00	13.12	10.36	10.34	124.056063	50	1.04	7.25	0.152	0	0.56	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2210.37	204.93	2011.43	0.50	0.74	50.92	11	12.64	270.99	3.91
48.696	7.012	3.95	12.96	10.62	10.50	126.024063	50	1.04	7.25	0.149	0	0.56	0.56	0.574	3.99		0.90	0.25	16.00	114.48	2235.14	218.17	2019.98	0.50	0.74	61.56	10	13.00	274.29	3.96
49.696	7.156	3.90	12.79	10.69	10.67	127.992063	50	1.04	7.25	0.146	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2253.92	225.40	2028.52	0.61	0.74	62.40	10	13.17	277.56	4.01
50.696	7.300	3.85	12.63	19.85	10.83	129.960063	50	1.04	7.25	0.143	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2272.69	235.63	2037.06	0.51	0.74	63.14	10	13.33	280.87	4.06
51.696	7.444	3.80	12.46	20.02	10.99	131.928063	50	1.04	7.25	0.140	0	0.56	0.56	0.574	3.99		0.00	0.25	10.00	114.48	2291.47	245.67	2045.60	0.31	0.74	63.88	10	13.49	284.10	4.11
52.696	7.588	3.75	12.30	20.18	11.10	133.896063	50	1.04	7.25	0.138	0	0.56	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2310.24	256.10	2054.14	0.61	0.74	64.62	10	13.66	287.45	4.10
53.696	7.732	3.70	12.14	20.34	11.32	135.864063	50	1.04	7.25	0.135	0	0.55	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2329.02	266.34	2062.68	0.52	0.74	65.36	10	13.82	290.74	4.21
54.696	7.670	3.65	11.97	20.51	11.40	137.832063	50	1.04	7.25	0.133	0	0.56	0.55	0.674	3.99		0.00	0.25	18.00	114.48	2347.79	276.57	2071.22	0.52	0.74	66.10	0	13.99	294.03	4.25
55.696	8.020	3.60	11.61	20.67	11.66	139.800063	50	1.04	7.25	0.130	0	0.55	0.56	0.574	3.99		0.00	0.25	18.00	114.48	2366.57	286.80	2079.78	0.52	0.74	66.84	0	14.16	297.32	4.31
56.696	6.164	3.55	11.64	20.84	11.81	141.768063	50	1.04	7.25	0.128	0	0.55	0.66	0.074	3.90		0.00	0.25	10.00	114.48	2385.34	297.04	2088.30	0.52	0.74	67.58	0	14.31	300.61	4.36
57.696	0.308	3.50	11.48	21.00	11.96	143.736063	50	1.04	7.26	0.128	0	0.66	0.66	0.674	3.99		0.00	0.25	10.00	114.48	2404.12	307.27	2096.65	0.52	0.74	68.32	0	14.48	303.90	4.41
58.696	0.452	3.45	11.32	21.18	12.14	145.704063	50	1.04	7.25	0.124	0	0.55	0.55	0.574	3.99		0.00	0.25	10.00	114.48	2422.69	317.50	2105.39	0.63	0.74	69.06	0	14.64	307.10	4.46
59.696	0.596	3.40	11.16	21.33	12.31	147.672063	60	1.04	7.25	0.121	0	0.55	0.65	0.574	3.99		0.00	0.25	16.00	114.48	2441.67	327.74	2113.93	0.53	0.74	69.80	0	14.81	310.46	4.51
50.696	8.740	3.35	10.99	21.49	12.47	149.640063	50	1.04	7.25	0.110	0	8.56	0.55	0.574	3.99		0.00	0.25	18.00	114.48	2460.44	337.97	2122.47	0.63	0.74	70.54	0	14.97	313.77	4.56
01.696	0.884	3.30	10.82	21.66	12.63	131.608063	50	1.04	7.26	0.110	0	0.56	0.56	0.674	3.99		0.00	0.25	18.00	114.48	2479.21	348.20	2131.01	0.53	0.74	71.25	0	16.13	317.06	4.61
62.696	0.028	3.25	10.66	21.82	12.60	103.576063	50	1.04	7.25	0.110	0	0.66	0.55	0.574	3.99		0.00	0.25	10.00	114.48	2497.99	358.44	2139.56	0.53	0.74	72.02	0	18.30	320.36	4.66
63.696	0.172	3.20	10.50	21.96	12.96	155.544063	58	1.04	7.26	0.114	0	0.55	0.55	0.674	3.99		0.00	0.25	18.00	114.48	2518.76	368.67	2148.09	0.64	0.74	72.76	8	15.46	323.66	4.71
64.696	9.318	3.10	10.33	22.10	13.13	157.512063	50	1.04	7.25	0.112	0	0.55	0.55	0.674	3.99		0.00	0.25	18.00	114.48	2535.64	378.91	2156.63	0.64	0.74	73.60	8	10.63	326.04	4.76
65.696	0.460	3.10	10.17	22.31	13.29	159.480063	50	1.04	7.25	0.110	0	0.56	0.56	0.674	3.99		0.00	0.25	18.00	114.48	2564.31	389.14	2165.17	0.64	8.74	74.24	8	10.79	330.23	4.81
66.696	0.604	3.05	10.00	22.48	13.45	101.448063	50	1.04	7.25	0.109	0	0.55	0.55	0.574	3.99		0.00	0.25	10.00	114.48	2573.09	399.37	2173.72	0.54	0.74	74.98	0	10.96	333.52	4.86

67.696	8.748	3.00	9.64	22.64	13.82	163.416063	50	1.04	7.25	0.107	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2591.86	409.01	2182.26	0.55	0.74	75.72	7	10.12	336.81	4.91
68.696	9.892	2.95	9.68	22.80	13.78	165.384063	50	1.04	7.25	0.106	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2610.64	419.64	2190.80	0.55	0.74	76.46	7	16.29	340.10	4.96
69.696	10.036	2.90	9.51	22.97	13.96	167.352063	50	1.04	7.25	0.104	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2629.41	430.07	2199.34	0.55	0.74	77.20	7	16.45	343.39	5.01
70.696	10.180	2.85	9.35	23.13	14.11	169.320063	50	1.04	7.25	0.103	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2648.19	440.31	2207.88	0.55	0.74	77.94	7	16.61	346.68	5.06
71.696	10.324	2.80	9.18	23.30	14.27	171.288063	50	1.04	7.25	0.101	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2666.96	450.54	2216.42	0.55	0.74	78.68	7	16.77	349.97	5.11
72.696	10.468	2.75	9.02	23.46	14.44	173.256063	50	1.04	7.25	0.100	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2685.74	460.77	2224.96	0.56	0.74	79.42	7	16.94	353.26	5.16
73.696	10.612	2.70	8.86	23.62	14.60	175.224063	50	1.04	7.25	0.098	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2704.51	471.01	2233.50	0.56	0.74	80.16	6	17.10	356.55	5.21
74.696	10.756	2.65	8.69	23.79	14.77	177.192063	50	1.04	7.25	0.097	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2723.29	481.24	2242.05	0.56	0.74	80.90	6	17.27	359.84	5.26
75.696	10.900	2.60	8.53	23.95	14.93	179.160063	50	1.04	7.25	0.096	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2742.06	491.47	2250.59	0.56	0.74	81.64	6	17.43	363.13	5.31
76.696	11.044	2.55	8.36	24.12	15.09	181.128063	50	1.04	7.25	0.095	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2760.84	501.71	2259.13	0.56	0.74	82.38	6	17.59	366.42	5.36
77.696	11.188	2.50	8.20	24.28	15.25	183.096063	50	1.04	7.25	0.093	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2779.61	511.94	2267.67	0.57	0.74	83.12	6	17.76	369.72	5.41
78.696	11.332	2.45	8.04	24.44	15.42	185.064063	50	1.04	7.25	0.092	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2798.39	522.18	2276.21	0.57	0.74	83.86	6	17.92	373.01	5.46
79.696	11.476	2.40	7.87	24.61	15.59	187.032063	50	1.04	7.25	0.091	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2817.16	532.41	2284.75	0.57	0.74	84.59	5	18.09	376.30	5.51
80.696	11.620	2.35	7.71	24.77	15.70	189.000063	50	1.04	7.25	0.090	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2835.93	542.64	2293.29	0.57	0.74	85.33	5	18.25	379.59	5.56
81.696	11.764	2.30	7.54	24.94	15.91	190.968063	50	1.04	7.25	0.089	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2854.71	552.88	2301.83	0.58	0.74	86.07	5	18.41	382.88	5.61
82.696	11.908	2.25	7.38	25.10	16.08	192.936063	50	1.04	7.25	0.088	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2873.48	563.11	2310.37	0.58	0.74	86.81	5	18.58	386.17	5.66
83.696	12.052	2.20	7.22	25.26	16.24	194.904063	50	1.04	7.25	0.087	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2892.26	573.34	2318.92	0.58	0.74	87.55	5	18.74	389.46	5.71
84.696	12.196	2.15	7.05	25.43	16.41	196.872063	50	1.04	7.25	0.086	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2911.03	583.58	2327.46	0.58	0.74	88.29	5	18.91	392.75	5.76
85.696	12.340	2.10	6.89	25.59	16.57	198.840063	50	1.04	7.25	0.085	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2929.81	593.81	2336.00	0.58	0.74	89.03	4	19.07	396.04	5.81
86.696	12.484	2.05	6.72	25.76	16.73	200.808063	50	1.04	7.25	0.084	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2948.58	604.04	2344.54	0.59	0.74	89.77	4	19.23	399.33	5.86
87.696	12.628	2.00	6.56	25.92	16.90	202.776063	50	1.04	7.25	0.083	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2967.36	614.28	2353.08	0.59	0.74	90.51	4	19.40	402.62	5.91
88.696	12.772	1.95	6.40	26.08	17.06	204.744063	50	1.04	7.25	0.082	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	2986.13	624.51	2361.62	0.59	0.74	91.25	4	19.56	405.91	5.96
89.696	12.916	1.90	6.23	26.25	17.23	206.712063	50	1.04	7.25	0.081	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3004.91	634.75	2370.16	0.59	0.74	91.99	4	19.73	409.20	6.01
90.696	13.060	1.85	6.07	26.41	17.39	208.680063	50	1.04	7.25	0.080	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3023.68	644.98	2378.70	0.59	0.74	92.73	4	19.89	412.49	6.06
91.696	13.204	1.80	5.90	26.58	17.55	210.648063	50	1.04	7.25	0.079	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3042.46	655.21	2387.24	0.60	0.74	93.47	3	20.05	415.78	6.11
92.696	13.348	1.75	5.74	26.74	17.72	212.616063	50	1.04	7.25	0.078	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3061.23	665.45	2395.79	0.60	0.74	94.21	3	20.22	419.08	6.16
93.696	13.492	1.70	5.58	26.90	17.88	214.584063	50	1.04	7.25	0.077	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3080.01	675.68	2404.33	0.60	0.74	94.95	3	20.38	422.37	6.21
94.696	13.636	1.65	5.41	27.07	18.05	216.552063	50	1.04	7.25	0.077	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3098.78	685.91	2412.87	0.60	0.74	95.69	3	20.55	425.66	6.26
95.696	13.780	1.60	5.25	27.23	18.21	218.520063	50	1.04	7.25	0.076	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3117.56	696.15	2421.41	0.61	0.74	96.43	3	20.71	428.95	6.31
96.696	13.924	1.55	5.08	27.40	18.37	220.488063	50	1.04	7.25	0.075	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3136.33	706.38	2429.95	0.61	0.74	97.17	3	20.87	432.24	6.36
97.696	14.068	1.50	4.92	27.56	18.54	222.456063	50	1.04	7.25	0.074	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3155.10	716.61	2438.49	0.61	0.74	97.91	2	21.04	435.53	6.41
98.696	14.212	1.45	4.76	27.72	18.70	224.424063	50	1.04	7.25	0.073	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3173.88	726.85	2447.03	0.61	0.74	98.65	2	21.20	438.82	6.46
99.696	14.356	1.40	4.59	27.89	18.87	226.392063	50	1.04	7.25	0.073	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3192.65	737.08	2455.57	0.61	0.74	99.39	2	21.37	442.11	6.51
100.696	14.500	1.35	4.43	28.05	19.03	228.360063	50	1.04	7.25	0.072	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3211.43	747.31	2464.11	0.62	0.74	100.13	2	21.53	445.40	6.56
101.696	14.644	1.30	4.26	28.22	19.19	230.328063	50	1.04	7.25	0.071	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3230.20	757.55	2472.66	0.62	0.74	100.87	2	21.69	448.69	6.61
102.696	14.788	1.25	4.10	28.38	19.36	232.296063	50	1.04	7.25	0.071	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3248.98	767.78	2481.20	0.62	0.74	101.61	2	21.86	451.98	6.66
103.696	14.932	1.20	3.94	28.54	19.52	234.264063	50	1.04	7.25	0.070	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3267.75	778.02	2489.74	0.62	0.74	102.35	1	22.02	455.27	6.71
104.696	15.076	1.15	3.77	28.71	19.69	236.232063	50	1.04	7.25	0.069	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3286.53	788.25	2498.28	0.62	0.74	103.09	1	22.19	458.56	6.76
105.696	15.220	1.10	3.61	28.87	19.85	238.200063	50	1.04	7.25	0.069	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3305.30	798.48	2506.82	0.63	0.74	103.83	1	22.35	461.85	6.81
106.696	15.364	1.05	3.44	29.04	20.01	240.168063	50	1.04	7.25	0.068	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3324.08	808.72	2515.36	0.63	0.74	104.57	1	22.51	465.15	6.86
107.696	15.508	1.00	3.28	29.20	20.18	242.136063	50	1.04	7.25	0.067	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3342.85	818.95	2523.90	0.63	0.74	105.31	1	22.68	468.44	6.91
108.696	15.652	0.95	3.12	29.36	20.34	244.104063	50	1.04	7.25	0.067	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3361.63	829.18	2532.44	0.63	0.74	106.05	1	22.84	471.73	6.96
109.696	15.796	0.90	2.95	29.53	20.51	246.072063	50	1.04	7.25	0.066	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3380.40	839.42	2540.98	0.64	0.74	106.79	0	23.01	475.02	7.01
110.696	15.940	0.85	2.79	29.69	20.67	248.040063	50	1.04	7.25	0.066	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3399.18	849.65	2549.53	0.64	0.74	107.53	0	23.17	478.31	7.06
111.696	16.084	0.80	2.62	29.86	20.83	250.008063	50	1.04	7.25	0.065	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3417.95	859.88	2558.07	0.64	0.74	108.27	0	23.33	481.60	7.11
112.696	16.228	0.75	2.46	30.02	21.00	251.976063	50	1.04	7.25	0.064	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3436.73	870.12	2566.61	0.64	0.74	109.01	0	23.50	484.89	7.16
113.696	16.372	0.70	2.30	30.19	21.16	253.944063	50	1.04	7.25	0.064	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3455.50	880.35	2575.15	0.64	0.74	109.75	0	23.66	488.18	7.21
114.696	16.516	0.65	2.13	30.35	21.33	255.912063	50	1.04	7.25	0.063	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3474.28	890.59	2583.69	0.65	0.74	110.49	0	23.83	491.47	7.26
115.696	16.660	0.60	1.97	30.51	21.49	257.880063	50	1.04	7.25	0.063	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3493.05	900.82	2592.23	0.65	0.74	111.23	-1	23.99	494.76	7.31
116.696	16.804	0.55	1.80	30.68	21.65	259.848063	50	1.04	7.25	0.062	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3511.82	911.05	2600.77	0.65	0.74	111.97	-1	24.15	498.05	7.36
117.696	16.948	0.50	1.64	30.84	21.82	261.816063	50	1.04	7.25	0.062	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3530.60	921.29	2609.31	0.65	0.74	112.71	-1	24.32	501.34	7.41
118.696	17.092	0.45	1.48	31.00	21.98	263.784063	50	1.04	7.25	0.061	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3549.37	931.52	2617.85	0.65	0.74	113.45	-1	24.48	504.63	7.46
119.696	17.236	0.40	1.31	31.17	22.15	265.752063	50	1.04	7.25	0.061	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3568.15	941.76	2626.40	0.66	0.74	114.19	-1	24.65	507.92	7.51
120.696	17.380	0.35	1.15	31.33	22.31	267.720063	50	1.04	7.25	0.060	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3586.92	951.99	2634.94	0.66	0.74	114.93	-1	24.81	511.22	7.56
121.696	17.524	0.30	0.98	31.50	22.47	269.688063	50	1.04	7.25	0.060	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3605.70	962.22	2643.48	0.66	0.74	115.67	-2	24.97	514.51	7.61
122.696	17.668	0.25	0.82	31.66	22.64	271.656063	50	1.04	7.25	0.059	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3624.47	972.46	2652.02	0.66	0.74	116.41	-2	25.14	517.80	7.66
123.696	17.812	0.20	0.66	31.82	22.80	273.624063	50	1.04	7.25	0.059	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3643.25	982.69	2660.56	0.67	0.74	117.15	-2	25.30	521.09	7.71
124.696	17.956	0.15	0.49	31.99	22.97	275.592063	50	1.04	7.25	0.058	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3662.02	992.92	2669.10	0.67	0.74	117.89	-2	25.47	524.38	7.76
125.696	18.100	0.10	0.33	32.15	23.13	277.560063	50	1.04	7.25	0.058	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3680.80	1003.16	2677.64	0.67	0.74	118.62	-2	25.63	527.67	7.81
126.696	18.244	0.05	0.16	32.32	23.29	279.528063	50	1.04	7.25	0.057	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3699.57	1013.39	2686.18	0.67	0.74	119.36	-2	25.79	530.96	7.86
127.696	18.388	0.00	0.00	32.48	23.46	281.496063	50	1.04	7.25	0.057	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3718.35	1023.62	2694.72	0.67	0.74	120.10	-3	25.96	534.25	7.91
128.696	18.532	-0.05	-0.16	32.64	23.62	283.464063	50	1.04	7.25	0.056	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3737.12	1033.86	2703.27	0.68	0.74	120.84	-3	26.12	537.54	7.96
129.696	18.676	-0.10	-0.33	32.81	23.79	285.432063	50	1.04	7.25	0.056	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3755.90	1044.09	2711.81	0.68	0.74	121.58	-3	26.29	540.83	8.01
130.696	18.820	-0.15	-0.49	32.97	23.95	287.400063	50	1.04	7.25	0.055	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3774.67	1054.32	2720.35	0.68	0.74	122.32	-3	26.45	544.12	8.06
131.696	18.964	-0.20	-0.66	33.14	24.11	289.368063	50	1.04	7.25	0.055	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3793.45	1064.56	2728.89	0.68	0.74	123.06	-3	26.61	547.41	8.11
132.696	19.108	-0.25	-0.82	33.30	24.28	291.336063	50	1.04	7.25	0.055	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3812.22	1074.79	2737.43	0.68	0.74	123.80	-3	26.78	550.70	8.16
133.696	19.252	-0.30	-0.98	33.46	24.44	293.304063	50	1.04	7.25	0.054	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3830.99	1085.02	2745.97	0.69	0.74	124.54	-3	26.94	553.99	8.21
134.696	19.396	-0.35	-1.15	33.63	24.61	295.272063	50	1.04	7.25	0.054	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3849.77	1095.26	2754.51	0.69	0.74	125.28	-4	27.11	557.28	8.26
135.696	19.540	-0.40	-1.31	33.79	24.77	297.240063	50	1.04	7.25	0.053	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3868.54	1105.49	2763.05	0.69	0.74	126.02	-4	27.27	560.58	8.31
136.696	19.684	-0.45	-1.48	33.96	24.93	299.208063	50	1.04	7.25	0.053	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3887.32	1115.72	2771.59	0.69	0.74	126.76	-4	27.43	563.87	8.36
137.696	19.828	-0.50	-1.64	34.12	25.10	301.176063	50	1.04	7.25	0.053	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3906.09	1125.96	2780.14	0.70	0.74	127.50	-4	27.60	567.16	8.41
138.696	19.972	-0.55	-1.80	34.28	25.26	303.144063	50	1.04	7.25	0.052	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3924.87	1136.19	2788.68	0.70	0.74	128.24	-4	27.76	570.45	8.46
139.696	20.116	-0.60	-1.97	34.45	25.43	305.112063	50	1.04	7.25	0.052	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3943.64	1146.43	2797.22	0.70	0.74	128.98	-4	27.93	573.74	8.51
140.696	20.260	-0.65	-2.13	34.61	25.59	307.080063	50	1.04	7.25	0.052	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3962.42	1156.66	2805.76	0.70	0.74	129.72	-5	28.09	577.03	8.56
141.696	20.404	-0.70	-2.30	34.78	25.75	309.048063	50	1.04	7.25	0.051	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3981.19	1166.89	2814.30	0.70	0.74	130.46	-5	28.25	580.32	8.61
142.696	20.548	-0.75	-2.46	34.94	25.92	311.016063	50	1.04	7.25	0.051	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	3999.97	1177.13	2822.84	0.71	0.74	131.20	-5	28.42	583.61	8.66
143.696	20.692	-0.80	-2.62	35.10	26.08	312.984063	50	1.04	7.25	0.050	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4018.74	1187.36	2831.38	0.71	0.74	131.94	-5	28.58	586.90	8.71
144.696	20.836	-0.85	-2.79	35.27	26.25	314.952063	50	1.04	7.25	0.050	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4037.52	1197.59	2839.92	0.71	0.74	132.68	-5	28.75	590.19	8.76
145.696	20.980	-0.90	-2.95	35.43	26.41	316.920063	50	1.04	7.25	0.050	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4056.29	1207.83	2848.46	0.71	0.74	133.42	-5	28.91	593.48	8.81
146.696	21.124	-0.95	-3.12	35.60	26.57	318.888063	50	1.04	7.25	0.049	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4075.07	1218.06	2857.01	0.71	0.74	134.16	-6	29.07	596.77	8.86
147.696	21.268	-1.00	-3.28	35.76	26.74	320.856063	50	1.04	7.25	0.049	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4093.84	1228.29	2865.55	0.72	0.74	134.90	-6	29.24	600.06	8.91
148.696	21.412	-1.05	-3.44	35.92	26.90	322.824063	50	1.04	7.25	0.048	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4112.62	1238.53	2874.09	0.72	0.74	135.64	-6	29.40	603.35	8.96
149.696	21.556	-1.10	-3.61	36.09	27.07	324.792063	50	1.04	7.25	0.048	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4131.39	1248.76	2882.63	0.72	0.74	136.38	-6	29.57	606.65	9.01
150.696	21.700	-1.15	-3.77	36.25	27.23	326.760063	50	1.04	7.25	0.048	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4150.17	1258.99	2891.17	0.72	0.74	137.12	-6	29.73	609.94	9.06
151.696	21.844	-1.20	-3.94	36.42	27.39	328.728063	50	1.04	7.25	0.048	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4168.94	1269.23	2899.71	0.72	0.74	137.86	-6	29.89	613.23	9.11
152.696	21.988	-1.25	-4.10	36.58	27.56	330.696063	50	1.04	7.25	0.047	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4187.71	1279.46	2908.25	0.73	0.74	138.60	-7	30.06	616.52	9.16
153.696	22.132	-1.30	-4.26	36.74	27.72	332.664063	50	1.04	7.25	0.047	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4206.49	1289.70	2916.79	0.73	0.74	139.34	-7	30.22	619.81	9.21
154.696	22.276	-1.35	-4.43	36.91	27.89	334.632063	50	1.04	7.25	0.047	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4225.26	1299.93	2925.33	0.73	0.74	140.08	-7	30.39	623.10	9.26
155.696	22.420	-1.40	-4.59	37.07	28.05	336.600063	50	1.04	7.25	0.047	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4244.04	1310.16	2933.88	0.73	0.74	140.82	-7	30.55	626.39	9.31
156.696	22.564	-1.45	-4.76	37.24	28.21	338.568063	50	1.04	7.25	0.046	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4262.81	1320.40	2942.42	0.74	0.74	141.56	-7	30.71	629.68	9.36
157.696	22.708	-1.50	-4.92	37.40	28.38	340.536063	50	1.04	7.25	0.046	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4281.59	1330.63	2950.96	0.74	0.74	142.30	-7	30.88	632.97	9.41
158.696	22.852	-1.55	-5.08	37.56	28.54	342.504063	50	1.04	7.25	0.046	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4300.36	1340.86	2959.50	0.74	0.74	143.04	-8	31.04	636.26	9.46
159.696	22.996	-1.60	-5.25	37.73	28.71	344.472063	50	1.04	7.25	0.045	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4319.14	1351.10	2968.04	0.74	0.74	143.78	-8	31.21	639.55	9.51
160.696	23.140	-1.65	-5.41	37.89	28.87	346.440063	50	1.04	7.25	0.045	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4337.91	1361.33	2976.58	0.74	0.74	144.52	-8	31.37	642.84	9.56
161.696	23.284	-1.70	-5.58	38.06	29.03	348.408063	50	1.04	7.25	0.045	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4356.69	1371.56	2985.12	0.75	0.74	145.26	-8	31.53	646.13	9.61
162.696	23.428	-1.75	-5.74	38.22	29.20	350.376063	50	1.04	7.25	0.045	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4375.46	1381.80	2993.66	0.75	0.74	146.00	-8	31.70	649.42	9.66
163.696	23.572	-1.80	-5.90	38.38	29.36	352.344063	50	1.04	7.25	0.044	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4394.24	1392.03	3002.20	0.75	0.74	146.74	-8	31.86	652.71	9.71
164.696	23.716	-1.85	-6.07	38.55	29.53	354.312063	50	1.04	7.25	0.044	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4413.01	1402.27	3010.75	0.75	0.74	147.48	-9	32.03	656.01	9.76
165.696	23.860	-1.90	-6.23	38.71	29.69	356.280063	50	1.04	7.25	0.044	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4431.79	1412.50	3019.29	0.75	0.74	148.22	-9	32.19	659.30	9.81
166.696	24.004	-1.95	-6.40	38.88	29.85	358.248063	50	1.04	7.25	0.044	0	0.55	0.55	0.574	3.99	0.00	0.25	18.00	114.48	4450.56	1422.73	3027.83	0.76	0.74	148.96	-9	32.35	662.59	9.86
167.696	24.148	-2.00	-6.56	39.04	30.02	360.216063	90	1.88	13.05	0.078	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4471.42	1432.97	3038.46	0.76	1.33	150.29	-9	32.52	668.51	9.91
168.696	24.292	-2.05	-6.72	39.20	30.18	362.184063	90	1.88	13.05	0.077	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4492.28	1443.20	3049.08	0.76	1.33	151.62	-9	32.68	674.43	9.96
169.696	24.436	-2.10	-6.89	39.37	30.35	364.152063	90	1.88	13.05	0.077	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4513.14	1453.43	3059.71	0.76	1.33	152.95	-9	32.85	680.36	10.01
170.696	24.580	-2.15	-7.05	39.53	30.51	366.120063	90	1.88	13.05	0.076	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4534.00	1463.67	3070.34	0.77	1.33	154.28	-10	33.01	686.28	10.06
171.696	24.724	-2.20	-7.22	39.70	30.67	368.088063	90	1.88	13.05	0.076	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4554.86	1473.90	3080.96	0.77	1.33	155.61	-10	33.17	692.20	10.11
172.696	24.868	-2.25	-7.38	39.86	30.84	370.056063	90	1.88	13.05	0.076	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4575.73	1484.13	3091.59	0.77	1.33	156.95	-10	33.34	698.13	10.16
173.696	25.012	-2.30	-7.54	40.02	31.00	372.024063	90	1.88	13.05	0.076	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4596.59	1494.37	3102.22	0.78	1.33	158.28	-10	33.50	704.05	10.21
174.696	25.156	-2.35	-7.71	40.19	31.17	373.992063	90	1.88	13.05	0.075	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4617.45	1504.60	3112.85	0.78	1.33	159.61	-10	33.67	709.97	10.26
175.696	25.300	-2.40	-7.87	40.35	31.33	375.960063	90	1.88	13.05	0.074	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4638.31	1514.83	3123.47	0.78	1.33	160.94	-10	33.83	715.90	10.31
176.696	25.444	-2.45	-8.04	40.52	31.49	377.928063	90	1.88	13.05	0.074	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4659.17	1525.07	3134.10	0.78	1.33	162.27	-11	33.99	721.82	10.36
177.696	25.588	-2.50	-8.20	40.68	31.66	379.896063	90	1.88	13.05	0.073	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4680.03	1535.30	3144.73	0.79	1.33	163.60	-11	34.16	727.74	10.41
178.696	25.732	-2.55	-8.36	40.84	31.82	381.864063	90	1.88	13.05	0.073	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4700.89	1545.54	3155.35	0.79	1.33	164.93	-11	34.32	733.67	10.46
179.696	25.876	-2.60	-8.53	41.01	31.99	383.832063	90	1.88	13.05	0.073	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4721.75	1555.77	3165.98	0.79	1.33	166.27	-11	34.49	739.59	10.51
180.696	26.020	-2.65	-8.69	41.17	32.15	385.800063	90	1.88	13.05	0.072	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4742.61	1566.00	3176.61	0.79	1.33	167.60	-11	34.65	745.51	10.56
181.696	26.164	-2.70	-8.86	41.34	32.31	387.768063	90	1.88	13.05	0.072	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4763.47	1576.24	3187.24	0.80	1.33	168.93	-11	34.81	751.44	10.61
182.696	26.308	-2.75	-9.02	41.50	32.48	389.736063	90	1.88	13.05	0.071	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4784.33	1586.47	3197.86	0.80	1.33	170.26	-12	34.98	757.36	10.66
183.696	26.452	-2.80	-9.18	41.66	32.64	391.704063	90	1.88	13.05	0.071	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4805.19	1596.70	3208.49	0.80	1.33	171.59	-12	35.14	763.28	10.71
184.696	26.596	-2.85	-9.35	41.83	32.81	393.672063	90	1.88	13.05	0.071	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4826.05	1606.94	3219.12	0.80	1.33	172.92	-12	35.31	769.21	10.76
185.696	26.740	-2.90	-9.51	41.99	32.97	395.640063	90	1.88	13.05	0.070	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4846.92	1617.17	3229.74	0.81	1.33	174.25	-12	35.47	775.13	10.81
186.696	26.884	-2.95	-9.68	42.16	33.13	397.608063	90	1.88	13.05	0.070	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4867.78	1627.40	3240.37	0.81	1.33	175.59	-12	35.63	781.06	10.86
187.696	27.028	-3.00	-9.84	42.32	33.30	399.576063	90	1.88	13.05	0.070	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4888.64	1637.64	3251.00	0.81	1.33	176.92	-12	35.80	786.98	10.91
188.696	27.172	-3.05	-10.00	42.48	33.46	401.544063	90	1.88	13.05	0.069	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4909.50	1647.87	3261.63	0.82	1.33	178.25	-13	35.96	792.90	10.96
189.696	27.316	-3.10	-10.17	42.65	33.63	403.512063	90	1.88	13.05	0.069	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4930.36	1658.11	3272.25	0.82	1.33	179.58	-13	36.13	798.82	11.01
190.696	27.460	-3.15	-10.33	42.81	33.79	405.480063	90	1.88	13.05	0.068	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4951.22	1668.34	3282.88	0.82	1.33	180.91	-13	36.29	804.74	11.06
191.696	27.604	-3.20	-10.50	42.98	33.95	407.448063	90	1.88	13.05	0.068	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4972.08	1678.57	3293.51	0.82	1.33	182.25	-13	36.45	810.67	11.11
192.696	27.748	-3.25	-10.66	43.14	34.12	409.416063	90	1.88	13.05	0.068	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	4992.94	1688.81	3304.14	0.83	1.33	183.58	-13	36.62	816.59	11.16
193.696	27.892	-3.30	-10.82	43.30	34.28	411.384063	90	1.88	13.05	0.067	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5013.80	1699.04	3314.76	0.83	1.33	184.91	-13	36.78	822.51	11.21
194.696	28.036	-3.35	-10.99	43.47	34.45	413.352063	90	1.88	13.05	0.067	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5034.66	1709.27	3325.39	0.83	1.33	186.24	-13	36.95	828.44	11.26
195.696	28.180	-3.40	-11.15	43.63	34.61	415.320063	90	1.88	13.05	0.067	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5055.52	1719.51	3336.02	0.83	1.33	187.57	-14	37.11	834.36	11.31
196.696	28.324	-3.45	-11.32	43.80	34.77	417.288063	90	1.88	13.05	0.066	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5076.38	1729.74	3346.64	0.84	1.33	188.90	-14	37.27	840.28	11.36
197.696	28.468	-3.50	-11.48	43.96	34.94	419.256063	90	1.88	13.05	0.066	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5097.25	1739.97	3357.27	0.84	1.33	190.24	-14	37.44	846.21	11.41
198.696	28.612	-3.55	-11.64	44.12	35.10	421.224063	90	1.88	13.05	0.066	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5118.11	1750.21	3367.90	0.84	1.33	191.57	-14	37.60	852.13	11.46
199.696	28.756	-3.60	-11.81	44.29	35.27	423.192063	90	1.88	13.05	0.066	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5138.97	1760.44	3378.53	0.84	1.33	192.90	-14	37.77	858.06	11.51
200.696	28.900	-3.65	-11.97	44.45	35.43	425.160063	90	1.88	13.05	0.065	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5159.83	1770.67	3389.15	0.85	1.33	194.23	-14	37.93	863.98	11.56
201.696	29.044	-3.70	-12.14	44.62	35.59	427.128063	90	1.88	13.05	0.065	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5180.69	1780.91	3399.78	0.85	1.33	195.56	-15	38.09	869.90	11.61
202.696	29.188	-3.75	-12.30	44.78	35.76	429.096063	90	1.88	13.05	0.064	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5201.55	1791.14	3410.41	0.85	1.33	196.89	-15	38.26	875.82	11.66
203.696	29.332	-3.80	-12.46	44.94	35.92	431.064063	90	1.88	13.05	0.064	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5222.41	1801.38	3421.03	0.86	1.33	198.22	-15	38.42	881.75	11.71
204.696	29.476	-3.85	-12.63	45.11	36.09	433.032063	90	1.88	13.05	0.064	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5243.27	1811.61	3431.66	0.86	1.33	199.55	-15	38.59	887.67	11.76
205.696	29.620	-3.90	-12.79	45.27	36.25	435.000063	90	1.88	13.05	0.063	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5264.13	1821.84	3442.29	0.86	1.33	200.89	-15	38.75	893.59	11.81
206.696	29.764	-3.95	-12.95	45.44	36.41	436.968063	90	1.88	13.05	0.063	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5284.99	1832.08	3452.92	0.86	1.33	202.22	-15	38.91	899.52	11.86
207.696	29.908	-4.00	-13.12	45.60	36.58	438.936063	90	1.88	13.05	0.063	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5305.85	1842.31	3463.54	0.87	1.33	203.55	-16	39.08	905.44	11.91
208.696	30.052	-4.05	-13.28	45.76	36.74	440.904063	90	1.88	13.05	0.063	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5326.71	1852.54	3474.17	0.87	1.33	204.88	-16	39.24	911.36	11.96
209.696	30.196	-4.10	-13.45	45.93	36.91	442.872063	90	1.88	13.05	0.062	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5347.57	1862.78	3484.80	0.87	1.33	206.21	-16	39.41	917.29	12.01
210.696	30.340	-4.15	-13.61	46.09	37.07	444.840063	90	1.88	13.05	0.062	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5368.44	1873.01	3495.42	0.87	1.33	207.55	-16	39.57	923.21	12.06
211.696	30.484	-4.20	-13.78	46.25	37.23	446.808063	90	1.88	13.05	0.062	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5389.30	1883.24	3506.05	0.88	1.33	208.88	-16	39.73	929.13	12.11
212.696	30.628	-4.25	-13.94	46.42	37.40	448.776063	90	1.88	13.05	0.061	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5410.16	1893.48	3516.68	0.88	1.33	210.21	-16	39.90	935.06	12.16
213.696	30.772	-4.30	-14.10	46.58	37.56	450.744063	90	1.88	13.05	0.061	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5431.02	1903.71	3527.31	0.88	1.33	211.54	-17	40.06	940.98	12.21
214.696	30.916	-4.35	-14.27	46.75	37.73	452.712063	90	1.88	13.05	0.061	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5451.88	1913.95	3537.93	0.88	1.33	212.87	-17	40.23	946.90	12.26
215.696	31.060	-4.40	-14.43	46.91	37.89	454.680063	90	1.88	13.05	0.061	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5472.74	1924.18	3548.56	0.89	1.33	214.20	-17	40.39	952.83	12.31
216.696	31.204	-4.45	-14.60	47.08	38.05	456.648063	90	1.88	13.05	0.060	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5493.60	1934.41	3559.19	0.89	1.33	215.54	-17	40.55	958.75	12.36
217.696	31.348	-4.50	-14.76	47.24	38.22	458.616063	90	1.88	13.05	0.060	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5514.46	1944.65	3569.82	0.89	1.33	216.87	-17	40.72	964.67	12.41
218.696	31.492	-4.55	-14.92	47.40	38.38	460.584063	90	1.88	13.05	0.060	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5535.32	1954.88	3580.44	0.90	1.33	218.20	-17	40.88	970.60	12.46
219.696	31.636	-4.60	-15.09	47.57	38.55	462.552063	90	1.88	13.05	0.059	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5556.18	1965.11	3591.07	0.90	1.33	219.53	-18	41.05	976.52	12.51
220.696	31.780	-4.65	-15.25	47.73	38.71	464.520063	90	1.88	13.05	0.059	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5577.04	1975.35	3601.70	0.90	1.33	220.86	-18	41.21	982.44	12.56
221.696	31.924	-4.70	-15.42	47.90	38.87	466.488063	90	1.88	13.05	0.059	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5597.90	1985.58	3612.32	0.90	1.33	222.19	-18	41.37	988.37	12.61
222.696	32.068	-4.75	-15.58	48.06	39.04	468.456063	90	1.88	13.05	0.059	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5618.77	1995.81	3622.95	0.91	1.33	223.52	-18	41.54	994.29	12.66
223.696	32.212	-4.80	-15.74	48.22	39.20	470.424063	90	1.88	13.05	0.058	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5639.63	2006.05	3633.58	0.91	1.33	224.86	-18	41.70	1000.21	12.71
224.696	32.356	-4.85	-15.91	48.39	39.37	472.392063	90	1.88	13.05	0.058	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5660.49	2016.28	3644.21	0.91	1.33	226.19	-18	41.87	1006.14	12.76
225.696	32.500	-4.90	-16.07	48.55	39.53	474.360063	90	1.88	13.05	0.058	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5681.35	2026.51	3654.83	0.91	1.33	227.52	-19	42.03	1012.06	12.81
226.696	32.644	-4.95	-16.24	48.72	39.69	476.328063	90	1.88	13.05	0.058	0	0.55	0.55	1.034	7.18	0.00	0.25	20.00	127.20	5702.21	2036.75	3665.46	0.92	1.33	228.85	-19	42.19	1017.98	12.86

227.696	32.788	-5.00	-16.40	48.88	39.86	478.296063	90	1.88	13.05	0.057	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	5723.07	2046.98	3676.09	0.92	1.33	230.10	-10	42.36	1023.91	12.91
228.696	32.932	-5.05	-16.56	49.04	40.02	480.264063	90	1.88	13.05	0.057	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	5743.93	2057.22	3686.71	0.92	1.33	231.61	-18	42.52	1029.83	12.96
229.696	33.076	-5.10	-16.73	49.21	40.18	482.232063	90	1.88	13.05	0.057	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	5764.79	2067.45	3697.34	0.92	1.33	232.95	-19	42.69	1035.75	13.01
230.696	33.220	-5.15	-16.89	49.37	40.35	484.200063	90	1.88	13.05	0.057	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	5785.65	2077.68	3707.97	0.93	1.33	234.16	-19	42.85	1041.67	13.06
231.696	33.364	-5.20	-17.05	49.54	40.51	486.168063	90	1.88	13.05	0.056	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	5806.51	2087.92	3718.60	0.93	1.33	235.51	-20	43.01	1047.60	13.11
232.696	33.508	-5.25	-17.22	49.70	40.68	488.136063	90	1.88	13.05	0.056	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	5827.37	2098.16	3729.22	0.93	1.33	236.84	-20	43.18	1053.52	13.16
233.696	33.652	-5.30	-17.38	49.86	40.84	490.104063	90	1.88	13.05	0.056	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	5848.23	2108.39	3739.85	0.93	1.33	238.17	-20	43.34	1059.44	13.21
234.696	33.796	-5.35	-17.55	50.03	41.01	492.072063	90	1.88	13.05	0.056	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	5869.09	2118.62	3750.48	0.94	1.33	239.50	-20	43.51	1065.37	13.26
235.696	33.940	-5.40	-17.71	50.19	41.17	494.040063	90	1.88	13.05	0.056	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	5889.96	2128.86	3761.10	0.94	1.33	240.84	-20	43.67	1071.29	13.31
236.696	34.084	-5.45	-17.88	50.36	41.33	496.008063	90	1.88	13.05	0.056	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	5910.82	2139.09	3771.73	0.94	1.33	242.17	-20	43.83	1077.21	13.36
237.696	34.228	-5.50	-18.04	50.52	41.50	497.976063	90	1.88	13.05	0.055	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	5931.68	2149.32	3782.36	0.95	1.33	243.50	-21	44.00	1083.14	13.41
238.696	34.372	-5.55	-18.20	50.68	41.66	499.944063	90	1.88	13.05	0.055	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	5952.54	2159.56	3792.99	0.95	1.33	244.83	-21	44.16	1089.06	13.46
239.696	34.516	-5.60	-18.37	50.85	41.83	501.912063	90	1.88	13.05	0.054	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	5973.40	2169.79	3803.61	0.95	1.33	246.16	-21	44.33	1094.98	13.51
240.696	34.660	-5.65	-18.53	51.01	41.99	503.880063	90	1.88	13.05	0.054	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	5994.25	2180.02	3814.24	0.95	1.33	247.49	-21	44.49	1100.91	13.56
241.696	34.804	-5.70	-18.70	51.18	42.15	505.848063	90	1.88	13.05	0.054	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	6015.12	2190.25	3824.87	0.96	1.33	248.83	-21	44.65	1106.83	13.61
242.696	34.948	-5.75	-18.86	51.34	42.32	507.816063	90	1.88	13.05	0.054	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	6035.98	2200.49	3835.50	0.96	1.33	250.16	-21	44.82	1112.75	13.66
243.696	35.092	-5.80	-19.02	51.50	42.48	509.784063	90	1.88	13.05	0.054	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	6056.84	2210.72	3846.12	0.96	1.33	251.49	-22	44.98	1118.68	13.71
244.696	35.236	-5.85	-19.19	51.67	42.65	511.752063	90	1.88	13.05	0.053	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	6077.70	2220.95	3856.75	0.96	1.33	252.82	-22	45.15	1124.60	13.76
245.696	35.380	-5.90	-19.35	51.83	42.81	513.720063	90	1.88	13.05	0.053	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	6098.56	2231.19	3867.38	0.97	1.33	254.15	-22	45.31	1130.52	13.81
246.696	35.524	-5.95	-19.52	52.00	42.97	515.688063	90	1.88	13.05	0.053	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	6119.42	2241.42	3878.00	0.97	1.33	255.48	-22	45.47	1136.45	13.86
247.696	35.668	-6.00	-19.68	52.16	43.14	517.656063	90	1.88	13.05	0.053	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	6140.29	2251.65	3888.63	0.97	1.33	256.81	-22	45.64	1142.37	13.91
248.696	35.812	-6.05	-19.84	52.32	43.30	519.624063	90	1.88	13.05	0.052	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	6161.15	2261.89	3899.26	0.97	1.33	258.15	-22	45.80	1148.29	13.96
249.696	35.956	-6.10	-20.01	52.49	43.47	521.592063	90	1.88	13.05	0.052	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	6182.01	2272.12	3909.89	0.98	1.33	259.48	-23	45.97	1154.22	14.01
250.696	36.100	-6.15	-20.17	52.65	43.63	523.560063	90	1.88	13.05	0.052	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	6202.87	2282.35	3920.51	0.98	1.33	260.81	-23	46.13	1160.14	14.06
251.696	36.244	-6.20	-20.34	52.82	43.79	525.528063	90	1.88	13.05	0.052	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	6223.73	2292.59	3931.14	0.98	1.33	262.14	-23	46.29	1166.06	14.11
252.696	36.388	-6.25	-20.50	52.98	43.96	527.496063	90	1.88	13.05	0.052	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	6244.59	2302.82	3941.77	0.99	1.33	263.47	-23	46.46	1171.99	14.16
253.696	36.532	-6.30	-20.66	53.14	44.12	529.464063	90	1.88	13.05	0.051	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	6265.45	2313.05	3952.39	0.99	1.33	264.80	-23	46.62	1177.91	14.21
254.696	36.676	-6.35	-20.83	53.31	44.29	531.432063	90	1.88	13.05	0.051	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	6286.31	2323.29	3963.02	0.99	1.33	266.14	-23	46.79	1183.83	14.26
255.696	36.820	-6.40	-20.99	53.47	44.45	533.400063	90	1.88	13.05	0.051	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	6307.17	2333.52	3973.65	0.99	1.33	267.47	-23	46.95	1189.76	14.31
256.696	36.964	-6.45	-21.16	53.64	44.61	535.368063	90	1.88	13.05	0.051	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	6328.03	2343.76	3984.25	1.00	1.33	268.80	-24	47.11	1195.68	14.36
257.696	37.108	-6.50	-21.32	53.80	44.78	537.336063	90	1.88	13.05	0.051	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	6348.89	2353.99	3994.90	1.00	1.33	270.13	-24	47.28	1201.60	14.41
258.696	37.252	-6.55	-21.48	53.96	44.94	539.304063	90	1.88	13.05	0.050	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	6369.75	2364.22	4005.53	1.00	1.33	271.46	-24	47.44	1207.53	14.46
259.696	37.396	-6.60	-21.65	54.13	45.11	541.272063	98	1.88	13.05	0.050	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	6390.61	2374.46	4016.18	1.00	1.33	272.79	-24	47.61	1213.45	14.51
260.696	37.540	-6.65	-21.81	54.29	45.27	543.240063	90	1.88	13.05	0.050	0	0.55	0.55	1.034	7.16		0.00	0.25	20.00	127.20	6411.48	2384.69	4026.78	1.01	1.33	274.13	-24	47.77	1219.37	14.56
261.696	37.684	-6.70	-21.98	54.46	45.43	545.208063	120	2.51	17.40	0.067	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6432.34	2394.92	4037.41	1.01	1.78	275.90	-24	47.93	1227.27	14.61
262.696	37.828	-6.75	-22.14	54.62	45.60	547.176063	120	2.51	17.40	0.066	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6453.20	2405.16	4048.04	1.01	1.78	277.68	-25	48.10	1235.17	14.66
263.696	37.972	-6.80	-22.30	54.78	45.76	549.144063	120	2.51	17.40	0.066	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6474.06	2415.39	4058.67	1.01	1.78	279.45	-25	48.26	1243.07	14.71
264.696	38.116	-6.85	-22.47	54.95	45.93	551.112063	120	2.51	17.40	0.066	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6494.92	2425.63	4069.29	1.02	1.78	281.23	-25	48.43	1250.96	14.76
265.696	38.260	-6.90	-22.63	55.11	46.09	553.080063	120	2.51	17.40	0.066	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6515.78	2435.86	4079.92	1.02	1.78	283.00	-25	48.59	1258.86	14.81
266.696	38.404	-6.95	-22.80	55.28	46.25	555.048063	120	2.51	17.40	0.066	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6536.64	2446.09	4090.55	1.02	1.78	284.78	-25	48.76	1266.76	14.86
267.696	38.548	-7.00	-22.96	55.44	46.42	557.016063	120	2.51	17.40	0.065	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6557.50	2456.33	4101.18	1.03	1.78	286.55	-25	48.92	1274.66	14.91
268.696	38.692	-7.05	-23.12	55.60	46.58	558.984063	120	2.51	17.40	0.065	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6578.36	2466.56	4111.80	1.03	1.78	288.33	-26	49.08	1282.56	14.96
269.696	38.836	-7.10	-23.29	55.77	46.75	560.952063	120	2.51	17.40	0.065	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6599.22	2476.79	4122.43	1.03	1.78	290.10	-26	49.25	1290.45	15.01
270.696	38.980	-7.15	-23.45	55.93	46.91	562.920063	120	2.51	17.40	0.064	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6620.08	2487.03	4133.06	1.03	1.78	291.88	-26	49.41	1298.35	15.06
271.696	39.124	-7.20	-23.62	56.10	47.07	564.888063	120	2.51	17.40	0.064	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6640.94	2497.26	4143.68	1.04	1.78	293.66	-26	49.57	1306.25	15.11
272.696	39.268	-7.25	-23.78	56.26	47.24	566.856063	120	2.51	17.40	0.064	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6661.81	2507.49	4154.31	1.04	1.78	295.43	-26	49.74	1314.14	15.16
273.696	39.412	-7.30	-23.94	56.42	47.40	568.824063	120	2.51	17.40	0.064	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6682.67	2517.73	4164.94	1.04	1.78	297.21	-26	49.90	1322.04	15.21
274.696	39.556	-7.35	-24.11	56.59	47.57	570.792063	120	2.51	17.40	0.063	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6703.53	2527.96	4175.57	1.04	1.78	298.98	-27	50.07	1329.94	15.26
275.696	39.700	-7.40	-24.27	56.75	47.73	572.760063	120	2.51	17.40	0.063	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6724.39	2538.19	4186.19	1.05	1.78	300.76	-27	50.23	1337.84	15.31
276.696	39.844	-7.45	-24.44	56.92	47.89	574.728063	120	2.51	17.40	0.063	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6745.25	2548.43	4196.82	1.05	1.78	302.53	-27	50.39	1345.73	15.36
277.696	39.988	-7.50	-24.60	57.08	48.06	576.696063	120	2.51	17.40	0.063	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6766.11	2558.66	4207.45	1.05	1.78	304.31	-27	50.56	1353.63	15.41
278.696	40.132	-7.55	-24.76	57.24	48.22	578.664063	120	2.51	17.40	0.062	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6786.97	2568.90	4218.07	1.05	1.78	306.08	-27	50.72	1361.53	15.46
279.696	40.276	-7.60	-24.93	57.41	48.39	580.632063	120	2.51	17.40	0.062	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6807.83	2579.13	4228.70	1.06	1.78	307.86	-27	50.89	1369.43	15.51
280.696	40.420	-7.65	-25.09	57.57	48.55	582.600063	120	2.51	17.40	0.062	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6828.69	2589.36	4239.33	1.06	1.78	309.64	-28	51.05	1377.33	15.56
281.696	40.564	-7.70	-25.26	57.74	48.71	584.568063	120	2.51	17.40	0.062	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6849.55	2599.60	4249.96	1.06	1.78	311.41	-28	51.21	1385.22	15.61
282.696	40.708	-7.75	-25.42	57.90	48.88	586.536063	120	2.51	17.40	0.062	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6870.41	2609.83	4260.58	1.07	1.78	313.19	-28	51.38	1393.12	15.66
283.696	40.852	-7.80	-25.58	58.06	49.04	588.504063	120	2.51	17.40	0.061	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6891.27	2620.06	4271.21	1.07	1.78	314.96	-28	51.54	1401.02	15.71
284.696	40.996	-7.85	-25.75	58.23	49.21	590.472063	120	2.51	17.40	0.061	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6912.13	2630.30	4281.84	1.07	1.78	316.74	-28	51.71	1408.92	15.76
285.696	41.140	-7.90	-25.91	58.39	49.37	592.440063	120	2.51	17.40	0.061	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6933.00	2640.53	4292.46	1.07	1.78	318.51	-28	51.87	1416.81	15.81
286.696	41.284	-7.95	-26.08	58.56	49.53	594.408063	120	2.51	17.40	0.061	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6953.86	2650.76	4303.09	1.08	1.78	320.29	-29	52.03	1424.71	15.86
287.696	41.428	-8.00	-26.24	58.72	49.70	596.376063	120	2.51	17.40	0.060	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6974.72	2661.00	4313.72	1.08	1.78	322.06	-29	52.20	1432.61	15.91
288.696	41.572	-8.05	-26.40	58.88	49.86	598.344063	120	2.51	17.40	0.060	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	6995.58	2671.23	4324.35	1.08	1.78	323.84	-29	52.36	1440.51	15.96
289.696	41.716	-8.10	-26.57	59.05	50.03	600.312063	120	2.51	17.40	0.060	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7016.44	2681.47	4334.97	1.08	1.78	325.61	-29	52.53	1448.40	16.01
290.696	41.860	-8.15	-26.73	59.21	50.19	602.280063	120	2.51	17.40	0.060	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7037.30	2691.70	4345.60	1.09	1.78	327.39	-29	52.69	1456.30	16.06
291.696	42.004	-8.20	-26.90	59.38	50.35	604.248063	120	2.51	17.40	0.060	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7058.16	2701.93	4356.23	1.09	1.78	329.17	-29	52.85	1464.20	16.11
292.696	42.148	-8.25	-27.06	59.54	50.52	606.216063	120	2.51	17.40	0.059	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7079.02	2712.17	4366.86	1.09	1.78	330.94	-30	53.02	1472.10	16.16
293.696	42.292	-8.30	-27.22	59.70	50.68	608.184063	120	2.51	17.40	0.059	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7099.88	2722.40	4377.48	1.09	1.78	332.72	-30	53.18	1480.00	16.21
294.696	42.436	-8.35	-27.39	59.87	50.85	610.152063	120	2.51	17.40	0.059	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7120.74	2732.63	4388.11	1.10	1.78	334.49	-30	53.35	1487.89	16.26
295.696	42.580	-8.40	-27.55	60.03	51.01	612.120063	120	2.51	17.40	0.059	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7141.60	2742.87	4398.74	1.10	1.78	336.27	-30	53.51	1495.79	16.31
296.696	42.724	-8.45	-27.72	60.20	51.17	614.088063	120	2.51	17.40	0.059	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7162.46	2753.10	4409.36	1.10	1.78	338.04	-30	53.67	1503.69	16.36
297.696	42.868	-8.50	-27.88	60.36	51.34	616.056063	120	2.51	17.40	0.058	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7183.33	2763.33	4419.99	1.10	1.78	339.82	-30	53.84	1511.59	16.41
298.696	43.012	-8.55	-28.04	60.52	51.50	618.024063	120	2.51	17.40	0.058	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7204.19	2773.57	4430.62	1.11	1.78	341.59	-31	54.00	1519.48	16.46
299.696	43.156	-8.60	-28.21	60.69	51.67	619.992063	120	2.51	17.40	0.058	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7225.05	2783.80	4441.25	1.11	1.78	343.37	-31	54.17	1527.38	16.51
300.696	43.300	-8.65	-28.37	60.85	51.83	621.960063	120	2.51	17.40	0.058	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7245.91	2794.03	4451.87	1.11	1.78	345.14	-31	54.33	1535.28	16.56
301.696	43.444	-8.70	-28.54	61.02	51.99	623.928063	120	2.51	17.40	0.058	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7266.77	2804.27	4462.50	1.12	1.78	346.92	-31	54.49	1543.18	16.61
302.696	43.588	-8.75	-28.70	61.18	52.16	625.896063	120	2.51	17.40	0.057	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7287.63	2814.50	4473.13	1.12	1.78	348.70	-31	54.66	1551.07	16.66
303.696	43.732	-8.80	-28.86	61.34	52.32	627.864063	120	2.51	17.40	0.057	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7308.49	2824.74	4483.76	1.12	1.78	350.47	-31	54.82	1558.97	16.71
304.696	43.876	-8.85	-29.03	61.51	52.49	629.832063	120	2.51	17.40	0.057	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7329.35	2834.97	4494.38	1.12	1.78	352.25	-32	54.99	1566.87	16.76
305.696	44.020	-8.90	-29.19	61.67	52.65	631.800063	120	2.51	17.40	0.057	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7350.21	2845.20	4505.01	1.13	1.78	354.02	-32	55.15	1574.77	16.81
306.696	44.164	-8.95	-29.36	61.84	52.81	633.768063	120	2.51	17.40	0.057	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7371.07	2855.44	4515.64	1.13	1.78	355.80	-32	55.31	1582.66	16.86
307.696	44.308	-9.00	-29.52	62.00	52.98	635.736063	120	2.51	17.40	0.057	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7391.93	2865.67	4526.26	1.13	1.78	357.57	-32	55.48	1590.56	16.91
308.696	44.452	-9.05	-29.68	62.16	53.14	637.704063	120	2.51	17.40	0.056	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7412.79	2875.90	4536.89	1.13	1.78	359.35	-32	55.64	1598.46	16.96
309.696	44.596	-9.10	-29.85	62.33	53.31	639.672063	120	2.51	17.40	0.056	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7433.65	2886.14	4547.52	1.14	1.78	361.12	-32	55.81	1606.36	17.01
310.696	44.740	-9.15	-30.01	62.49	53.47	641.640063	120	2.51	17.40	0.056	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7454.52	2896.37	4558.14	1.14	1.78	362.90	-33	55.97	1614.25	17.06
311.696	44.884	-9.20	-30.18	62.65	53.63	643.608063	120	2.51	17.40	0.056	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7475.38	2906.60	4568.77	1.14	1.78	364.67	-33	56.13	1622.15	17.11
312.696	45.028	-9.25	-30.34	62.82	53.80	645.576063	120	2.51	17.40	0.056	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7496.24	2916.84	4579.40	1.14	1.78	366.45	-33	56.30	1630.05	17.16
313.696	45.172	-9.30	-30.50	62.98	53.96	647.544063	120	2.51	17.40	0.055	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7517.10	2927.07	4590.03	1.15	1.78	368.23	-33	56.46	1637.95	17.21
314.696	45.316	-9.35	-30.67	63.15	54.13	649.512063	120	2.51	17.40	0.055	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7537.96	2937.31	4600.65	1.15	1.78	370.00	-33	56.63	1645.85	17.26
315.696	45.460	-9.40	-30.83	63.31	54.29	651.480063	120	2.51	17.40	0.055	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7558.82	2947.54	4611.28	1.15	1.78	371.78	-33	56.79	1653.74	17.31
316.696	45.604	-9.45	-31.00	63.48	54.45	653.448063	120	2.51	17.40	0.055	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7579.68	2957.77	4621.91	1.16	1.78	373.55	-33	56.96	1661.64	17.36
317.696	45.748	-9.50	-31.16	63.64	54.62	655.416063	120	2.51	17.40	0.055	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7600.54	2968.01	4632.54	1.16	1.78	375.33	-34	57.12	1669.54	17.41
318.696	45.892	-9.55	-31.32	63.80	54.78	657.384063	120	2.51	17.40	0.055	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7621.40	2978.24	4643.16	1.16	1.78	377.10	-34	57.28	1677.44	17.46
319.696	46.036	-9.60	-31.49	63.97	54.95	659.352063	120	2.51	17.40	0.054	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7642.26	2988.47	4653.79	1.16	1.78	378.88	-34	57.45	1685.33	17.51
320.696	46.180	-9.65	-31.65	64.13	55.11	661.320063	120	2.51	17.40	0.054	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7663.12	2998.71	4664.42	1.17	1.78	380.66	-34	57.61	1693.23	17.56
321.696	46.324	-9.70	-31.82	64.30	55.27	663.288063	120	2.51	17.40	0.054	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7683.98	3008.94	4675.04	1.17	1.78	382.43	-34	57.77	1701.13	17.61
322.696	46.468	-9.75	-31.98	64.46	55.44	665.256063	120	2.51	17.40	0.054	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7704.85	3019.17	4685.67	1.17	1.78	384.20	-34	57.94	1709.03	17.66
323.696	46.612	-9.80	-32.14	64.62	55.60	667.224063	120	2.51	17.40	0.054	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7725.71	3029.41	4696.30	1.17	1.78	385.98	-35	58.10	1716.92	17.71
324.696	46.756	-9.85	-32.31	64.79	55.77	669.192063	120	2.51	17.40	0.054	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7746.57	3039.64	4706.93	1.18	1.78	387.76	-35	58.27	1724.82	17.76
325.696	46.900	-9.90	-32.47	64.95	55.93	671.160063	120	2.51	17.40	0.053	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7767.43	3049.87	4717.55	1.18	1.78	389.53	-35	58.43	1732.72	17.81
326.696	47.044	-9.95	-32.64	65.12	56.09	673.128063	120	2.51	17.40	0.053	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7788.29	3060.11	4728.18	1.18	1.78	391.31	-35	58.59	1740.62	17.86
327.696	47.188	-10.00	-32.80	65.28	56.26	675.096063	120	2.51	17.40	0.053	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7809.15	3070.34	4738.81	1.19	1.78	393.08	-35	58.76	1748.52	17.91
328.696	47.332	-10.05	-32.96	65.44	56.42	677.064063	120	2.51	17.40	0.053	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7830.01	3080.58	4749.43	1.19	1.78	394.86	-35	58.92	1756.41	17.96
329.696	47.476	-10.10	-33.13	65.61	56.59	679.032063	120	2.51	17.40	0.053	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7850.87	3090.81	4760.06	1.19	1.78	396.63	-36	59.09	1764.31	18.01
330.696	47.620	-10.15	-33.29	65.77	56.75	681.000063	120	2.51	17.40	0.053	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7871.73	3101.04	4770.69	1.19	1.78	398.41	-36	59.25	1772.21	18.06
331.696	47.764	-10.20	-33.46	65.94	56.91	682.968063	120	2.51	17.40	0.052	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7892.59	3111.28	4781.32	1.20	1.78	400.18	-36	59.41	1780.11	18.11
332.696	47.908	-10.25	-33.62	66.10	57.08	684.936063	120	2.51	17.40	0.052	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7913.45	3121.51	4791.94	1.20	1.78	401.96	-36	59.58	1788.00	18.16
333.696	48.052	-10.30	-33.78	66.26	57.24	686.904063	120	2.51	17.40	0.052	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7934.31	3131.74	4802.57	1.20	1.78	403.73	-36	59.74	1795.90	18.21
334.696	48.196	-10.35	-33.95	66.43	57.41	688.872063	120	2.51	17.40	0.052	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7955.17	3141.98	4813.20	1.20	1.78	405.51	-36	59.91	1803.80	18.26
335.696	48.340	-10.40	-34.11	66.59	57.57	690.840063	120	2.51	17.40	0.052	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7976.04	3152.21	4823.82	1.21	1.78	407.28	-37	60.07	1811.70	18.31
336.696	48.484	-10.45	-34.28	66.76	57.73	692.808063	120	2.51	17.40	0.052	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	7996.90	3162.44	4834.45	1.21	1.78	409.06	-37	60.23	1819.59	18.36
337.696	48.628	-10.50	-34.44	66.92	57.90	694.776063	120	2.51	17.40	0.052	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8017.76	3172.68	4845.08	1.21	1.78	410.84	-37	60.40	1827.49	18.41
338.696	48.772	-10.55	-34.60	67.08	58.06	696.744063	120	2.51	17.40	0.051	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8038.62	3182.91	4855.71	1.21	1.78	412.61	-37	60.56	1835.39	18.46
339.696	48.916	-10.60	-34.77	67.25	58.23	698.712063	120	2.51	17.40	0.051	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8059.48	3193.15	4866.33	1.22	1.78	414.39	-37	60.73	1843.29	18.51
340.696	49.060	-10.65	-34.93	67.41	58.39	700.680063	120	2.51	17.40	0.051	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8080.34	3203.38	4876.96	1.22	1.78	416.10	-37	60.89	1851.19	18.56
341.696	49.204	-10.70	-35.10	67.58	58.55	702.648063	120	2.51	17.40	0.051	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8101.20	3213.61	4887.59	1.22	1.78	417.94	-38	61.05	1859.08	18.61
342.696	49.348	-10.75	-35.26	67.74	58.72	704.616063	120	2.51	17.40	0.051	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8122.06	3223.85	4898.22	1.22	1.78	419.71	-38	61.22	1866.98	18.66
343.696	49.492	-10.80	-35.42	67.90	58.88	706.584063	120	2.51	17.40	0.051	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8142.92	3234.08	4908.84	1.23	1.78	421.49	-38	61.38	1874.88	18.71
344.696	49.636	-10.85	-35.59	68.07	59.05	708.552063	120	2.51	17.40	0.050	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8163.78	3244.31	4919.47	1.23	1.78	423.26	-38	61.55	1882.78	18.76
345.696	49.780	-10.90	-35.75	68.23	59.21	710.520063	120	2.51	17.40	0.050	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8184.64	3254.55	4930.10	1.23	1.78	425.04	-38	61.71	1890.67	18.81
346.696	49.924	-10.95	-35.92	68.40	59.37	712.488063	120	2.51	17.40	0.050	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8205.50	3264.78	4940.72	1.24	1.78	426.82	-38	61.87	1898.57	18.86
347.696	50.068	-11.00	-36.08	68.56	59.54	714.456063	120	2.51	17.40	0.050	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8226.37	3275.01	4951.35	1.24	1.78	428.59	-39	62.04	1906.47	18.91
348.696	50.212	-11.05	-36.24	68.72	59.70	716.424063	120	2.51	17.40	0.050	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8247.23	3285.25	4961.98	1.24	1.78	430.37	-39	62.20	1914.37	18.96
349.696	50.356	-11.10	-36.41	68.89	59.87	718.392063	120	2.51	17.40	0.050	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8268.09	3295.48	4972.61	1.24	1.78	432.14	-39	62.37	1922.26	19.01
350.696	50.500	-11.15	-36.57	69.05	60.03	720.360063	120	2.51	17.40	0.050	0	0.55	0.55	1.378	9.57		0.00	0.25	20.00	127.20	8288.95	3305.71	4983.23	1.25	1.78	433.92	-39	62.53	1930.16	19.06
351.696	50.644	-11.20	-36.74	69.22	60.19	722.328063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	16.00	114.48	8307.72	3316.95	4991.77	1.87	2.41	436.33	-39	62.69	1940.86	19.11
352.696	50.788	-11.25	-36.90	69.38	60.36	724.296063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	16.00	114.48	8326.50	3326.19	5000.32	1.87	2.40	438.73	-39	62.86	1951.57	19.16
353.696	50.932	-11.30	-37.06	69.54	60.52	726.264063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	16.00	114.48	8345.27	3336.42	5008.86	1.86	2.40	441.13	-40	63.02	1962.25	19.21
354.696	51.076	-11.35	-37.23	69.71	60.69	728.232063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	16.00	114.48	8364.05	3346.65	5017.40	1.86	2.40	443.53	-40	63.19	1972.91	19.26
355.696	51.220	-11.40	-37.39	69.87	60.85	730.200063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	16.00	114.48	8382.82	3356.88	5025.94	1.86	2.39	445.92	-40	63.35	1983.54	19.31
356.696	51.364	-11.45	-37.56	70.04	61.01	732.168063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	16.00	114.48	8401.60	3367.12	5034.48	1.86	2.39	448.30	-40	63.51	1994.16	19.36
357.696	51.508	-11.50	-37.72	70.20	61.18	734.136063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	16.00	114.48	8420.37	3377.35	5043.02	1.85	2.38	450.69	-40	63.68	2004.75	19.41
358.696	51.652	-11.55	-37.88	70.36	61.34	736.104063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.37	0.37	16.00	114.48	8439.15	3387.58	5051.56	1.85	2.38	453.06	-40	63.84	2015.33	19.46
359.696	51.796	-11.60	-38.05	70.53	61.51	738.072063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	16.00	114.48	8457.92	3397.82	5060.10	1.84	2.37	455.44	-41	64.01	2025.88	19.51
360.696	51.940	-11.65	-38.21	70.69	61.67	740.040063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	16.00	114.48	8476.69	3408.05	5068.64	1.84	2.37	457.81	-41	64.17	2036.42	19.56
361.696	52.084	-11.70	-38.38	70.86	61.83	742.008063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	16.00	114.48	8495.47	3418.28	5077.18	1.84	2.36	460.17	-41	64.33	2046.93	19.61
362.696	52.228	-11.75	-38.54	71.02	62.00	743.976063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	16.00	114.48	8514.24	3428.52	5085.73	1.83	2.36	462.53	-41	64.50	2057.43	19.66
363.696	52.372	-11.80	-38.70	71.18	62.16	745.944063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	16.00	114.48	8533.02	3438.75	5094.27	1.83	2.36	464.88	-41	64.66	2067.90	19.71
364.696	52.516	-11.85	-38.87	71.35	62.33	747.912063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	16.00	114.48	8551.79	3448.99	5102.81	1.82	2.35	467.23	-41	64.83	2078.36	19.76
365.696	52.660	-11.90	-39.03	71.51	62.49	749.880063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.36	0.36	16.00	114.48	8570.57	3459.22	5111.35	1.82	2.34	469.58	-42	64.99	2088.78	19.81
366.696	52.804	-11.95	-39.20	71.68	62.65	751.848063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	16.00	114.48	8589.34	3469.45	5119.89	1.82	2.34	471.92	-42	65.15	2099.19	19.86
367.696	52.948	-12.00	-39.36	71.84	62.82	753.816063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	16.00	114.48	8608.12	3479.69	5128.43	1.81	2.34	474.25	-42	65.32	2109.58	19.91
368.696	53.092	-12.05	-39.52	72.00	62.98	755.784063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	16.00	114.48	8626.89	3489.92	5136.97	1.81	2.33	476.58	-42	65.48	2119.94	19.96
369.696	53.236	-12.10	-39.69	72.17	63.15	757.752063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	16.00	114.48	8645.67	3500.15	5145.51	1.81	2.33	478.91	-42	65.65	2130.29	20.01
370.696	53.380	-12.15	-39.85	72.33	63.31	759.720063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	16.00	114.48	8664.44	3510.39	5154.05	1.80	2.32	481.23	-42	65.81	2140.61	20.06
371.696	53.524	-12.20	-40.02	72.50	63.47	761.688063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	16.00	114.48	8683.22	3520.62	5162.60	1.80	2.32	483.55	-43	65.97	2150.92	20.11
372.696	53.668	-12.25	-40.18	72.66	63.64	763.656063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	16.00	114.48	8701.99	3530.85	5171.14	1.79	2.31	485.86	-43	66.14	2161.20	20.16
373.696	53.812	-12.30	-40.34	72.82	63.80	765.624063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.35	0.35	16.00	114.48	8720.77	3541.09	5179.68	1.79	2.31	488.16	-43	66.30	2171.48	20.21
374.696	53.956	-12.35	-40.51	72.99	63.97	767.592063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	16.00	114.48	8739.54	3551.32	5188.22	1.79	2.30	490.47	-43	66.47	2181.70	20.26
375.696	54.100	-12.40	-40.67	73.15	64.13	769.560063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	16.00	114.48	8758.32	3561.55	5196.76	1.78	2.30	492.76	-43	66.63	2191.91	20.31
376.696	54.244	-12.45	-40.84	73.32	64.29	771.528063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	16.00	114.48	8777.09	3571.79	5205.30	1.78	2.29	495.05	-43	66.79	2202.11	20.36
377.696	54.388	-12.50	-41.00	73.48	64.46	773.496063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	16.00	114.48	8795.87	3582.02	5213.84	1.78	2.29	497.34	-44	66.96	2212.28	20.41
378.696	54.532	-12.55	-41.16	73.64	64.62	775.464063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	16.00	114.48	8814.64	3592.26	5222.38	1.77	2.28	499.62	-44	67.12	2222.43	20.46
379.696	54.676	-12.60	-41.33	73.81	64.79	777.432063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	16.00	114.48	8833.41	3602.49	5230.93	1.77	2.28	501.90	-44	67.29	2232.56	20.51
380.696	54.820	-12.65	-41.49	73.97	64.95	779.400063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	16.00	114.48	8852.19	3612.72	5239.47	1.76	2.27	504.17	-44	67.45	2242.67	20.56
381.696	54.964	-12.70	-41.66	74.14	65.11	781.368063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.34	0.34	16.00	114.48	8870.96	3622.96	5248.01	1.76	2.27	506.44	-44	67.61	2252.75	20.61
382.696	55.108	-12.75	-41.82	74.30	65.28	783.336063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.33	0.33	16.00	114.48	8889.74	3633.19	5256.55	1.76	2.26	508.70	-44	67.78	2262.81	20.66
383.696	55.252	-12.80	-41.98	74.46	65.44	785.304063		0.00	0.00	0.000	1	0.55	0.55	0.000	0.00	30	0.33	0.33	16.00	114.48	8908.51	3643.42	5265.09	1.76	2.26	510.96	-44	67.94	2272.85	20.71
																									FOS	1.33				

```
LPILEP4
SR4 Loveridge OC - AB1L B.O.F = 9.500m Free Head Conditions
2       3       1       1       0       0
100     2       -1.7    4       0
0       0.355   0.0007849       0.09931 32000000
4       0.355   0.0007849       0.09931 32000000
7       14      14      0       0
3       -1.7    0.2     271000  271000
4       0.2     2.5     24430   24430
3       2.5     4.5     271000  271000
3       4.5     6.3     271000  271000
3       6.3     14.6    271000  271000
4       14.6    19.2    33900   33900
4       19.2    20.9    33900   33900
-1.7    19.2
0.2     19.2
0.2     15.5
2.5     15.5
2.5     19.2
4.5     19.2
4.5     9.39
6.3     9.39
6.3     8.49
14.6    8.49
14.6    8.19
19.2    8.19
19.2    8.19
20.9    8.19
-1.7    100     0       0.005   0
0.2     100     0       0.005   0
0.2     0       33      0       0
2.5     0       33      0       0
2.5     100     0       0.005   0
4.5     100     0       0.005   0
4.5     100     0       0.005   0
6.3     100     0       0.005   0
6.3     100     0       0.005   0
14.6    100     0       0.005   0
14.6    0       35      0       0
19.2    0       35      0       0
19.2    0       36      0       0
20.9    0       36      0       0
0       1       1
1
1       152     0       300
0
1       1       0
100     2.54E-7 2.54
8       1
300
41000   270000  0       0
0       0.355   0       0       0
9.29E-5 4       0       0.0625
445     0       0.025
```

```
LPILEP4
SR4 Loveridge OC - AB1L B.O.F = 10.750m Free Head Conditions
2         3         1         1         0         0
100       2         -4.8      5         0
0         0.355     0.0007849           0.09931   32000000
5         0.355     0.0007849           0.09931   32000000
7         14        14        0         0
3         -4.8      1.45      271000    271000
4         1.45      3.75      24430     24430
3         3.75      5.75      271000    271000
3         5.75      7.55      271000    271000
3         7.55      15.85     271000    271000
4         15.85     20.45     33900     33900
4         20.45     22.15     33900     33900
-4.8      19.2
1.45      19.2
1.45      15.5
3.75      15.5
3.75      19.2
5.75      19.2
5.75      9.39
7.55      9.39
7.55      8.49
15.85     8.49
15.85     8.19
20.45     8.19
20.45     8.19
22.15     8.19
-4.8      100       0         0.005     0
1.45      100       0         0.005     0
1.45      0         33        0         0
3.75      0         33        0         0
3.75      100       0         0.005     0
5.75      100       0         0.005     0
5.75      100       0         0.005     0
7.55      100       0         0.005     0
7.55      100       0         0.005     0
15.85     100       0         0.005     0
15.85     0         35        0         0
20.45     0         35        0         0
20.45     0         36        0         0
22.15     0         36        0         0
0         1         1
1
1         149       0         300
0
1         1         0
100       2.54E-7   2.54
8         1
300
41000     270000    0         0
0         0.355     0         0         0
9.29E-5   4         0         0.0625
445       0         0.025
```

```
LPILEP4
SR4 Loveridge OC - AB1L B.O.F = 11.950m Free Head Conditions
2       3       1       1       0       0
100     2       -5      5.5     0
0       0.355   0.0007849       0.09931 32000000
5.5     0.355   0.0007849       0.09931 32000000
7       14      14      0       0
3       -5      2.65    271000  271000
4       2.65    4.95    24430   24430
3       4.95    6.95    271000  271000
3       6.95    8.75    271000  271000
3       8.75    17.05   271000  271000
4       17.05   21.65   33900   33900
4       21.65   23.35   33900   33900
-5      19.2
2.65    19.2
2.65    15.5
4.95    15.5
4.95    19.2
6.95    19.2
6.95    9.39
8.75    9.39
8.75    8.49
17.05   8.49
17.05   8.19
21.65   8.19
21.65   8.19
23.35   8.19
-5      100     0       0.005   0
2.65    100     0       0.005   0
2.65    0       33      0       0
4.95    0       33      0       0
4.95    100     0       0.005   0
6.95    100     0       0.005   0
6.95    100     0       0.005   0
8.75    100     0       0.005   0
8.75    100     0       0.005   0
17.05   100     0       0.005   0
17.05   0       35      0       0
21.65   0       35      0       0
21.65   0       36      0       0
23.35   0       36      0       0
0       1       1
1
1       149     0       300
0
1       1       0
100     2.54E-7 2.54
8       1
300
41000   270000  0       0
0       0.355   0       0       0
9.29E-5 4       0       0.0625
445     0       0.025
```

```
LPILEP4
SR4 Loveridge OC - AB1L B.O.F = 13.200m Free Head Conditions
2       3       1       1       0       0
100     2       -5.1    4       0
0       0.355   0.0007849       0.09931 32000000
4       0.355   0.0007849       0.09931 32000000
7       14      14      0       0
3       -5.1    3.9     271000  271000
4       3.9     6.2     24430   24430
3       6.2     8.2     271000  271000
3       8.2     10      271000  271000
3       10      18.3    271000  271000
4       18.3    22.9    33900   33900
4       22.9    24.6    33900   33900
-5.1    19.2
3.9     19.2
3.9     15.5
6.2     15.5
6.2     19.2
8.2     19.2
8.2     9.39
10      9.39
10      8.49
18.3    8.49
18.3    8.19
22.9    8.19
22.9    8.19
24.6    8.19
-5.1    100     0       0.005   0
3.9     100     0       0.005   0
3.9     0       33      0       0
6.2     0       33      0       0
6.2     100     0       0.005   0
8.2     100     0       0.005   0
8.2     100     0       0.005   0
10      100     0       0.005   0
10      100     0       0.005   0
18.3    100     0       0.005   0
18.3    0       35      0       0
22.9    0       35      0       0
22.9    0       36      0       0
24.6    0       36      0       0
0       1       1
1
1       149     0       300
0
1       1       0
100     2.54E-7 2.54
8       1
300
41000   270000  0       0
0       0.355   0       0       0
9.29E-5 4       0       0.0625
445     0       0.025
```

```
LPILEP4
SR4 Loveridge OC - AB1R B.O.F = 9.200m Free Head Conditions
2       3       1       1       0       0
100     2       -1.8    4       0
0       0.355   0.0007849       0.09931 32000000
4       0.355   0.0007849       0.09931 32000000
7       14      14      0       0
3       -1.8    -0.1    271000  271000
4       -0.1    2.2     24430   24430
3       2.2     4.2     271000  271000
3       4.2     6       271000  271000
3       6       14.3    271000  271000
4       14.3    18.9    33900   33900
4       18.9    20.6    33900   33900
-1.8    19.2
-0.1    19.2
-0.1    15.5
2.2     15.5
2.2     19.2
4.2     19.2
4.2     9.39
6       9.39
6       8.49
14.3    8.49
14.3    8.19
18.9    8.19
18.9    8.19
20.6    8.19
-1.8    100     0       0.005   0
-0.1    100     0       0.005   0
-0.1    0       33      0       0
2.2     0       33      0       0
2.2     100     0       0.005   0
4.2     100     0       0.005   0
4.2     100     0       0.005   0
6       100     0       0.005   0
6       100     0       0.005   0
14.3    100     0       0.005   0
14.3    0       35      0       0
18.9    0       35      0       0
18.9    0       36      0       0
20.6    0       36      0       0
0       1       1
1
1       135     0       300
0
1       1       0
100     2.54E-7 2.54
8       1
300
41000   270000  0       0
0       0.355   0       0       0
9.29E-5 4       0       0.0625
445     0       0.025
```

```
LPILEP4
SR4 Loveridge OC - AB1R B.O.F = 10.450m Free Head Conditions
2       3       1       1       0       0
100     2       -4.7    5       0
0       0.355   0.0007849       0.09931 32000000
5       0.355   0.0007849       0.09931 32000000
7       14      14      0       0
3       -4.7    1.15    271000  271000
4       1.15    3.45    24430   24430
3       3.45    5.45    271000  271000
3       5.45    7.25    271000  271000
3       7.25    15.55   271000  271000
4       15.55   20.15   33900   33900
4       20.15   21.85   33900   33900
-4.7    19.2
1.15    19.2
1.15    15.5
3.45    15.5
3.45    19.2
5.45    19.2
5.45    9.39
7.25    9.39
7.25    8.49
15.55   8.49
15.55   8.19
20.15   8.19
20.15   8.19
21.85   8.19
-4.7    100     0       0.005   0
1.15    100     0       0.005   0
1.15    0       33      0       0
3.45    0       33      0       0
3.45    100     0       0.005   0
5.45    100     0       0.005   0
5.45    100     0       0.005   0
7.25    100     0       0.005   0
7.25    100     0       0.005   0
15.55   100     0       0.005   0
15.55   0       35      0       0
20.15   0       35      0       0
20.15   0       36      0       0
21.85   0       36      0       0
0       1       1
1
1       149     0       300
0
1       1       0
100     2.54E-7 2.54
8       1
300
41000   270000  0       0
0       0.355   0       0       0
9.29E-5 4       0       0.0625
445     0       0.025
```

```
LPILEP4
SR4 Loveridge OC - AB1R B.O.F = 11.650m Free Head Conditions
2       3       1       1       0       0
100     2       -4.7    5.5     0
0       0.355   0.0007849       0.09931 32000000
5.5     0.355   0.0007849       0.09931 32000000
7       14      14      0       0
3       -4.7    2.35    271000  271000
4       2.35    4.65    24430   24430
3       4.65    6.65    271000  271000
3       6.65    8.45    271000  271000
3       8.45    16.75   271000  271000
4       16.75   21.35   33900   33900
4       21.35   23.05   33900   33900
-4.7    19.2
2.35    19.2
2.35    15.5
4.65    15.5
4.65    19.2
6.65    19.2
6.65    9.39
8.45    9.39
8.45    8.49
16.75   8.49
16.75   8.19
21.35   8.19
21.35   8.19
23.05   8.19
-4.7    100     0       0.005   0
2.35    100     0       0.005   0
2.35    0       33      0       0
4.65    0       33      0       0
4.65    100     0       0.005   0
6.65    100     0       0.005   0
6.65    100     0       0.005   0
8.45    100     0       0.005   0
8.45    100     0       0.005   0
16.75   100     0       0.005   0
16.75   0       35      0       0
21.35   0       35      0       0
21.35   0       36      0       0
23.05   0       36      0       0
0       1       1
1
1       149     0       300
0
1       1       0
100     2.54E-7 2.54
8       1
300
41000   270000  0       0
0       0.355   0       0       0
9.29E-5 4       0       0.0625
445     0       0.025
```

```
LPILEP4
SR4 Loveridge OC - AB1R B.O.F = 12.900m Free Head Conditions
2       3       1       1       0       0
100     2       -4.7    4       0
0       0.355   0.0007849       0.09931 32000000
4       0.355   0.0007849       0.09931 32000000
7       14      14      0       0
3       -4.7    3.6     271000  271000
4       3.6     5.9     24430   24430
3       5.9     7.9     271000  271000
3       7.9     9.7     271000  271000
3       9.7     18      271000  271000
4       18      22.6    33900   33900
4       22.6    24.3    33900   33900
-4.7    19.2
3.6     19.2
3.6     15.5
5.9     15.5
5.9     19.2
7.9     19.2
7.9     9.39
9.7     9.39
9.7     8.49
18      8.49
18      8.19
22.6    8.19
22.6    8.19
24.3    8.19
-4.7    100     0       0.005   0
3.6     100     0       0.005   0
3.6     0       33      0       0
5.9     0       33      0       0
5.9     100     0       0.005   0
7.9     100     0       0.005   0
7.9     100     0       0.005   0
9.7     100     0       0.005   0
9.7     100     0       0.005   0
18      100     0       0.005   0
18      0       35      0       0
22.6    0       35      0       0
22.6    0       36      0       0
24.3    0       36      0       0
0       1       1
1
1       149     0       300
0
1       1       0
100     2.54E-7 2.54
8       1
300
41000   270000  0       0
0       0.355   0       0       0
9.29E-5 4       0       0.0625
445     0       0.025
```

```
LPILEP4
SR4 Loveridge OC - AB4L B.O.F = 8.500m Free Head Conditions
2       3       1       1       0       0
100     2       -1.75   6       0
0       0.355   0.0007849       0.09931 32000000
6       0.355   0.0007849       0.09931 32000000
7       14      14      0       0
3       -1.75   1.4     271000  271000
4       1.4     2.2     24430   24430
3       2.2     3.5     136000  136000
3       3.5     10.5    136000  136000
3       10.5    15.2    136000  136000
3       15.2    19.7    271000  271000
4       19.7    21.3    33900   33900
-1.75   18
1.4     18
1.4     18
2.2     18
2.2     18
3.5     18
3.5     8.19
10.5    8.19
10.5    10.19
15.2    10.19
15.2    10.19
19.7    10.19
19.7    8.19
21.3    8.19
-1.75   100     0       0.005   0
1.4     100     0       0.005   0
1.4     0       33      0       0
2.2     0       33      0       0
2.2     50      0       0.007   0
3.5     50      0       0.007   0
3.5     50      0       0.007   0
10.5    50      0       0.007   0
10.5    90      0       0.007   0
15.2    90      0       0.007   0
15.2    120     0       0.005   0
19.7    120     0       0.005   0
19.7    0       36      0       0
21.3    0       36      0       0
0       1       1
1
1       108     0       300
0
1       1       0
100     2.54E-7 2.54
8       1
108
42000   270000  0       0
0       0.355   0       0       0
9.29E-5 6       0       0.0625
445     0       0.025
```

```
LPILEP4
SR4 Loveridge OC - AB4L B.O.F = 9.700m Free Head Conditions
2       3       1       1       0       0
100     2       -5.6    6       0
0       0.355   0.0007849       0.09931 32000000
6       0.355   0.0007849       0.09931 32000000
8       16      16      0       0
3       -5.6    -0.55   271000  271000
3       -0.55   2.6     136000  136000
4       2.6     3.4     24430   24430
3       3.4     4.7     136000  136000
3       4.7     11.7    136000  136000
3       11.7    16.4    136000  136000
3       16.4    20.9    271000  271000
4       20.9    22.5    33900   33900
-5.6    19
-0.55   19
-0.55   19
2.6     19
2.6     18
3.4     18
3.4     18
4.7     18
4.7     8.19
11.7    8.19
11.7    10.19
16.4    10.19
16.4    10.19
20.9    10.19
20.9    8.19
22.5    8.19
-5.6    100     0       0.005   0
-0.55   100     0       0.005   0
-0.55   100     0       0.007   0
2.6     100     0       0.007   0
2.6     0       33      0       0
3.4     0       33      0       0
3.4     50      0       0.007   0
4.7     50      0       0.007   0
4.7     50      0       0.007   0
11.7    50      0       0.007   0
11.7    90      0       0.007   0
16.4    90      0       0.007   0
16.4    120     0       0.005   0
20.9    120     0       0.005   0
20.9    0       36      0       0
22.5    0       36      0       0
0       1       1
1
1       138     0       300
0
1       1       0
100     2.54E-7 2.54
8       1
300
42000   270000  0       0
0       0.355   0       0       0
9.29E-5 6       0       0.0625
445     0       0.025
```

```
LPILEP4
SR4 Loveridge OC - AB4L B.O.F = 10.950m Free Head Conditions
2       3       1       1       0       0
100     2       -5.6    6       0
0       0.355   0.0007849       0.09931 32000000
6       0.355   0.0007849       0.09931 32000000
8       16      16      0       0
3       -5.6    0.7     271000  271000
3       0.7     3.85    136000  136000
4       3.85    4.65    24430   24430
3       4.65    5.95    136000  136000
3       5.95    12.95   136000  136000
3       12.95   17.65   136000  136000
3       17.65   22.15   271000  271000
4       22.15   23.75   33900   33900
-5.6    18
0.7     18
0.7     18
3.85    18
3.85    18
4.65    18
4.65    18
5.95    18
5.95    8.19
12.95   8.19
12.95   10.19
17.65   10.19
17.65   10.19
22.15   10.19
22.15   8.19
23.75   8.19
-5.6    100     0       0.007   0
0.7     100     0       0.007   0
0.7     50      0       0.005   0
3.85    50      0       0.005   0
3.85    0       33      0       0
4.65    0       33      0       0
4.65    50      0       0.007   0
5.95    50      0       0.007   0
5.95    50      0       0.007   0
12.95   50      0       0.007   0
12.95   90      0       0.007   0
17.65   90      0       0.007   0
17.65   120     0       0.005   0
22.15   120     0       0.005   0
22.15   0       36      0       0
23.75   0       36      0       0
0       1       1
1
1       149     0       300
0
1       1       0
100     2.54E-7 2.54
8       1
300
42000   270000  0       0
0       0.355   0       0       0
9.29E-5 6       0       0.0625
445     0       0.025
```

```
LPILEP4
SR4 Loveridge OC - AB4L B.O.F = 12.150m Free Head Conditions
2       3       1       1       0       0
100     2       -5.5    6       0
0       0.355   0.0007849       0.09931 32000000
6       0.355   0.0007849       0.09931 32000000
8       16      16      0       0
3       -5.5    1.9     271000  271000
3       1.9     5.05    136000  136000
4       5.05    5.85    24430   24430
3       5.85    7.15    136000  136000
3       7.15    14.15   136000  136000
3       14.15   18.85   136000  136000
3       18.85   23.35   271000  271000
4       23.35   24.95   33900   33900
-5.5    18
1.9     18
1.9     18
5.05    18
5.05    18
5.85    18
5.85    18
7.15    18
7.15    8.19
14.15   8.19
14.15   10.19
18.85   10.19
18.85   10.19
23.35   10.19
23.35   8.19
24.95   8.19
-5.5    100     0       0.005   0
1.9     100     0       0.005   0
1.9     50      0       0.007   0
5.05    50      0       0.007   0
5.05    0       33      0       0
5.85    0       33      0       0
5.85    50      0       0.007   0
7.15    50      0       0.007   0
7.15    50      0       0.007   0
14.15   50      0       0.007   0
14.15   90      0       0.007   0
18.85   90      0       0.007   0
18.85   120     0       0.005   0
23.35   120     0       0.005   0
23.35   0       36      0       0
24.95   0       36      0       0
0       1       1
1
1       155     0       300
0
1       1       0
100     2.54E-7 2.54
8       1
300
42000   270000  0       0
0       0.355   0       0       0
9.29E-5 6       0       0.0625
445     0       0.025
```

```
LPILEP4
SR4 Loveridge OC - AB4R B.O.F = 7.050m Free Head Conditions
2       3       1       1       0       0
100     2       -3.2    5       0
0       0.355   0.0007849       0.09931 32000000
5       0.355   0.0007849       0.09931 32000000
7       14      14      0       0
3       -3.2    -0.05   136000  136000
4       -0.05   0.75    24430   24430
3       0.75    2.05    136000  136000
3       2.05    9.05    136000  136000
3       9.05    13.75   136000  136000
3       13.75   18.25   271000  271000
4       18.25   19.85   33900   33900
-3.2    18
-0.05   18
-0.05   18
0.75    18
0.75    18
2.05    18
2.05    8.19
9.05    8.19
9.05    10.19
13.75   10.19
13.75   10.19
18.25   10.19
18.25   8.19
19.85   8.19
-3.2    50      0       0.007   0
-0.05   50      0       0.007   0
-0.05   0       33      0       0
0.75    0       33      0       0
0.75    50      0       0.007   0
2.05    50      0       0.007   0
2.05    50      0       0.007   0
9.05    50      0       0.007   0
9.05    90      0       0.007   0
13.75   90      0       0.007   0
13.75   120     0       0.005   0
18.25   120     0       0.005   0
18.25   0       36      0       0
19.85   0       36      0       0
0       1       1
1
1       125     0       300
0
1       1       0
100     2.54E-7 2.54
8       1
300
41000   270000  0       0
0       0.355   0       0       0
9.29E-5 4       0       0.0625
445     0       0.025
```

```
SR4 Loveridge OC, Bent 2, Stage 1, BOF 7.45m, 765 mm CIDH Piles Load
GROUP7.0.3
2 0 0 1 1 0 0 0 0 3 0 1
1 1
0 100 100 1.0000000E-04 2.5399986E-06 1.0000000E+00 1.0000000E+00
4.5480000E+04 0.0000000E+00 0.0000000E+00 9.9960000E+03 1.5493000E+04 0.0000000E+00
24
1 1   1 0 0 0 0 0 -1.145 12.595 0 90 -2.45 0
1 1   1 0 0 0 0 0 -1.145 10.305 0 90 -2.45 0
1 1   1 0 0 0 0 0 -1.145 8.015 0 90 -2.45 0
1 1   1 0 0 0 0 0 -1.145 5.725 0 90 -2.45 0
1 1   1 0 0 0 0 0 -1.145 3.435 0 90 -2.45 0
1 1   1 0 0 0 0 0 -1.145 1.145 0 90 -2.45 0
1 1   1 0 0 0 0 0 -1.145 -1.145 0 90 -2.45 0
1 1   1 0 0 0 0 0 -1.145 -3.435 0 90 -2.45 0
1 1   1 0 0 0 0 0 -1.145 -5.725 0 90 -2.45 0
1 1   1 0 0 0 0 0 -1.145 -8.015 0 90 -2.45 0
1 1   1 0 0 0 0 0 -1.145 -10.305 0 90 -2.45 0
1 1   1 0 0 0 0 0 -1.145 -12.595 0 90 -2.45 0
1 1   1 0 0 0 0 0 1.145 12.595 0 90 -2.45 0
1 1   1 0 0 0 0 0 1.145 10.305 0 90 -2.45 0
1 1   1 0 0 0 0 0 1.145 8.015 0 90 -2.45 0
1 1   1 0 0 0 0 0 1.145 5.725 0 90 -2.45 0
1 1   1 0 0 0 0 0 1.145 3.435 0 90 -2.45 0
1 1   1 0 0 0 0 0 1.145 1.145 0 90 -2.45 0
1 1   1 0 0 0 0 0 1.145 -1.145 0 90 -2.45 0
1 1   1 0 0 0 0 0 1.145 -3.435 0 90 -2.45 0
1 1   1 0 0 0 0 0 1.145 -5.725 0 90 -2.45 0
1 1   1 0 0 0 0 0 1.145 -8.015 0 90 -2.45 0
1 1   1 0 0 0 0 0 1.145 -10.305 0 90 -2.45 0
1 1   1 0 0 0 0 0 1.145 -12.595 0 90 -2.45 0
1
1 1 100 20 21500000 2
0 20 0.765 0.46 0.034317449 0.034317449 1 1 356955
7 14 14 0
1 10 -2.45 0.35 136000
2 4 0.35 1.15 24430
3 10 1.15 2.45 136000
4 10 2.45 9.45 136000
5 10 9.45 14.15 136000
6 10 14.15 18.65 271000
7 4 18.65 20.25 33900
-2.45 18
0.35 18
0.35 18
1.15 18
1.15 18
2.45 18
2.45 8.19
9.45 8.19
9.45 10.19
14.15 10.19
14.15 10.19
18.65 10.19
18.65 8.19
20.25 8.19
-2.45 50 0 0.007 27.4 450 0
0.35 50 0 0.007 27.4 450 0
0.35 0 33 0 64 1150 0
1.15 0 33 0 69 1150 0
1.15 50 0 0.007 27.4 450 0
2.45 50 0 0.007 27.4 450 0
2.45 50 0 0.007 27.4 450 0
```

```
9.45 50 0 0.007 27.4 450 0
9.45 90 0 0.007 49.5 810 0
14.15 90 0 0.007 49.5 810 0
14.15 120 0 0.005 66 1080 0
18.65 120 0 0.005 66 1080 0
18.65 0 36 0 401 2900 0
20.25 0 36 0 388 2900 0
1.0000000E+00
1
1 1
1896
1 34
19.950578 3.937E-5
99.73051 0.00019685
179.44092 0.00035433
259.03936 0.00051181
337.68987 0.00066929
355.16182 0.00082677
396.93577 0.00098425
435.2683 0.00114173
471.52744 0.00129921
505.91915 0.00145669
539.25213 0.00161417
571.7452 0.00177165
603.59281 0.00192913
634.58968 0.00208661
665.34883 0.00224409
695.84036 0.00240157
725.50723 0.00255906
754.97514 0.00271654
784.39204 0.00287402
813.21862 0.0030315
841.84448 0.00318898
870.49479 0.00334646
898.54687 0.00350394
926.39557 0.00366142
954.03642 0.0038189
981.68703 0.00397638
1179.8211 0.00515748
1348.6443 0.00633858
1429.1324 0.00751969
1494.9514 0.00870079
1531.052 0.00988189
1547.4047 0.01106299
1562.15 0.01224409
1562.15 0.0134252
```

```
SR4 Loveridge OC, Bent 2, Stage 2, BOF 7.10m, 765 mm CIDH Piles Load
GROUP7.0.3
2 0 0 1 1 0 0 0 0 3 0 1
1 1
0 100 100 1.0000000E-04 2.5399986E-06 1.0000000E+00 1.0000000E+00
6.1492000E+04 0.0000000E+00 0.0000000E+00 1.4217000E+04 2.4310000E+04 0.0000000E+00
32
1 1   1 0 0 0 0 0 -1.145 17.175 0 90 -2.8 0
1 1   1 0 0 0 0 0 -1.145 14.885 0 90 -2.8 0
1 1   1 0 0 0 0 0 -1.145 12.595 0 90 -2.8 0
1 1   1 0 0 0 0 0 -1.145 10.305 0 90 -2.8 0
1 1   1 0 0 0 0 0 -1.145 8.015 0 90 -2.8 0
1 1   1 0 0 0 0 0 -1.145 5.725 0 90 -2.8 0
1 1   1 0 0 0 0 0 -1.145 3.435 0 90 -2.8 0
1 1   1 0 0 0 0 0 -1.145 1.145 0 90 -2.8 0
1 1   1 0 0 0 0 0 -1.145 -1.145 0 90 -2.8 0
1 1   1 0 0 0 0 0 -1.145 -3.435 0 90 -2.8 0
1 1   1 0 0 0 0 0 -1.145 -5.725 0 90 -2.8 0
1 1   1 0 0 0 0 0 -1.145 -8.015 0 90 -2.8 0
1 1   1 0 0 0 0 0 -1.145 -10.305 0 90 -2.8 0
1 1   1 0 0 0 0 0 -1.145 -12.595 0 90 -2.8 0
1 1   1 0 0 0 0 0 -1.145 -14.885 0 90 -2.8 0
1 1   1 0 0 0 0 0 -1.145 -17.175 0 90 -2.8 0
1 1   1 0 0 0 0 0 1.145 17.175 0 90 -2.8 0
1 1   1 0 0 0 0 0 1.145 14.885 0 90 -2.8 0
1 1   1 0 0 0 0 0 1.145 12.595 0 90 -2.8 0
1 1   1 0 0 0 0 0 1.145 10.305 0 90 -2.8 0
1 1   1 0 0 0 0 0 1.145 8.015 0 90 -2.8 0
1 1   1 0 0 0 0 0 1.145 5.725 0 90 -2.8 0
1 1   1 0 0 0 0 0 1.145 3.435 0 90 -2.8 0
1 1   1 0 0 0 0 0 1.145 1.145 0 90 -2.8 0
1 1   1 0 0 0 0 0 1.145 -1.145 0 90 -2.8 0
1 1   1 0 0 0 0 0 1.145 -3.435 0 90 -2.8 0
1 1   1 0 0 0 0 0 1.145 -5.725 0 90 -2.8 0
1 1   1 0 0 0 0 0 1.145 -8.015 0 90 -2.8 0
1 1   1 0 0 0 0 0 1.145 -10.305 0 90 -2.8 0
1 1   1 0 0 0 0 0 1.145 -12.595 0 90 -2.8 0
1 1   1 0 0 0 0 0 1.145 -14.885 0 90 -2.8 0
1 1   1 0 0 0 0 0 1.145 -17.175 0 90 -2.8 0
1
1 1 100 19.75 21500000 2
0 19.75 0.765 0.46 0.034317449 0.034317449 1 1 356955
7 14 14 0
1 10 -2.8 0 136000
2 4 0 0.8 24430
3 10 0.8 2.1 136000
4 10 2.1 9.1 136000
5 10 9.1 13.8 136000
6 10 13.8 18.3 271000
7 4 18.3 19.9 33900
-2.8 18
0 18
0 18
0.8 18
0.8 18
2.1 18
2.1 8.19
9.1 8.19
9.1 10.19
13.8 10.19
13.8 10.19
18.3 10.19
18.3 8.19
```

```
19.9 8.19
-2.8 50 0 0.007 27.4 450 0
0 50 0 0.007 27.4 450 0
0 0 33 0 64 1150 0
0.8 0 33 0 69 1150 0
0.8 50 0 0.007 27.4 450 0
2.1 50 0 0.007 27.4 450 0
2.1 50 0 0.007 27.4 450 0
9.1 50 0 0.007 27.4 450 0
9.1 90 0 0.007 49.5 810 0
13.8 90 0 0.007 49.5 810 0
13.8 120 0 0.005 66 1080 0
18.3 120 0 0.005 66 1080 0
18.3 0 36 0 401 2900 0
19.9 0 36 0 388 2900 0
1.0000000E+00
1
1 1
1896
1 34
19.950578 3.937E-5
99.73051 0.00019685
179.44092 0.00035433
259.03936 0.00051181
337.68987 0.00066929
355.16182 0.00082677
396.93577 0.00098425
435.2683 0.00114173
471.52744 0.00129921
505.91915 0.00145669
539.25213 0.00161417
571.7452 0.00177165
603.59281 0.00192913
634.58968 0.00208661
665.34883 0.00224409
695.84036 0.00240157
725.50723 0.00255906
754.97514 0.00271654
784.39204 0.00287402
813.21862 0.0030315
841.84448 0.00318898
870.49479 0.00334646
898.54687 0.00350394
926.39557 0.00366142
954.03642 0.0038189
981.68703 0.00397638
1179.8211 0.00515748
1348.6443 0.00633858
1429.1324 0.00751969
1494.9514 0.00870079
1531.052 0.00988189
1547.4047 0.01106299
1562.15 0.01224409
1562.15 0.0134252
```

```
SR4 Loveridge OC, Bent 3, Stage 1, BOF 7.15m, 765 mm CIDH Piles Load
GROUP7.0.3
2 0 0 1 1 0 0 0 0 3 0 1
1 1
0 100 100 1.0000000E-04 2.5399986E-06 1.0000000E+00 1.0000000E+00
4.2329000E+04 0.0000000E+00 0.0000000E+00 9.3410000E+03 1.5973000E+04 0.0000000E+00
24
1 1   1 0 0 0 0 0 -1.145 13.74 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 11.45 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 9.16 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 6.87 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 4.58 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 2.29 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 0 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 -2.29 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 -4.58 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 -6.87 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 -9.16 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 -11.45 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 -13.74 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 13.74 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 11.45 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 9.16 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 6.87 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 4.58 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 2.29 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 0 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 -2.29 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 -4.58 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 -6.87 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 -9.16 0 90 -2.75 0
1
1 1 100 19.6 21500000 2
0 19.6 0.765 0.46 0.034317449 0.034317449 1 1 356955
7 14 14 0
1 10 -2.75 0.05 136000
2 4 0.05 0.85 24430
3 10 0.85 2.15 136000
4 10 2.15 9.15 136000
5 10 9.15 13.85 136000
6 10 13.85 18.35 271000
7 4 18.35 19.95 33900
-2.75 18
0.05 18
0.05 18
0.85 18
0.85 18
2.15 18
2.15 8.19
9.15 8.19
9.15 10.19
13.85 10.19
13.85 10.19
18.35 10.19
18.35 8.19
19.95 8.19
-2.75 50 0 0.007 27.4 450 0
0.05 50 0 0.007 27.4 450 0
0.05 0 33 0 64 1150 0
0.85 0 33 0 69 1150 0
0.85 50 0 0.007 27.4 450 0
2.15 50 0 0.007 27.4 450 0
2.15 50 0 0.007 27.4 450 0
```

```
9.15 50 0 0.007 27.4 450 0
9.15 90 0 0.007 49.5 810 0
13.85 90 0 0.007 49.5 810 0
13.85 120 0 0.005 66 1080 0
18.35 120 0 0.005 66 1080 0
18.35 0 36 0 401 2900 0
19.95 0 36 0 388 2900 0
1.0000000E+00
1
1 1
1896
1 34
19.950578 3.937E-5
99.73051 0.00019685
179.44092 0.00035433
259.03936 0.00051181
337.68987 0.00066929
355.16182 0.00082677
396.93577 0.00098425
435.2683 0.00114173
471.52744 0.00129921
505.91915 0.00145669
539.25213 0.00161417
571.7452 0.00177165
603.59281 0.00192913
634.58968 0.00208661
665.34883 0.00224409
695.84036 0.00240157
725.50723 0.00255906
754.97514 0.00271654
784.39204 0.00287402
813.21862 0.0030315
841.84448 0.00318898
870.49479 0.00334646
898.54687 0.00350394
926.39557 0.00366142
954.03642 0.0038189
981.68703 0.00397638
1179.8211 0.00515748
1348.6443 0.00633858
1429.1324 0.00751969
1494.9514 0.00870079
1531.052 0.00988189
1547.4047 0.01106299
1562.15 0.01224409
1562.15 0.0134252
```

```
SR4 Loveridge OC, Bent 3, Stage 2, BOF 7.10m, 765 mm CIDH Piles Load
GROUP7.0.3
2 0 0 1 1 0 0 0 0 3 0 1
1 1
0 100 100 1.0000000E-04 2.5399986E-06 1.0000000E+00 1.0000000E+00
5.4802000E+04 0.0000000E+00 0.0000000E+00 1.3345000E+04 2.2820000E+04 0.0000000E+00
32
1 1   1 0 0 0 0 0 -1.145 17.175 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 14.885 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 12.595 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 10.305 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 8.015 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 5.725 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 3.435 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 1.145 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 -1.145 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 -3.435 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 -5.725 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 -8.015 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 -10.305 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 -12.595 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 -14.885 0 90 -2.75 0
1 1   1 0 0 0 0 0 -1.145 -17.175 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 17.175 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 14.885 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 12.595 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 10.305 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 8.015 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 5.725 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 3.435 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 1.145 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 -1.145 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 -3.435 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 -5.725 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 -8.015 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 -10.305 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 -12.595 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 -14.885 0 90 -2.75 0
1 1   1 0 0 0 0 0 1.145 -17.175 0 90 -2.75 0
1
1 1 100 19.6 21500000 2
0 19.6 0.765 0.46 0.034317449 0.034317449 1 1 356955
7 14 14 0
1 10 -2.75 0.05 136000
2 4 0.05 0.85 24430
3 10 0.85 2.15 136000
4 10 2.15 9.15 136000
5 10 9.15 13.85 136000
6 10 13.85 18.35 271000
7 4 18.35 19.95 33900
-2.85 18
0.05 18
0.05 18
0.85 18
0.85 18
2.15 18
2.15 8.19
9.15 8.19
9.15 10.19
13.85 10.19
13.85 10.19
18.35 10.19
18.35 8.19
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19.95 8.19
-2.85 50 0 0.007 27.4 450 0
0.05 50 0 0.007 27.4 450 0
0.05 0 33 0 64 1150 0
0.85 0 33 0 69 1150 0
0.85 50 0 0.007 27.4 450 0
2.15 50 0 0.007 27.4 450 0
2.15 50 0 0.007 27.4 450 0
9.15 50 0 0.007 27.4 450 0
9.15 90 0 0.007 49.5 810 0
13.85 90 0 0.007 49.5 810 0
13.85 120 0 0.005 66 1080 0
18.35 120 0 0.005 66 1080 0
18.35 0 36 0 401 2900 0
19.95 0 36 0 388 2900 0
1.0000000E+00
1
1 1
1896
1 34
19.950578 3.937E-5
99.73051 0.00019685
179.44092 0.00035433
259.03936 0.00051181
337.68987 0.00066929
355.16182 0.00082677
396.93577 0.00098425
435.2683 0.00114173
471.52744 0.00129921
505.91915 0.00145669
539.25213 0.00161417
571.7452 0.00177165
603.59281 0.00192913
634.58968 0.00208661
665.34883 0.00224409
695.84036 0.00240157
725.50723 0.00255906
754.97514 0.00271654
784.39204 0.00287402
813.21862 0.0030315
841.84448 0.00318898
870.49479 0.00334646
898.54687 0.00350394
926.39557 0.00366142
954.03642 0.0038189
981.68703 0.00397638
1179.8211 0.00515748
1348.6443 0.00633858
1429.1324 0.00751969
1494.9514 0.00870079
1531.052 0.00988189
1547.4047 0.01106299
1562.15 0.01224409
1562.15 0.0134252
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LIQUEFACTION ANALYSIS

Project	SR4 Pump Plant				
Proj. #					
Boring	B-7				
PGA =	0.6	(97), Boore et al. (97), and Sadigh et al. (97)			
M_w =	7				
eff-strair	0.6				
GW exis	26.2	ft	8	m	
GW-EQ	26.2	ft	8	m	

Sampler	Symbol	Corr. Factor
SPT	S	1
Mod.Cal	M	0.8
Californi	C	0.7

Hammer type :	Type		C_E	Code
	Donut		0.75	1
	Safety		0.95	2
	Auto		1.05	3
Borehole Diameter	(inch)	(mm)	C_B	
	2.5-4.5	65-115	1	1
	6	150	1.05	2
	8	200	1.15	3
Rod Length	(feet)	(m)	C_R	
	Default			999
Sampling Method	Type		Cs	
	Stand		1	1
	No liners		1.2	2

Magnitude Scaling Meth = [I] (for M<7.5, I for Idriss, A for Andrus and Stokoe, or Ave for an Average of the two [Defaults to Idriss and Idriss for M>7.5])

Tokimatsu & Seed (1984)

Soil USCS	Depth ft	Depth m	In situ γ_m kN.m^3	γ_m pcf	σ_o psf	u psf	σ'_o psf	rd	CSR	N raw	Sampler	N SPT	Fines Content %	In-Situ C_N	C_E	C_B	C_R	C_S	In-Situ $(N_1)_{60-cs}$	$CRR_{7.5,1tsf}$ Critical	Magnitude Correction NCEER K_m Middle	K_σ	K_α	Above GWT?	F.S. NCEER	Magnitude Scaled CSR	Vol Strain (%)	Settlement (mm)	Settlement (inches)
SM	11.48	3.50	16.61	105.6	1212.74	0	1213	0.973	0.350	26	M	20.8	15	1.32	1.05	1.00	0.75	1.00	25	0.287	1.22	1.000	1.00	Y	-				
ML	31.16	9.50	18.35	116.7	3508.89	307	3202	0.920	0.363	19	M	15.2	57	0.81	1.05	1.00	0.95	1.00	19	0.203	1.22	0.934	1.00	N	0.64	0.3258	1.50	15	0.59

N_{SPT}	if mod cal, N x 0.8
C_N	$(1/\sigma_v')$^0.5 in tsf
$(N_1)_{60}$	N_{SPT} x C_N x correction factors
$(N_1)_{60cs}$	NCEER eqn 5 pg 7
CSR	NCEER Fig 2 pg 6
K_M	NCEER Fig 12 pg 26
K_σ	NCEER Fig 13 pg 30
K_α	NCEER not adviseable pg 31
CSR_{SqMo}	CSR_{Sq} x K_M x K_σ x K_α
r_d	from NCEER eqn 2 pg 3
CSR_{eq}	0.65 x amax x (σ_v/σ_v') x r_d
FS_{liq}	CSR_{SqMod}/CSR_{eq}

LIQUEFACTION ANALYSIS

Project	SR4 Loveridge Road			
Proj. #				
Boring	B-9			
PGA =	0.6	; (97), Boore et al. (97), and Sadigh et al. (97)		
N_{eq} =	7			
eff-strain	0.65			
GW exist.	42.6	ft	13	m
GW-EQ	42.6	ft	13	m

Sampler:	Symbol	Corr. Factor
SPT	S	1
Mod.Cal	M	0.8
California	C	0.7

Hammer type:	Type		C_B	Code
	Donut		0.75	1
	Safety		0.95	2
	Auto		1.05	3
Borehole Diameter	(inch)	(mm)	C_B	
	2.5-4.5	65-115	1	1
	6	150	1.05	2
	8	200	1.15	3
Rod Length	(feet)	(m)	C_R	
	Default			999
Sampling Method	Type		Cs	
	Stand		1	1
	No liners		1.2	2

Magnitude Scaling Mech = [I] (for M<7.5, I for Idriss, A for Andrus and Stokoe, or Ave for an Average of the two [Defaults to Idriss and Idriss for M>7.5])

Soil USCS	Depth ft	Depth m	γ_m kN.m3	γ_m pcf	σ_o psf	In situ u psf	In situ σ'_o psf	EQ u psf	EQ σ'_o psf	EQ rd	EQ CSR	H raw	Sampler	N SPT	Fines Conte %	In-Situ C_N	EQ C_N	C_E	C_B	C_R	C_S	In-Situ $(N\ 1)_{60cs}$	EQ $(N\ 1)_{60cs}$	$CRR_{7.5,1ref}$ Critical	Magnitude Corrections Idriss, 95 NS	NCEER K_{Mc} Lower	Upper	Magnitude Correction NCEER K_{Mc} Middle	K_σ	K_α	Above GWT?	F.S. NCEER	Magnitude Scaled CSR	Vol Strain (%)	thickness (m)	Settlement (mm)	Settlement (inches)
SM	11.48	3.5	19.15	121.8	1398.49	0	1398	0	1398	0.973	0.380	14	M	11.2	28	1.23	1.23	1.05	1.00	0.75	1.00	17	17	0.181	1.190	1.19	1.26	1.22	1.000	1.00	Y	-	0.3182				
SC	28.24	8.0	19.15	121.8	3198.54	0	3197	0	3197	0.939	0.366	18	M	14.4	28	0.81	0.81	1.05	1.00	0.95	1.00	17	17	0.184	1.190	1.19	1.26	1.22	0.935	1.00	Y	-	0.3284				
SC	41.00	12.5	20.59	131.0	5129.59	0	5130	0	5130	0.840	0.328	18	M	14.4	28	0.64	0.64	1.05	1.00	1.00	1.00	14	14	0.153	1.190	1.19	1.26	1.22	0.641	1.00	Y	-	0.3267				
SP	90.20	27.5	20.59	131.0	11573.07	2968	8605	2968	8605	0.524	0.275	97	M	77.6	28	0.50	0.50	1.05	1.00	1.00	1.00	48	48	1.050	1.190	1.19	1.26	1.22	0.725	1.00	N	3.39	0.3180				

N_{SPT} if mod cal, N x 0.8
C_N $(1/\sigma_o')^{0.5}$ in tsf
$(N_1)_{60}$ N_{SPT} x C_N x correction factors
$(N_1)_{60-60cs}$ NCEER eqn 5 pg 7
CSR NCEER Fig 2 pg 6
K_M NCEER Fig 12 pg 26
K_σ NCEER Fig 13 pg 30
K_α NCEER not advisable pg 31
CSR_{eqm} CSR_{eq} x K_M x K_σ x K_α
r_d from NCEER eqn 2 pg 3
CSR_{eq} 0.65 x amax x (σ_o/σ_o') x r_d
FS_{Sq} CSR_{eqm}/CSR_{eq}

LIQUEFACTION ANALYSIS

Project	SR4 Loveridge Road				
Proj. #					
Boring	B-10				
PGA =	0.6	s (97), Boore et al. (97), and Sadigh et al. (97)			
M_w =	7				
eff-strain	0.65				
GW exist.	42.6	ft	13	m	
GW-EQ	42.6	ft	13	m	

Sampler:	Symbol	Corr. Factor
SPT	S	1
Mod.Cal	M	0.8
California	C	0.7

Hammer type :	Type		C_E	Code
	Donut		0.75	1
	Safety		0.95	2
	Auto		1.05	3
Borehole Diameter	(inch)	(mm)	C_B	
	2.5-4.5	65-115	1	1
	6	150	1.05	2
	8	200	1.15	3
Rod Length	(feet)	(m)	C_R	
	Default			999
Sampling Method	Type		C_S	
	Stand		1	1
	No liners		1.2	2

18.32679
18.92901
30.35186

Magnitude Scaling Meth = 1 (for M<7.5, 1 for Idriss, A for Andrus and Stokoe, or Ave for an Average of the two [Defaults to Idriss and Idriss for M>7.5])

Soil USCS	Depth ft	Depth m	γ_m kN/m3	γ_m pcf	In situ σ_o psf	In situ u_o psf	In situ σ'_o psf	EQ u_o psf	EQ σ'_o psf	EQ r_d	EQ CSR	N raw	Sampler	N SPT	Fines Conten %	In-Situ C_N	EQ C_N	C_E	C_B	C_R	C_S	In-Situ $(N_1)_{60cs}$	EQ $(N_1)_{60cs}$	$CRR_{7.5,1atm}$ critical	NCEER K_σ Lower	Upper	Magnitude Correction NCEER K_σ Middle	K_α	K_α	Above GWT?	F.S. NCEER	Magnitude Scaled CSR	Vol Strain (%)	Thickness (in)	Settlement (mm)	Settlement (inches)
SP-SM	29.24	8.0	18.84	120.4	3160.561	0	3161	0	3161	0.939	0.266	25	M	20	28	0.82	0.82	1.05	1.00	0.85	1.00	22	22	0.244	1.19	1.26	1.22	0.937	1.00	Y	-	0.3070				
SM	70.52	21.5	18.84	120.4	6494.009	1740	6754	1740	6754	0.800	0.294	36	M	28.8	28	0.56	0.56	1.05	1.00	1.00	1.00	22	22	0.239	1.19	1.26	1.22	0.779	1.00	N	0.78	0.2467	1.00	1.50	15	0.59
SP	90.20	27.5	19.02	122.9	10912.19	2968	7944	2968	7944	0.524	0.281	56	S	56	28	0.52	0.52	1.05	1.00	1.00	1.00	37	37	1.050	1.19	1.26	1.22	0.742	1.00	N	3.40	0.2353				

N_{SPT} If mod cal, N x 0.8
C_N $(1/\sigma_o)^{0.5}$ in tsf
$(N_1)_{60}$ $N_{SPT} \times C_N \times$ correction factors
$(N_1)_{60\,cs}$ NCEER eqn 5 pg 7
CSR NCEER Fig 2 pg 6
K_M NCEER Fig 12 pg 26
K_α NCEER Fig 13 pg 30
K_α NCEER not advisable pg 31
CSR_{spec} $CSR_{eq} \times K_M \times K_\sigma \times K_\alpha$
r_d from NCEER eqn 2 pg 3
CSR_{eq} 0.65 x amax x $(\sigma_o/\sigma_o') \times r_d$
FS_{liq} CSR_{spec}/CSR_{eq}

Settlement due to the additional approach embankment

By: Shobhna Upadhyaya

Side Slopes (H:V)	1.5 : 1
Fill Unit Weight	18.8 kN/m3
Embankment Height	2.0 m
Top width	7.0 m
Bottom Width	10.0 m
Height of equiv. rectangle	1.7 m
Footing Pressure	666.7 psf
Groundwater at	21.3 ft
Depth to Start Sett. Calc.	0.0 ft

Stress Distribution under the Corner of a Uniform Vertical Loading on a Rectangular Area:

Size of loaded area:	Length	32.8	ft	
	Width	32.8	ft	0.2
Size of a quarter of the loaded area	l	16.4	ft	0.54
	b	16.4	ft	

SETTLEMENT DUE TO ADDITIONAL EMBANKMENT 52.3 mm

Layer	Depth (m)	Thickness (m)	Unit Weight (kN/m3)	z (ft)	Thickness (ft)	Unit Wt. (pcf)	CR_c	CCE	σ_{vo} (psf)	Water Pressure (psf)	σ'_{vo} (psf)	R1 lz	R2 bz	R3 lbz	I Factor	$\Delta\sigma$ (psf)	σ'_{vf} (psf)	OCR	σ'_p (psf)	Comp. Range ?	S_{GEOP} (in)	Settlement (mm)
CL	0.25	0.50	19.00	0.8	1.6	120.8	0.028	0.097	99.1	0.0	99.1	16.4	16.4	23.2	1.00	666.6	765.7	2	198.2	Y		
CL	0.75	0.50	19.00	2.5	1.6	120.8	0.028	0.097	297.3	0.0	297.3	16.6	16.6	23.3	1.00	665.1	962.3	2	594.5	Y	0.57	14
CL	1.75	1.50	19.00	5.7	4.9	120.8	0.028	0.097	693.6	0.0	693.6	17.4	17.4	23.9	0.97	648.2	1341.9	2	1387.2	N	0.47	12
CL	3.25	1.50	19.00	10.7	4.9	120.8	0.028	0.097	1288.2	0.0	1288.2	19.6	19.6	25.5	0.87	580.1	1868.3	2	2576.3	N	0.27	7
CL	4.75	1.50	19.30	15.6	4.9	122.7	0.032	0.096	1887.4	0.0	1887.4	22.6	22.6	27.9	0.73	483.7	2371.1	2	3774.8	N	0.19	5
CL	6.00	1.00	19.30	19.7	3.3	122.7	0.032	0.096	2390.6	0.0	2390.6	25.6	25.6	30.4	0.61	404.3	2795.0	2	4781.3	N	0.09	2
CL	7.00	1.00	19.30	23.0	3.3	122.7	0.032	0.096	2793.3	102.3	2690.9	28.2	28.2	32.6	0.52	348.0	3039.0	2	5381.9	N	0.07	2
CL	8.00	1.00	19.30	26.2	3.3	122.7	0.032	0.096	3195.9	307.0	2888.9	30.9	30.9	35.0	0.45	299.5	3188.4	2	5777.7	N	0.05	1
CL	9.00	1.00	19.30	29.5	3.3	122.7	0.032	0.096	3598.5	511.7	3086.8	33.8	33.8	37.5	0.39	258.5	3345.3	2	6173.6	N	0.04	1
CL	10.50	2.00	18.50	34.4	6.6	117.7	0.05	0.159	4185.7	818.7	3367.0	38.1	38.1	41.5	0.31	209.1	3576.1	2	6734.1	N	0.10	3
CL	12.50	2.00	18.50	41.0	6.6	117.7	0.05	0.159	4957.6	1228.0	3729.5	44.2	44.2	47.1	0.24	160.6	3890.2	2	7459.1	N	0.07	2
CL	14.00	1.00	18.50	45.9	3.3	117.7	0.05	0.159	5536.5	1535.0	4001.4	48.8	48.8	51.4	0.20	133.8	4135.2	2	8002.8	N	0.03	1
CL	15.25	1.50	19.30	50.0	4.9	122.7	0.05	0.159	6031.4	1790.9	4240.5	52.6	52.6	55.1	0.17	116.0	4356.5	2	8481.0	N	0.03	1
CL	16.75	1.50	19.30	54.9	4.9	122.7	0.05	0.159	6635.3	2097.9	4537.4	57.3	57.3	59.6	0.15	98.7	4636.2	2	9074.8	N	0.03	1
CL	18.50	2.00	19.00	60.7	6.6	120.8	0.05	0.159	7333.6	2456.1	4877.6	62.9	62.9	65.0	0.12	82.9	4960.4	2	9755.1	N	0.03	1
CL	20.50	2.00	19.00	67.2	6.6	120.8	0.05	0.159	8126.3	2866.4	5260.9	69.2	69.2	71.1	0.10	68.9	5329.8	2	10521.8	N	0.02	1
																					2.06	52.31

Note: z is the depth from the ground surface to the mid point of the sublayer.

Settlement due to the additional approach embankment
Shobhna Upadhyaya

Side Slopes (H:V)	**1.5 : 1**	
Fill Unit Weight	18.8	kN/m3
Embankment Height	2.0	m
Top width	7.0	m
Bottom Width	10.0	m
Height of equiv. rectangl	1.7	m
Footing Pressure	666.7	psf
Groundwater at	36.0	ft
Depth to Start Sett. Calc.	0.0	ft

Stress Distribution under the Corner of a Uniform Vertical Loading on a Rectangular Area:

Size of the Spread Footing:	Length	32.8 ft	ws	0.2
	Width	32.8 ft	e0	0.54
Size of a quarter of the proposed footing:	l	16.4 ft		
	b	16.4 ft		

SETTLEMENT DUE TO COLUMN LOAD **43.7 mm**

Layer	Depth (m)	Thickness (m)	Unit Weight (kN/m3)	z (ft)	Thickness (ft)	Unit Wt. (pcf)	CRc	CCE	σvo (psf)	Water Pressure (psf)	σ'vo (psf)	R1 Iz	R2 bz	R3 Ibz	I Factor	Δσ (psf)	σ'vf (psf)	OCR	σ'p (psf)	Comp. Range ?	S_{GEOP} (in)	Settlement (mm)
CL	0.75	1.5	18.8	2.5	4.9	119.6	0.08	0.4	294.1	0.0	294.1	16.6	16.6	23.3	1.00	665.1	959.2	2	588.3	Y		
CL	2.25	1.5	18.8	7.4	4.9	119.6	0.08	0.4	882.4	0.0	882.4	18.0	18.0	24.3	0.95	630.8	1513.3	2	1764.8	N	1.11	28
CL	3.25	0.5	18.8	10.7	1.6	119.6	0	0	1274.6	0.0	1274.6	19.6	19.6	25.5	0.87	580.1	1854.7	2	2549.2	N	0.00	0
CL	4.5	2	18.8	14.8	6.6	119.6	0.028	0.144	1764.8	0.0	1764.8	22.1	22.1	27.5	0.75	500.2	2265.1	2	3529.6	N	0.24	6
CL	6.5	2	18.8	21.3	6.6	119.6	0.028	0.144	2549.2	0.0	2549.2	26.9	26.9	31.5	0.56	375.2	2924.4	2	5098.4	N	0.13	3
CL	8.25	1.5	18.8	27.1	4.9	119.6	0.028	0.144	3235.5	0.0	3235.5	31.6	31.6	35.6	0.43	288.6	3524.1	2	6471.0	N	0.06	2
CL	9.75	1.5	18.8	32.0	4.9	119.6	0.028	0.144	3823.8	0.0	3823.8	35.9	35.9	39.5	0.35	232.1	4055.9	2	7647.6	N	0.04	1
CL	11.25	1.5	18.8	36.9	4.9	119.6	0.028	0.144	4412.1	56.2	4355.9	40.4	40.4	43.6	0.28	188.9	4544.8	2	8711.8	N	0.03	1
CL	13	2	18.13	42.6	6.6	115.3	0.028	0.144	5084.4	414.3	4670.1	45.7	45.7	48.5	0.23	150.9	4821.0	2	9340.1	N	0.03	1
CL	15	2	18.13	49.2	6.6	115.3	0.028	0.144	5840.8	823.7	5017.1	51.9	51.9	54.4	0.18	119.3	5136.4	2	10034.3	N	0.02	1
CL	17	2	18.13	55.8	6.6	115.3	0.028	0.144	6597.2	1233.0	5364.2	58.1	58.1	60.4	0.14	96.2	5460.4	2	10728.4	N	0.02	0
CL	19	2	18.13	62.3	6.6	115.3	0.028	0.144	7353.6	1642.4	5711.3	64.4	64.4	66.5	0.12	79.0	5790.3	2	11422.5	N	0.01	0
CL	21	2	18.13	68.9	6.6	115.3	0.028	0.144	8110.1	2051.7	6058.3	70.8	70.8	72.7	0.10	65.9	6124.3	2	12116.7	N	0.01	0
CL	23	2	18.13	75.4	6.6	115.3	0.028	0.144	8866.5	2461.1	6405.4	77.2	77.2	78.9	0.08	55.8	6461.2	2	12810.8	N	0.01	0
CL	24.75	1.5	18.8	81.2	4.9	119.6	0.028	0.144	9538.8	2819.2	6719.6	82.8	82.8	84.4	0.07	48.7	6768.2	2	13439.2	N	0.01	0
CL	26.25	1.5	18.8	86.1	4.9	119.6	0.028	0.144	10127.1	3126.2	7000.8	87.6	87.6	89.2	0.07	43.6	7044.4	2	14001.7	N	0.00	0
																					1.72	43.75

Note: z is the depth from the ground surface to the mid point of the sublayer.

URS

Job: SR4-Loveridge Road OC (Replace)
Description: Passive Pressure for Abutments

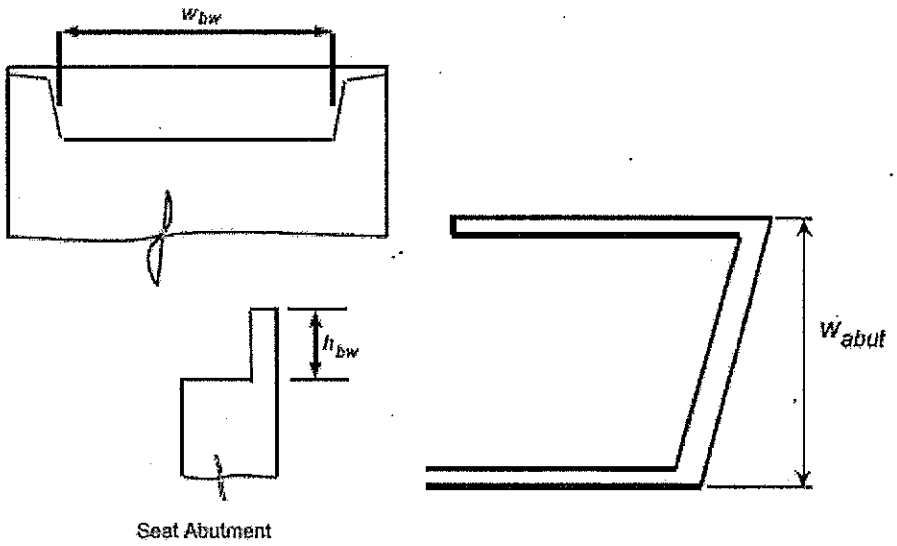
Project No.:26814911
Computed by: SBM
Checked by: Shobhna

Page ____ of ____
Sheet ____ of ____
Date: 01/17/06
Date: 01/26/07

Reference

Objective: To calculate the Passive resistance at abutment according to Caltrans Seismic Design Criteria (CSDC) (V1.3) Section 7.8.1

Data/Assumptions:



Figures 7.14B and 7.14C of CSDC V1.3

Loveridge Road OC is a skewed bridge. Both Abutments (1 and 4) were Seat Abutments.
The following table provides parameters used in the calculations.

Parameter	Abutment 1	Abutment 4
w_{bw} (m)	56.750	59.300
h_{bw} (m)	1.915	1.915
Skew angle, θ (degrees)	42.484	48.547

Parameters from Structural Engineer (Email is Attached)

URS

Job: SR4-Loveridge Road OC (Replace) | Project No.:26814911 | Page ____ of ____
Description: Passive Pressure for Abutments | Computed by: SBM | Sheet ____ of ____
Checked by: Shobhna | Date: 01/17/06
Date: 01/26/07

	Reference
For Abutment 1	
The longitudinal Abutment Response based on Section 7.8.1 of CSDC V1.3	
The maximum passive force, $$P_{bw} = A_e \times 239kPa \times \left(\frac{h_{bw}}{1.7}\right)kN$$ ✓	Eq 7.44 of CSDC
where A_e = the effective area for seat abutments and defined as $$A_e = h_{bw} \times w_{bw}$$ ✓	Eq 7.45 of CSDC
for skewed bridges, Effective abutment width is w_{abut} $$w_{abut} = w_{bw} \times \cos\theta$$ $$w_{abut} = 56.75 \times \cos(42.484)$$ $$w_{abut} = 41.88m$$ ✓	
The effective area, $$A_e = h_{bw} \times w_{bw}$$ $$A_e = 1.915 \times 41.88$$ $$A_e = 80.20m$$ ✓	
Then the maximum passive force, $$P_{bw} = A_e \times 239kPa \times \left(\frac{h_{bw}}{1.7}\right)kN$$ $$P_{bw} = 80.2 \times 239 \times \left(\frac{1.915}{1.7}\right)kN$$ $$P_{bw} = 21{,}592kN$$ ✓	
Say, P_{bw} = 21,600 kN ✓	
Estimated equivalent pressure = $P_{bw} / A_e \times h_{bw}$ = 140 kN/m^3 ✓	
The maximum passive pressure = $239 \times \left(\frac{h_{bw}}{1.7}\right) = 239x\left(\frac{1.915}{1.7}\right) = 269kpa$ ✓	

URS

Job: SR4-Loveridge Road OC (Replace) | Project No.:26814911 | Page ____ of ____
Description: Passive Pressure for Abutments | Computed by: SBM | Sheet ____ of ____
Checked by: Shobhna | Date: 01/17/06
Date: 01/26/07

	Reference
For Abutment 4 (Similar to Abutment 1)	
The longitudinal Abutment Response based on Section 7.8.1 of CSDC V1.3	
The maximum passive force, $$P_{bw} = A_e \times 239kPa \times \left(\frac{h_{bw}}{1.7}\right)kN$$ ✓	Eq 7.44 of CSDC
where A_e = the effective area for seat abutments and defined as $$A_e = h_{bw} \times w_{bw}$$	Eq 7.45 of CSDC
∴ for skewed bridges, Effective abutment width is w_{abut} $$w_{abut} = w_{bw} \times \cos\theta$$ $$w_{abut} = 59.30 \times \cos(48.547)$$ $$w_{abut} = 39.26m$$ ✓	
The effective area $$A_e = h_{bw} \times w_{bw}$$ $$A_e = 1.915 \times 39.26$$ $$A_e = 75.18m$$ ✓	
Then the maximum passive force $$P_{bw} = A_e \times 239kPa \times \left(\frac{h_{bw}}{1.7}\right)kN$$ $$P_{bw} = 75.18 \times 239 \times \left(\frac{1.915}{1.7}\right)kN$$ $$P_{bw} = 20{,}240kN$$ Say, P_{bw} = 20,200 kN ✓	
Estimated equivalent pressure = $P_{bw} / A_e \times h_{bw}$ = 140 kN/m^3	
The maximum passive pressure = $239 \times \left(\frac{h_{bw}}{1.7}\right) = 239x\left(\frac{1.915}{1.7}\right) = 269kpa$ ✓	

7.7.3.4 *Minimum Pile Shaft Length*

Pile shafts must have sufficient length to ensure stable load-deflection characteristics.

7.7.3.5 *Enlarged Pile Shafts*

Type II shafts typically are enlarged relative to the column diameter to contain the inelastic action to the column. Enlarged shafts shall be at least 18 inches (450 mm) larger than the column diameter and the reinforcement shall satisfy the clearance requirements for CIP piling specified in Bridge Design Details 13-22.

7.7.4 Pile Extensions

Pile extensions must perform in a ductile manner and meet the ductility requirements of column elements specified in Section 4.1.

7.8 Abutments

7.8.1 Longitudinal Abutment Response

The linear elastic demand model shall include an effective abutment stiffness, K_{eff} that accounts for expansion gaps, and incorporates a realistic value for the embankment fill response. The abutment embankment fill stiffness is nonlinear and is dependent upon on the material properties of the abutment backfill. Based on passive earth pressure tests and the force deflection results from large-scale abutment testing at UC Davis, the initial embankment fill stiffness is $20\ \frac{\text{kip/in}}{\text{ft}}$ ($11.5\ \frac{kN/mm}{m}$). The initial stiffness[15] shall be adjusted proportional to the backwall/diaphragm height, as documented in Equation 7.43.

$$K_{abut} = \begin{cases} K_i \times w \times \left(\frac{h}{5.5}\right) & \text{U.S. units} \\ K_i \times w \times \left(\frac{h}{1.7}\right) & \text{S.I. units} \end{cases} \tag{7.43}$$

Where, w is the width of the backwall or the diaphragm for seat and diaphragm abutments, respectively.

The passive pressure resisting the movement at the abutment increases linearly with the displacement, as shown in Figure 7.14A. The maximum passive pressure of 5.0 ksf (239 kPa), presented in Equation 7.44 is based on the ultimate static force developed in the full scale abutment testing conducted at UC Davis [Maroney, 1995]. The height proportionality factor, $\left(h/5.5\ ft\right)\left(h/1.7\ m\right)$ is based on the height of the UC Davis abutment specimen 5.5 ft (1.7 m).

$$P_{bw}\ or\ P_{dia} = \begin{cases} A_e \times 5.0\ ksf \times \left(\frac{h_{bw}\ or\ h_{dia}}{5.5}\right) & (ft, kip) \\ A_e \times 239\ kPa \times \left(\frac{h_{bw}\ or\ h_{dia}}{1.7}\right) & (m, kN) \end{cases} \tag{7.44}$$

[15] This proportionality may be revised in future as more data becomes available.

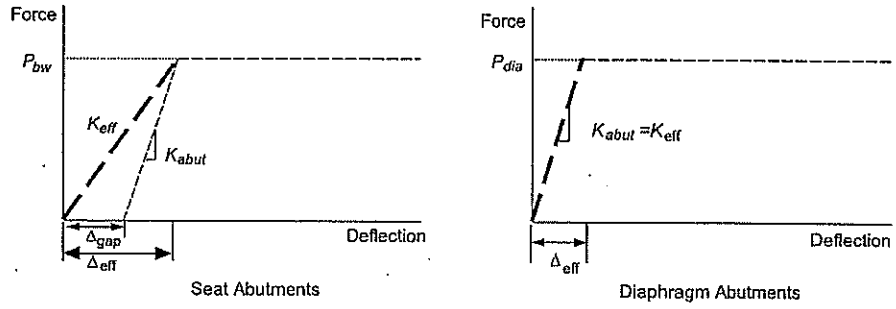


Figure 7.14A Effective Abutment Stiffness

The effective abutment area for calculating the ultimate longitudinal force capacity of an abutment is presented in Equation 7.45.

For seat abutments the backwall is typically designed to break off in order to protect the foundation from inelastic action. The area considered effective for mobilizing the backfill longitudinally is equal to the area of the backwall.

For diaphragm abutments the entire diaphragm, above and below the soffit, is typically designed to engage the backfill immediately when the bridge is displaced longitudinally. Therefore, the effective abutment area is equal to the entire area of the diaphragm. If the diaphragm has not been designed to resist the passive earth pressure exerted by the abutment backfill, the effective abutment area is limited to the portion of the diaphragm above the soffit of the girders.

$$A_e = \begin{cases} h_{bw} \times w_{bw} & \text{Seat Abutments} \\ h_{dia} \times w_{dia} & \text{Diaphragm Abutments} \end{cases} \tag{7.45}$$

$h_{dia} = h_{dia}^{*}$ = Effective height if the diaphragm is not designed for full soil pressure (see Figure 7.14B).

$h_{dia} = h_{dia}^{**}$ = Effective height if the diaphragm is designed for full soil pressure (see Figure 7.14B).

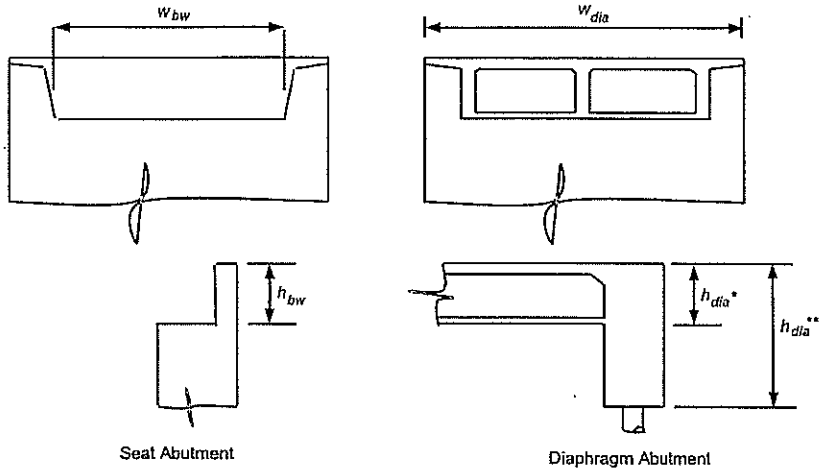


Figure 7.14B Effective Abutment Area

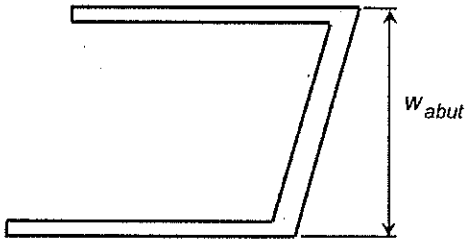


Figure 7.14C Effective Abutment Width for Skewed Bridges

The abutment displacement coefficient R_A shall be used in the assessment of the effectiveness of the abutment.

$$R_A = \Delta_D / \Delta_{eff}$$

where:

Δ_D = The longitudinal displacement demand at the abutment from elastic analysis.

Δ_{eff} = The effective longitudinal abutment displacement at idealized yield.

If $R_A \leq 2$ The elastic response is dominated by the abutments. The abutment stiffness is large relative to the stiffness of the bents or piers. The column displacement demands generated by the linear elastic model can be used directly to determine the displacement demand and capacity assessment of the bents or piers

If $R_A \geq 4$ The elastic model is insensitive to the abutment stiffness. The abutment contribution to the overall bridge response is small and the abutments are insignificant to the longitudinal seismic performance. The bents and piers will sustain significant deformation. The effective abutment stiffness K_{eff} in the elastic model shall be reduced to a minimum residual stiffness K_{res}, and the elastic analysis shall be repeated for revised column displacements. The residual spring has no relevance to the actual stiffness provided by the failed backwall or diaphragm but should suppress unrealistic response modes associated with a completely released end condition.

Satrajit
Das/Morrisville/URSCorp
01/18/2006 06:53 AM

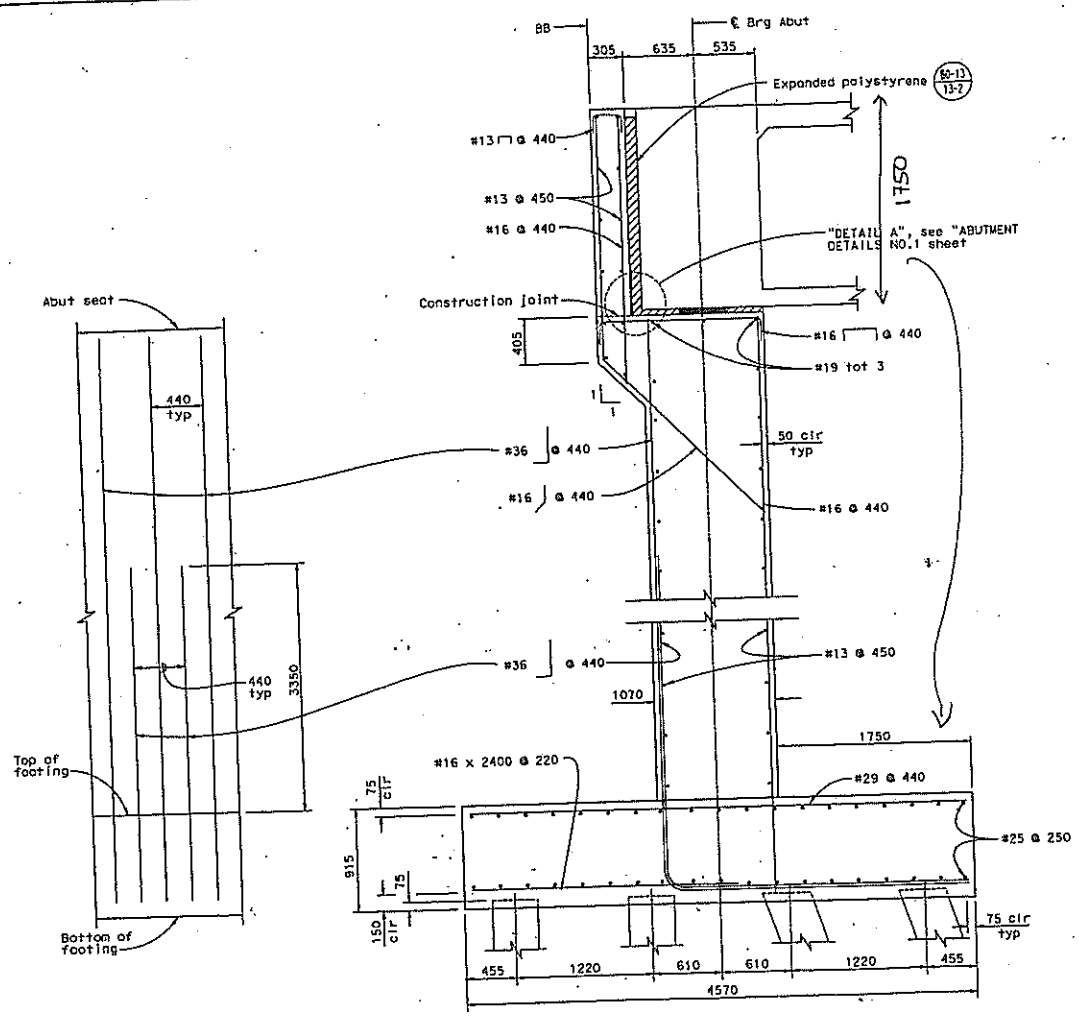
To Sathish Murugaiah/Oakland/URSCorp@URSCorp
cc Philip Meymand/Oakland/URSCorp@URSCorp
bcc
Subject Re: SR4 - Loveridge OC - Passive Pressure

The numbers I would use are:

W_{bw} = 56.75m (Abut.1) & 59.30m (Abut.4)
h_{bw} = 1.915 m
Skew angle = 42.484 degrees (Abut.1) & 48.547 degrees (Abut.4)

==========

Satrajit Das, Ph.D, PE
Senior Project Engineer (Structures)/
Design Manager
URS Corporation - North Carolina
Tel: 919-461-1514 (Direct)
Fax: 919-461-1415
Web: http://www.urscorp.com



SECTION A-A
1:20

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

Caltrans Metric

DIST	COUNTY	ROUTE
04	CC	4

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

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

CONTRA COSTA TRANSPORTATION
3478 BUSKIRK AVENUE, SUITE
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

Emil Vergara
DESIGN OVERSIGHT

SIGN OFF DATE

DESIGN DETAIL SHEET METRIC (REV. 3/4/99)

	BY	CHECKED
DESIGN	S. Doe	
DETAILS	A. Sanchez	
QUANTITIES		

ORIGINAL SCALE IN MILLIMETERS FOR REVISED PLANS 0 10 20 30 40 50 60 70 80 90 100

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

W. LoFranchi
PROJECT ENGINEER

CU 04275
EA 228501
FILE =) REQUEST

BRIDGE NO. 28-0394
KILOMETER POST 38.8

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

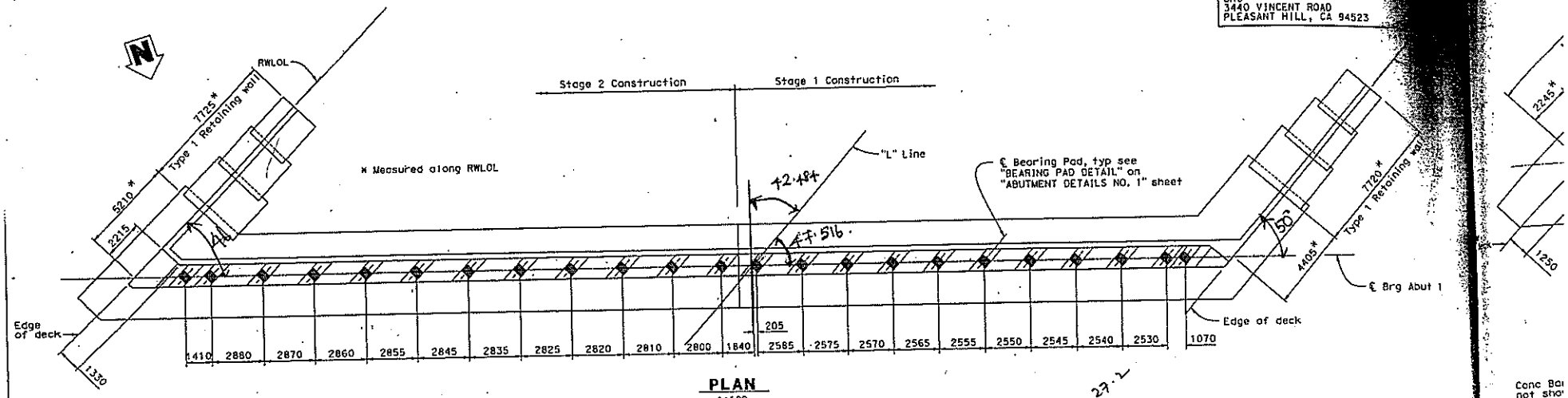
LOVERIDGE ROAD OC (REPLACE)

ABUTMENT 1 DETAILS

SHEET 9

Notes:

1. For footing and pile information, see "ABUTMENT 1 PILE LAYOUT" sheet.
2. For "SECTION A-A" see "ABUTMENT 1 DETAILS" sheet.
3. For "EXTERNAL KEY DETAIL" and "BEARING PAD DETAIL" see "ABUTMENT DETAILS" sheet.
4. Extend footing and abutment reinforcement 1250 mm beyond construction joint to lap with stage 2 construction.



PLAN
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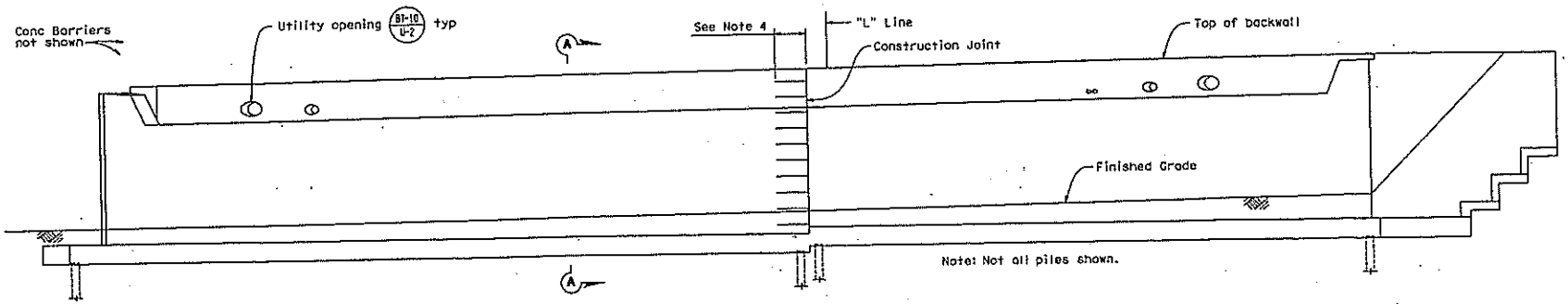

ELEVATION
1:100

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

DIST	COUNTY	ROUTE
04	CC	4

Caltrans Metric

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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

Emil Vergara
DESIGN OVERSIGHT

SIGN OFF DATE

DESIGN DETAIL SHEET (METRIC) REV. 3/1/90

DESIGN	BY S. Das	CHECKED
DETAILS	BY A. Sanchez	CHECKED
QUANTITIES	BY	CHECKED

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

W. LaFranchi
PROJECT ENGINEER

CU 04275
EA 228501
FILE => REQUEST

BRIDGE NO. 28-0394
KILOMETER POST 38.8

DIRECTOR PRINTS BEARING CARRIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

LOVERIDGE ROAD OC (REPLACE)
ABUTMENT 1 LAYOUT

Appendix

SHEET 5

Notes:

1. For footing and pile information, see "ABUTMENT 4 PILE LAYOUT" sheet.
2. For "SECTION A-A" see "ABUTMENT 4 DETAILS" sheet.
3. For "EXTERNAL KEY DETAIL" and "BEARING PAD DETAIL" see "ABUTMENT DETAILS NO. 1" sheet.
4. Extend footing and abutment reinforcement 1250 mm beyond construction joint to lap with stage 2 construction.

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

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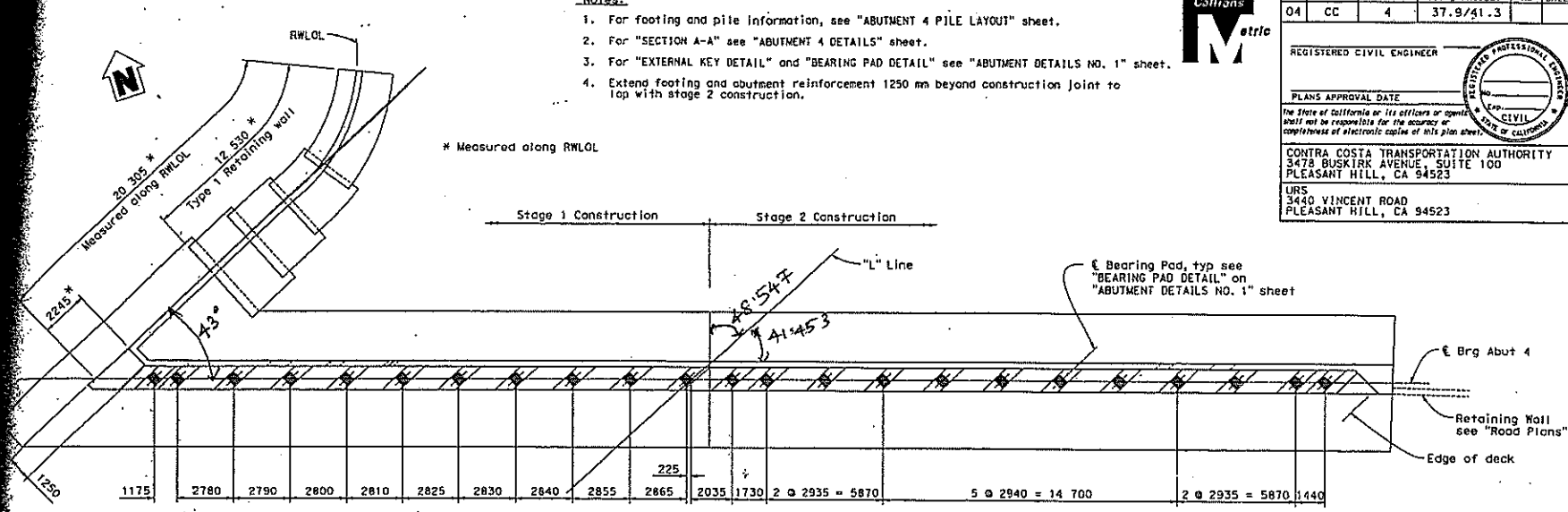
REGISTERED PROFESSIONAL ENGINEER — No. — Exp. — CIVIL — STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523



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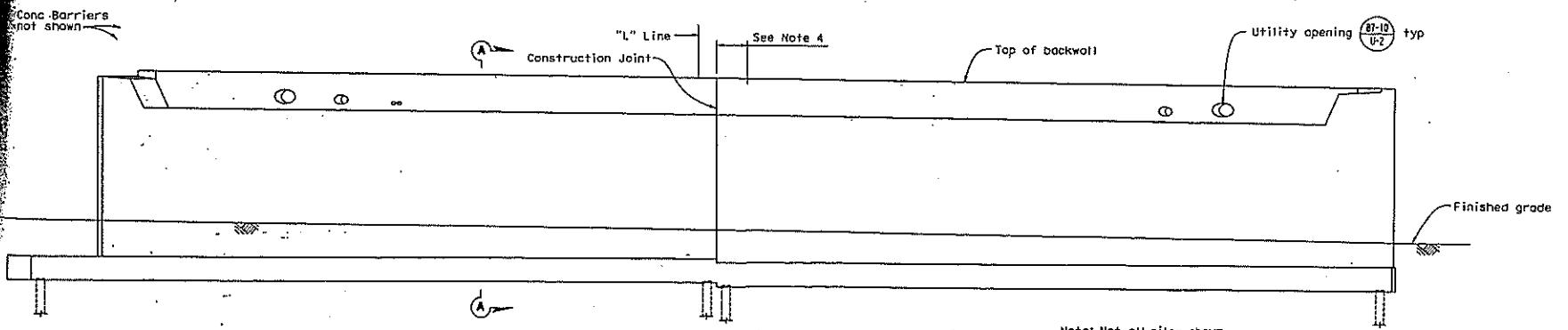


ELEVATION
1:100

Note: Not all piles shown.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

CONTRACTOR SHALL VERIFY ALL DIMENSIONS BEFORE LAYING OUT OR FABRICATING ANY MATERIAL.

DESIGN	BY S. Das	CHECKED	
DETAILS	BY A. Sanchez	CHECKED	
QUANTITIES	BY	CHECKED	

PREPARED FOR THE STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

W. LaFranchi
PROJECT ENGINEER

CU 04275
EA 228501

BRIDGE NO. 28-0394
KILOMETER POST 38.6

LOVERIDGE ROAD OC (REPLACE)
ABUTMENT 4 LAYOUT

Appendix F 84

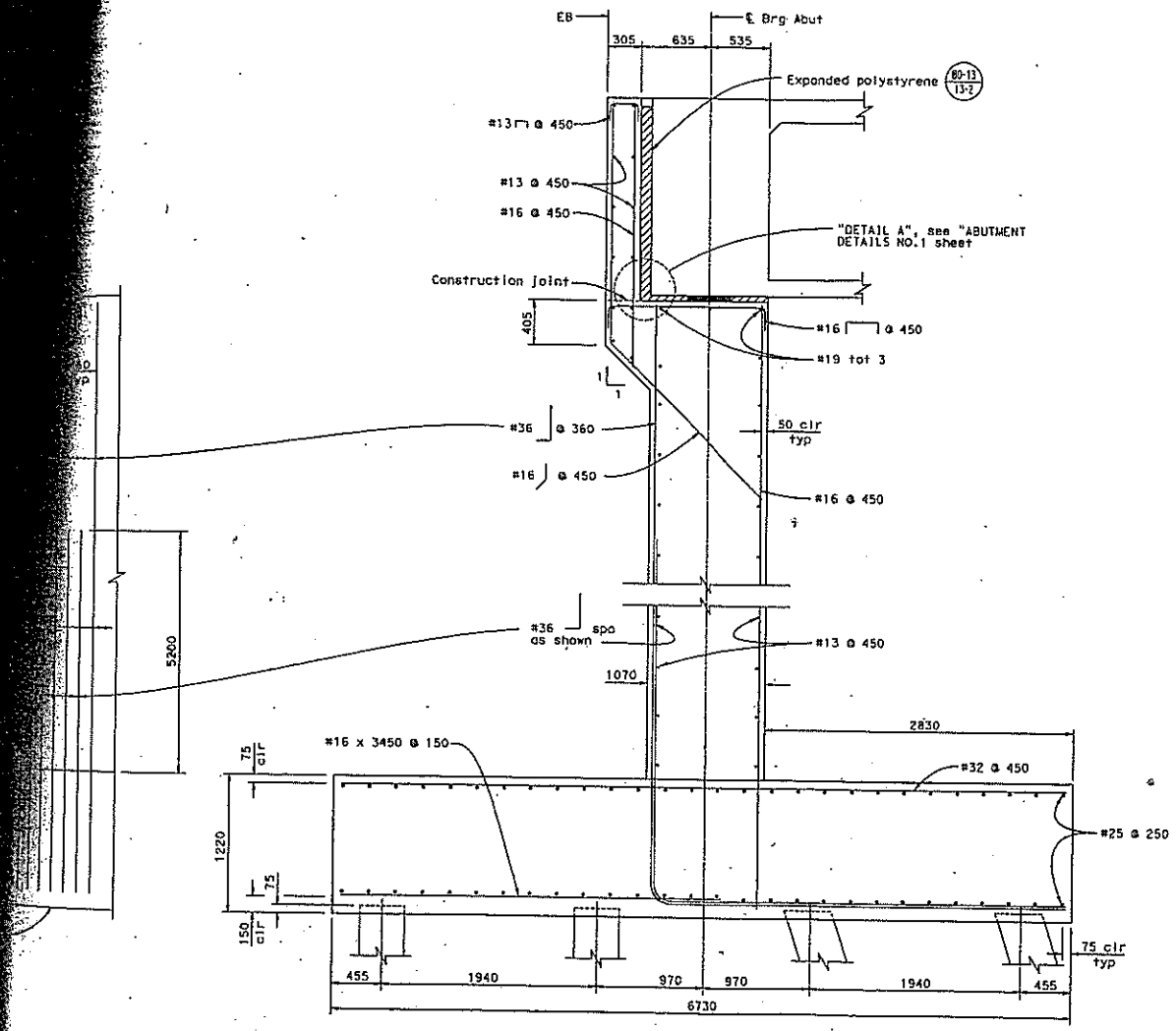
ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 6

DATE PLOTTED => 9/JUNE
TIME PLOTTED => 07:16



SECTION A-A

1:20

SHALL VERIFY ALL FIELD DIMENSIONS BEFORE FABRICATING ANY MATERIAL.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

DESIGN	BY S. Dae	CHECKED
DETAILS	BY A. Sánchez	CHECKED
QUANTITIES	BY	CHECKED

PREPARED FOR THE STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

W. LaFranchi
PROJECT ENGINEER

CU 04275
EA 228501

BRIDGE NO. 28-0394
KILOMETER POST 38.8

LOVERIDGE ROAD OC (REPLACE)

ABUTMENT 4 DETAILS

SHEET 10

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS

DISREGARD PRINTS BEARING EARLIER REVISION DATES

PLOTTING DATES (PRELIMINARY STAGE ONLY)

DATE PLOTTED => 07/JUL/2005 TIME PLOTTED => 07:11:46

SCHEME => MODEL

Appendix F
References

American Society for Testing and Materials (ASTM), 2000, v. 04.08 for ASTM test methods, Soil and Rock (1): D-420 to D-5779.

California Geological Survey (CGS), 2003, Fault investigation reports for development sites within Alquist-Priolo Earthquake Fault Zones in Northern California, 1974-2000, CGS CD 2003-01.

Ensoft, Inc., 2000, User's Manual, LPILE plus 4.0 for Windows, October.

FEMA, 1996, National Flood Insurance Program, (www.fema.gov).

Graymer, R.W., Jones, D.L., and Brabb, E.E., 1994, Preliminary geologic map of the Niles 7.5-minute quadrangle, Alameda County, California: U.S. Geological Survey Open-File Report 94-132, scale 1:24,000.

Knudsen, K.L., Sowers, J.M., Witter, R.C., Wentworth, C.M. and Helley, E.J., 2000, Preliminary maps of Quaternary deposits and liquefaction susceptibility, nine-county San Francisco Bay region: A digital database, U.S. Geological Survey, Open-File Report 00-444, 60 p.

Mualchin, L., 1996, California seismic hazard map 1996 based on maximum credible earthquakes (MCE), California Department of Transportation.

NCEER, (1998), "Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils", edited by Youd, T.L., and Idriss, I.M., Technical report NCEER-98-0022.

State of California, Department of Transportation, 1996, "Soil & Rock Logging Classification Manual".

State of California, Department of Transportation, "Guidelines for Structures Foundation Reports, Version 2.0", March 2006.

State of California, Department of Transportation, "Caltrans Memo to Designers 5-20, August 2004.

State of California, Department of Transportation, "Seismic Design Criteria, Version 1.4", June 2006.

State of California, Department of Transportation, "Standard Plans, Metric, July 2004.

Tokimatsu, A.M., Seed, H.B., 1987, Evaluation of Settlements in Sands Due to Earthquake Shaking, Journal of Geotechnical Engineering, Vol 133, No. 8, August.

U.S. Department of Transportation, Federal Highway Administration, 1998, " Design and Construction of Driven Pile Foundations" Workshop manual Volume I, Publication No. FHWA-HI-97-013, November.

U.S. Department of Transportation, Federal Highway Administration, 1998, " Design and Construction of Driven Pile Foundations" Workshop manual Volume II, Publication No. FHWA-HI-97-014, November.

U.S. Department of Transportation, Federal Highway Administration, 1999, " Drilled Shafts – Construction Procedures and Design Methods", Publication No. FHWA-IF-99-025, August.

U. S. Geological Survey, "Quaternary geology of Contra Costa County and surrounding parts of Alameda, Marin, Sonoma, Solano, Sacramento, and San Joaquin Counties, California", by E.J. Helley and R.W. Graymer, Open File Report 97-98, 1997.

Wills, C. J., 1991, The Antioch fault, Contra Costa County, California: Fault Evaluation Report FER-228, California Division of Mines and Geology, 28p., November 6.

Working Group for California Earthquake Probabilities, 2003, Summary of earthquake probabilities in the San Francisco Bay area, 2003-2032, US Geological Survey, Fact Sheet 039-03 6 p.

Appendix G

Caltrans Review Comments And Responses

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

[X] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 03/23/05

FILE: 04 (District) CC (County) 4 (Route) 23.7/26.8 (PM)

SUB CONSULTANT: URS
PRIME CONSULTANT: URS
GENERAL PLAN DATED: 03/04/05
Report Date: 03/07/05
Contract No.:
FOUNDATION PLAN DATED: 03/04/05
Loveridge Road OC (Replace) (Structure Name)
04-228501 (EA Number)
28-0096R/L (Bridge Number)

Submittal (Check One): [ ] 1st [ ] 2nd [ ] 3rd [ ] 4th [X] Other: Type Selection

The following comments for the above referenced project are based on
(a) the Type Selection Report, dated 03/07/05, prepared by URS, and
(b) the Preliminary Foundation Investigation Report, dated 03/07/05, prepared by URS.

1. The seismic data are generally acceptable. We concur with the following data:
   (1) Controlling faults: Coast Ranges Sierran Block boundary zone (CRSB)
   (2) Style of fault: reverse
   (3) MCE: Mw=7.0
   (4) Distance from bridge to fault: about 6.25 km
   (5) Soil type: D

2. We concur that precast driven piles and CIDH piles are suitable foundation alternatives. Final foundation report should provide brief discussion regarding the selection of a particular pile type.

3. Please incorporate the field acceptance criteria currently used by Caltrans, Gates formula, into Special Provision if driven piles are recommended in the final foundation report.

4. Please indicate potential need to use temporary casing due to possible caving to avoid potential construction claim if CIDH piles are recommended in the final foundation report, even though caving is not a major concern due to site mainly consisting of clay.

REGISTERED PROFESSIONAL ENGINEER
CAROLINE JINHUA CHEN
No. C 62488
Exp. 6/30/05
CIVIL
STATE OF CALIFORNIA

[X] Special Funded Project (OSFP) [ ] Local Assistance Project (OSFP) [ ] OSCM Project
Approval: Type Selection

OSFP/OSCM

Caroline Chen
Office of Geotechnical Design - West

cc: OGDs, Lab File Room (Sacramento), DES Specifications and Estimates (Stayton-4 copies), Structure Construction R.E. Pending File

Revised 05/04

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

☐ MR. EARL SEABERG, CHIEF, OSFP
☐ MR. VONG TOAN, CHIEF, OSCM
Attention:

DATE: 03/23/05

FILE:

04	CC	4	23.71/26.8
District	County	Route	PM

Loveridge Road OC (Replace)
Structure Name

04-228501	28-0096R/L
EA Number	Bridge Number

5. LOTBs:

(1) If groundwater is not marked on the LOTB, a note should be added at the bottom of each boring to indicate whether groundwater was not encountered or not measured during exploration.
(2) As-built LOTBs: Please check out website http://www.dot.ca.gov/hq/esc/geotech/requests/asbloth.pdf to see sample as-built LOTB for the current format.
(3) Boring B-7 shown on the plan view (Figure 2) should be provided as well considering its proximity to the proposed structure.

Revised 05/04

SR4(E) Widening Project Loveridge Road to Somersville Road – Loveridge Road Overcrossing - EA 228501

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	October 24, 2005
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	March 23, 2005		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 35% PS&E**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
	Report					
1		The seismic data generally acceptable. We concur with the following data: (1) Controlling faults: Coast Ranges Sierran Block boundary zone (CRSB) (2) Style of fault: reverse (3) MCE: Mw = 7.0 (4) Distance from bridge to fault: about 6.25 km (5) Soil type: D	Concur	A		A
2		We concur that precast driven pile and CIDH piles are suitable foundation alternatives. Final foundation report should provide brief discussion regarding the selection of a particular pile type	Report has been revised to include this.	A		A
3		Please incorporate the field acceptance criteria currently used by Caltrans, Gates Formula, into Special Provision if driven piles are recommended in the final foundation report	Report has been revised to include this.	A		A
4		Please indicate potential need to use temporary casing due to possible caving to avoid potential construction claim if CIDH piles are recommended in the final foundation report, even though caving is not a major concern due to site mainly consisting of clay.	CIDH pile are not recommended in the final foundation report	A		A
5	LOTB's	(1) If groundwater is not marked on the LOTB, a note should be added at the bottom of each boring to indicate whether ground water was not encountered or not measured during exploration.	Report has been revised to include this.	A		A
		(2) As-built LOTBs: Please check out website http://www.dot.ca.gov/hq/esc/geotech/requests/asblotb.pdf to see sample as-built LOTB for the current format.	Report has been revised to include this.	A		A

SR4(E) Widening Project Loveridge Road to Somersville Road – Loveridge Road Overcrossing - EA 228501

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	October 24, 2005
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	March 23, 2005		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 35% PS&E**	

Revision Action Code: A-Will Comply; B-Consultant to Evaluate; C-Will Not Incorporate; D-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		(3) Boring B-7 shown on the plan view (Figure 2) should be provided as well considering its proximity to the proposed structure.	Report has been revised to include this.	A		A

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

ALREADY CC'D SATNAM IT

[X] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 12/14/05

FILE: 04 (District) CC (County) 4 (Route) 23.71/26.8 (PM)

SUB CONSULTANT: URS
PRIME CONSULTANT: URS
GENERAL PLAN DATED: 10/19/05
Report Date: 10/24/05
Contract No.:
FDN PLAN DATED: 10/19/05

Loveridge Road OC (Replace) (Structure Name)
04-228501 (EA Number)
28-0394 (replace 28-0096) (Bridge Number)

Submittal (*Check One*): [X] 1st [ ] 2nd [ ] 3rd [ ] 4th [ ] Other: Type Selection

Report

1. Section 4.1: Time of referenced previous field exploration is not correct.
2. Section 4.2: Based on Boring B-7, alluvium encountered below fill consists predominantly of very stiff to hard clay, not medium stiff to stiff clay. Please check and revise. Please also check subsurface soil conditions described based on borings B-9 and B-10.
3. Section 5.2: Please include a column showing the elevation of top of each soil layer. A silty sand layer about 1 to 2 m thick was encountered based on the borings. Such a layer could be added in to the soil profile. But the clayey/sandy clay layered listed on the table is mainly sandy clay based on the borings. It is more appropriate to specify its soil parameters in the form of cohesive soil.
4. Section 5.3: Since historically groundwater was encountered at elevation 5.9m, why was the design groundwater table specified at elevation 4 m, instead of 5.9m or higher?
5. Section 8.3: Pile type should specify the alternative used (e.g., Alt "X" or whatever recommended). Nominal capacity/demand should be rounded up to the nearest 50 kN and pile tip elevation should be specified for the rounded value accordingly. Identification of location should be more appropriate, e.g., Abut 1 should be Abut 1R, and if it is not wing wall/return wall of the abutment, the location should be identified as Abut 1L or Abut 1R, not Abut 1LW or Abut 1RW. The symbols used to identify wing wall/return wall, such as H=10.45, are misleading. The numbers used are bottom of footing elevation, not the height of each wall segment. Please use symbol appropriately. Add note if necessary.

REGISTERED PROFESSIONAL ENGINEER
CAROLINE JINXIA CHEN
No. C 62438
Exp. 9/30/07
CIVIL
STATE OF CALIFORNIA

[X] Special Funded Project (OSFP) [ ] Local Assistance Project (OSFP) [ ] OSCM Project

Approval: C3-Not Approved

OSFP/OSCM

Caroline Chen
Office of Geotechnical Design - West

cc: OGDx, Lab File Room (Sacramento) DES Specifications and Estimates (JStayton-4 copies) Structure Construction R.E. Pending File

Revised 05/04

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

☐ MR. EARL SEABERG, CHIEF, OSFP
☐ MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 12/14/05

FILE:	04	CC	4	23.71/26.8
	District	County	Route	PM

Loveridge Road OC (Replace)
Structure Name

04-228501	28-0394
EA Number	Bridge Number

6. Section 8.3: It seems soil profiles different from what presented on Table 2 were used in computing vertical pile capacity based on the input files attached in Appendix E. If it is considered that certain locations are more represented by certain soil profile, which appears so in this site, please present each generalized soil profile separately. Calculation input and soil profiles should be consistent.
7. Our calculations of vertical capacity for piles at Bents 2 and 3, and Abutment 4, based on Boring B-9, which is more representative for Bent 3 and Abutment 4, show that the pile tips need to be deeper. Please check your input soil parameters.
8. Section 8.3: What is the lateral load used to determine the pile tip?
9. Several piles at Abutment 4 wing wall have center-to-center spacing less than 3 pile diameters. Is pile group effect accounted for when computing vertical pile capacity?
10. Section 8.3: Passive resistance at abutment should be recommended in accordance with Caltrans Seismic Design Criteria (V1.3), Section 7.8.1.
11. Section 8.4: How long is considered sufficient for the waiting period? Please specify waiting period.
12. Sections 8.4 and 8.5: Section 8.4 states that downdrag on the pile will be negligible, but Section 8.5 indicates that negative skin friction may be an issue. Please be consistent and verify.
13. Some of the existing foundation appears to be located within the footprint of the proposed new foundation. Will they be removed? How is the conflict to be resolve if they are to stay?
14. LOTBs:
    (1) Please add note to indicate the type of hammer used.
    (2) Report states that auger drilling was followed by rotary wash from certain depth for Borings B-9 and B-10. Appropriate symbols should be marked on the LOTBs accordingly
    (3) Some symbols of soils do not match the legend of earth materials, e.g., sandy silt/silty sand, and sandy clay. Please check all and revise.
    (4) Boring B-9: For soil at elevation about 12m, "Push" doesn't seem to be consistent with description. If it is meant to be punch core, "push" should be removed.
    (5) Location of borings should be presented as station and offset referencing to certain alignment line, not in the form of easting and northing.

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

☐ MR. EARL SEABERG, CHIEF, OSFP
☐ MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 12/14/05

FILE:

04	CC	4	23.71/26.8
District	County	Route	PM

Loveridge Road OC (Replace)
Structure Name

04-228501	28-0394
EA Number	Bridge Number

(6) Please pay attention to the presentation of LOTBs. Grids showing elevation on the LOTB sheets should not strike through the text describing soil properties or areas showing field/lab record. Plan view should not be overlapped by the grid lines or any other objects that do not belong to it.

General comments:

15. Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	August 8, 2006
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	December 14, 2005		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 65% PS&E**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
	Report					
1	Section 4.1	Time of referenced previous field exploration is not correct.	Agreed. Report has been corrected accordingly.	A		A
2	Section 4.2	Based on Boring B-7, alluvium encountered below fill consists predominantly of very stiff to hard clay, not medium stiff to stiff clay. Please check and revise. Please also check subsurface soil conditions described based on borings B-9 and B-10.	Agreed. Report has been revised accordingly.	A		A
3	Section 5.2	Please include a column showing the elevation of top of each soil layer. A silty sand layer about 1 to 2 m thick was encountered based on the borings. Such a layer could be added in to the soil profile. But the clayey/ sandy clay layered listed on the table is mainly sandy clay based on the borings. It is more appropriate to specify its soil parameters in the form of cohesive soil.	Have been provided.	A		A

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	August 8, 2006
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	December 14, 2005		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 65% PS&E**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
4	Section 5.3	Since historically ground water was encountered at elevation 5.9 m, why was the design groundwater table specified at elevation 4 m, instead of 5.9m or higher?	Groundwater water table: please see Comment 4 in our 1st review comment. We have three groundwater readings at the site: elev +5.9 in July 1970, elev +3.4 in January 2005, and elev +4.1 in January 2006 (after significant rains). We relied on the measurements made by URS in 2005 to make our recommended groundwater elevation of +4, but agree that this can be slightly raised based on the 2006 reading to elevation +5, which is within the range of seasonal variation we have seen in this area.	A		A

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	August 8, 2006
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	December 14, 2005		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 65% PS&E**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
5	Section 8.3	Pile type should be specify the alternative used (e.g., Alt "X" or whatever recommended). Nominal capacity/demand should be rounded up to the nearest 50 kN and pile tip elevation should be specified for the rounded value accordingly. Identification of location should be more appropriate, e.g., Abut 1 should be Abut 1R, and if it is not wing wall/return wall of the abutment, the location should be identified as Abut 1L or Abut 1R, not Abut 1LW or Abut 1RW. The symbols used to identify wing wall/return wall, such as H=10.45, are misleading. The numbers used are the bottom of footing elevation, not the height of each wall segment. Please use symbol appropriately. Add note if necessary.	Agreed. Report has been revised accordingly.	A		A
6	Section 8.3	It seems soil profiles different from what presented on Table 2 were used in computing vertical pile capacity based on the input files attached in Appendix E. If it is considered that certain locations are more represented by certain soil profile, which appears so in this site, please present each generalized soil profile separately. Calculation input and soil profile should be consistent.	Agreed. Report has been revised accordingly.	A		A
7		Our calculations of vertical capacity for piles at Bents 2 and 3, and Abutment 4, based on Boring B-9, which is more representative for Bent 3 and Abutment 4, show that the pile tips need to be deeper. Please check your input soil parameters.	Agreed. Report has been revised accordingly.	A		A
8	Section 8.3	What is the lateral load used to determine the pile tip?	Have been provided.	A		A

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	August 8, 2006
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	December 14, 2005		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 65% PS&E**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
9		Several piles at Abutment 4 wing wall have center-to-center spacing less than 3 pile diameters. Is pile group effect accounted for when computing vertical pile capacity?	Yes, analysis was performed for specific group geometry.	A		A
10	Section 8.3	Passive resistance at abutment should be recommended in accordance with Caltrans Seismic Design Criteria (V1.3), Section 7.8.1.	Agreed. Report has been revised accordingly.	A		A
11	Section 8.4	How long is considered sufficient for the waiting period? Please specify waiting period	A 120 day waiting period is specified.	A		A
12	Section 8.4 and 8.5	Section 8.4 states that downdrag on the pile will be negligible, but Section 8.5 indicates that negative skin friction may be an issue. Please be consistent and verify.	Agreed. Report has been revised accordingly.	A		A
13		Some of the existing foundation appears to be located within the footprint of the proposed new foundation. Will they be removed? How is the conflict to be resolve if they are to stay?	Any interference with existing foundations will be resolved by removing those foundations.	A		A
14	LOTBs:	(1) Please add note to indicate the type of hammer used.	Agreed. LOTBs have been revised accordingly.	A		A
		(2) Report states that auger drilling was followed by rotary wash from certain depth for Borings B-9 and B-10. Appropriate symbols should be marked on the LOTB accordingly.	Agreed. LOTBs have been revised accordingly.	A		A
		(3) Some symbols of soils do not much the legend of earth materials, e.g., sandy silt/silty sand, and sandy clay. Please check all and revise.	Agreed. LOTBs have been revised accordingly.	A		A

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	August 8, 2006
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	December 14, 2005		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 65% PS&E**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	RevisionAction	JRT Disp.	Final Disp.
		(4) Boring B-9: For soil at elevation about 12 m, "Push" doesn't seem to be consistent with description. If it is meant to be punch core, "push" should be removed.	Agreed. These are locations where Shelby sample is collected. LOTBs have been revised accordingly.	A		A
		(5) Location of borings should be presented as station and offset referencing to certain alignment line, not in the form of easting and northing.	Have been provided in the next submittal.	A		A
		(6) Please pay attention to the presentation of LOTBs. Grids showing elevation on the LOTB sheets should not strike through the text describing soil properties or the area showing field/lab record. Plan view should not be overlapped by the grid lines or any other objects that do not belong to it.	Agreed. LOTBs have been revised accordingly.	A		A
	General Comments					
15		Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.	Have been provided.	A		A

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

[x] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 9/28/06

FILE: 04 (District) CC (County) 4 (Route) 23.71/26.8 (PM)

SUB CONSULTANT: URS
PRIME CONSULTANT: URS
GENERAL PLAN DATED: 7/28/06
Report Date: 8/8/06
Contract No.:
FDN PLAN DATED: 7/28/06
Structure Name: Loveridge Road OC (Replace)
EA Number: 04-228501
Bridge Number: 28-0394 (replace 28-0096)

Submittal (*Check One*): [ ] 1st [X] 2nd [ ] 3rd [ ] 4th [ ] Other: Type Selection

Report

1. Section 8.3: What are the soil parameters based to compute the equivalent fluid pressure for the recommended passive resistance? The recommended value seems too high. Passive resistance at abutment should be recommended in accordance with Caltrans Seismic Design Criteria (V1.3), Section 7.8.1.
1. Section 8.4, embankment settlement: Why is 120 day waiting period recommended? How much settlement is expected to complete during specified waiting period? Please indicate that settlement monitoring program is recommended.
2. LOTBs: Please add note to indicate the type of hammer used on every LOTB sheet.

General comments

3. Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.

REGISTERED PROFESSIONAL ENGINEER
CAROLINE JINXIA CHEN
No. C 62438
Exp. 9/30/07
CIVIL
STATE OF CALIFORNIA

[X] Special Funded Project (OSFP) [ ] Local Assistance Project (OSFP) [ ] OSCM Project

Approval: C2- Approved subject to verification

OSFP/OSCM

Caroline Chen
Office of Geotechnical Design - West

cc: OGDx, Lab File Room (Sacramento) DES Specifications and Estimates (JStayton-4 copies) Structure Construction R.E. Pending File

SR4(E) Widening Project Loveridge Road to Somersville Road –
Loveridge Road Overcrossing - EA 228501

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	February 28, 2007
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	September 28, 2006		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 95% PS&E**	

Revision Action Code: A-Will Comply; B-Consultant to Evaluate; C-Will Not Incorporate; D-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
	Report					
1	Section 8.3	What are the soil parameters based to compute the equivalent fluid pressure for the recommended passive resistance? The recommended value seems too high. Passive resistance at abutment should be recommended in accordance with Caltrans Seismic Design Criteria (V 1.3), Section 7.8.1.	Passive resistance at abutment were recommended in accordance with Caltrans Seismic Design Criteria (V 1.4), Section 7.8.1. The calculation procedure is provided in Appendix E.	A		A
2	Section 8.4	Embankment settlement: Why is 120 day waiting period recommended? How much settlement is expected to complete during specified waiting period? Please indicate that settlement monitoring program is recommended.	We expect that the 50% of the settlement to complete during the 120 day waiting period. The fill settlement may be monitored using a settlement monument.	A		A
3	LOTB's	Please add note to indicate the type of hammer used on every LOTB sheet.	Agreed. LOTBs have been revised accordingly.	A		A

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	February 28, 2007
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	September 28, 2006		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 95% PS&E**		

Revision Action Code: A-Will Comply; B-Consultant to Evaluate; C-Will Not Incorporate; D-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
	General					
4		Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.	Caltrans comments and responses to comments were provided in Appendix F with References in the previous submittals. In the final submission Caltrans comments and responses to comments are provided in Appendix G.	A		A

CONTRA COSTA TRANSPORTATION AUTHORITY

#2

California Department of Transportation

Caltrans

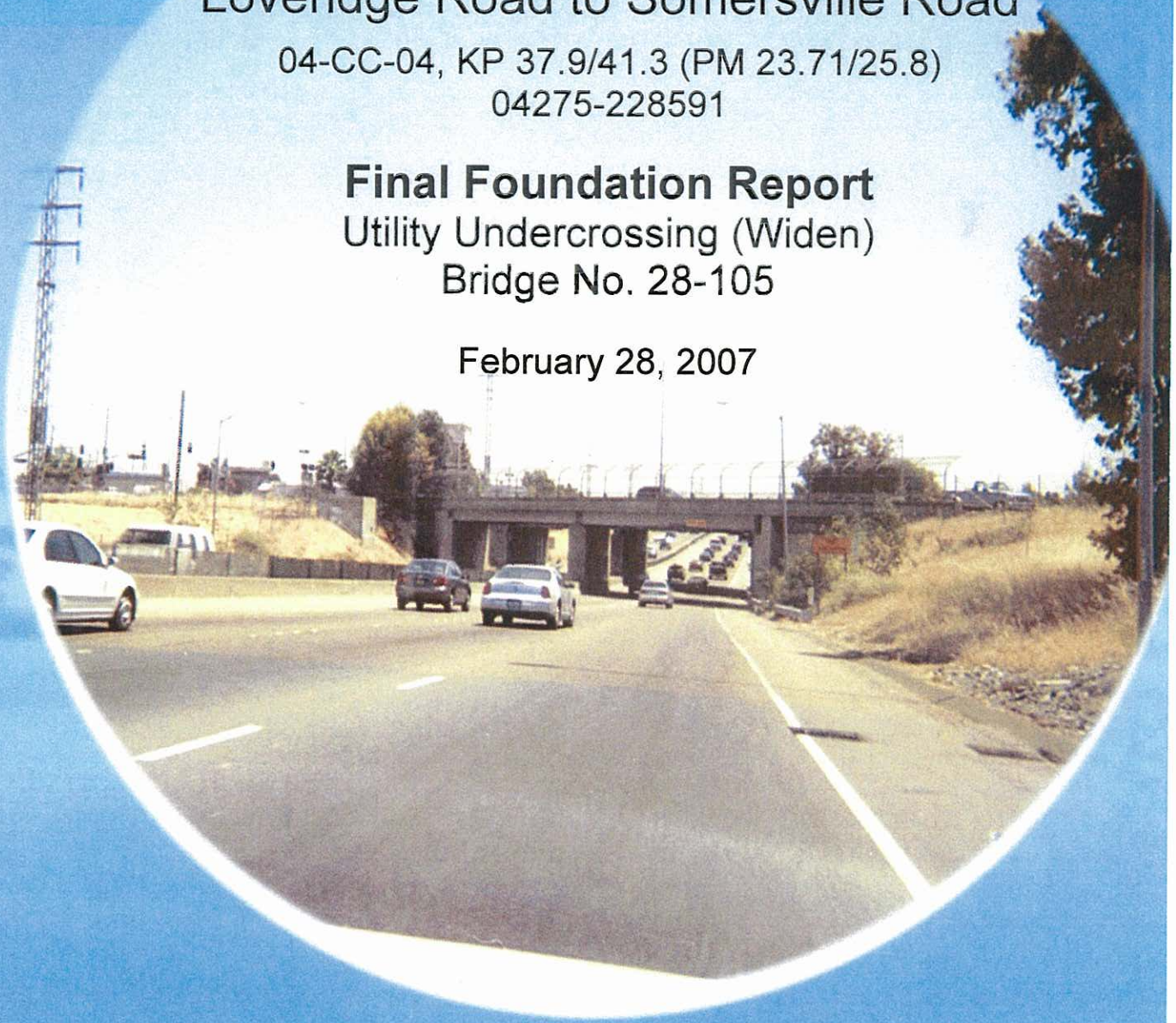
SR4 (East) Widening Project
Loveridge Road to Somersville Road

04-CC-04, KP 37.9/41.3 (PM 23.71/25.8)
04275-228591

Final Foundation Report

Utility Undercrossing (Widen)
Bridge No. 28-105

February 28, 2007



URS

URS

February 28, 2007
Project No. 26814911

Ms. Susan Miller
Project Director
Contra Costa Transportation Authority
3478 Buskirk Avenue, Suite 100
Pleasant Hill, CA 94523

Subject: **SR4 (East) Widening Project**
Loveridge Road to Somersville Road
Foundation Report: Utilities Undercrossing (widen)

Dear Ms. Miller,

URS is pleased to provide you with this Foundation Report for the Utilities Undercrossing (Bridge No. 28-105) widen project located in Antioch, California.

This report has been prepared in accordance with Caltrans guidelines for foundation reports, and replaces our foundation report (95% Submittal) for this structure dated August 8, 2006.

It has been our pleasure to be of service to Contra Costa Transportation Authority on this project. If you should have any questions, please contact the undersigned.

Sincerely,
URS CORPORATION

Philip Meymand, Ph.D., G.E.
Project Manager

Said Salah-Mars, Ph.D., P.E.
Engineering Department Manager

REGISTERED PROFESSIONAL ENGINEER
PHILIP J. MEYMAND
No. GE2596
Exp. 6-30-07
GEOTECHNICAL
STATE OF CALIFORNIA

Enclosure

URS Corporation
1333 Broadway, Suite 800
Oakland, CA 94612-1924
Tel: 510.893.3600
Fax: 510.874.3268

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The proposed State Route (SR) 4 (East) Widening Project - Loveridge Road to Somersville Road will widen SR4 from its current four lanes to an eight-lane facility from west of Loveridge Road (KP 37.9) to the Somersville Road Interchange (KP 41.3). This Project is part of Contra Costa County Transportation Authority's (CCTA's) overall plan to continue the widening of SR4 further into East County and is consistent with the Phase 1 Implementation Plan recommendation made in the SR4 (east) Railroad Avenue to SR160 Major Investment Study (MIS).

The proposed project will widen the freeway from two to four lanes providing three, mixed-flow and one High Occupancy Vehicle (HOV) lane in each direction. From SR 242 to west of Loveridge Road, the above improvements have either been completed, or are under construction. The improvements will conform to the existing four lane facility just before the Somersville Road overcrossing. Some of the significant features of this project include:

- Widening and reconstruction of the Loveridge Road interchange. The existing Loveridge Road Overcrossing and Camp Stoneman Road Underpass will be removed.
- Reconstruction of the eastbound diagonal on- and off-ramps at the Loveridge Interchange.
- Improvements at the intersection of Loveridge Road with California Avenue/ North Park Boulevard to accommodate the projected traffic volumes and increase public safety.
- Reconstruction of the Century Boulevard undercrossing structure.
- Extension of an existing utilities undercrossing structure west of Century Boulevard OC to accommodate the widened freeway.
- Provisions in the freeway median and at the Loveridge Interchange to accommodate a future mass transit extension.
- Reconstruction of the storm water pump station located in the northwest corner of the Loveridge Interchange to accommodate new construction features.
- Construction of a number of retaining and sound walls.

The subject of this foundation report (FR) is the Utilities Undercrossing approximately 50m west of Century Boulevard Undercrossing structure located in Antioch, California. Figure 1 presents the site location plan for this structure.

1.1 PURPOSE AND SCOPE OF THIS STUDY

The purpose of this FR is to document existing foundation conditions and make foundation recommendations for the proposed structure.

1.2 PROJECT SCOPE OF WORK

The scope of work for this study includes:

- Site reconnaissance
- Review of as-built structure drawings, logs of test borings (LOTBs), geologic maps, foundation report, and other existing information
- Preparation of this FR, which includes:

- Description of site geology and evaluation of geologic hazards;
- Assessment of subsurface conditions based on available information;
- Foundation recommendations for proposed structure; and
- Construction considerations.

2.1 GENERAL

Originally constructed in 1952, the Utilities Undercrossing (UUC) is a two span, inverted, U-frame structure with east and west walls supported on spread footings. The as-built drawings are presented in Appendix A. The mid-span of the structure is supported on individual columns (spaced about 2.3m on center) bearing on a continuous spread footing. At the north and south ends of the structure, four retaining walls connect to the ends of the east and west walls, forming the openings to the UUC. The top of each retaining wall conforms to the sloping sides of the embankment. The thickness of embankment fill and structural pavement above the top of structure is about 1.5m.

Based on available as-built drawings, the UUC structure is about 40m long, spanning about 9.45m under the roadway. It consists of two spans of 4.725m each. The proposed widening will add two lanes on each direction, resulting in approximately 11.2m and 9.6m more width on the westbound and eastbound directions, respectively. To accommodate the lane widening, the northern end of the UUC will be extended approximately 7.9m, whereas the southern end will be extended about 5.7m.

2.2 EXISTING FOUNDATIONS

The dimensions and foundation elevations of the spread footings are summarized below:

Table 1
Existing Foundation Information

Location	Type	Footing width	Design Bearing Capacity	1952 Datum Bottom of Footing Elevation	Estimated Footing Bottom Elevation (m)
West Wall	Spread Footings	1.2m	239 kPa	57.0	18.0
East Wall	Spread Footings	1.2m	239 kPa	57.0	18.0
Center Row of Columns	Spread Footings	0.91m	239 kPa	57.0	18.0
End-wall Retaining Walls	Spread Footings	Trapezoidal varying from1.3m to 2.8m	239 kPa	57.0	18.0

Bottom elevations of the footings were estimated from current topographic data and depth of footing from finished ground surface.

3.1 REGIONAL GEOLOGY

The SR4 project is located near the boundary between the Central Valley and the Coast Range physiographic province, at the northern end of the Diablo Range. The Coast Ranges are characterized by north to northwest trending elongated mountain ranges and intervening valleys. The Franciscan Complex underlies the core of the Diablo Range, which is in fault contact with the Great Valley sediments of the Central Valley province to the east. Younger sedimentary deposits from Paleocene to Pleistocene in age (65 million to 0.1 million years old) are widely distributed along the margin of the Diablo range and along the foothills through which the SR 4 alignment crosses and skirts around (Graymer, et al, 2002). These sedimentary rocks are in turn locally overlain by more recent alluvium and alluvial fan deposits and by bay mud deposits along the Sacramento River margin.

3.2 SEISMOTECTONIC SETTING

The SR 4 project lies within a domain of north-northwest oriented right-lateral strike-slip faulting, the San Andreas fault system, that accommodates the majority of the plate motion between the Pacific and North American plates. In addition to the right-lateral strike-slip deformation, a component of compression oriented normal to the plate boundary is manifest as a series of folds and thrust faults, including the Coast Range-Sierran Block Boundary zone, oriented parallel and sub-parallel to the faults of the San Andreas system. In contrast, regional compression in the Mount Diablo region, within which the SR 4 project is situated, has a more northerly orientation, which has resulted in a series of folds and thrusts that are at a distinct oblique angle to the main strike-slip faults.

The San Francisco Bay area is a region of relatively high seismic activity. This historical seismicity is associated with the active faults of the San Andreas system. During historical times there have been almost 8,000 earthquakes of Richter local magnitude (M_L) 2.0 or larger, of which 14 earthquakes were **M** 6.0 or greater. These include the 1836 M_L 6¼ event on the San Andreas fault; the 1868 M_L 6.8 event on the southern Hayward fault; the 1889 **M** 6¼ Collinsville earthquake, possibly on the Pittsburg-Kirby Hills fault; the 1898 M_L 6.7 'Mare Island' earthquake; the 1906 **M** 7.9 'Great San Francisco Earthquake' on the San Andreas fault; a 1911 M_L 6.6 event on the southern Calaveras fault; and the 1989 **M** 7.0 Loma Prieta event, located on a fault paralleling the Santa Cruz Mountains segment of the San Andreas fault.

3.3 SITE GEOLOGY

The sediments in the project area are a combination of surficial deposits of Holocene to Pleistocene (recent to 2 million years old) alluvium, alluvial fan and terrace deposits consisting of medium dense to dense sandy gravel or gravelly sand that generally grades finer, and medium dense sand that fines upward to sandy or silty clay (USGS, OFR 97-98).

4.1 PREVIOUS FIELD EXPLORATIONS

A previous relevant field exploration for the adjacent Century Boulevard Undercrossing (formerly Standard Oil Road Undercrossing) was completed on December 26, 1950 (Boring No. 1). Boring No. 1 encountered about topsoil (sandy loam) in the upper 1m. Below the topsoil was a layer of brown clayey sand about 1.5m thick. Below the sand deposit, alternating layers of silts and clays were encountered to the terminal depth of the boring, about 15m below original ground surface; interbeds of silty sand were observed below a depth of 11m. Groundwater was not encountered at the time of drilling. The log of test boring (LOTB) obtained from this subsurface investigation is provided in Appendix A.

4.2 CURRENT FIELD EXPLORATIONS

The current field investigation for the proposed reconstruction of the nearby Century Boulevard Undercrossing located at a distance of about 50 m east of the subject site are considered applicable to the UUC site. Three exploratory borings, B-19 through B-21, were performed in January 2005. Two CPT soundings (CPT-01 & CPT-02 were advanced on July 21, 2005. CPT-01 was located about 3.5 m west from the edge of Century Boulevard and about 20 m south from the edge west bound of SR4. CPT-02 was located 1.2 m east from the edge of Century Boulevard and about 6 m north from bore hole B-21. The approximate boring and CPT locations are shown on Figure 2. The borings and CPT soundings were located in the field based on hand tape measurements from available reference points. A hand-held global positioning system (GPS) unit was used to record coordinates and elevation at these boring locations. Taber Consultants from West Sacramento, California performed the drilling of the rotary wash borings. Messrs Phil Respess and Sathish Murugaiah of our firm supervised the drilling and logged the borings in accordance with the Caltrans Soil & Rock Logging Classification Manual (1996).

All borings were drilled using a truck-mounted Diedrich D-120 rig equipped with a 63.5-kg automatic trip hammer. Boring B-19 was advanced to a depth of 9.6m using a solid-stem auger. Borings B-20 and B-21 were initially advanced to depths of 6.1m and 13.7 m, respectively, using a solid-stem auger, and subsequently advanced to a depth of about 27.9m by the rotary wash method using a 124-mm diameter drag bit.

The borings were generally sampled at 1.5-m intervals. A Modified California split-spoon drive sampler (50.8 mm fitted with four 101.6-mm-ong, 49-mm ID, brass liners) was used to sample in clayey material. A 0.6-m long split barrel SPT drive sampler (35-mm -ID) was used to sample granular materials. As noted above, all samplers were driven using a 63.5-kg safety hammer dropping 762 mm. All samples were carefully sealed, labeled, and transported to our Geotechnical laboratory in Pleasant Hill, California for review and testing.

On completion of the drilling, a piezometer was constructed in Boring B-20 as shown on the log of boring, and the ground surface was restored to its initial elevation. Borings B-19 and B-21 were backfilled with cement grout, and the ground surface was also restored to its initial elevation. Excess drill cuttings and fluid from the boring were contained in 55-gallon drums and were hauled off-site for disposal.

Gregg Drilling and Testing, Inc from Martinez, California performed the CPT investigations. Mr. Segaran Logeswaran of our firm supervised the CPT investigations in accordance with revised

(2202) ASTM standards (D 5778-95). CPT-01 and CPT-02 were adsvanced to a depth of 60 feet. The both CPT tests were conducted using an integrated electronic cone system contains a 20 ton capacity cone with a tip area of 15 square centimeters and a friction sleeve area of 225 square centimeters. The cone is designed with an equal area ratio of 0.85.

The cone takes measurements of cone bearing (qc), sleeve friction (fs) and dynamic pore water pressure (u2) at 5-cm intervals during penetration to provide a nearly continuous hydrogeologic log.

Both CPT soundings encountered mostly clayey silt layer with inter bedded silt and silty clay layers. A 0.3 m thick silty sand layer was encountered in CPT-01. A pore pressure dissipation test conducted at a depth of 16.90 m of CPT-01 and measured hydrostatic water pressures.

The log of test borings (LOTB) and CPT results obtained from this subsurface investigation are included in Appendix B.

4.3 LABORATORY TESTING

Laboratory soil tests were performed on soil samples recovered from the field exploration to evaluate their engineering properties. The tests were performed in accordance with the ASTM Standards for Testing. The following tests were performed:

- Moisture content (ASTM D2216)
- Dry density (ASTM D2937)
- Particle-size (sieve) analysis (ASTM D-422 and D-1140)
- Unconfined compressive strength (ASTM D2166)
- Atterberg limits (ASTM D4318)
- Unconsolidated undrained triaxial (UU) (ASTM D2850)
- Laboratory Compaction Test (ASTM D1557-B)
- Consolidation Test (ASTM D2345 Method A)

Results of the laboratory tests are presented in Appendix C and on the LOTBs of the corresponding sample depths.

5.1 SITE TOPOGRAPHY

Development of the freeway, bridges and underpassing has resulted in the placement of fill embankments. The original ground surface is relatively flat, ranging in elevation from about 2m to 4m. Vegetation in the vicinity of the proposed improvements consists of grasses and shrubs.

5.2 SUBSURFACE CONDITIONS

Boring B-19 revealed about 2.5m of fat clay fill of stiff consistency. Below the fill, the native soils consist of sandy lean clay and lean clay extending to about a depth 9.3m. The last sample, before terminating the boring at a depth of 9.6m, encountered about 0.3m of silty sand. No groundwater was encountered in this boring.

Boring B-20 encountered about 1.6 m of fill consisting of 100 mm thick gravel base and sandy lean clay. Below the fill, native soil consisting predominantly of medium stiff to stiff sandy clay and silty clay with layers of medium dense silty sand and silt was encountered to the maximum explored depth of 27.9 m. Groundwater was not encountered in the boring prior to switching to the rotary wash drilling method at a depth of about 6.1m.

Boring B-21 encountered about 0.2 m of fill consisting of sand and gravel. Below the fill, native soil consisting predominantly of medium stiff to stiff sandy clay and silty clay with layers of loose to medium dense silty/clean sand and silt was encountered to the maximum explored depth of 27.9 m. Groundwater was encountered in the boring at a depth of about 13.3 m at the time of drilling.

Construction of the roadway embankment resulted in the placement of approximately 1.7m of fill on the north and south sides of the crossing. Results of the subsurface investigation indicate that the underlying native soils consist of alluvium to the maximum explored depth. The alluvium is composed of predominately stiff sandy and silty clay (consistencies vary from soft to hard) with layers of medium dense silty sand. A 0.6m thick layer of medium dense silty/clean sand was encountered at about 13m below the ground surface.

Based on the results of our current investigation, Caltrans standards, and on our previous experience with similar soils, a generalized geologic cross-section was developed as shown on Figure 3. Estimated geotechnical engineering parameters for the soil layers are summarized below in Table 2.

5.3 GROUNDWATER CONDITIONS

Groundwater was not encountered in the previous exploration, however groundwater was encountered at an elevation of about 4.0 meters during the subsurface investigations conducted in January of 2005 and at an elevation of about 4.4 meters during the subsurface investigations conducted in July of 2005. According to the groundwater measurements taken in January of 2006 at the piezometer constructed in Boring B-20, the groundwater was at the elevation of about 4.4 meters. The recommended design groundwater elevation is 5 m.

Table 2
Soil Parameters

Soil Type	Elevation of Top of the Layer (m)	Layer Thickness (m)	Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (deg)
Fill	19.1	2.6	18.8	90	0
Clay	16.5	2.5	18.8	52.5	0
Sand	14.0	2.5	18.8	0	33
Clay	11.5	13.5	18.1	143.5	0
Sandy Clay	-2.0	5.5	19.1	0	30
Hard Silt	-7.5	1.5	18.8	200	0

6.1 LIQUEFACTION

Liquefaction is a phenomenon in which a sudden increase in pore pressure due to strong earthquake shaking causes relatively loose, cohesionless soils below the water table to undergo temporary but substantial loss of shear strength. Liquefaction can result in loss of foundation bearing capacity, differential settlements, and lateral spreading.

Based on a review of the liquefaction susceptibility map of the San Francisco Bay region (Knudsen et al., 2000), the alluvium underlying the SR 4 Century Boulevard undercrossing is classified as having a "low" liquefaction susceptibility.

Our initial soil investigation (Borings B-20 and B-21) identified a thin layer of potentially liquefiable cohesionless soil but did not provide adequate information (SPT blowcounts) to perform a liquefaction susceptibility analysis. In order to obtain a continuous profile, we recommended additional CPT investigations be performed in our preliminary foundation report. The data obtained from the CPTs was used to evaluate the potential for liquefaction at the site. The liquefaction susceptibility analysis was performed using the CPT data in accordance with the methods proposed by Robertson and Wride (1997) using an iterated soil behavior index (I_c) value and applied corrections for layer thickness. Soils having an I_c value of 2.6 and above were considered to be sufficiently clayey and non-liquefiable.

Based on the discussion in Section 6.2, the design earthquake used to evaluate liquefaction potential has a peak ground acceleration of 0.6g, with a maximum magnitude of 7.0. The design groundwater elevation of 5 m (depth of 13 m) was used for calculating liquefaction potential. Liquefaction potential is predicted at depths where the earthquake loading exceeds the soil resistance, or when the factor of safety against liquefaction, expressed as:

FS_L = *(cyclic shear stress required to cause liquefaction) / (equivalent cyclic shear stress induced by earthquake)*

is less than 1. The California Geological Survey recommends that liquefaction potential be considered if the factor of safety is less than 1.3. Based upon the results of our analysis, the probability of liquefaction within the sand zones encountered in the soil profile is considered to be low except for a 1 m thick layer at a depth of 17 m which is susceptible to liquefaction.

In order to compute post liquefaction settlements from the CPT data, the CPT tip resistance was converted to N_{60} values and normalized for overburden pressure using the methods of Robertson and Campanella (1985 and 1988). The method developed by Tokimatsu and Seed (1987) was developed for clean sands. It is commonly understood that an elevated fines content in sand will reduce the observed N_{60} blowcounts for a given relative density. A correction of the N_{60} blowcounts was applied based upon the fines content as suggested by Seed and by Stark and Mesri (1992). As suggested by Robertson and Wride (1997), soil having a normalized friction ratio (F) less than 0.5 and an I_c value of between 2.36 and 1.64 was considered to be "clean sand" and no correction to N_{60} was applied. The volumetric strains were estimated from the computed clean sand equivalent blow count and the magnitude scaled cyclic stress ratio. The analysis of CPT data shows negligible seismically induced settlements of the structure at locations where liquefaction occurs. The results of the liquefaction analysis are contained in Appendix E.

Given the depth and limited extent of the soils susceptible to liquefaction, surface expression of liquefaction during a seismic event is anticipated to be negligible. Since the potentially liquefiable zones lie below the bottom of the footings recommended in Section 7.2, we do not expect any adverse impact on the load-carrying capacity of the proposed foundations.

6.2 FAULT RUPTURE

No active faults have been mapped underlying the SR 4 alignment between Loveridge Road and Somersville Road. The project site is not within Alquist-Priolo special studies zones (CGS, 2003). The potential for surface fault rupture at the site is therefore considered to be low.

6.3 LANDSLIDES AND SLOPE FAILURE

Due to the relatively flat topography at the site, landsliding is not considered a hazard. Slumping or distress of the embankment fill slopes at the site was not noted during the site reconnaissance.

6.4 GROUND SUBSIDENCE/HEAVE

Due to the relatively dense/stiff character of the underlying alluvium, the potential for ground subsidence and heave is considered to be low.

6.5 FLOOD

FEMA flood zone maps (http://www.esri.com/hazards) indicate that the site is located outside of the 100- and 500-year flood plain. Therefore the potential for flooding hazard is considered to be very small.

6.6 SCOUR

Because the existing and proposed structure supports are located outside waterways, scour is not an issue for foundation design.

6.7 CORROSION

As part of our study, near surface soil samples were collected at four locations at the Century Boulevard Undercrossing site located in the vicinity of the subject site. The results of the tests conducted for Century Boulevard Undercrossing are considered applicable to the subject site and are presented in Appendix D. The samples were analyzed for corrosivity by V&A Consulting Engineers, Inc. The soil samples were analyzed for pH, resistivity, chlorides and sulphates. The soil samples were analyzed for pH, resistivity, chlorides and sulphates. The results of the sulfate, chloride, pH and resistivity testing indicate the near surface site soil is considered noncorrosive to buried concrete, reinforced concrete and mortar coated steel pipe.

7.1 DESIGN ASSUMPTIONS

The generalized geologic profile with soil stratigraphy, soil engineering parameters, and estimated groundwater level is presented as Figure 3. This generalized soil profile was the basis for developing foundation recommendations for the proposed widening.

Based on our understanding of the structural details of the existing and proposed extension of UUC and the subsurface conditions revealed from previous and our current field explorations, we believe it is feasible to support a similar inverted U frame structure on CIDH piles. The generalized geologic profile shown on Figure 3 forms the basis of our foundation recommendations for the proposed extension. Since the extended structure will be embedded in embankment fill, we expect the soil-structure interaction characteristics of the structure will be similar to those of a box culvert structure. Therefore, our recommendations for geotechnical design parameters and construction considerations will be similar to those for box culvert design.

7.2 FOUNDATION ALTERNATIVES

Shallow Foundations – The existing structure is supported on spread footings which were constructed prior to installation of the utility lines. In fact some of the existing utility lines are directly above the spread footings, and therefore installation of new spread footings is directly impeded by the existing utilities. Spread footing foundation selection would therefore require utility relocation, which is not a recommended alternative.

Driven precast concrete piles – Driven precast concrete piles are a suitable foundation alternative from the technical standpoint, but have certain constructability disadvantages. Precast concrete piles offer advantages in shallow groundwater and caving soil conditions, and are generally more economical that other pile types. However, as noted in Caltrans Memo To Designers 21-19, a larger work area is required to install driven piles than for CIDH piles (diameter < 24 in). Driven piles have greater noise and vibration impacts.

Cast-in-drilled-hole (CIDH) piles – CIDH piles have the advantages of easy penetration into dense/hard soil zones, the availability of larger diameters for increased lateral capacity (such as for retrofit applications), and adaptability of length to variable subsurface conditions. The presence of shallow groundwater or caving soils can complicate the use of CIDH piles. From the constructability standpoint, CIDH piling rigs are more economical to mobilize than pile driving rigs, can work in limited access conditions, and have significantly lower noise and vibration impacts during pile installation than driving operations, and can be installed in close proximity to existing structures.

Driven pipe piles or cast-in-steel-shell (CISS) piles – Driven pipe piles are technically feasible for support of the bridge abutments, but have the same constructability limitations as driven precast concrete piles. While pipe piles or CISS piles can adjust pile diameter and wall thickness to obtain increased lateral stiffness, they have a disadvantage owing to the high cost of steel.

7.3 PROPOSED FOUNDATIONS

Due to access, noise and vibration considerations CIDH piles are the recommended foundation alternative. This foundation type will not require utility relocation. Based on field investigations,

we expect the CIDH piles will encounter groundwater between approximate elevations 4.0 and 5.0 m. Details for the proposed foundations are summarized in Table 3.

Table 3
Pile Data Table

Location	Pile Type/ Size	Design Loading (kN)	Nominal Capacity (kN)		Design Tip Elevations (m)*	Specified Tip Elevations (m)
			Compression	Tension		
Abut 1 B.O.F^{+} = 17.600	460mm CIDH (600 kN)	N/A	800	0	8.8(1), 9.6(3)	8.8
Abut 2 B.O.F = 17.600	460mm CIDH (600 kN)	N/A	800	0	8.8(1), 9.6(3)	8.8

* Design tip elevation is controlled by the following demands:
(1) Compression, (2) Tension, (3) Lateral Loads
+ B.O.F = Bottom of footing elevation in meters.

The drilled piers primarily derive their resistance through skin friction between the pier concrete and surrounding soils. Thorough cleaning of the pier bottom, which is especially difficult if drilling mud is used, is required to develop full end-bearing capacity. The end-bearing capacity was not considered in estimating the pile tip elevations presented in Table 3. The frictional pier resistance was calculated using the procedures recommended by the FHWA manual IF-99-025(1999).

Also presented in Table 3 are the design tip elevations for lateral (service) loads of 90 kN for abutments 1 and 2. The computer program LPILE Plus 5.0 was utilized to analyze the individual pile response to applied lateral and axial loads with a series of nonlinear springs that are internally generated by the program as a function of user-specified soil properties. The piles were modeled according to Caltrans Standard plan B2-8. In addition, the piles were modeled with pinned head conditions. LPILE data is included in Appendix E.

For computing the lateral resistance of piles arrayed in groups, a group efficiency factor should be applied for pile lateral resistance in the direction of loading. For pile spacing of 5 diameters or greater, an efficiency factor of 100% shall be applied; for pile spacing of 4 diameters, an efficiency factor of 80% shall be applied; and for pile spacing of 3 diameters, an efficiency factor of 60% shall be applied.

For abutments constructed with compacted structural backfill, passive resistance may be developed by the abutment walls. To estimate resistance to lateral loads, an allowable equivalent fluid unit weight of 30 kN/m^3 (up to a maximum pressure of 120 kPa) can be used to calculate the ultimate passive pressure; however, resistance offered by the upper 0.30 m of soil should be neglected when computing passive soil resistance.

7.4 LATERAL EARTH PRESSURES

7.4.1 Background

There has been considerable research performed by agencies on loading of different types of culverts, including reinforced concrete box culverts. The majority of this research has been performed by Caltrans, (Bacher et al., 1980, 1982, 1983 and 1990). Based on long-term monitoring of instrumentation of box culverts, which included strain gauges and soil load cells, the research indicates soil loads increase over a period of 2 years or more. It was found that the lateral pressures can be as much as the vertical pressures. Therefore, the traditional loading (Case 1) wherein the lateral pressure is taken as the active pressure (about 1/3 of the vertical pressure) has been supplemented with a second loading (Case 2) wherein the lateral pressure is also taken as 100 percent of the vertical pressure. According to Caltrans (Bacher and Friedman, 1990), these two loadings are applied separately and the resulting maximum moments are utilized in design. The full lateral pressure (22 kPa/m) condition also satisfies the saturated fill condition. Based on these considerations, we recommend the following geotechnical design parameters.

7.4.2 Static Loading Conditions

The box culvert structures should be designed for two distinct static loading conditions: Case 1 (traditional loading) and Case 2 (supplemental loading), as discussed below.

For Case 1, the culvert should be designed for the following load combinations:

- Walls should be designed to resist an equivalent lateral fluid pressure of 6.6 kPa/m
- Roof should be designed to resist a column of soil with a moist unit weight of 22 kN/m^3

For Case 2, the culvert should be designed for the following load combination:

- Walls should be designed to resist an equivalent lateral fluid pressure of 22 kPa/m
- Roof should be designed to resist a column of soil with a moist unit weight of 22 kN/m^3

7.4.3 Traffic Loading Conditions

No additional surcharge pressure due to traffic loading should be applied to the walls.

All reinforced concrete box culvert roofs with less than 3m of cover should be designed for the following two conditions:

- 600 mm of cover with HS 20-44 live load
- 3m of cover

It is recommended that impact loads be applied only to the roof slab of the box culvert, with the magnitude shown as follows:

- For earth cover of 300 mm or less, use 30 percent impact
- For earth cover of 301 mm to 600 mm, use 20 percent impact

- For earth cover of 601 mm to 900 mm, use 10 percent impact
- For earth cover greater than 900 mm, no impact

No impact load is recommended for the culvert invert. Consideration should also be given to structural design of the box culvert if loaded construction equipment passes over the top.

These requirements, including sample design calculations, are provided in Section 6 of the Caltrans Bridge Design Practice entitled "Underground Structures Design Practice" (1992). These criteria are also listed in sheet D82 of the Caltrans Standard Plans (1999).

7.4.4 Earthquake Loading Conditions

According to Caltrans (1990), "observations of all types of underground structures in the 1971 San Fernando earthquake area and in the 1989 San Francisco (Loma Prieta) earthquake area, affirmed the cushioning effect the soil has on the performance of an underground structure during an earthquake. There were no failures due to an increase in soil pressures. Underground structures must move with the surrounding soil during earthquakes and usually will be supported by the interacting design against crushing or collapse even if the structure joints are strained. If the earth does fault across a culvert, the tremendous forces will shear the submerged structure regardless of how the structure was designed. In special cases where underground structures are in soft ground (bay mud), consideration should be given to providing longitudinal structure continuity."

Considering the upper bound (22 kPa/m) of the two bands of lateral pressure recommended in Section 8.4.2 entitled "Static Loading Conditions," and the discussion in the previous paragraph, we believe design of the modified box culvert walls and roof for increased loads during earthquake shaking is unnecessary.

7.5 EARTHWORK

All earthwork construction for fill and backfill should be completed in accordance with the applicable sections of the Caltrans Standard Specifications. Specific additions and modifications to those specification requirements are discussed in the following paragraphs.

7.5.1 Site Preparation

Before any grading begins, all locations to be filled should be cleared of the existing improvements (i.e. rails, posts, curbs, pavements, etc.), all debris, vegetation, and any soils containing roots or other vegetative matter in accordance with Section 16 of Caltrans Standard Specifications. A stripping depth of approximately 100 to 150 mm is estimated. The entire root ball of large shrubs should be removed, including all roots greater than 25 mm in diameter.

7.5.2 Demolition of Existing End Walls and Footings

We assume existing end retaining walls and their spread footings will be partially removed, as necessary. The Contractor should carry out necessary precautionary steps to minimize disturbance of the subgrade soils during the demolition and removal. In addition, we understand that numerous buried utilities run along this undercrossing. Therefore, removal or temporary

relocation of the utilities may be required prior to demolition of the existing walls and footings. The Contractor should clear all utilities prior to any digging.

7.5.3 Removal of Existing Fills

The pavement, aggregate base and soil fill identified in the previous exploratory borings should be excavated and replaced with properly compacted fill. The excavated material can be reused as fill provided it is placed in accordance with the provisions stated below in Section 8.4.4.

If expansive soils are encountered within the excavation for the culvert end wall, the expansive soil materials should not be placed as part of the backfill for the new box culverts. Expansive soil materials are defined as having either an Expansion Index (EI) greater than 50, (Expansion Index to be determined in accordance with ASTM D 4829) or a Sand Equivalent (SE) less than 20 (Sand Equivalent to be determined in accordance with California Test Method 216). This requirement is supplemental to the structure backfill and pervious backfill material requirements as shown on the plans and set in the Standard Specifications under Sections 19-3.06 and 19-3.065, respectively..

7.5.4 Placement and Compaction of Fill

All fills should be constructed in accordance with Caltrans Standard Specifications Section 19, entitled "Earthwork." Relative compaction of not less than 95 percent (ASTM D1577 or Caltrans 216, using dry weight basis) should be obtained in all fill materials.

Materials intended for use as fill should be a soil or soil/rock mixture that is free of organic matter and other deleterious substances. They should not contain rocks or lumps over 150 mm in greatest dimension and not more than 15 percent larger than 64 mm. In addition, it should have a Plasticity Index (PI) of less than 12 and an R-value greater than 15. All import material should meet these requirements and should be approved by the Engineer prior to construction. Asphalt concrete and aggregate base that are broken up to meet the size requirements for fill material detailed above, could be reused as fill.

7.5.5 Keying and Benching

Fills placed on existing slopes with inclinations steeper than 6 to 1 (horizontal to vertical) should be keyed and benched to provide a bond at the interface as specified in Caltrans Standard Specifications Section 19-6 "Embankment Construction."

The opinions, conclusions and recommendations presented herein are based on subsurface information developed by URS and others. The recommendations presented in this report are based on the assumption that the soil and geologic conditions do not deviate substantially from those anticipated by the information contained in the existing logs of test borings. If any variations are encountered during construction, the Geotechnical Professional should be contacted so that supplemental recommendations can be made.

If existing facilities, utilities, soils/bedrock conditions, road/structure distress, slope distress or groundwater/seepage conditions other than those noted in this report are present on the site, then their presence was not known, or was not considered in the preparation of this report. Locating utilities and evaluating potential utility interference is outside the scope of this report. Individuals utilizing this report shall inform URS Corporation if they are aware of any additional facilities or site conditions so that their presence and impact upon the project (or vice-versa) can be properly evaluated and recommendations modified to address geotechnical issues as necessary.

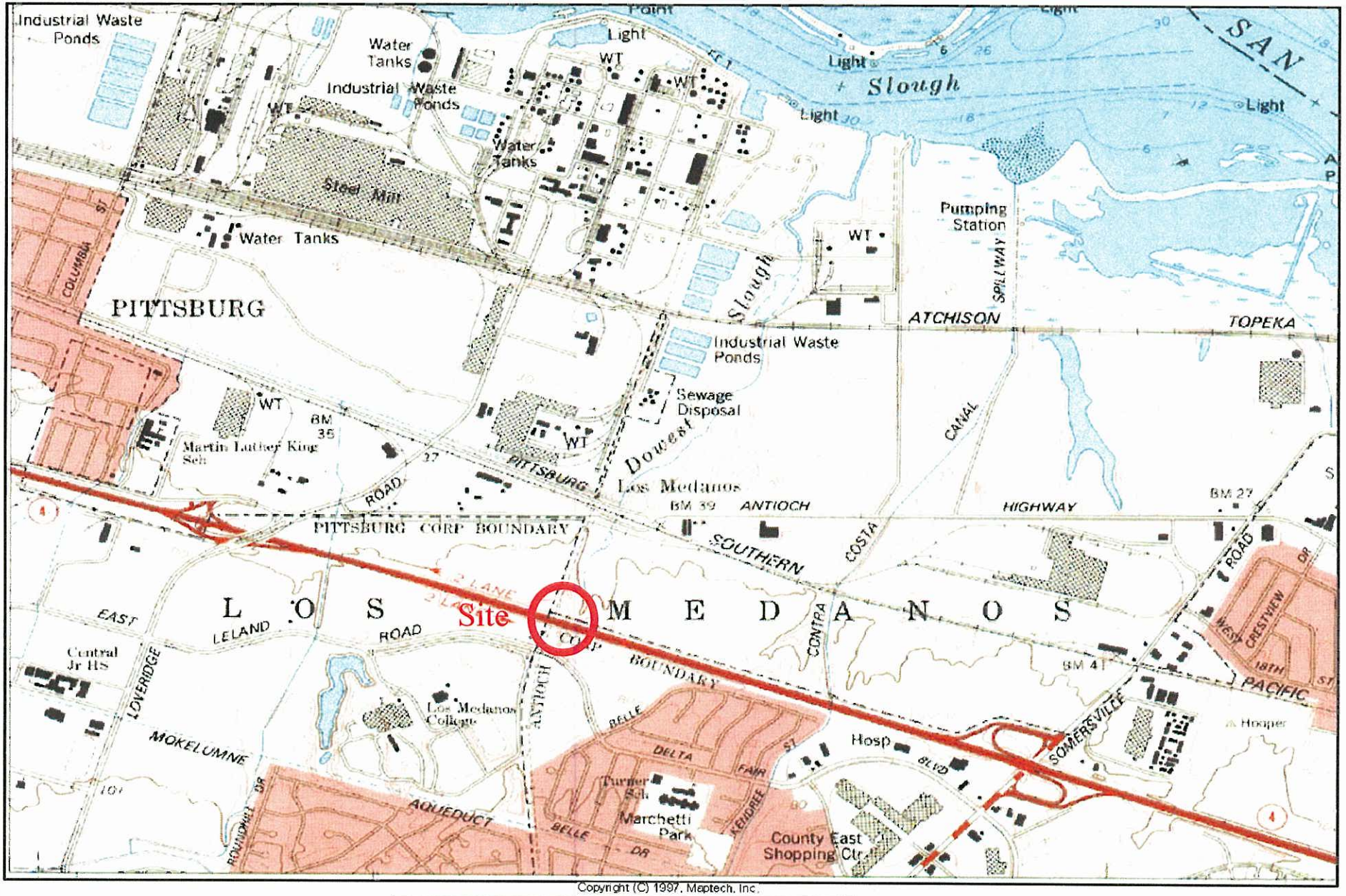
The Geotechnical Professional shall be given the opportunity to review the final specifications and drawings to verify that those documents are consistent with the intent of the geotechnical recommendations.

Geotechnical issues may arise during construction that were not apparent at the time this report was prepared. The Geotechnical Professional should be retained during construction to review the soil conditions encountered and the construction procedures used. All earthwork, pile and wall installation and testing should be completed under the direct observation of the Geotechnical Professional.

Specific review and investigation for environmental issues and subsurface environmental contamination were beyond the scope of our services.

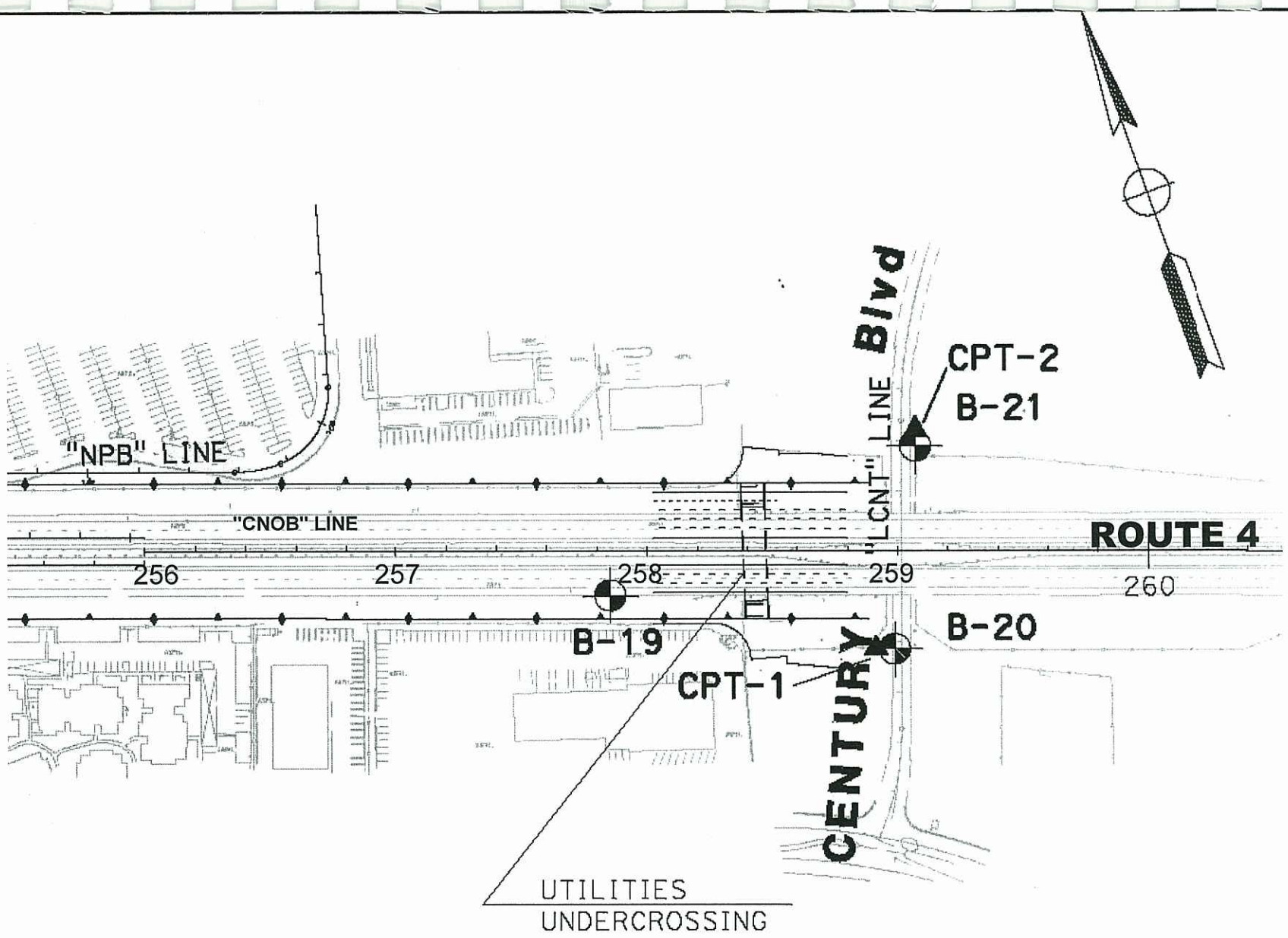
The opinions and recommendations presented in this report were developed with the standard of care commonly used by other professionals practicing at the same time, within the same locality and under the same limitations. No other warranties are included, either express or implied, as to the professional advice included in this report.

Figures

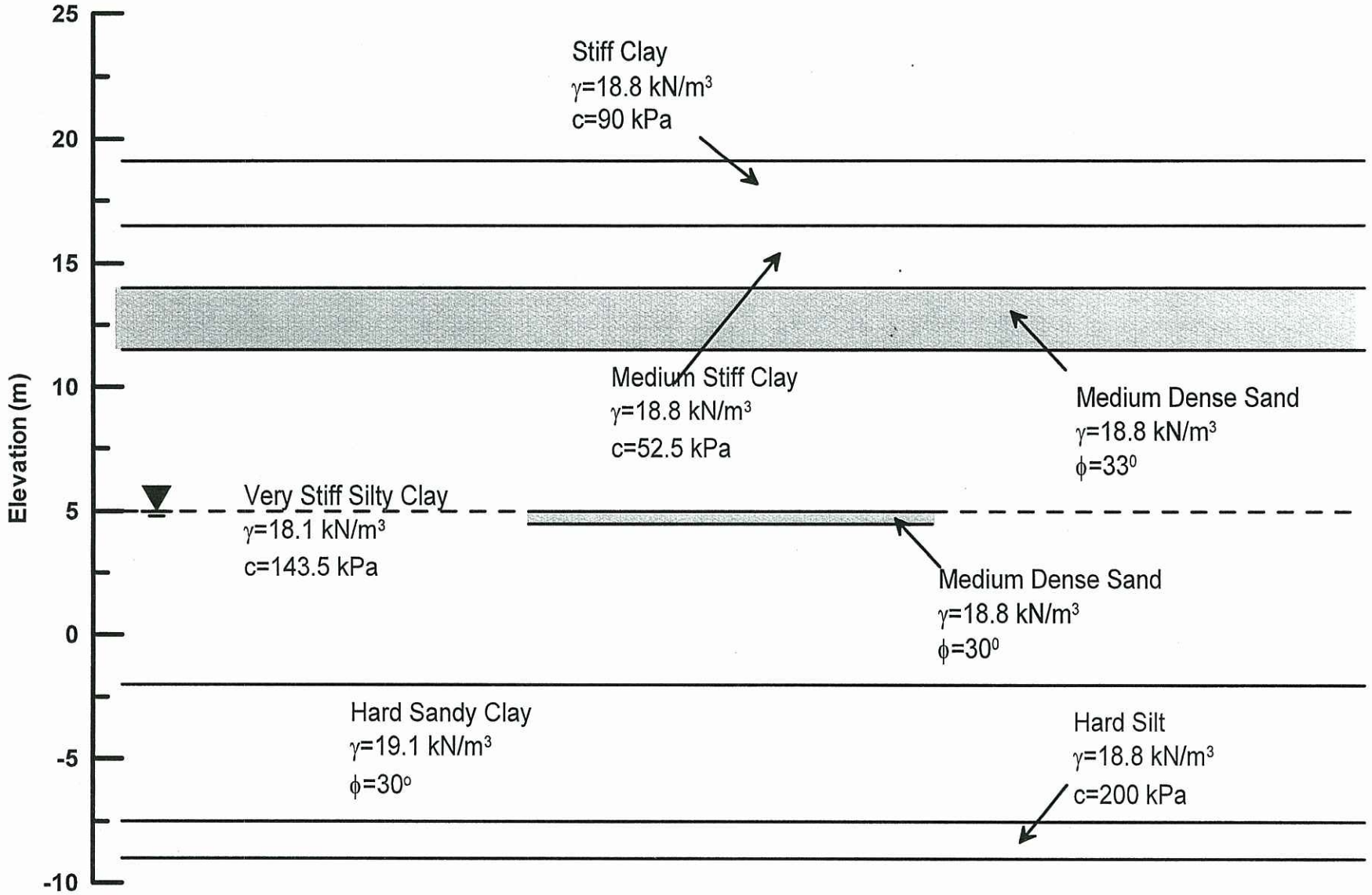


Copyright (C) 1997, Maptech, Inc.

Project No. 26814910	SR 4 (EAST) WIDENING PROJECT LOVERIDGE ROAD TO SOMERSVILLE ROAD, Pittsburg CA	**Site Location Plan** **Utilities Undercrossing**	FIGURE 1
	URS		



Project No. 26814910	SR 4 (EAST) WIDENING PROJECT LOVERIDGE TO SOMERSVILLE ROAD, Pittsburg CA	**Boring Locations** **Utility Undercrossing**	FIGURE 2
	URS		



Project No. 26814910	SR 4 (EAST) WIDENING PROJECT LOVERIDGE TO SOMERSVILLE ROAD, Pittsburg, CA	**Generalized Geologic Cross Section** UTILITY UNDERCROSSING	FIGURE 3
	URS		

Appendix A

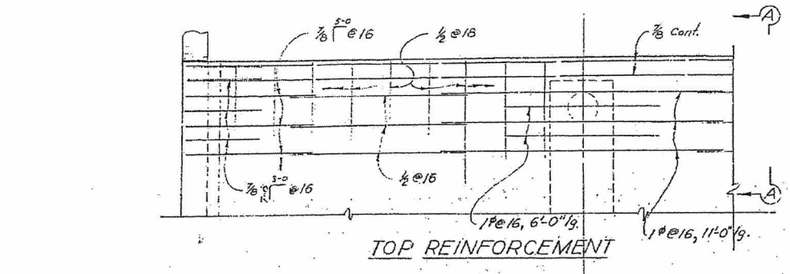
As-Built Plans And Log Of Test Borings From Previous Investigations

FED. ROAD DIV. No.	STATE	PROJ. No.	FISCAL YEAR	SHEET No.	TOTAL SHEETS
7	CAL.				

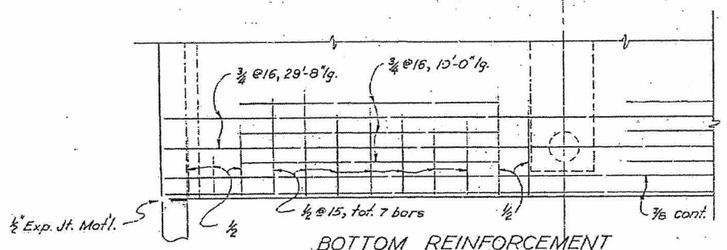
DIST.	COUNTY	ROUTE	SECTION	SHEET No.	TOTAL SHEETS
IV	C.C.	~~75~~	F	46	

Stewart Mitchell
BRIDGE ENGINEER — CIVIL AND STRUCTURAL ENGINEER — LICENSE 5436

DATE APPROVED March 6, 1952

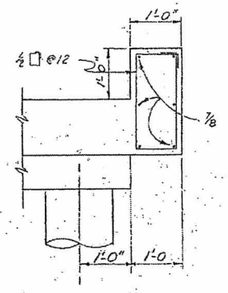


TOP REINFORCEMENT

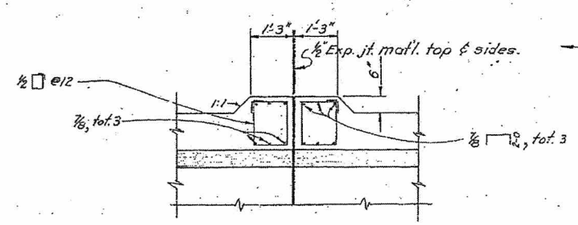


BOTTOM REINFORCEMENT

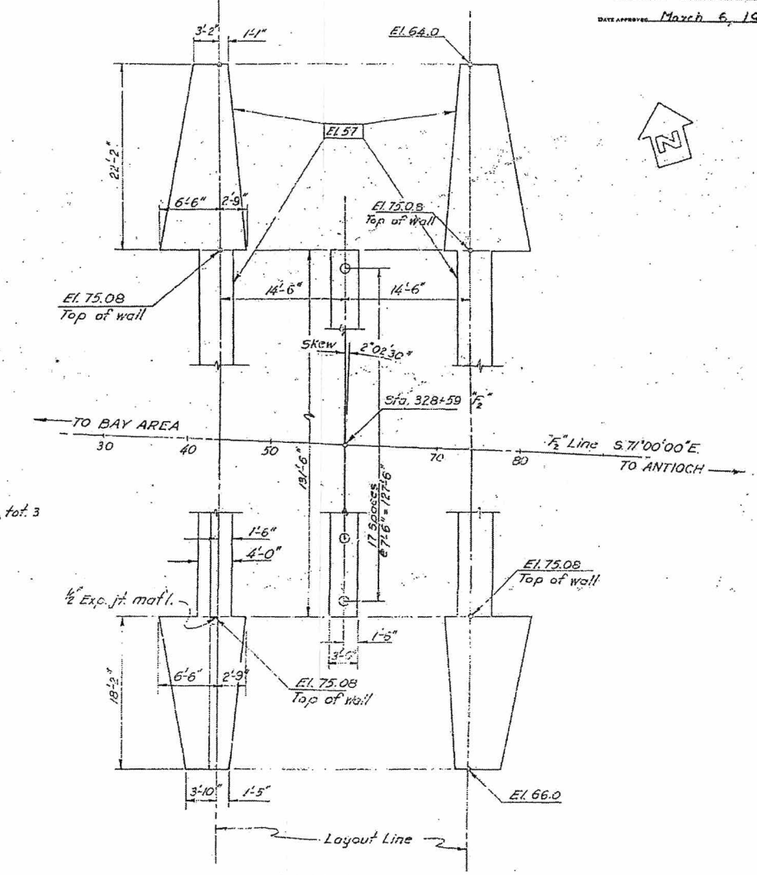
HALF DECK PLAN
Scale: 3/8" = 1'-0"



SECTION A-A
Scale: 3/4" = 1'-0"



EXPANSION JOINT
Scale: 1/2" = 1'-0"

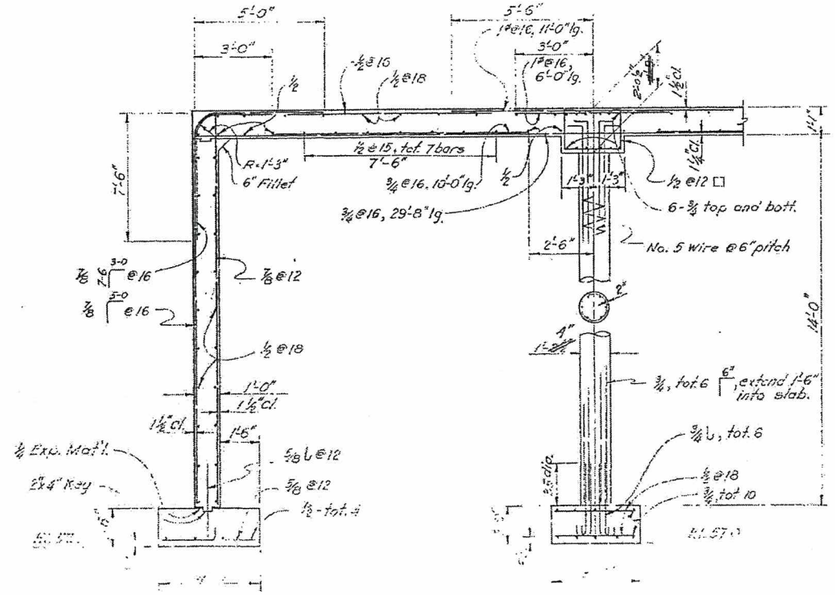


FOUNDATION PLAN
Scale: 1/8" = 1'-0"

5.0 Indicates bottom of footing elevation.

B.M. No. 33
"F" S. Side P.C.C. Base Steel Tower #4/1
148' Lt. "F2" 329+02
El. 62.05

Note: For retaining wall details see Sh. #5, top of wall as for Railroad Avenue Undercrossing.



TYPICAL SECTION
Scale: 3/8" = 1'-0"

AS BUILT PLANS
Contract No. 52-04TC27
Date Completed
Document No. 40002542

MICROFILMED

SUPPLEMENTAL SHEET

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

UTILITIES UNDERCROSSING

Appendix A

FOUNDATION PLAN & DETAILS

SCALE As Noted	BRIDGE 28-105	FILE	DRAWING SC-2932-2

BRIDGE DEPARTMENT

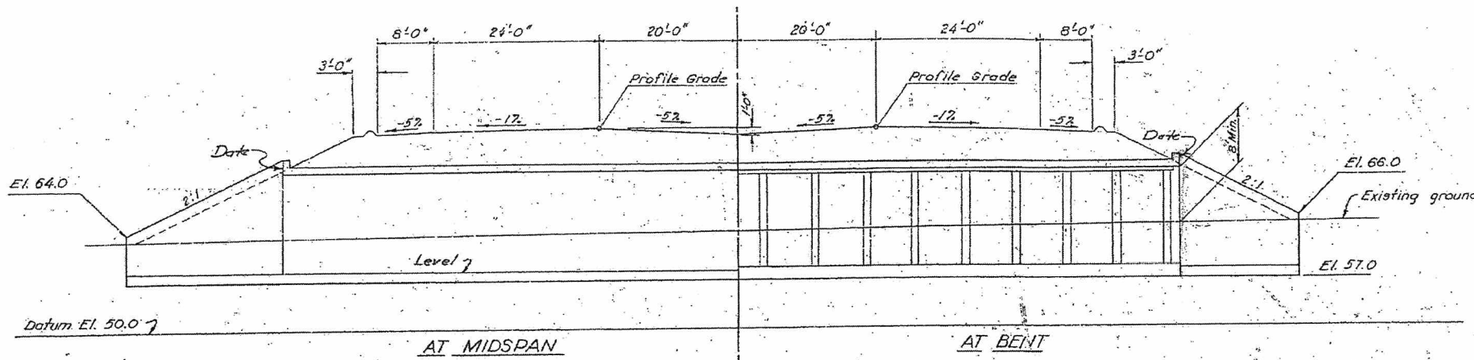
Submitted by		Chief Engineer			
DESIGN	By	J.C.C. 2-52	Checked	G.D.G. 2-52	
DETAILS	By	J.C.C. 2-52	Checked	G.D.G. 2-52	
QUANTITIES	By	J.C.C. 2-52	Checked	G.D.G. 2-52	
SPECIFICATIONS	By		Checked		
Approval Recommended by			Date of Approval		

DIST.	COUNTY	ROUTE	SECTION	SHEET NO.	TOTAL SHEETS
IV	C.C.	~~75~~ 04	~~F~~	45	

Bridge Engineer — Civil and Structural Engineer — License 14814

Date Approved March 6, 1952

State Highway Engineer
Civil Engineer — License 3084



LONGITUDINAL SECTION
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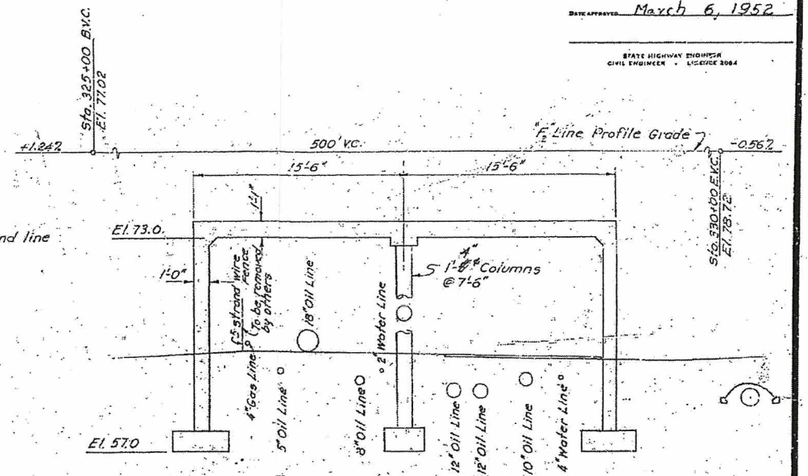
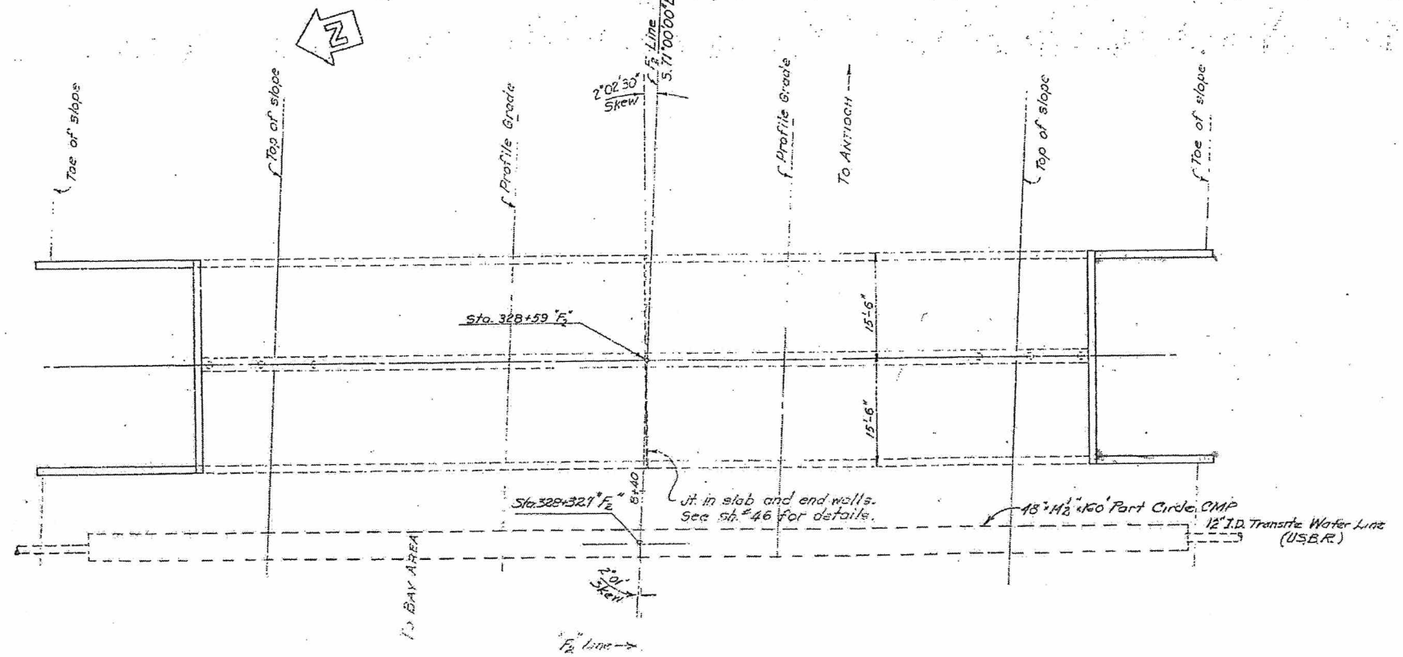


TYPICAL SECTION
Scale: 1"=5'-0"



PLAN
Scale: 1"=10'-0"

THIS SET OF PLANS HAS BEEN CORRECTED TO CORRESPOND TO THE "AS BUILT" PRINTS DATED 1-26-53, AS SUBMITTED BY RESIDENT ENGINEER R. E. Neff
TRACINGS CORRECTED BY: TEC DATE: 3-23-53

MICROFILMED

INDEX TO PLANS

SHEET NO.	TITLE
45	General Plan
46	Foundation Plan & Details

For General Notes See Sh. #3
Unit Soil Pressure = 2½ Tons/1" ft.
SUPPLEMENTAL SHEET

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

UTILITIES UNDERCROSSING
ABOUT 2 MILES EAST OF PITTSBURG
IN CONTRA COSTA COUNTY

GENERAL PLAN

SCALE AS NOTED	BRIDGE 28-105	FILE	DRAWING SC-2932-1

PREL. DRAWING NO. B-2932 (Y)

Live Loading: H20-S16-44

AS BUILT PLANS
Contract No. 52-04TC27
Date Completed
Document No. 40002542

BRIDGE DEPARTMENT

Checked by	Date	Submitted	Date	Approved	Date
DESIGN					
DETAILS					
QUANTITIES					
SPECIFICATIONS					

Appendix A
2

F-246(3)

187 140

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

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

DIST.	COUNTY	ROUTE	KILOMETER POST-TOTAL PROJECT	Sheet No.	Total Sheets
04	CC		37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

Philip Meymand
No. 2596
Exp. 6/30/07
GEOTECHNICAL
REGISTERED PROFESSIONAL ENGINEER
STATE OF CALIFORNIA

UTILITIES UC (WIDEN)

AS-BUILT LOG OF TEST BORINGS

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

CU: 04275
EA: 228501

BRIDGE No. 28-0105

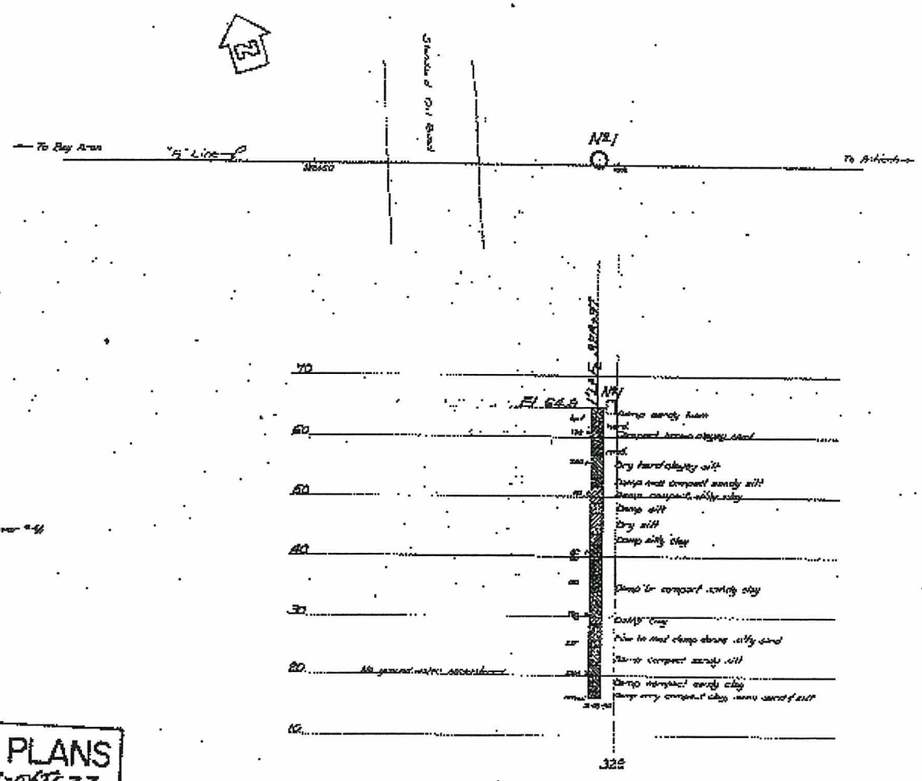
Sheet 12 of 12

Revisions made to this Log of Test Borings from the original 1951 Log of Test Borings are the addition of the following table and notes:

Boring	Station	Offset from "EB4" Line
N-1	258+55.06	0.84 Rt

Notes:

1. See the General Plan and/or Foundation Plan for Metric Stationing.
2. Structure Design produced the data presented in the table above. The data are the metric locations for the As-Built Test Borings referenced to the proposed new structure location. This table is presented on the As-Built Log of Test Boring sheet for the convenience of any bidder, contractor or other interested party.



BM 23

"O" S side B.C.C. brass steel tower "4-4" near "L" "G" 2538.025
Elev. 62.05

AS BUILT PLANS
Contract No. 52-046127
Date Completed
Document No. 1002562

No Change
THIS SET OF PLANS HAS BEEN REVISED TO CORRESPOND TO THE AS BUILT CONDITIONS AS SHOWN ON THE RECORD DRAWINGS BY
DATE 7-26-99 BY [illegible]
CONTRACTOR [illegible]

CLASSIFICATION OF SOILS AND ROCKS ON STANDARD GRADE SEE LIMITS

LEGEND OF BORING OPERATIONS

LEGEND OF EARTH MATERIALS

ABBREVIATIONS

NOTES

MICROFILMED

STANDARD OIL ROAD UNDERCROSSING

1" = 10'

28-99

C-2548-4

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY SUPERVISION AND CONTROL ON FILM MADE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE 8/21/97 SIGNATURE [illegible] TITLE [illegible]

Appendix A
3

Appendix B

Log Of Test Borings From Current Investigation

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Phillip Meymand — No. 2596 — Exp. 6/30/07 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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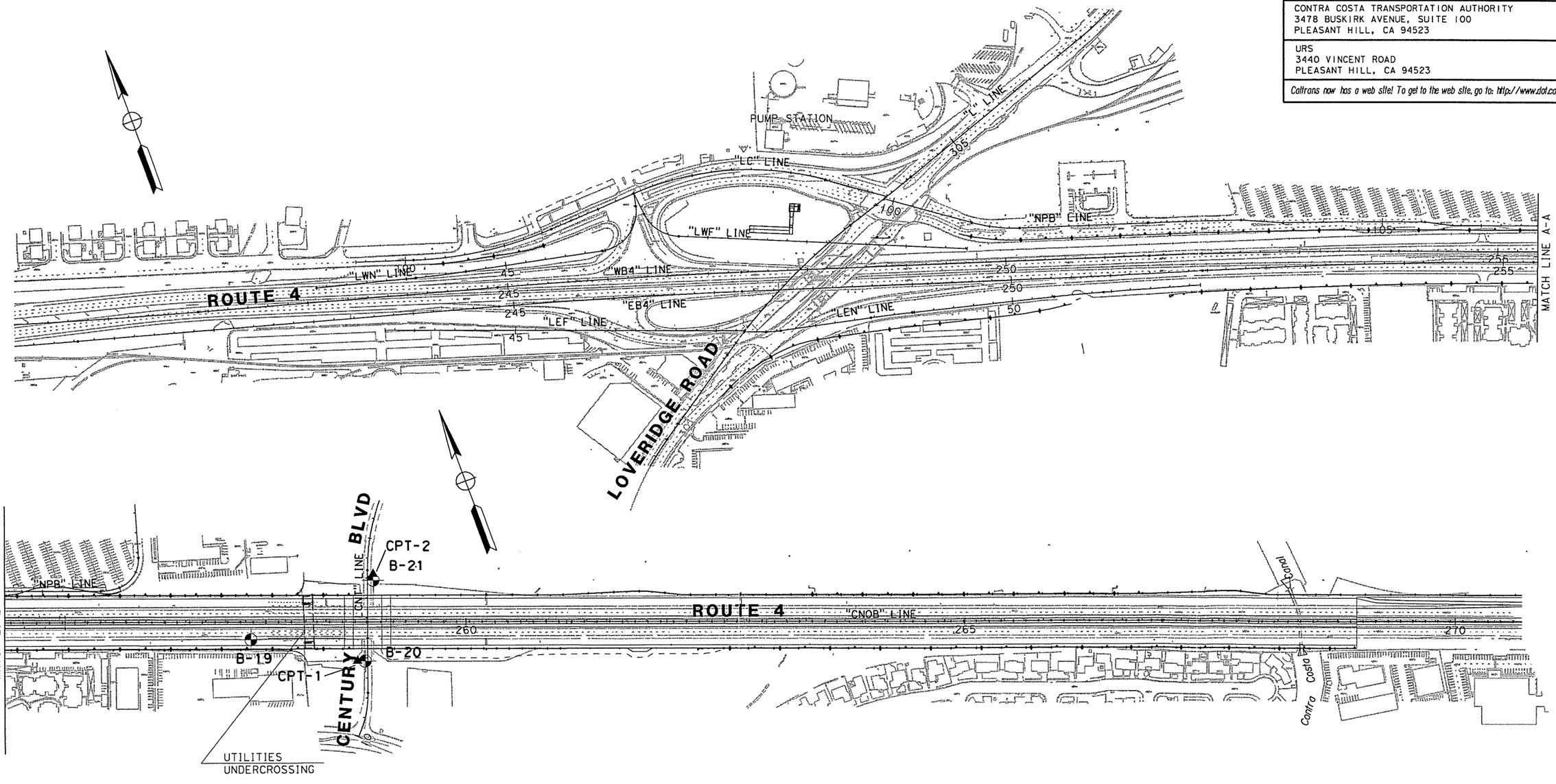
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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



UTILITIES UC (WIDEN) FOUNDATION REPORT
SITE AND BORING LOCATIONS

ALL DIMENSIONS ARE IN
METERS UNLESS OTHERWISE SHOWN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans
DESIGN OVERSIGHT
SOTERO ANGELES

	CALCULATED/ DESIGNED BY	DATE	REVISED BY
	E.A.J	06/06	
	CHECKED BY	DATE	DATE REVISED
	BR	06/06	

LAST REVISION 00-00-00 | DATE PLOTTED => 1/31/2007 | TIME PLOTTED => 5:01:42 PM

FOR REDUCED PLANS ORIGINAL 0 10 20 30 40 | USERNAME => cesomer0 | CU 04275 | EA 22859*

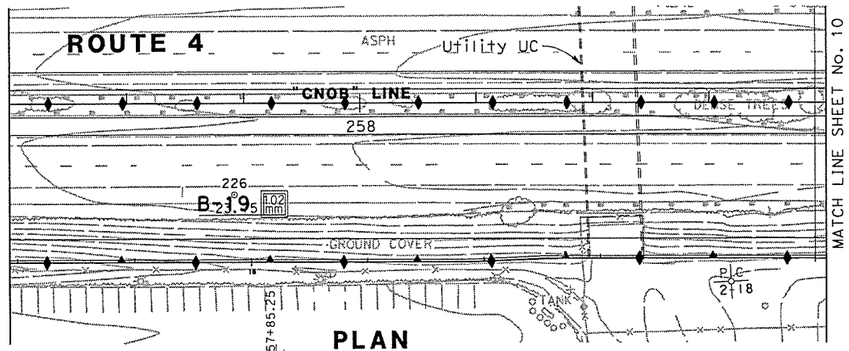
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

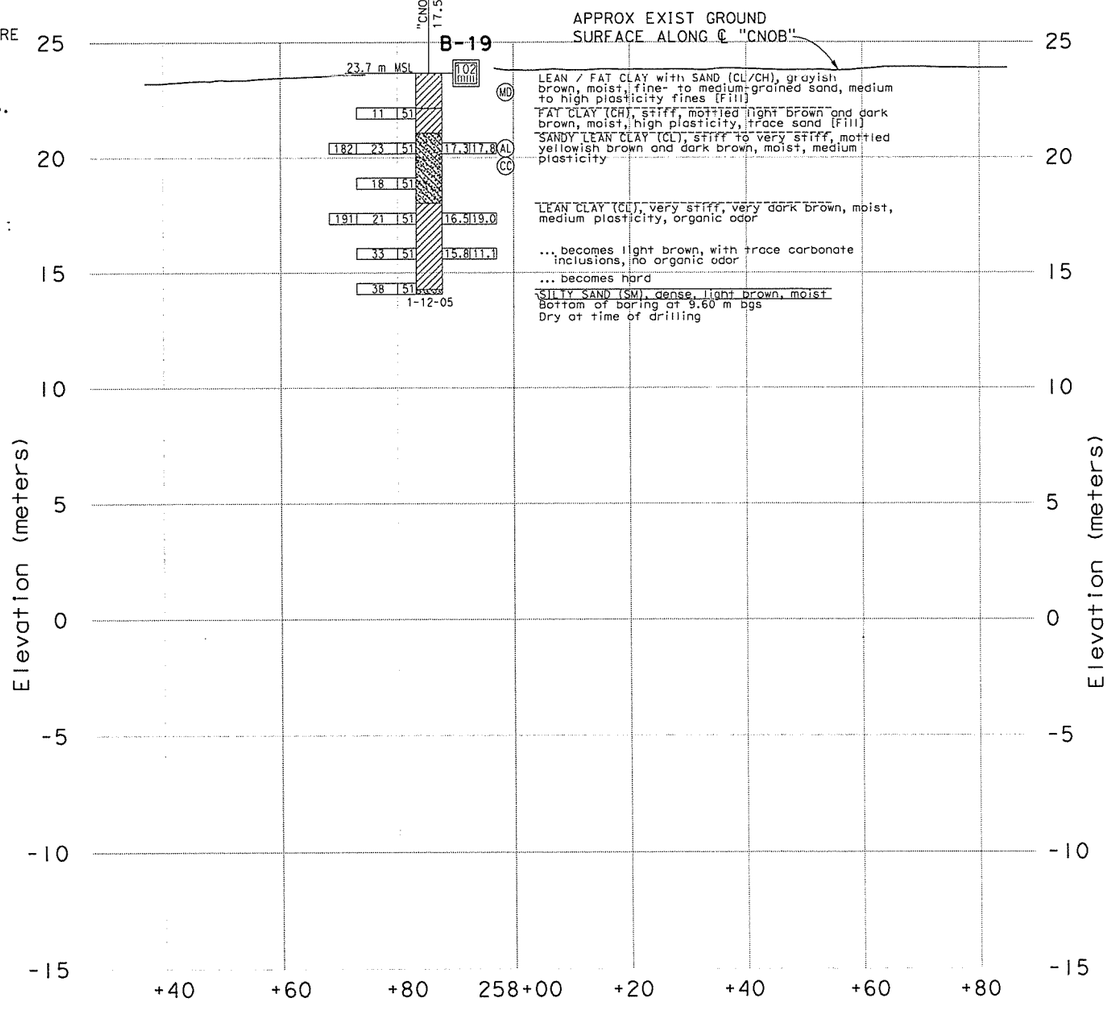
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/07 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

LEGEND OF BORING OPERATIONS

TEST TYPE
(A) Atterberg Limit (C) Corrosivity Test (CO) Consolidation (D) Direct Shear (HY) Hydrometer (M) Mod. Density, Ltd. Compaction, Expansion (R) Resistance R-value Test (SA) Sieve Analysis (SS) Swell/Settlement Test (U) Unconsolidated Undrained Triaxial Compression (UC) Unconsolidated Undrained Triaxial Compression (V) Vane Shear

Location, B-No., Top Hole El., Description of material (Classification, Consistency, Color, Moisture, Geologic Origin), Test Type, Sample No., Blows/0.3m, Recovery %, Bulk Density (kN/m³), Moisture Content %, Dry Density (kN/m³), Liquid Limit %, Plastic Limit %, Plasticity Index, Passing #200 Sieve %, Unconfined Compressive Strength (kPa), Shear Strength (kPa), Vane Sheer, Boring Date
ROTARY SAMPLE BORING (RB)

Location, B-No., Top Hole El., Description of material (Classification, Consistency, Color, Moisture, Geologic Origin), Test Type, Sample No., Blows/0.3m, Recovery %, Bulk Density (kN/m³), Moisture Content %, Dry Density (kN/m³), Liquid Limit %, Plastic Limit %, Plasticity Index, Passing #200 Sieve %, Unconfined Compressive Strength (kPa), Shear Strength (kPa), Vane Sheer, Boring Date
AUGER BORING (DAT)

Location, B-No., Top Hole El., Pressure measured during insertion of cone penetrometer, Pressure measured during extraction of cone penetrometer, Friction Ratio (%), Boring Date
ELECTRONIC CONE PENETROMETER TEST
Cone Penetrometer dimensions and testing procedures conform to ASTM standard D 3441-86, or as noted.

57 mm CONE PENETRATION
SAMPLE BORING (DRY)
ROTARY SAMPLE BORING (RB)
AUGER BORING (DRY)
TEST PIT
DIAMOND CORE BORING
JET BORING
ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS
GRAVEL, SAND, SILT, CLAY, SANDY CLAY or CLAYEY SAND, SANDY SILT or SILTY SAND, SILTY CLAY, CLAYEY SILT, PEAT and/or ORGANIC MATTER, FILL MATERIAL, COBBLE, IGNEOUS ROCK, SEDIMENTARY ROCK, METAMORPHIC

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/04/05

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

H. BERGER
PROJECT ENGINEER

BRIDGE NO. 28-0105
KILOMETER POST 39.9(24.8)

UTILITIES UC (WIDEN)
LOG OF TEST BORINGS NO. 1

CU 04275
EA 228501

DISREGARD PRINTS BEARING EARLIER REVISION DATES →
REVISION DATES (PRELIMINARY STAGE ONLY): 10/11/05 | 7/28/06 | 02/16/07

SHEET 9 OF 12

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

FILE => ...\28-0105-z-1tb01.dgn

USERNAME => csomer0 DATE PLOTTED => 2/1/2007 TIME PLOTTED => 8:37:47 AM

BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

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No. BART-185

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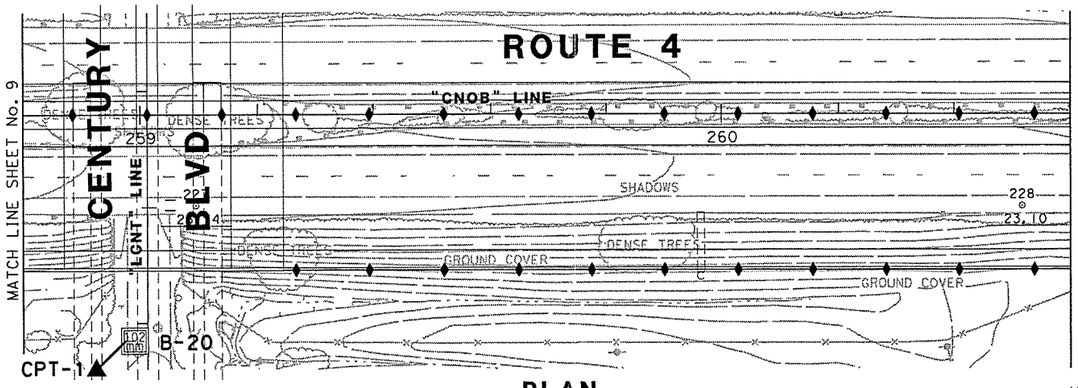
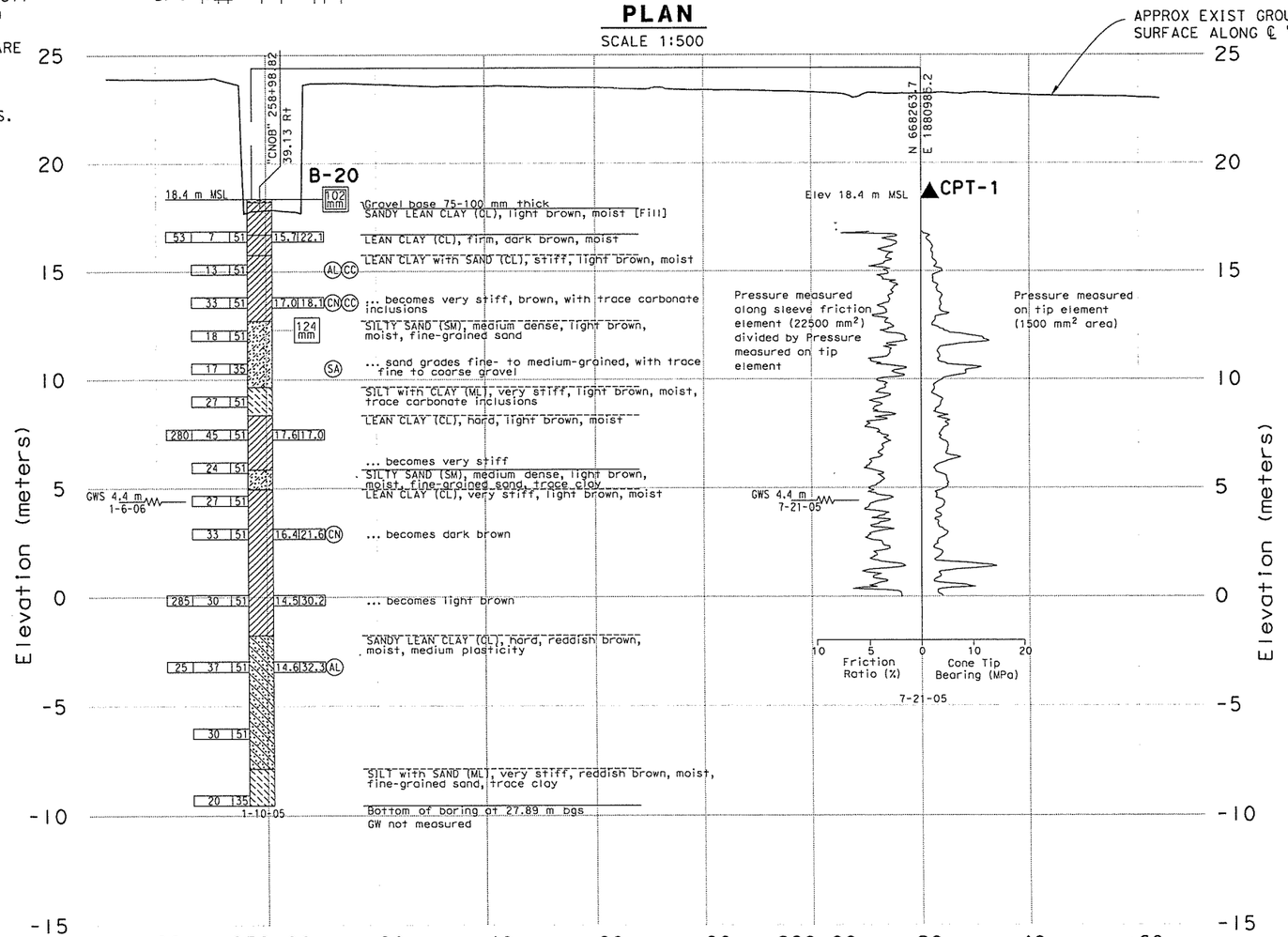


PLAN
SCALE 1:500



NOTE:

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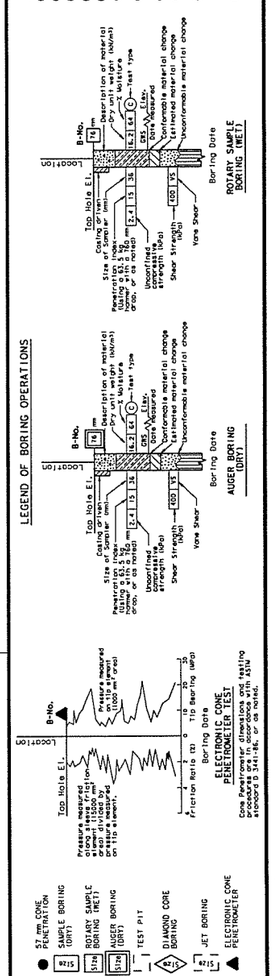
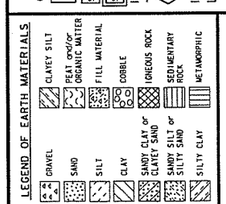
PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS



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DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER ____ DATE

REGISTERED PROFESSIONAL ENGINEER
Phillip Weymand
No. 2596
Exp. 6/30/07
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/04/05

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

H. BERGER
PROJECT ENGINEER

BRIDGE NO. 28-0395
KILOMETER POST 40.0 (24.9)

UTILITIES UC (WIDEN)
LOG OF TEST BORINGS NO. 2

CU 04275
EA 228501

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/11/05 7/28/06 02/16/07

SHEET 10 OF 11

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

FILE => ...\28-0105-z-1tb02.dgn

USERNAME => casomer0 DATE PLOTTED => 2/1/2007 TIME PLOTTED => 8:38:35 AM

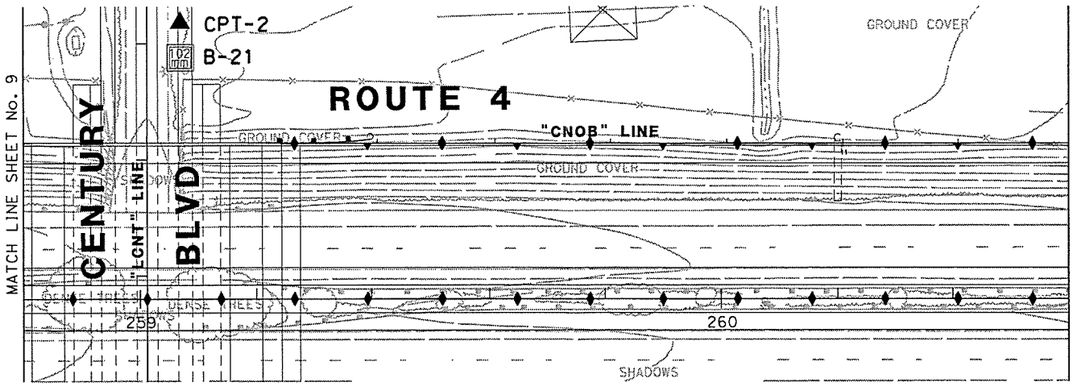
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

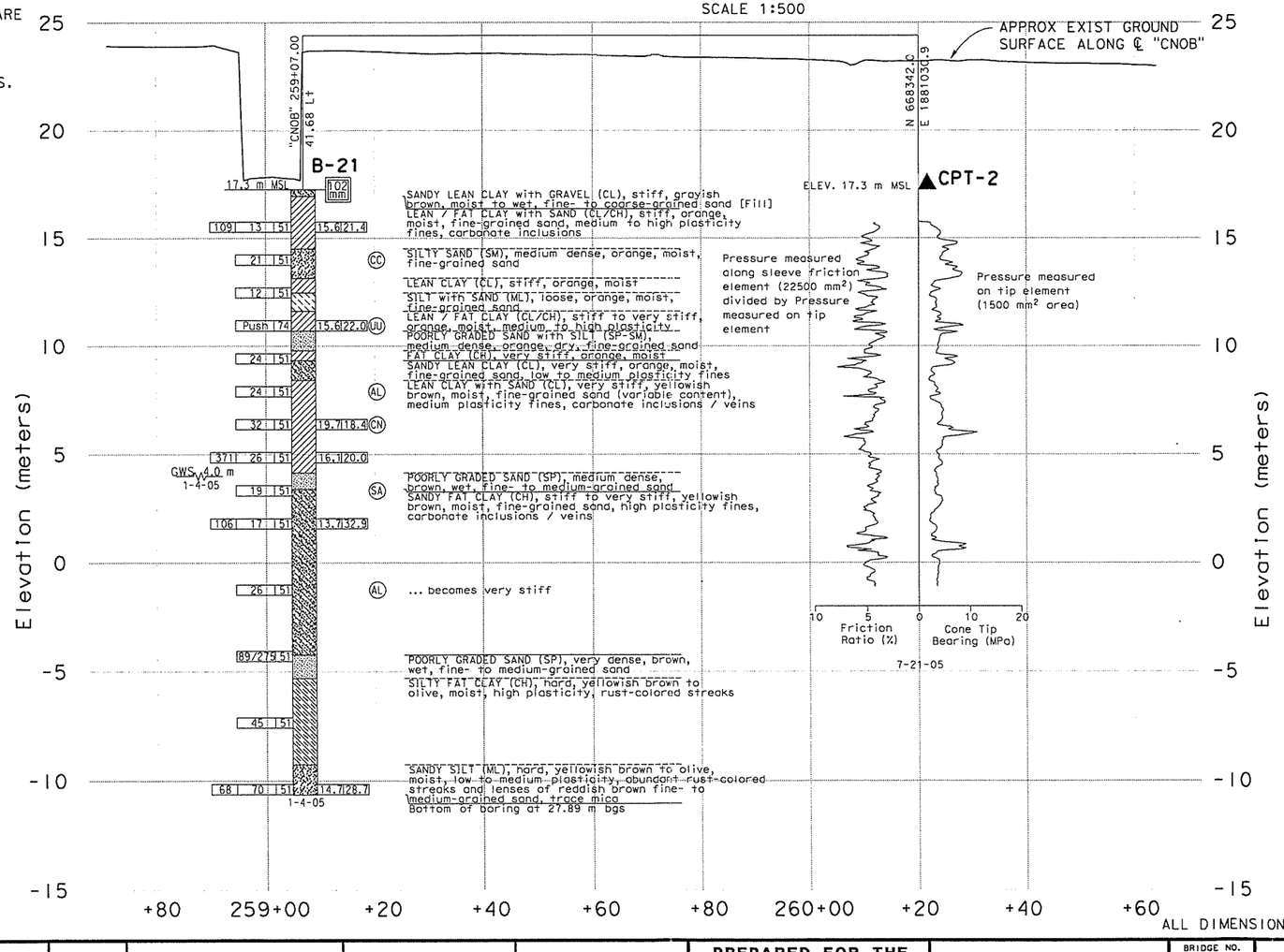
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



SCALE 1:500



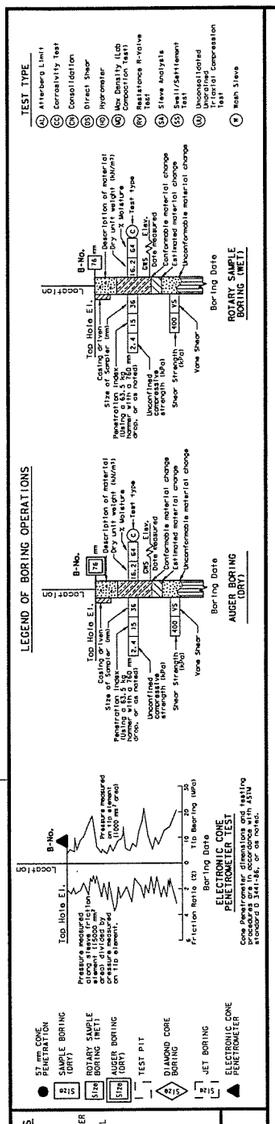
ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

PROFILE VIEW
Horiz 1:500
Vert 1:125

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

GRAVEL, SAND, SILT, CLAY, SANDY CLAY or CLAYEY SAND, SANDY SILT or SILTY SAND, SILTY CLAY, CLAYEY SILT, PEAT and/or ORGANIC MATTER, FILL MATERIAL, COBBLE, CAHCEOUS ROCK, SEDIMENTARY ROCK, METAMORPHIC

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/ 0.3m)	Granular	SPT N-Value (Blows/ 0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	P. RESPESS FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	N. MEYER	DATE: 01/04/05		

BRIDGE NO. 28-0395
KILOMETER POST 40.0(24.9)

UTILITIES UC (WIDEN)
LOG OF TEST BORINGS NO. 3

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)
ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100
CU 04275
EA 228501
FILE => ...\28-0105-z-1tb03.dgn
DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES (PRELIMINARY STAGE ONLY) 10/17/05 7/28/06 02/16/07
SHEET 11 OF 11

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER ~~ENGINEER~~ DATE

PLANS APPROVAL DATE

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

REGISTERED PROFESSIONAL ENGINEER — Phillip Meymand — No. 2596 — Exp. 6/30/07 — GEOTECHNICAL — STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

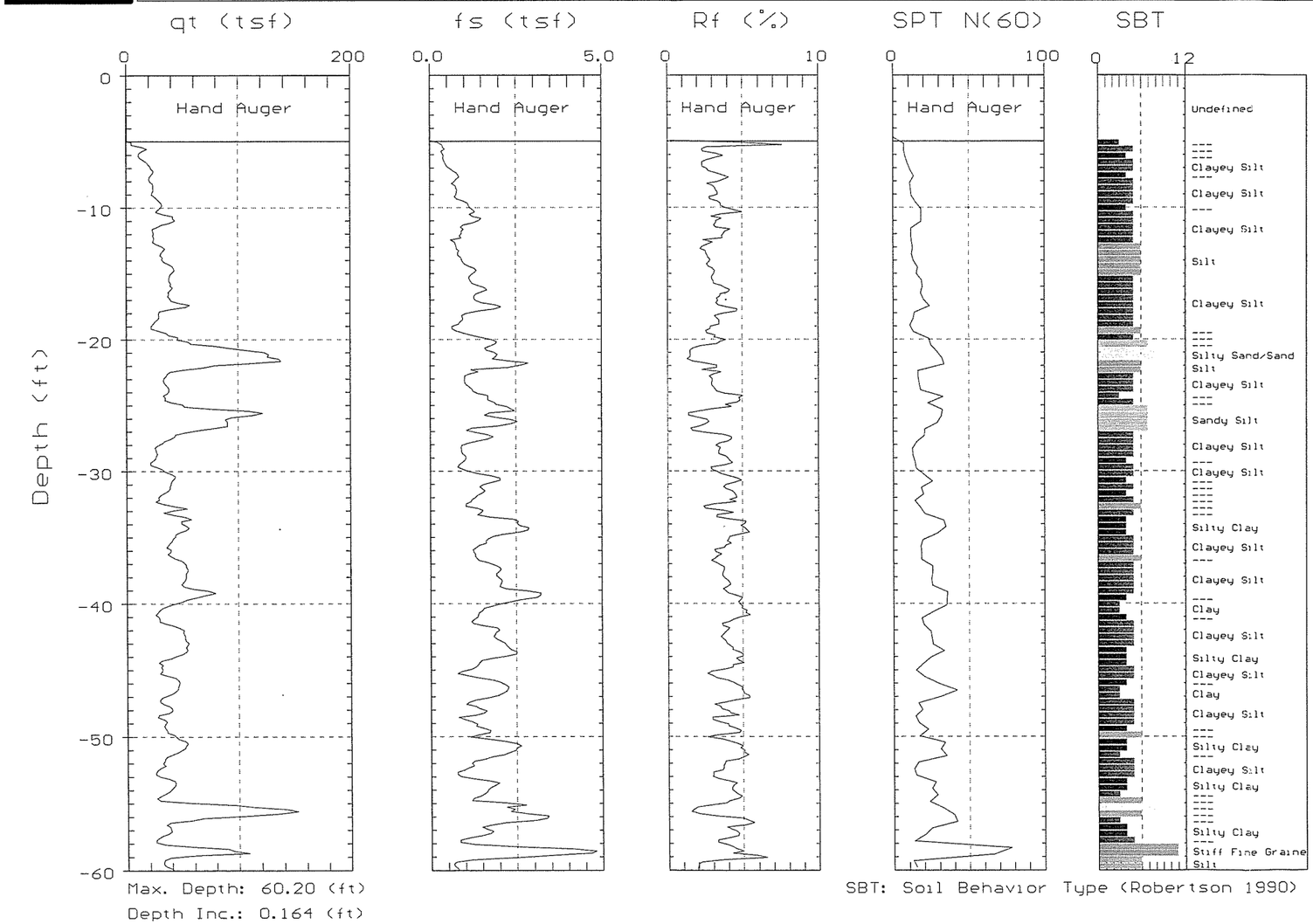
USERNAME => cesomer0 DATE PLOTTED => 2/1/2007 TIME PLOTTED => 8:39:30 AM

GREGG

URS

Site: STATE ROUTE 4
Location: CPT-01

Engineer: S.LOGESWARAN
Date: 07:21:05 11:16



Max. Depth: 60.20 (ft)
Depth Inc.: 0.164 (ft)

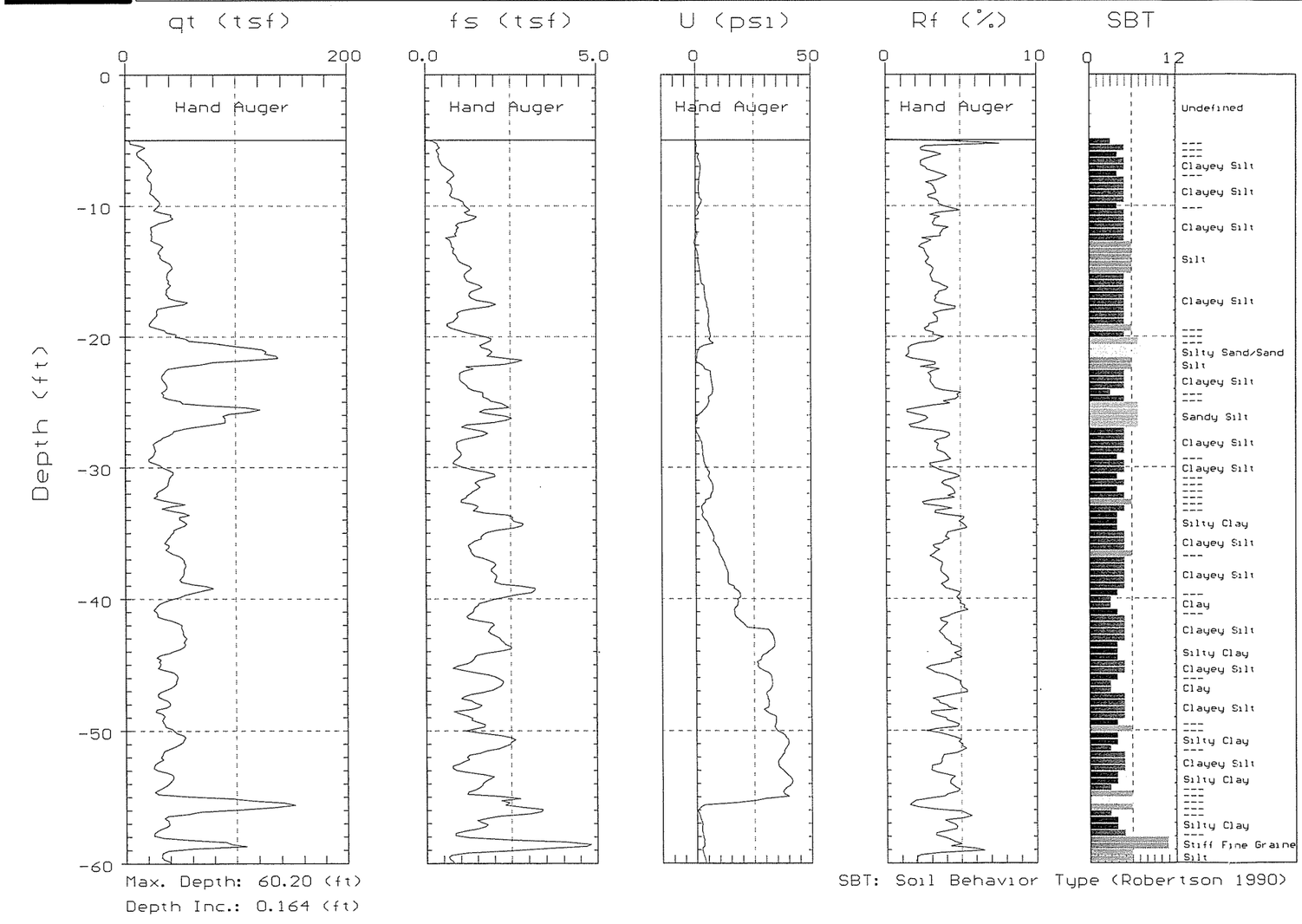
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: STATE ROUTE 4
Location: CPT-01

Engineer: S.LOGESWARAN
Date: 07:21:05 11:16



Max. Depth: 60.20 (ft)
Depth Inc.: 0.164 (ft)

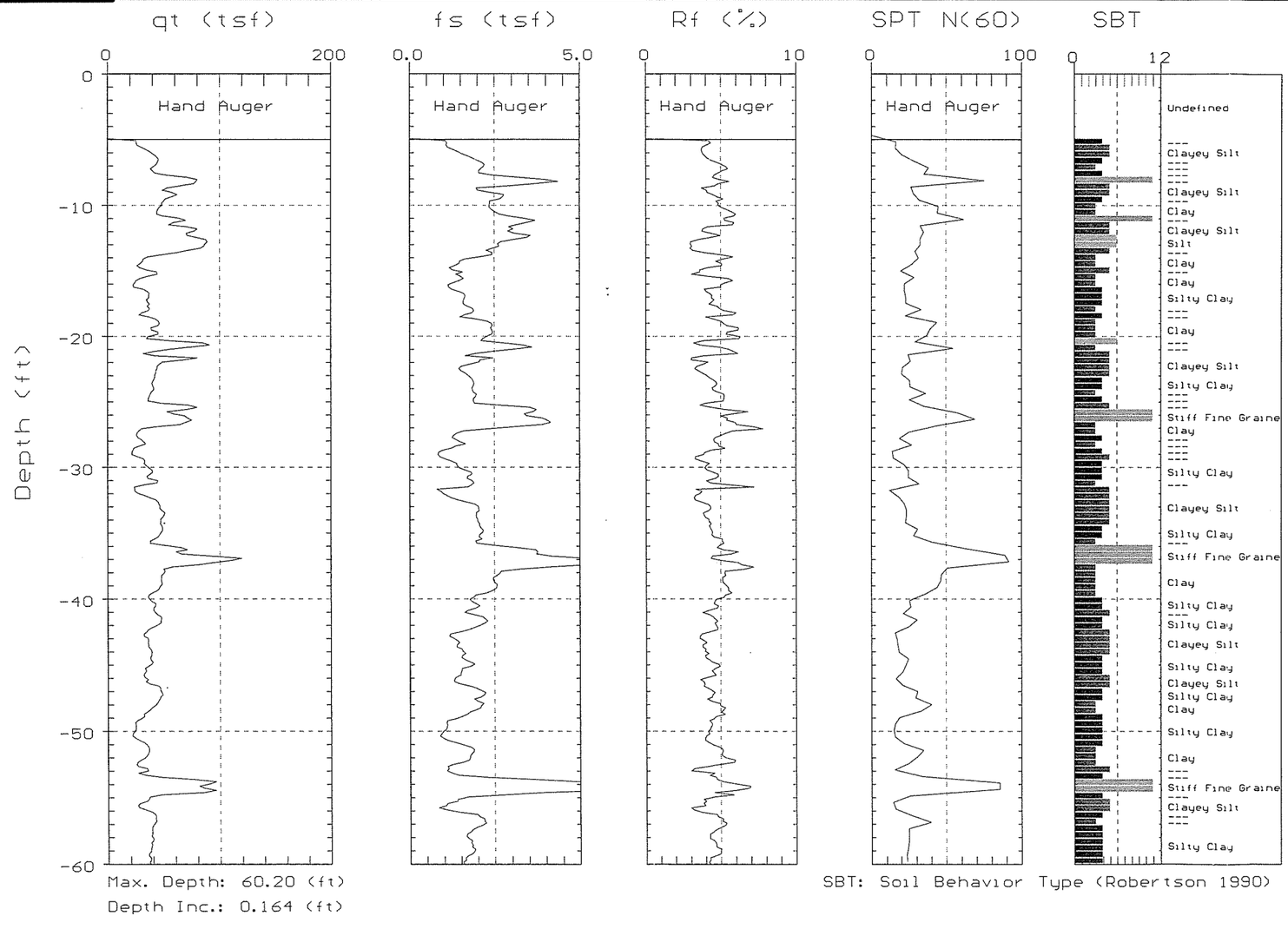
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: STATE ROUTE 4
Location: CPT-02

Engineer: S.LOGESWARAN
Date: 07:21:05 13:08



Max. Depth: 60.20 (ft)
Depth Inc.: 0.164 (ft)

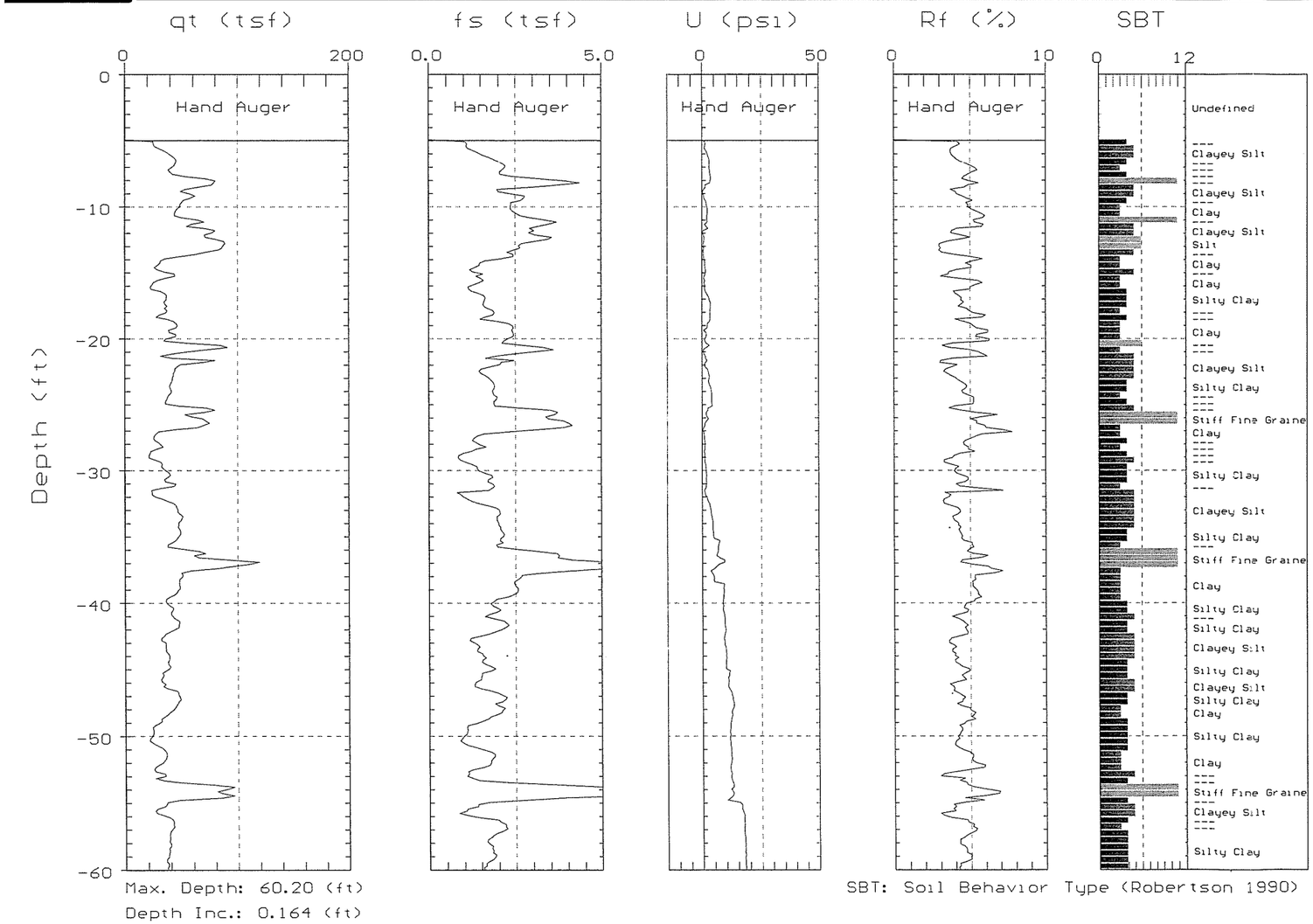
SBT: Soil Behavior Type (Robertson 1990)

GREGG

URS

Site: STATE ROUTE 4
Location: CPT-02

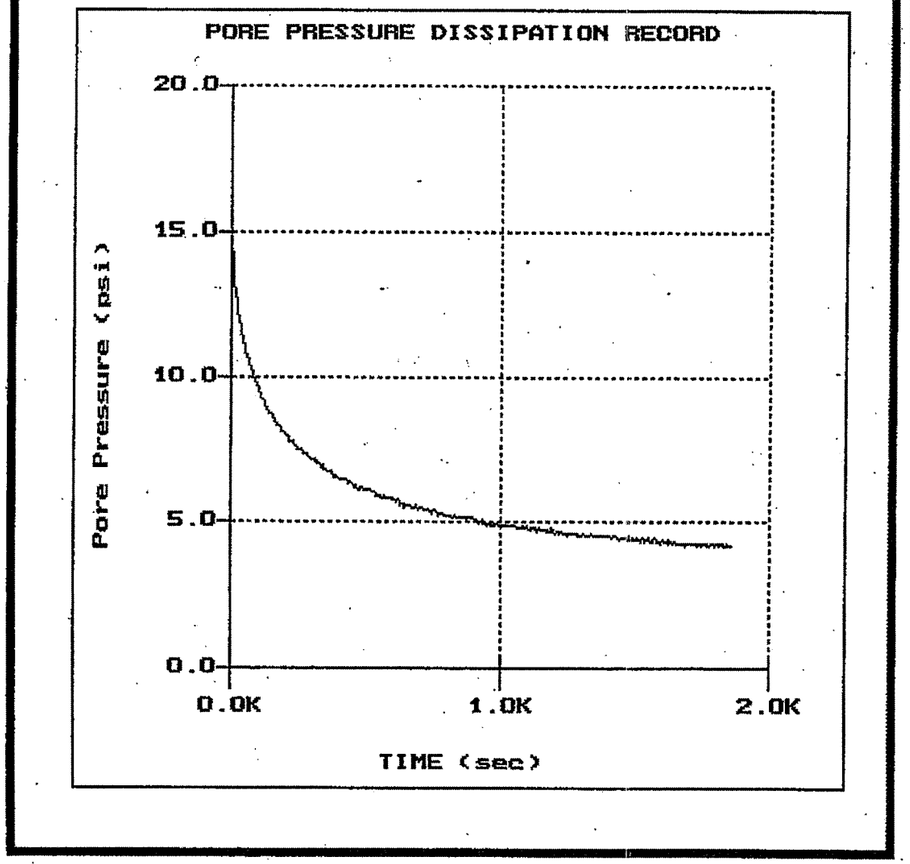
Engineer: S.LOGESWARAN
Date: 07:21:05 13:08



URS

Site:STATE ROUTE 4
Location:CPT-01

Engineer:S.LOGESWARA
Date:07:21:05 11:16



File: 293C01.PPC
Depth (m): 16.90
(ft): 55.45
Duration : 1860.0s
U-min: 4.15 1840.0s
U-max: 14.93 0.0s

Appendix C
Laboratory Test Results

Appendix C
Laboratory Test Results

The water content, dry density and unconfined compressive strength were determined for selected samples to estimate the strength and compressibility of the underlying soils. The results of these tests, together with the resistance to penetration of the sampler are shown at the corresponding sample location on the Logs of Borings presented in Appendix A. Table C-1 provides a summary of the results.

Atterberg limit tests were performed on a selected cohesive sample to determine the plasticity characteristics. The results of that test are presented Figure C-1.

Gradations were performed on granular samples to determine the grain size distributions; the results of these tests are presented on Figure C-2.

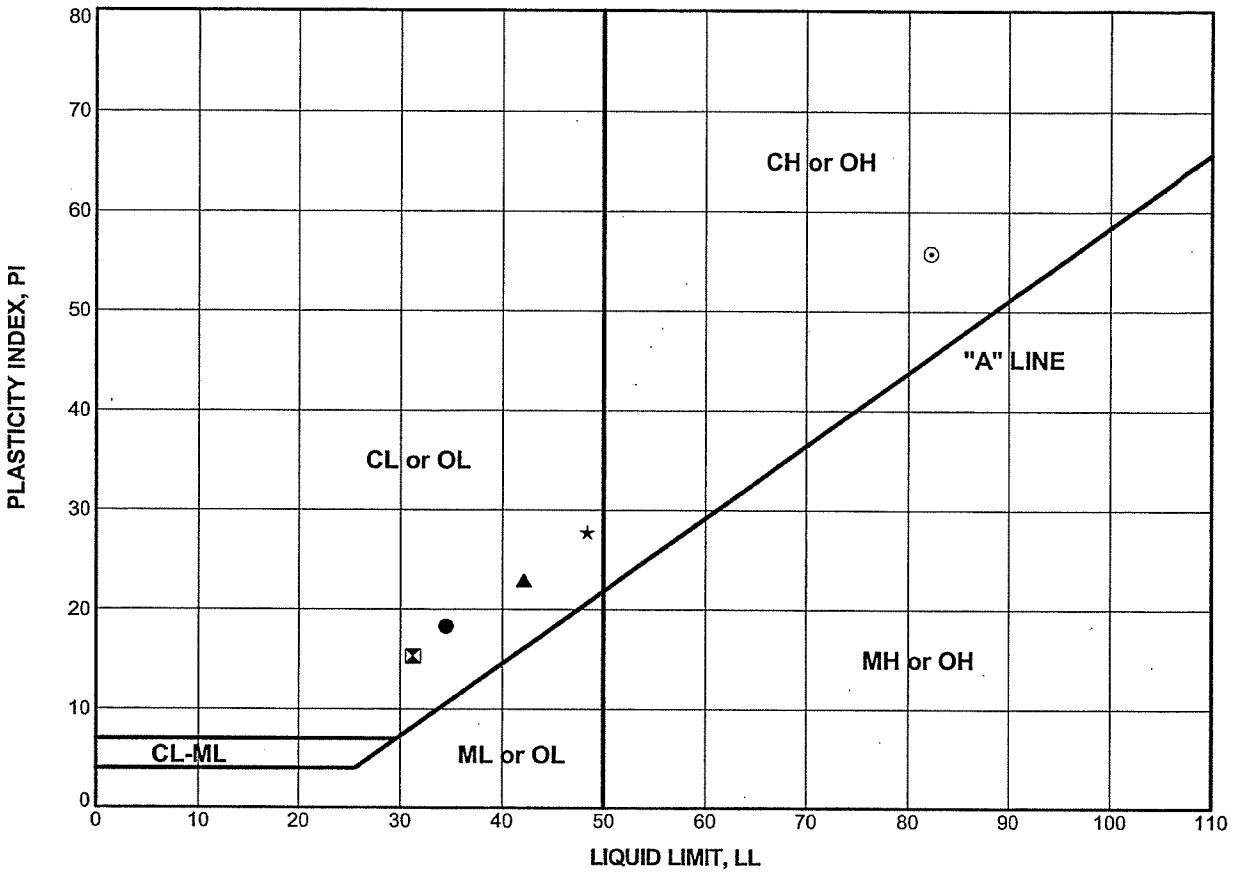
Consolidation test results for 3 selected samples are presented graphically on Figures B-3 through B-5.

TABLE C-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information			USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, kN/m³	Sieve			Atterberg Limits			Unconfined Compressive Strength, kPa	UU Triaxial		Other Tests
Boring Number	Sample Number	Depth, meters				Gravel, %	Sand, %	<#200, %	LL	PL	PI		Peak Deviator Stress, kPa	Confining Pressure, kPa	
B-19	19-1	0.6-1.5	CL/CH												COMP
B-19	19-3A	3.0-3.7	CL												CORR
B-19	19-3-4	3.35	CL	17.8	17.3				34	16	18	182			
B-19	19-5-4	6.40	CL	19.0	16.5							191			
B-19	19-6-4	7.92	CL	11.1	15.8										
B-20	20-1-4	1.83	CL	22.1	15.7							53			
B-20	20-2-3	3.20	CL						31	16	15				CORR
B-20	20-3-3	4.72	CL	18.1	17.0										CONS
B-20	20-3-4	4.88	CL												CORR
B-20	20-5	7.77	SM			3	72	25							
B-20	20-7-4	10.97	CL	17.0	17.6							280			
B-20	20-10-4	15.54	CL	21.6	16.4										CONS
B-20	20-11-4	18.59	CL	30.2	14.5							285			
B-20	20-12-4	21.64	CL	32.3	14.6				42	19	23	25			
B-21	21-1-3	1.83	CL/CH	21.4	15.6							109			
B-21	21-2-2	3.20	SM												CORR
B-21	21-4	6.10	CL/CH	22.0	15.6								135	86	
B-21	21-6-3	9.45	CL						48	21	27				
B-21	21-7-3	10.97	CL	18.4	16.6										CONS
B-21	21-8-3	12.50	CL	20.0	16.1							371			
B-21	21-9-2	13.87	CH			1	30	70							
B-21	21-10-2	15.39	CH	32.9	13.7							106			
B-21	21-11-2	18.44	CH						82	26	56				
B-21	21-14-2	27.58	ML	28.7	14.7							68			

The laboratory tests were performed in general accordance with the following ASTM standards:

Water Content - ASTM Test Method D2216
Dry Unit Weight - ASTM Test Method D2937
Particle Size Distribution Analysis by Mechanical Sieving and Hydrometer - ASTM Test Method D422
Atterberg Limits - ASTM Test Method D4318
Unconfined Compressive Strength Test (UC, q_u in kPa) - ASTM Test Method D2166
Unconsolidated Undrained Triaxial Compression Test (UU Triaxial) - ASTM Test Method D2850
One-dimensional Consolidation Test (CONS) - ASTM Test Method D2435
One-dimensional Swell/Settlement Potential Test (SWELL) - ASTM Test Method D4546
Laboratory Compaction Test (COMP) - ASTM Test Method D1557-B
Corrosivity Suite of Chemical Tests (CORR) - Redox by ASTM Test Method D1498; pH by ASTM Test Method D4972; Resistivity by ASTM Test Method G57; Sulfate Content and Chloride Content by ASTM Test Method D4327



Boring Number	Sample Number	Depth (meters)	Test Symbol	Moisture Content (%)	LL	PL	PI	Classification
B-19	19-3-4	3.35	●	18	34	16	18	Sandy Lean Clay (CL)
B-20	20-2-3	3.20	⊠		31	16	15	Lean Clay with Sand (CL)
B-20	20-12-4	21.64	▲	32	42	19	23	Sandy Lean Clay (CL)
B-21	21-6-3	9.45	★		48	21	27	Lean Clay with Sand (CL)
B-21	21-11-2	18.44	⊙		82	26	56	Sandy Fat Clay (CH)

Report: ATTERBERG_PLOT_12 PTS; File: OAK_SR4PITTS.GPJ; 2/24/2005

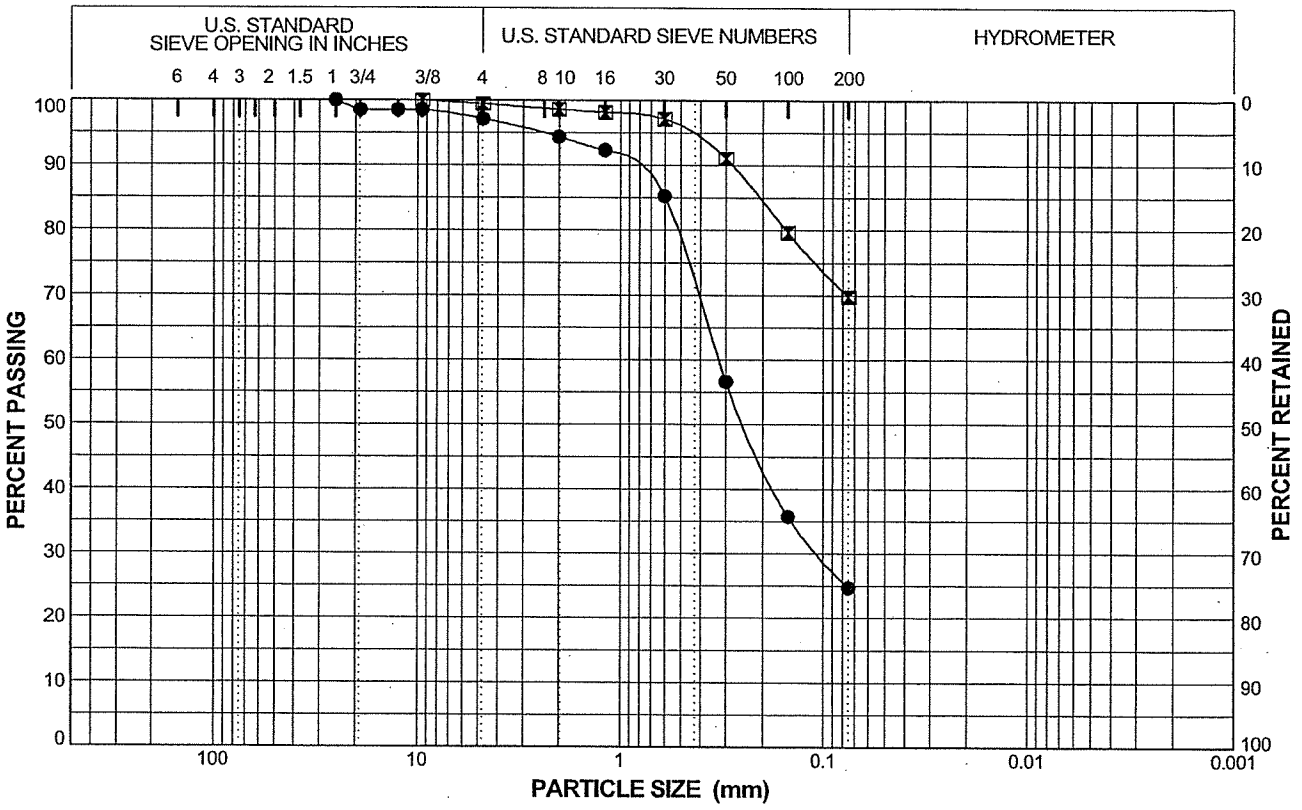
State Route 4 Loveridge to Somersville Road
Utility Crossing Bridge No. 28-105
26814910.24000

PLASTICITY CHART

URS

Figure C-1

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (meters)	Symbol	LL	PI	Classification
B-20	20-5	7.77	●			Silty Sand (SM)
B-21	21-9-2	13.87	⊠			Sandy Fat Clay (CH)

Report: SIEVE_5_CURVES_OAK; File: OAK_SR4PITTS.GPJ; 2/24/2005

State Route 4 Loveridge to Somersville Road
Utility Crossing Bridge No. 28-105
26814910.24000

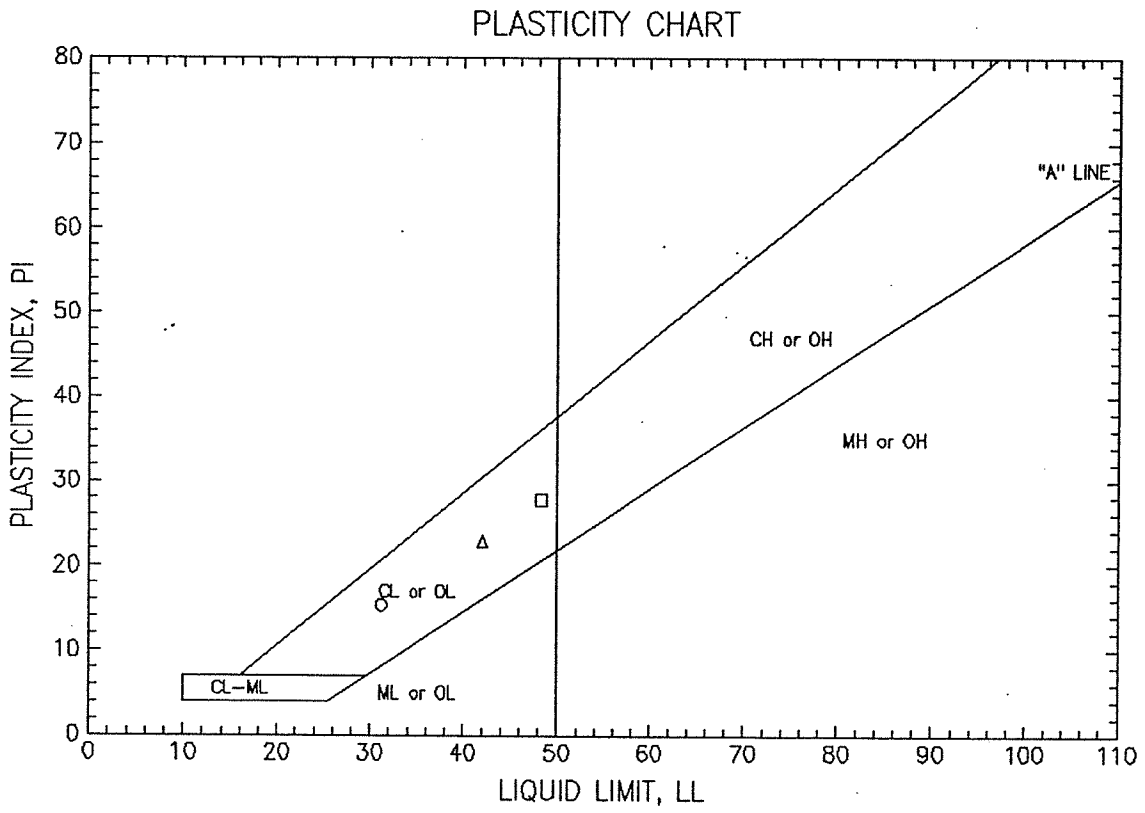
PARTICLE SIZE DISTRIBUTION CURVES

URS

Figure C-2

URS

Project : SR 4 Loveridge to Somersville Rd.
Project No. : 26814910.24000
Location : Pittsburg, CA
Date : Mon Jan 24 2005



Symbol	Boring No.	Sample No.	Liquid Limit	Plastic Limit	Plasticity Index
○	CB-20	2-3	31.19	15.85	15.34
△	CB-20	12-4	42.07	19.15	22.92
□	CB-21	6-3	48.32	20.54	27.78

Figure 1

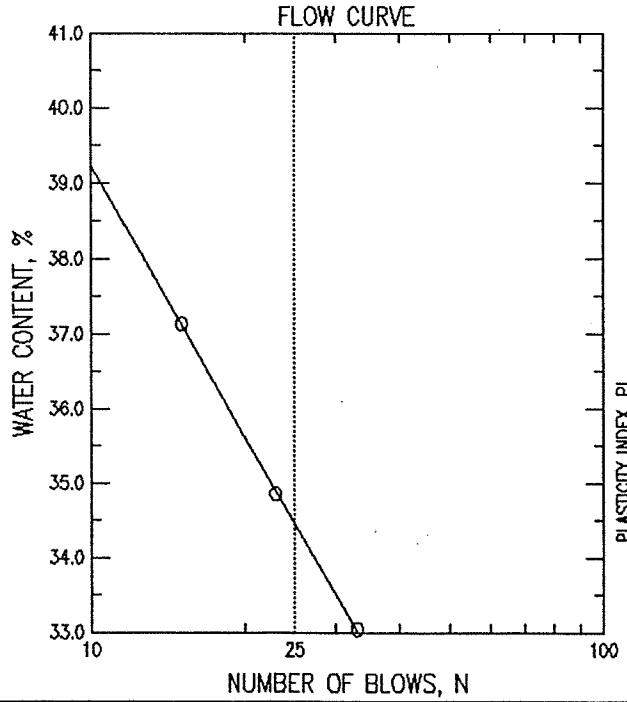
URS

ATTERBERG LIMITS

PROJECT	PROJECT NUMBER	TESTED BY	BORING NUMBER
SR 4 Loveridge to Somersville Rd.	26814910.24000	R. Taraya	B-19
LOCATION		CHECKED BY	SAMPLE NUMBER
Pittsburg, CA		S. Capps	3-4
SAMPLE DESCRIPTION		DATE	FILENAME
Yellowish brown sandy silty clay		Fri Feb 11 2005	B19-3-04

LIQUID LIMIT DETERMINATIONS					
CONTAINER NUMBER	88	25	87		
WT. WET SOIL + TARE	26.09	25.75	24.83		
WT. DRY SOIL + TARE	22.38	21.92	21.05		
WT. WATER	3.71	3.83	3.78		
TARE WT.	11.15	10.93	10.87		
WT. DRY SOIL	11.23	10.99	10.18		
WATER CONTENT, W_N (%)	33.04	34.85	37.13		
NUMBER OF BLOWS, N	33	23	15		
ONE-POINT LIQUID LIMIT, LL	34.17	34.50	34.91		

PLASTIC LIMIT DETERMINATIONS					
CONTAINER NUMBER	47				
WT. WET SOIL + TARE	35.33				
WT. DRY SOIL + TARE	31.96				
WT. WATER	3.37				
TARE WT.	11.08				
WT. DRY SOIL	20.88				
WATER CONTENT (%)	16.14				



SUMMARY OF RESULTS	
NATURAL WATER CONTENT, W (%)	6.2
LIQUID LIMIT, LL	34.5
PLASTIC LIMIT, PL	16.1
PLASTICITY INDEX, PI	18.3
LIQUIDITY INDEX, LI*	-0.54

*LI = (W - PL)/PI

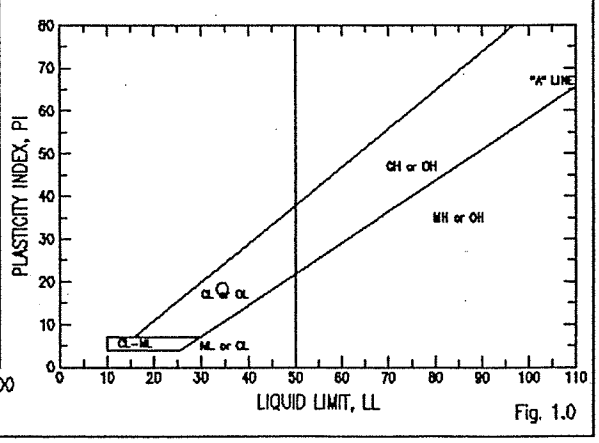


Fig. 1.0

URS

Fri Feb 11 10:48:48 2005

GEOTECHNICAL LABORATORY TEST DATA

Project : SR 4 Loveridge to Somersville Rd.
Project No. : 26814910.24000
Boring No. : B-19
Sample No. : 3-4
Location : Pittsburg, CA
Soil Description : Yellowish brown sandy silty clay
Remarks :

Depth : 11.0 feet
Test Date : 02/10/2005
Test Method : ASTM D4318

Filename : B19-3-04
Elevation : NA
Tested by : R. Taraya
Checked by : S. Capps

Natural Moisture Content

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Moisture Content (%)
1) B19-3-4	0.00	237.22	223.29	6.24

Average Moisture Content = 6.24

Plastic Limit

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Moisture Content (%)
1) 47	11.08	35.33	31.96	16.14

Plastic Limit = 16.14

Liquid Limit

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Number of Drops	Moisture Content (%)
1) 88	11.15	26.09	22.38	33	33.04
2) 25	10.93	25.75	21.92	23	34.85
3) 87	10.87	24.83	21.05	15	37.13

Liquid Limit = 34.46
Plastic Index = 18.32

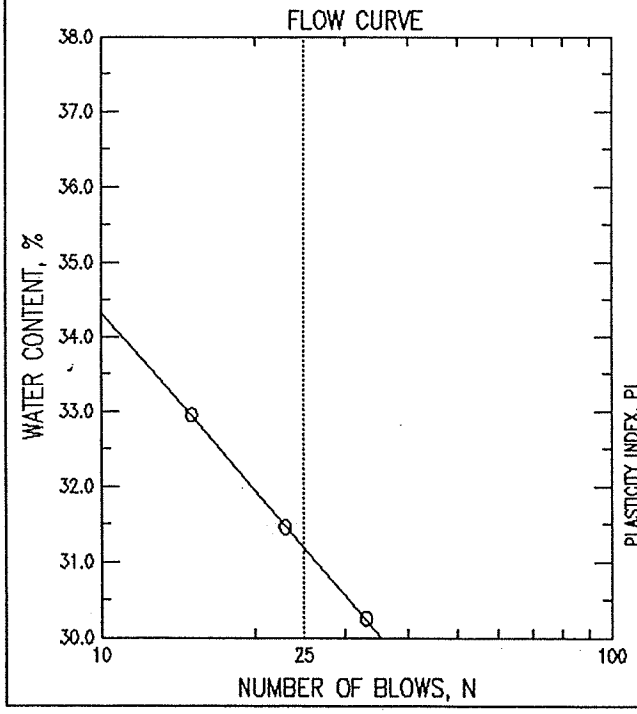
URS

ATTERBERG LIMITS

PROJECT	PROJECT NUMBER	TESTED BY	BORING NUMBER
SR 4 Loveridge to Somersville Rd.	26814910.24000	R. Taraya	CB-20
LOCATION		CHECKED BY	SAMPLE NUMBER
Pittsburg, CA		S. Capps	2-3
SAMPLE DESCRIPTION		DATE	FILENAME
Brown fine sandy silty clay		Mon Jan 24 2005	B20-2-3

LIQUID LIMIT DETERMINATIONS					
CONTAINER NUMBER	60	70	74		
WT. WET SOIL + TARE	27.28	26.8	25.99		
WT. DRY SOIL + TARE	23.65	23.01	22.3		
WT. WATER	3.63	3.79	3.69		
TARE WT.	11.65	10.96	11.1		
WT. DRY SOIL	12	12.05	11.2		
WATER CONTENT, W_N (%)	30.25	31.45	32.95		
NUMBER OF BLOWS, N	33	23	15		
ONE-POINT LIQUID LIMIT, LL	31.26	31.14	30.97		

PLASTIC LIMIT DETERMINATIONS					
CONTAINER NUMBER	29				
WT. WET SOIL + TARE	32.79				
WT. DRY SOIL + TARE	29.78				
WT. WATER	3.01				
TARE WT.	10.79				
WT. DRY SOIL	18.99				
WATER CONTENT (%)	15.85				



SUMMARY OF RESULTS	
NATURAL WATER CONTENT, W (%)	
LIQUID LIMIT, LL	31.2
PLASTIC LIMIT, PL	15.9
PLASTICITY INDEX, PI	15.3
LIQUIDITY INDEX, LI*	

*LI = (W - PL)/PI

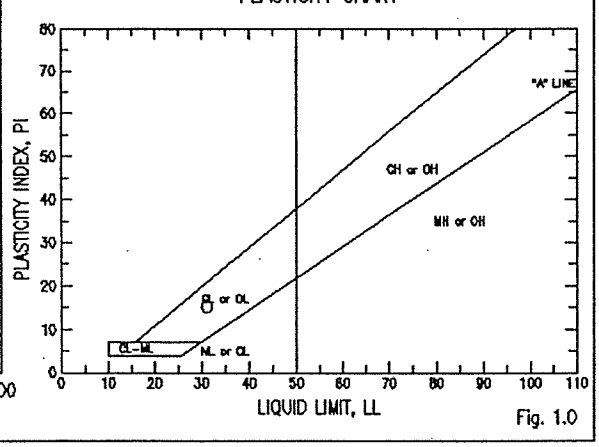


Fig. 1.0

URS

Mon Jan 24 10:42:31 2005 Page : 1

GEOTECHNICAL LABORATORY TEST DATA

Project : SR 4 Loveridge to Somersville Rd.
Project No. : 26814910.24000 Depth : 10.5 feet
Boring No. : CB-20 Test Date : 01/21/2005
Sample No. : 2-3 Test Method : ASTM D4318
Location : Pittsburg, CA
Soil Description : Brown fine sandy silty clay
Remarks :

Filename : B20-2-3
Elevation : NA
Tested by : R. Taraya
Checked by : S. Capps

Plastic Limit

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Moisture Content (%)
1) 29	10.79	32.79	29.78	15.85

Plastic Limit = 15.85

Liquid Limit

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Number of Drops	Moisture Content (%)
1) 60	11.65	27.28	23.65	33	30.25
2) 70	10.96	26.80	23.01	23	31.45
3) 74	11.10	25.99	22.30	15	32.95

Liquid Limit = 31.19
Plastic Index = 15.34

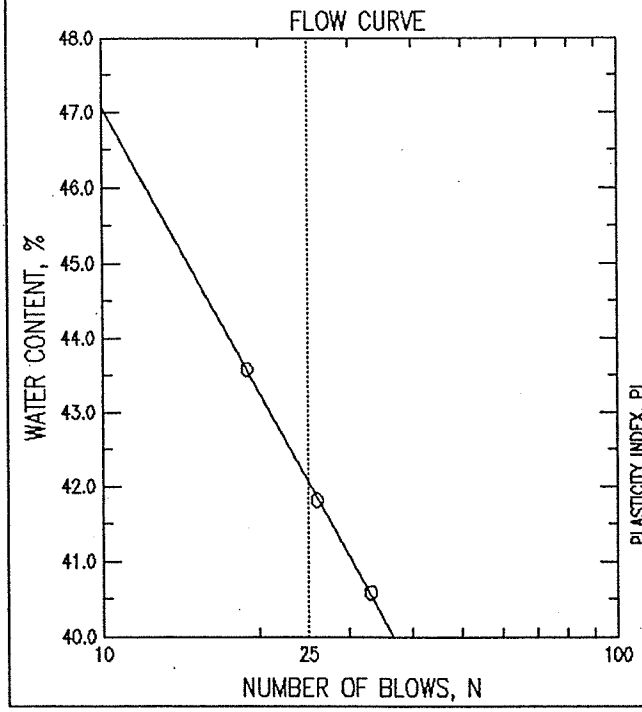
URS

ATTERBERG LIMITS

PROJECT	PROJECT NUMBER	TESTED BY	BORING NUMBER
SR 4 Loveridge to Somersville Rd.	26814910.24000	R. Taraya	CB-20
LOCATION Pittsburg, CA		CHECKED BY S. Capps	SAMPLE NUMBER 12-4
SAMPLE DESCRIPTION Light brown silty clay with gravel		DATE Mon Jan 24 2005	FILENAME B20-12-4

LIQUID LIMIT DETERMINATIONS					
CONTAINER NUMBER	31	47	65		
WT. WET SOIL + TARE	27.26	24.84	24.38		
WT. DRY SOIL + TARE	22.76	20.78	20.34		
WT. WATER	4.5	4.06	4.04		
TARE WT.	11.67	11.07	11.07		
WT. DRY SOIL	11.09	9.71	9.27		
WATER CONTENT, W_N (%)	40.58	41.81	43.58		
NUMBER OF BLOWS, N	33	26	19		
ONE-POINT LIQUID LIMIT, LL	41.96	42.01	42.16		

PLASTIC LIMIT DETERMINATIONS					
CONTAINER NUMBER	77				
WT. WET SOIL + TARE	35.58				
WT. DRY SOIL + TARE	31.61				
WT. WATER	3.97				
TARE WT.	10.88				
WT. DRY SOIL	20.73				
WATER CONTENT (%)	19.15				



SUMMARY OF RESULTS	
NATURAL WATER CONTENT, W (%)	
LIQUID LIMIT, LL	42.1
PLASTIC LIMIT, PL	19.2
PLASTICITY INDEX, PI	22.9
LIQUIDITY INDEX, LI*	

*LI = (W - PL)/PI

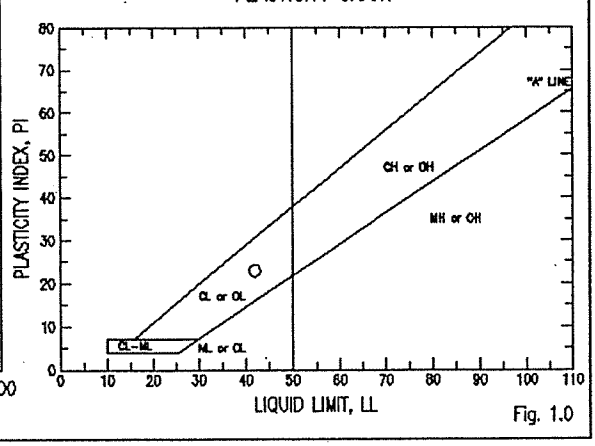


Fig. 1.0

URS

Mon Jan 24 10:42:33 2005

GEOTECHNICAL LABORATORY TEST DATA

Project : SR 4 Loveridge to Somersville Rd.
Project No. : 26814910.24000
Boring No. : CB-20
Sample No. : 12-4
Location : Pittsburg, CA
Soil Description : Light brown silty clay with gravel
Remarks :

Filename : B20-12-4
Depth : 71.0 feet
Test Date : 01/21/2005
Test Method : ASTM D4318
Elevation : NA
Tested by : R. Taraya
Checked by : S. Capps

Plastic Limit

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Moisture Content (%)
1) 77	10.88	35.58	31.61	19.15

Plastic Limit = 19.15

Liquid Limit

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Number of Drops	Moisture Content (%)
1) 31	11.67	27.26	22.76	33	40.58
2) 47	11.07	24.84	20.78	26	41.81
3) 65	11.07	24.38	20.34	19	43.58

Liquid Limit = 42.07
Plastic Index = 22.92

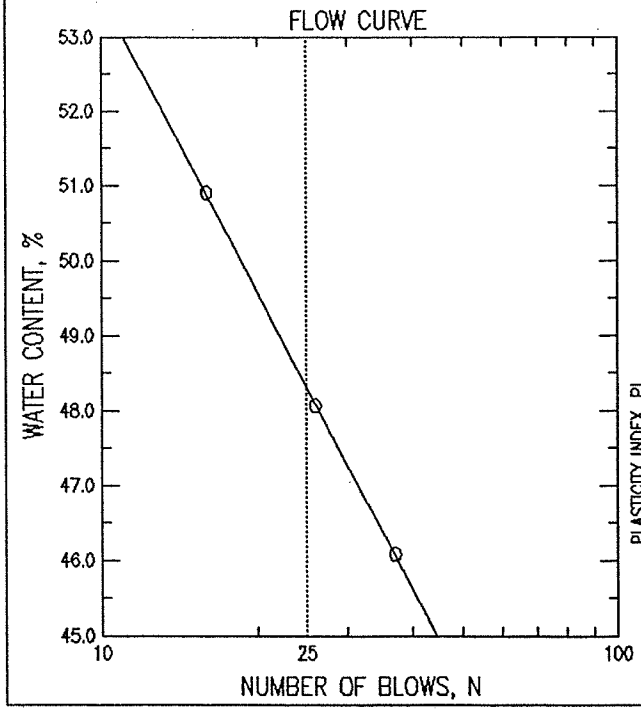
URS

ATTERBERG LIMITS

PROJECT	PROJECT NUMBER	TESTED BY	BORING NUMBER
SR 4 Loveridge to Somersville Rd.	26814910.24000	R. Taraya	CB-21
LOCATION Pittsburg, CA		CHECKED BY S. Capps	SAMPLE NUMBER 6-3
SAMPLE DESCRIPTION Brown silty clay		DATE Mon Jan 24 2005	FILENAME B21-6-3

LIQUID LIMIT DETERMINATIONS					
CONTAINER NUMBER	49	37	27		
WT. WET SOIL + TARE	24.73	26.21	25.95		
WT. DRY SOIL + TARE	20.32	21.25	21.15		
WT. WATER	4.41	4.96	4.8		
TARE WT.	10.75	10.93	11.72		
WT. DRY SOIL	9.57	10.32	9.43		
WATER CONTENT, W_N (%)	46.08	48.06	50.90		
NUMBER OF BLOWS, N	37	26	16		
ONE-POINT LIQUID LIMIT, LL	48.32	48.29	48.23		

PLASTIC LIMIT DETERMINATIONS					
CONTAINER NUMBER	76				
WT. WET SOIL + TARE	33.98				
WT. DRY SOIL + TARE	30.08				
WT. WATER	3.9				
TARE WT.	11.09				
WT. DRY SOIL	18.99				
WATER CONTENT (%)	20.54				



SUMMARY OF RESULTS	
NATURAL WATER CONTENT, W (%)	
LIQUID LIMIT, LL	48.3
PLASTIC LIMIT, PL	20.5
PLASTICITY INDEX, PI	27.8
LIQUIDITY INDEX, LI*	

*LI = (W - PL)/PI

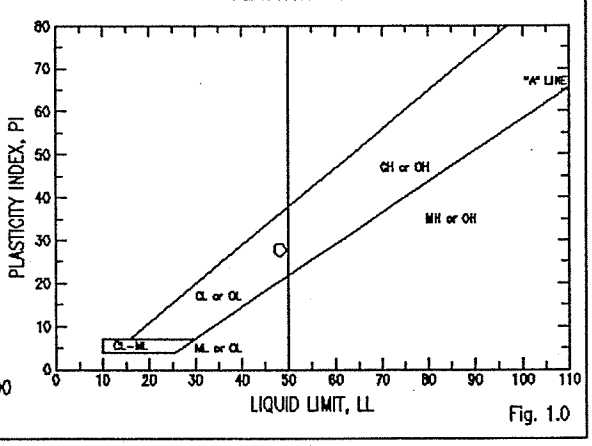


Fig. 1.0

URS

Mon Jan 24 10:42:34 2005 Page : 1

GEOTECHNICAL LABORATORY TEST DATA

Project : SR 4 Loveridge to Somersville Rd.
Project No. : 26814910.24000
Boring No. : CB-21
Sample No. : 6-3
Location : Pittsburg, CA
Soil Description : Brown silty clay
Remarks :

Depth : 31.0 feet
Test Date : 01/21/2005
Test Method : ASTM D4318

Filename : B21-6-3
Elevation : NA
Tested by : R. Taraya
Checked by : S. Capps

Plastic Limit

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Moisture Content (%)
1) 76	11.09	33.98	30.08	20.54

Plastic Limit = 20.54

Liquid Limit

Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Number of Drops	Moisture Content (%)
1) 49	10.75	24.73	20.32	37	46.08
2) 37	10.93	26.21	21.25	26	48.06
3) 27	11.72	25.95	21.15	16	50.90

Liquid Limit = 48.32
Plastic Index = 27.78

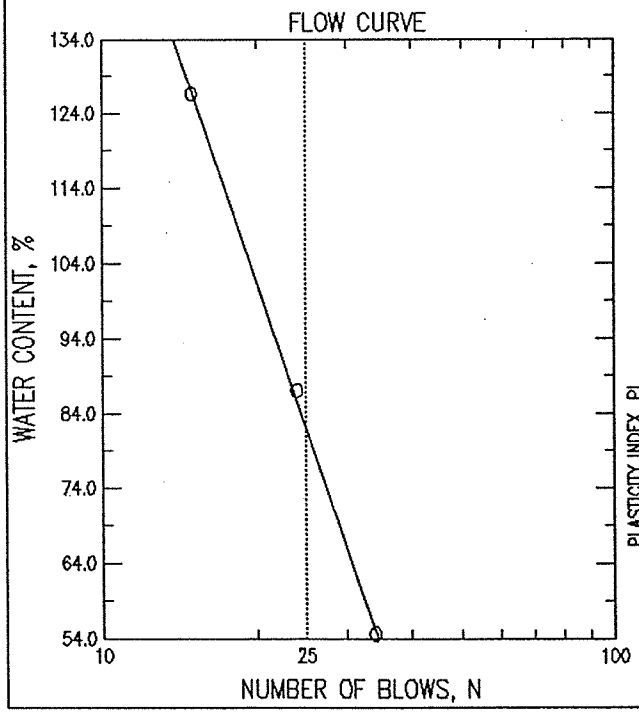
URS

ATTERBERG LIMITS

PROJECT	PROJECT NUMBER	TESTED BY	BORING NUMBER
SR 4 Loveridge to Somersville Rd.	26814910.24000	R. Taraya	CB-21
LOCATION		CHECKED BY	SAMPLE NUMBER
Pittsburg, CA		S. Capps	11-2
SAMPLE DESCRIPTION		DATE	FILENAME
Brown silty clay		Thu Feb 03 2005	B21-11-2

LIQUID LIMIT DETERMINATIONS					
CONTAINER NUMBER	80	83	87		
WT. WET SOIL + TARE	23.53	25.74	26.45		
WT. DRY SOIL + TARE	19.06	19.19	17.74		
WT. WATER	4.47	6.55	8.71		
TARE WT.	10.87	11.66	10.86		
WT. DRY SOIL	8.19	7.53	6.88		
WATER CONTENT, W_N (%)	54.58	86.99	126.60		
NUMBER OF BLOWS, N	34	24	15		
ONE-POINT LIQUID LIMIT, LL	56.65	86.56	119.01		

PLASTIC LIMIT DETERMINATIONS					
CONTAINER NUMBER	42				
WT. WET SOIL + TARE	33.01				
WT. DRY SOIL + TARE	28.41				
WT. WATER	4.6				
TARE WT.	11.01				
WT. DRY SOIL	17.4				
WATER CONTENT (%)	26.44				



SUMMARY OF RESULTS	
NATURAL WATER CONTENT, W (%)	
LIQUID LIMIT, LL	82.2
PLASTIC LIMIT, PL	26.4
PLASTICITY INDEX, PI	55.8
LIQUIDITY INDEX, LI*	

*LI = (W - PL)/PI

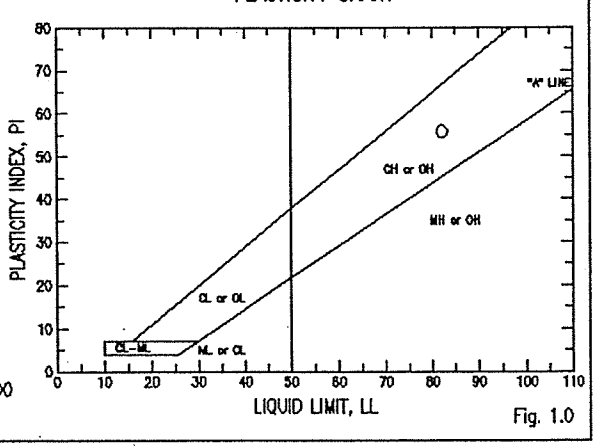


Fig. 1.0

URS

Thu Feb 03 09:52:03 2005

GEOTECHNICAL LABORATORY TEST DATA

Project : SR 4 Loveridge to Somersville Rd.
Project No. : 26814910.24000
Boring No. : CB-21
Sample No. : 11-2
Location : Pittsburg, CA
Soil Description : Brown silty clay
Remarks :

Depth : 60.5 feet
Test Date : 02/02/2005
Test Method : ASTM D4318

Filename : B21-11-2
Elevation : NA
Tested by : R. Taraya
Checked by : S. Capps

Plastic Limit

	Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Moisture Content (%)
1)	42	11.01	33.01	28.41	26.44

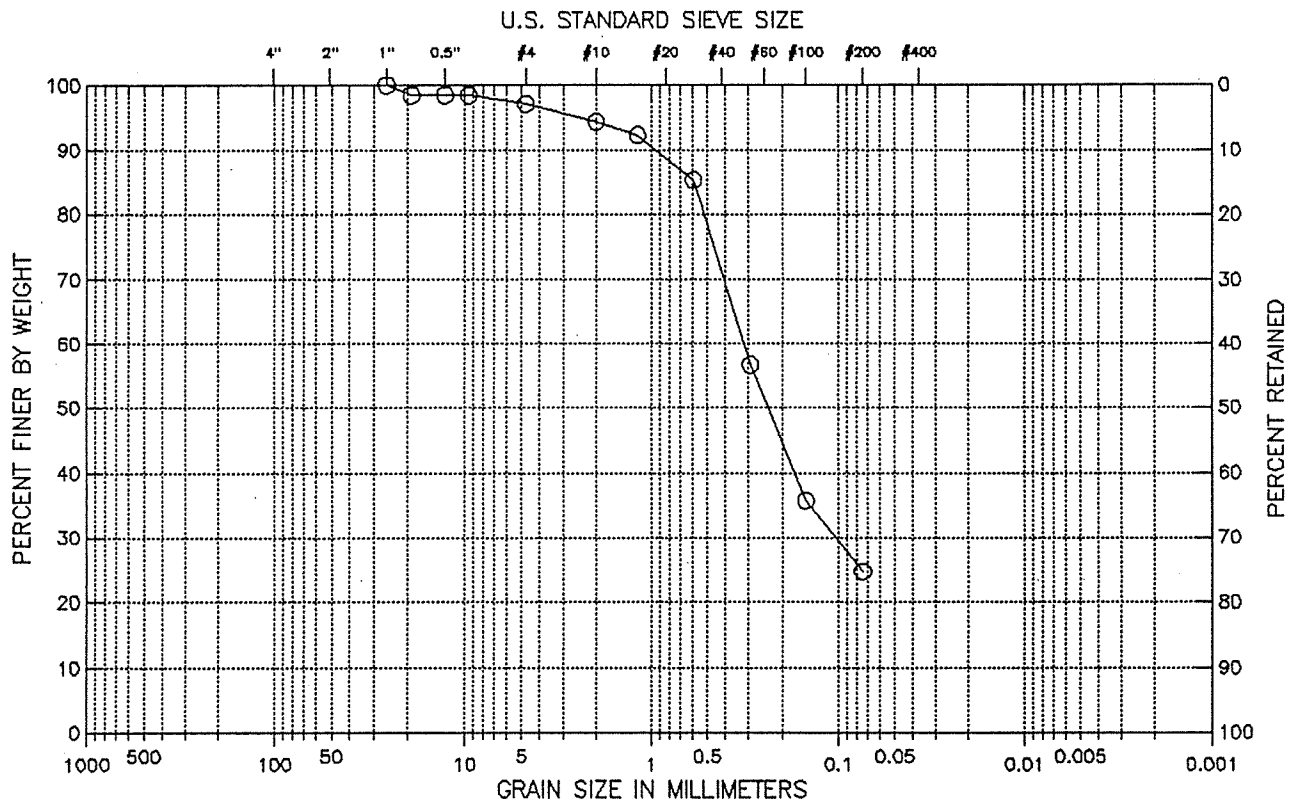
Plastic Limit = 26.44

Liquid Limit

	Moisture Content ID	Mass of Container (gm)	Mass of Container and Moist Soil (gm)	Mass of Container and Dried Soil (gm)	Number of Drops	Moisture Content (%)
1)	80	10.87	23.53	19.06	34	54.58
2)	83	11.66	25.74	19.19	24	86.99
3)	87	10.86	26.45	17.74	15	126.60

Liquid Limit = 82.24
Plastic Index = 55.81

	Boring No. : CB-20 Sample No: 5-spt Tested by : R. Taraya Filename : B20-5-SP	Project : SR 4 Loveridge to Somersville Rd. Project No.: 26814910.24000 Location: Pittsburg, CA Date : Mon Jan 24 2005



Classification :

Visual Description :
Brown silty sand

Remarks :
Depth: 25-26.4 feet

Figure 1

URS

Mon Jan 24 10:42:32 2005

GEOTECHNICAL LABORATORY TEST DATA

Project : SR 4 Loveridge to Somersville Rd.
Project No. : 26814910.24000
Boring No. : CB-20
Sample No. : 5-spt
Location : Pittsburg, CA
Soil Description : Brown silty sand
Remarks : Depth: 25-26.4 feet

Depth : 25-26.4 feet
Test Date : 01/21/2005
Test Method : ASTM D422

Filename : B20-5-SP
Elevation : NA
Tested by : R. Taraya
Checked by : S. Capps

COARSE SIEVE SET

Sieve Mesh	Sieve Openings Inches	Millimeters	Weight Retained (gm)	Cumulative Weight Retained (gm)	Percent Finer (%)
1"	1.012	25.70	0.00	0.00	100
0.75"	0.748	19.00	8.84	8.84	99
0.5"	0.500	12.70	0.00	8.84	99
0.375"	0.374	9.51	0.00	8.84	99
#4	0.187	4.75	8.08	16.92	97
#10	0.079	2.00	16.42	33.34	94
#16	0.047	1.19	12.03	45.37	92
#30	0.023	0.60	41.55	86.92	85
#50	0.012	0.30	169.08	256.00	57
#100	0.006	0.15	123.60	379.60	36
#200	0.003	0.07	65.00	444.60	25

Total Dry Weight of Sample = 590.4

D85 : 0.5910 mm
D60 : 0.3203 mm
D50 : 0.2375 mm
D30 : 0.1037 mm
D15 : N/A
D10 : N/A

Soil Classification
ASTM Group Symbol : N/A
ASTM Group Name : N/A
AASHTO Group Symbol : A-1-b(0)
AASHTO Group Name : Stone Fragments, Gravel and Sand

URS

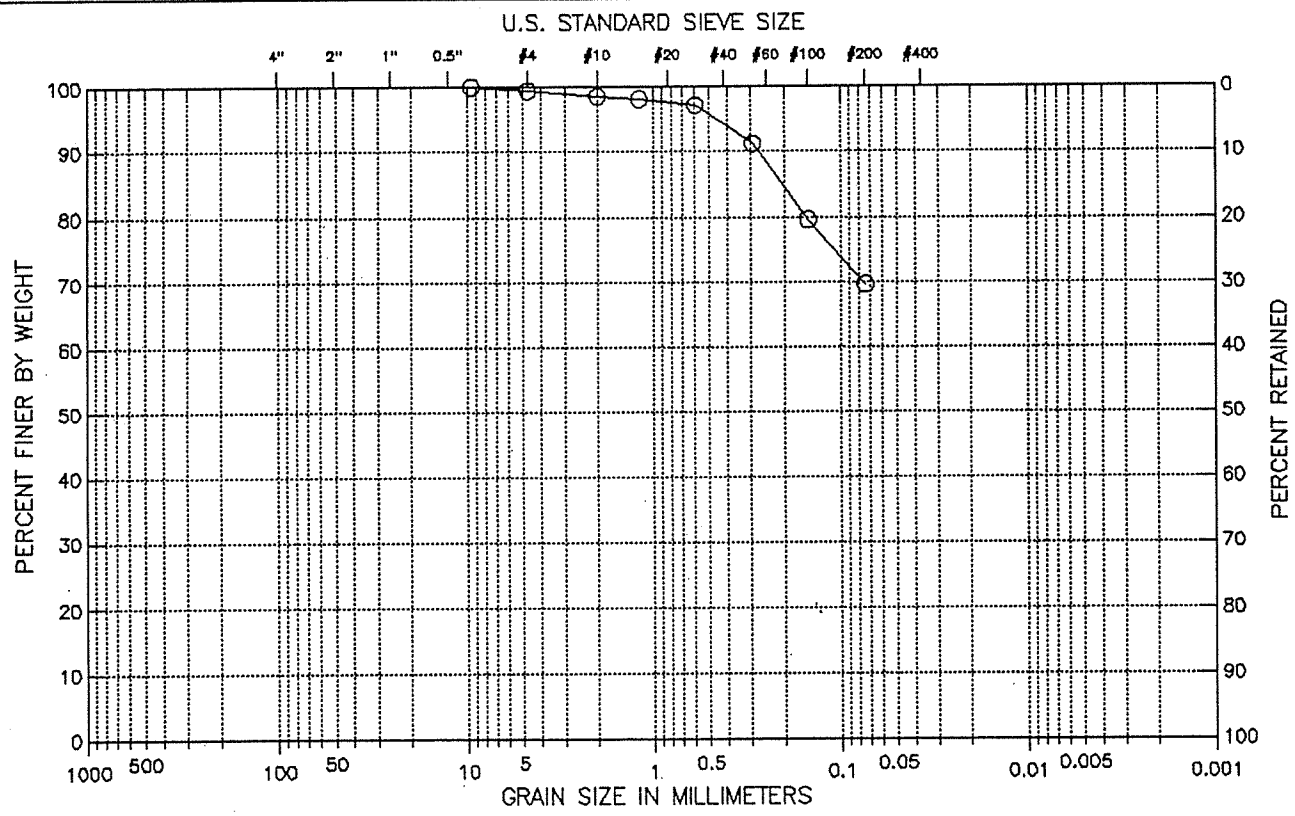
Unconsolidated Undrained Triaxial Test
ASTM D2850

Project Name:	SR 4 Loveridge to Somersville Rd.	Total Unit Weight, pcf:	121.2
Project Number:	26814910.24000	Dry Unit Weight, pcf:	99.3
Location:	Pittsburg, CA	Moisture Content, %:	22.04
Boring Number:	CB-21	Saturation, %:	87.7
Sample Number:	4	Void Ratio:	0.666
Depth, ft:	20-22	Confining Pressure, psf:	1,800
Date Tested:	01/21/05	Peak Deviator Stress, psf:	2,812
Description:	Brown sandy clay	Strain @ Failure, %:	3.50
Sample Diameter, in:	2.860	Sample Height, in:	5.945

Dial Reading, inches	Load Reading, pounds	Axial Strain, percent	Deviator Stress, psf
0.000	0.0	0.00	0.0
0.006	11.0	0.10	246
0.012	20.5	0.20	459
0.018	30.0	0.30	670
0.024	39.5	0.40	882
0.030	49.0	0.50	1093
0.045	71.0	0.75	1580
0.059	89.5	1.00	1986
0.089	121.0	1.50	2672
0.119	125.0	2.00	2746
0.149	127.0	2.50	2776
0.178	129.0	3.00	2805
0.208	130.0	3.50	2812
0.238	128.0	4.00	2754
0.268	125.0	4.50	2676
0.297	118.0	5.00	2513
0.327	98.5	5.50	2086
0.357	94.0	6.00	1981
0.386	91.0	6.50	1907
0.416	89.0	7.00	1855
0.446	87.5	7.50	1814
0.476	85.5	8.00	1763
0.535	82.5	9.00	1683
0.595	79.5	10.00	1604
0.654	77.5	11.00	1546
0.713	77.0	12.00	1519
0.773	76.5	13.00	1492
0.832	75.5	14.00	1455
0.892	75.0	15.00	1429
0.951	75.0	16.00	1412
1.011	74.5	17.00	1386
1.070	74.0	18.00	1360
1.130	74.0	19.00	1344
1.189	73.5	20.00	1318

URS

	Boring No. : CB-21 Sample No: 9-2 Tested by : R. Taraya Filename : B21-9-02	Project : SR 4 Loveridge to Somersville Rd. Project No.: 26814910.24000 Location: Pittsburg, CA Date : Wed Feb 02 2005



Classification :

Visual Description :
Brown sandy silty clay

Remarks :
Depth: 45.5 feet

Figure 1

URS

Wed Feb 02 09:54:13 2005 Page : 1

GEOTECHNICAL LABORATORY TEST DATA

Project : SR 4 Loveridge to Somersville Rd. Filename : B21-9-02
Project No. : 26814910.24000 Depth : 45.5 feet Elevation : NA
Boring No. : CB-21 Test Date : 02/02/2005 Tested by : R. Taraya
Sample No. : 9-2 Test Method : ASTM D422 Checked by : S. Capps
Location : Pittsburg, CA
Soil Description : Brown sandy silty clay
Remarks : Depth: 45.5 feet

COARSE SIEVE SET

Sieve Mesh	Sieve Openings Inches	Millimeters	Weight Retained (gm)	Cumulative Weight Retained (gm)	Percent Finer (%)
0.375"	0.374	9.51	0.00	0.00	100
#4	0.187	4.75	2.65	2.65	99
#10	0.079	2.00	3.77	6.42	99
#16	0.047	1.19	1.98	8.40	98
#30	0.023	0.60	4.73	13.13	97
#50	0.012	0.30	27.71	40.84	91
#100	0.006	0.15	52.21	93.05	80
#200	0.003	0.07	45.06	138.11	70

Total Dry Weight of Sample = 456.58

D85 : 0.2055 mm
D60 : N/A
D50 : N/A
D30 : N/A
D15 : N/A
D10 : N/A

Soil Classification
ASTM Group Symbol : N/A
ASTM Group Name : N/A
AASHTO Group Symbol : A-4(0)
AASHTO Group Name : Silty Soils

URS

ASTM D2166
Unconfined Compressive Strength

Project Name: SR 4 Loveridge to Somersville Rd.

Project Number: 26814910.24000

Location: Pittsburg, CA

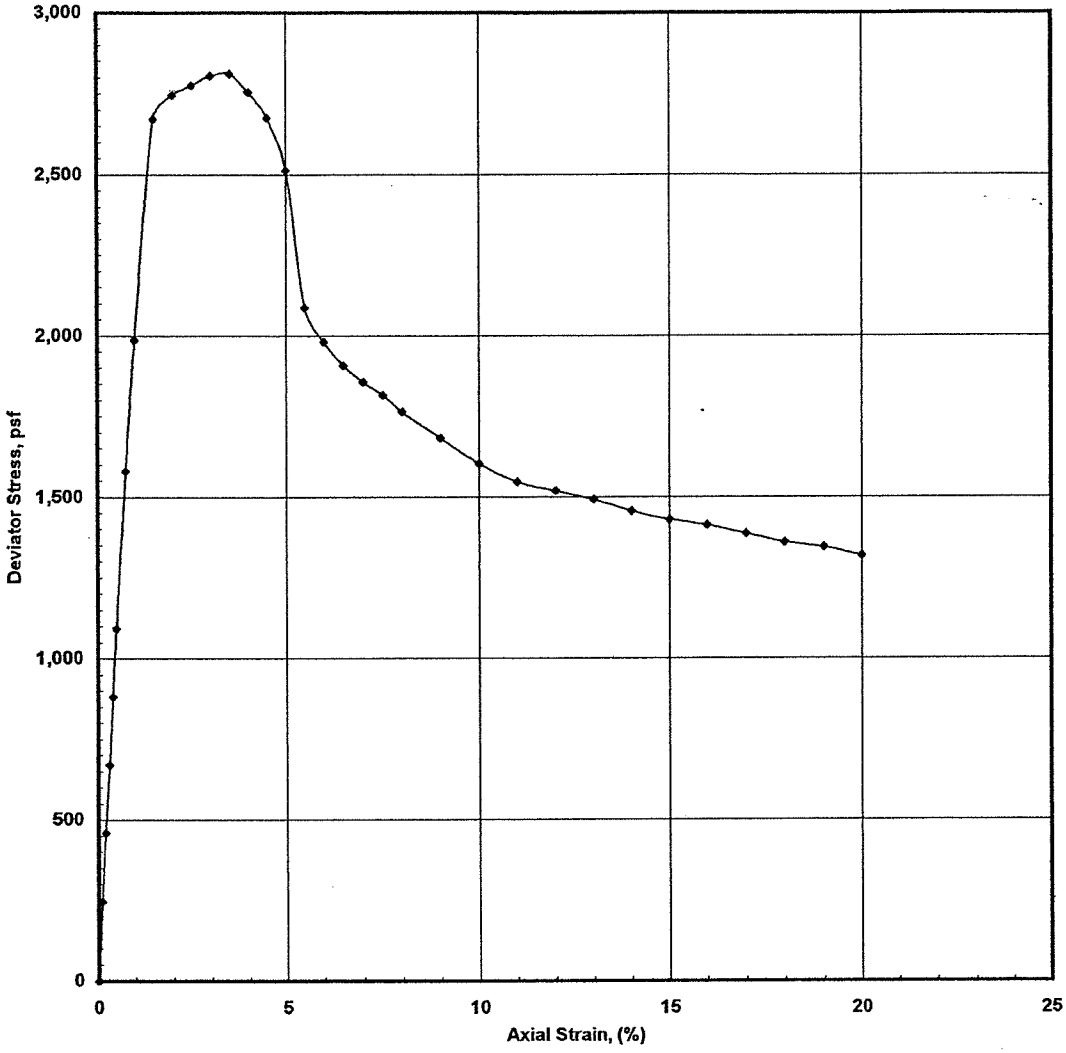
Boring/ Sample Number	Moisture Content %	Total Unit Weight pcf	Dry Unit Weight pcf	Unconfined Compressive Strength, psf	Strain at Failure	Sample Description
CB20-1-4	22.12	122.3	100.1	1116	8.6%	Dark brown clay
CB20-7-4	16.96	131.3	112.3	5848	4.3%	Yellowish brown fine sandy silty clay
CB20-11-4	30.23	120.2	92.3	5955	4.3%	Light brown clay
CB20-12-4	32.33	123.4	93.2	519	6.6%	Light brown fine sandy silty clay with voids
CB21-1-3	21.38	120.3	99.2	2273	4.8%	Brown silty clay with calcareous nodules
CB21-8-3	20.02	123.2	102.6	7754	8.7%	Brown silty clay
CB21-10-2	32.92	115.7	87.1	2208	9.6%	Brown fine sandy silty clay
CB21-14-2	28.67	120.6	93.7	1414	7.4%	Brown sandy silt/silty sand

URS

Unconsolidated Undrained Triaxial Test
ASTM D2850

Project Name:	SR 4 Loveridge to Somersville Rd.	Total Unit Weight, pcf:	121.2
Project Number:	26814910.24000	Dry Unit Weight, pcf:	99.3
Location:	Pittsburg, CA	Moisture Content, %:	22.04
Boring Number:	CB-21	Saturation, %:	87.7
Sample Number:	4	Void Ratio:	0.666
Depth, ft:	20-22	Confining Pressure, psf:	1,800
Date Tested:	01/21/05	Peak Deviator Stress, psf:	2,812
Description:	Brown sandy clay	Strain @ Failure, %:	3.50
Sample Diameter, in:	2.860	Sample Height, in:	5.945

Dial Reading, inches	Load Reading, pounds	Axial Strain, percent	Deviator Stress, psf
0.000	0.0	0.00	0.0
0.006	11.0	0.10	246
0.012	20.5	0.20	459
0.018	30.0	0.30	670
0.024	39.5	0.40	882
0.030	49.0	0.50	1093
0.045	71.0	0.75	1580
0.059	89.5	1.00	1986
0.089	121.0	1.50	2672
0.119	125.0	2.00	2746
0.149	127.0	2.50	2776
0.178	129.0	3.00	2805
0.208	130.0	3.50	2812
0.238	128.0	4.00	2754
0.268	125.0	4.50	2676
0.297	118.0	5.00	2513
0.327	98.5	5.50	2086
0.357	94.0	6.00	1981
0.386	91.0	6.50	1907
0.416	89.0	7.00	1855
0.446	87.5	7.50	1814
0.476	85.5	8.00	1763
0.535	82.5	9.00	1683
0.595	79.5	10.00	1604
0.654	77.5	11.00	1546
0.713	77.0	12.00	1519
0.773	76.5	13.00	1492
0.832	75.5	14.00	1455
0.892	75.0	15.00	1429
0.951	75.0	16.00	1412
1.011	74.5	17.00	1386
1.070	74.0	18.00	1360
1.130	74.0	19.00	1344
1.189	73.5	20.00	1318



Description: Brown sandy clay

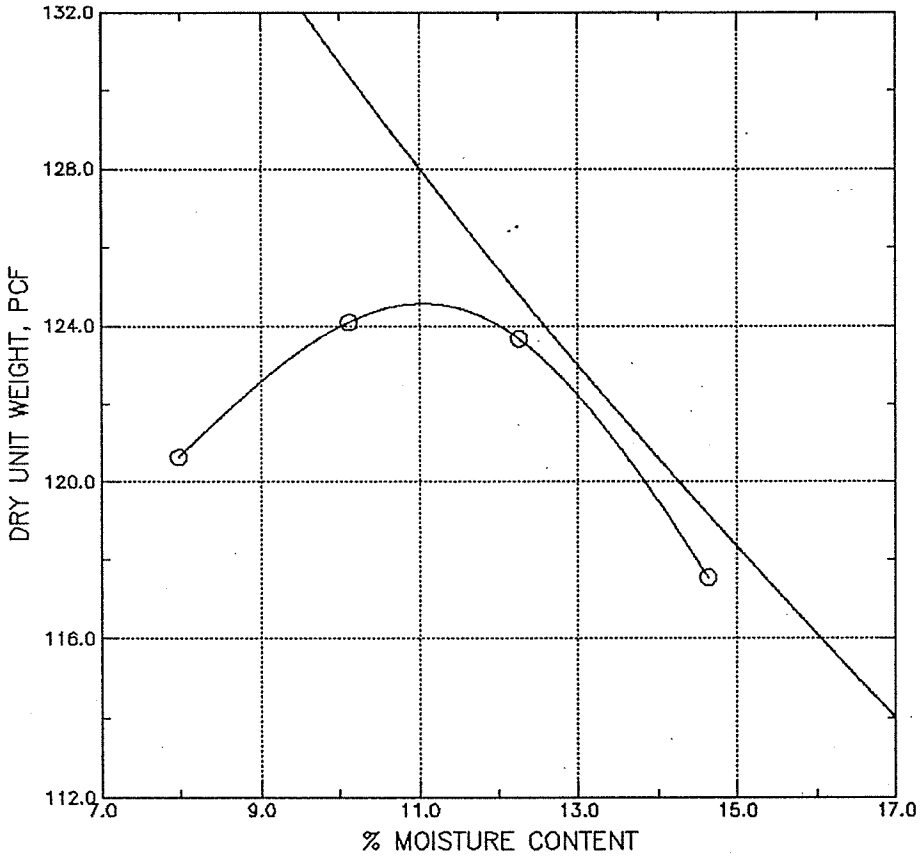
Boring Number	Sample Number	Sample Depth (feet)	Dry Unit Weight (pcf)	Initial Moisture Content (%)	Specific Gravity (assumed)	Void Ratio	Initial Saturation (%)	Height/ Diameter Ratio	Rate of Shearing (%/min)	Confining Pressure (psf)	Peak Deviator Stress (psf)	Peak Shear Stress (psf)
CB-21	4	20-22	99.3	22.0	2.65	0.666	87.7	2.08	0.75	1,800	2,812	1,406

Project Name: SR 4	**UNCONSOLIDATED UNDRAINED TRIAXIAL TEST STRESS VS. STRAIN ASTM D2850**	URS
Project Number: 26814910.24000		Figure No.
Location: Pittsburg, , CA		

URS

	Boring No. : B-19 Sample No. : 1 Tested by : S. Capps Filename : B19-01	Project : SR 4 Loveridge to Somersville Rd. Project No.: 26814910.24000 Location : Pittsburg, CA Date: Fri Feb 04 2005

COMPACTION



Sample Description	: Brown sandy clay
Compaction Test Designation	: ASTM D1557-B
Maximum Dry Density	: 124.6 PCF
Optimum Moisture Content	: 11.1 %

Figure 2

URS

Fri Feb 04 08:45:06 2005

GEOTECHNICAL LABORATORY TEST DATA

Project : SR 4 Loveridge to Somersville Rd.
Project No. : 26814910.24000
Boring No. : B-19
Sample No. : 1
Location : Pittsburg, CA
Soil Description : Brown sandy clay
Remarks :

Depth : 2.0-5.0 feet
Test Date : 02/04/2005
Test Method : ASTM D1557-B

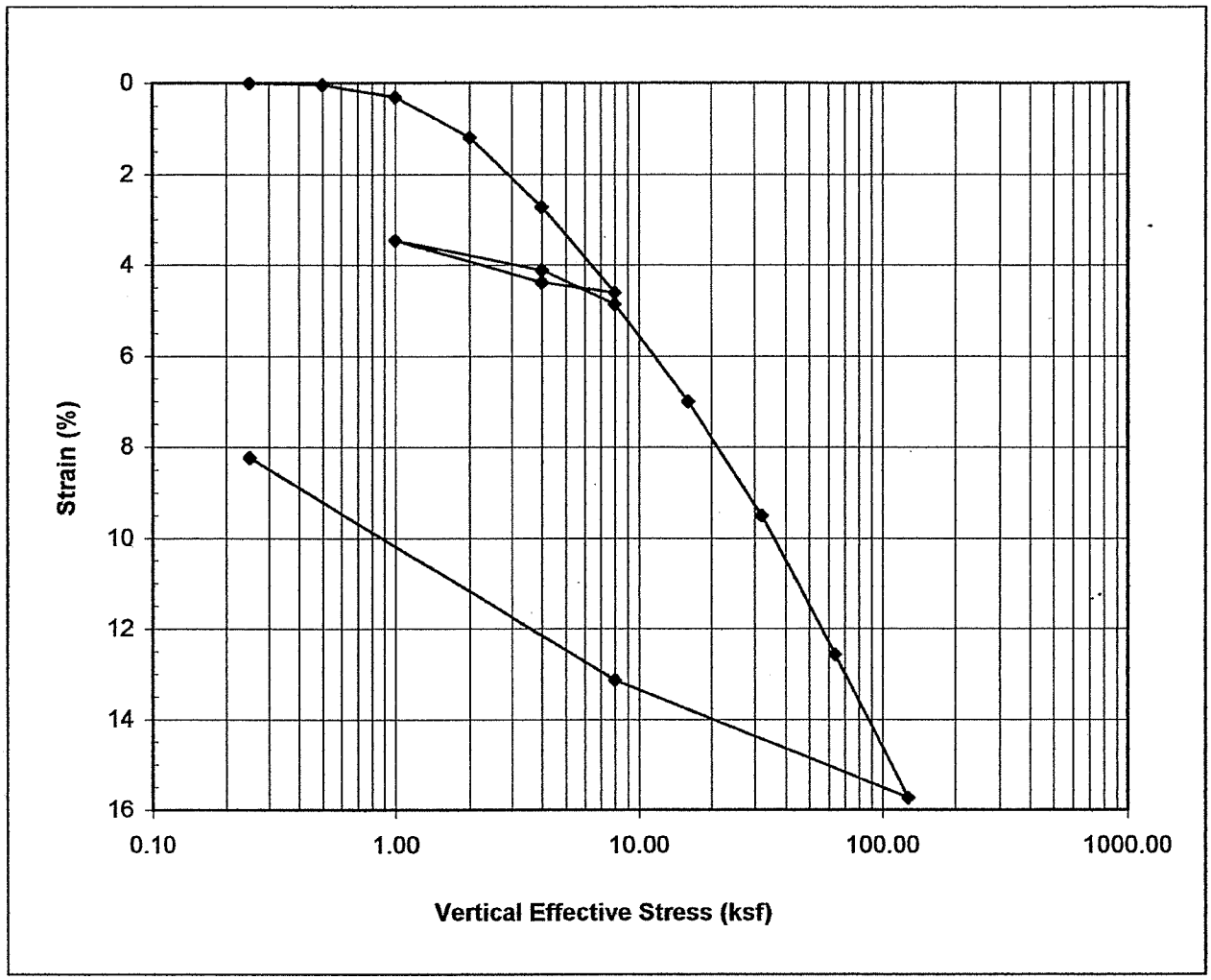
Filename : B19-01
Elevation : NA
Tested by : S. Capps
Checked by : R. Taraya

COMPACTION TEST

Mold ID : 4-1
Method Used : ASTM D1557-B
Volume of Mold : 0.03325 ft^3
Mass of Mold : 1856.6 gm
Specific Gravity : 2.65

Moisture Content ID	Mass of Container (gm)	Mass of Container + Moist Soil (gm)	Mass of Container + Dry Soil (gm)	Mass of Mold + Specimen (gm)	Moisture Content (%)	Dry Density (PCF)
	0.00	1960.10	1815.30	3821.30	8.0	120.6
	0.00	2059.80	1870.50	3917.40	10.1	124.1
	0.00	2092.10	1863.60	3950.40	12.3	123.7
	0.00	2031.30	1772.00	3888.70	14.6	117.5

Optimum Dry Density = 124.6 PCF
Optimum Moisture Content = 11.1 %



Boring: CB-20 Sample: 3-3 Depth, ft: 15.5

Description: Brown sandy clay

	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est.	Liquid Limit	Plasticity Index
Initial	18.05	128.0	108.5	0.611	82.7	0.9000	1.926	2.800	NA	NA
Final	17.07	138.4	118.2	0.478	99.9	0.8259				

Project: **SR 4**
Project #: **26814910**
Date: **01/20/05**

URS

Consolidation Test

Figure:

URS

Consolidation Test
ASTM D2435 Method A

Project Name: SR 4

Date: 01/20/05

Project Number: 26814910 .24000

Boring Number: CB-20 **Sample Number:** 3-3

Depth, ft: 15.5

Location: Pittsburg, CA

Load, Grams	Load, ksf	Load, tsf	Initial Dial, Inches	Frame Corr.	Dial Change	Final Dial, Inches	Change in Height, in.	Strain, Incre., %	Strain, Cum., %
250	0.25	0.13	0.3000	0.0009	0.0009	0.2991	0.0000	0.00	0.00
500	0.50	0.25	0.2991	0.0007	0.0010	0.2981	0.0003	0.03	0.03
1000	1	0.5	0.2981	0.0007	0.0032	0.2949	0.0025	0.28	0.31
2000	2	1	0.2949	0.0010	0.0090	0.2859	0.0080	0.89	1.20
4000	4	2	0.2859	0.0012	0.0149	0.2710	0.0137	1.52	2.72
8000	8	4	0.2710	0.0010	0.0179	0.2531	0.0169	1.88	4.60
4000	4	2	0.2531	0.0005	-0.0024	0.2555	-0.0019	-0.21	4.39
1000	1	0.50	0.2555	0.0010	-0.0094	0.2649	-0.0084	-0.93	3.46
4000	4	2	0.2649	0.0009	0.0068	0.2581	0.0059	0.66	4.11
8000	8	4	0.2581	0.0007	0.0074	0.2507	0.0067	0.74	4.86
16000	16	8	0.2507	0.0009	0.0202	0.2305	0.0193	2.14	7.00
32000	32	16	0.2305	0.0005	0.0231	0.2074	0.0226	2.51	9.51
64000	64	32	0.2074	0.0008	0.0283	0.1791	0.0275	3.06	12.57
128000	128	64	0.1791	0.0016	0.0301	0.1490	0.0285	3.17	15.73
8000	8	4	0.1490	0.0015	-0.0249	0.1739	-0.0234	-2.60	13.13
250	0.25	0.13	0.1739	0.0036	-0.0477	0.2216	-0.0441	-4.90	8.23
					Total	Change	0.0741		
					in	Height, in.			

URS

Consolidation Test
ASTM D2435 Method A

Frame 5

Project Name: SR 4 **Date:** 01/20/05

Project Number: 26814910.24000

Boring Number: CB-20 **Sample Number:** 3-3

Depth, ft: 15.5 **Description:** Brown sandy clay

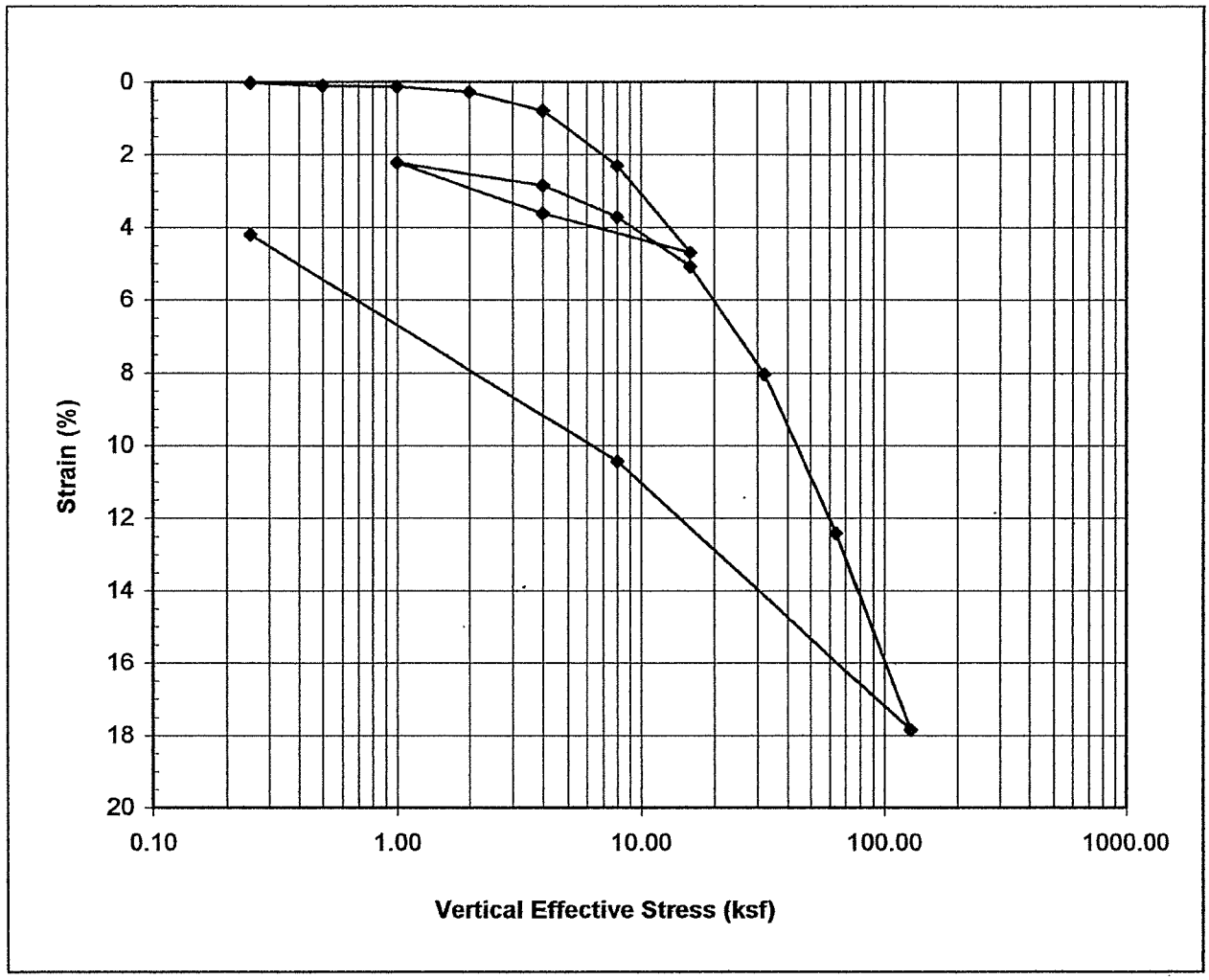
Location: Pittsburg, CA **Liquid Limit:** NA

Plastic Limit: NA

Plasticity Index: NA

Tested By: S. Capps **Reviewed By:** R. Taraya

Water Content Determination	Soil Adjacent to Sample	Sample at Start of Test	Sample at End of Test
Wet Soil + Tare, grams	315.8	297.5	296.77
Dry Soil + Tare, grams	283.48	284.02	284.02
Tare, grams	104.56	209.34	209.34
Weight of Water, grams	32.32	13.48	12.75
Weight of Dry Soil, grams	178.92	74.68	74.68
Water Content, %	18.06	18.05	17.07
Height of Gage Block, in:	0.7160	Dial Reading on Gage Block, in:	0.7450
Dial Reading on Sample, in:	0.9290		
Height of Sample, initial, in:	0.9000	Height of Sample, Final, in:	0.8259
Change in Height during Test, in:	0.0741	Estimated Specific Gravity:	2.80
Diameter of Ring, in:	1.926	Ring Number	R-7
Initial Area of Sample, cm^2:	18.80	Volume of Solids, Vs=Ws/Gs:	26.67
Volume of Sample, Initial, cm^3:	42.97	Volume of Sample, Final, cm^3	39.43
Volume of Voids, Initial, Vei, cm^3	16.30	Volume of Voids, Final, Vef, cm^3:	12.76
Volume of Water, Initial, Wwi, cm^3:	13.48	Volume of Water, Final, Wwf, cm^3:	12.75
Degree of Saturation, Initial, %	82.7	Degree of Saturation, Final, %	99.9
Total Unit Weight, Initial, pcf:	128.0	Total Unit Weight, Final, pcf:	138.4
Dry Unit Weight, Initial, pcf:	108.5	Dry Unit Weight, Final, pcf:	118.2
Initial Void Ratio:	0.6110	Final Void Ratio:	0.4784



Boring: CB-20 Sample: 10-4 Depth, ft: 51.0

Description: Brown sandy clay

	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est.	Liquid Limit	Plasticity Index
Initial	21.60	126.8	104.2	0.610	95.2	0.8940	1.939	2.690	NA	NA
Final	20.17	130.8	108.8	0.543	100.0	0.8565				

Project: **SR 4**

Project #: **26814910**

Date: **01/20/05**

URS

Consolidation Test

Figure:

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Consolidation Test
ASTM D2435 Method A

Project Name: SR 4 Date: 01/20/05

Project Number: 26814910 .24000

Boring Number: CB-20 **Sample Number:** 10-4

Depth, ft: 51.0

Location: Pittsburg, CA

Load, Grams	Load, ksf	Load, tsf	Initial Dial, Inches	Frame Corr.	Dial Change	Final Dial, Inches	Change in Height, in.	Strain, Incre., %	Strain, Cum., %
250	0.25	0.13	0.3000	0.0008	0.0010	0.2990	0.0002	0.02	0.02
500	0.50	0.25	0.2990	0.0006	0.0012	0.2978	0.0006	0.07	0.09
1000	1	0.50	0.2978	0.0007	0.0010	0.2968	0.0003	0.03	0.12
2000	2	1	0.2968	0.0009	0.0023	0.2945	0.0014	0.16	0.28
4000	4	2	0.2945	0.0010	0.0055	0.2890	0.0045	0.50	0.78
8000	8	4	0.2890	0.0014	0.0149	0.2741	0.0135	1.51	2.29
16000	16	8	0.2741	0.0015	0.0230	0.2511	0.0215	2.40	4.70
4000	4	2	0.2511	0.0024	-0.0120	0.2631	-0.0096	-1.07	3.62
1000	1	0.50	0.2631	0.0011	-0.0136	0.2767	-0.0125	-1.40	2.23
4000	4	2	0.2767	0.0010	0.0066	0.2701	0.0056	0.63	2.85
8000	8	4	0.2701	0.0013	0.0090	0.2611	0.0077	0.86	3.71
16000	16	8	0.2611	0.0013	0.0135	0.2476	0.0122	1.36	5.08
32000	32	16	0.2476	0.0011	0.0275	0.2201	0.0264	2.95	8.03
64000	64	32	0.2201	0.0013	0.0404	0.1797	0.0391	4.37	12.40
128000	128	64	0.1797	0.0020	0.0506	0.1291	0.0486	5.44	17.84
8000	8	4	0.1291	0.0035	-0.0697	0.1988	-0.0662	-7.40	10.44
250	0.25	0.13	0.1988	0.0041	-0.0599	0.2587	-0.0558	-6.24	4.19
					Total	Change	0.0375		
					in	Height, in.			

Consolidation Test
ASTM D2435 Method A

Frame_6

URS

Project Name: SR 4 **Date:** 01/20/05

Project Number: 26814910.24000

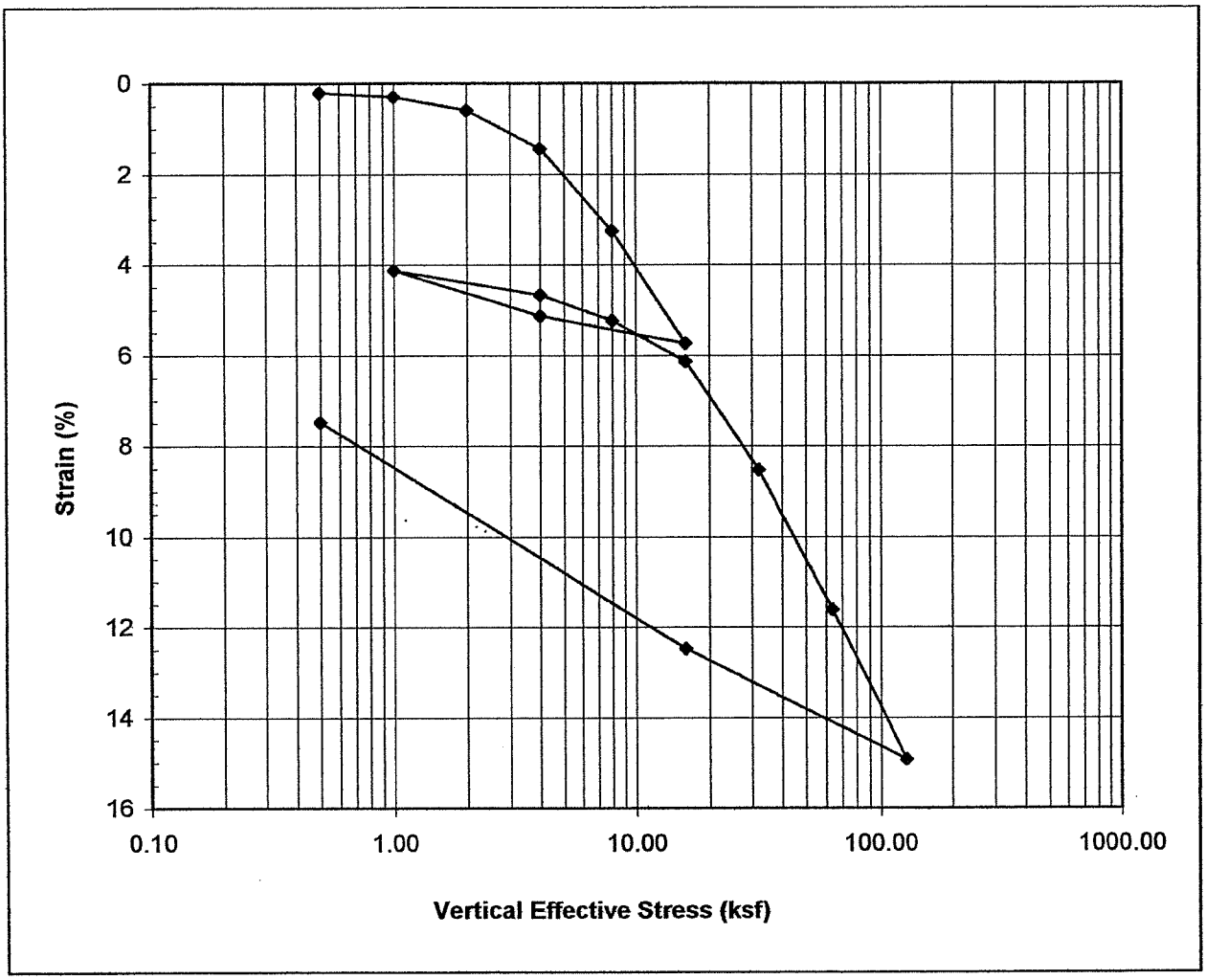
Boring Number: CB-20 **Sample Number:** 10-4

Depth, ft: 51.0 **Description:** Brown sandy clay

Location: Pittsburg, CA **Liquid Limit:** NA
Plastic Limit: NA
Plasticity Index: NA

Tested By: S. Capps **Reviewed By:** R. Taraya

Water Content Determination	Soil Adjacent to Sample	Sample at Start of Test	Sample at End of Test
Wet Soil + Tare, grams	339.57	307.42	306.39
Dry Soil + Tare, grams	298.31	291.81	291.81
Tare, grams	107.3	219.54	219.54
Weight of Water, grams	41.26	15.61	14.58
Weight of Dry Soil, grams	191.01	72.27	72.27
Water Content, %	21.60	21.60	20.17
Height of Gage Block, in:	0.7160	Dial Reading on Gage Block, in:	0.7280
Dial Reading on Sample, in:	0.9060		
Height of Sample, initial, in:	0.8940	Height of Sample, Final, in:	0.8565
Change in Height during Test, in:	0.0375	Estimated Specific Gravity:	2.69
Diameter of Ring, in:	1.939	Ring Number	R-8
Initial Area of Sample, cm^2:	19.05	Volume of Solids, Vs=Ws/Gs:	26.87
Volume of Sample, Initial, cm^3:	43.26	Volume of Sample, Final, cm^3	41.45
Volume of Voids, Initial, Vei, cm^3	16.39	Volume of Voids, Final, Vef, cm^3:	14.58
Volume of Water, Initial, Wwi, cm^3:	15.61	Volume of Water, Final, Wwf, cm^3:	14.58
Degree of Saturation, Initial, %	95.2	Degree of Saturation, Final, %	100.0
Total Unit Weight, Initial, pcf:	126.8	Total Unit Weight, Final, pcf:	130.8
Dry Unit Weight, Initial, pcf:	104.2	Dry Unit Weight, Final, pcf:	108.8
Initial Void Ratio:	0.6102	Final Void Ratio:	0.5427



Boring: CB-21 Sample: 7-3 Depth, ft: 36.0

Description: Brown sandy clay

	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est	Liquid Limit	Plasticity Index
Initial	18.41	125.4	105.9	0.585	84.7	0.8960	1.938	2.690	NA	NA
Final	17.33	134.3	114.5	0.466	100.0	0.8291				

Project: **SR 4**
Project #: **26814910**
Date: **01/20/05**

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Consolidation Test

Figure:

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Consolidation Test
ASTM D2435 Method A

Project Name: SR 4 Date: 01/20/05

Project Number: 26814910 .24000

Boring Number: CB-21 **Sample Number:** 7-3

Depth, ft: 36.0

Location: Pittsburg, CA

Load, Grams	Load, ksf	Load, tsf	Initial Dial, Inches	Frame Corr.	Dial Change	Final Dial, Inches	Change in Height, in.	Strain, Incre., %	Strain, Cum., %
500	0.50	0.25	0.3000	0.0008	0.0026	0.2974	0.0018	0.20	0.20
1000	1.00	0.50	0.2974	0.0004	0.0013	0.2961	0.0009	0.10	0.30
2000	2	1	0.2961	0.0006	0.0032	0.2929	0.0026	0.29	0.59
4000	4	2	0.2929	0.0003	0.0079	0.2850	0.0076	0.85	1.44
8000	8	4	0.2850	0.0008	0.0170	0.2680	0.0162	1.81	3.25
16000	16	8	0.2680	0.0007	0.0230	0.2450	0.0223	2.49	5.74
4000	4	2	0.2450	0.0008	-0.0062	0.2512	-0.0054	-0.60	5.13
1000	1	0.50	0.2512	0.0007	-0.0097	0.2609	-0.0090	-1.00	4.13
4000	4	2	0.2609	0.0001	0.0049	0.2560	0.0048	0.54	4.67
8000	8	4	0.2560	0.0007	0.0058	0.2502	0.0051	0.57	5.23
16000	16	8	0.2502	0.0008	0.0089	0.2413	0.0081	0.90	6.14
32000	32	16	0.2413	0.0009	0.0223	0.2190	0.0214	2.39	8.53
64000	64	32	0.2190	0.0014	0.0291	0.1899	0.0277	3.09	11.62
128000	128	64	0.1899	0.0020	0.0316	0.1583	0.0296	3.30	14.92
16000	16	8	0.1583	0.0030	-0.0249	0.1832	-0.0219	-2.44	12.48
500	0.50	0.25	0.1832	0.0018	-0.0467	0.2299	-0.0449	-5.01	7.47
					Total	Change	0.0669		
					in	Height, in.			

URS

Consolidation Test
ASTM D2435 Method A

Frame 7

Project Name: SR 4 **Date:** 01/20/05

Project Number: 26814910.24000

Boring Number: CB-21 **Sample Number:** 7-3

Depth, ft: 36.0 **Description:** Brown sandy clay

Location: Pittsburg, CA **Liquid Limit:** NA

Plastic Limit: NA

Plasticity Index: NA

Tested By: S. Capps **Reviewed By:** R. Taraya

Water Content Determination	Soil Adjacent to Sample	Sample at Start of Test	Sample at End of Test
Wet Soil + Tare, grams	331.5	314.86	314.06
Dry Soil + Tare, grams	294.4	301.32	301.32
Tare, grams	92.84	227.79	227.79
Weight of Water, grams	37.1	13.54	12.74
Weight of Dry Soil, grams	201.56	73.53	73.53
Water Content, %	18.41	18.41	17.33
Height of Gage Block, in:	0.7160	Dial Reading on Gage Block, in:	0.7470
Dial Reading on Sample, in:	0.9270		
Height of Sample, initial, in:	0.8960	Height of Sample, Final, in:	0.8291
Change in Height during Test, in:	0.0669	Estimated Specific Gravity:	2.69
Diameter of Ring, in:	1.938	Ring Number	R-6
Initial Area of Sample, cm^2:	19.03	Volume of Solids, Vs=Ws/Gs:	27.33
Volume of Sample, Initial, cm^3:	43.31	Volume of Sample, Final, cm^3	40.08
Volume of Voids, Initial, Vei, cm^3	15.98	Volume of Voids, Final, Vef, cm^3:	12.74
Volume of Water, Initial, Wwi, cm^3:	13.54	Volume of Water, Final, Wwf, cm^3:	12.74
Degree of Saturation, Initial, %	84.7	Degree of Saturation, Final, %	100.0
Total Unit Weight, Initial, pcf:	125.4	Total Unit Weight, Final, pcf:	134.3
Dry Unit Weight, Initial, pcf:	105.9	Dry Unit Weight, Final, pcf:	114.5
Initial Void Ratio:	0.5845	Final Void Ratio:	0.4662

Appendix D

Corrosivity Test Results

STATE ROUTE 4 HIGHWAY WIDENING PROJECT
WEST OF LOVERIDGE ROAD, PITTSBURG, CA
TO SOMERSVILLE ROAD, ANTIOCH, CA

CENTURY BOULEVARD UNDERPASS
FOUNDATION INVESTIGATION REPORT

Prepared for:

URS Corporation
1333 Broadway, Suite 800
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Prepared By:

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March 2006

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EXECUTIVE SUMMARY

V&A Consulting Engineers (V&A) was retained by URS Corporation to perform a Soil Corrosivity Investigation for the proposed State Route 4 Highway Widening Project Between Loveridge Road in Pittsburg, CA to Somersville Road in Antioch, CA. The objective of this investigation is to measure various soil parameters and evaluate the results to determine the corrosivity of the soil to the proposed underpass at Century Boulevard associated with the highway widening project. Corrosivity was determined at the underpass site to depths ranging from 0 to 6 meters below grade.

The California Department of Transportation, Division of Engineering Services, Materials Engineering and Testing Services, Corrosion Technology Branch has published "Corrosion Guidelines" (Guidelines) to define corrosive soil. The Guidelines consider soil to be corrosive to structural elements (steel reinforced concrete) if one or more of the following conditions exist for water or soil samples:

> ***"Chloride concentration is 500 ppm (mg/kg) or greater, sulfate concentration is 2,000 mg/kg or greater, or the pH is 5.5 or less."***

A wide variety of soluble salts is typically found in soils. Two soils having the same resistivity may have significantly different corrosion characteristics, depending on the specific ions available. The major constituents that accelerate corrosion are chlorides, sulfates and the acidity (pH) of the soil. Chloride ions tend to break down otherwise protective surface deposits, and can result in corrosion of reinforcing steel in concrete structures. Sulfates in soil can be highly aggressive to portland cement concrete by combining chemically with certain constituents of the concrete, principally tricalcium aluminate. This reaction is accompanied by expansion and eventual disruption of the concrete matrix. High concentrations of bicarbonates tend to decrease soil resistivities. Although bicarbonates are not aggressive to buried concrete, bicarbonates will lower the soil resistivity which can promote corrosion activity.

This report provides recommendations for corrosion control for the various structural foundation materials under consideration. This foundation investigation is in accordance with Caltrans Corrosion Guidelines dated September 2003 (Guidelines). The materials considered as part of this investigation include buried reinforced concrete, prestressed concrete piles, and steel pipe piles.

Acidity, as indicated by the pH of the soil, is another important factor of soil. The lower the pH (the more acidic the environment), the higher the corrosivity will be with respect to buried metallic and concrete structures. As pH increases above 7 (the neutral value), conditions become increasingly more alkaline and passive to buried structures.

Evaluation of the soil environment is reported in terms of potential damage to the structures due to corrosion. Soil resistivity measurements were conducted in the field during the initial stages of the work. In addition, soil samples collected by URS during the geotechnical investigation were forwarded to Sequoia Analytical Laboratory in Sacramento, CA, for testing. The soil borings were analyzed for 'as-received' resistivity, minimum resistivity, and pH. The soil borings with a minimum resistivity of 1,000 ohm-cm or less were analyzed for water soluble chloride ion concentration and water soluble sulfate ion concentration.

Based on the results of the corrosion analyses, the soil is determined to be *non-corrosive* in accordance with the Guidelines.

The pH of the soil samples analyzed ranged from 7.6 to 8.2 and the soil is considered to be *non-corrosive* in accordance with the Guidelines.

The water soluble chloride ion concentration is below the detection level of 15 milligrams per kilogram (mg/kg), and the water soluble sulfate ion concentration of the soil sample tested is 39 mg/kg. The chloride ion and sulfate ion concentrations are determined to be *non-corrosive* in accordance with the Guidelines.

CONCLUSIONS

- Soil samples were obtained for corrosion analysis at boring locations B-20 and B-21. Based on the results of the corrosion analyses, the site is considered non-corrosive.
- The proposed structure is not within 300 m (1000 ft.) of salt or brackish water.
- The in-situ resistivity measured at the Century Boulevard Underpass site is considered to be non-corrosive to steel pipe piles in accordance with the Guidelines.
- The chloride ion concentration is less than 15 mg/kg for Soil Samples B-20 and B-21 and is considered to be non-corrosive to buried reinforced concrete, cast in place piles, and prestressed concrete piles in accordance with the Guidelines.
- The sulfate ion concentration is less than 50 mg/kg for Soil Samples B-20 and B-21 and is considered to be non-corrosive to buried reinforced concrete, cast in place piles, and prestressed concrete piles in accordance with the Guidelines.
- The pH of the soil is greater than 7.0 for Soil Samples B-20 and B-21 and is considered to be non-corrosive to buried reinforced concrete, cast in place piles, and prestressed concrete piles in accordance with the Guidelines.

RECOMMENDATIONS

Based on the test data and review of the project requirements, specific recommendations for each structural foundation material alternative are listed below:

Buried Reinforced Concrete Structures, Prestressed Concrete Piles and Cast in Place Concrete Piles

Buried concrete structures should be constructed of durable concrete as described in Section 8.22 of the Caltrans Bridge Design Specifications and ACI Standards 201.2R and 222R. These recommendations include, but are not limited to, the following:

- The water/cement ratio should not exceed 0.50.
- A concrete cover of a minimum of 5.1 centimeters should be applied over all steel reinforcement.
- Salt-free sand and potable water should be used.
- Type II modified cement should be used.
- The concrete should be allowed to cure according to the manufacturer's recommendations.

Steel Pipe Piles

A conservative approach for the design of pipe piles would be to assume that corrosion will occur at a rate of 0.025 millimeters per year between grade and a depth 1 meter below the water table, in accordance with the Guidelines. It is important to note that structural considerations for pipe piles may require increases in metal wall thickness to withstand both installation and structural loadings, as they have not been considered in this analysis.

TEST METHODS

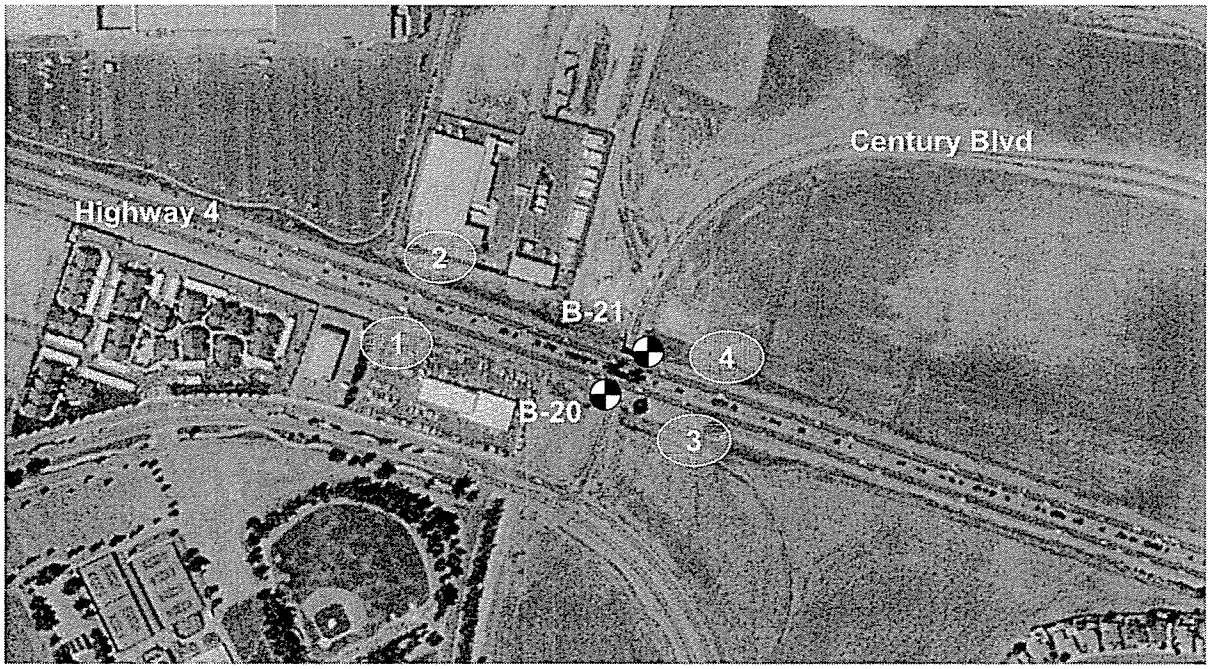
In attempting to predict corrosion problems associated with a particular type of structure prior to installation, it is necessary to investigate the soil conditions the structure will encounter. Since corrosion is an electrochemical process accompanied by current flow, the electrochemical characteristics of a soil are of primary importance when evaluating corrosivity. Test methods utilized during this investigation reflect the most practical methods of evaluating corrosivity.

Soil Resistivity

In-situ resistivity of the soil was measured at four locations at the Century Boulevard Underpass site. Figure 1 shows the project vicinity map. Figure 2 shows the in-situ soil resistivity and soil boring locations.

Figure 1 - Vicinity and Project Site Map[1]

[1] Map courtesy of the USGS and the TerraServer Team



In-Situ Soil Resistivity Location, See Table 1 (Typical of 4)
Soil Sample Location, See Table 2 (Typical of 2)

Figure 2 - Soil Resistivity Testing and Soil Sample Locations[2]

In-situ soil resistivity was measured using the Wenner 4-Electrode Method, with a Model 400 Soil Resistance Meter, manufactured by Nilsson Electrical Laboratory, Inc. The Wenner Method involves the use of four metal probes or electrodes, driven into the ground along a straight line, equidistant from each other, as shown in Figure 3.

[2] Map courtesy of the USGS and the TerraServer Team

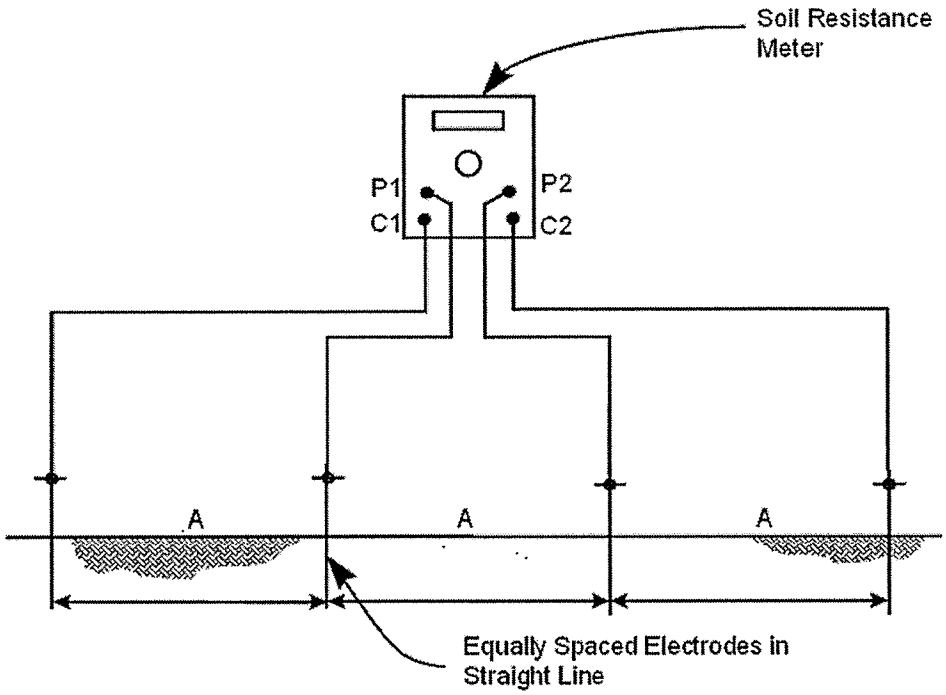


Figure 3 - Soil Resistivity Measurement Using the Wenner 4-Electrode Method

An alternating current from the Soil Resistance Meter causes a current to flow through the soil between the outside electrodes, C1 and C2. Due to the resistance of the soil, the current creates a voltage gradient, which is proportional to the average resistance of the soil mass to a depth equal to the distance between electrodes. The voltage drop is then measured across pins, P1 and P2. Resistivity of the soil is then computed from the instrument reading according to the following formula:

$$\rho = 2 \cdot \pi \cdot A \cdot R$$

Where:

ρ	=	soil resistivity (ohm-cm)
A	=	distance between electrodes (cm)
R	=	soil resistance, instrument reading (ohms)
π	=	3.14 (approx.)

Soil resistivity measurements were conducted with electrodes spaced at 1.5, 3, 4.5, and 6 meters. The resistivity values obtained represent the average resistivity of the soil to a depth equal to the electrode spacing. An additional method of calculating the soil resistivity using the data from the 4-Electrode Method is the Barnes-Layer Resistivity Calculation. The Barnes Layer Calculation is used to determine the resistivity of the soil for each soil layer. While the 4-Electrode Method at 3-meter

electrode spacing will consider all 3 meters of soil below the surface, the Barnes-Layer method will consider the resistivity of only the layer of soil between 1.5 and 3 meters below the surface. This method assumes the soil layers are a uniform thickness and parallel to the surface.

$$\rho_{b-a} = KR_{b-a}$$

and

$$\frac{1}{R_{b-a}} = \frac{1}{R_a} - \frac{1}{R_b}$$

Where:

ρ_{b-a}	=	Soil resistivity of layer depth b-a (ohm-cm)
a	=	Soil depth to top of layer (cm)
b	=	Soil depth to bottom of layer (cm)
R_a	=	Soil resistance read at depth a (ohms)
R_b	=	Soil resistance read at depth b (ohms)
R_{b-a}	=	Resistance of soil layer from a to b (cm)
K	=	Layer constant (cm)
	=	2 π (b-a)

Soil resistance is measured at electrode spacings of 1.5, 3, 4.5, and 6 meters. Barnes Layer resistivity is calculated for layers 0 to 1.5, 1.5 to 3, 3 to 4.5, and 4.5 to 6 meters below grade. The results of both methods are listed on Table 1.

To supplement the resistivity data obtained during field testing, two soil samples from the Century Boulevard Underpass site were obtained from URS for analysis of minimum soil resistivity using a soil box, as shown in Figure 4.

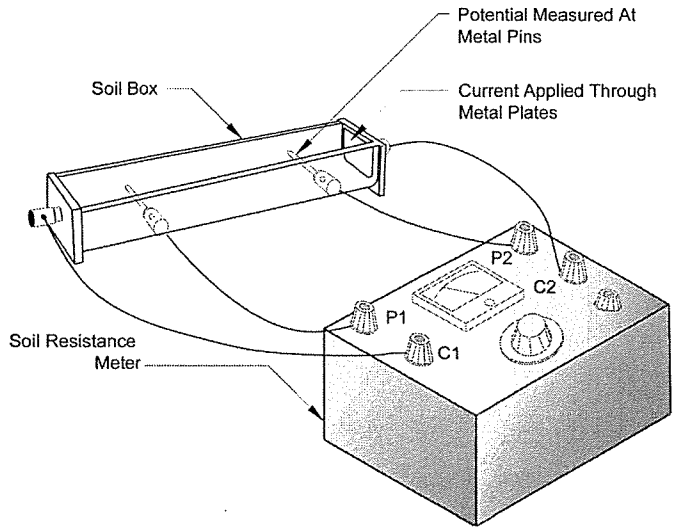


Figure 4 - Soil Resistivity Measurement Using the Soil Box Method

The soil box apparatus consists of a small plastic box with metal end plates. Dirt from the soil sample is tightly packed into the box and current is passed through the soil sample. The current causes a voltage drop across the soil sample and soil resistivity is determined using the above referenced Soil Resistance Meter.

The soil samples were placed in the soil box and the soil resistivity was measured in the "as-received" state. Distilled water was added to the soil sample in 10-mL increments and the resistivity was measured after each watering. As the soil sample became more saturated, the soil resistivity decreased until the minimum soil resistivity was reached.

Laboratory Analysis of Soil

The soil samples have a minimum resistivity greater than or equal to 1,000 ohm-cm and were forwarded to CERCO Analytical Laboratory in Pleasanton, CA, for testing. Both samples were tested for pH, and Soil Sample B-20 with a minimum resistivity of 1,000 ohm-cm was also tested for water soluble chloride and water soluble sulfate ion concentration.

TEST RESULTS

Data obtained during this investigation has been summarized in tabular form for analysis and presentation. Table 1 lists the results of the in-situ soil resistivity measurements conducted at the site. Table 2 lists the "as-received" and minimum soil resistivity for each sample collected as well as

the chemical analysis of the sample. The locations of the soil samples and the in-situ resistivity test locations are shown on Figure 2.

In-Situ Soil Resistivity

Table 1 - In-Situ Soil Resistivity Data

Site*	Depth (meters)	Resistivity (ohm-cm)	Layer Resistivity (ohm-cm)	Layer (meters)
1	1.5	1,053	1,053	0 – 1.5
	3.0	823	676	1.5 – 3.0
	4.5	747	630	3.0 – 4.5
	6.0	728	676	4.5 – 6.0
2	1.5	1,149	1,149	0 – 1.5
	3.0	785	596	1.5 – 3.0
	4.5	1,034	2,827	3.0 – 4.5
	6.0	1,187	2,137	4.5 – 6.0
3	1.5	1,436	1,436	0 – 1.5
	3.0	1,111	906	1.5 – 3.0
	4.5	948	733	3.0 – 4.5
	6.0	651	336	4.5 – 6.0
4	1.5	1,053	1,053	0 – 1.5
	3.0	938	846	1.5 – 3.0
	4.5	891	808	3.0 – 4.5
	6.0	728	470	4.5 – 6.0

Since corrosion is a natural electrochemical process accompanied by the flow of electrical current, it is important to understand how easily current will travel through the soil surrounding the steel or steel reinforced concrete structure. Resistivity is a measure of the ability of a soil to conduct an electric current. Soil resistivity is primarily dependent on the chemical and moisture content of the soil. As the concentration of chemical constituents increases, the soil resistivity will decrease. Additional moisture generally decreases the soil resistivity up to the point where the maximum solubility for the dissolved ionic chemicals is achieved. Beyond the maximum solubility, an increase in moisture generally increases the resistivity as the chemicals become more and more diluted. Since corrosion rate depends on current flow through the soil to and from the metal, soil corrosivity normally increases as soil resistivity decreases.

Based upon analysis of the in-situ soil resistivity results for the Century Boulevard Underpass site, shown in Table 1, the soil is determined to be *non-corrosive* to a depth of 6 meters below grade to the buried reinforced concrete, cast in place concrete piles, and prestressed concrete piles, in accordance with the Guidelines.

Soil samples were obtained for corrosion analyses at the following locations:

Laboratory Analysis of Soil Samples

Table 2 - Soil Resistivity and Chemical Data

Item No.	Boring No.	Station	Sample No.	Depth (meters)	Soil Resistivity (ohm-cm)		Chemical Data		
					As-Received	Minimum	pH	Sulfate (mg/kg)	Chloride (mg/kg)
1	B - 20	259	2	4	1,200	1,000	8.2	39	ND
2	B - 21	259	2	2	4,300	2,300	7.6	--	--

ND – Not Detected. Below the detection level of 15 mg/kg.

Based on the results of the corrosion analyses, the site is considered to be *non-corrosive.*

Appendix E
Analysis And Calculations

Liquefaction Analysis using CPT
CRR for CPT based upon: National Center for Earthquake Engineering Research (NCEER)
Technical Report NCEER-97-0022 edited by T. L. Youd and I. M. Idriss, published December 31, 1997
Settlement Based on: Tokimatsu and Seed 1984
Computed by Shobhna Upadhyaya
Project: SR4
Project No. 26814190
Date: 10/10/2005
PGA from A&S 1997
CPT 1

1 Atmosphere (psf) =	2117	psf
GW Depth (ft) =	42.64	
GW Depth for EQ (ft) =	42.64	ft
I_c Correction (Y or N) =	Y	
EQ Magnitude =	7	M
Magnitude Scaling Meth =	I	(for M<7.5, I for Idriss, A for Andrus and Stokoe, or Ave for an Average of the two [Defaults to Idriss and Idriss for M>7.5])
Site PGA =	0.6	g
Max. Depth of Liq. =	50	ft
Silty N Increase? (Y or N)	N	

Steps for Calculation
1) Import Depth and Qt data from CPT soil parameter file or direct reference
2) Adjust Depth to Correlate with values
3) Select Unit Weights
4) Import friction values from CPT soil parameter file or raw data
5) Select Variables (GW Depth, Is Correction, EQ Mag, Scaling Method, and PGA)
6) Review for sensitivity and need to correlate fine grained with lab data
7) Calculate and enter Thickness correction factor for each thin dense sand layer - Kh = 0.5(H/1000-1.45)^2+1 <--- H in mm
8) Import $(N_1)_{60}$ Values from Soil Parameter File
9) Compare (N1)60 calculated values
10) Enter volumetric strains values from Fig. Tokimatsu and Seed (1987)
11) Review Calculated Settlement

Tokimatsu & Seed (1984)

Total Post Liquefaction Settlement (CPT) = 0.207 inches

Depth (ft)	Soil Unit Wt. (psf)	Total Vert. Stress (psf)	Pore Press Investigati (psf)	Pore press @ EQ (psf)	Kh Thin Layer Correction	Qt (tsf)	n=1.0 Q	fs (tsf)	F	CLAY n=1.0 Ic	SAND n=0.5 Q (0.5)	SAND n=0.5 Ic	SILT/SAND n=0.75 q_{c1N}	SILT/SAND n=0.75 Ic ($C_{Dw\ 0.75}$)	Check for Sensitivity	Need for Sampling	Ic For Calcs.	Corrected $(q_{c1N})_{cs}$	$CRR_{7.5}$	Applied MMW CRR_{mag}	CSR	Factor of Safety	7.0 Magnitude Scaled CSR	CPTINT $(N)_{60}$ Value (CPT1.xls)	Site Specific Apparent % Fines	$(N_1)_{60cs}$ Value	Volumetric Strain (%)	Sand Settlement (inches)
0.246	120.0	29.52	0	0		0	-0.02789	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3903	#NUM!	0.3272		#NUM!			
0.738	120.0	88.56	0	0		0	-0.08367	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3900	#NUM!	0.3270		#NUM!			
1.23	120.0	147.6	0	0		0	-0.13944	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3896	#NUM!	0.3267		#NUM!			
1.722	120.0	206.64	0	0		0	-0.19522	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3892	#NUM!	0.3263		#NUM!			
2.215	120.0	265.8	0	0		0	-0.25111	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3888	#NUM!	0.3259		#NUM!			
2.707	120.0	324.84	0	0		0	-0.30689	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3883	#NUM!	0.3256		#NUM!			
3.199	120.0	383.88	0	0		0	-0.36266	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3879	#NUM!	0.3252		#NUM!			
3.691	120.0	442.92	0	0		0	-0.41844	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3874	#NUM!	0.3248		#NUM!			
4.183	120.0	501.96	0	0		0	-0.47422	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3869	#NUM!	0.3244		#NUM!			
4.675	120.0	561	0	0		0	-0.53	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3865	#NUM!	0.3240		#NUM!			
5.167	120.0	620.04	0	0		7.71	13.98201	0.32	4.324336	2.97446						check	2.97446					0.3860		0.3237	7.2	77.0	14		
5.659	120.0	679.08	0	0		14.54	26.83129	0.37	2.605549	2.615972						check	2.615972					0.3856		0.3233	8.6	49.4	16		
6.152	120.0	738.24	0	0		12.59	23.09094	0.39	3.19126	2.722064						check	2.722064					0.3852		0.3229	9	56.7	16		
6.644	120.0	797.28	0	0		19.54	36.16695	0.46	2.403173	2.493404	29.46707	2.562258				check	2.562258	91.44878	0.151124	0.180253		0.3847	0.468526	0.3226	8	45.9	15		
7.136	120.0	856.32	0	0		23.32	43.25336	0.68	2.970491	2.495827	34.00417	2.573582				check	2.573582	107.752	0.196348	0.234194		0.3843	0.609414	0.3222	9.3	46.6	16		
7.628	120.0	915.36	0	0		21.08	38.96518	0.81	3.927783	2.612085						check	2.612085					0.3839		0.3218	10.3	49.1	17		
8.12	120.0	974.4	0	0		22.79	42.14039	0.7	3.138619	2.520383	31.05706	2.618977	38.5293	2.549007		check	2.549007	116.6934	0.227782	0.271687		0.3834	0.708539	0.3215	10.2	45.1	17		
8.612	120.0	1033.44	0	0		23.77	43.93629	0.78	3.354365	2.527	31.44207	2.633983	38.45165	2.569183		check	2.569183	120.8624	0.244194	0.291262		0.3830	0.760419	0.3211	10.3	46.3	17		
9.104	120.0	1092.48	0	0		25.17	45.07865	0.76	3.08645	2.494035	32.38301	2.600501	39.05466	2.539757		check	2.539757	116.2906	0.226257	0.269868		0.3826	0.705328	0.3208	9	44.5	16		
9.596	120.0	1151.52	0	0		30.92	52.70293	1.08	3.55916	2.488725	38.8696	2.583319				check	2.583319	125.3975	0.263379	0.314145		0.3822	0.821935	0.3204	10.7	47.2	18		
10.088	120.0	1210.56	0	0		28.54	46.15173	1.26	4.510516	2.60263						check	2.60263					0.3818		0.3201	12.5	48.5	20		
10.581	120.0	1269.72	0	0		38.75	60.03708	1.31	3.436954	2.438358	46.49573	2.516638				check	2.516638	132.6981	0.297309	0.354615		0.3814	0.92981	0.3198	12.3	43.1	19		
11.073	120.0	1328.76	0	0		38.12	56.3768	1.23	3.283886	2.443289	44.66458	2.515468				check	2.515468	127.1992	0.271397	0.323709		0.3810	0.849676	0.3194	11.8	43.0	19		
11.565	120.0	1387.8	0	0		24.83	34.78325	0.93	3.853149	2.642079						check	2.642079					0.3806		0.3191	9.6	51.1	17		
12.057	120.0	1446.84	0	0		24.34	32.64574	0.9	3.810682	2.659005						check	2.659005					0.3802		0.3187	9.1	52.3	16		
12.549	120.0	1505.88	0	0		25.17	32.42896	0.69	2.825893	2.575016	27.35066	2.631726	30.70013	2.593163		check	2.593163	100.8534	0.175401	0.20921		0.3798	0.550888	0.3184	8.3	47.9	15		
13.041	120.0	1564.92	0	0		33.35	41.62199	0.8	2.456434	2.453179	35.78561	2.503049				check	2.503049	99.62367	0.171954	0.205098		0.3794	0.540637	0.3181	9.5	42.3	17		
13.533	120.0	1623.96	0	0		31.26	37.49849	0.84	2.7588	2.520467	32.84286	2.564056				check	2.564056	102.2632	0.179458	0.214049		0.3790	0.564834	0.3177	9	46.0	16		
14.025	120.0	1683	0	0		34.35	39.81996	0.96	2.864945	2.51182	35.50443	2.549124				check	2.549124	107.5552	0.195712	0.233435		0.3786	0.616653	0.3174	9.6	45.1	17		
14.518	120.0	1742.16	0	0		42.23	47.48005	1.27	3.07068	2.476137	43.07197	2.506956				check	2.506956	120.7677	0.243808	0.290802		0.3781	0.76903	0.3170	11.4	42.5	18		
15.01	120.0	1801.2	0	0		39.63	43.004	1.22	3.150062	2.515019	39.667	2.540747				check	2.540747	118.3292	0.234084	0.279204		0.3777	0.739164	0.3167	10.7	44.6	18		
15.502	120.0	1860.24	0	0		38.84	40.75805	1.2	3.165402	2.533512	38.20652	2.554193				check	2.554193	116.8246	0.228281	0.272282		0.3773	0.721635	0.3163	10.4	45.4	17		
15.994	120.0	1919.28	0	0		40.22	40.91155	1.56	3.973473	2.600407						check	2.600407					0.3769		0.3160	11.1	48.3	18		
16.486	120.0	1978.32	0	0		37.54	36.95139	1.39	3.802922	2.619052						check	2.619052					0.3765		0.3156	10.1	49.6	17		
16.978	120.0	2037.36	0	0		41.67	39.90588	1.38	3.394724	2.560925	39.14807	2.567009				check	2.567009	122.5599	0.251209	0.29963		0.3760	0.796818	0.3153	10.7	46.2	18		
17.47	120.0	2096.4	0	0		49.91	46.61496	1.95	3.990848	2.56156	46.38761	2.563054				check	2.563054	144.1713	0.358689	0.427826		0.3756	1.139066	0.3149	12.6	45.9	20		
17.962	120.0	2155.44	0	0		29.13	26.02928	1.12	3.992545	2.745556						check	2.745556					0.3751		0.3145	7.6	58.4	15		
18.454	120.0	2214.48	0	0		27.19	23.55656	0.93	3.565574	2.746193						check	2.746193					0.3747		0.3141	6.9	58.5	14		
18.947	120.0	2273.64	0	0		22.64	18.9152	0.7	3.255332	2.794989						check	2.794989					0.3742		0.3137	5.7	62.2	13		
19.439	120.0	2332.68	0	0		34.16	28.2882	0.98	2.970268	2.634288						check	2.634288					0.3737		0.3133	7.8	50.6	15		
19.931	120.0	2391.72	0	0		49.11	40.06668	1.73	3.610625	2.578041	42.5871	2.558917				check	2.558917	131.3558	0.290781	0.346829		0.3733	0.929191	0.3129	11.6	45.7	19		
20.423	120.0	2450.76	0	0		77.21	62.00903	1.76	2.316258	2.307749	66.71828	2.284745					2.284745	126.8129	0.269659	0.321635		0.3728	0.862853	0.3125	15.9	30.5	22		
20.915	120.0	2509.8	0	0		120.14	94.73671	1.83	1.539301	2.052084	103.1519	2.025344					2.025344	137.6604	0.322611	0.384794		0.3722	1.033714	0.3121	22	19.4	26		
21.407	120.0	2568.84	0	0		133.68	103.0781	2.03	1.533284	2.024386	113.5467	1.994369					1.994369	146.7834	0.374113	0.446223		0.3717	1.200442	0.3116	23.9	18.3	28		
21.899	120.0	2627.88	0	0		87.48	65.57838	2.59	3.005824	2.369869	73.06393	2.337364					2.337364	151.5674	0.403818	0.481653		0.3712	1.297657	0.3112	17.8	33.1	24		
22.391	120.0	2686.92	0	0		42.42	30.57519	1.25	3.0431	2.615348						check	2.615348					0.3706		0.3107	8.3	49.3	15		
22.884	120.0	2746.08	0	0		34.2	23.90823	1.01	3.076739	2.700324						check	2.700324					0.3700		0.3102	6.8	55.1	14		
23.376	120.0	2805.12	0	0		35.58	24.3679	1.08	3.159979	2.701289						check	2.701289					0.3694		0.3097	7	55.2	14		
23.868	120.0	2864.16	0	0		37.6	25.25552	1.29	3.566697	2.723248						check	2.723248					0.3688		0.3092	7.3	56.8	14		
24.36	120.0	2923.2	0	0		34.28	22.45375	1.68	5.11908	2.865435						check	2.865435					0.3682		0.3087	7	67.7	14		
24.852	120.0	2982.24	0	0		47.25	30.68759	2.01	4.39259	2.720692						check	2.720692					0.3675		0.3081	8.8	56.6	16		
25.344	120.0	3041.28	0	0		101.74	65.90604	2.18	2.175228	2.269773	78.9938	2.213207					2.213207	134.2687	0.305117	0.363928		0.3668	0.992076	0.3076	18.3	27.1	24		
25.836	120.0	3100.32	0	0		98.63	62.62569	1.95	2.008656	2.26252	75.78711	2.20196					2.20196	126.6847	0.269084	0.32095		0.3661	0.876608	0.3070	17.4	26.6	23		
26.328	120.0	3159.36	0	0		90.82	56.49266	2.3	2.57731	2.36902	69.01304	2.306749					2.306749	135.9957	0.313915	0.374422		0.3654	1.024708	0.3063	16.6	31.5	23		
26.821	120.0	3218.52	0	0		64.99	39.38502	1.2	1.89332	2.39918	48.56225	2.328791					2.328791	99.28877	0.17103	0.203996		0.3646	0.559453	0.3057	11.9	32.6	18		
27.313	120.0	3277.56	0	0		42.46	24.90952	1.73	4.237992	2.777042						check	2.777042					0.3638		0.3050	7.4	60.8	14		

USING CPT RESULTS

27.805	120.0	3336.6	0	0	31.64	17.96541	1.14	3.803588	2.854718			check	2.854718				0.3630			0.3044	5.6	66.9	13		
28.297	120.0	3395.64	0	0	26.17	14.41388	0.91	3.718508	2.923552			check	2.923552				0.3622			0.3037	4.7	72.6	12		
28.789	120.0	3454.68	0	0	26.72	14.46887	1.01	4.041186	2.944525			check	2.944525				0.3613			0.3029	4.7	74.4	12		
29.281	120.0	3513.72	0	0	22.29	11.68741	0.92	4.480562	3.045134			check	3.045134				0.3604			0.3022	4.1	83.4	11		
29.773	120.0	3572.76	0	0	31.24	16.48788	0.97	3.293313	2.845107			check	2.845107				0.3595			0.3014	5.1	66.1	12		
30.265	120.0	3631.8	0	0	42.27	22.27771	1.75	4.32589	2.819299			check	2.819299				0.3585			0.3006	6.8	64.0	14		
30.758	120.0	3690.96	0	0	40.35	20.86423	1.8	4.674776	2.862912			check	2.862912				0.3575			0.2997	6.5	67.5	14		
31.25	120.0	3750	0	0	38.27	19.41067	1.53	4.203874	2.85657			check	2.85657				0.3565			0.2988	6	67.0	13		
31.742	120.0	3809.04	0	0	30.81	15.1773	1.41	4.877968	2.979934			check	2.979934				0.3554			0.2979	5.1	77.5	12		
32.234	120.0	3868.08	0	0	29.47	14.23753	1.16	4.212673	2.961227			check	2.961227				0.3543			0.2970	4.7	75.8	12		
32.726	120.0	3927.12	0	0	46.4	22.63055	1.33	2.993039	2.71133			check	2.71133				0.3531			0.2961	6.5	55.9	14		
33.218	120.0	3986.16	0	0	42.65	20.39904	1.53	3.763197	2.809148			check	2.809148				0.3519			0.2951	6.2	63.2	13		
33.71	120.0	4045.2	0	0	52.02	24.71937	2.51	5.020261	2.828951			check	2.828951				0.3507			0.2940	7.6	64.8	15		
34.202	120.0	4104.24	0	0	54.15	25.38735	2.77	5.316915	2.837498			check	2.837498				0.3495			0.2930	7.8	65.5	15		
34.694	120.0	4163.28	0	0	45.23	20.72806	2.17	5.02916	2.886079			check	2.886079				0.3482			0.2919	6.6	69.4	14		
35.187	120.0	4222.44	0	0	40.24	18.06007	1.65	4.32744	2.888634			check	2.888634				0.3468			0.2908	5.7	69.6	13		
35.679	120.0	4281.48	0	0	37.61	16.56869	1.35	3.806113	2.882263			check	2.882263				0.3455			0.2896	5.2	69.1	12		
36.171	120.0	4340.52	0	0	38.5	16.73981	1.31	3.605861	2.864157			check	2.864157				0.3441			0.2885	5.2	67.6	12		
36.663	120.0	4399.56	0	0	47.68	20.67489	1.5	3.298137	2.768338			check	2.768338				0.3426			0.2872	6.1	60.1	13		
37.155	120.0	4458.6	0	0	53.7	23.08828	1.98	3.846849	2.774203			check	2.774203				0.3411			0.2860	6.9	60.6	14		
37.647	120.0	4517.64	0	0	53.38	22.63181	1.96	3.834027	2.779853			check	2.779853				0.3396			0.2847	6.7	61.0	14		
38.139	120.0	4576.68	0	0	51.98	21.71516	2.06	4.145565	2.815566			check	2.815566				0.3381			0.2834	6.6	63.7	14		
38.631	120.0	4635.72	0	0	53.19	21.94789	2.1	4.127996	2.810855			check	2.810855				0.3365			0.2821	6.6	63.4	14		
39.124	120.0	4694.88	0	0	74.25	30.6302	3.07	4.269667	2.712862			check	2.712862				0.3349			0.2807	8.8	56.0	16		
39.616	120.0	4753.92	0	0	55	22.1388	2.69	5.111829	2.86956			check	2.86956				0.3332			0.2794	6.9	68.1	14		
40.108	120.0	4812.96	0	0	36.35	14.10505	1.79	5.273466	3.02606			check	3.02606				0.3315			0.2780	4.9	81.6	12		
40.6	120.0	4872	0	0	27.17	10.15353	1.45	5.862376	3.165548			check	3.165548				0.3298			0.2765	3.8	95.2	11		
41.092	120.0	4931.04	0	0	28.81	10.68516	1.29	4.896661	3.099559			check	3.099559				0.3281			0.2751	3.9	88.6	11		
41.584	120.0	4990.08	0	0	41.25	15.5328	1.59	4.102701	2.924525			check	2.924525				0.3263			0.2736	5	72.6	12		
42.076	120.0	5049.12	0	0	50.72	19.09063	1.94	4.025277	2.84998			check	2.84998				0.3245			0.2721	5.9	66.5	13		
42.568	120.0	5108.16	0	0	52.21	19.4418	1.94	3.906886	2.835602			check	2.835602				0.3227			0.2706	6	65.3	13		
43.061	120.0	5167.32	26.2704	26.2704	53.77	19.9128	2.23	4.356631	2.858165			check	2.858165				0.3225			0.2704	6.2	67.1	13		
43.553	120.0	5226.36	56.9712	56.9712	52	19.10741	2.45	4.960838	2.90864			check	2.90864				0.3225			0.2704	6.1	71.3	13		
44.045	120.0	5285.4	87.672	87.672	38.1	13.64338	1.83	5.161137	3.031187			check	3.031187				0.3225			0.2704	4.7	82.1	12		
44.537	120.0	5344.44	118.3728	118.3728	29.92	10.42764	1.38	5.064633	3.116934			check	3.116934				0.3224			0.2703	3.8	90.3	11		
45.029	120.0	5403.48	149.0736	149.0736	30.56	10.60377	0.97	3.481912	3.013267			check	3.013267				0.3222			0.2701	3.6	80.5	11		
45.521	120.0	5462.52	179.7744	179.7744	41.82	14.79865	1.46	3.735091	2.915703			check	2.915703				0.3220			0.2699	4.7	71.9	12		
46.013	120.0	5521.56	210.4752	210.4752	46.21	16.36171	2.17	4.994336	2.961565			check	2.961565				0.3217			0.2697	5.3	75.8	12		
46.505	120.0	5580.6	241.176	241.176	43.25	15.15508	2.19	5.412793	3.009551			check	3.009551				0.3214			0.2694	5.1	80.1	12		
46.997	120.0	5639.64	271.8768	271.8768	32	10.87238	1.66	5.688793	3.134243			check	3.134243				0.3210			0.2691	4	92.0	11		
47.49	120.0	5698.8	302.64	302.64	33.35	11.30456	1.16	3.803204	3.013503			check	3.013503				0.3206			0.2688	3.8	80.5	11		
47.982	120.0	5757.84	333.3408	333.3408	38.95	13.29932	1.54	4.269348	2.988035			check	2.988035				0.3201			0.2684	4.4	78.2	11		
48.474	120.0	5816.88	364.0416	364.0416	29.28	9.672599	1.05	3.981562	3.079792			check	3.079792				0.3196			0.2680	3.4	86.7	10		
48.966	120.0	5875.92	394.7424	394.7424	33.92	11.30488	1.3	4.195979	3.039184			check	3.039184				0.3191			0.2675	3.9	82.9	11		
49.458	120.0	5934.96	425.4432	425.4432	34.92	11.59903	1.66	5.195208	3.087615			check	3.087615				0.3185			0.2671	4.1	87.5	11		
49.95	120.0	5994	456.144	456.144	43.84	14.75047	1.41	3.452244	2.895931			check	2.895931				0.3180			0.2666	4.6	70.2	12		
50.442	120.0	6053.04	486.8448	486.8448	52.55	17.79437	2.43	4.906763	2.928871			check	2.928871				0.3173			0.2660	5.7	73.0	13		
50.934	120.0	6112.08	517.5456	517.5456	48.06	16.08855	2.42	5.377305	2.987986			check	2.987986				0.3167			0.2655	5.3	78.2	12		
51.427	120.0	6171.24	548.3088	548.3088	36.03	11.71787	1.83	5.554817	3.102492			check	3.102492				0.3160			0.2649	4.2	88.9	11		
51.919	120.0	6230.28	579.0096	579.0096	32.81	10.50909	1.24	4.175807	3.063194			check	3.063194				0.3153			0.2643	3.7	85.1	11		
52.411	120.0	6289.32	609.7104	609.7104	27.09	8.432037	0.95	3.967369	3.127176			check	3.127176				0.3146			0.2637	3.1	91.3	10		
52.903	120.0	6348.36	640.4112	640.4112	30.03	9.409972	0.96	3.574644	3.062095			check	3.062095				0.3138			0.2631	3.3	85.0	10		
53.395	120.0	6407.4	671.112	671.112	42.52	13.70792	1.86	4.730862	3.005631			check	3.005631				0.3131			0.2625	4.6	79.8	12		
53.887	120.0	6466.44	701.8128	701.8128	38.63	12.28068	1.68	4.746194	3.043719			check	3.043719				0.3123			0.2619	4.2	83.3	11		
54.379	120.0	6525.48	732.5136	732.5136	29.43	9.034149	1.41	5.388413	3.182603			check	3.182603				0.3116			0.2612	3.4	96.9	10		
54.871	120.0	6584.52	763.2144	763.2144	60.48	19.64774	2.05	3.584684	2.808317			check	2.808317				0.3108			0.2606	5.8	63.2	13		
55.364	120.0	6643.68	793.9776	793.9776	136.15	45.41365	2.32	1.746618	2.329016	75.49059	2.161672		2.161672	119.1177	0.237185	0.282902	0.3100	0.912561	LIQUEFY	0.2599	17.1	24.8	22	1.50	0.08874
55.856	120.0	6702.72	824.6784	824.6784	103.08	33.93261	3.2	3.208707	2.596425	56.54226	2.435253	check	2.435253	139.2113	0.330903	0.394685	0.3092	1.276383	LIQUEFY	0.2593	9	38.3	16	2.00	0.11808
56.348	120.0	6761.76	855.3792	855.3792	43.42	13.55792	2.34	5.844284	3.06797			check	3.06797				0.3084			0.2586	4.7	85.6	12		
56.84	120.0	6820.8	886.08	886.08	38.75	11.90944	1.63	4.61239	3.046462			check	3.046462				0.3076			0.2579	4.1	83.5	11		
57.332	120.0	6879.84	916.7808	916.7808	31.85	9.528693	1.42	4.998226	3.144323			check	3.144323				0.3068			0.2573	3.5	93.0	11		
57.824	120.0	6938.88	947.4816	947.4816	27.96	8.17524	0.98	4.001542	3.140273			check	3.140273				0.3061			0.2566	3	92.6	10		
58.316	120.0	6997.92	978.1824	978.1824	81.41	25.88519	3.8	4.877358	2.805745			check	2.805745				0.3053			0.2559	7.7	63.0	15		
58.808	120.0	7056.96	1008.883	1008.883	69.08	21.67681	3.56	5.430843	2.894042			check	2.894042				0.3045			0.2553	6.7	70.1	14		
59.3	120.0	7116	1039.584	1039.584	32.64	9.57209	0.85	2.92277	3.006159			check	3.006159				0.3037			0.2546	3.2	79.8	10		
59.793	120.0	7175.16	1070.347	1070.347	38.56	11.45733	0.75	2.144547	2.866908			check	2.866908				0.3030			0.2540	3.5	67.8	11		

Liquefaction Analysis using CPT

CRR for CPT based upon: National Center for Earthquake Engineering Research (NCEER)
Technical Report NCEER-97-0022 edited by T. L. Youd and I. M. Idriss, published December 31, 1997

Settlement Based on: Tokimatsu and Seed 1984

Computed by Shobhna Upadhyaya

Project: SR4

Project No. 26814190

Date: 10/10/2005

PGA from A&S 1997

CPT 2

1 Atmosphere (psf) =	2117	psf
GW Depth (ft) =	42.64	
GW Depth for EQ (ft) =	42.64	ft
I_c Correction (Y or N) =	Y	
EQ Magnitude =	7	M
Magnitude Scaling Meth =	I	(for M<7.5, I for Idriss, A for Andrus and Stokoe, or Ave for an Average of the two [Defaults to Idriss and Idriss for M>7.5])
Site PGA =	0.6	g
Max. Depth of Liq. =	50	ft
Silty N Increase? (Y or N)	N	

Steps for Calculation
1) Import Depth and Qt data from CPT soil parameter file or direct reference
2) Adjust Depth to Correlate with values
3) Select Unit Weights
4) Import friction values from CPT soil parameter file or raw data
5) Select Variables (GW Depth, Is Correction, EQ Mag, Scaling Method, and PGA)
6) Review for sensitivity and need to correlate fine grained with lab data
7) Calculate and enter Thickness correction factor for each thin dense sand layer - Kh = 0.5(H/1000-1.45)^2+1 <--- H in mm
8) Import $(N_1)_{60}$ Values from Soil Parameter File
9) Compare (N1)60 calculated values
10) Enter volumetric strains values from Fig. Tokimatsu and Seed (1984)
11) Review Calculated Settlement

Tokimatsu & Seed (1984)

Total Post Liquefaction Settlement (CPT) = 0.000 inches

Depth (ft)	Soil Unit Wt. (psf)	Total Vert. Stress (psf)	Pore Press Investigatl (psf)	Pore press @ EQ (psf)	Kh Thin Layer Correction	Qt (tsf)	n=1.0 Q	fs (tsf)	F	CLAY n=1.0 Ic	n=0.5 Q (0.5)	SAND n=0.5 Ic	n=0.75 q_{c1N}	SILT/SAND n=0.75 Ic ($C_{Q\ w\ 0.75}$)	Check for Sensitivity	Need for Sampling	Ic For Calcs.	Corrected $(q_{c1N})_{cs}$	$CRR_{7.5}$	Applied MMW CRR_{mag}	CSR	Factor of Safety	7.0 Magnitude Scaled CSR	USING CPT RESULTS: CPTINT $(N)_{60}$ Value (CPT1.xls)	Site Specific Apparent % Fines	$(N_1)_{60cs}$ Value	Volumetric Strain (%)	Sand Settlement (inches)
0.246	120.0	29.52	0	0		0	-0.02789	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3903	#NUM!	0.3272		#NUM!		
0.738	120.0	88.56	0	0		0	-0.08367	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3900	#NUM!	0.3270		#NUM!		
1.23	120.0	147.6	0	0		0	-0.13944	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3895	#NUM!	0.3267		#NUM!		
1.722	120.0	206.64	0	0		0	-0.19522	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3892	#NUM!	0.3263		#NUM!		
2.215	120.0	265.8	0	0		0	-0.25111	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3888	#NUM!	0.3259		#NUM!		
2.707	120.0	324.84	0	0		0	-0.30689	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3883	#NUM!	0.3256		#NUM!		
3.199	120.0	383.88	0	0		0	-0.36266	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3879	#NUM!	0.3252		#NUM!		
3.691	120.0	442.92	0	0		0	-0.41844	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3874	#NUM!	0.3248		#NUM!		
4.183	120.0	501.96	0	0		0	-0.47422	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3869	#NUM!	0.3244		#NUM!		
4.675	120.0	561	0	0		0	-0.53	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3865	#NUM!	0.3240		#NUM!		
5.167	120.0	620.04	0	0		25.66	47.89793	1.08	4.260358	2.5736	44.25245	2.597625				check	2.597625	146.5734	0.372852	0.444719	0.3860	1.152	0.3237	12.2	48.2	19		
5.659	120.0	679.08	0	0		33.73	63.09015	1.27	3.803462	2.455641	55.69696	2.492671				check	2.492671	152.1449	0.407533	0.486085	0.3856	1.260601	0.3233	14.5	41.6	22		
6.152	120.0	738.24	0	0		42.69	79.96387	1.7	4.01693	2.404665	67.70574	2.452374				check	2.452374	171.909	0.552475	0.658964	0.3852	1.710893	0.3229		39.3			
6.644	120.0	797.28	0	0		44.76	83.81929	2.11	4.756392	2.447817	68.29187	2.504985				check	2.504985	190.7919	0.725896	0.865812	0.3847	2.250476	0.3226		42.4			
7.136	120.0	856.32	0	0		39.8	74.39176	2.11	5.35916	2.520734	58.48402	2.588254				check	2.588254	190.3979	0.721903	0.861049	0.3843	2.240602	0.3222		47.6			
7.628	120.0	915.36	0	0		55.23	103.4904	2.55	4.655636	2.383648	78.69275	2.458078				check	2.458078	201.8738	0.845109	1.008002	0.3839	2.625909	0.3218		39.6			
8.12	120.0	974.4	0	0		78.51	147.4214	4.02	5.15234	2.32946	108.6482	2.40602				check	2.40602	253.9227	1.602607	1.911507	0.3834	4.985073	0.3215		36.7			
8.612	120.0	1033.44	0	0		55.64	104.1536	2.32	4.208748	2.347371	74.5353	2.439948				check	2.439948	185.0641	0.669453	0.79849	0.3830	2.084677	0.3211		38.6			
9.104	120.0	1092.48	0	0		58.94	106.9013	2.63	4.503906	2.363655	76.79435	2.453878				check	2.453878	195.5154	0.775066	0.924459	0.3826	2.41617	0.3208		39.4			
9.596	120.0	1151.52	0	0		50.08	85.98069	2.47	4.989472	2.45703	63.4127	2.541765				check	2.541765	189.5181	0.713046	0.850484	0.3822	2.225225	0.3204		44.6			
10.088	120.0	1210.56	0	0		46.68	76.12133	2.38	5.165522	2.502048	57.56243	2.580805				check	2.580805	184.8449	0.667361	0.795995	0.3818	2.084889	0.3201		47.1			
10.581	120.0	1269.72	0	0		45.93	71.34666	2.69	5.938827	2.566773	55.25444	2.638097	63.66713	2.598207		check	2.598207	211.105	0.954941	1.139005	0.3814	2.9865	0.3198		48.2			
11.073	120.0	1328.76	0	0		64.31	95.79701	3.5	5.4992	2.461473	75.89529	2.523924				check	2.523924	219.5158	1.06374	1.268774	0.3810	3.3303	0.3194		43.5			
11.565	120.0	1387.8	0	0		68.4	97.57328	3.05	4.504764	2.388101	79.00124	2.446013				check	2.446013	198.3033	0.805225	0.960431	0.3806	2.523633	0.3191		38.9			
12.057	120.0	1446.84	0	0		72.91	99.78516	3.18	4.405251	2.374454	82.49275	2.426522				check	2.426522	199.9546	0.823493	0.98222	0.3802	2.583626	0.3187		37.8			
12.549	120.0	1505.88	0	0		85.43	112.4619	3.07	3.625539	2.275898	94.85062	2.322735					2.322735	191.9616	0.737849	0.880068	0.3798	2.317385	0.3184		32.3			
13.041	120.0	1564.92	0	0		85.3	108.0152	2.57	3.040789	2.227945	92.86891	2.270805					2.270805	172.5948	0.558152	0.665735	0.3794	1.754873	0.3181	21.9	29.8	28		
13.533	120.0	1623.96	0	0		61.03	74.16195	2.38	3.952305	2.420819	64.95437	2.459246				check	2.459246	166.9825	0.513008	0.61189	0.3790	1.614661	0.3177	16.7	39.7	24		
14.025	120.0	1683	0	0		32.9	38.09685	1.73	5.396385	2.716514						check	2.716514				0.3786		0.3174	10.9	56.3	18		
14.518	120.0	1742.16	0	0		28	31.14401	1.33	4.902517	2.748954						check	2.748954				0.3781		0.3170	9.1	58.7	16		
15.01	120.0	1801.2	0	0		41.18	44.72507	1.41	3.500549	2.534279	41.25452	2.55958				check	2.55958	127.401	0.27231	0.324797	0.3777	0.859869	0.3167	11.2	45.7	18		
15.502	120.0	1860.24	0	0		29.96	31.2109	1.52	5.235984	2.768227						check	2.768227				0.3773		0.3163	9.2	60.1	16		
15.994	120.0	1919.28	0	0		23.32	23.30078	1.2	5.36664	2.867471						check	2.867471				0.3769		0.3160	7.3	67.9	14		
16.486	120.0	1978.32	0	0		34.71	34.09038	1.42	4.211046	2.674915						check	2.674915				0.3765		0.3156	9.6	53.4	17		
16.978	120.0	2037.36	0	0		36.05	34.38893	1.61	4.595887	2.698528						check	2.698528				0.3760		0.3153	9.8	55.0	17		
17.47	120.0	2096.4	0	0		36.24	33.57355	1.62	4.603345	2.706494						check	2.706494				0.3756		0.3149	9.6	55.6	17		
17.962	120.0	2155.44	0	0		34.85	31.33679	1.66	5.507475	2.782408						check	2.782408				0.3751		0.3145	9.3	61.2	16		
18.454	120.0	2214.48	0	0		35.92	31.44102	1.69	4.654542	2.743022						check	2.743022				0.3747		0.3141	9.2	58.2	16		
18.947	120.0	2273.64	0	0		45.67	39.17347	2.39	5.366785	2.70639						check	2.70639				0.3742		0.3137	11.2	55.6	18		
19.439	120.0	2332.68	0	0		41.16	34.28988	2.43	6.075963	2.785329						check	2.785329				0.3737		0.3133	10.2	61.4	17		
19.931	120.0	2391.72	0	0		38.71	31.37001	2.29	6.104365	2.813759						check	2.813759				0.3733		0.3129	9.5	63.6	17		
20.423	120.0	2450.76	0	0		76.83	61.69892	2.72	3.597664	2.444528	66.38463	2.422794				check	2.422794	159.8426	0.459805	0.548432	0.3728	1.471281	0.3125	16.8	37.6	24		
20.915	120.0	2509.8	0	0		57.09	44.49366	3.06	5.480424	2.674986						check	2.674986				0.3722		0.3121	12.5	53.4	20		
21.407	120.0	2568.84	0	0		51.36	38.98692	2.02	4.033902	2.619965						check	2.619965				0.3717		0.3116	10.7	49.6	18		
21.899	120.0	2627.88	0	0		54.7	40.63052	1.97	3.690102	2.580189	45.26835	2.546536				check	2.546536	136.4826	0.316437	0.37743	0.3712	1.016862	0.3112	12.3	44.9	19		
22.391	120.0	2686.92	0	0		43.83	31.62472	1.49	3.506993	2.644956						check	2.644956				0.3706		0.3107	8.8	51.3	16		
22.884	120.0	2746.08	0	0		42.61	30.03333	1.71	4.146765	2.710502						check	2.710502				0.3700		0.3102	8.6	55.9	16		
23.376	120.0	2805.12	0	0		40.35	27.76882	1.87	4.801343	2.778786						check	2.778786				0.3694		0.3097	8.3	60.9	15		
23.868	120.0	2864.16	0	0		40.76	27.4621	1.86	4.729464	2.777833						check	2.777833				0.3688		0.3092	8.2	60.8	15		
24.36	120.0	2923.2	0	0		37.97	24.97838	1.93	5.286455	2.840929						check	2.840929				0.3682		0.3087	7.7	65.7	15		
24.852	120.0	2982.24	0	0		39.97	25.80535	1.89	4.911785	2.808807						check	2.808807				0.3675		0.3081	7.8	63.2	15		
25.344	120.0	3041.28	0	0		74.02	47.67687	3.29	4.537971	2.594758	57.14464	2.541075				check	2.541075	170.5687	0.54151	0.645886	0.3668	1.7607	0.3076	15.4	44.6	22		
25.836	120.0	3100.32	0	0		60.24	37.8605	3.49	5.946515	2.748825						check	2.748825				0.3661		0.3070	11.1	58.7	18		
26.328	120.0	3159.36	0	0		72.04	44.60417	4.03	5.719531	2.687867						check	2.687867				0.3654		0.3063	12.6	54.3	20		
26.821	120.0	3218.52	0	0		45.85	27.49136	3.12	7.052323	2.898648						check	2.898648				0.3646		0.3057	8.7	70.5	16		
27.313	120.0	3277.56	0	0		26.43	15.12785	1.43	5.768171	3.02814						check	3.02814				0.3638		0.3050	5.2	81.8	12		

27.805	120.0	3336.6	0	0
28.297	120.0	3395.64	0	0
28.789	120.0	3454.68	0	0
29.281	120.0	3513.72	0	0
29.773	120.0	3572.76	0	0
30.265	120.0	3631.8	0	0
30.758	120.0	3690.96	0	0
31.25	120.0	3750	0	0
31.742	120.0	3809.04	0	0
32.234	120.0	3868.08	0	0
32.726	120.0	3927.12	0	0
33.218	120.0	3986.16	0	0
33.71	120.0	4045.2	0	0
34.202	120.0	4104.24	0	0
34.694	120.0	4163.28	0	0
35.187	120.0	4222.44	0	0
35.679	120.0	4281.48	0	0
36.171	120.0	4340.52	0	0
36.663	120.0	4399.56	0	0
37.155	120.0	4458.6	0	0
37.647	120.0	4517.64	0	0
38.139	120.0	4576.68	0	0
38.631	120.0	4635.72	0	0
39.124	120.0	4694.88	0	0
39.616	120.0	4753.92	0	0
40.108	120.0	4812.96	0	0
40.6	120.0	4872	0	0
41.092	120.0	4931.04	0	0
41.584	120.0	4990.08	0	0
42.076	120.0	5049.12	0	0
42.568	120.0	5108.16	0	0
43.061	120.0	5167.32	26.2704	26.2704
43.553	120.0	5226.36	56.9712	56.9712
44.045	120.0	5285.4	87.672	87.672
44.537	120.0	5344.44	118.3728	118.3728
45.029	120.0	5403.48	149.0736	149.0736
45.521	120.0	5462.52	179.7744	179.7744
46.013	120.0	5521.56	210.4752	210.4752
46.505	120.0	5580.6	241.176	241.176
46.997	120.0	5639.64	271.8768	271.8768
47.49	120.0	5698.8	302.64	302.64
47.982	120.0	5757.84	333.3408	333.3408
48.474	120.0	5816.88	364.0416	364.0416
48.966	120.0	5875.92	394.7424	394.7424
49.458	120.0	5934.96	425.4432	425.4432
49.95	120.0	5994	456.144	456.144
50.442	120.0	6053.04	486.8448	486.8448
50.934	120.0	6112.08	517.5456	517.5456
51.427	120.0	6171.24	548.3088	548.3088
51.919	120.0	6230.28	579.0096	579.0096
52.411	120.0	6289.32	609.7104	609.7104
52.903	120.0	6348.36	640.4112	640.4112
53.395	120.0	6407.4	671.112	671.112
53.887	120.0	6466.44	701.8128	701.8128
54.379	120.0	6525.48	732.5136	732.5136
54.871	120.0	6584.52	763.2144	763.2144
55.364	120.0	6643.68	793.9776	793.9776
55.856	120.0	6702.72	824.6784	824.6784
56.348	120.0	6761.76	855.3792	855.3792
56.84	120.0	6820.8	886.08	886.08
57.332	120.0	6879.84	916.7808	916.7808
57.824	120.0	6938.88	947.4816	947.4816
58.316	120.0	6997.92	978.1824	978.1824
58.808	120.0	7056.96	1008.883	1008.883
59.3	120.0	7116	1039.584	1039.584
59.793	120.0	7175.16	1070.347	1070.347

29.56	16.71864	1.36	4.876003	2.947679
28.3	15.66843	1.41	5.300317	2.992627
21.89	11.67266	0.89	4.4141	3.041583
30.71	16.48005	1.06	3.661088	2.87358
34.5	18.3128	1.41	4.310131	2.882892
39.1	20.53202	1.75	4.69369	2.869308
38.82	20.03518	1.75	4.732989	2.879698
33.37	16.79733	1.81	5.746944	2.992844
25.26	12.26318	0.9	3.653485	2.988672
38.01	18.65316	1.25	3.464911	2.816595
46.04	22.44721	1.88	4.265317	2.812791
48.83	23.49977	2.02	4.312837	2.801014
49.04	23.24602	1.98	4.211207	2.797711
47.76	22.27349	2.05	4.485003	2.829713
48.63	22.36139	2.15	4.618852	2.836899
44.35	20.00681	2.09	4.94806	2.892897
42.31	18.76419	2.15	5.352352	2.936356
65.84	29.33738	3.54	5.559941	2.805677
92.73	41.15422	4.37	4.827117	2.658425
95.59	41.87893	5.57	5.966108	2.719909
52.85	22.39717	3.38	6.681006	2.945328
48.89	20.36483	2.57	5.514825	2.918569
48.23	19.80799	2.51	5.466964	2.92496
45.78	18.5021	2.52	5.802099	2.964261
37.45	14.75542	2.04	5.816433	3.038698
39.84	15.5553	1.85	4.942095	2.975381
41.31	15.95813	1.92	4.939034	2.966715
44.78	17.1625	1.88	4.442924	2.912952
47.66	18.1019	2.24	4.959597	2.926277
39.71	14.72947	1.9	5.109527	3.002831
32.92	11.88918	1.29	4.248183	3.025087
35.86	12.94535	1.39	4.177142	2.991398
36.92	13.27307	1.44	4.197416	2.984146
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38.71	13.79155	1.65	4.578528	2.994634
36.03	12.68583	1.74	5.220795	3.058758
32.96	11.44433	1.51	4.995246	3.081519
34.18	11.83156	1.33	4.233078	3.025813
43.44	15.22625	1.74	4.280474	2.942831
48.17	16.89724	2.18	4.807037	2.940158
46.29	16.10056	2	4.603988	2.944161
41.8	14.35011	2.13	5.472613	3.030704
34.69	11.65689	1.8	5.663662	3.109587
29.22	9.589925	1.33	5.06049	3.145406
24.57	7.841893	1.09	5.045708	3.214224
23.38	7.361333	0.99	4.856989	3.226464
24.59	7.748014	0.99	4.591096	3.194086
34.18	11.12656	1.56	5.012216	3.092012
36.31	11.81746	1.86	5.598299	3.101795
32.2	10.29321	1.76	6.051258	3.169612
26.17	8.108071	1.31	5.689384	3.234196
32.37	10.22988	1.15	3.93892	3.057422
52.94	17.34094	2.46	4.946086	2.939632
89.33	29.87072	5.36	6.225552	2.834776
89.11	29.63845	5.2	6.05727	2.828727
40.43	12.75925	1.98	5.331504	3.062605
29.73	9.02889	1.18	4.468316	3.133604
33.71	10.32951	1.14	3.755109	3.041745
42.12	13.11772	2.08	5.369249	3.05528
41.46	12.82271	2.19	5.755645	3.082193
39.03	11.93685	1.85	5.198078	3.078062
39.2	11.92729	1.68	4.701857	3.051119
38.9	11.76166	1.81	5.112844	3.078553
38.03	11.40909	1.87	5.420051	3.104752
36.73	10.91828	1.71	5.15495	3.106021
37.18	11.00523	1.59	4.733211	3.080381

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check	3.104752
check	3.106021
check	3.080381

0.3630	0.3044	5.5	74.6	13
0.3622	0.3037	5.3	78.6	12
0.3613	0.3029	4.1	83.1	11
0.3604	0.3022	5.2	68.4	12
0.3595	0.3014	5.8	69.2	13
0.3585	0.3006	6.4	68.0	13
0.3575	0.2997	6.3	68.9	13
0.3565	0.2988	5.7	78.6	13
0.3554	0.2979	4.1	78.3	11
0.3543	0.2970	5.7	63.8	13
0.3531	0.2961	6.8	63.5	14
0.3519	0.2951	7.1	62.6	14
0.3507	0.2940	7	62.4	14
0.3495	0.2930	6.8	64.9	14
0.3482	0.2919	6.9	65.4	14
0.3468	0.2908	6.3	70.0	13
0.3455	0.2896	6.1	73.7	13
0.3441	0.2885	8.9	63.0	16
0.3426	0.2872	11.5	52.2	19
0.3411	0.2860	12.1	56.6	19
0.3396	0.2847	7.3	74.4	14
0.3381	0.2834	6.6	72.1	14
0.3365	0.2821	6.4	72.7	13
0.3349	0.2807	6.1	76.1	13
0.3332	0.2794	5.1	82.8	12
0.3315	0.2780	5.2	77.1	12
0.3298	0.2765	5.3	76.3	12
0.3281	0.2751	5.5	71.7	13
0.3263	0.2736	5.9	72.8	13
0.3245	0.2721	5	79.5	12
0.3227	0.2706	4.1	81.6	11
0.3225	0.2704	4.3	78.5	11
0.3225	0.2704	4.4	77.8	11
0.3225	0.2704	4.6	77.1	12
0.3224	0.2703	4.6	78.8	12
0.3222	0.2701	4.4	84.7	11
0.3220	0.2699	4	86.9	11
0.3217	0.2697	4	81.6	11
0.3214	0.2694	4.9	74.2	12
0.3210	0.2691	5.4	74.0	12
0.3206	0.2688	5.2	74.3	12
0.3201	0.2684	4.9	82.1	12
0.3196	0.2680	4.2	89.6	11
0.3191	0.2675	3.5	93.1	11
0.3185	0.2671	3	100.0	10
0.3180	0.2666	2.9	100.0	10
0.3173	0.2660	2.9	98.1	10
0.3167	0.2655	3.9	87.9	11
0.3160	0.2649	4.2	88.8	11
0.3153	0.2643	3.8	95.6	11
0.3146	0.2637	3.2	100.0	10
0.3138	0.2631	3.5	84.6	11
0.3131	0.2625	5.5	73.9	13
0.3123	0.2619	9	65.3	16
0.3116	0.2612	8.9	64.8	16
0.3108	0.2606	4.4	85.1	11
0.3100	0.2599	3.3	92.0	10
0.3092	0.2593	3.5	83.1	11
0.3084	0.2586	4.5	84.4	12
0.3076	0.2579	4.5	86.9	12
0.3068	0.2573	4.2	86.5	11
0.3061	0.2566	4.1	84.0	11
0.3053	0.2559	4.1	86.6	11
0.3045	0.2553	4.1	89.1	11
0.3037	0.2546	3.9	83.2	11
0.3030	0.2540	3.9	86.8	11

SETTLEMENT ANALYSIS RESULTS SR 4 WIDENING

UUC_ST&RW4

NUMBER OF SOIL LAYERS: 8

SOIL	TOP	BOTTOM	GAMMA	CC	CR	PC	E*10**6	MU	CA	A	TZERO	
1	58	48	121	0.13	0.015	6000	0.8	0.45	0.008	1	1
2	48	39	125	0	0	5000	0.4	0.3	0	1	1
3	39	29	125	0.11	0.015	4500	2.7	0.45	0.007	1	1
4	29	19	125	0.11	0.015	5000	2.7	0.45	0.007	1	1
5	19	18	125	0	0	6500	0.4	0.3	0	1	1
6	18	14	125	0.14	0.02	7000	0.3	0.5	0.009	1	1
7	14	-2	57.6	0.14	0.02	10000	0.3	0.5	0.009	1	1
8	-2	-22	57.6	0.14	0.02	17500	0.3	0.5	0.009	1	1

PROJECT LIFE: 20.0

NUMBER OF INITIAL LOADED AREAS: 11

AREA	CX	CY	ANGLE	ELEV	WIDTH	LENGTH	LOAD
1	27.5	40	0	58	55	50	375
2	30.5	40	0	58	61	50	375
3	33.5	40	0	58	67	50	375
4	36.5	40	0	58	73	50	375
5	39.5	40	0	58	79	50	375
6	27.5	-40	0	58	55	50	375
7	30.5	-40	0	58	61	50	375
8	33.5	-40	0	58	67	50	375
9	36.5	-40	0	58	73	50	375
10	39.5	-40	0	58	79	50	375
11	42.5	0	0	58	85	130	847

NUMBER OF LOADED AREAS: 23

AREA	CX	CY	ANGLE	ELEV	WIDTH	LENGTH	LOAD
1	27.5	40	0	58	55	50	375
2	30.5	40	0	58	61	50	375
3	33.5	40	0	58	67	50	375
4	36.5	40	0	58	73	50	375
5	39.5	40	0	58	79	50	375
6	27.5	-40	0	58	55	50	375
7	30.5	-40	0	58	61	50	375
8	33.5	-40	0	58	67	50	375
9	36.5	-40	0	58	73	50	375
10	39.5	-40	0	58	79	50	375
11	42.5	0	0	58	85	130	847
12	82	40	0	58	6	50	375
13	79	40	0	58	12	50	375
14	76	40	0	58	18	50	375
15	72	40	0	58	24	50	375
16	69	40	0	58	30	50	375
17	82	-40	0	58	6	50	375
18	79	-40	0	58	12	50	375
19	76	-40	0	58	18	50	375
20	72	-40	0	58	24	50	375
21	69	-40	0	58	30	50	375
22	76.5	15	0	58	17	4	3000
23	76.5	-15	0	58	17	4	3000

SETTLEMENT POINT : 76.5, 15.0
Center of Footing

SOIL LAYER	INITIAL STRESS (PSF)	VERTICAL STRESS INCREASE (PSF)	HORIZ. X STRESS INCREASE (PSF)	HORIZ. Y STRESS INCREASE (PSF)	SKEMPTON BJERRUM FACTOR	CONSOL. COMP. (IN.)	ELASTIC COMP. (IN.)	TOTAL COMP. (IN.)
1	1607.2	2070.6	800.4	634.1	1	0.647	0.249	0.896
2	2694.1	890.5	122.7	367.7	1	0	0.339	0.339
3	3849.6	562.5	40.8	253.8	1	0.107	0.036	0.143
4	5077	414.1	17.9	171.4	1	0.449	0.035	0.484
5	5747.8	362.3	12.3	138	1	0	0.028	0.028
6	6051	342.5	10.5	125.1	1	0.023	0.121	0.144
7	6717	278.6	5.9	85.2	1	0.068	0.483	0.551
8	7652.8	200.9	2.5	44.4	1	0.054	0.564	0.618
						1.348	1.855	3.203

Ignoring consol. comp. for Layers 1 to 5 (above GWS) 0.145 4 mm
Elastic comp. in Layers 1 to 5 (above GWS) 0.667 17 mm

SETTLEMENT POINT : 85.0, 15.0
Edge of Footing

SOIL LAYER	INITIAL STRESS (PSF)	VERTICAL STRESS INCREASE (PSF)	HORIZ. X STRESS INCREASE (PSF)	HORIZ. Y STRESS INCREASE (PSF)	SKEMPTON BJERRUM FACTOR	CONSOL. COMP. (IN.)	ELASTIC COMP. (IN.)	TOTAL COMP. (IN.)
1	1044.4	1098.1	600.9	405.3	1	0.562	0.094	0.656
2	2290.3	612.2	183.8	295.9	1	0	0.18	0.18
3	3545	452.7	79.9	221.3	1	0.094	0.021	0.115
4	4838	381.5	39.9	155.8	1	0.25	0.024	0.274
5	5535.6	324.7	28.5	127.3	1	0	0.021	0.021
6	5851.4	309.9	24.7	116	1	0.022	0.087	0.109
7	6557.1	259.2	14.6	80.4	1	0.065	0.374	0.439
8	7545.9	192	6.4	42.7	1	0.052	0.47	0.522
						1.044	1.271	2.316

Ignoring consol. comp. for Layers 1 to 5 (above GWS) 0.138 4 mm
Elastic comp. in Layers 1 to 5 (above GWS) 0.34 9 mm

SETTLEMENT POINT : 76.5, -15.0
Center of Footing

SOIL LAYER	INITIAL STRESS (PSF)	VERTICAL STRESS INCREASE (PSF)	HORIZ. X STRESS INCREASE (PSF)	HORIZ. Y STRESS INCREASE (PSF)	SKEMPTON BJERRUM FACTOR	CONSOL. COMP. (IN.)	ELASTIC COMP. (IN.)	TOTAL COMP. (IN.)
1	1607.2	2070.6	800.4	634.1	1	0.647	0.249	0.896
2	2694.1	890.5	122.7	367.7	1	0	0.339	0.339
3	3849.6	562.5	40.8	253.8	1	0.107	0.036	0.143
4	5077	414.1	17.9	171.4	1	0.449	0.035	0.484
5	5747.8	362.3	12.3	138	1	0	0.028	0.028
6	6051	342.5	10.5	125.1	1	0.023	0.121	0.144
7	6717	278.6	5.9	85.2	1	0.068	0.483	0.551
8	7652.8	200.9	2.5	44.4	1	0.054	0.564	0.618
						1.348	1.855	3.203

Ignoring consol. comp. for Layers 1 to 5 (above GWS) 0.145 4 mm
Elastic comp. in Layers 1 to 5 (above GWS) 0.667 17 mm

SETTLEMENT POINT : 85.0, -15.0
Edge of Footing

SOIL LAYER	INITIAL STRESS (PSF)	VERTICAL STRESS INCREASE (PSF)	HORIZ. X STRESS INCREASE (PSF)	HORIZ. Y STRESS INCREASE (PSF)	SKEMPTON BJERRUM FACTOR	CONSOL. COMP. (IN.)	ELASTIC COMP. (IN.)	TOTAL COMP. (IN.)
1	1044.4	1098.1	600.9	405.3	1	0.562	0.094	0.656
2	2290.3	612.2	183.8	295.9	1	0	0.18	0.18
3	3545	452.7	79.9	221.3	1	0.094	0.021	0.115
4	4838	361.5	39.9	155.8	1	0.25	0.024	0.274
5	5538.6	324.7	28.5	127.3	1	0	0.021	0.021
6	5851.4	309.9	24.7	116	1	0.022	0.087	0.109
7	6557.1	259.2	14.6	80.4	1	0.065	0.374	0.439
8	7545.9	192	6.4	42.7	1	0.052	0.47	0.522
						1.044	1.271	2.316

Ignoring consol. comp. for Layers 1 to 5 (above GWS) 0.138 4 mm
Elastic comp. in Layers 1 to 5 (above GWS) 0.34 9 mm

SETTLEMENT POINT : 70.0, 40.0
Mid point of new wall fill

SOIL LAYER	INITIAL STRESS (PSF)	VERTICAL STRESS INCREASE (PSF)	HORIZ. X STRESS INCREASE (PSF)	HORIZ. Y STRESS INCREASE (PSF)	SKEMPTON BJERRUM FACTOR	CONSOL. COMP. (IN.)	ELASTIC COMP. (IN.)	TOTAL COMP. (IN.)
1	2195	1110	679.7	823.4	1	0.32	0.129	0.449
2	3261.3	916.2	209.2	406.8	1	0	0.463	0.463
3	4275.3	667.4	70.4	207.6	1	0.578	0.06	0.638
4	5345.5	474	27.1	118.9	1	0.487	0.052	0.539
5	5946.2	397.9	17.3	93.5	1	0	0.036	0.036
6	6222.3	368.9	14.3	84.8	1	0.024	0.162	0.186
7	6805	280	7.2	60.5	1	0.067	0.57	0.637
8	7684.9	186.8	2.7	36.7	1	0.05	0.58	0.63
						1.526	2.052	3.578

Ignoring consol. comp. for Layers 1 to 5 (above GWS) 0.141 4 mm
Elastic comp. in Layers 1 to 5 (above GWS) 0.74 19 mm

SETTLEMENT POINT : 85.0, 40.0
Edge of new wall fill

SOIL LAYER	INITIAL STRESS (PSF)	VERTICAL STRESS INCREASE (PSF)	HORIZ. X STRESS INCREASE (PSF)	HORIZ. Y STRESS INCREASE (PSF)	SKEMPTON BJERRUM FACTOR	CONSOL. COMP. (IN.)	ELASTIC COMP. (IN.)	TOTAL COMP. (IN.)
1	1058.1	812.2	551.8	622.3	1	0.445	0.037	0.482
2	2345.7	703.7	225.8	330.7	1	0	0.214	0.214
3	3592.1	548.8	101	181.2	1	0.111	0.029	0.14
4	4851.2	413.5	47.1	109.3	1	0.319	0.03	0.349
5	5530.7	355.6	32.2	87.5	1	0	0.023	0.023
6	5837.7	332.8	27.4	79.9	1	0.023	0.098	0.121
7	6519.4	259.9	15	58	1	0.065	0.377	0.442
8	7490.8	178.8	6.1	35.7	1	0.049	0.429	0.478
						1.013	1.237	2.249

Ignoring consol. comp. for Layers 1 to 5 (above GWS) 0.138 4 mm
Elastic comp. in Layers 1 to 5 (above GWS) 0.333 8 mm

SETTLEMENT POINT : 70.0, -40.0
Mid point of new wall fill

SOIL LAYER	INITIAL STRESS (PSF)	VERTICAL STRESS INCREASE (PSF)	HORIZ. X STRESS INCREASE (PSF)	HORIZ. Y STRESS INCREASE (PSF)	SKEMPTON BJERRUM FACTOR	CONSOL. COMP. (IN.)	ELASTIC COMP. (IN.)	TOTAL COMP. (IN.)
1	2195	1110	679.7	823.4	1	0.32	0.129	0.449
2	3261.3	916.2	209.2	406.8	1	0	0.463	0.463
3	4275.9	667.4	70.4	207.6	1	0.578	0.06	0.638
4	5345.5	474	27.1	118.9	1	0.487	0.052	0.539
5	5946.2	397.9	17.3	93.5	1	0	0.036	0.036
6	6222.3	368.9	14.3	84.8	1	0.024	0.162	0.186
7	6805	280	7.2	60.5	1	0.067	0.57	0.637
8	7664.9	186.8	2.7	36.7	1	0.05	0.58	0.63
						1.528	2.052	3.578

Ignoring consol. comp. for Layers 1 to 5 (above GWS) 0.141 4 mm
Elastic comp. in Layers 1 to 5 (above GWS) 0.74 19 mm

SETTLEMENT POINT : 85.0, -40.0
Edge of new wall fill

SOIL LAYER	INITIAL STRESS (PSF)	VERTICAL STRESS INCREASE (PSF)	HORIZ. X STRESS INCREASE (PSF)	HORIZ. Y STRESS INCREASE (PSF)	SKEMPTON BJERRUM FACTOR	CONSOL. COMP. (IN.)	ELASTIC COMP. (IN.)	TOTAL COMP. (IN.)
1	1058.1	812.2	551.8	622.3	1	0.445	0.037	0.482
2	2345.7	703.7	225.8	330.7	1	0	0.214	0.214
3	3592.1	548.8	101	181.2	1	0.111	0.029	0.14
4	4851.2	413.5	47.1	109.3	1	0.319	0.03	0.349
5	5530.7	355.6	32.2	87.5	1	0	0.023	0.023
6	5837.7	332.6	27.4	79.9	1	0.023	0.098	0.121
7	6519.4	259.9	15	58	1	0.065	0.377	0.442
8	7490.6	178.6	6.1	35.7	1	0.049	0.429	0.478
						1.013	1.237	2.249

Ignoring consol. comp. for Layers 1 to 5 (above GWS) 0.138 4 mm
Elastic comp. in Layers 1 to 5 (above GWS) 0.333 8 mm

URS

Page 1 of ____

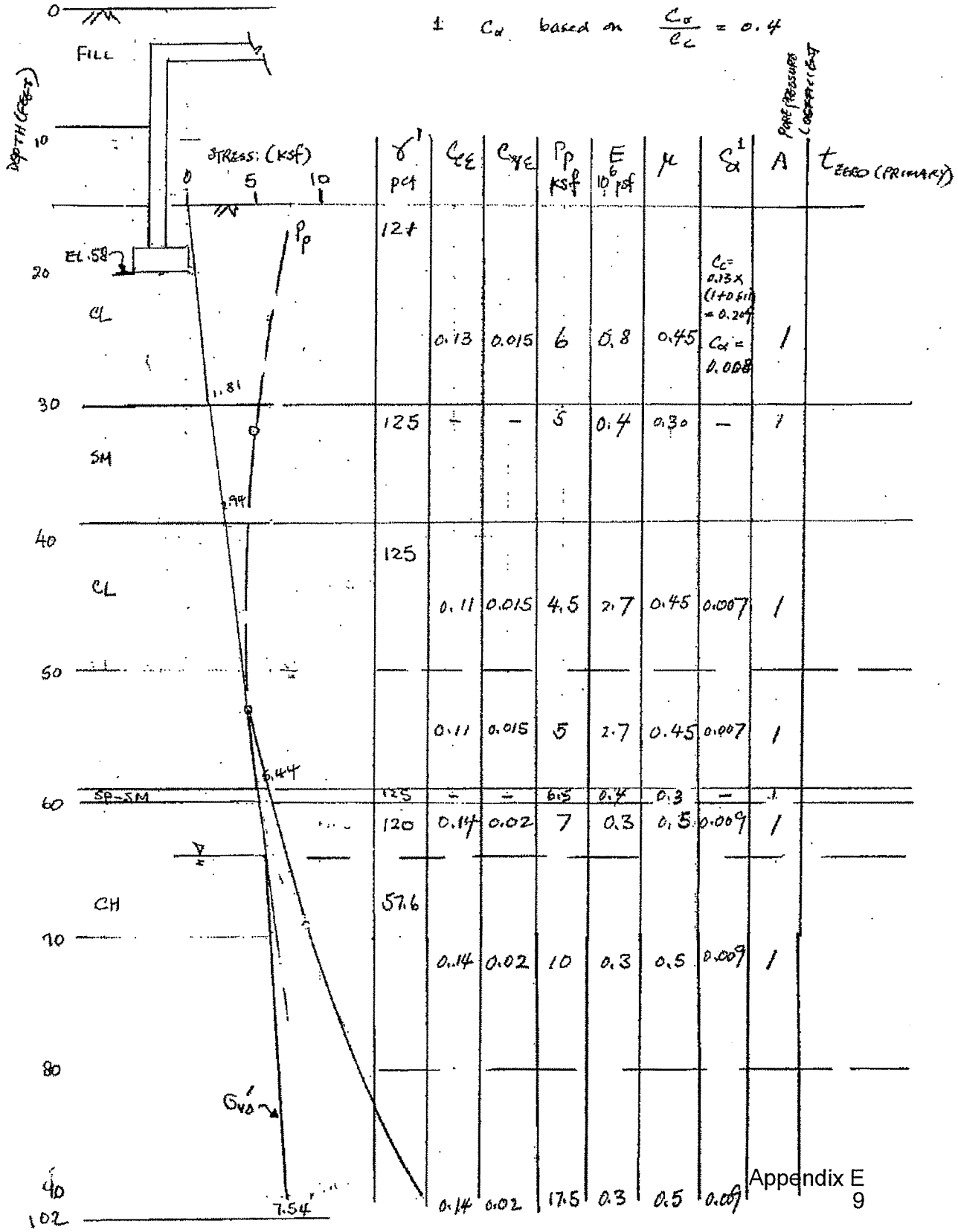
Job SR 4 WIDENING - LOVERIDGE | Project No. 26814928 | Sheet ____ of ____

Description UTILITIES UNDERCROSSING - # RW No. 4 | Computed by SSH | Date 2-23-05

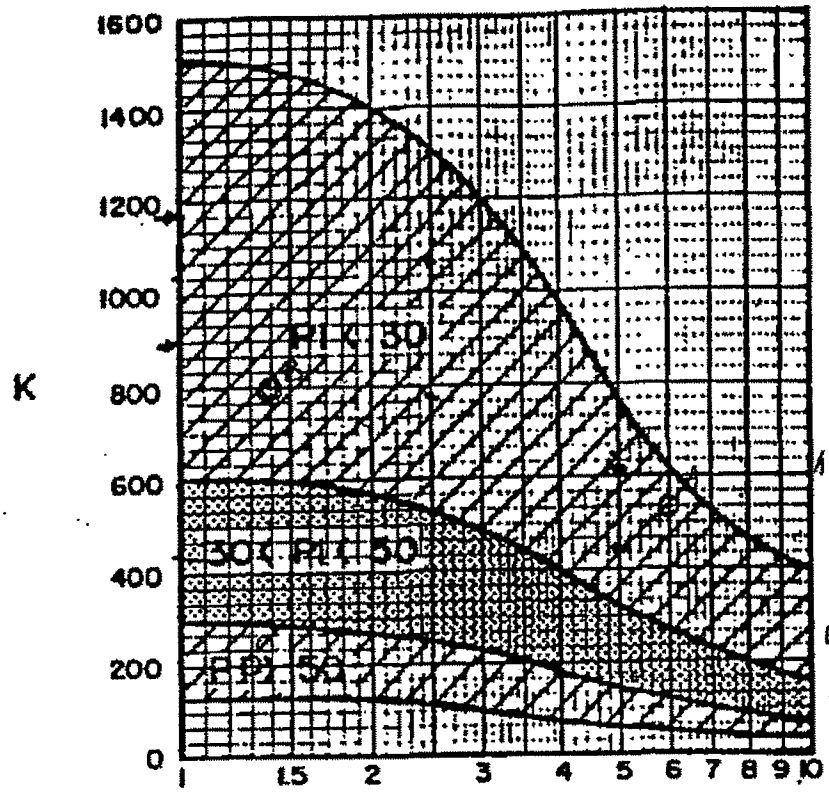
SETTLEMENT ANALYSIS | Checked by ____ | Date ____

Reference

1 C_α based on $\frac{C_\alpha}{C_c} = 0.4$



γ' pcf	$C_{c\varepsilon}$	$C_{r\varepsilon}$	P_p ksf	E 10^6 psf	μ	C_α'	A	t_{ZERO} (PRIMARY)
124	0.13	0.015	6	0.8	0.45	$C_c = 0.13 \times (1+0.61) = 0.209$; $C_\alpha = 0.008$	1	
125	–	–	5	0.4	0.30	–	1	
125	0.11	0.015	4.5	2.7	0.45	0.007	1	
125	0.11	0.015	5	2.7	0.45	0.007	1	
125	–	–	6.5	0.4	0.3	–	1	
120	0.14	0.02	7	0.3	0.5	0.009	1	
57.6	0.14	0.02	10	0.3	0.5	0.009	1	
	0.14	0.02	17.5	0.3	0.5	0.009		



A CL @ 0 ft.

$E = 500 \times 1679 = 839583$ psi.

K S_u S_y 0.8×10^6

B CL @ 30 ft.

$E = 800 \times 3400 = 2,720,000$

S_y 2.7×10^6

C CL @ 50 ft

$E = 200 \times 1400 = 280\,000$

S_y 0.3×10^6

$E_u = KS_u$

E_u = UNDRAINED MODULUS OF CLAY

K = FACTOR FROM CHART ABOVE

S_u = UNDRAINED SHEAR STRENGTH OF CLAY

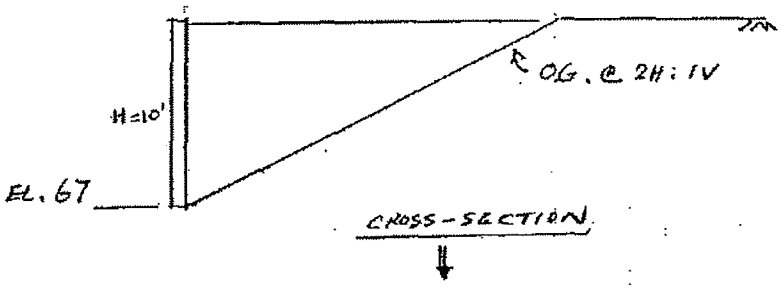
FIG. 2 CHART FOR ESTIMATING UNDRAINED MODULUS OF CLAY

Job SR4 WIDENING - LOWERIDGE | Project No. 26814928 | Sheet ____ of ____

Description UTILITIES UNDERCROSSING | Computed by SSH | Date 2-23-05

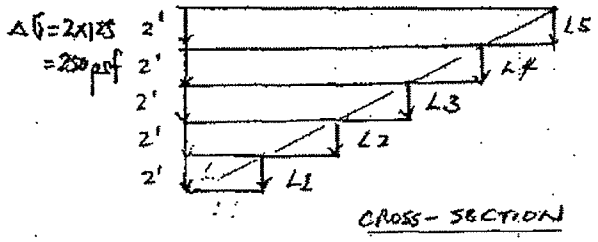
STRESS INCREASE DUE TO WALL FILL | Checked by ____ | Date ____

Reference

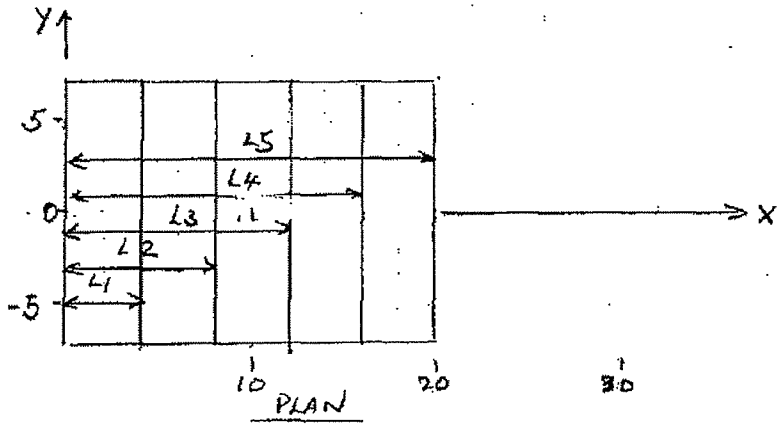


CROSS-SECTION

APPROXIMATION BASED ON UNIFORM LOAD AREAS



CROSS-SECTION



PLAN

"DEFORM" INPUT

```
5
2,0,0, 67, 4, 14, 250
4,0,0, 67, 8, 14, 250
6,0,0, 67, 12, 14, 250
8,0,0, 67, 16, 14, 250
10,0,0, 67, 20, 14, 250
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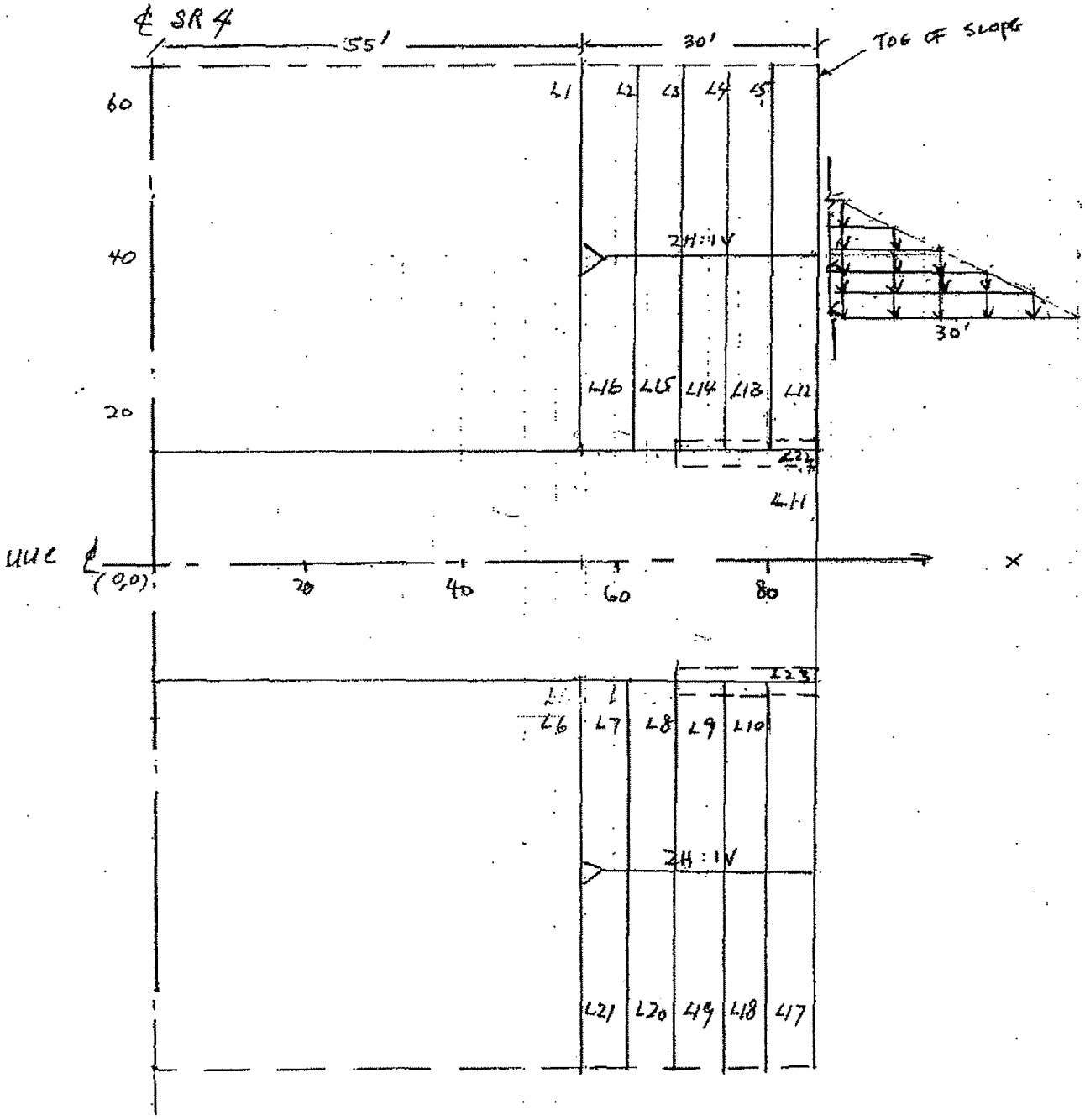
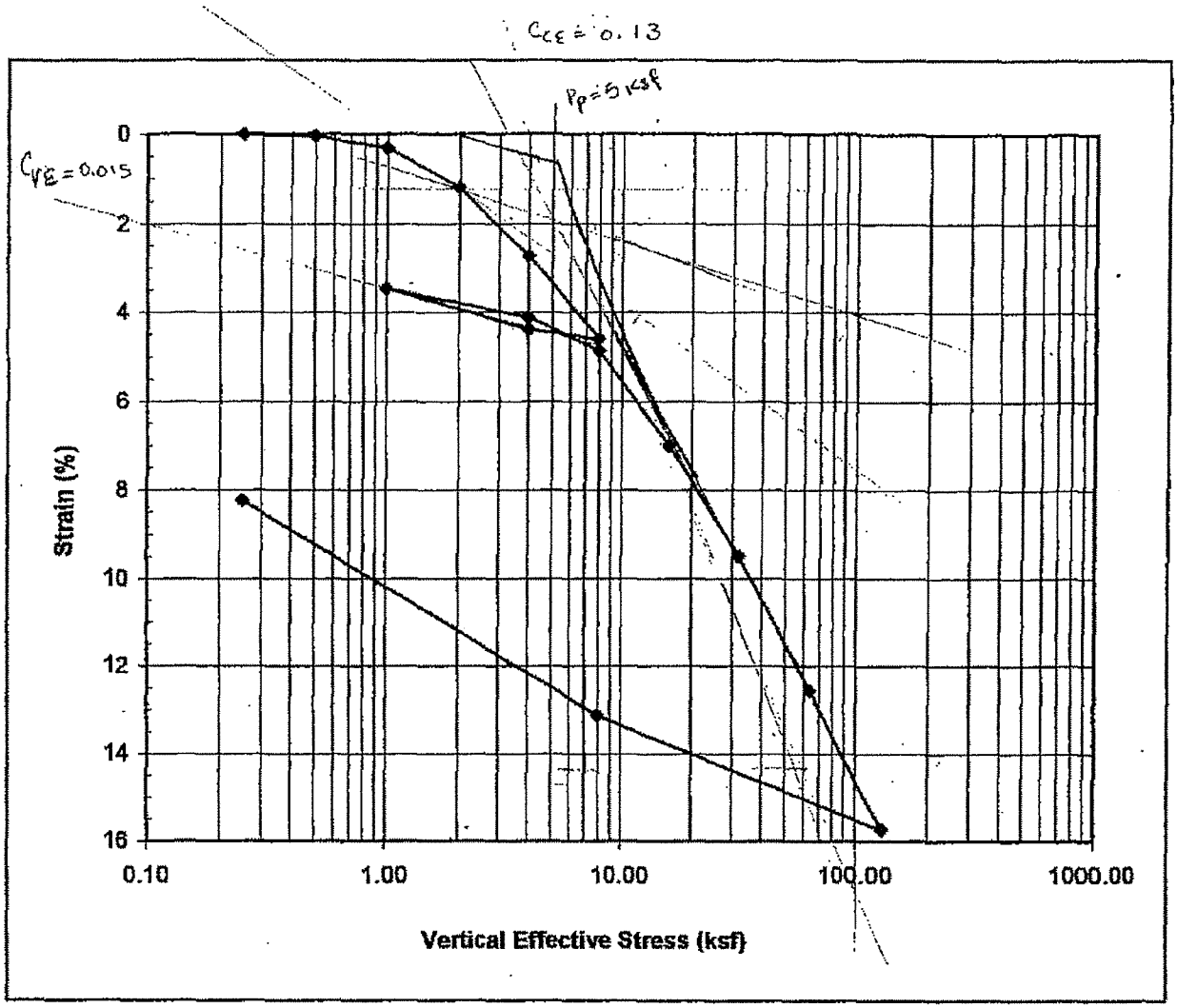
↑ THIS CAN BE INCREASED TO SIMULATE A LONGER WALL FILL.

INITIAL LOADS





Boring: CB-20 Sample: 3-3 Depth, ft: 15.5

Description: Brown sandy clay

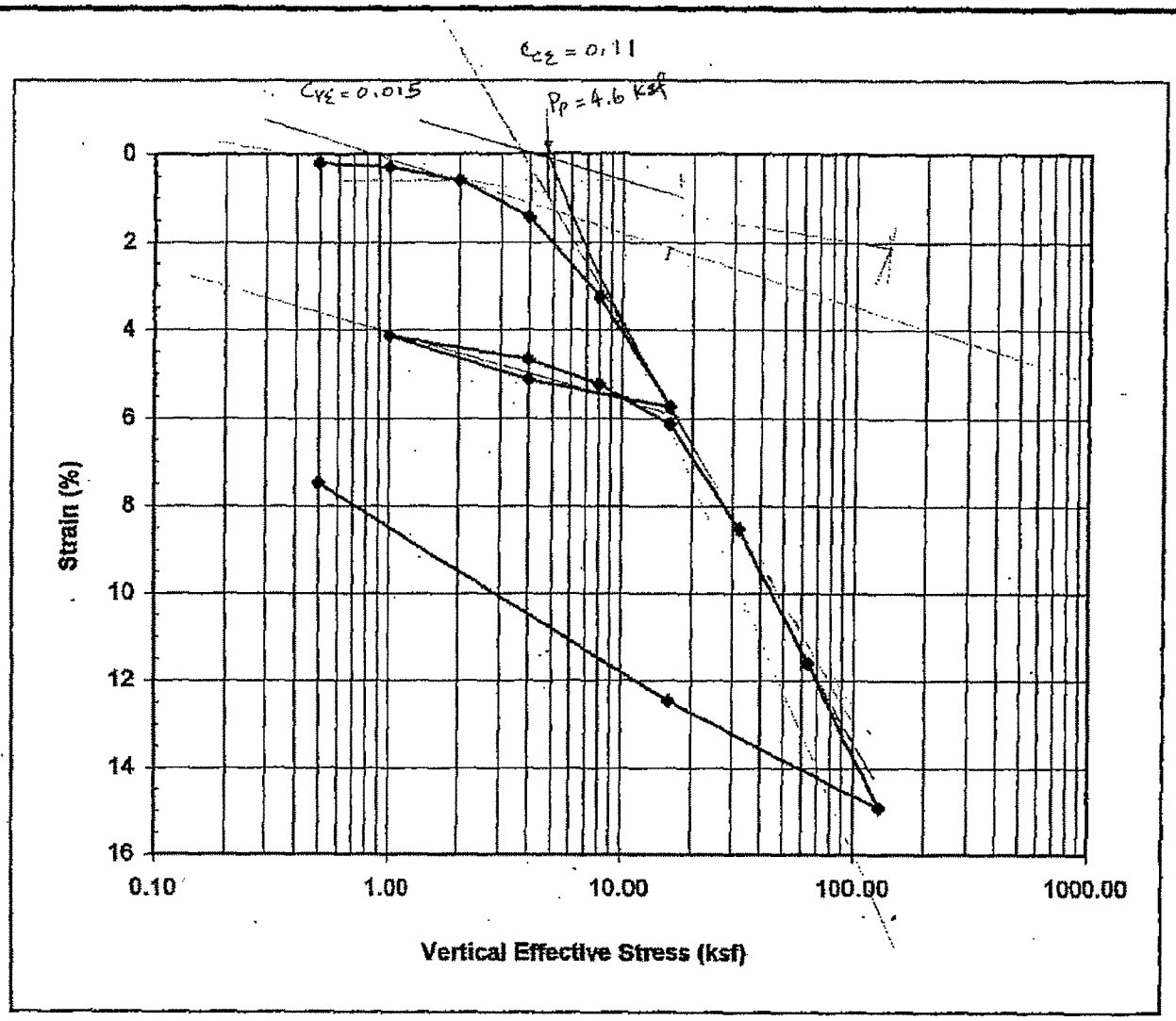
	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est.	Liquid Limit	Plasticity Index
Initial	16.05	128.0	108.5	0.611	82.7	0.9000	1.926	2.800	NA	NA
Final	17.07	138.4	118.2	0.478	99.9	0.8259				

Project: SR 4
Project #: 26814910
Date: 01/20/05

URS

Consolidation Test

Figure:



Boring: CB-21 Sample: 7-3 Depth, ft: 36.0

Description: Brown sandy clay

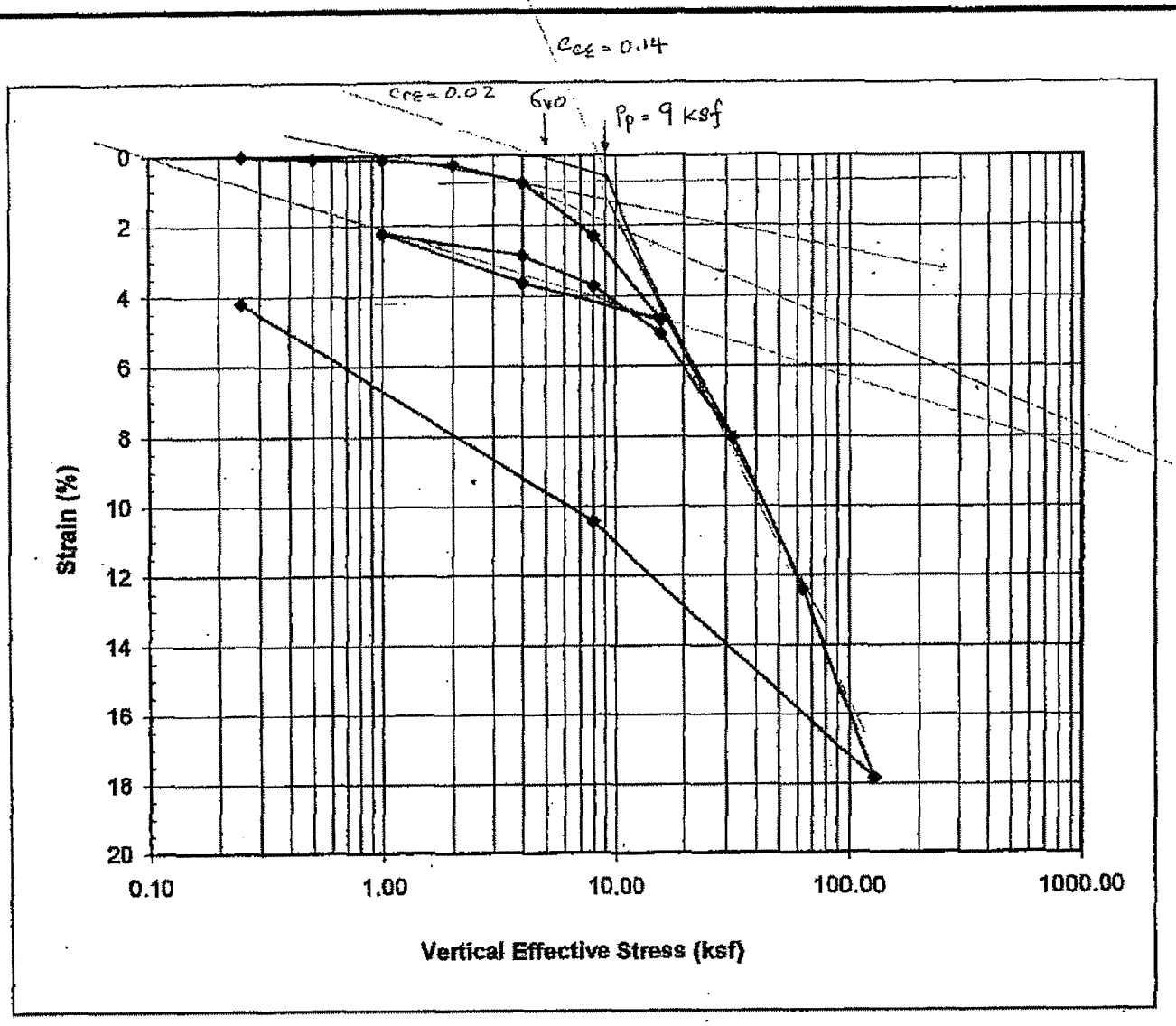
	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est	Liquid Limit	Plasticity Index
Initial	18.41	125.4	105.9	0.585	84.7	0.8960	1.938	2.690	NA	NA
Final	17.33	134.3	114.5	0.466	100.0	0.8291				

Project: SR 4
Project #: 26814910
Date: 01/20/05

URS

Consolidation Test

Figure:



Boring: CB-20 Sample: 10-4 Depth, ft: 51.0

Description: Brown sandy clay

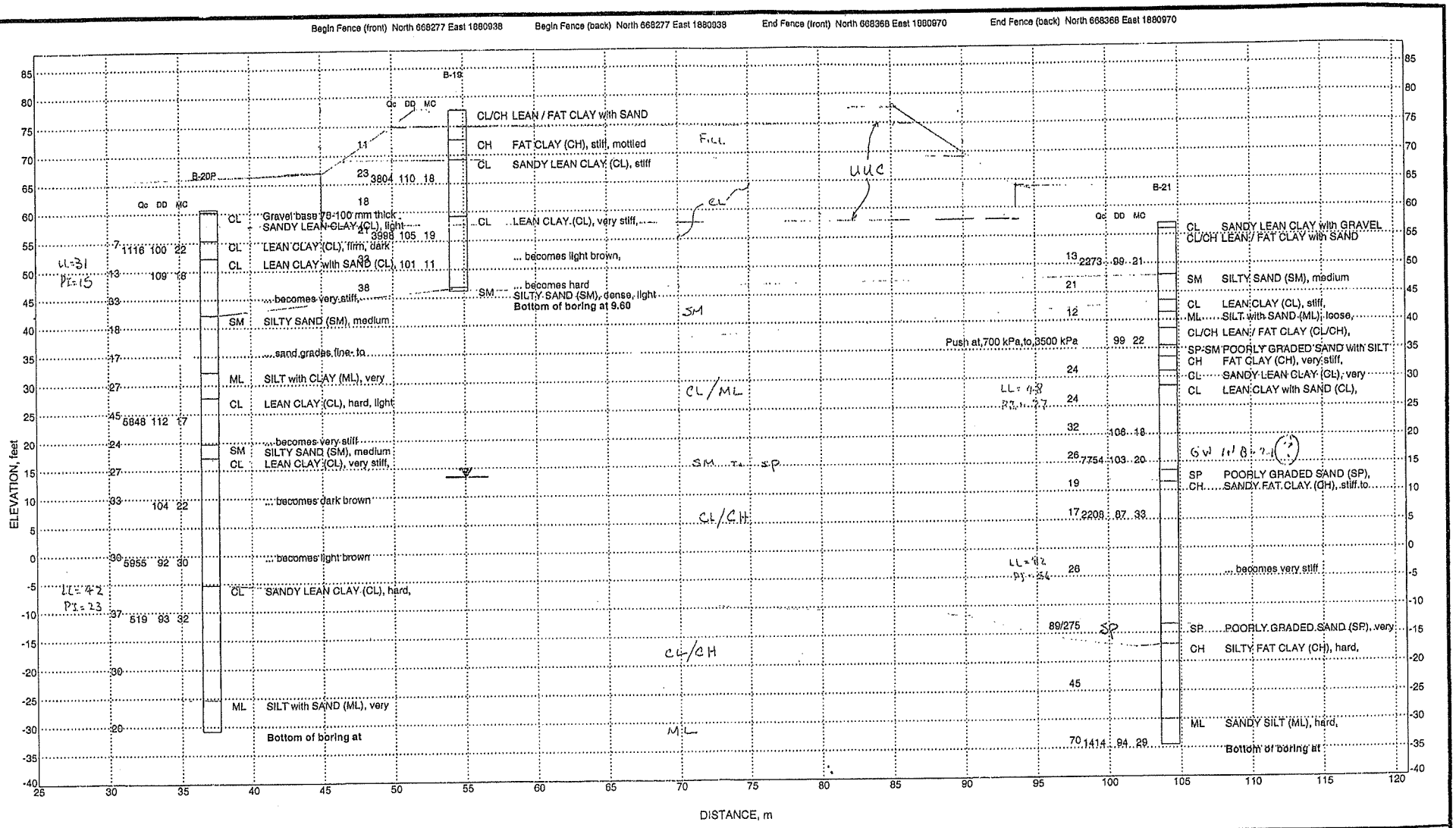
	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est.	Liquid Limit	Plasticity Index
Initial	21.60	126.8	104.2	0.610	95.2	0.8940	1.939	2.690	NA	NA
Final	20.17	130.8	108.8	0.543	100.0	0.8565				

Project: SR 4
Project #: 26814910
Date: 01/20/05

URS

Consolidation Test

Figure:



Project: State Route 4 Loveridge to Somersville Road Project Number: 26814910.24000	**CROSS SECTION Looking West Utilities Undercrossing**	Figure 0 of 0 Appendix E

2/23/05 2CONE_PILE_BSIZE_DOTDAT.COM OAK_SR4PITTS.GPJ

Woodward-Clyde Consultants

SR4: Utility Undercrossing **Abutments 18 in CIDH Piles**

B 1.5 ft 18 in WT 46.36 ft Axial Capacity 180.00 kips 801.0

Patm (psi)	Patm (ksf)	Depth (ft)	Depth (in)	Su (ksf)	Su (psi)	Su/pa	Coh (0) / Non Coh (1)	α	f_{maxi} (ksf)	f_{maxi} (psi)	Unit Wt. (pcf)	σ'	q_{maxi} (ksf)	ΔR_{SN} (kips)	R_{SN} (kips)	kN
14.696	2.116224	0.5	6	0.00	0.00	0	0	0.55	0	0.00	120.00	0.06	0.00	0.00	0.00	0
14.696	2.116224	1	12	0.00	0.00	0	0	0.55	0	0.00	120.00	0.12	0.00	0.00	0.00	0
14.696	2.116224	1.5	18	0.00	0.00	0	0	0.55	0	0.00	120.00	0.18	0.00	0.00	0.00	0
14.696	2.116224	2	24	0.00	0.00	0	0	0.55	0	0.00	120.00	0.24	0.00	0.00	0.00	0
14.696	2.116224	2.5	30	0.00	0.00	0	0	0.55	0	0.00	120.00	0.30	0.00	0.00	0.00	0
14.696	2.116224	3	36	0.00	0.00	0	0	0.55	0	0.00	120.00	0.36	0.00	0.00	0.00	0
14.696	2.116224	3.5	42	0.00	0.00	0	0	0.55	0	0.00	120.00	0.42	0.00	0.00	0.00	0
14.696	2.116224	4	48	0.00	0.00	0	0	0.55	0	0.00	120.00	0.48	0.00	0.00	0.00	0
14.696	2.116224	4.5	54	0.00	0.00	0	0	0.55	0	0.00	120.00	0.54	0.00	0.00	0.00	0
14.696	2.116224	5	60	0.00	0.00	0	0	0.55	0	0.00	120.00	0.60	0.00	0.00	0.00	0
14.696	2.116224	5.5	66	0.00	0.00	0	0	0.55	0	0.00	120.00	0.66	0.00	0.00	0.00	0
14.696	2.116224	6	72	1.88	13.06	0.888375	0	0.55	1.034	7.18	120.00	0.72	0.00	2.44	2.44	10.84156
14.696	2.116224	6.5	78	1.88	13.06	0.888375	0	0.55	1.034	7.18	120.00	0.78	0.00	2.44	4.87	21.68312
14.696	2.116224	7	84	1.88	13.06	0.888375	0	0.55	1.034	7.18	120.00	0.84	0.00	2.44	7.31	32.52467
14.696	2.116224	7.5	90	1.88	13.06	0.888375	0	0.55	1.034	7.18	120.00	0.90	0.00	2.44	9.75	43.36623
14.696	2.116224	8	96	1.88	13.06	0.888375	0	0.55	1.034	7.18	120.00	0.96	0.00	2.44	12.18	54.20779
14.696	2.116224	8.5	102	1.88	13.06	0.888375	0	0.55	1.034	7.18	120.00	1.02	0.00	2.44	14.62	65.04935
14.696	2.116224	9	108	1.10	7.61	0.517904	0	0.55	0.6028	4.19	120.00	1.08	0.00	1.42	16.04	71.36974
14.696	2.116224	9.5	114	1.10	7.61	0.517904	0	0.55	0.6028	4.19	120.00	1.14	0.00	1.42	17.46	77.69014
14.696	2.116224	10	120	1.10	7.61	0.517904	0	0.55	0.6028	4.19	120.00	1.20	0.00	1.42	18.88	84.01054
14.696	2.116224	10.5	126	1.10	7.61	0.517904	0	0.55	0.6028	4.19	120.00	1.26	0.00	1.42	20.30	90.33094
14.696	2.116224	11	132	1.10	7.61	0.517904	0	0.55	0.6028	4.19	120.00	1.32	0.00	1.42	21.72	96.65133
14.696	2.116224	11.5	138	1.10	7.61	0.517904	0	0.55	0.6028	4.19	120.00	1.38	0.00	1.42	23.14	102.9717
14.696	2.116224	12	144	1.10	7.61	0.517904	0	0.55	0.6028	4.19	120.00	1.44	0.00	1.42	24.56	109.2921
14.696	2.116224	12.5	150	1.10	7.61	0.517904	0	0.55	0.6028	4.19	120.00	1.50	0.00	1.42	25.98	115.6125
14.696	2.116224	13	156	1.10	7.61	0.517904	0	0.55	0.6028	4.19	120.00	1.56	0.00	1.42	27.40	121.9329
14.696	2.116224	13.5	162	1.10	7.61	0.517904	0	0.55	0.6028	4.19	120.00	1.62	0.00	1.42	28.82	128.2533
14.696	2.116224	14	168	1.10	7.61	0.517904	0	0.55	0.6028	4.19	120.00	1.68	0.00	1.42	30.24	134.5737
14.696	2.116224	14.5	174	1.10	7.61	0.517904	0	0.55	0.6028	4.19	120.00	1.74	0.00	1.42	31.66	140.8941
14.696	2.116224	15	180	1.10	7.61	0.517904	0	0.55	0.6028	4.19	120.00	1.80	0.00	1.42	33.08	147.2145
14.696	2.116224	15.5	186	1.10	7.61	0.517904	0	0.55	0.6028	4.19	120.00	1.86	0.00	1.42	34.50	153.5349
14.696	2.116224	16	192	1.10	7.61	0.517904	0	0.55	0.6028	4.19	120.00	1.92	0.00	1.42	35.92	159.8553
14.696	2.116224	16.5	198	1.10	7.61	0.517904	0	0.55	0.6028	4.19	120.00	1.98	0.00	1.42	37.34	166.1757
14.696	2.116224	17	204	0.00	0.00	0	1	0.55	0	0.00	120.00	2.04	1.93	4.55	41.89	186.4192
14.696	2.116224	17.5	210	0.00	0.00	0	1	0.55	0	0.00	120.00	2.10	1.97	4.64	46.53	207.0774
14.696	2.116224	18	216	0.00	0.00	0	1	0.55	0	0.00	120.00	2.16	2.01	4.73	51.27	228.1429
14.696	2.116224	18.5	222	0.00	0.00	0	1	0.55	0	0.00	120.00	2.22	2.05	4.82	56.09	249.6079
14.696	2.116224	19	228	0.00	0.00	0	1	0.55	0	0.00	120.00	2.28	2.08	4.91	61.00	271.4652
14.696	2.116224	19.5	234	0.00	0.00	0	1	0.55	0	0.00	120.00	2.34	2.12	5.00	66.00	293.7073
14.696	2.116224	20	240	0.00	0.00	0	1	0.55	0	0.00	120.00	2.40	2.16	5.08	71.08	316.327
14.696	2.116224	20.5	246	0.00	0.00	0	1	0.55	0	0.00	120.00	2.46	2.19	5.17	76.25	339.3171
14.696	2.116224	21	252	0.00	0.00	0	1	0.55	0	0.00	120.00	2.52	2.23	5.25	81.50	362.6707
14.696	2.116224	21.5	258	0.00	0.00	0	1	0.55	0	0.00	120.00	2.58	2.26	5.33	86.83	386.3806
14.696	2.116224	22	264	0.00	0.00	0	1	0.55	0	0.00	120.00	2.64	2.29	5.41	92.23	410.4401
14.696	2.116224	22.5	270	0.00	0.00	0	1	0.55	0	0.00	120.00	2.70	2.33	5.48	97.72	434.8423
14.696	2.116224	23	276	0.00	0.00	0	1	0.55	0	0.00	120.00	2.76	2.36	5.56	103.28	459.5805
14.696	2.116224	23.5	282	0.00	0.00	0	1	0.55	0	0.00	120.00	2.82	2.39	5.63	108.91	484.648
14.696	2.116224	24	288	0.00	0.00	0	1	0.55	0	0.00	120.00	2.88	2.42	5.71	114.62	510.0381
14.696	2.116224	24.5	294	0.00	0.00	0	1	0.55	0	0.00	120.00	2.94	2.45	5.78	120.39	535.7445
14.696	2.116224	25	300	0.00	0.00	0	1	0.55	0	0.00	120.00	3.00	2.48	5.85	126.24	561.7606
14.696	2.116224	25.5	306	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	3.06	0.00	3.88	130.12	579.0436
14.696	2.116224	26	312	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	3.12	0.00	3.88	134.01	596.3267
14.696	2.116224	26.5	318	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	3.17	0.00	3.88	137.89	613.6097
14.696	2.116224	27	324	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	3.23	0.00	3.88	141.77	630.8928
14.696	2.116224	27.5	330	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	3.29	0.00	3.88	145.66	648.1758
14.696	2.116224	28	336	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	3.35	0.00	3.88	149.54	665.4589
14.696	2.116224	28.5	342	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	3.40	0.00	3.88	153.43	682.742
14.696	2.116224	29	348	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	3.46	0.00	3.88	157.31	700.025
14.696	2.116224	29.5	354	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	3.52	0.00	3.88	161.19	717.3081
14.696	2.116224	30	360	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	3.58	0.00	3.88	165.08	734.5911
14.696	2.116224	30.5	366	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	3.63	0.00	3.88	168.96	751.8742
14.696	2.116224	31	372	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	3.69	0.00	3.88	172.84	769.1572
14.696	2.116224	31.5	378	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	3.75	0.00	3.88	176.73	786.4403
14.696	2.116224	32	384	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	3.81	0.00	3.88	180.61	803.7234
14.696	2.116224	32.5	390	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	3.86	0.00	3.88	184.50	821.0064
14.696	2.116224	33	396	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	3.92	0.00	3.88	188.38	838.2895
14.696	2.116224	33.5	402	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	3.98	0.00	3.88	192.26	855.5725
14.696	2.116224	34	408	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	4.04	0.00	3.88	196.15	872.8556
14.696	2.116224	34.5	414	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	4.09	0.00	3.88	200.03	890.1387
14.696	2.116224	35	420	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	4.15	0.00	3.88	203.91	907.4217
14.696	2.116224	35.5	426	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	4.21	0.00	3.88	207.80	924.7048
14.696	2.116224	36	432	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	4.27	0.00	3.88	211.68	941.9878
14.696	2.116224	36.5	438	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	4.32	0.00	3.88	215.57	959.2709
14.696	2.116224	37	444	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	4.38	0.00	3.88	219.45	976.5539
14.696	2.116224	37.5	450	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	4.44	0.00	3.88	223.33	993.837
14.696	2.116224	38	456	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	4.50	0.00	3.88	227.22	1011.12
14.696	2.116224	38.5	462	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	4.55	0.00	3.88	231.10	1028.403
14.696	2.116224	39	468	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	4.61	0.00	3.88	234.99	1045.686
14.696	2.116224	39.5	474	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	4.67	0.00	3.88	238.87	1062.969
14.696	2.116224	40	480	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	4.73	0.00	3.88	242.75	1080.252
14.696	2.116224	40.5	486	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	4.78	0.00	3.88	246.64	1097.535
14.696	2.116224	41	492	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	4.84	0.00	3.88	250.52	1114.818
14.696	2.116224	41.5	498	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	4.90	0.00	3.88	254.40	1132.101

SR4: Utility Undercrossing **Abutments 18 in CIDH Piles**

B 1.5 ft 18 in WT 46.36 ft Axial Capacity 180.00 kips 801.0

Patm (psi)	Patm (ksf)	Depth (ft)	Depth (in)	Su (ksf)	Su (psi)	Su/pa	Coh (0) / Non Coh (1)	α	f_{maxi} (ksf)	f_{maxi} (psi)	Unit Wt. (pcf)	σ'	q_{maxi} (ksf)	ΔR_{SN} (kips)	R_{SN} (kips)	kN
14.696	2.116224	42	504	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	4.96	0.00	3.88	258.29	1149.385
14.696	2.116224	42.5	510	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.01	0.00	3.88	262.17	1166.668
14.696	2.116224	43	516	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.07	0.00	3.88	266.06	1183.951
14.696	2.116224	43.5	522	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.13	0.00	3.88	269.94	1201.234
14.696	2.116224	44	528	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.19	0.00	3.88	273.82	1218.517
14.696	2.116224	44.5	534	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.24	0.00	3.88	277.71	1235.8
14.696	2.116224	45	540	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.30	0.00	3.88	281.59	1253.083
14.696	2.116224	45.5	546	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.36	0.00	3.88	285.48	1270.366
14.696	2.116224	46	552	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.42	0.00	3.88	289.36	1287.649
14.696	2.116224	46.5	558	0.00	0.00	0	1	0.55	0	0.00	120.00	5.44	3.16	7.44	296.80	1320.762
14.696	2.116224	47	564	0.00	0.00	0	1	0.55	0	0.00	120.00	5.47	3.15	7.42	304.22	1353.765
14.696	2.116224	47.5	570	0.00	0.00	0	1	0.55	0	0.00	120.00	5.50	3.14	7.39	311.61	1386.657
14.696	2.116224	48	576	0.00	0.00	0	1	0.55	0	0.00	120.00	5.53	3.13	7.37	318.97	1419.437
14.696	2.116224	48.5	582	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.56	0.00	3.88	322.86	1436.721
14.696	2.116224	49	588	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.58	0.00	3.88	326.74	1454.004
14.696	2.116224	49.5	594	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.61	0.00	3.88	330.63	1471.287
14.696	2.116224	50	600	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.64	0.00	3.88	334.51	1488.57
14.696	2.116224	50.5	606	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.66	0.00	3.88	338.39	1505.853
14.696	2.116224	51	612	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.69	0.00	3.88	342.28	1523.136
14.696	2.116224	51.5	618	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.71	0.00	3.88	346.16	1540.419
14.696	2.116224	52	624	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.74	0.00	3.88	350.05	1557.702
14.696	2.116224	52.5	630	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.77	0.00	3.88	353.93	1574.985
14.696	2.116224	53	636	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.79	0.00	3.88	357.81	1592.268
14.696	2.116224	53.5	642	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.82	0.00	3.88	361.70	1609.551
14.696	2.116224	54	648	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.85	0.00	3.88	365.58	1626.834
14.696	2.116224	54.5	654	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.87	0.00	3.88	369.46	1644.117
14.696	2.116224	55	660	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.90	0.00	3.88	373.35	1661.4
14.696	2.116224	55.5	666	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.92	0.00	3.88	377.23	1678.683
14.696	2.116224	56	672	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.95	0.00	3.88	381.12	1695.966
14.696	2.116224	56.5	678	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	5.98	0.00	3.88	385.00	1713.249
14.696	2.116224	57	684	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.00	0.00	3.88	388.88	1730.533
14.696	2.116224	57.5	690	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.03	0.00	3.88	392.77	1747.816
14.696	2.116224	58	696	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.06	0.00	3.88	396.65	1765.099
14.696	2.116224	58.5	702	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.08	0.00	3.88	400.54	1782.382
14.696	2.116224	59	708	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.11	0.00	3.88	404.42	1799.665
14.696	2.116224	59.5	714	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.14	0.00	3.88	408.30	1816.948
14.696	2.116224	60	720	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.16	0.00	3.88	412.19	1834.231
14.696	2.116224	60.5	726	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.19	0.00	3.88	416.07	1851.514
14.696	2.116224	61	732	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.21	0.00	3.88	419.95	1868.797
14.696	2.116224	61.5	738	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.24	0.00	3.88	423.84	1886.08
14.696	2.116224	62	744	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.27	0.00	3.88	427.72	1903.363
14.696	2.116224	62.5	750	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.29	0.00	3.88	431.61	1920.646
14.696	2.116224	63	756	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.32	0.00	3.88	435.49	1937.929
14.696	2.116224	63.5	762	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.35	0.00	3.88	439.37	1955.212
14.696	2.116224	64	768	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.37	0.00	3.88	443.26	1972.495
14.696	2.116224	64.5	774	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.40	0.00	3.88	447.14	1989.778
14.696	2.116224	65	780	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.42	0.00	3.88	451.03	2007.061
14.696	2.116224	65.5	786	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.45	0.00	3.88	454.91	2024.345
14.696	2.116224	66	792	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.48	0.00	3.88	458.79	2041.628
14.696	2.116224	66.5	798	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.50	0.00	3.88	462.68	2058.911
14.696	2.116224	67	804	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.53	0.00	3.88	466.56	2076.194
14.696	2.116224	67.5	810	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.56	0.00	3.88	470.44	2093.477
14.696	2.116224	68	816	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.58	0.00	3.88	474.33	2110.76
14.696	2.116224	68.5	822	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.61	0.00	3.88	478.21	2128.043
14.696	2.116224	69	828	3.00	20.81	1.416202	0	0.55	1.64835	11.45	115.00	6.63	0.00	3.88	482.10	2145.326
14.696	2.116224	69.5	834	0.00	0.00	0	1	0.55	0	0.00	120.00	6.66	2.49	5.88	487.97	2171.485
14.696	2.116224	70	840	0.00	0.00	0	1	0.55	0	0.00	120.00	6.69	2.48	5.84	493.81	2197.472
14.696	2.116224	70.5	846	0.00	0.00	0	1	0.55	0	0.00	120.00	6.72	2.46	5.80	499.61	2223.286

Appendix F
References

American Society for Testing and Materials (ASTM), v. 04.08 for ASTM test methods, Soil and Rock (1): D-420 to D-5779, 2000.

California Geological Survey (CGS), 2003, Fault investigation reports for development sites within Alquist-Priolo Earthquake Fault Zones in Northern California, 1974-2000, CGS CD 2003-01.

FEMA, 1996, National Flood Insurance Program, (www.fema.gov).

Graymer, R.W., Jones, D.L., and Brabb, E.E., 1994, Preliminary geologic map of the Niles 7.5-minute quadrangle, Alameda County, California: U.S. Geological Survey Open-File Report 94-132, scale 1:24,000.

Knudsen, K.L., Sowers, J.M., Witter, R.C., Wentworth, C.M. and Helley, E.J., 2000, Preliminary maps of Quaternary deposits and liquefaction susceptibility, nine-county San Francisco Bay region: A digital database, U.S. Geological Survey, Open-File Report 00-444, 60 p.

Mualchin, L., 1996, California seismic hazard map 1996 based on maximum credible earthquakes (MCE), California Department of Transportation.

NCEER, (1998), "Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils", edited by Youd, T.L., and Idriss, I.M., Technical report NCEER-98-0022.

Robertson, P. K. and Campanella, R. G. (1985). "Liquefaction Potential of Sands Using the Cone Penetration Test." Journal of Geotechnical Engineering Division of ASCE, March 1985.

Robertson, P. K. and Campanella, R. G. (1988). "Design Manual for use of CPT and CPTu." Pennsylvania Department of Transportation, (Penn DOT).

Robertson, P. K., and Wride C. E. (1997). "Cyclic Liquefacation and its Evaluation based on the SPT and CPT". Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils. National Center for Earthquake Engineering Research, Technical Report NCEER-97-0022, December 31, 1997.

Seed, H. B. and Idriss, I. M. (1982). "Ground Motions and Soil Liquefaction During Earthquakes", Monograph Series, Earthquake Engineering Research Institute, December, 1982.

Stark Timothy D., and Mesri, Gholamreza (1992). "Undrained Shear Strength of Liquified Sand for Stability Analysis." Journal of Geotechnical Engineering Division of ASCE, November, 1992.

State of California, Department of Transportation, "Caltrans Memo to Designers 5-20, August 2004.

State of California, Department of Transportation, "Guidelines for Structures Foundation Reports, Version 2.0", March 2006.

State of California, Department of Transportation, "Seismic Design Criteria, Version 1.4",June 2006.

State of California, Department of Transportation, "Soil & Rock Logging Classification Manual", 1996.

Tokimatsu, A.M., Seed, H.B., 1987, Evaluation of Settlements in Sands Due to Earthquake Shaking, Journal of Geotechnical Engineering, Vol 133, No. 8, August.

U. S. Department of Transportation, Federal Highway Administration, 1998, " Design and Construction of Driven Pile Foundations" Workshop manual Volume I, Publication No. FHWA-HI-97-013, November.

U. S. Department of Transportation, Federal Highway Administration, 1998, " Design and Construction of Driven Pile Foundations" Workshop manual Volume II, Publication No. FHWA-HI-97-014, November.

U. S. Geological Survey, "Quaternary geology of Contra Costa County and surrounding parts of Alameda, Marin, Sonoma, Solano, Sacramento, and San Joaquin Counties, California", by E.J. Helley and R.W. Graymer, Open File Report 97-98, 1997.

Wills, C. J., 1991, The Antioch fault, Contra Costa County, California: Fault Evaluation Report FER-228, California Division of Mines and Geology, 28p., November 6.

Working Group for California Earthquake Probabilities, 2003, Summary of earthquake probabilities in the San Francisco Bay area, 2003-2032, US Geological Survey, Fact Sheet 039-03 6 p.

Youd, T. Leslie and Noble, Steven K., (1997). "Magnitude Scaling Factors." Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils, Technical Report NCEER-97-0022, National Center for Earthquake Engineering Research, December 31, 1997.

Appendix G

Caltrans Review Comments And Responses

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

[X] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 03/23/05

FILE: 04 (District) CC (County) 4 (Route) 23.71/26.8 (PM)

SUB CONSULTANT: URS
PRIME CONSULTANT: URS
GENERAL PLAN DATED: 03/04/05
Report Date: 03/07/05
Contract No.:
FDN PLAN DATED: 03/04/05
Structure Name: Utilities UC
EA Number: 04-228501
Bridge Number: 28-0105

Submittal (Check One): [ ] 1st [ ] 2nd [ ] 3rd [ ] 4th [X] Other: Type Selection

The following comments for the above referenced project are based on
(a) the Type Selection Report, dated 03/07/05, prepared by URS, and
(b) the Preliminary Foundation Investigation Report, dated 03/07/05, prepared by URS.

1. The seismic data are generally acceptable. We concur with the following data:
   (1) Controlling faults: Coast Ranges Sierran Block boundary zone (CRSB)
   (2) Style of fault: reverse
   (3) MCE: Mw=7.0
   (4) Distance from bridge to fault: about 6.25 km
   (5) Soil type: D

2. LOTBs: If groundwater is not marked on the LOTB, a note should be added at the bottom of each boring to indicate whether groundwater was not encountered or not measured during exploration.

REGISTERED PROFESSIONAL ENGINEER
CAROLINE JINXIA CHEN
No. C 62430
Exp. 12/31/05
CIVIL
STATE OF CALIFORNIA

[X] Special Funded Project (OSFP) [ ] Local Assistance Project (OSFP) [ ] OSCM Project

Approval: Type Selection

OSFP/OSCM

Caroline Chen
Office of Geotechnical Design - West

cc: OGDx, Lab File Room (Sacramento) DES Specifications and Estimates (JStayton-4 copies) Structure Construction R.E. Pending File

ReyIsnd 05/04

SR4(E) Widening Project Loveridge Road to Somersville Road – Utilities Undercrossing - EA 228501

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	October 24, 2005
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	March 23, 2005		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 35% PS&E**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
	Report					
1		The seismic data generally acceptable. We concur with the following data: (1) Controlling faults: Coast Ranges Sierran Block boundary zone (CRSB) (2) Style of fault: reverse (3) MCE: Mw = 7.0 (4) Distance from bridge to fault: about 6.25 km (5) Soil type: D	Concur	A		A
2	LOTB's	If groundwater is not marked on the LOTBs, a note should be added at the bottom of each boring to indicate whether groundwater was not encountered or not measured during exploration	LOTB has been revised to include this.	A		A

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

[x] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 12/14/05

FILE: 04 (District) CC (County) 4 (Route) 23.71/26.8 (PM)

SUB CONSULTANT: URS
PRIME CONSULTANT: URS
GENERAL PLAN DATED: 10/11/05
Report Date: 10/24/05
Contract No.:
FDN PLAN DATED: 10/11/05
Structure Name: Utilities UC (Widen)
EA Number: 04-228501
Bridge Number: 28-0105

Submittal (*Check One*): [X] 1st [ ] 2nd [ ] 3rd [ ] 4th [ ] Other:

Report

1. Section 2.1: Some structure widening dimensions do not seem to be consistent with Plans. Please update.
2. Section 4.2: Report indicates that a piezometer was constructed in Boring B-20, which should be intended to measure groundwater table (GWT). But no GWT is shown on the log for Boring B-20. Please verify and revise.
3. Section 4.2: Report states that auger drilling was followed by rotary wash from certain depth for Borings B-20 and B-21. Appropriate symbols should be marked on the LOTBs accordingly.
4. Section 4.2: If GWT was also established using CPT, please mark it on LOTBs accordingly.
5. Section 5.2: Please include a column showing the elevation of top of each soil layer. Why is undrained shear strength of the sandy fat clay and fat clay assumed 0?
6. Section 6.7: A resistivity of less than 1000 ohms-cm itself does not indicate a corrosive site. Current Caltrans corrosion guidelines combine all four parameters to evaluate corrosion. Please comply with Section 5.5 of Caltrans Corrosion Guideline (2003) when evaluating a site to be corrosive to foundation elements or not. The Guideline is available at the following website: http://www.dot.ca.gov/hq/esc/ttsb/corrosion/CorrGuidelinesSept03.pdf.
7. Report and Plans are inconsistent in foundation recommendations. Report recommends spread footing, but Plans presents CIDH piles. Please revise accordingly. Space limit due to the existing utilities should be considered if spread footings are to be used.

REGISTERED PROFESSIONAL ENGINEER
CAROLINE JINXIA CHEN
No. C 62438
Exp. 9/30/07
CIVIL
STATE OF CALIFORNIA

[x] Special Funded Project (OSFP) [ ] Local Assistance Project (OSFP) [ ] OSCM Project

Approval: C3 – Not Approved

OSFP/OSCM

Caroline Chen
Office of Geotechnical Design - West

cc: OGDx, Lab File Room (Sacramento) DES Specifications and Estimates (JStayton-4 copies) Structure Construction R.E. Pending File

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

☐ MR. EARL SEABERG, CHIEF, OSFP
☐ MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 12/14/05

FILE:

04	CC	4	23.71/26.8
District	County	Route	PM

Utilities UC (Widen)
Structure Name

04-228501	28-0395
EA Number	Bridge Number

8. LOTBs:
   (1) Please add note to indicate the type of hammer used.
   (2) Some symbols of soils do not match the legend of earth materials. Please check all and revise.
   (3) Boring B-21: For soil at elevation about 11m, "Push" doesn't seem to be consistent with description of "stiff to very stiff". If it is meant to be punch core, "push" should be removed.
   (4) Location of borings should be presented as station and offset referencing to certain alignment line, not in the form of easting and northing.
   (5) Please pay attention to the presentation of LOTBs. Grids showing elevation on the LOTB sheets should not strike through the text describing soil properties or the area showing field/lab record.

9. Please add (Widen) to the name of the proposed structure on the cover page.

General Comments

10. Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.

SR4(E) Widening Project Loveridge Road to Somersville Road – Utilities Undercrossing - EA 228501

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	August 8, 2006
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	December 14, 2005		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 65% PS&E**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
	Report					
1	Section 4.2	Section 2.1: Some structure widening dimensions do not seem to be consistent with Plans. Please update.	Agreed. Have been updated.	A		A
2	Section 4.2	Section 4.2: Report indicates that a piezometer was constructed in Boring B-20, which should be intended to measure ground water table (GWT). But no GWT is shown on the log for Boring B-20. Please verify and revise.	Agreed. GWT was measured on Jan 06, 2006 and has been reported.	A		A
3	Section 4.2	Section 4.2: Report states that auger drilling was followed by rotary wash from certain depth for Borings B-20 and B-21. Appropriate symbols should be marked on the LOTBs accordingly.	Agreed. LOTBs have been revised accordingly.	A		A
4	Section 5.2	Section 4.2: It appears GWT was also established using CPT based on this section and Section 5.3. Please mark on LOTB accordingly.	Agreed. LOTBs have been revised accordingly.	A		A
5	Table 4	Please include a column showing the elevation of top of each soil layer. Why is undrianed shear strength of the sandy fat clay and fat clay assumed 0?	Agreed. The soil profile for the Utilities UC has been revised.	A		A
6	Section 7.7	Section 7.7: A resistivity of less than 1000 ohms-cm itself does not indicate a corrosive site. Current Caltrans corrosion guidelines combine all four parameters to evaluate corrosion. Please comply with Section 5.5 of Caltrans Corrosion Guideline (2003) when evaluating a site to be corrosive to foundation elements or not. The Guideline is available at the following website: http://www.dot.ca.gov/hq/esc/ttsb/corrosion/CorrGuidelinesSept03.pdf.	Agreed. Report has been revised accordingly.	A		A

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	August 8, 2006
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	December 14, 2005		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 65% PS&E**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
7	Section 8.3, Table 5	Report and Plans are inconsistent in foundation recommendations. Report recommends spread footing, but Plan presents CIDH piles. Please revise accordingly. Space limit due to the existing utilities should be considered if spread footings are to be used.	Agreed. Report has been revised accordingly.	A		A
8	LOTBs:	(1) Please add note to indicate the type of hammer used.	Agreed. LOTBs have been revised accordingly.	A		A
		(2) Some symbols of soils do not much the legend of earth materials. Please check all and revise	Agreed. LOTBs have been revised accordingly.	A		A
		(3) Boring B-21: For soil at elevation about 11 m, "Push" doesn't seem to be consistent with description of "stiff to very stiff". If it is meant to be punch core, "push" should be removed.	Agreed. These are locations where Shelby sample is collected. LOTBs have been revised accordingly.	A		A
		(4) Location of borings should be presented as station and offset referencing to certain alignment line, not in the form of easting and northing.	Have been provided.	A		A
		(5) Please pay attention to the presentation of LOTBs. Grids showing elevation on the LOTB sheets should not strike through the text describing soil properties or the area showing field/lab record.	LOTBs have been revised accordingly.	A		A
9		Please add (Widen) to the name of the proposed structure on the cover page.	Have been revised.	A		A

SR4(E) Widening Project Loveridge Road to Somersville Road –
Utilities Undercrossing - EA 228501

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	August 8, 2006
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	December 14, 2005		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 65% PS&E**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
	General Comments					
10		Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.	Have been provided.	A		A

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

[x] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 12/28/06

FILE: 04 (District) CC (County) 4 (Route) 23.71/26.8 (PM)

SUB CONSULTANT: URS
PRIME CONSULTANT: URS
GENERAL PLAN DATED: 7/28/06
Report Date: 8/8/2006
Contract No.:
FDN PLAN DATED: 7/28/06
Structure Name: Utilities UC (Widen)
EA Number: 04-228501
Bridge Number: 28-0105

Submittal (*Check One*): [ ] 1st [X] 2nd [ ] 3rd [ ] 4th [ ] Other:

Report

1. LOTB B-20 is not revised as stated in the Response to reflect the groundwater table established by the piezometer.
2. LOTBs B-20 and B-21 are not revised as stated in the Response to reflect the change of exploration method with depth.
3. Groundwater elevations established by CPT are not shown as stated in the Response.
4. Section 5.2:
   (1) Soil profile presented in Table 2 and Figure 3 are not consistent. Please check and revise.
   (2) Elevations of existing ground surfaces on north and south sides of the proposed foundations are different. Lower elevation should be used to develop soil profile to be used for pile capacity analysis. Using highest elevation as the Report did will lead to the overestimate of capacity contributed by sandy material. Please revise soil profile and recommended pile tip elevations accordingly.
5. Please briefly discuss the reasons why spread footing is not recommended.
6. Section 7.3:
   (1) What are the soil parameters based to compute the equivalent fluid pressure for the recommended passive resistance? The recommended value seems too high.
   (2) Put "N/A" under column "Design Loading."

REGISTERED PROFESSIONAL ENGINEER
CAROLINE JINXIA CHEN
No. C 62438
Exp. 9/30/07
CIVIL
STATE OF CALIFORNIA

[x] Special Funded Project (OSFP) [ ] Local Assistance Project (OSFP) [ ] OSCM Project

Approval: C3 – Not Approved

OSFP/OSCM

Caroline Chen
Office of Geotechnical Design - West

cc: OGDx, Lab File Room (Sacramento) DES Specifications and Estimates (JStayton-4 copies) Structure Construction R/E Pending File

Revised 05/04

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

[x] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 09/28/06

FILE:

04	CC	4	23.71/26.8
District	County	Route	PM

Utilities UC (Widen)
Structure Name

04-228501	28-0105
EA Number	Bridge Number

(3) The nominal compression capacity presented in the Report is 800 kN, differing from 1200 kN presented on Plans. Please check and revise pile tips accordingly. Please note that pile length should not exceed 30 times pile diameter.
(4) If temporary casing is anticipated due to potential caving or groundwater is anticipated to encounter during construction, the proposed CIDH piles should have a minimum diameter of 600mm.

7. LOTBs: Items mentioned in the following comments are not changed as stated in the Response:
   (1) Please add note to indicate the type of hammer used.
   (2) Some symbols of soils do not match the legend of earth materials. Please check all and revise.
   (3) Boring B-21: For soil at elevation about 11m, "Push" doesn't seem to be consistent with description of "stiff to very stiff". If it is meant to be punch core, "push" should be removed.
8. LOTBs: Please add location (station and offset) to the CPTs.

Plans

9. Pile Data Table (PDT) and LOTBs should be updated accordingly.
10. PDT is not shown on the sheet as noted on General Plan. Please revise.

General comments

11. Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.

SR4(E) Widening Project Loveridge Road to Somersville Road – Utilities Undercrossing - EA 228501

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	February 28, 2007
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	September 28, 2006		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 95% PS&E**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
	Report					
1		LOTB B-20 is not revised as stated in the Response to reflect the groundwater table established by the piezometer.	LOTBs have been revised as stated in the response.	A		A
2	Section 8.4	LOTBs B-20 and B-21 are not revised as stated in the Response to reflect the change of exploration method with depth.	LOTBs have been revised as stated in the response.	A		A
3		Groundwater elevations established by CPT are not shown as stated in the Response.	LOTBs have been revised as stated in the response.	A		A
4	Section 5.2	(1) Soil profile presented in Table 2 and Figure 3 are not consistent. Please check and revise.	Table 2 has been revised to be consistent with Figure 3.	A		A
		(2) Elevations of existing ground surfaces on north and south sides of the proposed foundations are different. Lower elevation should be used to develop soil profile to be used for the pile capacity analysis. Using highest elevation as the Report did will lead to the over estimate of capacity contributed by sandy material. Please revise soil profile and recommended pile tip elevations accordingly.	The finish grade elevations on the north and south sides were 19.8 m and 19.1 m respectively. The lower elevation of 19.1 m was used in our pile capacity analysis. Please refer to Appendix E for calculation spread sheet.	A		A
5		Please briefly discuss the reasons why spread footing is recommended.	To avoid existing utilities, drilled piers are recommended as spread footings may potentially conflict with existing utilities.	A		A

SR4(E) Widening Project Loveridge Road to Somersville Road – Utilities Undercrossing - EA 228501

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	February 28, 2007
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	September 28, 2006		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 95% PS&E**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
6	Section 7.3	(1) What are the soil parameters based to compute the equivalent fluid pressure for the recommended passive resistance? The recommended values seems too high.	Agreed. The report has been revfised accordingly.	A		A
		(2) Put "N/A" under column "Design Loading"	Agreed. PDT will be revised accordingly.	A		A
		(3) The nominal compression capacity presented in the Report is 800 kN, differing from 1200 kN presented on Plans. Please check and revise pile tips accordingly. Please note that pile length should not exceed 30 times pile diameter.	The plans will be revised to be consistent with the report. Pile lengths are smaller than 30 times pile diameter.	A		A
		(4) If temporary casing is anticipated due to potential caving or groundwater is anticipated to encounter during construction, the proposed CIDH piles should have a minimum diameter of 600 mm.	Agreed. Since measured ground water elevations are deeper than calculated pile tip elevations, we do not expect that the ground water is to encounter during construction.	A		A
7	LOTBs	Items mentioned in the following comments are not changed as stated in the Response:		A		A
		(1) Please add note to indicate the type of hammer used.	LOTBs have been revised as stated in the response.	A		A
		(2) Some symbols of soils do not match the legend of earth materials. Please check all and revise.	LOTBs have been revised as stated in the response.	A		A

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	February 28, 2007
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	September 28, 2006		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 95% PS&E**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		(3) Boring B-21: For soil at elevation about 11 m, " Push" doesn't seem to be consistent with description of "stiff to very stiff". If it is meant to be punch core "Push" should be removed	LOTBs have been revised as stated in the response.	A		A
8		LOTBs: Please add location (station and offset) to the CPTs.	Agreed. Locations have been added to CPTs.	A		A
	Plans					
9		Pile Data Table (PDT) and LOTBs should be updated accordingly.	Pile Data Table has been updated accordingly.	A		A
10		PDT is not shown on the sheet as noted on General Plan. Please revise.	Agreed. General Plan has been revised accordingly.	A		A
	General					
11		Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.	Caltrans comments and responses to comments were provided in Appendix F with References in the previous submittals. In the final submission Caltrans comments and responses to comments are provided in Appendix G.	A		A

CONTRA COSTA TRANSPORTATION AUTHORITY

California Department of Transportation

#4

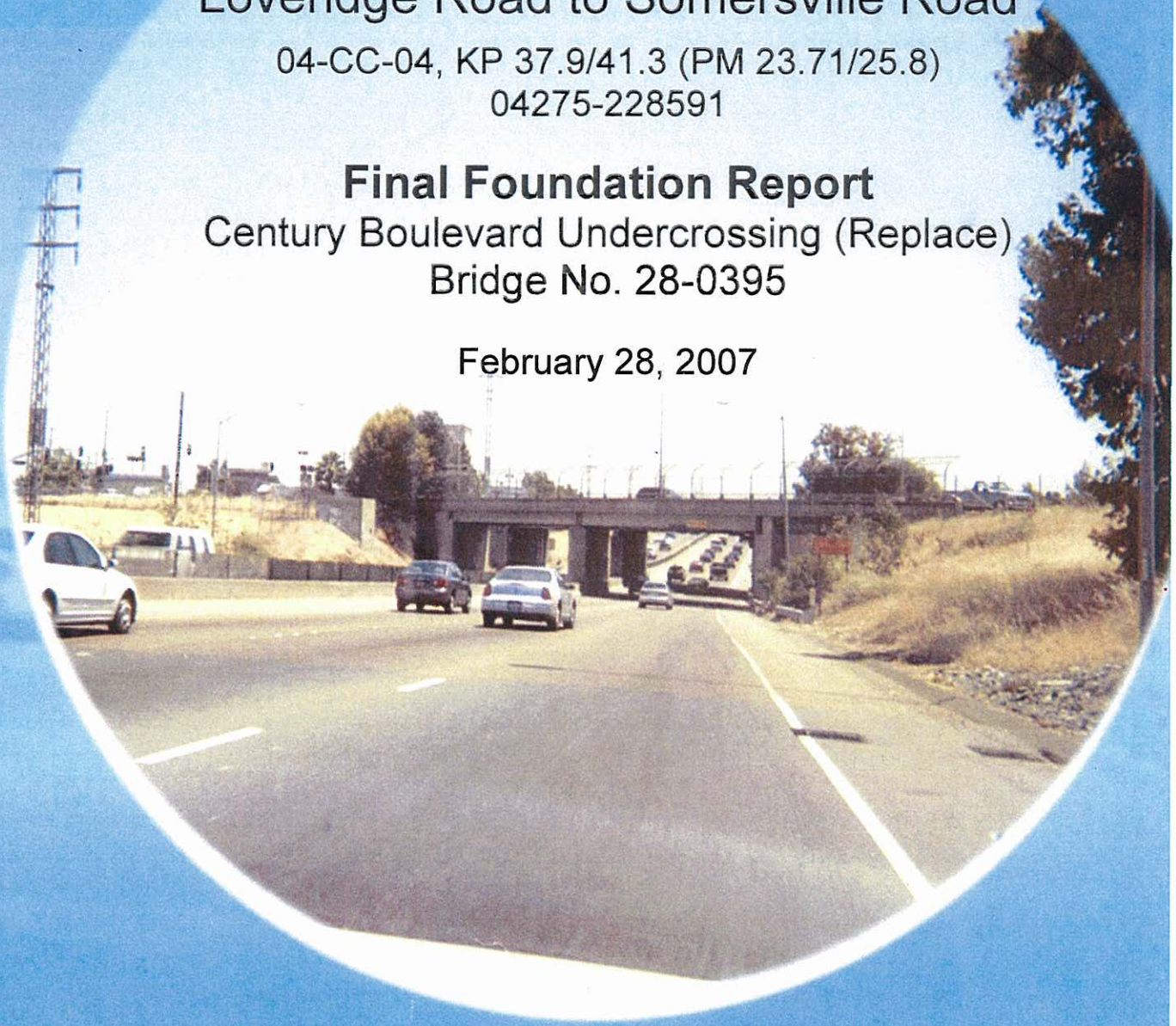
SR4 (East) Widening Project
Loveridge Road to Somersville Road

04-CC-04, KP 37.9/41.3 (PM 23.71/25.8)
04275-228591

Final Foundation Report

Century Boulevard Undercrossing (Replace)
Bridge No. 28-0395

February 28, 2007



URS

URS

February 28, 2007
Project No. 26814911

Ms. Susan Miller
Project Director
Contra Costa Transportation Authority
3478 Buskirk Avenue, Suite 100
Pleasant Hill, CA 94523

Subject: **SR4 (East) Widening Project**
Loveridge Road to Somersville Road
Foundation Report: Century Boulevard Undercrossing (replace)

Dear Ms. Miller,

URS is pleased to provide you with this Foundation Report for the Century Boulevard Undercrossing (Bridge No. 28-0395) replace project located in Antioch, California.

This report has been prepared in accordance with Caltrans guidelines for foundation reports, and replaces our foundation report (95% Submittal) for this structure dated August 8, 2006.

It has been our pleasure to be of service to Contra Costa Transportation Authority on this project. If you should have any questions, please contact the undersigned.

Sincerely,
URS CORPORATION

Philip Meymand, Ph.D., G.E.
Project Manager

Said Salah-Mars, Ph.D., P.E.
Engineering Department Manager

REGISTERED PROFESSIONAL ENGINEER
PHILIP J. MEYMAND
No. GE2596
Exp. 6-30-07
GEOTECHNICAL
STATE OF CALIFORNIA

Enclosure

URS Corporation
1333 Broadway, Suite 800
Oakland, CA 94612-1924
Tel: 510.893.3600
Fax: 510.874.3268

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The proposed State Route (SR) 4 (East) Widening Project - Loveridge Road to Somerville Road will widen SR4 from its current four lanes to an eight-lane facility from west of Loveridge Road (KP 37.9) to the Somersville Road Interchange (KP 42.0). This Project is part of Contra Costa Transportation Authority's (CCTA's) overall plan to continue the widening of SR4 further into East County and is consistent with the Phase 1 Implementation Plan recommendation made in the SR4 (east) Railroad Ave. to SR 160 Major Investment Study (MIS).

The proposed project will widen the freeway from two to four lanes providing three mixed-flow and one High Occupancy Vehicle (HOV) lane in each direction. From SR 242 to west of Loveridge Road, the above improvements have either been completed, or are under construction. The improvements will conform to the existing four lane facility just before the Somersville Road overcrossing. Some of the significant features of this project include:

- Widening and reconstruction of the Loveridge Road interchange. The existing Loveridge Road Overcrossing and Camp Stoneman Road Underpass will be removed.
- Reconstruction of the eastbound diagonal on- and off-ramps at the Loveridge Interchange.
- Improvements at the intersection of Loveridge Road with California Avenue/ North Park Boulevard to accommodate the projected traffic volumes and increase public safety.
- Reconstruction of the Century Boulevard undercrossing structure.
- Provisions in the freeway median and at the Loveridge Interchange to accommodate a future mass transit extension.
- Reconstruction of the storm water pump station located in the northwest corner of the Loveridge Interchange to accommodate new construction features.
- Construction of a number of retaining and sound walls.

The subject of this foundation report (FR) is the Century Boulevard undercrossing structure (Bridge No. 28-99 R/L) located in Antioch, California. Figure 1 shows the site location plan for this structure.

1.1 PURPOSE AND SCOPE OF THIS STUDY

Preliminary foundation recommendations for the Century Boulevard undercrossing structure were provided in our preliminary foundation report dated March 07, 2005. The purpose of this FR is to document existing foundation conditions, describe the results of the new field investigations and laboratory tests and make foundation recommendations.

1.2 PROJECT SCOPE OF WORK

The scope of work for this study includes:

- Perform site reconnaissance
- Review of as-built bridge drawings, logs of test borings (LOTBs), geologic maps, foundation report, and other existing information
- Perform subsurface investigation and laboratory testing program

- Prepare PFR and this FR, including:
  - Description of site geology and evaluation of geologic hazards;
  - Assessment of subsurface conditions based on available information;
  - Development of seismic design criteria;
  - Evaluation of capacity of existing foundations;
  - Foundation recommendations for proposed structure; and
  - Construction considerations.

2.1 HISTORY AND SUPERSTRUCTURE

The existing Century Boulevard Undercrossing is a single-span structure originally constructed in 1953. The structure consists of a reinforced concrete slab on closed abutments with straight wing walls.

2.2 EXISTING FOUNDATIONS

The abutments for the original 1953 bridge were founded on spread footings designed with an allowable soil bearing pressure of 120 kPa. The existing foundation details for the structure are summarized in Table 1.

Table 1
Existing Foundation Information

Support Location	Minimum Width (m)	Avg. Bottom of Footing Elevation (m)	Allowable Bearing Capacity (kPa)
Abut 1	2.3	15.3	120
Abut 2	2.3	15.3	120

As described above, the abutments of the existing bridge are founded on spread footings. We estimate the ultimate bearing pressure of the existing spread footings as 360 kPa (allowable bearing capacity 120 kPa).

2.3 PROPOSED STRUCTURE

The proposed bridge structure consists of a single-span cast-in-place pre-stressed concrete box structure and lowering the profile of Century Boulevard to meet vertical clearance requirements. The replacement structure will accommodate planned widening of Century Boulevard to provide two through lanes in each direction.

3.1 REGIONAL GEOLOGY

The SR4 project is located near the boundary between the Central Valley and the Coast Range physiographic province, at the northern end of the Diablo Range. The Coast Ranges are characterized by north to northwest trending elongated mountain ranges and intervening valleys. It is presumed that the Franciscan Complex, which is in fault contact with the Great Valley sediments of the Central Valley province to the east, is the basement bedrock that underlies all of Contra Costa County (USGS, 1997).

Younger sedimentary deposits from Paleocene to Pleistocene in age (65 million to 0.01 million years old or myo) are widely distributed along the margin of the Diablo Range and along the foothills through which the SR 4 alignment crosses and skirts around (Graymer, et al, 2002). The higher slopes to the immediate south and southeast of the project area correspond with the northern extension of the Pliocene-age (2 - 7 myo) Tulare Formation. Materials of this formation are described as poorly consolidated, non-marine sandstone, siltstone, and conglomerate, with some tuff (volcanic ash deposits) included.

Other formations to the south include the Pliocene Lawlor Tuff, the Miocene (7 – 26 myo) Neroly and Cierbo Sandstones, the Eocene (38 – 54 myo) Markley Formation, and the division D sandstone member of the Paleocene (54 – 65 myo) Meganos Formation (USGS, 1994).

More recent alluvial fan deposits eroded from the Diablo Range to the south, and alluvium and bay mud deposits along the Sacramento River margin in turn locally overlie these sedimentary rocks.

3.2 SEISMOTECTONIC SETTING

The SR 4 project lies within a domain of north-northwest oriented right-lateral strike-slip faulting, the San Andreas fault system, that accommodates the majority of the plate motion between the Pacific and North American plates. In addition to the right-lateral strike-slip deformation, a component of compression oriented normal to the plate boundary is manifest as a series of folds and thrust faults, including the Coast Range-Sierran Block Boundary zone, oriented parallel and sub-parallel to the faults of the San Andreas system. In contrast, regional compression in the Mount Diablo region, within which the SR 4 project is situated, has a more northerly orientation, which has resulted in a series of folds and thrusts that are at a distinct oblique angle to the main strike-slip faults.

The San Francisco Bay area is a region of relatively high seismic activity. This historical seismicity is associated with the active faults of the San Andreas system. During historical times there have been almost 8,000 earthquakes of Richter local magnitude (M_L) 2.0 or larger, of which 14 earthquakes were **M** 6.0 or greater. These include the 1836 M_L 6¼ event on the San Andreas fault; the 1868 M_L 6.8 event on the southern Hayward fault; the 1889 **M** 6¼ Collinsville earthquake, possibly on the Pittsburg-Kirby Hills fault; the 1898 M_L 6.7 'Mare Island' earthquake; the 1906 **M** 7.9 'Great San Francisco Earthquake' on the San Andreas fault; a 1911 M_L 6.6 event on the southern Calaveras fault; and the 1989 **M** 7.0 Loma Prieta event, located on a fault paralleling the Santa Cruz Mountains segment of the San Andreas fault.

3.3 SITE GEOLOGY

The sediments in the project area are a combination of surficial deposits of Holocene to Pleistocene (recent to 2 million years old) alluvium, alluvial fan and terrace deposits consisting of medium dense to dense sandy gravel or gravelly sand that generally grades finer, and medium dense sand that fines upward to sandy or silty clay (USGS, OFR 97-98).

4.1 PREVIOUS FIELD EXPLORATIONS

Previous field explorations in the area of the proposed improvements were completed in August 1951 (Boring B-1) for the original construction. Boring B-1 encountered about 1.5 m of fill consisting of brown clayey sand. Below the fill, native soil consisting of sandy/silty clay and sandy/clayey silt with a layer of silty sand was encountered to the maximum explored depth of 15.2 m. Groundwater was not encountered at the time of drilling. The log of test boring (LOTB) obtained from this subsurface investigation is provided in Appendix A.

4.2 CURRENT FIELD EXPLORATIONS

The current field investigation for the proposed reconstruction of the Century Boulevard Undercrossing consisted of two rotary-wash borings (B-20 & B-21) and two CPT soundings (CPT-01 & CPT-02). The borings were performed on January 04 and 10, 2005, and the CPT soundings were advanced on July 21, 2005. The boring locations were surveyed and the coordinates are provided in the LOTBs. CPT-01 was located about 3.5 m west of the edge of Century Boulevard and about 20 m south of the edge of west bound SR4. CPT-02 was located 1.2 m east of the edge of Century Boulevard and about 6 m north of bore hole B-21. The approximate CPT locations are shown on Figure 2. The CPT soundings were located in the field based on hand tape measurement from available reference points.

Taber Consultants from West Sacramento, California performed the drilling of the rotary wash borings. Mr. Phil Respess and Mr. Sathish Murugaiah of our firm supervised the drilling and logged the borings in general accordance with the Caltrans Soil & Rock Logging Classification Manual (1996).

Both borings were drilled using a truck-mounted Diedrich D-120 rig equipped with a 63.5 kg automatic trip hammer. Borings B-20 and B-21 were advanced to depths of 6.1 m and 13.7 m, respectively, using a 102 mm solid-stem auger, and subsequently advanced to a depth of about 27.9 m by the rotary wash method using a 124 mm diameter drag bit.

The borings were generally sampled at 1.5 m intervals. A Modified California split-spoon drive sampler (50.8 mm fitted with four 101.6 mm-long, 49 mm ID, brass liners) was used to sample in clayey material. A 0.6 m long split barrel SPT drive sampler (35 mm -ID) was used to sample granular materials. As noted above, all samplers were driven using a 63.5 kg safety hammer dropping 762 mm. All samples were carefully sealed, labeled, and transported to our Geotechnical laboratory in Pleasant Hill, California for review and testing.

Boring B-20 encountered about 1.6 m of fill consisting of a 100 mm thick gravel base and sandy lean clay. Below the fill, alluvium consisting predominantly of medium stiff to stiff sandy clay and silty clay with layers of medium dense silty sand and silt was encountered to the maximum explored depth of 27.9 m. Groundwater was not encountered in the boring prior to switching to the rotary wash drilling method at a depth of about 6.1m.

Boring B-21 encountered about 0.2 m of fill consisting of sand and gravel. Below the fill, alluvium consisting predominantly of medium stiff to stiff sandy clay and silty clay with layers of loose to medium dense silty/clean sand and silt was encountered to the maximum explored depth of 27.9 m. Groundwater was encountered in the boring at a depth of about 13.3 m at the time of drilling.

On completion of the drilling, a piezometer was constructed in Boring B-20 as shown on the boring log and the ground surface was restored to its initial elevation. On completion of the drilling, Boring B-21 was backfilled with cement grout, and the ground surface was restored to its initial elevation. Excess drill cuttings and fluid from the boring were contained in 55-gallon drums and were hauled off for disposal.

Gregg Drilling and Testing, Inc from Martinez, California performed the CPT investigations. Mr. Segaran Logeswaran of our firm supervised the CPT investigations in accordance with revised (2202) ASTM standards (D 5778-95). CPT-01 and CPT-02 were each advanced to a depth of 18.3 m. Both CPT tests were conducted using a 20-ton capacity cone with a tip area of 15 square centimeters and a friction sleeve area of 225 square centimeters. The cone is designed with an equal area ratio of 0.85.

The cone takes measurements of cone bearing (q_c), sleeve friction (f_s) and dynamic pore water pressure (u_2) at 5-cm intervals during penetration to provide a nearly continuous hydrogeologic log.

Both CPT soundings encountered conditions that correlate to mostly clayey silt with interbedded silt and silty clay layers. A 0.3 m thick silty sand layer was encountered in CPT-01 at a depth of 6.2 m. A pore pressure dissipation test was conducted at a depth of 16.9 m in CPT-01 and measured hydrostatic water pressures.

The Log of Test Borings (LOTB's) and the CPT logs obtained from the subsurface investigation are provided in Appendix B.

4.3 LABORATORY TESTING

Laboratory soil tests were performed on soil samples recovered from field exploration to evaluate their engineering properties. The tests were performed in accordance with the ASTM Standards for Testing. The following tests were performed:

- Water content (ASTM Test Method D2216)
- Dry unit weight (ASTM Test Method D2937)
- Atterberg limits (ASTM Test Method D4318)
- Particle size distribution analysis (Gradation) (ASTM Test Method D422)
- Unconfined compression (UC) (ASTM Test Method D2166)
- Unconsolidated undrained triaxial (UU) (ASTM Test Method D2850)
- One-dimensional consolidation (ASTM Test Method D2216)

Results of the laboratory tests are presented in Appendix C, and are also shown on the boring logs (Appendix B) at the corresponding sample locations.

5.1 SITE TOPOGRAPHY

Development of the freeway, bridges and underpassing has resulted in the placement of fill embankments. The original ground surface is relatively flat, ranging in elevation from about 17 to 19 meters. Vegetation in the vicinity of the proposed improvements consists of grasses and shrubs.

5.2 SUBSURFACE CONDITIONS

Construction of the roadway embankment resulted in the placement of approximately 1.7 m of fill on the north and south sides of the crossing. Results of the subsurface investigations indicate that the underlying native soils consist of alluvium to the maximum explored depth. The alluvium is composed of predominately stiff sandy and silty clay (consistencies vary from soft to hard) with layers of medium dense silty sand.

Based on the results of our current investigation, Caltrans standards, and on our previous experience with similar soils, generalized soil engineering parameters were developed for the purposes of this foundation evaluation and are tabulated below. A generalized geologic cross-section was also prepared, as is shown in Figure 3.

Table 2
Soil Parameters

Soil Type	Elevation of Top of the Layer (m)	Layer Thickness (m)	Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (deg)
Embankment Fill	24.0	6	20.1	0	40
Fill	18.0	1.5	18.8	30	0
Clay	16.5	2.5	18.8	52.5	0
Sand	14.0	2.5	18.8	0	33
Clay	11.5	13.5	18.1	143.5	0
Sandy Clay	-2.0	5.5	19.1	0	30
Hard Silt	-7.5	1.5	18.8	200	0

5.3 GROUNDWATER CONDITIONS

Groundwater was not encountered in the previous exploration, however groundwater was encountered at an elevation of about 4.0 meters during the subsurface investigations conducted in January of 2005 and at an elevation of about 4.4 meters during the subsurface investigations conducted in July of 2005. According to the groundwater measurements taken in January and March of 2006 at the piezometer constructed in Boring B-20, the groundwater was at the elevation of about 4.4 m and 4.7m respectively. The recommended design groundwater elevation is 5 m.

6.1 SEISMIC DESIGN METHODOLOGY

The seismic design methodology adopted for this project is based on the following current Caltrans standards:

1) Seismic Design Criteria (SDC), v 1.4, June 2006

2) Guidelines for Structures Foundation Reports, v 2.0, dated March 2006

3) California Seismic Hazard Map (Mualchin, 1996)

6.2 PEAK BEDROCK ACCELERATION

The closest faults to the Century Boulevard undercrossing are the Coast Ranges Sierran Block boundary zone (CRSB), the Antioch, and the Greenville faults. The faults are designated with the Maximum Credible Earthquake (MCE) magnitudes of 7.0, 6.75, and 7.25, respectively by the California Seismic Hazard Map (Mualchin, 1996). The locations of these faults and associated peak bedrock acceleration (PBA) contours were obtained from the California Seismic Hazard Map and transferred to a topographical map showing the Century Boulevard undercrossing. The closest mapped fault on the California Seismic Hazard Map is the Antioch fault, but the California Geological Survey does not consider this fault active. It had previously been mapped in 1976 as an Alquist-Priolo fault rupture zone, but more recent studies resulted in the fault no longer being classified as active (Wills, 1991). Even if the Antioch fault were considered active, the ground motions would be lower than those from the CRSB due to the larger magnitude and reverse style of faulting for the CRSB. The site is located within the 0.5 g PBA contour.

Table 3
Seismic Source Parameters

Fault	Type	MCE	Distance (km)	Near Field Effects?	Fault Type Effects?	PBA (g)
CRSB	Reverse	7.0	6.25	Y	Y	0.5
Greenville	Strike-slip	7.25	7.5	Y	N	-
Antioch	Strike-slip	6.75	5.5	Y	N	-

6.3 SITE SOIL PROFILE

Boring logs from the previous and current field explorations for the Century Boulevard undercrossing were reviewed. The weighted average of the recorded SPT blow counts over the depth of exploration (to a maximum depth of approximately 27 m) was used to determine the average standard penetration resistance value (N), which was found to be 19 (uncorrected). Although the depth of exploration did not reach a depth of 30 m, our understanding of the regional geology indicates the soils become stiffer and denser with depth. The standard penetration resistance was used to classify the soil profile based on the guidelines given in SDC Table B.1. Accordingly, this site is classified as a stiff soil site or Soil Profile Type D.

6.4 FAULT TYPE AND NEAR-FIELD SPECTRAL ACCELERATION INCREASES

The technical report that accompanies the California Seismic Hazard Map (Mualchin, 1996) indicates that the controlling fault, CRSB, has 'reverse' mode of fault displacement. To verify the PBA estimated using the seismic hazard map, PBA was also determined using the attenuation relationship presented by Sadigh et al. (1997) considering the reverse style of faulting for CRSB as recommended by Caltrans, Guidelines for Structures Foundation Reports, v 2.0 (2006). We recommend using the PBA of 0.6 g as calculated using the Sadigh et al. (1997) for this study. In addition, since the project site is less than 15 km from the nearest active fault, design spectral accelerations should be modified to account for near-fault effects as follows:

Period (sec)	Increase in Spectral Acceleration (%)
< 0.5	0
0.5 – 1.0	0 – 20 (determined by linear interpolation)
≥1	20

This does not include adjustments for bridges with fundamental periods of vibration greater than 1.5 seconds, which does not apply to this short structure.

6.5 DESIGN ACCELERATION RESPONSE SPECTRUM

Based on Caltrans SDC (Version 1.4), the design seismic response spectrum can be estimated with spectral acceleration values generated by:

- Soil Profile Type D
- Maximum Credible Earthquake (MCE) Magnitude 7.25 ± 0.25
- Peak bedrock acceleration 0.6 g (includes ARS increase for fault type)
- ARS increase for near-field effect

The Design Acceleration Response Spectrum (ARS) corresponding to Soil Type D, magnitude of controlling event 7.25 ± 0.25, and a PBA of 0.6 g was obtained from SDC Figure B.8 and modified to account for near field effects as described above. The Design Acceleration Response Spectrum is attached as Figure 4, and the spectral values are provided in Table 4.

Table 4
Spectral acceleration values (PBA = 0.6 g, M = 7.0, Soil Type D)

T (Sec)	S_a* (g)	S_a** (g)	S_a*** (g)
0.00	0.60	0.60	0.60
0.01	0.60	0.60	0.60
0.02	0.60	0.60	0.60
0.03	0.60	0.60	0.60
0.04	0.60	0.60	0.60
0.05	0.60	0.60	0.60
0.10	1.14	1.14	1.14
0.13	1.34	1.34	1.34
0.15	1.43	1.43	1.43
0.20	1.55	1.55	1.55
0.25	1.57	1.57	1.57
0.30	1.57	1.57	1.57
0.35	1.56	1.56	1.56
0.38	1.55	1.55	1.55
0.50	1.47	1.47	1.47
0.63	1.35	1.42	1.42
0.75	1.23	1.35	1.35
0.88	1.12	1.29	1.29
1.00	1.00	1.20	1.20
1.13	0.89	1.07	1.06
1.25	0.80	0.96	0.95
1.38	0.70	0.84	0.85
1.50	0.64	0.77	0.77
1.63	0.58	0.69	0.70
1.75	0.53	0.63	0.63
1.88	0.50	0.59	0.58
2.00	0.45	0.54	0.53
2.13	0.41	0.49	0.49
2.25	0.38	0.45	0.45
2.38	0.35	0.42	0.42
2.50	0.32	0.39	0.39
2.63	0.31	0.37	0.36
2.75	0.28	0.34	0.34
2.88	0.27	0.32	0.31
3.00	0.25	0.30	0.29
3.13	0.23	0.28	0.27
3.25	0.21	0.26	0.26
3.38	0.20	0.24	0.24
3.50	0.20	0.24	0.23
3.63	0.18	0.22	0.22
3.75	0.17	0.21	0.20
3.88	0.16	0.20	0.19
4.00	0.15	0.18	0.17

*From SDC **Modified for Near-field effects ***Modified to obtain a smooth curve

7.1 LIQUEFACTION

Liquefaction is a phenomenon in which a sudden increase in pore pressure due to strong earthquake shaking causes relatively loose, cohesionless soils below the water table to undergo temporary but substantial loss of shear strength. Liquefaction can result in loss of foundation bearing capacity, differential settlements, and lateral spreading.

Based on a review of the liquefaction susceptibility map of the San Francisco Bay region (Knudsen et al., 2000), the alluvium underlying the SR 4 Century Boulevard undercrossing is classified as having a "low" liquefaction susceptibility.

Our initial soil investigation (Borings B-20 and B-21) identified a thin layer of potentially liquefiable cohesionless soil but did not provide adequate information (SPT blowcounts) to perform a liquefaction susceptibility analysis. In order to obtain a continuous profile, we recommended additional CPT investigations be performed in our preliminary foundation report. The data obtained from the CPTs was used to evaluate the potential for liquefaction at the site. The liquefaction susceptibility analysis was performed using the CPT data in accordance with the methods proposed by Robertson and Wride (1997) using an iterated soil behavior index (I_c) value and applied corrections for layer thickness. Soils having an I_c value of 2.6 and above were considered to be sufficiently clayey and non-liquefiable.

Based on the discussion in Section 6.2, the design earthquake used to evaluate liquefaction potential has a peak ground acceleration of 0.6g, with a maximum magnitude of 7.0. The design groundwater elevation of 5 m (depth of 13 m) was used for calculating liquefaction potential. Liquefaction potential is predicted at depths where the earthquake loading exceeds the soil resistance, or when the factor of safety against liquefaction, expressed as:

FS_L = *(cyclic shear stress required to cause liquefaction) / (equivalent cyclic shear stress induced by earthquake)*

is less than 1. The California Geological Survey recommends that liquefaction potential be considered if the factor of safety is less than 1.3. Based upon the results of our analysis, the probability of liquefaction within the sand zones encountered in the soil profile is considered to be low except for a 1 m thick layer at a depth of 17 m which is susceptible to liquefaction.

In order to compute post liquefaction settlements from the CPT data, the CPT tip resistance was converted to N_{60} values and normalized for overburden pressure using the methods of Robertson and Campanella (1985 and 1988). The method developed by Tokimatsu and Seed (1987) was developed for clean sands. It is commonly understood that an elevated fines content in sand will reduce the observed N_{60} blowcounts for a given relative density. A correction of the N_{60} blowcounts was applied based upon the fines content as suggested by Seed and by Stark and Mesri (1992). As suggested by Robertson and Wride (1997), soil having a normalized friction ratio (F) less than 0.5 and an I_c value of between 2.36 and 1.64 was considered to be "clean sand" and no correction to N_{60} was applied. The volumetric strains were estimated from the computed clean sand equivalent blow count and the magnitude scaled cyclic stress ratio. The analysis of CPT data shows negligible seismically induced settlements of the structure at locations where liquefaction occurs. The results of the liquefaction analysis are contained in Appendix D.

Given the depth and limited extent of the soils susceptible to liquefaction, surface expression of liquefaction during a seismic event is anticipated to be negligible and we do not expect it to have an adverse impact on the load-carrying capacity of the proposed foundations. Since the potentially liquefiable zones lie below the tip of the piles recommended in Section 8.3, we do not expect deep foundations to experience any loss of skin friction or downdrag due to liquefaction.

7.2 FAULT RUPTURE

No active faults have been mapped underlying the SR 4 alignment between Loveridge Road and Sommersville Road. The project site is not with a Alquist-Priolo special studies zones (CGS, 2003). The potential for surface fault rupture at the site is therefore considered to be low.

7.3 LANDSLIDES AND SLOPE FAILURE

Due to the relatively flat topography at the site, landsliding is not considered a hazard. Slumping or distress of the embankment fill slopes at the site was not noted during the site reconnaissance.

7.4 GROUND SUBSIDENCE/HEAVE

Due to the relatively dense/stiff character of the underlying alluvium, the potential for ground subsidence and heave is considered to be low.

7.5 FLOOD

FEMA flood zone maps (http://www.esri.com/hazards) indicate that the site is located outside of the 100- and 500-year flood plain. Therefore the potential for flooding hazard is considered to be very small.

7.6 SCOUR

Because the existing and proposed structure supports are located outside waterways, scour is not an issue for foundation design.

7.7 CORROSION

As part of our study, near surface soil samples were collected for corrosion testing at four locations at the Century Boulevard Undercrossing site located in the vicinity of the subject site. The results of the tests are presented in Appendix E. The samples were analyzed for corrosivity by V&A Consulting Engineers, Inc. The soil samples were analyzed for pH, resistivity, chlorides and sulphates. The results of the sulfate, chloride, pH and resistivity testing indicate the near surface site soil is considered noncorrosive to buried concrete, reinforced concrete and mortar coated steel pipe.

8.1 DESIGN ASSUMPTIONS

The generalized geologic profile with soil stratigraphy, soil engineering parameters, and estimated groundwater level is presented as Figure 3. This generalized soil profile was the basis for developing foundation recommendations for the proposed widening.

8.2 FOUNDATION ALTERNATIVES

Driven precast concrete piles – Driven precast concrete piles are a suitable foundation alternative from the technical standpoint, but have certain constructability disadvantages. Precast concrete piles offer advantages in shallow groundwater and caving soil conditions, and are generally more economical that other pile types. However, as noted in Caltrans Memo To Designers 21-19, a larger work area is required to install driven piles than for CIDH piles (diameter < 24 in). Driven piles have greater noise and vibration impacts, but those considerations may not be pertinent to this project.

Cast-in-drilled-hole (CIDH) piles – CIDH piles have the advantages of easy penetration into dense/hard soil zones, the availability of larger diameters for increased lateral capacity (such as for retrofit applications), and adaptability of length to variable subsurface conditions. The presence of shallow groundwater or caving soils can complicate the use of CIDH piles. From the constructability standpoint, CIDH piling rigs are more economical to mobilize than pile driving rigs, can work in limited access conditions, and have significantly lower noise and vibration impacts during pile installation than driving operations.

Driven pipe piles or cast-in-steel-shell (CISS) piles – Driven pipe piles are technically feasible for support of the bridge abutments, but have the same constructability limitations as driven precast concrete piles. While pipe piles or CISS piles can adjust pile diameter and wall thickness to obtain increased lateral stiffness, they have a disadvantage owing to the high cost of steel.

8.3 PROPOSED FOUNDATIONS

Driven precast concrete piles are the recommended foundation system for this structure. Details for the proposed foundations are summarized in Table 5.

Pile capacities were computed using the program Driven 1.2 (2001). End bearing was neglected for pile tips on Clay. The Driven analyses are contained in Appendix E.

Pile driving should satisfy the field acceptance criteria currently used by Caltrans. The following Gates formula can be used verify the ultimate capacity.

$$Q_u = [7\sqrt{E_r}\log(10N_b)] - 550$$

where,

E_r = Rated Energy (Joules)

Q_u = Ultimate Capacity (kN)

N_b = Number of blows per 25 mm of penetration

Table 5
Pile Data Table

Location	Pile Type/ Size	Design Loading (kN)	Nominal Capacity (kN)		Design Tip Elevations (m)*	Specified Tip Elevations (m)
			Compression	Tension		
Abut 1 +B.O.F=15.950	Class 625 Alt "X" (355 mm)	600	1200	0	5.4(1) 10.0(3)	5.4
Abut 2 B.O.F=15.950	Class 625 Alt "X" (355 mm)	600	1200	0	5.4(1) 10.0(3)	5.4
Abut 2R B.O.F=17.540	Class 625 Alt "X" (355 mm)	600	1200	0	7.4(1) 9.0 (3)	7.4
Abut 2R B.O.F=18.740	Class 625 Alt "X" (355 mm)	600	1200	0	8.4(1) 10.2(3)	8.4

* Design tip elevation is controlled by the following demands:
(1) Compression, (2) Tension, (3) Lateral Loads
+B.O.F = Bottom of footing elevation.

Also presented in Table 5 are the design tip elevations for lateral (service) loads of 110 kN for abutments 1 and 2 and 90 kN for wing walls. The computer program LPILE Plus 4.0M was utilized to analyze the individual pile response to applied lateral and axial loads with a series of nonlinear springs that are internally generated by the program as a function of user-specified soil properties. The piles were modeled according to Caltrans Standard plan B2-8. In addition, the piles were modeled with pinned head conditions. LPILE data is included in Appendix E.

For computing the lateral resistance of piles arrayed in groups, a group efficiency factor should be applied for pile lateral resistance in the direction of loading. For pile spacing of 5 diameters or greater, an efficiency factor of 100% shall be applied; for pile spacing of 4 diameters, an efficiency factor of 80% shall be applied; and for pile spacing of 3 diameters, an efficiency factor of 60% shall be applied.

For abutments constructed with compacted structural backfill, passive resistance may be developed by the abutment walls. To estimate resistance to lateral loads according to Caltrans Seismic Design Criteria (V1.4), an equivalent fluid unit weight of 140 kN/m^3 (up to a maximum pressure of 168 kPa) can be used to calculate the ultimate passive pressure; however, resistance offered by the upper 0.30 m of soil should be neglected when computing passive soil resistance.

8.4 APPROACH EMBANKMENTS

The existing approach embankments at the Century Boulevard will be extended to accommodate the proposed widening. The proposed new widening will add two lanes to the outside of the existing structure. The planned approach embankments will be approximately 5 m high. The approach embankment will be constrained on three sides by retaining walls and have a side slopes of 2 H: 1V (horizontal: vertical) towards the south-east side.

Structure approach embankment material is expected to be imported from off-site sources. Native soils and existing fill materials (less any surficial debris or organic material) are expected to be suitable for incorporation into new embankment fills but it should be noted that local borrow sources have not been evaluated in this study. In general, all embankment materials should conform to Caltrans Standard Specifications.

Planned embankment slopes are anticipated to be generally 2H: 1V or flatter. Such slopes are expected to be appropriately stable. Overside run-off should be controlled by use of curbs and/or dikes. Slopes should be vegetated to minimized erosion potential. Where new fill is to be placed onto existing fill slopes or natural slopes exceeding 5H: 1V it should be placed on discrete benches cut fully into existing fill below any loose/soft or otherwise unsuitable materials.

We estimate long-term consolidation settlements for the proposed extension of the embankments will be on the order of 7 cm. We estimate differential settlements between the bridge and embankment will be less than 1 cm. We anticipate that both north and south embankment extensions will be constructed in one phase, and that a sufficient waiting period will occur prior to the construction of the foundation system and the bridge in order to reduce net differential settlement between the existing and widened structure. We recommend that a 120 day waiting period be implemented after embankment construction prior to bridge construction to minimize the effects of differential settlement. We expect that the 50% of the settlement will be completed during the 120 day waiting period. The progress of fill settlement may be monitored using settlement monuments. As a result of this, in our opinion, downdrag on the piles will be negligible. Depending upon construction staging, wick drains and/or surcharge loading may be employed to accelerate the rate of settlement.

Grading is expected to be performed in accordance with the latest edition of Caltrans Standard Specifications, including Section 19. Within 50 m of proposed bridge abutments, all fill should conform to structure approach embankment material and should be placed to at least 95% relative compaction (CTM 216) per Caltrans Standard Specifications. All other embankment fill at least 0.8 m below finished grade should be placed to at least 90% relative compaction (CTM 216). Expansive soil shall be excluded from the embankment zone shown in the attached Figure 5.

8.5 CONSTRUCTION CONSIDERATIONS

Potential construction considerations are expected to include:

- Physical conflicts: resolve potential conflicts with locations of new bridge supports and all existing facilities such as utilities.
- Loading conflicts: resolve potential conflicts with loading imposed on existing facilities by new bridge foundations or approaches.

- Settlement of approach fills.
- Jetting or predrilling for prestressed precast concrete driven piles installation shall not be permitted except where piles are to be installed through embankment to be constructed. At these locations, piles shall be predrilled through embankment material in accordance with Sec 49-1.06 of the standard specifications.

The opinions, conclusions and recommendations presented herein are based on subsurface information developed by URS and others. The recommendations presented in this report are based on the assumption that the soil and geologic conditions do not deviate substantially from those anticipated by the information contained in the existing logs of test borings. If any variations are encountered during construction, the Geotechnical Professional should be contacted so that supplemental recommendations can be made.

If existing facilities, utilities, soils/bedrock conditions, road/structure distress, slope distress or groundwater/seepage conditions other than those noted in this report are present on the site, then their presence was not known, or was not considered in the preparation of this report. Locating utilities and evaluating potential utility interference is outside the scope of this report. Individuals utilizing this report shall inform URS Corporation if they are aware of any additional facilities or site conditions so that their presence and impact upon the project (or vice-versa) can be properly evaluated and recommendations modified to address geotechnical issues as necessary.

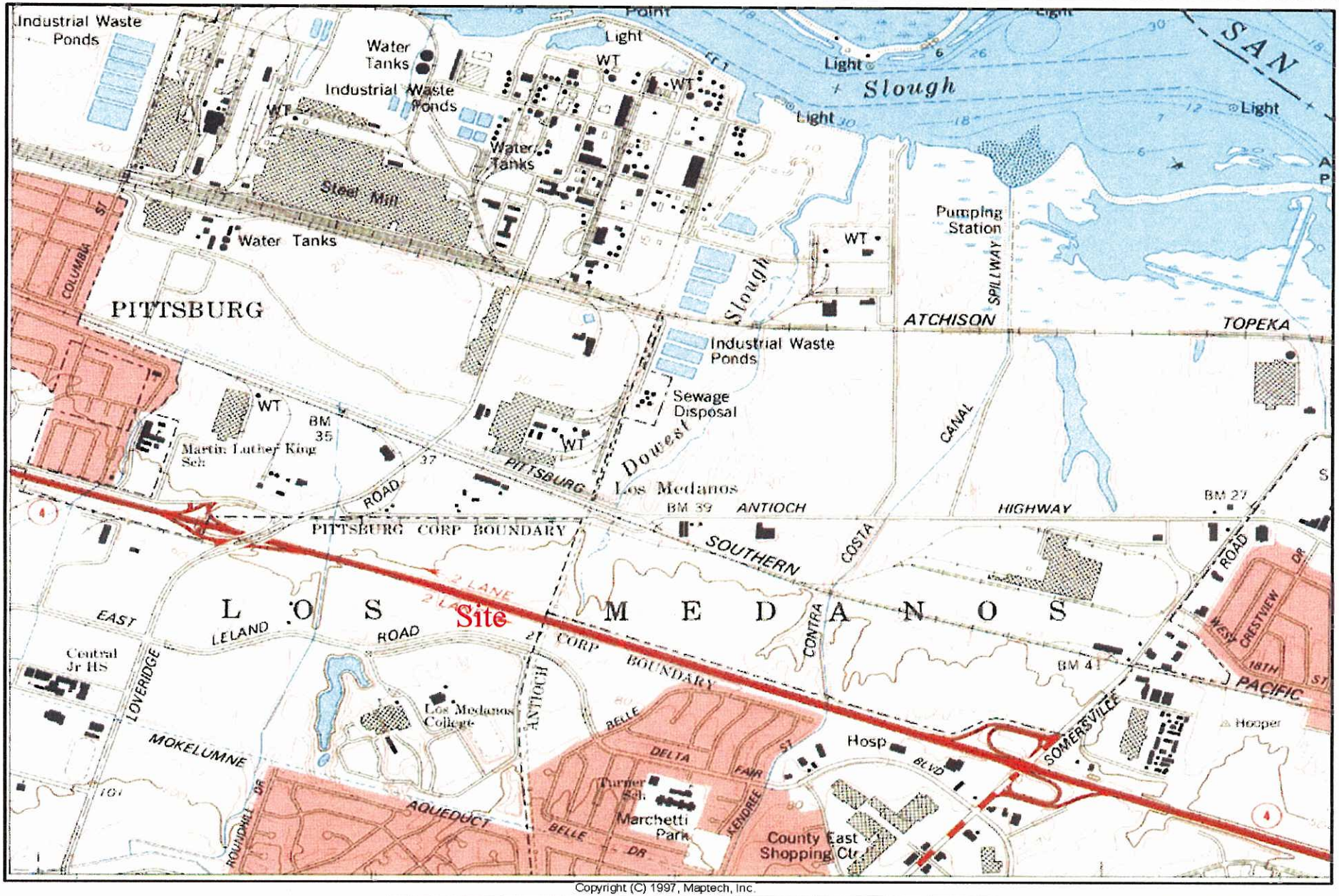
The Geotechnical Professional shall be given the opportunity to review the final specifications and drawings to verify that those documents are consistent with the intent of the geotechnical recommendations.

Geotechnical issues may arise during construction those were not apparent at the time this report was prepared. The Geotechnical Professional should be retained during construction to review the soil conditions encountered and the construction procedures used. All earthwork, pile and wall installation and testing should be completed under the direct observation of the Geotechnical Professional.

Specific review and investigation for environmental issues and subsurface environmental contamination were beyond the scope of our services.

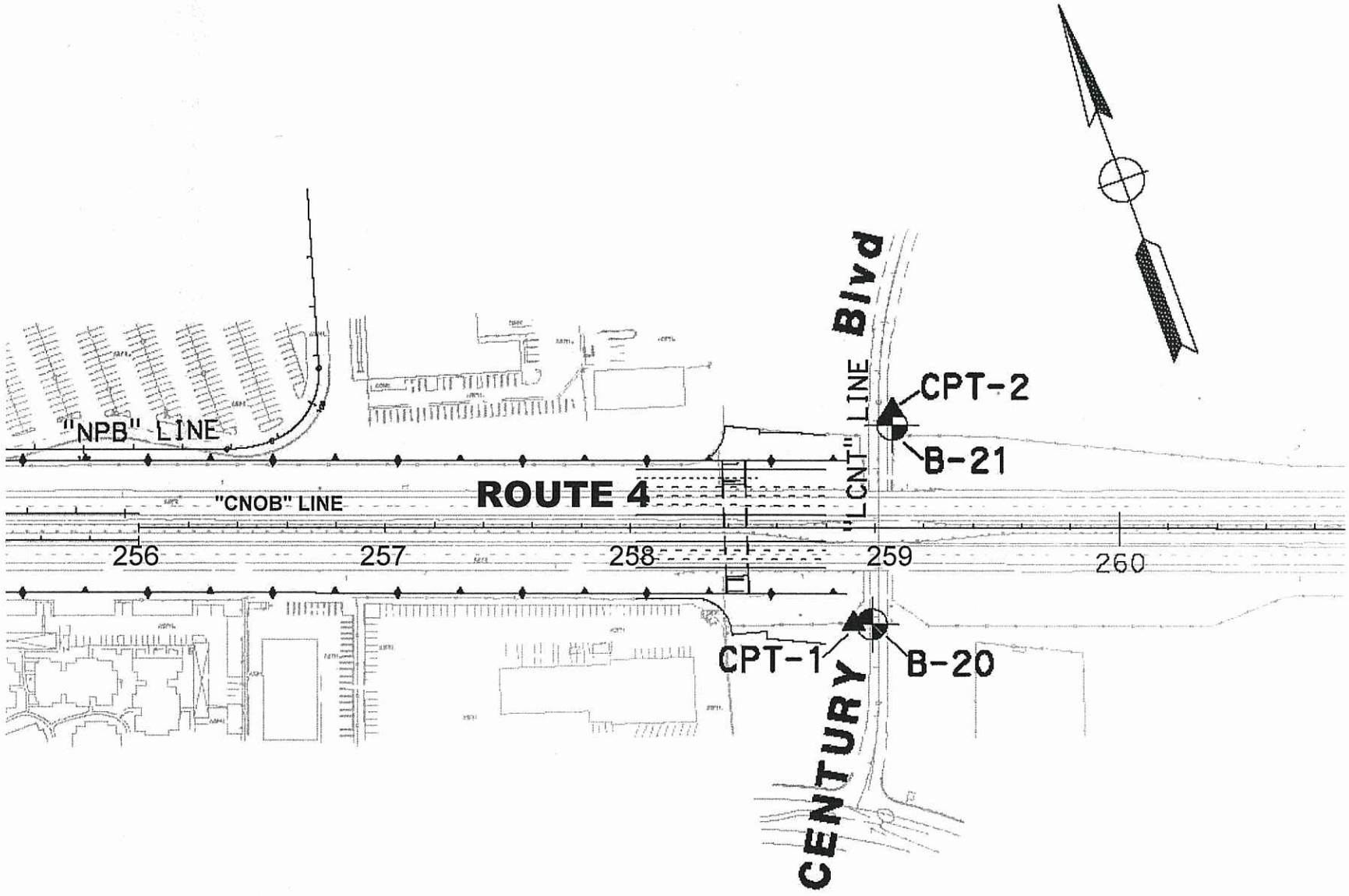
The opinions and recommendations presented in this report were developed with the standard of care commonly used by other professionals practicing at the same time, within the same locality and under the same limitations. No other warranties are included, either express or implied, as to the professional advice included in this report.

Figures

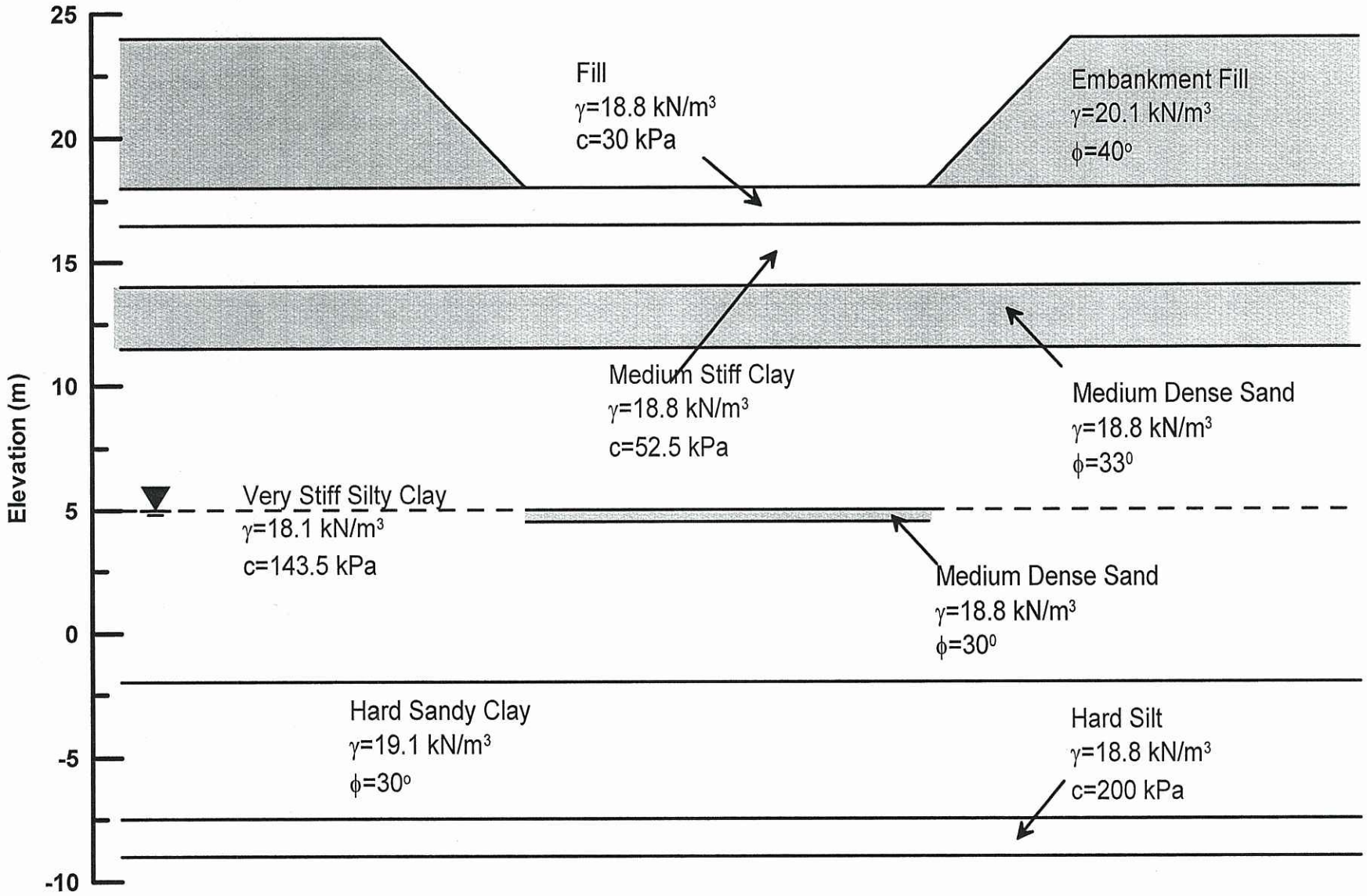


Copyright (C) 1997, Maptech, Inc.

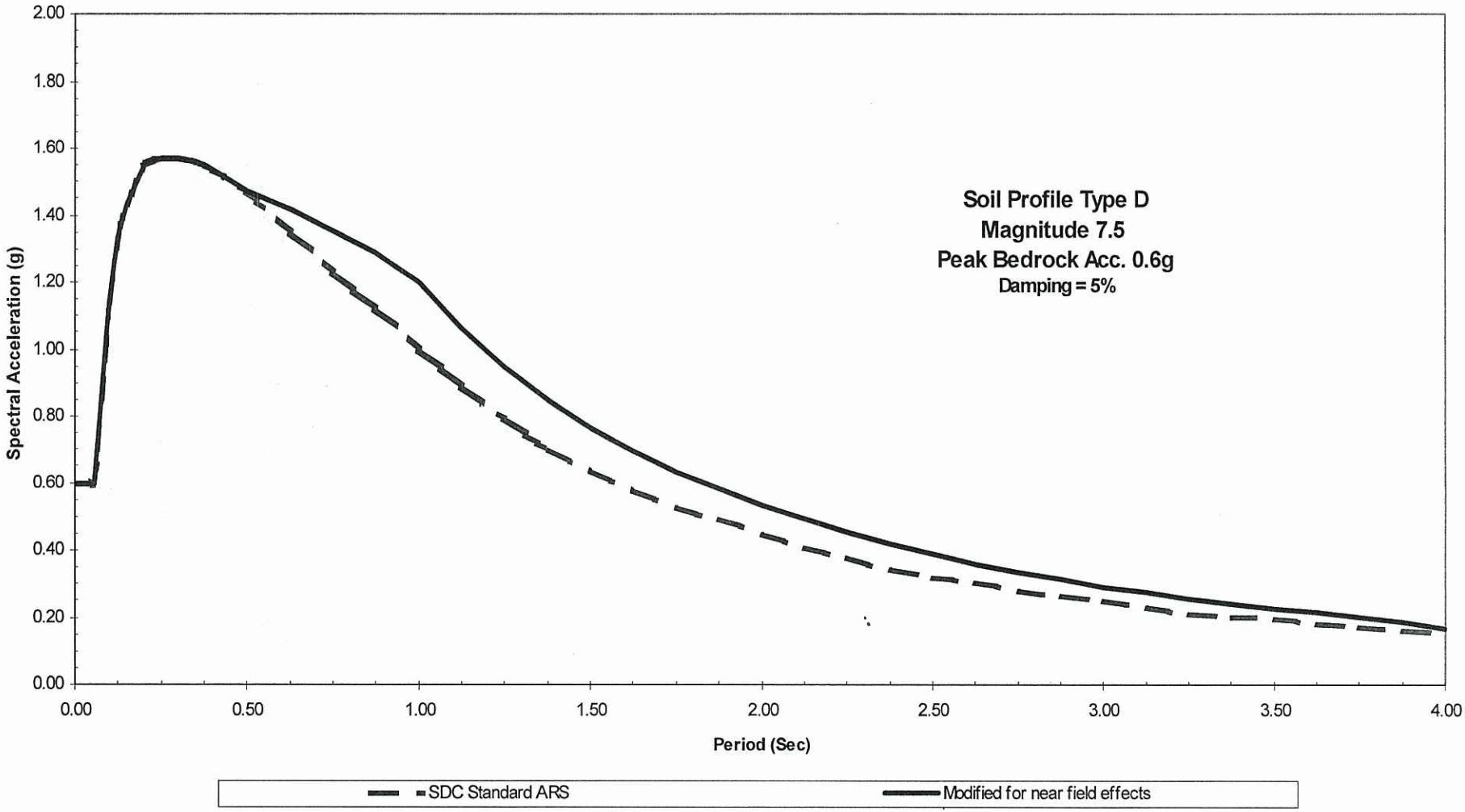
Project No. 26814910	SR 4 (EAST) WIDENING PROJECT LOVERIDGE TO SOMERSVILLE ROAD, Pittsburg CA	Site Location Plan	FIGURE 1
	URS		



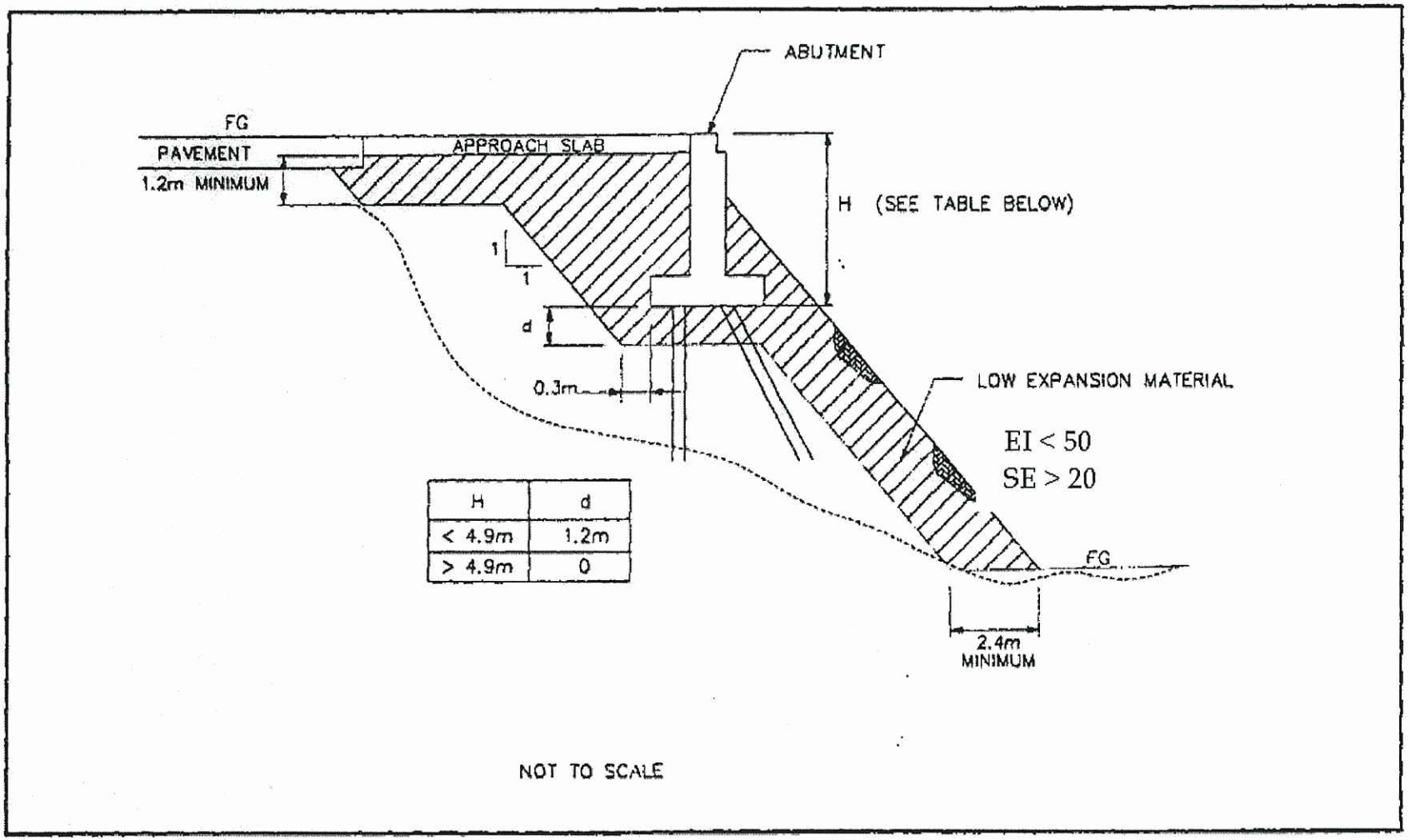
Project No. 26814910	SR 4 (EAST) WIDENING PROJECT LOVERIDGE TO SOMERSVILLE ROAD, Pittsburg CA	**Boring Locations Century Boulevard Undercrossing**	FIGURE 2
	URS		



Project No. 26814910	SR 4 (EAST) WIDENING PROJECT LOVERIDGE TO SOMERSVILLE ROAD, Pittsburg, CA	**Generalized Geologic Cross Section** CENTURY BOULEVARD UNDERCROSSING	FIGURE 3
	URS		



Project No. 26814910	SR 4 (EAST) WIDENING PROJECT LOVERIDGE TO SOMERSVILLE ROAD, Pittsburg CA	**Acceleration Response Spectrum**	FIGURE 4
	URS		



H	d
< 4.9m	1.2m
> 4.9m	0

Figure 5.4. of Guidelines for Structures Foundation Reports, March 2006, Caltrans

Project No. 26814910	SR 4 (EAST) WIDENING PROJECT LOVERIDGE TO SOMERSVILLE ROAD, Pittsburg, CA	**Expansive Soil Exclusion Zone in Bridge Abutment**	FIGURE 5
	URS	**CENTURY BOULEVARD UNDERCROSSING**	

Appendix A

Logs Of Test Borings From Previous Subsurface Investigations

107 140

August 27, 1951

CES - GEOTECHNICAL SERVICES

dered an informational document only.
ion seal with signature, license number
e confirm that this is a true and
s drawing is available and presented
tractor or other interested party.

POST-TOTAL PROJECT	Sheet No.	Total Sheets
37.9/41.3		

DATE

UC (REPLACE)

TEST BORINGS

NANCE UA	CU: 04275 EA: 228501	BRIDGE No. 28-0395
Borings from the re the addition		Sheet of

REGISTERED PROFESSIONAL ENGINEER
Philip Meymand
No. 2596
Exp. 6/30/07
GEOTECHNICAL
STATE OF CALIFORNIA

om "EB4" Line

oundation Plan for Metric Stationing.

data presented in the table above.
ions for the As-Built Test Borings
structure location. This table is
of Test Boring sheet for the conve-
tor or other interested party.

B

AS
Con
Date
Doc

No Change

CLASSIFICATION OF MATERIAL BASED ON STANDAR

MICROFILMED

STANDARD OIL ROAD UNDERCROSSING

1" = 10'

28-98 C-2548-4

Appendix A
1

Appendix B

Data Acquired From Current Subsurface Investigations

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

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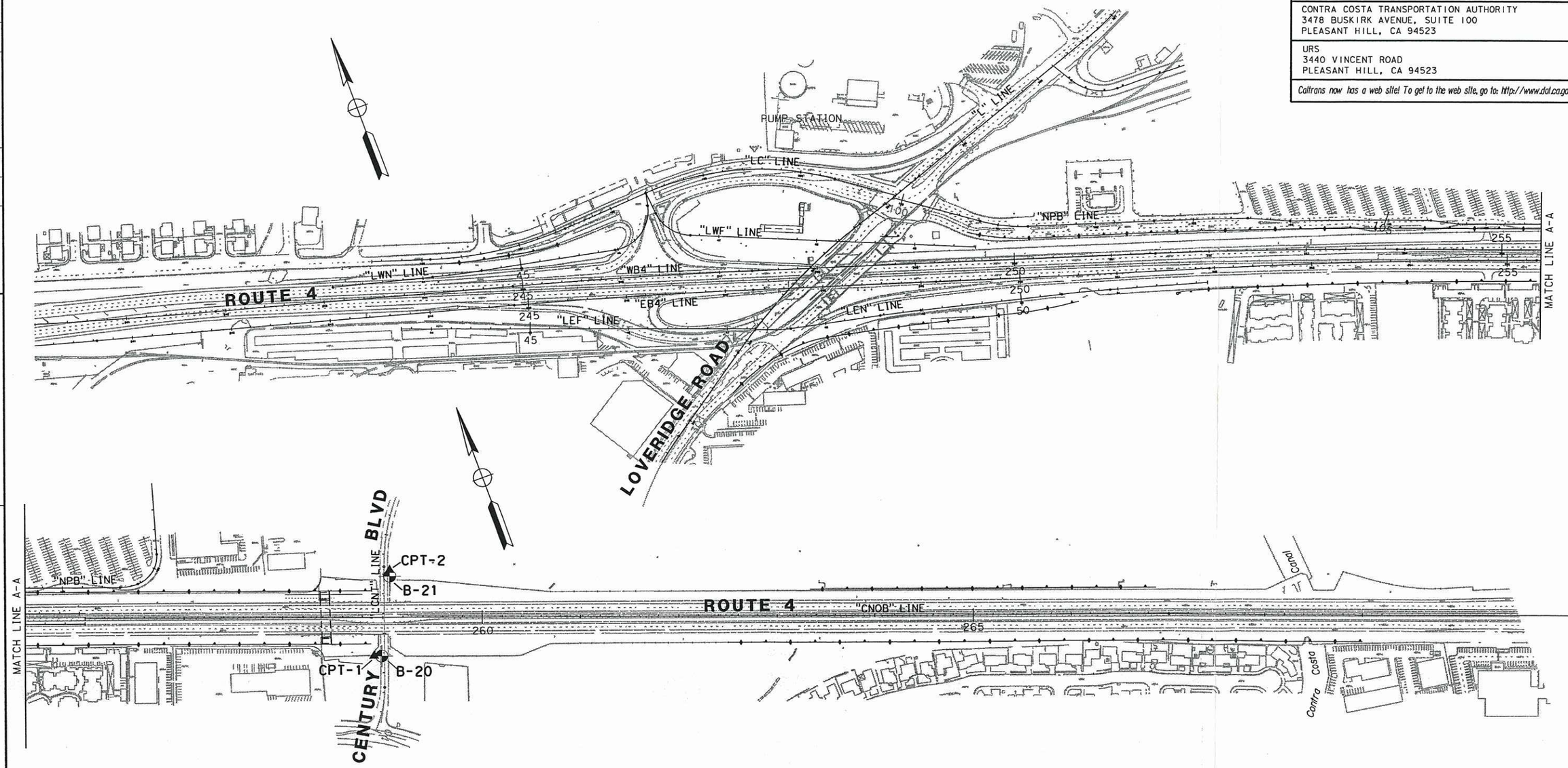
SOTERO ANGELES	CHECKED BY	06/06	DATE REVISED
	BR	06/06	

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans



CENTURY BLVD UC FOUNDATION REPORT
SITE AND BORING LOCATIONS

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS — 0 10 20 30 40

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DGN FILE => ...\lotb-keymap-century.dgn

CU 04275

EA 228591

LAST REVISION: DATE PLOTTED => 1/31/2007; TIME PLOTTED => 4:42:08 PM; 00-00-00

BENCH MARKS

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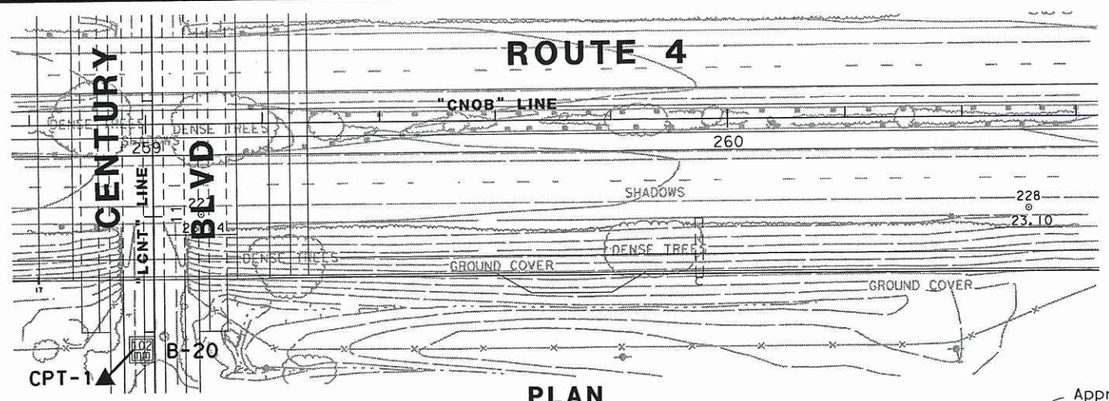
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



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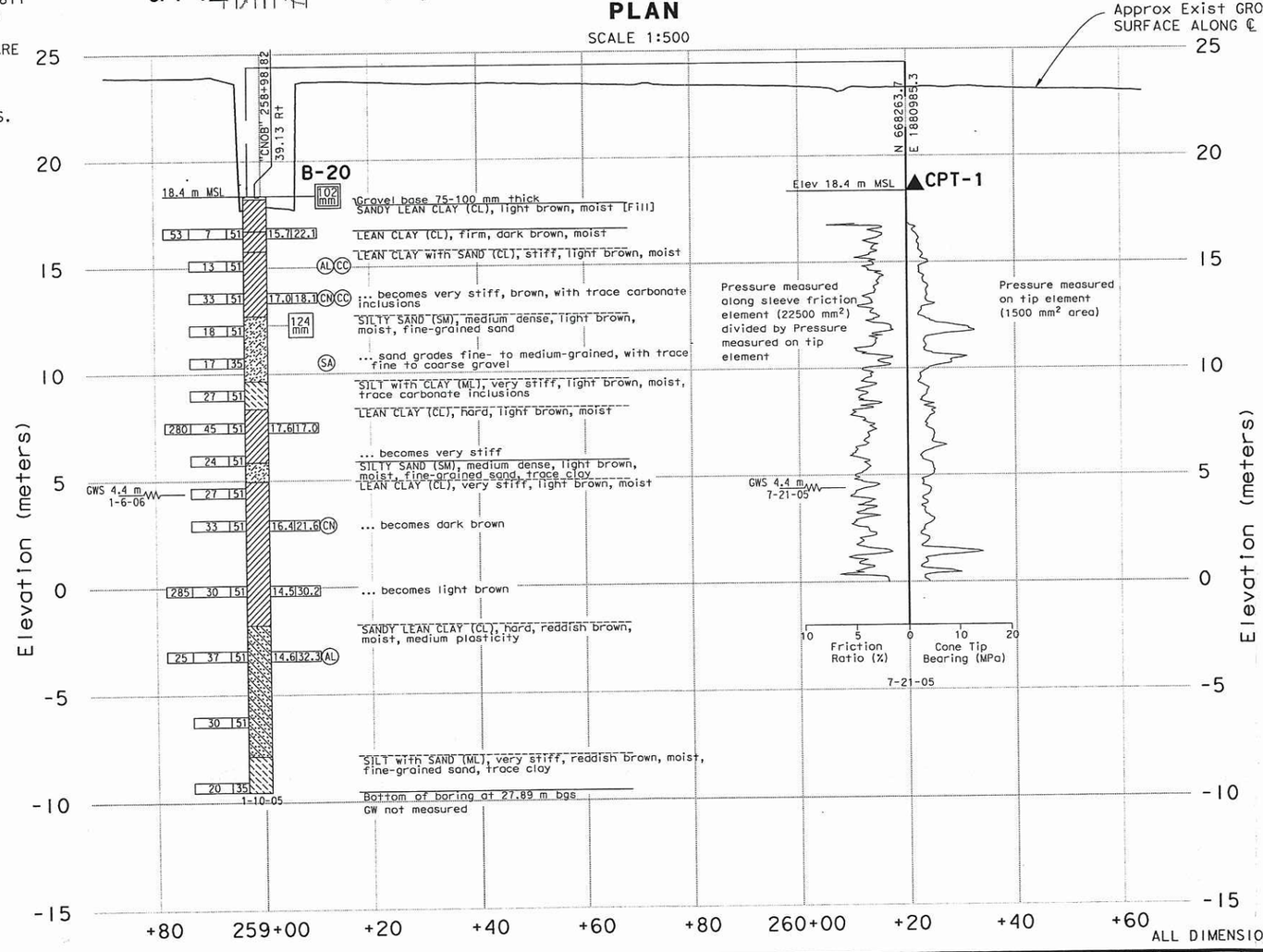
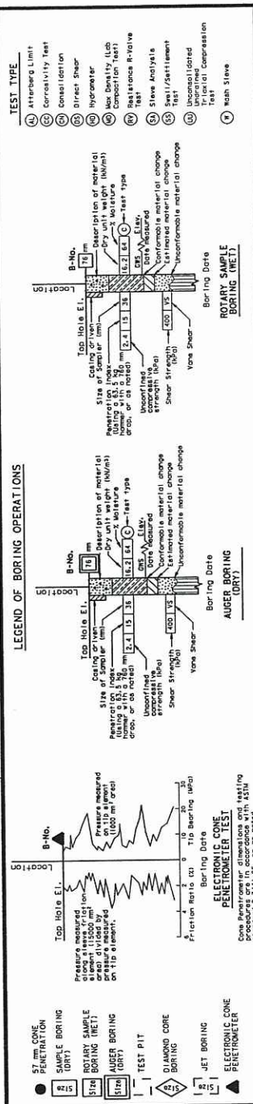


ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

PROFILE VIEW
Horiz 1:500
Vert 1:125

NOTE:
AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

LEGEND OF BORING OPERATIONS



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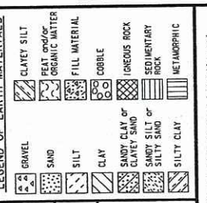

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	N. MEYER	DATE: 01/10/05		

CU 04275
EA 228501

BRIDGE NO.	CENTURY BLVD UC (REPLACE)
28-0395	
KILOMETER POST	LOG OF TEST BORINGS NO. 1
40.0	

DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES (PRELIMINARY STAGE ONLY): 10/17/05, 01/26/06, 02/16/07
SHEET 18 OF 20

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CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

Philip J Meyer
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DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
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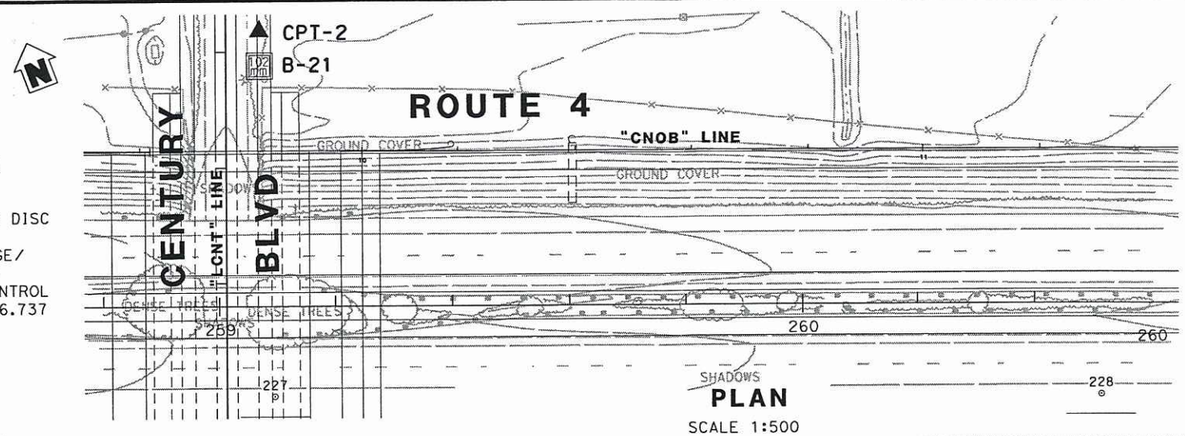
ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



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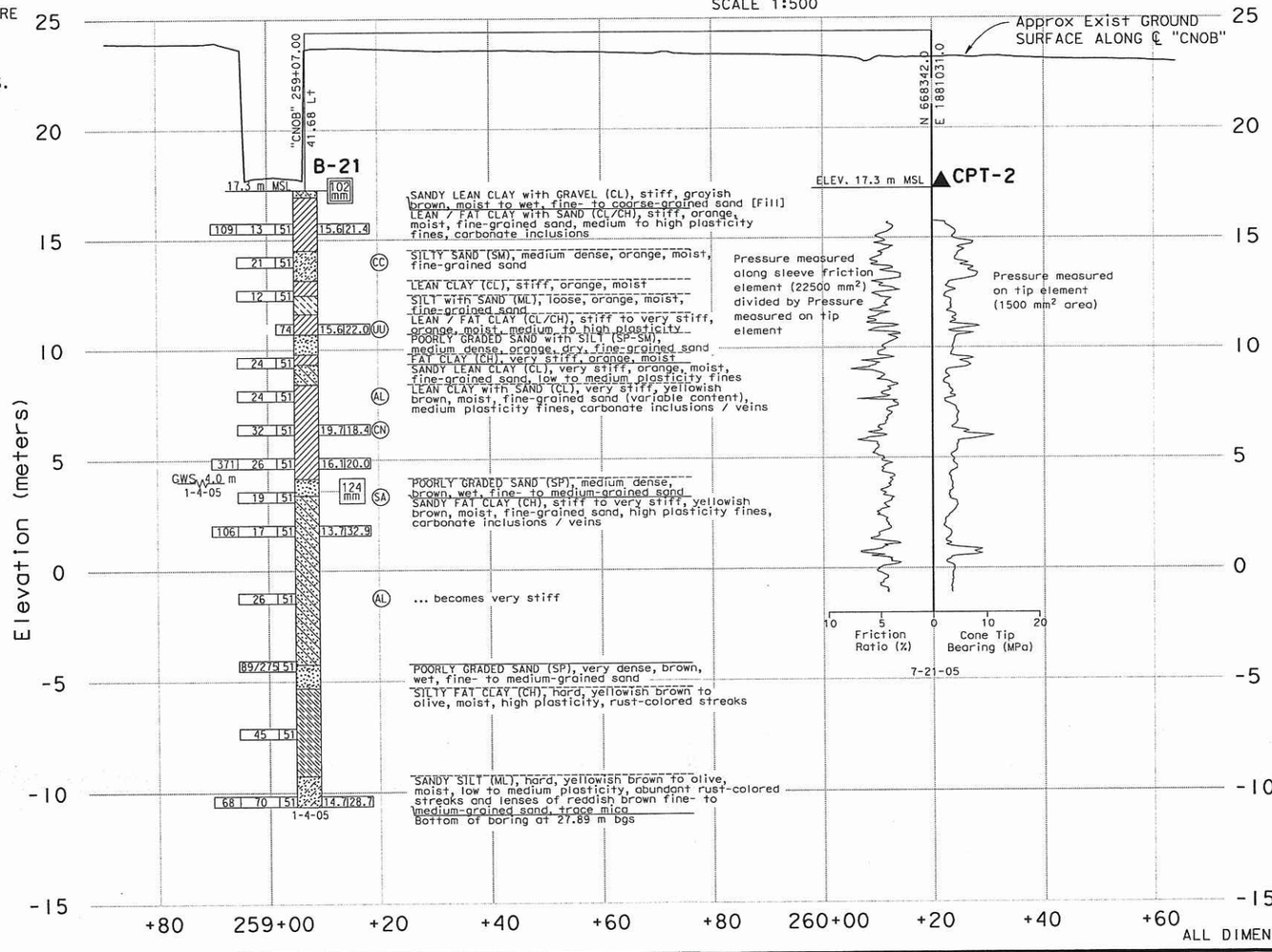
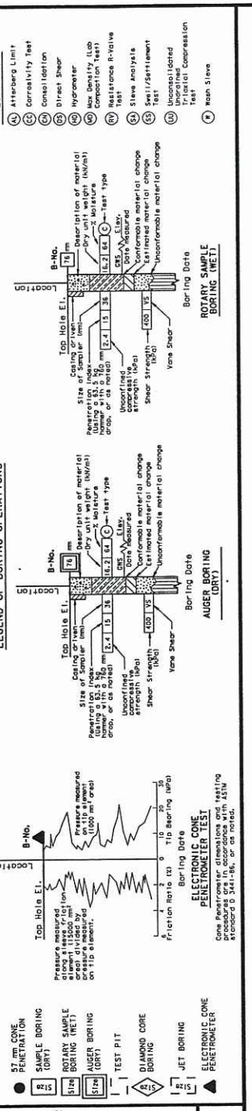


PROFILE VIEW
Horiz 1:500
Vert 1:125

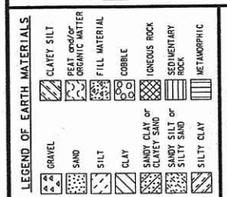
ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:
AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS



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DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	P. RESPESS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO. 28-0395
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/04/05		PROJECT ENGINEER	KILOMETER POST 40.0

CENTURY BLVD UC (REPLACE)
LOG OF TEST BORINGS NO. 2

CU 04275
EA 228501

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REVISION DATES (PRELIMINARY STAGE ONLY): 10/17/05 | 01/26/06 | 02/16/07

SHEET 19 OF 20

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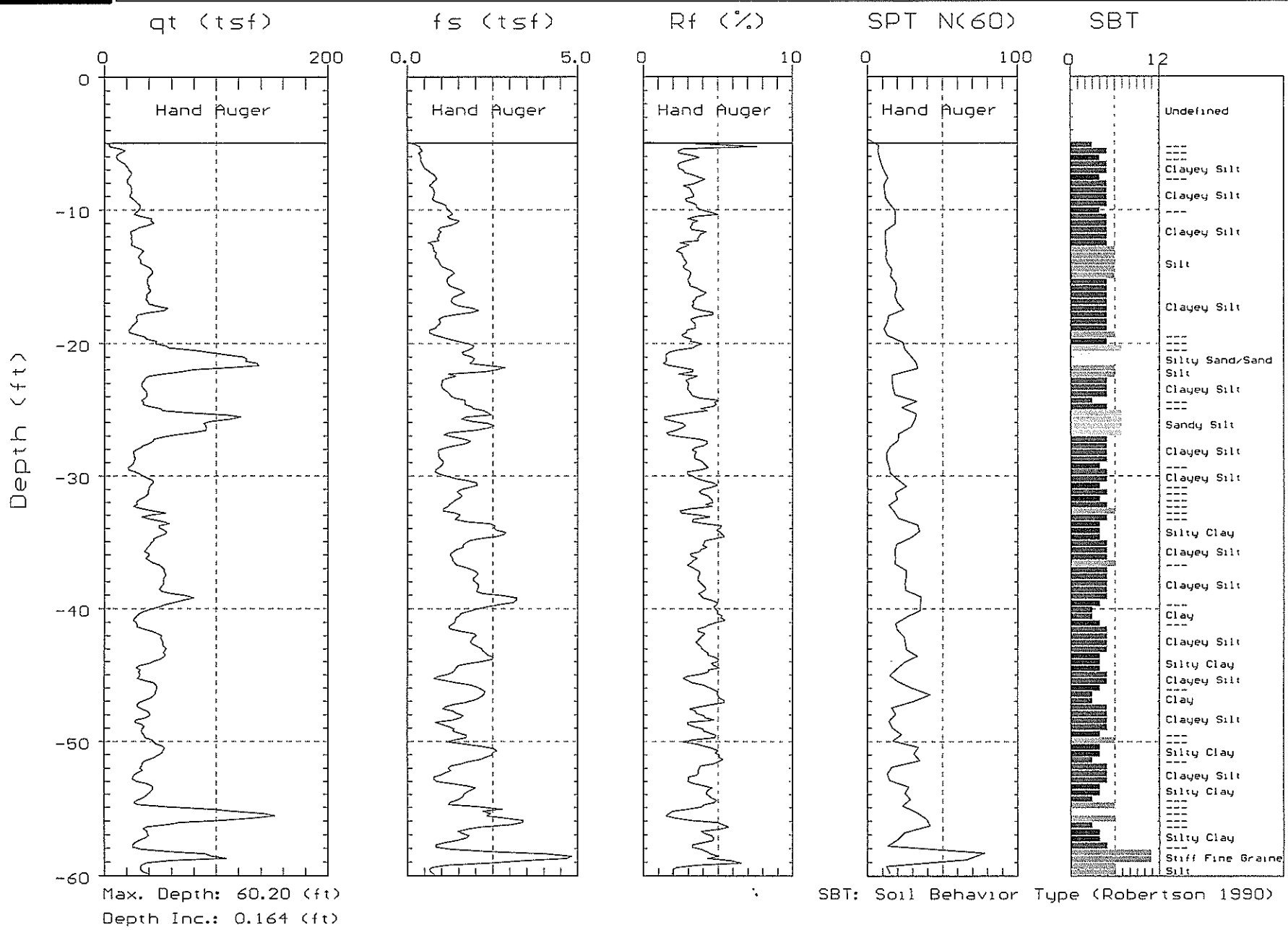
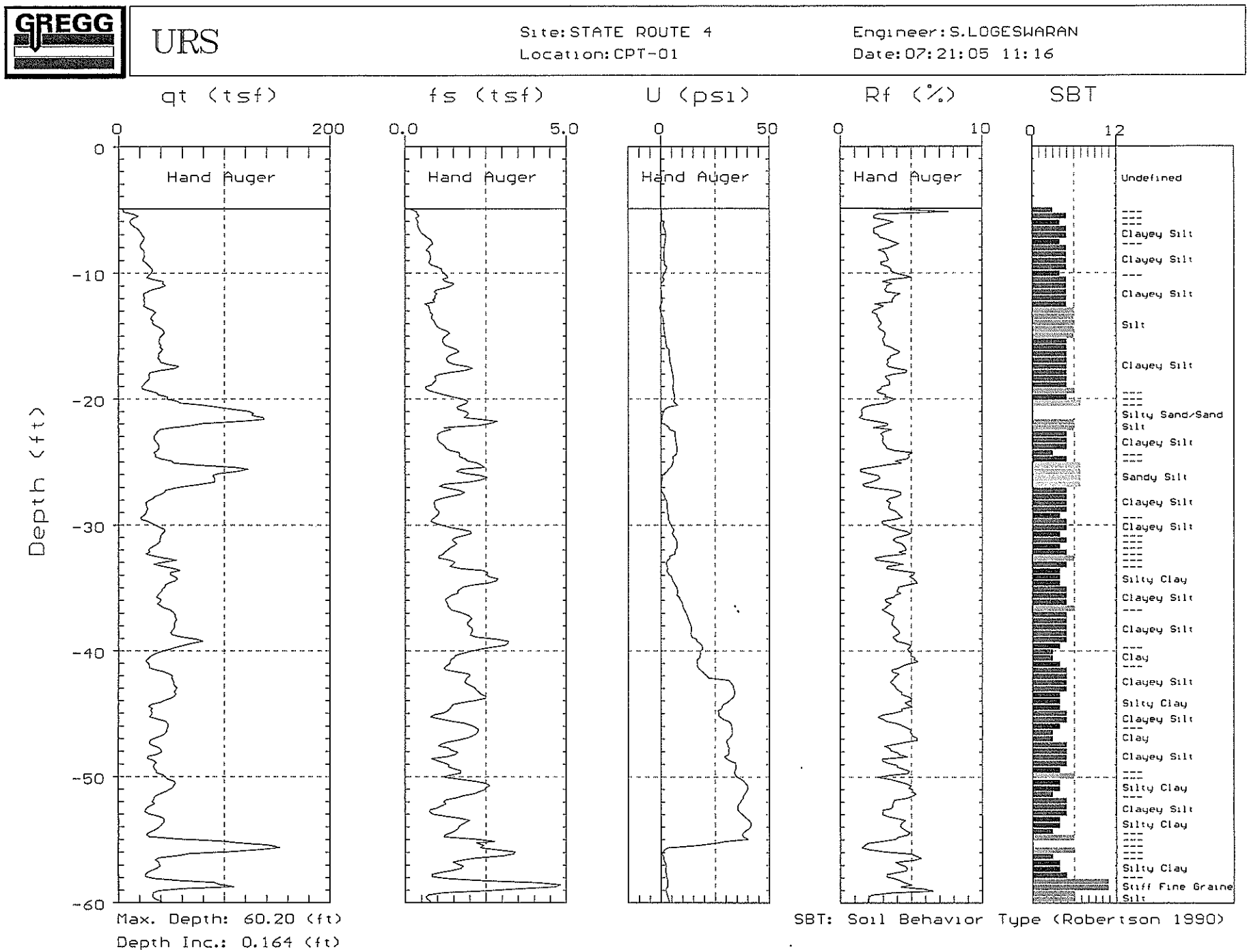
Date: 07:21:05 11:16

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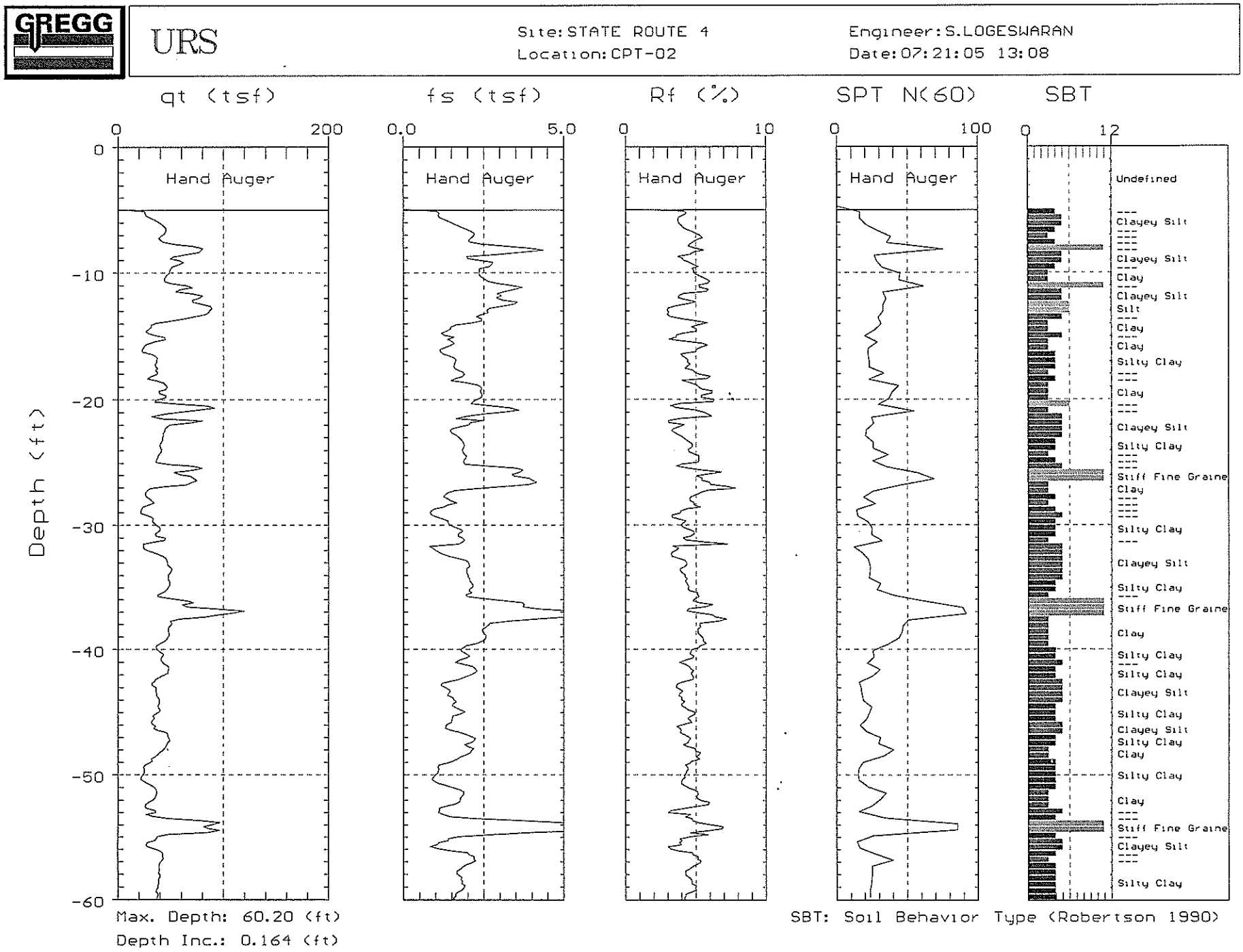
Location: CPT-01
Engineer: S.LOGESWARAN
Date: 07:21:05 11:16
qt (tsf)
fs (tsf)
U (psi)
Rf (%)
SBT
Hand Auger
Depth (ft)
Undefined
Clayey Silt
Silt
Silty Sand/Sand Silt
Sandy Silt
Silty Clay
Clay
Stiff Fine Grained Silt
Max. Depth: 60.20 (ft)
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson 1990)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Location: CPT-02
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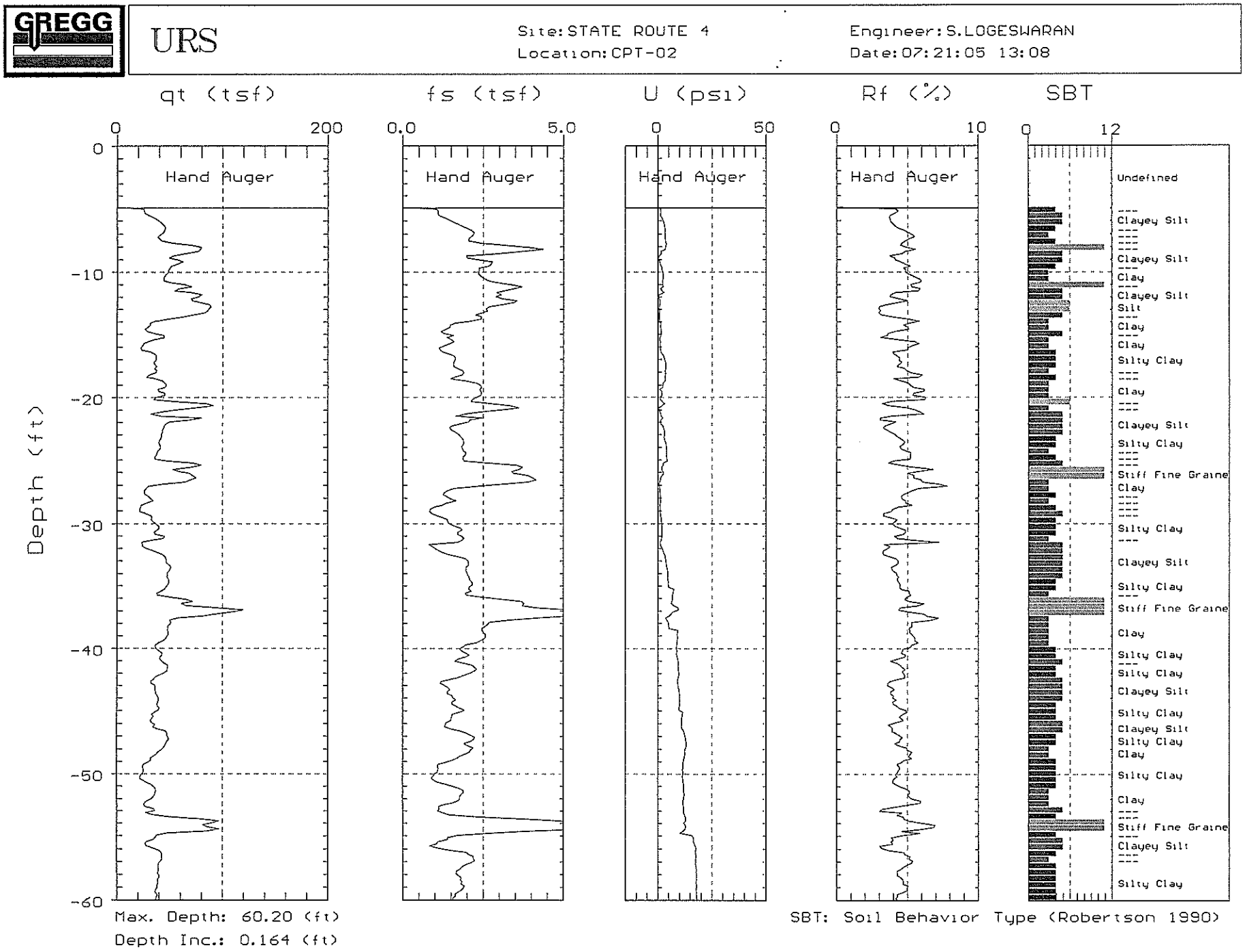
fs (tsf)
Rf (%)
SPT N(60)
SBT
Hand Auger
Depth (ft)
Undefined
Clayey Silt
Clay
Silty Clay
Silt
Stiff Fine Grained
Max. Depth: 60.20 (ft)
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson 1990)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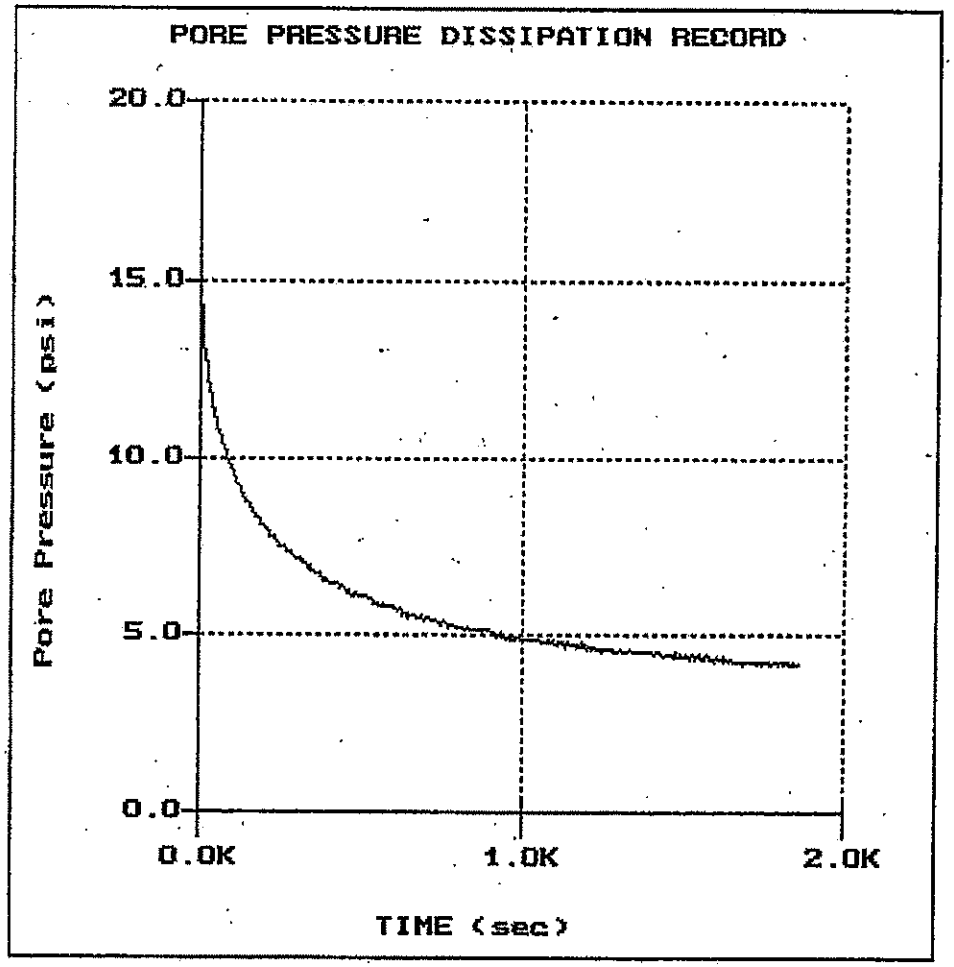
URS
Site: STATE ROUTE 4
Location: CPT-02
Engineer: S.LOGESWARAN
Date: 07:21:05 13:08
qt (tsf)
fs (tsf)
U (psi)
Rf (%)
SBT
Depth (ft)
Hand Auger
Undefined
Clayey Silt
Clay
Silty Clay
Silt
Stiff Fine Grained
Max. Depth: 60.20 (ft)
Depth Inc.: 0.164 (ft)
SBT: Soil Behavior Type (Robertson 1990)

URS

Site:STATE ROUTE 4
Location:CPT-01

Engineer:S.LOGESWARA
Date:07:21:05 11:16



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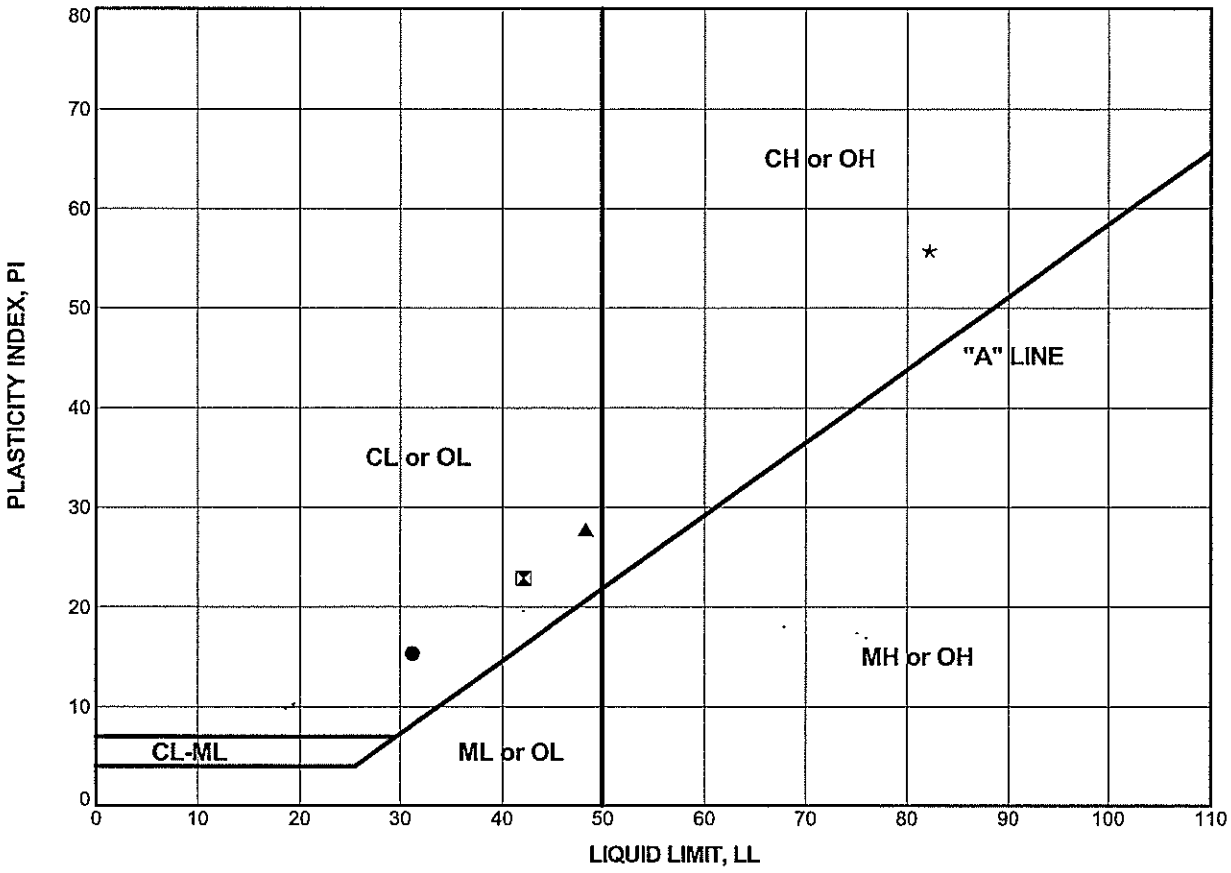
Appendix C
Laboratory Test Results

TABLE C-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information			USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, kN/m³	Sieve			Atterberg Limits			Unconfined Compressive Strength, kPa	UU Triaxial		Other Tests
Boring Number	Sample Number	Depth, meters				Gravel, %	Sand, %	<#200, %	LL	PL	PI		Peak Deviator Stress, kPa	Confining Pressure, kPa	
B-20	20-1-4	1.83	CL	22.1	15.7							53			
B-20	20-2-3	3.20	CL						31	16	15				
B-20	20-3-3	4.72	CL	18.1	17.0										CONS
B-20	20-5	7.77	SM			3	72	25							
B-20	20-7-4	10.97	CL	17.0	17.6							280			
B-20	20-10-4	15.54	CL	21.6	16.4										CONS
B-20	20-11-4	18.59	CL	30.2	14.5							285			
B-20	20-12-4	21.64	CL	32.3	14.6				42	19	23	25			
B-21	21-1-3	1.83	CL/CH	21.4	15.6							109			
B-21	21-4	6.10	CL/CH	22.0	15.6								135	86	
B-21	21-6-3	9.45	CL						48	21	27				
B-21	21-7-3	10.97	CL	18.4	16.6										CONS
B-21	21-8-3	12.50	CL	20.0	16.1							371			
B-21	21-9-2	13.87	CH			1	30	70							
B-21	21-10-2	15.39	CH	32.9	13.7							106			
B-21	21-11-2	18.44	CH						82	26	56				
B-21	21-14-2	27.58	ML	28.7	14.7							68			

The laboratory tests were performed in general accordance with the following ASTM standards:

Water Content - ASTM Test Method D2216
Dry Unit Weight - ASTM Test Method D2937
Particle Size Distribution Analysis by Mechanical Sieving - ASTM Test Method D422
Atterberg Limits - ASTM Test Method D4318
Unconfined Compressive Strength Test (UC, q_u in kPa) - ASTM Test Method D2166
Unconsolidated Undrained Triaxial Compression Test (UU Triaxial) - ASTM Test Method D2850
One-dimensional Consolidation Test (CONS) - ASTM Test Method 2435
One-dimensional Swell/Settlement Potential Test (SWELL) - ASTM Test Method 4546



Boring Number	Sample Number	Depth (meters)	Test Symbol	Moisture Content (%)	LL	PL	PI	Classification
B-20	20-2-3	3.20	●		31	16	15	Sandy Lean Clay (CL)
B-20	20-12-4	21.64	⊠	32	42	19	23	Sandy Lean Clay (CL)
B-21	21-6-3	9.45	▲		48	21	27	Lean Clay with Sand (CL)
B-21	21-11-2	18.44	★		82	26	56	Sandy Fat Clay (CH)

Report: ATTERBERG_PLOT_12.PTS; File: OAK_SR4PITTS.GPJ; 2/9/2005 B-21

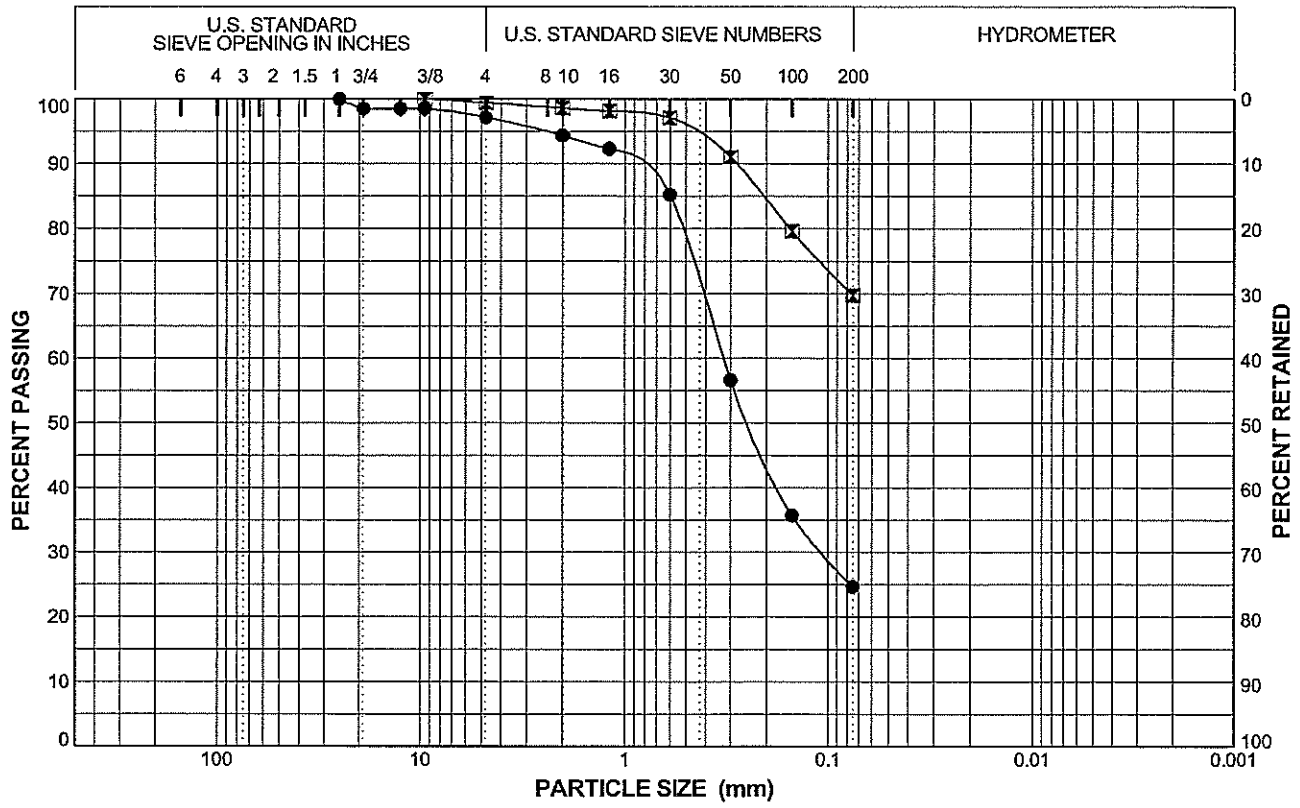
State Route 4 Loveridge to Somersville Road
Century Boulevard Undercrossing
26814910.24000

PLASTICITY CHART

URS

Figure C-1

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (meters)	Symbol	LL	PI	Classification
B-20	20-5	7.77	●			Silty Sand (SM)
B-21	21-9-2	13.87	⊠			Sandy Fat Clay (CH)

Report: SIEVE_5_CURVES_OAK; File: OAK_SR4PITTS.GPJ; 2/19/2005 B-21

State Route 4 Loveridge to Somersville Road
Century Boulevard Undercrossing
26814910.24000

PARTICLE SIZE DISTRIBUTION CURVES

URS

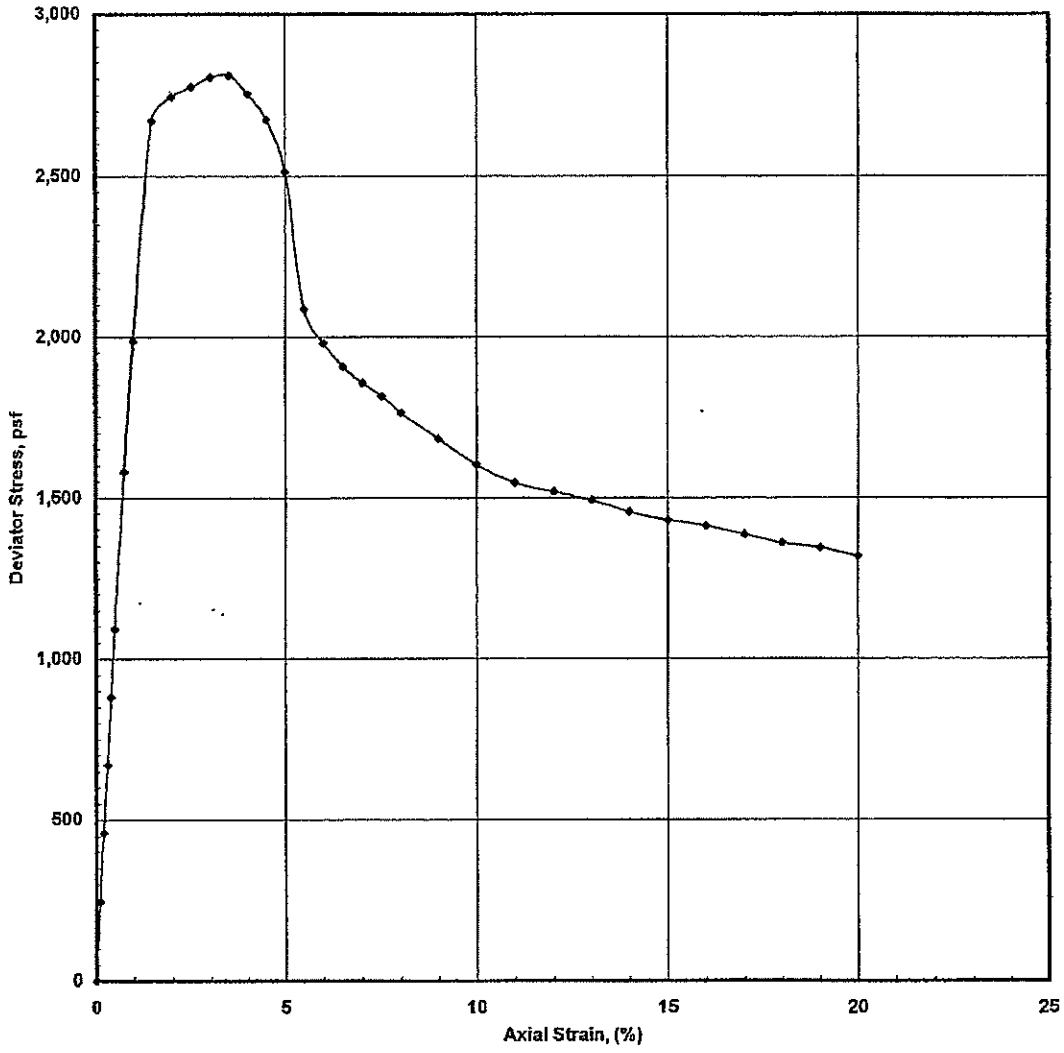
Figure C-2

URS

Unconsolidated Undrained Triaxial Test
ASTM D2850

Project Name:	SR 4 Loveridge to Somersville Rd.	Total Unit Weight, pcf:	121.2
Project Number:	26814910.24000	Dry Unit Weight, pcf:	99.3
Location:	Pittsburg, CA	Moisture Content, %:	22.04
Boring Number:	CB-21	Saturation, %:	87.7
Sample Number:	4	Void Ratio:	0.666
Depth, ft:	20-22	Confining Pressure, psf:	1,800
Date Tested:	01/21/05	Peak Deviator Stress, psf:	2,812
Description:	Brown sandy clay	Strain @ Failure, %:	3.50
Sample Diameter, in:	2.860	Sample Height, in:	5.945

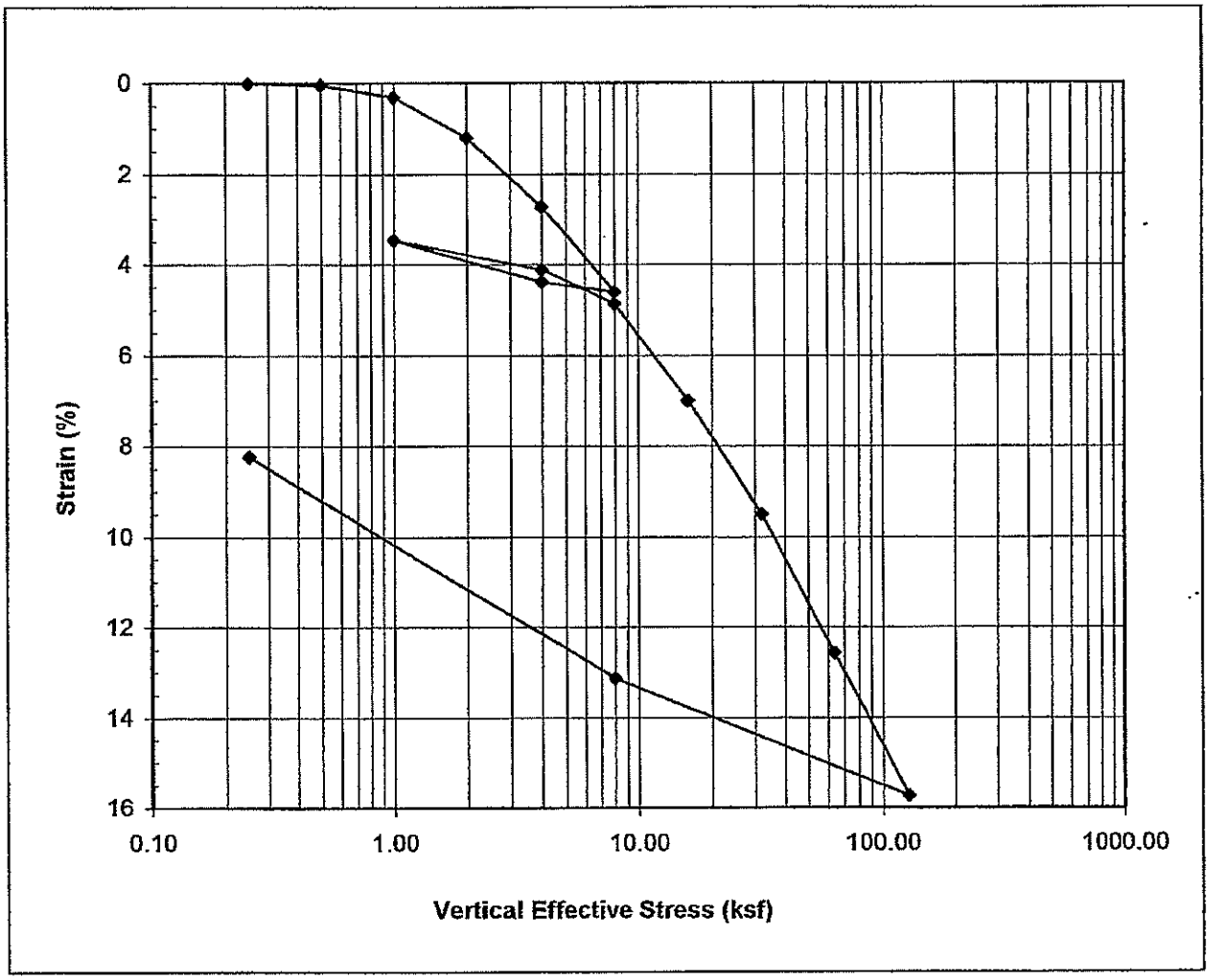
Dial Reading, inches	Load Reading, pounds	Axial Strain, percent	Deviator Stress, psf
0.000	0.0	0.00	0.0
0.006	11.0	0.10	246
0.012	20.5	0.20	459
0.018	30.0	0.30	670
0.024	39.5	0.40	882
0.030	49.0	0.50	1093
0.045	71.0	0.75	1580
0.059	89.5	1.00	1986
0.089	121.0	1.50	2672
0.119	125.0	2.00	2746
0.149	127.0	2.50	2776
0.178	129.0	3.00	2805
0.208	130.0	3.50	2812
0.238	128.0	4.00	2754
0.268	125.0	4.50	2676
0.297	118.0	5.00	2513
0.327	98.5	5.50	2086
0.357	94.0	6.00	1981
0.386	91.0	6.50	1907
0.416	89.0	7.00	1855
0.446	87.5	7.50	1814
0.476	85.5	8.00	1763
0.535	82.5	9.00	1683
0.595	79.5	10.00	1604
0.654	77.5	11.00	1546
0.713	77.0	12.00	1519
0.773	76.5	13.00	1492
0.832	75.5	14.00	1455
0.892	75.0	15.00	1429
0.951	75.0	16.00	1412
1.011	74.5	17.00	1386
1.070	74.0	18.00	1360
1.130	74.0	19.00	1344
1.189	73.5	20.00	1318



Description: Brown sandy clay

Boring Number	Sample Number	Sample Depth (feet)	Dry Unit Weight (pcf)	Initial Moisture Content (%)	Specific Gravity (assumed)	Void Ratio	Initial Saturation (%)	Height/ Diameter Ratio	Rate of Shearing (%/min)	Confining Pressure (psf)	Peak Deviator Stress (psf)	Peak Shear Stress (psf)
CB-21	4	20-22	99.3	22.0	2.65	0.666	87.7	2.08	0.75	1,800	2,812	1,406

Project Name: SR 4	**UNCONSOLIDATED UNDRAINED TRIAXIAL TEST STRESS VS. STRAIN ASTM D2850**	URS
Project Number: 26814910.24000		Figure No. C-3
Location: Pittsburg, , CA		



Boring: CB-20 Sample: 3-3 Depth, ft: 15.5

Description: Brown sandy clay

	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est.	Liquid Limit	Plasticity Index
Initial	18.05	128.0	108.5	0.611	82.7	0.9000	1.926	2.800	NA	NA
Final	17.07	138.4	118.2	0.478	99.9	0.8259				

Project: **SR 4**
Project #: **26814910**
Date: **01/20/05**

URS

Consolidation Test

Figure: C-4

URS

Consolidation Test
ASTM D2435 Method A

Project Name: SR 4 Date: 01/20/05

Project Number: 26814910 .24000

Boring Number: CB-20 **Sample Number:** 3-3

Depth, ft: 15.5

Location: Pittsburg, CA

Load, Grams	Load, ksf	Load, tsf	Initial Dial, Inches	Frame Corr.	Dial Change	Final Dial, Inches	Change in Height, in.	Strain, Incre., %	Strain, Cum., %
250	0.25	0.13	0.3000	0.0009	0.0009	0.2991	0.0000	0.00	0.00
500	0.50	0.25	0.2991	0.0007	0.0010	0.2981	0.0003	0.03	0.03
1000	1	0.5	0.2981	0.0007	0.0032	0.2949	0.0025	0.28	0.31
2000	2	1	0.2949	0.0010	0.0090	0.2859	0.0080	0.89	1.20
4000	4	2	0.2859	0.0012	0.0149	0.2710	0.0137	1.52	2.72
8000	8	4	0.2710	0.0010	0.0179	0.2531	0.0169	1.88	4.60
4000	4	2	0.2531	0.0005	-0.0024	0.2555	-0.0019	-0.21	4.39
1000	1	0.50	0.2555	0.0010	-0.0094	0.2649	-0.0084	-0.93	3.46
4000	4	2	0.2649	0.0009	0.0068	0.2581	0.0059	0.66	4.11
8000	8	4	0.2581	0.0007	0.0074	0.2507	0.0067	0.74	4.86
16000	16	8	0.2507	0.0009	0.0202	0.2305	0.0193	2.14	7.00
32000	32	16	0.2305	0.0005	0.0231	0.2074	0.0226	2.51	9.51
64000	64	32	0.2074	0.0008	0.0283	0.1791	0.0275	3.06	12.57
128000	128	64	0.1791	0.0016	0.0301	0.1490	0.0285	3.17	15.73
8000	8	4	0.1490	0.0015	-0.0249	0.1739	-0.0234	-2.60	13.13
250	0.25	0.13	0.1739	0.0036	-0.0477	0.2216	-0.0441	-4.90	8.23
					Total	Change	0.0741		
					in	Height, in.			

URS

Consolidation Test
ASTM D2435 Method A

Frame 5

Project Name: SR 4 **Date:** 01/20/05

Project Number: 26814910.24000

Boring Number: CB-20 **Sample Number:** 3-3

Depth, ft: 15.5 **Description:** Brown sandy clay

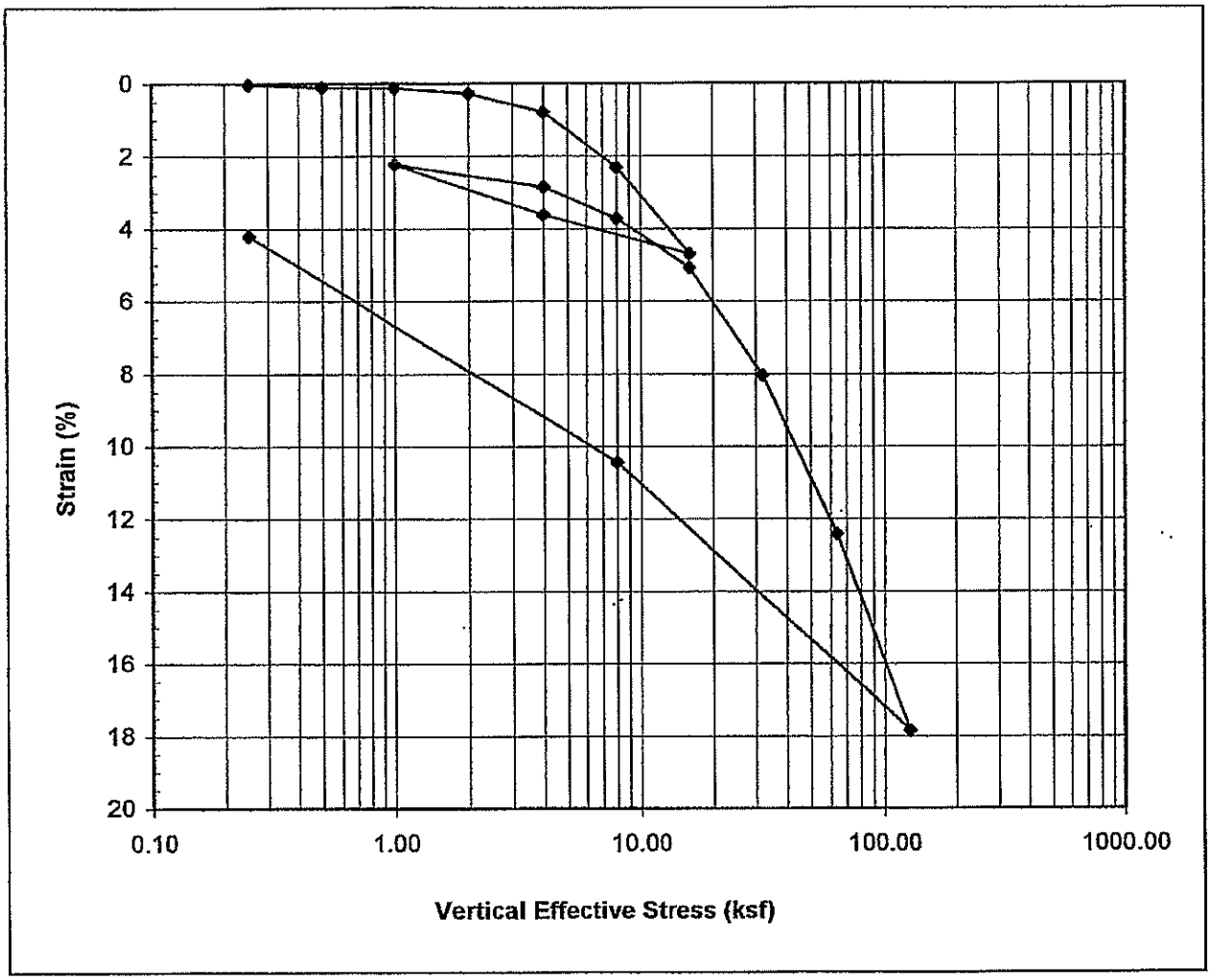
Location: Pittsburg, CA **Liquid Limit:** NA

Plastic Limit: NA

Plasticity Index: NA

Tested By: S. Capps **Reviewed By:** R. Taraya

Water Content Determination	Soil Adjacent to Sample	Sample at Start of Test	Sample at End of Test
Wet Soil + Tare, grams	315.8	297.5	296.77
Dry Soil + Tare, grams	283.48	284.02	284.02
Tare, grams	104.56	209.34	209.34
Weight of Water, grams	32.32	13.48	12.75
Weight of Dry Soil, grams	178.92	74.68	74.68
Water Content, %	18.06	18.05	17.07
Height of Gage Block, in:	0.7160	Dial Reading on Gage Block, in:	0.7450
Dial Reading on Sample, in:	0.9290		
Height of Sample, initial, in:	0.9000	Height of Sample, Final, in:	0.8259
Change in Height during Test, in:	0.0741	Estimated Specific Gravity:	2.80
Diameter of Ring, in:	1.926	Ring Number	R-7
Initial Area of Sample, cm^2:	18.80	Volume of Solids, Vs=Ws/Gs:	26.67
Volume of Sample, Initial, cm^3:	42.97	Volume of Sample, Final, cm^3	39.43
Volume of Voids, Initial, Vei, cm^3	16.30	Volume of Voids, Final, Vef, cm^3:	12.76
Volume of Water, Initial, Wwi, cm^3:	13.48	Volume of Water, Final, Wwf, cm^3:	12.75
Degree of Saturation, Initial, %	82.7	Degree of Saturation, Final, %	99.9
Total Unit Weight, Initial, pcf:	128.0	Total Unit Weight, Final, pcf:	138.4
Dry Unit Weight, Initial, pcf:	108.5	Dry Unit Weight, Final, pcf:	118.2
Initial Void Ratio:	0.6110	Final Void Ratio:	0.4784



Boring: CB-20 Sample: 10-4 Depth, ft: 51.0

Description: Brown sandy clay

	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est.	Liquid Limit	Plasticity Index
Initial	21.60	126.8	104.2	0.610	95.2	0.8940	1.939	2.690	NA	NA
Final	20.17	130.8	108.8	0.543	100.0	0.8565				

Project: **SR 4**
Project #: **26814910**
Date: **01/20/05**

URS

Consolidation Test

Figure: C-5

URS

Consolidation Test
ASTM D2435 Method A

Project Name: SR 4 **Date:** 01/20/05

Project Number: 26814910 .24000

Boring Number: CB-20 **Sample Number:** 10-4

Depth, ft: 51.0

Location: Pittsburg, CA

Load, Grams	Load, ksf	Load, tsf	Initial Dial, Inches	Frame Corr.	Dial Change	Final Dial, Inches	Change in Height, in.	Strain, Incre., %	Strain, Cum., %
250	0.25	0.13	0.3000	0.0008	0.0010	0.2990	0.0002	0.02	0.02
500	0.50	0.25	0.2990	0.0006	0.0012	0.2978	0.0006	0.07	0.09
1000	1	0.50	0.2978	0.0007	0.0010	0.2968	0.0003	0.03	0.12
2000	2	1	0.2968	0.0009	0.0023	0.2945	0.0014	0.16	0.28
4000	4	2	0.2945	0.0010	0.0055	0.2890	0.0045	0.50	0.78
8000	8	4	0.2890	0.0014	0.0149	0.2741	0.0135	1.51	2.29
16000	16	8	0.2741	0.0015	0.0230	0.2511	0.0215	2.40	4.70
4000	4	2	0.2511	0.0024	-0.0120	0.2631	-0.0096	-1.07	3.62
1000	1	0.50	0.2631	0.0011	-0.0136	0.2767	-0.0125	-1.40	2.23
4000	4	2	0.2767	0.0010	0.0066	0.2701	0.0056	0.63	2.85
8000	8	4	0.2701	0.0013	0.0090	0.2611	0.0077	0.86	3.71
16000	16	8	0.2611	0.0013	0.0135	0.2476	0.0122	1.36	5.08
32000	32	16	0.2476	0.0011	0.0275	0.2201	0.0264	2.95	8.03
64000	64	32	0.2201	0.0013	0.0404	0.1797	0.0391	4.37	12.40
128000	128	64	0.1797	0.0020	0.0506	0.1291	0.0486	5.44	17.84
8000	8	4	0.1291	0.0035	-0.0697	0.1988	-0.0662	-7.40	10.44
250	0.25	0.13	0.1988	0.0041	-0.0599	0.2587	-0.0558	-6.24	4.19
					Total	Change	0.0375		
					in	Height, in.			

Consolidation Test
ASTM D2435 Method A

Frame 6

URS

Project Name: SR 4

Project Number: 26814910.24000

Boring Number: CB-20

Depth, ft: 51.0

Location: Pittsburg, CA

Tested By: S. Capps

Date: 01/20/05

Sample Number: 10-4

Description: Brown sandy clay

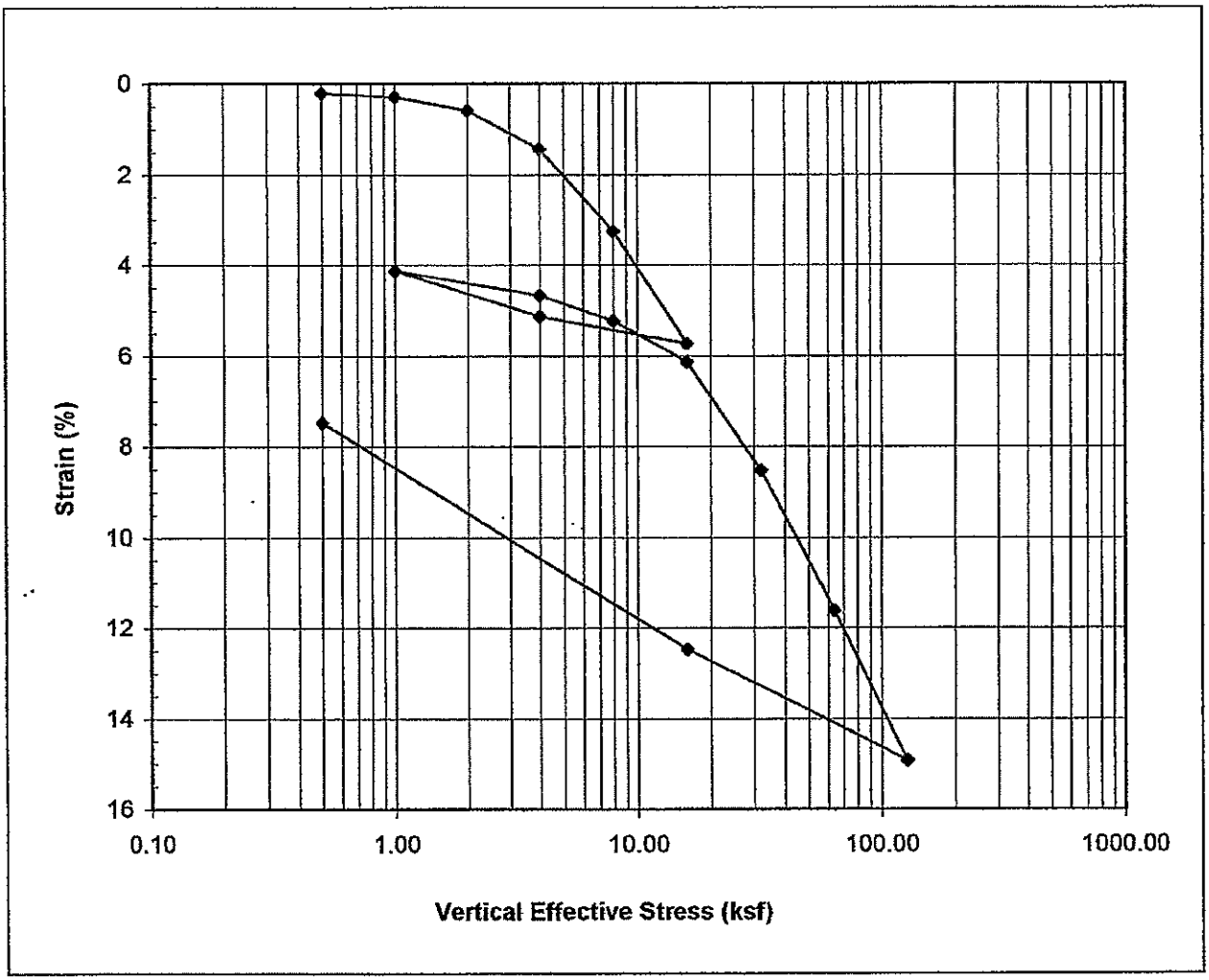
Liquid Limit: NA

Plastic Limit: NA

Plasticity Index: NA

Reviewed By: R. Taraya

Water Content Determination	Soil Adjacent to Sample	Sample at Start of Test	Sample at End of Test
Wet Soil + Tare, grams	339.57	307.42	306.39
Dry Soil + Tare, grams	298.31	291.81	291.81
Tare, grams	107.3	219.54	219.54
Weight of Water, grams	41.26	15.61	14.58
Weight of Dry Soil, grams	191.01	72.27	72.27
Water Content, %	21.60	21.60	20.17
Height of Gage Block, in:	0.7160	Dial Reading on Gage Block, in:	0.7280
Dial Reading on Sample, in:	0.9060		
Height of Sample, initial, in:	0.8940	Height of Sample, Final, in:	0.8565
Change in Height during Test, in:	0.0375	Estimated Specific Gravity:	2.69
Diameter of Ring, in:	1.939	Ring Number	R-8
Initial Area of Sample, cm^2:	19.05	Volume of Solids, Vs=Ws/Gs:	26.87
Volume of Sample, Initial, cm^3:	43.26	Volume of Sample, Final, cm^3	41.45
Volume of Voids, Initial, Vei, cm^3.	16.39	Volume of Voids, Final, Vef, cm^3:	14.58
Volume of Water, Initial, Wwi, cm^3:	15.61	Volume of Water, Final, Wwf, cm^3:	14.58
Degree of Saturation, Initial, %	95.2	Degree of Saturation, Final, %	100.0
Total Unit Weight, Initial, pcf:	126.8	Total Unit Weight, Final, pcf:	130.8
Dry Unit Weight, Initial, pcf:	104.2	Dry Unit Weight, Final, pcf:	108.8
Initial Void Ratio:	0.6102	Final Void Ratio:	0.5427



Boring: CB-21 Sample: 7-3 Depth, ft: 36.0

Description: Brown sandy clay

	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est	Liquid Limit	Plasticity Index
Initial	18.41	125.4	105.9	0.585	84.7	0.8960	1.938	2.690	NA	NA
Final	17.33	134.3	114.5	0.466	100.0	0.8291				

Project: **SR 4**
Project #: **26814910**
Date: **01/20/05**

URS

Consolidation Test

Figure: C-6

URS

Consolidation Test
ASTM D2435 Method A

Project Name: SR 4 Date: 01/20/05

Project Number: 26814910 .24000

Boring Number: CB-21 **Sample Number:** 7-3

Depth, ft: 36.0

Location: Pittsburg, CA

Load, Grams	Load, ksf	Load, tsf	Initial Dial, Inches	Frame Corr.	Dial Change	Final Dial, Inches	Change in Height, in.	Strain, Incre., %	Strain, Cum., %
500	0.50	0.25	0.3000	0.0008	0.0026	0.2974	0.0018	0.20	0.20
1000	1.00	0.50	0.2974	0.0004	0.0013	0.2961	0.0009	0.10	0.30
2000	2	1	0.2961	0.0006	0.0032	0.2929	0.0026	0.29	0.59
4000	4	2	0.2929	0.0003	0.0079	0.2850	0.0076	0.85	1.44
8000	8	4	0.2850	0.0008	0.0170	0.2680	0.0162	1.81	3.25
16000	16	8	0.2680	0.0007	0.0230	0.2450	0.0223	2.49	5.74
4000	4	2	0.2450	0.0008	-0.0062	0.2512	-0.0054	-0.60	5.13
1000	1	0.50	0.2512	0.0007	-0.0097	0.2609	-0.0090	-1.00	4.13
4000	4	2	0.2609	0.0001	0.0049	0.2560	0.0048	0.54	4.67
8000	8	4	0.2560	0.0007	0.0058	0.2502	0.0051	0.57	5.23
16000	16	8	0.2502	0.0008	0.0089	0.2413	0.0081	0.90	6.14
32000	32	16	0.2413	0.0009	0.0223	0.2190	0.0214	2.39	8.53
64000	64	32	0.2190	0.0014	0.0291	0.1899	0.0277	3.09	11.62
128000	128	64	0.1899	0.0020	0.0316	0.1583	0.0296	3.30	14.92
16000	16	8	0.1583	0.0030	-0.0249	0.1832	-0.0219	-2.44	12.48
500	0.50	0.25	0.1832	0.0018	-0.0467	0.2299	-0.0449	-5.01	7.47
					Total	Change	0.0669		
					in	Height, in.			

URS

Consolidation Test
ASTM D2435 Method A

Frame 7

Project Name: SR 4 **Date:** 01/20/05

Project Number: 26814910.24000

Boring Number: CB-21 **Sample Number:** 7-3

Depth, ft: 36.0 **Description:** Brown sandy clay

Location: Pittsburg, CA **Liquid Limit:** NA

Plastic Limit: NA

Plasticity Index: NA

Tested By: S. Capps **Reviewed By:** R. Taraya

Water Content Determination	Soil Adjacent to Sample	Sample at Start of Test	Sample at End of Test
Wet Soil + Tare, grams	331.5	314.86	314.06
Dry Soil + Tare, grams	294.4	301.32	301.32
Tare, grams	92.84	227.79	227.79
Weight of Water, grams	37.1	13.54	12.74
Weight of Dry Soil, grams	201.56	73.53	73.53
Water Content, %	18.41	18.41	17.33
Height of Gage Block, in:	0.7160	Dial Reading on Gage Block, in:	0.7470
Dial Reading on Sample, in:	0.9270		
Height of Sample, initial, in:	0.8960	Height of Sample, Final, in:	0.8291
Change in Height during Test, in:	0.0669	Estimated Specific Gravity:	2.69
Diameter of Ring, in:	1.938	Ring Number	R-6
Initial Area of Sample, cm^2:	19.03	Volume of Solids, Vs=Ws/Gs:	27.33
Volume of Sample, Initial, cm^3:	43.31	Volume of Sample, Final, cm^3	40.08
Volume of Voids, Initial, Vei, cm^3	15.98	Volume of Voids, Final, Vef, cm^3:	12.74
Volume of Water, Initial, Wwi, cm^3:	13.54	Volume of Water, Final, Wwf, cm^3:	12.74
Degree of Saturation, Initial, %	84.7	Degree of Saturation, Final, %	100.0
Total Unit Weight, Initial, pcf:	125.4	Total Unit Weight, Final, pcf:	134.3
Dry Unit Weight, Initial, pcf:	105.9	Dry Unit Weight, Final, pcf:	114.5
Initial Void Ratio:	0.5845	Final Void Ratio:	0.4662

Appendix D
Corrosivity Test Results

STATE ROUTE 4 HIGHWAY WIDENING PROJECT
WEST OF LOVERIDGE ROAD, PITTSBURG, CA
TO SOMERSVILLE ROAD, ANTIOCH, CA

CENTURY BOULEVARD UNDERPASS
FOUNDATION INVESTIGATION REPORT

Prepared for:

URS Corporation
1333 Broadway, Suite 800
Oakland, CA 94612

Prepared By:

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1999 Harrison Street, Suite 975
Oakland, CA 94612

March 2006

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Table 2. Soil Resistivity and Chemical Data 11

EXECUTIVE SUMMARY

V&A Consulting Engineers (V&A) was retained by URS Corporation to perform a Soil Corrosivity Investigation for the proposed State Route 4 Highway Widening Project Between Loveridge Road in Pittsburg, CA to Somersville Road in Antioch, CA. The objective of this investigation is to measure various soil parameters and evaluate the results to determine the corrosivity of the soil to the proposed underpass at Century Boulevard associated with the highway widening project. Corrosivity was determined at the underpass site to depths ranging from 0 to 6 meters below grade.

The California Department of Transportation, Division of Engineering Services, Materials Engineering and Testing Services, Corrosion Technology Branch has published "Corrosion Guidelines" (Guidelines) to define corrosive soil. The Guidelines consider soil to be corrosive to structural elements (steel reinforced concrete) if one or more of the following conditions exist for water or soil samples:

> ***"Chloride concentration is 500 ppm (mg/kg) or greater, sulfate concentration is 2,000 mg/kg or greater, or the pH is 5.5 or less."***

A wide variety of soluble salts is typically found in soils. Two soils having the same resistivity may have significantly different corrosion characteristics, depending on the specific ions available. The major constituents that accelerate corrosion are chlorides, sulfates and the acidity (pH) of the soil. Chloride ions tend to break down otherwise protective surface deposits, and can result in corrosion of reinforcing steel in concrete structures. Sulfates in soil can be highly aggressive to portland cement concrete by combining chemically with certain constituents of the concrete, principally tricalcium aluminate. This reaction is accompanied by expansion and eventual disruption of the concrete matrix. High concentrations of bicarbonates tend to decrease soil resistivities. Although bicarbonates are not aggressive to buried concrete, bicarbonates will lower the soil resistivity which can promote corrosion activity.

This report provides recommendations for corrosion control for the various structural foundation materials under consideration. This foundation investigation is in accordance with Caltrans Corrosion Guidelines dated September 2003 (Guidelines). The materials considered as part of this investigation include buried reinforced concrete, prestressed concrete piles, and steel pipe piles.

Acidity, as indicated by the pH of the soil, is another important factor of soil. The lower the pH (the more acidic the environment), the higher the corrosivity will be with respect to buried metallic and concrete structures. As pH increases above 7 (the neutral value), conditions become increasingly more alkaline and passive to buried structures.

Evaluation of the soil environment is reported in terms of potential damage to the structures due to corrosion. Soil resistivity measurements were conducted in the field during the initial stages of the work. In addition, soil samples collected by URS during the geotechnical investigation were forwarded to Sequoia Analytical Laboratory in Sacramento, CA, for testing. The soil borings were analyzed for 'as-received' resistivity, minimum resistivity, and pH. The soil borings with a minimum resistivity of 1,000 ohm-cm or less were analyzed for water soluble chloride ion concentration and water soluble sulfate ion concentration.

Based on the results of the corrosion analyses, the soil is determined to be *non-corrosive* in accordance with the Guidelines.

The pH of the soil samples analyzed ranged from 7.6 to 8.2 and the soil is considered to be *non-corrosive* in accordance with the Guidelines.

The water soluble chloride ion concentration is below the detection level of 15 milligrams per kilogram (mg/kg), and the water soluble sulfate ion concentration of the soil sample tested is 39 mg/kg. The chloride ion and sulfate ion concentrations are determined to be *non-corrosive* in accordance with the Guidelines.

CONCLUSIONS

- Soil samples were obtained for corrosion analysis at boring locations B-20 and B-21. Based on the results of the corrosion analyses, the site is considered non-corrosive.
- The proposed structure is not within 300 m (1000 ft.) of salt or brackish water.
- The in-situ resistivity measured at the Century Boulevard Underpass site is considered to be non-corrosive to steel pipe piles in accordance with the Guidelines.
- The chloride ion concentration is less than 15 mg/kg for Soil Samples B-20 and B-21 and is considered to be non-corrosive to buried reinforced concrete, cast in place piles, and prestressed concrete piles in accordance with the Guidelines.
- The sulfate ion concentration is less than 50 mg/kg for Soil Samples B-20 and B-21 and is considered to be non-corrosive to buried reinforced concrete, cast in place piles, and prestressed concrete piles in accordance with the Guidelines.
- The pH of the soil is greater than 7.0 for Soil Samples B-20 and B-21 and is considered to be non-corrosive to buried reinforced concrete, cast in place piles, and prestressed concrete piles in accordance with the Guidelines.

RECOMMENDATIONS

Based on the test data and review of the project requirements, specific recommendations for each structural foundation material alternative are listed below:

Buried Reinforced Concrete Structures, Prestressed Concrete Piles and Cast in Place Concrete Piles

Buried concrete structures should be constructed of durable concrete as described in Section 8.22 of the Caltrans Bridge Design Specifications and ACI Standards 201.2R and 222R. These recommendations include, but are not limited to, the following:

- The water/cement ratio should not exceed 0.50.
- A concrete cover of a minimum of 5.1 centimeters should be applied over all steel reinforcement.
- Salt-free sand and potable water should be used.
- Type II modified cement should be used.
- The concrete should be allowed to cure according to the manufacturer's recommendations.

Steel Pipe Piles

A conservative approach for the design of pipe piles would be to assume that corrosion will occur at a rate of 0.025 millimeters per year between grade and a depth 1 meter below the water table, in accordance with the Guidelines. It is important to note that structural considerations for pipe piles may require increases in metal wall thickness to withstand both installation and structural loadings, as they have not been considered in this analysis.

TEST METHODS

In attempting to predict corrosion problems associated with a particular type of structure prior to installation, it is necessary to investigate the soil conditions the structure will encounter. Since corrosion is an electrochemical process accompanied by current flow, the electrochemical characteristics of a soil are of primary importance when evaluating corrosivity. Test methods utilized during this investigation reflect the most practical methods of evaluating corrosivity.

Soil Resistivity

In-situ resistivity of the soil was measured at four locations at the Century Boulevard Underpass site. Figure 1 shows the project vicinity map. Figure 2 shows the in-situ soil resistivity and soil boring locations.

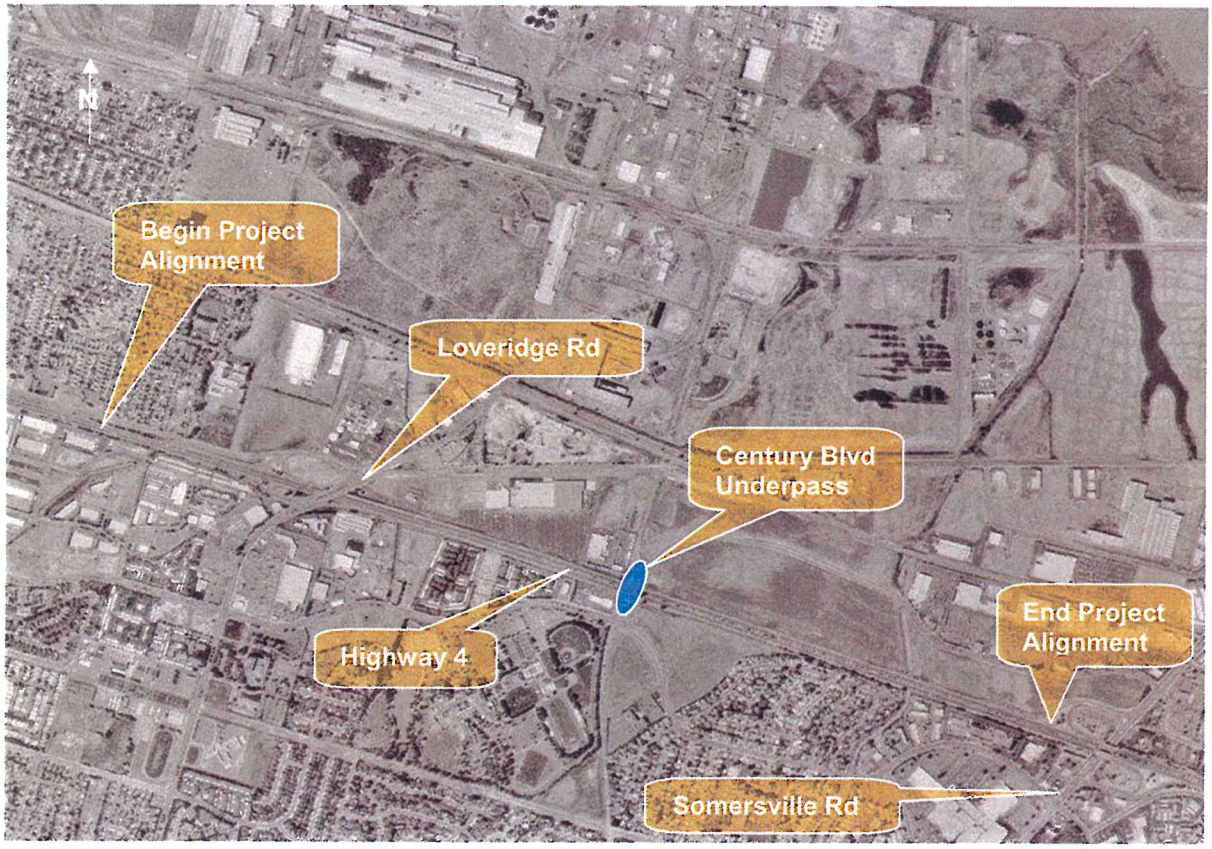
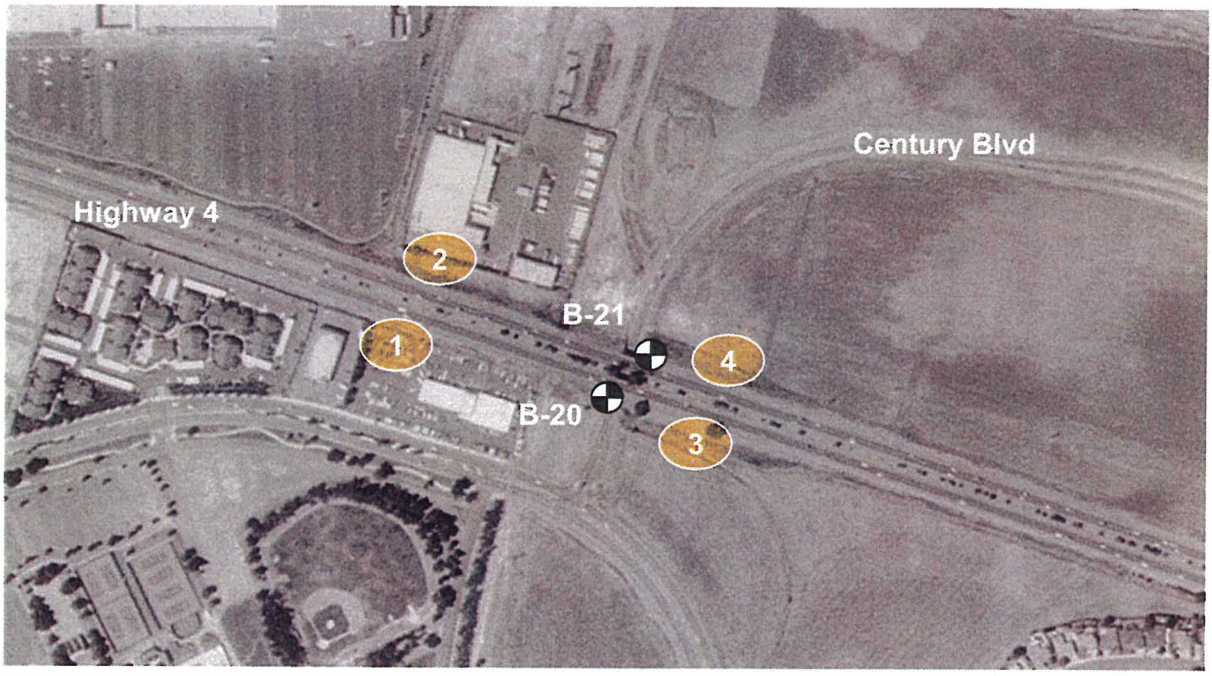


Figure 1 - Vicinity and Project Site Map[1]

[1] Map courtesy of the USGS and the TerraServer Team



In-Situ Soil Resistivity Location, See Table 1 (Typical of 4)
Soil Sample Location, See Table 2 (Typical of 2)

Figure 2 - Soil Resistivity Testing and Soil Sample Locations[2]

In-situ soil resistivity was measured using the Wenner 4-Electrode Method, with a Model 400 Soil Resistance Meter, manufactured by Nilsson Electrical Laboratory, Inc. The Wenner Method involves the use of four metal probes or electrodes, driven into the ground along a straight line, equidistant from each other, as shown in Figure 3.

[2] Map courtesy of the USGS and the TerraServer Team

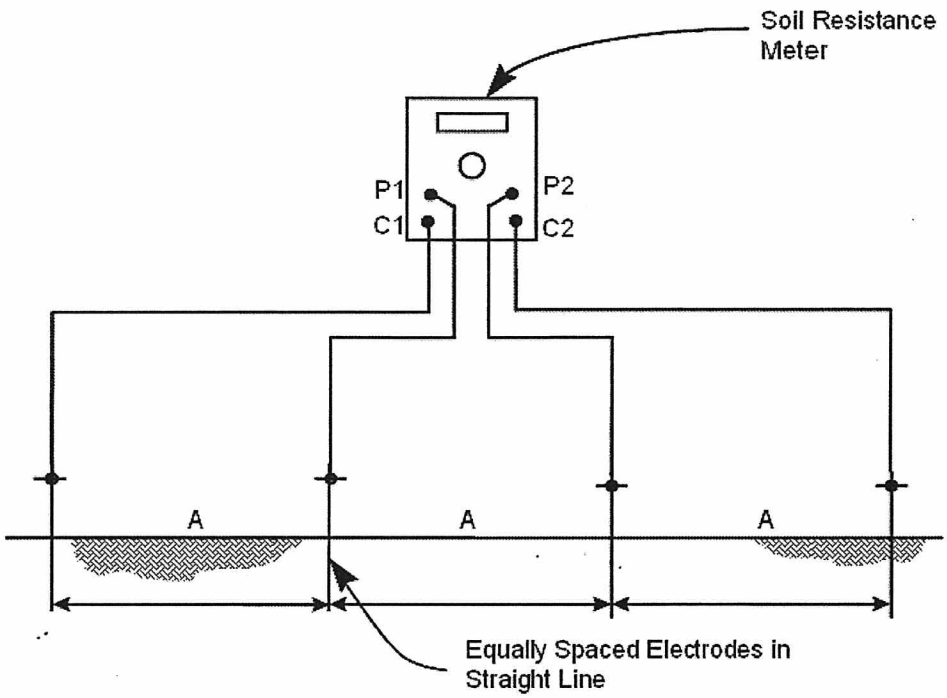


Figure 3 - Soil Resistivity Measurement Using the Wenner 4-Electrode Method

An alternating current from the Soil Resistance Meter causes a current to flow through the soil between the outside electrodes, C1 and C2. Due to the resistance of the soil, the current creates a voltage gradient, which is proportional to the average resistance of the soil mass to a depth equal to the distance between electrodes. The voltage drop is then measured across pins, P1 and P2. Resistivity of the soil is then computed from the instrument reading according to the following formula:

$$\rho = 2 \cdot \pi \cdot A \cdot R$$

Where:

ρ	=	soil resistivity (ohm-cm)
A	=	distance between electrodes (cm)
R	=	soil resistance, instrument reading (ohms)
π	=	3.14 (approx.)

Soil resistivity measurements were conducted with electrodes spaced at 1.5, 3, 4.5, and 6 meters. The resistivity values obtained represent the average resistivity of the soil to a depth equal to the electrode spacing. An additional method of calculating the soil resistivity using the data from the 4-Electrode Method is the Barnes-Layer Resistivity Calculation. The Barnes Layer Calculation is used to determine the resistivity of the soil for each soil layer. While the 4-Electrode Method at 3-meter

electrode spacing will consider all 3 meters of soil below the surface, the Barnes-Layer method will consider the resistivity of only the layer of soil between 1.5 and 3 meters below the surface. This method assumes the soil layers are a uniform thickness and parallel to the surface.

$$\rho_{b-a} = KR_{b-a}$$

and

$$\frac{1}{R_{b-a}} = \frac{1}{R_a} - \frac{1}{R_b}$$

Where:

ρ_{b-a}	=	Soil resistivity of layer depth b-a (ohm-cm)
a	=	Soil depth to top of layer (cm)
b	=	Soil depth to bottom of layer (cm)
R_a	=	Soil resistance read at depth a (ohms)
R_b	=	Soil resistance read at depth b (ohms)
R_{b-a}	=	Resistance of soil layer from a to b (cm)
K	=	Layer constant (cm)
	=	2 π (b-a)

Soil resistance is measured at electrode spacings of 1.5, 3, 4.5, and 6 meters. Barnes Layer resistivity is calculated for layers 0 to 1.5, 1.5 to 3, 3 to 4.5, and 4.5 to 6 meters below grade. The results of both methods are listed on Table 1.

To supplement the resistivity data obtained during field testing, two soil samples from the Century Boulevard Underpass site were obtained from URS for analysis of minimum soil resistivity using a soil box, as shown in Figure 4.

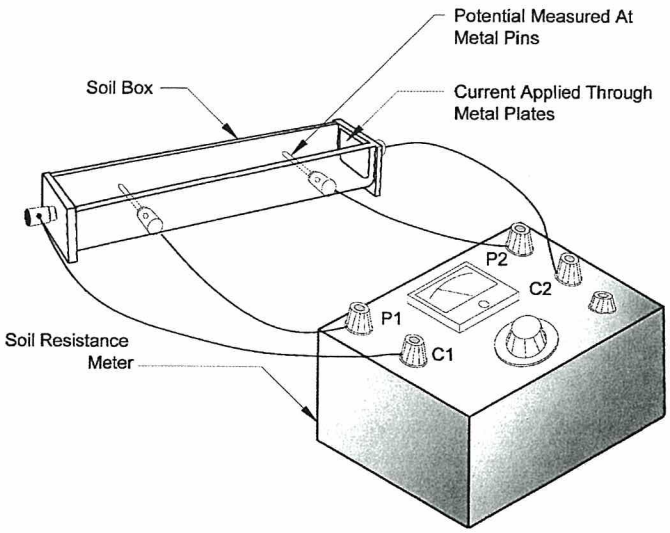


Figure 4 - Soil Resistivity Measurement Using the Soil Box Method

The soil box apparatus consists of a small plastic box with metal end plates. Dirt from the soil sample is tightly packed into the box and current is passed through the soil sample. The current causes a voltage drop across the soil sample and soil resistivity is determined using the above referenced Soil Resistance Meter.

The soil samples were placed in the soil box and the soil resistivity was measured in the "as-received" state. Distilled water was added to the soil sample in 10-mL increments and the resistivity was measured after each watering. As the soil sample became more saturated, the soil resistivity decreased until the minimum soil resistivity was reached.

Laboratory Analysis of Soil

The soil samples have a minimum resistivity greater than or equal to 1,000 ohm-cm and were forwarded to CERCO Analytical Laboratory in Pleasanton, CA, for testing. Both samples were tested for pH, and Soil Sample B-20 with a minimum resistivity of 1,000 ohm-cm was also tested for water soluble chloride and water soluble sulfate ion concentration.

TEST RESULTS

Data obtained during this investigation has been summarized in tabular form for analysis and presentation. Table 1 lists the results of the in-situ soil resistivity measurements conducted at the site. Table 2 lists the "as-received" and minimum soil resistivity for each sample collected as well as

the chemical analysis of the sample. The locations of the soil samples and the in-situ resistivity test locations are shown on Figure 2.

In-Situ Soil Resistivity

Table 1 - In-Situ Soil Resistivity Data

Site*	Depth (meters)	Resistivity (ohm-cm)	Layer Resistivity (ohm-cm)	Layer (meters)
1	1.5	1,053	1,053	0 – 1.5
	3.0	823	676	1.5 – 3.0
	4.5	747	630	3.0 – 4.5
	6.0	728	676	4.5 – 6.0
2	1.5	1,149	1,149	0 – 1.5
	3.0	785	596	1.5 – 3.0
	4.5	1,034	2,827	3.0 – 4.5
	6.0	1,187	2,137	4.5 – 6.0
3	1.5	1,436	1,436	0 – 1.5
	3.0	1,111	906	1.5 – 3.0
	4.5	948	733	3.0 – 4.5
	6.0	651	336	4.5 – 6.0
4	1.5	1,053	1,053	0 – 1.5
	3.0	938	846	1.5 – 3.0
	4.5	891	808	3.0 – 4.5
	6.0	728	470	4.5 – 6.0

Since corrosion is a natural electrochemical process accompanied by the flow of electrical current, it is important to understand how easily current will travel through the soil surrounding the steel or steel reinforced concrete structure. Resistivity is a measure of the ability of a soil to conduct an electric current. Soil resistivity is primarily dependent on the chemical and moisture content of the soil. As the concentration of chemical constituents increases, the soil resistivity will decrease. Additional moisture generally decreases the soil resistivity up to the point where the maximum solubility for the dissolved ionic chemicals is achieved. Beyond the maximum solubility, an increase in moisture generally increases the resistivity as the chemicals become more and more diluted. Since corrosion rate depends on current flow through the soil to and from the metal, soil corrosivity normally increases as soil resistivity decreases.

Based upon analysis of the in-situ soil resistivity results for the Century Boulevard Underpass site, shown in Table 1, the soil is determined to be *non-corrosive* to a depth of 6 meters below grade to the buried reinforced concrete, cast in place concrete piles, and prestressed concrete piles, in accordance with the Guidelines.

Soil samples were obtained for corrosion analyses at the following locations:

Laboratory Analysis of Soil Samples

Table 2 - Soil Resistivity and Chemical Data

Item No.	Boring No.	Station	Sample No.	Depth (meters)	Soil Resistivity (ohm-cm)		Chemical Data		
					As-Received	Minimum	pH	Sulfate (mg/kg)	Chloride (mg/kg)
1	B - 20	259	2	4	1,200	1,000	8.2	39	ND
2	B - 21	259	2	2	4,300	2,300	7.6	--	--

ND – Not Detected. Below the detection level of 15 mg/kg.

Based on the results of the corrosion analyses, the site is considered to be *non-corrosive.*

Appendix E
Analysis And Calculations

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[PROJECT CLIENT: Caltrans @ CCCTA]
[PROJECT MANAGER: Philip Meymand]
[COMPUTED BY: Sathish]
[DATE: 08/17/2005]
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[PROJECT MANAGER: Philip Meymand]
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[PROJECT NAME: SR4]
[PROJECT CLIENT: Caltrans @ CCCTA]
[PROJECT MANAGER: Philip Meymand]
[COMPUTED BY: Chaiwat]
[DATE: 08/17/2005]
[WATER TABLE - DRILLING: 15.1700]
[WATER TABLE - RESTDRIV: 15.1700]
[WATER TABLE - DESIGN: 15.1700]
[SOFT COMPRESSIBLE SOILS: FALSE]
     [DEPTH:  0.0000]
     [NOR]
[SCOURABLE SOILS: FALSE]
     [PIER:  0.0000]
     [CHANNEL DEGRADATION:  0.0000]
[PILE TYPE: CONCRETE PILE]
     [DEPTH:  1.5100]
     [SHAPE: SQUARE]
     [TIP DIAMETER:  0.0000]
     [SQUARE SIDE: 355.6000]

[END PROJECT INFORMATION]

[END OF FILE]
```

```
LPILEP4
SR4 Century Blvd Abut 1 BOF 15.95
2       3       1       1       1       0
200     2       -2.16   5.95    0
0       0.3556  0.0007849       0.09931 32000000
5.95    0.3556  0.0007849       0.09931 32000000
8       16      16      0       0
1       -2.16   -0.55   0       0
3       -0.55   1.95    136000  136000
4       1.95    4.45    24430   24430
3       4.45    10.95   271000  271000
4       10.95   11.45   5430    5430
3       11.45   17.95   271000  271000
3       17.95   23.45   8140    8140
7       23.45   24.95   543000  543000
-2.16   18.8
-0.55   18.8
-0.55   18.8
1.95    18.8
1.95    18.8
4.45    18.8
4.45    19.4
10.95   19.4
10.95   9
11.45   9
11.45   8.3
17.95   8.3
17.95   9.3
23.45   9.3
23.45   9
24.95   9
-2.16   30      0       0.01    0
-0.55   30      0       0.01    0
-0.55   52.5    0       0.007   0
1.95    52.5    0       0.007   0
1.95    0       33      0       0
4.45    0       33      0       0
4.45    143.5   0       0.005   0
10.95   143.5   0       0.005   0
10.95   0       30      0       0
11.45   0       30      0       0
11.45   143.5   0       0.005   0
17.95   143.5   0       0.005   0
17.95   12      0       0.02    0
23.45   12      0       0.02    0
23.45   700     0       0.004   0
24.95   700     0       0.004   0
0       1       1
1
1       110     0       300
0
1       1       0
100     2.54E-6 2.54
8       1
0
480000  270000  0       0
0       0.3556  0       0       0
9.29E-5 6       0       0.0625
445     0       0.025
```

```
LPILEP4
SR4 Century Blvd Abut 2 BOF 15.95
2       3       1       1       1       0
200     2       -2.16   5.95    0
0       0.3556  0.0007849       0.09931 32000000
5.95    0.3556  0.0007849       0.09931 32000000
8       16      16      0       0
1       -2.16   -0.55   0       0
3       -0.55   1.95    136000  136000
4       1.95    4.45    24430   24430
3       4.45    10.95   271000  271000
4       10.95   11.45   5430    5430
3       11.45   17.95   271000  271000
3       17.95   23.45   8140    8140
7       23.45   24.95   543000  543000
-2.16   18.8
-0.55   18.8
-0.55   18.8
1.95    18.8
1.95    18.8
4.45    18.8
4.45    19.4
10.95   19.4
10.95   9
11.45   9
11.45   8.3
17.95   8.3
17.95   9.3
23.45   9.3
23.45   9
24.95   9
-2.16   30      0       0.01    0
-0.55   30      0       0.01    0
-0.55   52.5    0       0.007   0
1.95    52.5    0       0.007   0
1.95    0       33      0       0
4.45    0       33      0       0
4.45    143.5   0       0.005   0
10.95   143.5   0       0.005   0
10.95   0       30      0       0
11.45   0       30      0       0
11.45   143.5   0       0.005   0
17.95   143.5   0       0.005   0
17.95   12      0       0.02    0
23.45   12      0       0.02    0
23.45   700     0       0.004   0
24.95   700     0       0.004   0
0       1       1
1
1       110     0       300
0
1       1       0
100     2.54E-6 2.54
8       1
0
480000  270000  0       0
0       0.3556  0       0       0
9.29E-5 6       0       0.0625
445     0       0.025
```

```
LPILEP4
SR4 Century Blvd Abut 2 BOF 17.54
2       3       1       1       1       0
200     2       -2.5    8.5     0
0       0.3556  0.0007849       0.09931 32000000
8.5     0.3556  0.0007849       0.09931 32000000
9       18      18      0       0
4       -2.5    -0.46   61000   61000
1       -0.46   1.04    0       0
3       1.04    3.54    136000  136000
4       3.54    6.04    24430   24430
3       6.04    12.54   271000  271000
4       12.54   13.04   5430    5430
3       13.04   19.54   271000  271000
3       19.54   25.04   8140    8140
7       25.04   26.54   543000  543000
-2.5    20.1
-0.46   20.1
-0.46   18.8
1.04    18.8
1.04    18.8
3.54    18.8
3.54    18.8
6.04    18.8
6.04    19.4
12.54   19.4
12.54   9
13.04   9
13.04   8.3
19.54   8.3
19.54   9.3
25.04   9.3
25.04   9
26.54   9
-2.5    0       36      0       0
-0.46   0       36      0       0
-0.46   30      0       0.01    0
1.04    30      0       0.01    0
1.04    52.5    0       0.007   0
3.54    52.5    0       0.007   0
3.54    0       33      0       0
6.04    0       33      0       0
6.04    143.5   0       0.005   0
12.54   143.5   0       0.005   0
12.54   0       30      0       0
13.04   0       30      0       0
13.04   143.5   0       0.005   0
19.54   143.5   0       0.005   0
19.54   12      0       0.02    0
25.04   12      0       0.02    0
25.04   700     0       0.004   0
26.54   700     0       0.004   0
0       1       1
1
1       90      0       300
0
1       1       0
100     2.54E-6 2.54
8       1
0
480000  270000  0       0
0       0.3556  0       0       0
9.29E-5 6       0       0.0625
```

445 0 0.025

```
LPILEP4
SR4 Century Blvd Abut 2 BOF 18.74
2         3         1         1         1         0
200       2         -2.5      8.5       0
0         0.3556    0.0007849           0.09931   32000000
8.5       0.3556    0.0007849           0.09931   32000000
9         18        18        0         0
4         -2.5      0.74      61000     61000
1         0.74      2.24      0         0
3         2.24      4.74      136000    136000
4         4.74      7.24      24430     24430
3         7.24      13.74     271000    271000
4         13.74     14.24     5430      5430
3         14.24     20.74     271000    271000
3         20.74     26.24     8140      8140
7         26.24     27.74     543000    543000
-2.5      20.1
0.74      20.1
0.74      18.8
2.24      18.8
2.24      18.8
4.74      18.8
4.74      18.8
7.24      18.8
7.24      19.4
13.74     19.4
13.74     9
14.24     9
14.24     8.3
20.74     8.3
20.74     9.3
26.24     9.3
26.24     9
27.74     9
-2.5      0         36        0         0
0.74      0         36        0         0
0.74      30        0         0.01      0
2.24      30        0         0.01      0
2.24      52.5      0         0.007     0
4.74      52.5      0         0.007     0
4.74      0         33        0         0
7.24      0         33        0         0
7.24      143.5     0         0.005     0
13.74     143.5     0         0.005     0
13.74     0         30        0         0
14.24     0         30        0         0
14.24     143.5     0         0.005     0
20.74     143.5     0         0.005     0
20.74     12        0         0.02      0
26.24     12        0         0.02      0
26.24     700       0         0.004     0
27.74     700       0         0.004     0
0         1         1
1
1         90        0         300
0
1         1         0
100       2.54E-6   2.54
8         1
0
480000    270000    0         0
0         0.3556    0         0         0
9.29E-5   6         0         0.0625
```

Liquefaction Analysis using CPT
CRR for CPT based upon: National Center for Earthquake Engineering Research (NCEER)
Technical Report NCEER-97-0022 edited by T. L. Youd and I. M. Idriss, published December 31, 1997
Settlement Based on: Tokimatsu and Seed 1984
Computed by Shobhna Upadhyaya
Project: SR4
Project No. 26814190
Date: 10/10/2005
PGA from A&S 1997
CPT 1

1 Atmosphere (psf) =	2117	psf
GW Depth (ft) =	42.64	
GW Depth for EQ (ft) =	42.64	ft
I_s Correction (Y or N) =	Y	
EQ Magnitude =	7	M
Magnitude Scaling Meth =	I	(for M<7.5, I for Idriss, A for Andrus and Stokoe, or Ave for an Average of the two [Defaults to Idriss and Idriss for M>7.5])
Site PGA =	0.6	g
Max. Depth of Liq. =	50	ft
Silty N Increase? (Y or N)	N	

Steps for Calculation
1) Import Depth and Qt data from CPT soil parameter file or direct reference
2) Adjust Depth to Correlate with values
3) Select Unit Weights
4) Import friction values from CPT soil parameter file or raw data
5) Select Variables (GW Depth, Is Correction, EQ Mag, Scaling Method, and PGA)
6) Review for sensitivity and need to correlate fine grained with lab data
7) Calculate and enter Thickness correction factor for each thin dense sand layer - Kh = 0.5(H/1000-1.45)^2+1 <--- H in mm
8) Import $(N_1)_{60}$ Values from Soil Parameter File
9) Compare (N1)60 calculated values
10) Enter volumetric strains values from Fig. Tokimatsu and Seed (1987)
11) Review Calculated Settlement

Total Post Liquefaction Settlement (CPT) = 0.207 Inches

Tokimatsu & Seed (1984)

Depth (ft)	Soil Unit Wt. (psf)	Total Vert. Stress (psf)	Pore Press Investigati (psf)	Pore press @EQ (psf)	Kh Thin Layer Correction	Qt (tsf)	n=1.0 Q	fs (tsf)	F
0.246	120.0	29.52	0	0		0	-0.02789	0	0
0.738	120.0	88.56	0	0		0	-0.08367	0	0
1.23	120.0	147.6	0	0		0	-0.13944	0	0
1.722	120.0	206.64	0	0		0	-0.19522	0	0
2.215	120.0	265.8	0	0		0	-0.25111	0	0
2.707	120.0	324.84	0	0		0	-0.30689	0	0
3.199	120.0	383.88	0	0		0	-0.36266	0	0
3.691	120.0	442.92	0	0		0	-0.41844	0	0
4.183	120.0	501.96	0	0		0	-0.47422	0	0
4.675	120.0	561	0	0		0	-0.53	0	0
5.167	120.0	620.04	0	0		7.71	13.98201	0.32	4.324336
5.659	120.0	679.08	0	0		14.54	26.83129	0.37	2.605549
6.152	120.0	738.24	0	0		12.59	23.09094	0.39	3.19126
6.644	120.0	797.28	0	0		19.54	36.16695	0.46	2.403173
7.136	120.0	856.32	0	0		23.32	43.25336	0.68	2.970491
7.628	120.0	915.36	0	0		21.08	38.96518	0.81	3.927783
8.12	120.0	974.4	0	0		22.79	42.14039	0.7	3.138619
8.612	120.0	1033.44	0	0		23.77	43.93629	0.78	3.354365
9.104	120.0	1092.48	0	0		25.17	45.07865	0.76	3.08645
9.596	120.0	1151.52	0	0		30.92	52.70293	1.08	3.55916
10.088	120.0	1210.56	0	0		28.54	46.15173	1.26	4.510516
10.581	120.0	1269.72	0	0		38.75	60.03708	1.31	3.436954
11.073	120.0	1328.76	0	0		38.12	56.3768	1.23	3.283886
11.565	120.0	1387.8	0	0		24.83	34.78325	0.93	3.853149
12.057	120.0	1446.84	0	0		24.34	32.64574	0.9	3.810882
12.549	120.0	1505.88	0	0		25.17	32.42896	0.69	2.825893
13.041	120.0	1564.92	0	0		33.35	41.62199	0.8	2.456434
13.533	120.0	1623.96	0	0		31.26	37.49849	0.84	2.7588
14.025	120.0	1683	0	0		34.35	39.81996	0.96	2.864945
14.518	120.0	1742.16	0	0		42.23	47.48005	1.27	3.07068
15.01	120.0	1801.2	0	0		39.63	43.004	1.22	3.150062
15.502	120.0	1860.24	0	0		38.84	40.75805	1.2	3.165402
15.994	120.0	1919.28	0	0		40.22	40.91155	1.56	3.973473
16.486	120.0	1978.32	0	0		37.54	36.95139	1.39	3.802922
16.978	120.0	2037.36	0	0		41.67	39.90588	1.38	3.394724
17.47	120.0	2096.4	0	0		49.91	46.61496	1.95	3.990848
17.962	120.0	2155.44	0	0		29.13	26.02928	1.12	3.992545
18.454	120.0	2214.48	0	0		27.19	23.55656	0.93	3.565574
18.947	120.0	2273.64	0	0		22.64	18.9152	0.7	3.255332
19.439	120.0	2332.68	0	0		34.16	28.2862	0.98	2.970268
19.931	120.0	2391.72	0	0		49.11	40.06668	1.73	3.610625
20.423	120.0	2450.76	0	0		77.21	62.00903	1.76	2.316258
20.915	120.0	2509.8	0	0		120.14	94.73671	1.83	1.539301
21.407	120.0	2568.84	0	0		133.68	103.0781	2.03	1.533284
21.899	120.0	2627.88	0	0		87.48	65.57838	2.59	3.005824
22.391	120.0	2686.92	0	0		42.42	30.57519	1.25	3.0431
22.884	120.0	2746.08	0	0		34.2	23.90823	1.01	3.076739
23.376	120.0	2805.12	0	0		35.58	24.3679	1.08	3.159979
23.868	120.0	2864.16	0	0		37.6	25.25552	1.29	3.566697
24.36	120.0	2923.2	0	0		34.28	22.45375	1.68	5.11908
24.852	120.0	2982.24	0	0		47.25	30.68759	2.01	4.39259
25.344	120.0	3041.28	0	0		101.74	65.90604	2.18	2.175228
25.836	120.0	3100.32	0	0		98.63	62.62569	1.95	2.008656
26.328	120.0	3159.36	0	0		90.82	56.49266	2.3	2.57731
26.821	120.0	3218.52	0	0		64.99	39.38502	1.2	1.89332
27.313	120.0	3277.56	0	0		42.46	24.90952	1.73	4.237992

Depth (ft)	CLAY n=1.0 Ic	SAND n=0.5 Q (0.5)	SAND n=0.5 Ic	n=0.75 q_{c1N}	SILT/SAND n=0.75 Ic ($C_{Q w 0.75}$)	Check for Sensitivity	Need for Sampling	Ic For Calcs.
0.246	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
0.738	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
1.23	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
1.722	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
2.215	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
2.707	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
3.199	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
3.691	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
4.183	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
4.675	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
5.167	2.97446						check	2.97446
5.659	2.615972						check	2.615972
6.152	2.722064						check	2.722064
6.644	2.493404	29.46707	2.562258				check	2.562258
7.136	2.495827	34.00417	2.573582				check	2.573582
7.628	2.612085						check	2.612085
8.12	2.520383	31.05706	2.618977	38.5293	2.549007		check	2.549007
8.612	2.527	31.44207	2.633983	38.45165	2.569183		check	2.569183
9.104	2.494035	32.38301	2.600501	39.05466	2.539757		check	2.539757
9.596	2.488725	38.8596	2.583319				check	2.583319
10.088	2.60263						check	2.60263
10.581	2.438358	46.49573	2.516638				check	2.516638
11.073	2.443289	44.66458	2.515468				check	2.515468
11.565	2.642079						check	2.642079
12.057	2.659005						check	2.659005
12.549	2.575016	27.35066	2.631726	30.70013	2.593163		check	2.593163
13.041	2.453179	35.78561	2.503049				check	2.503049
13.533	2.520467	32.84286	2.564056				check	2.564056
14.025	2.51182	35.50443	2.549124				check	2.549124
14.518	2.476137	43.07197	2.506956				check	2.506956
15.01	2.515019	39.667	2.540747				check	2.540747
15.502	2.533512	38.20652	2.554193				check	2.554193
15.994	2.600407						check	2.600407
16.486	2.619052						check	2.619052
16.978	2.560925	39.14807	2.567009				check	2.567009
17.47	2.56156	46.38761	2.563054				check	2.563054
17.962	2.745556						check	2.745556
18.454	2.746193						check	2.746193
18.947	2.794989						check	2.794989
19.439	2.634288						check	2.634288
19.931	2.578041	42.5871	2.558917				check	2.558917
20.423	2.307749	66.71828	2.284745					2.284745
20.915	2.052084	103.1519	2.025344					2.025344
21.407	2.024386	113.5467	1.994369					1.994369
21.899	2.369869	73.06393	2.337364					2.337364
22.391	2.615348						check	2.615348
22.884	2.700324						check	2.700324
23.376	2.701289						check	2.701289
23.868	2.723248						check	2.723248
24.36	2.865435						check	2.865435
24.852	2.720692						check	2.720692
25.344	2.269773	78.9938	2.213207					2.213207
25.836	2.26252	75.78711	2.20196					2.20196
26.328	2.36902	69.01304	2.306749					2.306749
26.821	2.39918	48.56225	2.328791					2.328791
27.313	2.777042						check	2.777042

Depth (ft)	Corrected $(q_{c1N})_{cs}$	$CRR_{7.5}$	Applied MMW CRR_{mag}	CSR	Factor of Safety	7.0 Magnitude Scaled CSR	CPTINT $(N)_{60}$ Value (CPT1.xls)	Site Specific Apparent % Fines	$(N_1)_{60cs}$ Value	Volumetric Strain (%)	Sand Settlement (inches)
0.246	#NUM!	#NUM!	#NUM!	0.3903	#NUM!	0.3272		#NUM!			
0.738	#NUM!	#NUM!	#NUM!	0.3900	#NUM!	0.3270		#NUM!			
1.23	#NUM!	#NUM!	#NUM!	0.3896	#NUM!	0.3267		#NUM!			
1.722	#NUM!	#NUM!	#NUM!	0.3892	#NUM!	0.3263		#NUM!			
2.215	#NUM!	#NUM!	#NUM!	0.3888	#NUM!	0.3259		#NUM!			
2.707	#NUM!	#NUM!	#NUM!	0.3883	#NUM!	0.3256		#NUM!			
3.199	#NUM!	#NUM!	#NUM!	0.3879	#NUM!	0.3252		#NUM!			
3.691	#NUM!	#NUM!	#NUM!	0.3874	#NUM!	0.3248		#NUM!			
4.183	#NUM!	#NUM!	#NUM!	0.3869	#NUM!	0.3244		#NUM!			
4.675	#NUM!	#NUM!	#NUM!	0.3865	#NUM!	0.3240		#NUM!			
5.167				0.3860		0.3237	7.2	77.0	14		
5.659				0.3856		0.3233	8.6	49.4	16		
6.152				0.3852		0.3229	9	56.7	16		
6.644	91.44878	0.151124	0.180253	0.3847	0.468526	0.3226	8	45.9	15		
7.136	107.752	0.196348	0.234194	0.3843	0.609414	0.3222	9.3	46.6	16		
7.628				0.3839		0.3218	10.3	49.1	17		
8.12	116.6934	0.227782	0.271687	0.3834	0.708539	0.3215	10.2	45.1	17		
8.612	120.8624	0.244194	0.291262	0.3830	0.760419	0.3211	10.3	46.3	17		
9.104	116.2906	0.226257	0.269868	0.3826	0.705328	0.3208	9	44.5	16		
9.596	125.3975	0.263379	0.314145	0.3822	0.821935	0.3204	10.7	47.2	18		
10.088				0.3818		0.3201	12.5	48.5	20		
10.581	132.6981	0.297309	0.354615	0.3814	0.92981	0.3198	12.3	43.1	19		
11.073	127.1992	0.271397	0.323709	0.3810	0.849676	0.3194	11.8	43.0	19		
11.565				0.3806		0.3191	9.6	51.1	17		
12.057				0.3802		0.3187	9.1	52.3	16		
12.549	100.8534	0.175401	0.20921	0.3798	0.550888	0.3184	8.3	47.9	15		
13.041	99.62367	0.171954	0.205098	0.3794	0.540637	0.3181	9.5	42.3	17		
13.533	102.2632	0.179458	0.214049	0.3790	0.564834	0.3177	9	46.0	16		
14.025	107.5552	0.195712	0.233435	0.3786	0.616653	0.3174	9.6	45.1	17		
14.518	120.7677	0.243808	0.290802	0.3781	0.76903	0.3170	11.4	42.5	18		
15.01	118.3292	0.234084	0.279204	0.3777	0.739164	0.3167	10.7	44.6	18		
15.502	116.8246	0.228281	0.272282	0.3773	0.721635	0.3163	10.4	45.4	17		
15.994				0.3769		0.3160	11.1	48.3	18		
16.486				0.3765		0.3156	10.1	49.6	17		
16.978	122.5599	0.251209	0.29963	0.3760	0.796818	0.3153	10.7	46.2	18		
17.47	144.1713	0.358689	0.427826	0.3756	1.139066	0.3149	12.6	45.9	20		
17.962				0.3751		0.3145	7.6	58.4	15		
18.454				0.3747		0.3141	6.9	58.5	14		
18.947				0.3742		0.3137	5.7	62.2	13		
19.439				0.3737		0.3133	7.8	50.6	15		
19.931	131.3558	0.290781	0.346829	0.3733	0.929191	0.3129	11.6	45.7	19		
20.423	126.8129	0.269659	0.321635	0.3728	0.862853	0.3125	15.9	30.5	22		
20.915	137.6604	0.322611	0.384794	0.3722	1.033714	0.3121	22	19.4	26		
21.407	146.7834	0.374113	0.446223	0.3717	1.200442	0.3116	23.9	18.3	28		
21.899	151.5674	0.403818	0.481653	0.3712	1.297657	0.3112	17.8	33.1	24		
22.391				0.3706		0.3107	8.3	49.3	15		
22.884				0.3700		0.3102	6.8	55.1	14		
23.376				0.3694		0.3097	7	55.2	14		
23.868				0.3688		0.3092	7.3	56.8	14		
24.36				0.3682		0.3087	7	67.7	14		
24.852				0.3675		0.3081	8.8	56.6	16		
25.344	134.2687	0.305117	0.363928	0.3668	0.992076	0.3076	18.3	27.1	24		
25.836	126.6847	0.269084	0.32095	0.3661	0.876608	0.3070	17.4	26.6	23		
26.328	135.9957	0.313915	0.374422	0.3654	1.024708	0.3063	16.6	31.5	23		
26.821	99.28877	0.17103	0.203996	0.3646	0.559453	0.3057	11.9	32.6	18		
27.313				0.3638		0.3050	7.4	60.8	14		

USING CPT RESULTS

27.805	120.0	3336.6	0	0	31.64	17.96541	1.14	3.803588	2.854718			check	2.854718				0.3630			0.3044	5.6	66.9	13		
28.297	120.0	3395.64	0	0	26.17	14.41388	0.91	3.718508	2.923552			check	2.923552				0.3622			0.3037	4.7	72.6	12		
28.789	120.0	3454.68	0	0	26.72	14.46887	1.01	4.041186	2.944525			check	2.944525				0.3613			0.3029	4.7	74.4	12		
29.281	120.0	3513.72	0	0	22.29	11.68741	0.92	4.480562	3.045134			check	3.045134				0.3604			0.3022	4.1	83.4	11		
29.773	120.0	3572.76	0	0	31.24	16.48788	0.97	3.293313	2.845107			check	2.845107				0.3595			0.3014	5.1	66.1	12		
30.265	120.0	3631.8	0	0	42.27	22.27771	1.75	4.32589	2.819299			check	2.819299				0.3585			0.3006	6.8	64.0	14		
30.758	120.0	3690.96	0	0	40.35	20.86423	1.8	4.674776	2.862912			check	2.862912				0.3575			0.2997	6.5	67.5	14		
31.25	120.0	3750	0	0	38.27	19.41067	1.53	4.203874	2.85657			check	2.85657				0.3565			0.2988	6	67.0	13		
31.742	120.0	3809.04	0	0	30.81	15.1773	1.41	4.877968	2.979934			check	2.979934				0.3554			0.2979	5.1	77.5	12		
32.234	120.0	3868.08	0	0	29.47	14.23753	1.16	4.212673	2.961227			check	2.961227				0.3543			0.2970	4.7	75.8	12		
32.726	120.0	3927.12	0	0	46.4	22.63055	1.33	2.993039	2.71133			check	2.71133				0.3531			0.2961	6.5	55.9	14		
33.218	120.0	3986.16	0	0	42.65	20.39904	1.53	3.763197	2.809148			check	2.809148				0.3519			0.2951	6.2	63.2	13		
33.71	120.0	4045.2	0	0	52.02	24.71937	2.51	5.020261	2.828951			check	2.828951				0.3507			0.2940	7.6	64.8	15		
34.202	120.0	4104.24	0	0	54.15	25.38735	2.77	5.316915	2.837498			check	2.837498				0.3495			0.2930	7.8	65.5	15		
34.694	120.0	4163.28	0	0	45.23	20.72806	2.17	5.02916	2.886079			check	2.886079				0.3482			0.2919	6.6	69.4	14		
35.187	120.0	4222.44	0	0	40.24	18.06007	1.65	4.32744	2.888634			check	2.888634				0.3468			0.2908	5.7	69.6	13		
35.679	120.0	4281.48	0	0	37.61	16.56869	1.35	3.806113	2.882263			check	2.882263				0.3455			0.2896	5.2	69.1	12		
36.171	120.0	4340.52	0	0	38.5	16.73981	1.31	3.605861	2.864157			check	2.864157				0.3441			0.2885	5.2	67.6	12		
36.663	120.0	4399.56	0	0	47.68	20.67489	1.5	3.298137	2.768338			check	2.768338				0.3426			0.2872	6.1	60.1	13		
37.155	120.0	4458.6	0	0	53.7	23.08828	1.98	3.846849	2.774203			check	2.774203				0.3411			0.2860	6.9	60.6	14		
37.647	120.0	4517.64	0	0	53.38	22.63181	1.96	3.834027	2.779853			check	2.779853				0.3396			0.2847	6.7	61.0	14		
38.139	120.0	4576.68	0	0	51.98	21.71516	2.06	4.145565	2.815566			check	2.815566				0.3381			0.2834	6.6	63.7	14		
38.631	120.0	4635.72	0	0	53.19	21.94789	2.1	4.127996	2.810855			check	2.810855				0.3365			0.2821	6.6	63.4	14		
39.124	120.0	4694.88	0	0	74.25	30.6302	3.07	4.269667	2.712862			check	2.712862				0.3349			0.2807	8.8	56.0	16		
39.616	120.0	4753.92	0	0	55	22.1388	2.69	5.111829	2.86956			check	2.86956				0.3332			0.2794	6.9	68.1	14		
40.108	120.0	4812.96	0	0	36.35	14.10505	1.79	5.273466	3.02606			check	3.02606				0.3315			0.2780	4.9	81.6	12		
40.6	120.0	4872	0	0	27.17	10.15353	1.45	5.862376	3.165548			check	3.165548				0.3298			0.2765	3.8	95.2	11		
41.092	120.0	4931.04	0	0	28.81	10.68516	1.29	4.896661	3.099559			check	3.099559				0.3281			0.2751	3.9	88.6	11		
41.584	120.0	4990.08	0	0	41.25	15.5328	1.59	4.102701	2.924525			check	2.924525				0.3263			0.2736	5	72.6	12		
42.076	120.0	5049.12	0	0	50.72	19.09063	1.94	4.025277	2.84998			check	2.84998				0.3245			0.2721	5.9	66.5	13		
42.568	120.0	5108.16	0	0	52.21	19.4418	1.94	3.906886	2.835602			check	2.835602				0.3227			0.2706	6	65.3	13		
43.061	120.0	5167.32	26.2704	26.2704	53.77	19.9128	2.23	4.356631	2.858165			check	2.858165				0.3225			0.2704	6.2	67.1	13		
43.553	120.0	5226.36	56.9712	56.9712	52	19.10741	2.45	4.960838	2.90864			check	2.90864				0.3225			0.2704	6.1	71.3	13		
44.045	120.0	5285.4	87.672	87.672	38.1	13.64338	1.83	5.161137	3.031187			check	3.031187				0.3225			0.2704	4.7	82.1	12		
44.537	120.0	5344.44	118.3728	118.3728	29.92	10.42764	1.38	5.064633	3.116934			check	3.116934				0.3224			0.2703	3.8	90.3	11		
45.029	120.0	5403.48	149.0736	149.0736	30.56	10.60377	0.97	3.481912	3.013267			check	3.013267				0.3222			0.2701	3.6	80.5	11		
45.521	120.0	5462.52	179.7744	179.7744	41.82	14.79865	1.46	3.735091	2.915703			check	2.915703				0.3220			0.2699	4.7	71.9	12		
46.013	120.0	5521.56	210.4752	210.4752	46.21	16.36171	2.17	4.994336	2.961565			check	2.961565				0.3217			0.2697	5.3	75.8	12		
46.505	120.0	5580.6	241.176	241.176	43.25	15.15508	2.19	5.412793	3.009551			check	3.009551				0.3214			0.2694	5.1	80.1	12		
46.997	120.0	5639.64	271.8768	271.8768	32	10.87238	1.66	5.688793	3.134243			check	3.134243				0.3210			0.2691	4	92.0	11		
47.49	120.0	5698.8	302.64	302.64	33.35	11.30456	1.16	3.803204	3.013503			check	3.013503				0.3206			0.2688	3.8	80.5	11		
47.982	120.0	5757.84	333.3408	333.3408	38.95	13.29932	1.54	4.269348	2.988035			check	2.988035				0.3201			0.2684	4.4	78.2	11		
48.474	120.0	5816.88	364.0416	364.0416	29.28	9.672599	1.05	3.981562	3.079792			check	3.079792				0.3196			0.2680	3.4	86.7	10		
48.966	120.0	5875.92	394.7424	394.7424	33.92	11.30488	1.3	4.195979	3.039184			check	3.039184				0.3191			0.2675	3.9	82.9	11		
49.458	120.0	5934.96	425.4432	425.4432	34.92	11.59903	1.66	5.195208	3.087615			check	3.087615				0.3185			0.2671	4.1	87.5	11		
49.95	120.0	5994	456.144	456.144	43.84	14.75047	1.41	3.452244	2.895931			check	2.895931				0.3180			0.2666	4.6	70.2	12		
50.442	120.0	6053.04	486.8448	486.8448	52.55	17.79437	2.43	4.906763	2.928871			check	2.928871				0.3173			0.2660	5.7	73.0	13		
50.934	120.0	6112.08	517.5456	517.5456	48.06	16.08855	2.42	5.377305	2.987986			check	2.987986				0.3167			0.2655	5.3	78.2	12		
51.427	120.0	6171.24	548.3088	548.3088	36.03	11.71787	1.83	5.554817	3.102492			check	3.102492				0.3160			0.2649	4.2	88.9	11		
51.919	120.0	6230.28	579.0096	579.0096	32.81	10.50909	1.24	4.175807	3.063194			check	3.063194				0.3153			0.2643	3.7	85.1	11		
52.411	120.0	6289.32	609.7104	609.7104	27.09	8.432037	0.95	3.967369	3.127176			check	3.127176				0.3146			0.2637	3.1	91.3	10		
52.903	120.0	6348.36	640.4112	640.4112	30.03	9.409972	0.96	3.574644	3.062095			check	3.062095				0.3138			0.2631	3.3	85.0	10		
53.395	120.0	6407.4	671.112	671.112	42.52	13.70792	1.86	4.730862	3.005631			check	3.005631				0.3131			0.2625	4.6	79.8	12		
53.887	120.0	6466.44	701.8128	701.8128	38.63	12.28068	1.68	4.746194	3.043719			check	3.043719				0.3123			0.2619	4.2	83.3	11		
54.379	120.0	6525.48	732.5136	732.5136	29.43	9.034149	1.41	5.388413	3.182603			check	3.182603				0.3116			0.2612	3.4	96.9	10		
54.871	120.0	6584.52	763.2144	763.2144	60.48	19.64774	2.05	3.584684	2.808317			check	2.808317				0.3108			0.2606	5.8	63.2	13		
55.364	120.0	6643.68	793.9776	793.9776	136.15	45.41365	2.32	1.746618	2.329016	75.49059	2.161672		2.161672	119.1177	0.237185	0.282902	0.3100	0.912561	LIQUEFY	0.2599	17.1	24.8	22	1.50	0.08874
55.856	120.0	6702.72	824.6784	824.6784	103.08	33.93261	3.2	3.208707	2.596425	56.54226	2.435253	check	2.435253	139.2113	0.330903	0.394685	0.3092	1.276383	LIQUEFY	0.2593	9	38.3	16	2.00	0.11808
56.348	120.0	6761.76	855.3792	855.3792	43.42	13.55792	2.34	5.844284	3.06797			check	3.06797				0.3084			0.2586	4.7	85.6	12		
56.84	120.0	6820.8	886.08	886.08	38.75	11.90944	1.63	4.61239	3.046462			check	3.046462				0.3076			0.2579	4.1	83.5	11		
57.332	120.0	6879.84	916.7808	916.7808	31.85	9.528693	1.42	4.998226	3.144323			check	3.144323				0.3068			0.2573	3.5	93.0	11		
57.824	120.0	6938.88	947.4816	947.4816	27.96	8.17524	0.98	4.001542	3.140273			check	3.140273				0.3061			0.2566	3	92.6	10		
58.316	120.0	6997.92	978.1824	978.1824	81.41	25.88519	3.8	4.877358	2.805745			check	2.805745				0.3053			0.2559	7.7	63.0	15		
58.808	120.0	7056.96	1008.883	1008.883	69.08	21.67681	3.56	5.430843	2.894042			check	2.894042				0.3045			0.2553	6.7	70.1	14		
59.3	120.0	7116	1039.584	1039.584	32.64	9.57209	0.85	2.92277	3.006159			check	3.006159				0.3037			0.2546	3.2	79.8	10		
59.793	120.0	7175.16	1070.347	1070.347	38.56	11.45733	0.75	2.144547	2.866908			check	2.866908				0.3030			0.2540	3.5	67.8	11		

Liquefaction Analysis using CPT

CRR for CPT based upon: National Center for Earthquake Engineering Research (NCEER)
Technical Report NCEER-97-0022 edited by T. L. Youd and I. M. Idriss, published December 31, 1997

Settlement Based on: Tokimatsu and Seed 1984

Computed by Shobhna Upadhyaya

Project: SR4

Project No. 26814190

Date: 10/10/2005

PGA from A&S 1997

CPT 2

1 Atmosphere (psf) =	2117	psf
GW Depth (ft) =	42.64	
GW Depth for EQ (ft) =	42.64	ft
I_s Correction (Y or N) =	Y	
EQ Magnitude =	7	M
Magnitude Scaling Meth =	I	(for M<7.5, I for Idriss, A for Andrus and Stokoe, or Ave for an Average of the two [Defaults to Idriss and Idriss for M>7.5])
Site PGA =	0.6	g
Max. Depth of Liq. =	50	ft
Silty N Increase? (Y or N)	N	

Steps for Calculation

1) Import Depth and Qt data from CPT soil parameter file or direct reference
2) Adjust Depth to Correlate with values
3) Select Unit Weights
4) Import friction values from CPT soil parameter file or raw data
5) Select Variables (GW Depth, Is Correction, EQ Mag, Scaling Method, and PGA)
6) Review for sensitivity and need to correlate fine grained with lab data
7) Calculate and enter Thickness correction factor for each thin dense sand layer - Kh = 0.5(H/1000-1.45)^2+1 <--- H in mm
8) Import $(N_1)_{60}$ Values from Soil Parameter File
9) Compare (N1)60 calculated values
10) Enter volumetric strains values from Fig. Tokimatsu and Seed (1984)
11) Review Calculated Settlement

Tokimatsu & Seed (1984)

Total Post Liquefaction Settlement (CPT) = 0.000 inches

Depth (ft)	Soil Unit Wt. (psf)	Total Vert. Stress (psf)	Pore Press Investigatl (psf)	Pore press @ EQ (psf)	Kh Thin Layer Correction	n=1.0 Qt (tsf)	n=1.0 Q	fs (tsf)	F	CLAY n=1.0 Ic	CLAY n=0.5 Q (0.5)	SAND n=0.5 Ic	SILT/SAND n=0.75 q_{c1N}	SILT/SAND n=0.75 Ic ($C_{Q\,w\,0.75}$)	Check for Sensitivity	Need for Sampling	Ic For Calcs.	Corrected $(q_{c1N})_{cs}$	$CRR_{7.5}$	Applied MMW CRR_{mag}	CSR	Factor of Safety	7.0 Magnitude Scaled CSR	CPTINT $(N)_{60}$ Value (CPT1.xls)	Site Specific Apparent % Fines	$(N_1)_{60cs}$ Value	Volumetric Strain (%)	Sand Settlement (inches)
0.246	120.0	29.52	0	0		0	-0.02789	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3903	#NUM!	0.3272		#NUM!			
0.738	120.0	88.56	0	0		0	-0.08367	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3900	#NUM!	0.3270		#NUM!			
1.23	120.0	147.6	0	0		0	-0.13944	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3896	#NUM!	0.3267		#NUM!			
1.722	120.0	206.64	0	0		0	-0.19522	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3892	#NUM!	0.3263		#NUM!			
2.215	120.0	265.8	0	0		0	-0.25111	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3886	#NUM!	0.3259		#NUM!			
2.707	120.0	324.84	0	0		0	-0.30689	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3883	#NUM!	0.3256		#NUM!			
3.199	120.0	383.88	0	0		0	-0.36266	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3879	#NUM!	0.3252		#NUM!			
3.691	120.0	442.92	0	0		0	-0.41844	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3874	#NUM!	0.3248		#NUM!			
4.183	120.0	501.96	0	0		0	-0.47422	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3869	#NUM!	0.3244		#NUM!			
4.675	120.0	561	0	0		0	-0.53	0	0	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	0.3865	#NUM!	0.3240		#NUM!			
5.167	120.0	620.04	0	0		25.66	47.89793	1.08	4.260358	2.5736	44.25245	2.597625				check	2.597625	146.5734	0.372852	0.444719	0.3860	1.152	0.3237	12.2	48.2	19		
5.659	120.0	679.08	0	0		33.73	63.09015	1.27	3.803482	2.455541	55.69696	2.492671				check	2.492671	152.1449	0.407533	0.486085	0.3856	1.260601	0.3233	14.5	41.6	22		
6.152	120.0	738.24	0	0		42.69	79.96387	1.7	4.01693	2.404665	67.70574	2.452374				check	2.452374	171.909	0.552475	0.658964	0.3852	1.710893	0.3229		39.3			
6.644	120.0	797.28	0	0		44.76	83.81929	2.11	4.756392	2.447817	68.29187	2.504985				check	2.504985	190.7919	0.725896	0.865812	0.3847	2.250476	0.3226		42.4			
7.136	120.0	856.32	0	0		39.8	74.39176	2.11	5.35916	2.520734	58.48402	2.588254				check	2.588254	190.3979	0.721903	0.861049	0.3843	2.240602	0.3222		47.6			
7.628	120.0	915.36	0	0		55.23	103.4904	2.55	4.655636	2.383648	78.69275	2.458078				check	2.458078	201.8738	0.845109	1.008002	0.3839	2.625909	0.3218		39.6			
8.12	120.0	974.4	0	0		78.51	147.4214	4.02	5.15234	2.32946	108.6482	2.40602				check	2.40602	253.9227	1.602607	1.911507	0.3834	4.985073	0.3215		36.7			
8.612	120.0	1033.44	0	0		55.64	104.1536	2.32	4.208748	2.347371	74.5353	2.439948				check	2.439948	185.0641	0.669453	0.79849	0.3830	2.084677	0.3211		38.6			
9.104	120.0	1092.48	0	0		58.94	106.9013	2.63	4.503906	2.363655	76.79435	2.453878				check	2.453878	195.5154	0.775066	0.924459	0.3826	2.41617	0.3208		39.4			
9.596	120.0	1151.52	0	0		50.08	85.98069	2.47	4.989472	2.45703	63.4127	2.541765				check	2.541765	189.5181	0.713046	0.850484	0.3822	2.225225	0.3204		44.6			
10.088	120.0	1210.56	0	0		46.68	76.12133	2.38	5.165522	2.502048	57.56243	2.580805				check	2.580805	184.8449	0.667361	0.795995	0.3818	2.084889	0.3201		47.1			
10.581	120.0	1269.72	0	0		45.93	71.34666	2.69	5.938827	2.566773	55.25444	2.638097	63.66713	2.598207		check	2.598207	211.105	0.954941	1.139005	0.3814	2.9865	0.3198		48.2			
11.073	120.0	1328.76	0	0		64.31	95.79701	3.5	5.4992	2.461473	75.89529	2.523924				check	2.523924	219.5158	1.06374	1.268774	0.3810	3.3303	0.3194		43.5			
11.565	120.0	1387.8	0	0		68.4	97.57328	3.05	4.504764	2.388101	79.00124	2.446013				check	2.446013	198.3033	0.805225	0.960431	0.3806	2.523633	0.3191		38.9			
12.057	120.0	1446.84	0	0		72.91	99.78516	3.18	4.405251	2.374454	82.49275	2.426522				check	2.426522	199.9546	0.823493	0.98222	0.3802	2.583626	0.3187		37.8			
12.549	120.0	1505.88	0	0		85.43	112.4619	3.07	3.625539	2.275898	94.85062	2.322735					2.322735	191.9616	0.737849	0.880068	0.3798	2.317385	0.3184		32.3			
13.041	120.0	1564.92	0	0		85.3	108.0152	2.57	3.040789	2.227945	92.86891	2.270805					2.270805	172.5948	0.558152	0.665735	0.3794	1.754873	0.3181	21.9	29.8	28		
13.533	120.0	1623.96	0	0		61.03	74.16195	2.38	3.952305	2.420819	64.95437	2.459246				check	2.459246	166.9825	0.513008	0.61189	0.3790	1.614661	0.3177	16.7	39.7	24		
14.025	120.0	1683	0	0		32.9	38.09685	1.73	5.396385	2.716514						check	2.716514				0.3786		0.3174	10.9	56.3	18		
14.518	120.0	1742.16	0	0		28	31.14401	1.33	4.902517	2.748954						check	2.748954				0.3781		0.3170	9.1	58.7	16		
15.01	120.0	1801.2	0	0		41.18	44.72507	1.41	3.500549	2.534279	41.25452	2.55958				check	2.55958	127.401	0.27231	0.324797	0.3777	0.859869	0.3167	11.2	45.7	18		
15.502	120.0	1860.24	0	0		29.96	31.2109	1.52	5.235984	2.768227						check	2.768227				0.3773		0.3163	9.2	60.1	16		
15.994	120.0	1919.28	0	0		23.32	23.30078	1.2	5.36664	2.867471						check	2.867471				0.3769		0.3160	7.3	67.9	14		
16.486	120.0	1978.32	0	0		34.71	34.09038	1.42	4.211046	2.674915						check	2.674915				0.3765		0.3156	9.6	53.4	17		
16.978	120.0	2037.36	0	0		36.05	34.38893	1.61	4.595887	2.698528						check	2.698528				0.3760		0.3153	9.8	55.0	17		
17.47	120.0	2096.4	0	0		36.24	33.57355	1.62	4.603345	2.706494						check	2.706494				0.3756		0.3149	9.6	55.6	17		
17.962	120.0	2155.44	0	0		34.85	31.33679	1.86	5.507475	2.782408						check	2.782408				0.3751		0.3145	9.3	61.2	16		
18.454	120.0	2214.48	0	0		35.92	31.44102	1.69	4.854542	2.743022						check	2.743022				0.3747		0.3141	9.2	58.2	16		
18.947	120.0	2273.64	0	0		45.67	39.17347	2.39	5.366785	2.70639						check	2.70639				0.3742		0.3137	11.2	55.6	18		
19.439	120.0	2332.68	0	0		41.16	34.28988	2.43	6.075963	2.785329						check	2.785329				0.3737		0.3133	10.2	61.4	17		
19.931	120.0	2391.72	0	0		38.71	31.37001	2.29	6.104365	2.813759						check	2.813759				0.3733		0.3129	9.5	63.6	17		
20.423	120.0	2450.76	0	0		76.83	61.69892	2.72	3.597664	2.444528	66.38463	2.422794				check	2.422794	159.8426	0.459805	0.548432	0.3728	1.471281	0.3125	16.8	37.6	24		
20.915	120.0	2509.8	0	0		57.09	44.49366	3.06	5.480424	2.674986						check	2.674986				0.3722		0.3121	12.5	53.4	20		
21.407	120.0	2568.84	0	0		51.36	38.98692	2.02	4.033902	2.619965						check	2.619965				0.3717		0.3116	10.7	49.6	18		
21.899	120.0	2627.88	0	0		54.7	40.63052	1.97	3.690102	2.580189	45.26835	2.546536				check	2.546536	136.4826	0.316437	0.37743	0.3712	1.016862	0.3112	12.3	44.9	19		
22.391	120.0	2686.92	0	0		43.83	31.62472	1.49	3.506993	2.644956						check	2.644956				0.3706		0.3107	8.8	51.3	16		
22.884	120.0	2746.08	0	0		42.61	30.03333	1.71	4.146765	2.710502						check	2.710502				0.3700		0.3102	8.6	55.9	16		
23.376	120.0	2805.12	0	0		40.35	27.76882	1.87	4.801343	2.778786						check	2.778786				0.3694		0.3097	8.3	60.9	15		
23.868	120.0	2864.16	0	0		40.76	27.4621	1.86	4.729464	2.777833						check	2.777833				0.3688		0.3092	8.2	60.8	15		
24.36	120.0	2923.2	0	0		37.97	24.97838	1.93	5.286455	2.840929						check	2.840929				0.3682		0.3087	7.7	65.7	15		
24.852	120.0	2982.24	0	0		39.97	25.80535	1.89	4.911785	2.808807						check	2.808807				0.3675		0.3081	7.8	63.2	15		
25.344	120.0	3041.28	0	0		74.02	47.67687	3.29	4.537971	2.594758	57.14464	2.541075				check	2.541075	170.5687	0.54151	0.645886	0.3668	1.7607	0.3076	15.4	44.6	22		
25.836	120.0	3100.32	0	0		60.24	37.8605	3.49	5.946515	2.748825						check	2.748825				0.3661		0.3070	11.1	58.7	18		
26.328	120.0	3159.36	0	0		72.04	44.60417	4.03	5.719531	2.687867						check	2.687867				0.3654		0.3063	12.6	54.3	20		
26.821	120.0	3218.52	0	0		45.85	27.49136	3.12	7.052323	2.898648						check	2.898648				0.3646		0.3057	8.7	70.5	16		
27.313	120.0	3277.56	0	0		26.43	15.12785	1.43	5.768171	3.02814						check	3.02814				0.3638		0.3050	5.2	81.8	12		

27.805	120.0	3336.8	0	0	29.56	15.71864	1.36	4.576003	2.947679	check	2.947579	0.3630	0.3044	5.5	74.6	13
28.297	120.0	3385.64	0	0	28.3	15.66843	1.41	5.300317	2.992627	check	2.992627	0.3622	0.3037	5.3	76.5	12
28.789	120.0	3454.68	0	0	21.89	11.67266	0.89	4.4141	3.041583	check	3.041583	0.3613	0.3029	4.1	83.1	11
29.291	120.0	3513.72	0	0	30.71	15.48005	1.06	3.661066	2.87358	check	2.87358	0.3604	0.3022	5.2	68.4	12
29.773	120.0	3572.76	0	0	34.5	16.3128	1.41	4.310131	2.882892	check	2.882992	0.3595	0.3014	5.6	69.2	13
30.265	120.0	3631.8	0	0	39.1	20.53202	1.76	4.69369	2.869306	check	2.869308	0.3585	0.3006	6.4	66.0	13
30.758	120.0	3690.96	0	0	36.82	20.03516	1.75	4.732969	2.879698	check	2.879698	0.3575	0.2997	5.3	68.9	13
31.25	120.0	3750	0	0	33.37	16.79733	1.61	5.746944	2.992644	check	2.992644	0.3565	0.2988	5.7	78.6	13
31.742	120.0	3809.04	0	0	25.26	12.26316	0.9	3.853465	2.968672	check	2.968672	0.3554	0.2979	4.1	78.3	11
32.234	120.0	3868.08	0	0	36.01	15.65316	1.26	3.464911	2.816695	check	2.816695	0.3543	0.2970	5.7	63.6	13
32.726	120.0	3927.12	0	0	46.04	22.44721	1.88	4.265317	2.612791	check	2.612791	0.3531	0.2961	8.6	63.5	14
33.218	120.0	3986.16	0	0	48.83	23.49977	2.02	4.312837	2.601014	check	2.601014	0.3519	0.2951	7.1	62.5	14
33.71	120.0	4045.2	0	0	49.04	23.24602	1.98	4.211207	2.797711	check	2.797711	0.3507	0.2940	7	62.4	14
34.202	120.0	4104.24	0	0	47.76	22.27349	2.05	4.485003	2.829713	check	2.829713	0.3496	0.2930	6.6	64.9	14
34.694	120.0	4163.28	0	0	48.63	22.36139	2.15	4.616852	2.836699	check	2.836699	0.3482	0.2919	6.9	65.4	14
35.187	120.0	4222.44	0	0	44.35	20.00681	2.09	4.94806	2.892897	check	2.892897	0.3468	0.2908	6.3	70.0	13
35.679	120.0	4281.48	0	0	42.31	18.76419	2.15	5.352362	2.936356	check	2.936356	0.3455	0.2896	6.1	73.7	13
36.171	120.0	4340.52	0	0	65.64	29.33738	3.54	5.559941	2.805677	check	2.805677	0.3441	0.2885	6.9	63.0	15
36.663	120.0	4399.56	0	0	92.73	41.15422	4.37	4.827117	2.658425	check	2.658425	0.3426	0.2872	11.5	52.2	19
37.155	120.0	4458.6	0	0	95.59	41.67893	5.67	6.966106	2.719909	check	2.719909	0.3411	0.2860	12.1	56.6	19
37.647	120.0	4517.64	0	0	52.85	22.39717	3.38	6.661006	2.945328	check	2.945328	0.3396	0.2847	7.3	74.4	14
38.138	120.0	4576.68	0	0	48.89	20.36483	2.57	5.614625	2.918569	check	2.918569	0.3381	0.2834	6.6	72.1	14
38.631	120.0	4635.72	0	0	48.23	19.60799	2.51	5.466964	2.92496	check	2.92496	0.3365	0.2821	6.4	72.7	13
39.124	120.0	4694.88	0	0	45.78	18.5021	2.52	5.802099	2.964261	check	2.964261	0.3349	0.2807	6.1	76.1	13
39.616	120.0	4753.92	0	0	37.45	14.75542	2.04	5.616433	3.038698	check	3.038698	0.3332	0.2794	8.1	82.6	12
40.108	120.0	4812.96	0	0	39.64	15.5553	1.85	4.942095	2.975381	check	2.975381	0.3315	0.2780	5.2	77.1	12
40.6	120.0	4872	0	0	41.31	15.95813	1.92	4.939034	2.966715	check	2.966715	0.3296	0.2765	5.3	76.3	12
41.092	120.0	4931.04	0	0	44.78	17.1825	1.88	4.442924	2.912962	check	2.912952	0.3281	0.2751	5.5	71.7	13
41.584	120.0	4990.06	0	0	47.66	18.1019	2.24	4.959597	2.926277	check	2.926277	0.3263	0.2736	5.9	72.8	13
42.076	120.0	5049.12	0	0	39.71	14.72947	1.9	5.109527	3.002831	check	3.002831	0.3245	0.2721	5	79.5	12
42.568	120.0	5108.16	0	0	32.92	11.88915	1.29	4.248163	3.025087	check	3.025087	0.3227	0.2706	4.1	81.6	11
43.061	120.0	5167.32	26.2704	26.2704	35.86	12.94535	1.39	4.177142	2.991398	check	2.991398	0.3226	0.2704	4.3	78.6	11
43.553	120.0	5226.36	56.9712	56.9712	36.92	13.27307	1.44	4.197416	2.984146	check	2.984146	0.3225	0.2704	4.4	77.8	11
44.045	120.0	5285.4	87.672	87.672	38.97	13.97615	1.58	4.349346	2.976117	check	2.976117	0.3225	0.2704	4.6	77.1	12
44.537	120.0	5344.44	118.3728	118.3728	38.71	13.79165	1.65	4.578526	2.994634	check	2.994634	0.3224	0.2703	4.5	78.8	12
45.029	120.0	5403.48	149.0736	149.0736	36.03	12.68563	1.74	5.226795	3.058758	check	3.058758	0.3222	0.2701	4.4	84.7	11
45.521	120.0	5462.52	179.7744	179.7744	32.96	11.44433	1.51	4.995246	3.081519	check	3.081519	0.3220	0.2699	4	86.9	11
46.013	120.0	5521.56	210.4752	210.4752	34.16	11.83156	1.33	4.233076	3.025613	check	3.025613	0.3217	0.2697	4	81.6	11
46.505	120.0	5580.6	241.176	241.176	43.44	15.22625	1.74	4.280474	2.942631	check	2.942631	0.3214	0.2694	4.9	74.2	12
46.997	120.0	5639.64	271.5768	271.5768	48.17	16.89724	2.15	4.607037	2.940155	check	2.940155	0.3210	0.2691	5.4	74.0	12
47.49	120.0	5698.6	302.64	302.64	48.29	16.10056	2	4.603966	2.944161	check	2.944161	0.3206	0.2688	5.2	74.3	12
47.982	120.0	5757.84	333.3408	333.3408	41.6	14.35011	2.13	5.472613	3.030704	check	3.030704	0.3201	0.2684	4.9	82.1	12
48.474	120.0	5816.88	364.0416	364.0416	34.69	11.65689	1.8	5.663662	3.109587	check	3.109587	0.3196	0.2680	4.2	89.6	11
48.966	120.0	5875.92	394.7424	394.7424	29.22	9.569926	1.33	5.06049	3.145406	check	3.145406	0.3191	0.2675	3.5	93.1	11
49.466	120.0	5934.96	425.4432	425.4432	24.57	7.641893	1.09	6.045706	3.214224	check	3.214224	0.3185	0.2671	3	100.0	10
49.95	120.0	5994	456.144	456.144	23.38	7.361333	0.99	4.556989	3.226464	check	3.226464	0.3180	0.2666	2.9	100.0	10
50.442	120.0	6053.04	486.8448	486.8448	24.59	7.748014	0.99	4.591096	3.194086	check	3.184086	0.3173	0.2660	2.9	96.1	10
50.934	120.0	6112.08	517.5456	517.5456	34.18	11.12656	1.56	5.012216	3.092012	check	3.092012	0.3167	0.2655	3.9	87.9	11
51.427	120.0	6171.24	548.3088	548.3088	36.31	11.81745	1.86	5.596299	3.101795	check	3.101795	0.3160	0.2649	4.2	88.8	11
51.919	120.0	6230.28	579.0096	579.0096	32.2	10.29321	1.76	5.051268	3.169612	check	3.169612	0.3153	0.2643	3.6	95.6	11
52.411	120.0	6289.32	609.7104	609.7104	26.17	8.108071	1.31	5.689384	3.234196	check	3.234196	0.3146	0.2637	3.2	100.0	10
52.903	120.0	6348.36	640.4112	640.4112	32.37	10.22968	1.15	3.93892	3.057422	check	3.057422	0.3136	0.2631	3.5	84.8	11
53.395	120.0	6407.4	671.112	671.112	62.94	17.34094	2.48	4.946086	2.939632	check	2.939632	0.3131	0.2625	5.5	73.8	13
53.887	120.0	6466.44	701.8128	701.8128	69.33	29.57072	5.36	5.225552	2.834776	check	2.834776	0.3123	0.2619	9	65.3	16
54.379	120.0	6525.48	732.5136	732.5136	69.11	29.63845	5.2	6.05727	2.828727	check	2.828727	0.3116	0.2612	6.9	64.8	16
54.871	120.0	6584.52	763.2144	763.2144	40.43	12.75925	1.96	5.331504	3.062606	check	3.062606	0.3108	0.2606	4.4	65.1	11
55.364	120.0	6643.68	793.9776	793.9776	29.73	9.02869	1.18	4.468316	3.133604	check	3.133604	0.3100	0.2599	3.3	92.0	10
55.856	120.0	6702.72	824.6784	824.6784	33.71	10.32951	1.14	3.765109	3.041745	check	3.041745	0.3092	0.2593	3.8	83.1	11
56.348	120.0	6761.76	855.3792	855.3792	42.12	13.11772	2.08	5.369249	3.05526	check	3.05526	0.3084	0.2586	4.5	84.4	12
56.84	120.0	6820.8	886.08	886.08	41.46	12.82271	2.19	5.755645	3.082193	check	3.082193	0.3076	0.2579	4.5	86.9	12
57.332	120.0	6879.84	916.7808	916.7808	39.03	11.93685	1.85	5.198075	3.078062	check	3.078062	0.3068	0.2573	4.2	86.5	11
57.824	120.0	6938.88	947.4816	947.4816	39.2	11.92729	1.68	4.701857	3.051119	check	3.051119	0.3061	0.2566	4.1	84.0	11
58.316	120.0	6997.92	978.1824	978.1824	38.9	11.76166	1.61	5.112844	3.078553	check	3.078553	0.3053	0.2559	4.1	86.6	11
58.808	120.0	7056.96	1008.883	1008.883	38.03	11.40909	1.57	5.420051	3.104752	check	3.104752	0.3045	0.2553	4.1	89.1	11
59.3	120.0	7116	1039.584	1039.584	36.73	10.91825	1.71	5.15495	3.106021	check	3.106021	0.3037	0.2546	3.9	89.2	11
59.793	120.0	7175.16	1070.347	1070.347	37.15	11.00523	1.59	4.733211	3.080381	check	3.080381	0.3030	0.2540	3.9	86.6	11

Settlement due to the additional approach embankment

By: Shobhna Upadhyaya

Side Slopes (H:V)	**2 : 1**
Fill Unit Weight	18.8 kN/m3
Embankment Height	**5.0 m**
Top width	7.0 m
Bottom Width	17.0 m
Height of equiv. rectangle	**3.5 m**
Footing Pressure	**1384.2 psf**
Groundwater at	**45.2 ft**
Depth to Start Sett. Calc.	0.0 ft

Stress Distribution under the Corner of a Uniform Vertical Loading on a Rectangular Area:

Size of loaded area:	**Length**	**55.76**	**ft**
	Width	**55.76**	**ft**
Size of a quarter of the loaded area	l	27.88	ft
	b	27.88	ft

SETTLEMENT DUE TO ADDITIONAL EMBANKMENT 71.2 mm

Layer	Depth (m)	Thickness (m)	Unit Weight (kN/m3)	z (ft)	Thickness (ft)	Unit Wt. (pcf)	CRc	CCE	σvo (psf)	Water Pressure (psf)	σ'vo (psf)	R1 Iz	R2 bz	R3 Ibz	I Factor	Δσ (psf)	σ'vf (psf)	OCR	σ'p (psf)	Comp. Range ?	S_{BEOP} (in)	Settlement (mm)
FILL	0.75	1.50	18.80	2.5	4.9	119.6	0.028	0.097	294.1	0.0	294.1	28.0	28.0	39.5	1.00	1383.5	1877.6	2	588.3	Y		
CLAY	2.25	1.50	18.80	7.4	4.9	119.6	0.028	0.097	882.4	0.0	882.4	28.8	28.8	40.1	0.99	1388.5	2248.9	2	1764.8	Y	1.10	28
CLAY	3.50	1.00	18.80	11.5	3.3	119.8	0.028	0.097	1372.6	0.0	1372.8	30.2	30.2	41.1	0.98	1325.0	2697.7	2	2745.3	N	0.32	8
SAND	4.63	1.25	18.80	15.2	4.1	119.6	0	0	1813.8	0.0	1813.8	31.7	31.7	42.2	0.91	1264.9	3078.7	2	3627.7	N	0.00	0
SAND	5.88	1.25	18.80	19.3	4.1	119.6	0	0	2304.1	0.0	2304.1	33.9	33.9	43.9	0.85	1178.7	3482.7	2	4608.2	N	0.00	0
CLAY	7.50	2.00	18.10	24.8	6.6	115.1	0.032	0.096	2925.8	0.0	2926.8	37.2	37.2	46.5	0.78	1050.7	3977.5	2	5853.5	N	0.34	9
CLAY	9.50	2.00	18.10	31.2	6.6	115.1	0.032	0.096	3681.9	0.0	3681.9	41.8	41.8	50.3	0.64	891.9	4573.8	2	7363.9	N	0.24	6
CLAY	11.50	2.00	18.10	37.7	6.6	115.1	0.032	0.096	4437.1	0.0	4437.1	48.9	46.9	54.8	0.54	748.6	5185.7	2	8874.2	N	0.17	4
CLAY	12.75	0.50	18.10	41.8	1.8	115.1	0.032	0.096	4909.1	0.0	4909.1	50.3	50.3	57.5	0.48	670.2	5579.2	2	9818.1	N	0.03	1
SAND	13.25	0.50	18.80	43.5	1.6	119.6	0	0	5101.5	0.0	5101.5	51.6	51.8	58.7	0.48	641.3	5742.8	2	10203.0	N	0.00	0
CLAY	13.75	0.50	18.13	45.1	1.8	115.3	0.05	0.159	5294.1	0.0	5294.1	53.0	53.0	59.9	0.44	613.7	5907.8	2	10588.2	N	0.05	1
CLAY	15.00	2.00	18.13	49.2	6.6	115.3	0.05	0.159	5766.9	247.1	5519.8	58.6	56.6	63.0	0.40	550.6	6070.4	2	11039.5	N	0.16	4
CLAY	17.00	2.00	18.13	55.8	6.6	115.3	0.05	0.159	6523.3	656.4	5866.8	62.3	62.3	66.3	0.34	465.2	6332.1	2	11733.7	N	0.13	3
CLAY	19.00	2.00	18.13	62.3	6.6	115.3	0.05	0.159	7279.7	1065.8	6213.9	68.3	68.3	73.7	0.29	396.0	6609.9	2	12427.8	N	0.11	3
CLAY	21.00	2.00	19.11	68.9	6.6	121.5	0.05	0.189	8056.5	1475.1	6581.4	74.3	74.3	79.4	0.25	339.8	6921.2	2	13182.8	N	0.09	2
CLAY	23.00	2.00	19.11	75.4	6.6	121.5	0.05	0.159	8853.8	1884.5	6969.4	80.4	80.4	85.1	0.21	293.8	7263.2	2	13938.7	N	0.07	2
CLAY	24.75	1.50	19.11	81.2	4.9	121.5	0.05	0.159	9551.5	2242.7	7308.8	85.8	85.8	90.2	0.19	260.4	7569.2	2	14617.7	N	0.04	1

Note: z is the depth from the ground surface to the mid point of the sublayer. **2.80** **71.23**

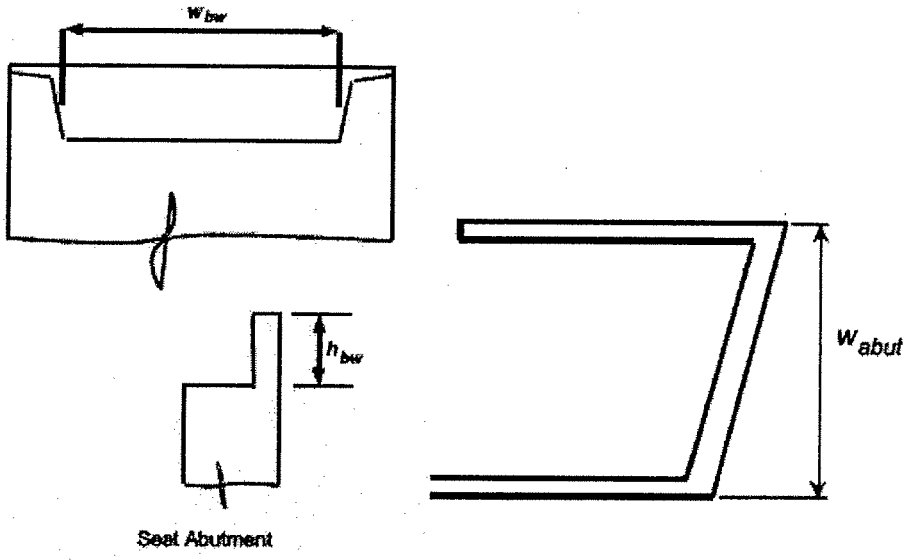
445 0 0.025

URS

Job: SR4-Century Blvd UC (Replace)
Description: Passive Pressure for Abutments

Project No.: 26814911
Computed by: SBM
Checked by: Shobha

Page ____ of ____
Sheet ____ of ____
Date: 01/17/06
Date: 01/26/07

	Reference
Objective: To calculate the Passive resistance at abutment according to Caltrans Seismic Design Criteria (CSDC) (V1.3) Section 7.8.1	
Data/Assumptions:	
	Figures 7.14B and 7.14C of CSDC V1.3
Century Boulevard UC is not a skewed bridge. Both Abutments (1 and 4) were Seat Abutments. The following table provides parameters used in the calculations.	
	Parameters from 65% Drawings

Parameter	Abutment 1&2
w_{bw} (m)	50.8
h_{bw} (m)	1.2

URS

Job: SR4-Century Blvd UC (Replace)
Description: Passive Pressure for Abutments

Project No.:26814911
Computed by: SBM
Checked by: Shobha

Page ____ of ____
Sheet ____ of ____
Date: 01/17/06
Date: 01/26/07

	Reference
For Abutment 1 & 2	
The longitudinal Abutment Response based on Section 7.8.1 of CSDC V1.3	
The maximum passive force, $$P_{bw} = A_e \times 239kPa \times \left(\frac{h_{bw}}{1.7}\right)kN$$ ✓	Eq 7.44 of CSDC
where A_e = the effective area for seat abutments and defined as $$A_e = h_{bw} \times w_{bw}$$ $$A_e = 1.2 \times 50.8$$ $$A_e = 60.96m$$ ✓	Eq 7.44 of CSDC
Then the maximum passive force, $$\therefore P_{bw} = A_e \times 239kPa \times \left(\frac{h_{bw}}{1.7}\right)kN$$ $$P_{bw} = 60.96 \times 239 \times \left(\frac{1.2}{1.7}\right)kN$$ $$P_{bw} = 10{,}284kN$$ Say, P_{bw} = 10,300 kN ✓	Eq 7.44 of CSDC
Estimated equivalent pressure = $P_{bw} / A_e \times h_{bw}$ = [redacted] kN/m^3 ✓	
The maximum passive pressure = $239 \times \left(\frac{h_{bw}}{1.7}\right) = 239x\left(\frac{1.2}{1.7}\right)$ = [redacted]	

7.7.3.4 *Minimum Pile Shaft Length*

Pile shafts must have sufficient length to ensure stable load-deflection characteristics.

7.7.3.5 *Enlarged Pile Shafts*

Type II shafts typically are enlarged relative to the column diameter to contain the inelastic action to the column. Enlarged shafts shall be at least 18 inches (450 mm) larger than the column diameter and the reinforcement shall satisfy the clearance requirements for CIP piling specified in Bridge Design Details 13-22.

7.7.4 Pile Extensions

Pile extensions must perform in a ductile manner and meet the ductility requirements of column elements specified in Section 4.1.

7.8 Abutments

7.8.1 Longitudinal Abutment Response

The linear elastic demand model shall include an effective abutment stiffness, K_{eff} that accounts for expansion gaps, and incorporates a realistic value for the embankment fill response. The abutment embankment fill stiffness is nonlinear and is dependent upon on the material properties of the abutment backfill. Based on passive earth pressure tests and the force deflection results from large-scale abutment testing at UC Davis, the initial embankment fill stiffness is $20\ \frac{\text{kip/in}}{\text{ft}}$ ($11.5\ \frac{kN/mm}{m}$). The initial stiffness[15] shall be adjusted proportional to the backwall/diaphragm height, as documented in Equation 7.43.

$$K_{abut} = \begin{cases} K_i \times w \times \left(\frac{h}{5.5}\right) & \text{U.S. units} \\ K_i \times w \times \left(\frac{h}{1.7}\right) & \text{S.I. units} \end{cases} \tag{7.43}$$

Where, w is the width of the backwall or the diaphragm for seat and diaphragm abutments, respectively.

The passive pressure resisting the movement at the abutment increases linearly with the displacement, as shown in Figure 7.14A. The maximum passive pressure of 5.0 ksf (239 kPa), presented in Equation 7.44 is based on the ultimate static force developed in the full scale abutment testing conducted at UC Davis [Maroney, 1995]. The height proportionality factor, $\frac{h}{5.5\ ft}\left(\frac{h}{1.7\ m}\right)$ is based on the height of the UC Davis abutment specimen 5.5 ft (1.7 m).

$$P_{bw}\ or\ P_{dia} = \begin{cases} A_e \times 5.0\ ksf \times \left(\frac{h_{bw}\ or\ h_{dia}}{5.5}\right) & (ft, kip) \\ A_e \times 239\ kPa \times \left(\frac{h_{bw}\ or\ h_{dia}}{1.7}\right) & (m, kN) \end{cases} \tag{7.44}$$

[15] This proportionality may be revised in future as more data becomes available.

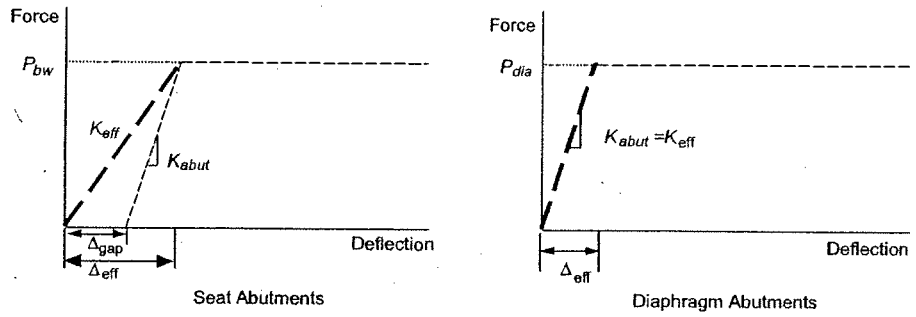


Figure 7.14A Effective Abutment Stiffness

The effective abutment area for calculating the ultimate longitudinal force capacity of an abutment is presented in Equation 7.45.

For seat abutments the backwall is typically designed to break off in order to protect the foundation from inelastic action. The area considered effective for mobilizing the backfill longitudinally is equal to the area of the backwall.

For diaphragm abutments the entire diaphragm, above and below the soffit, is typically designed to engage the backfill immediately when the bridge is displaced longitudinally. Therefore, the effective abutment area is equal to the entire area of the diaphragm. If the diaphragm has not been designed to resist the passive earth pressure exerted by the abutment backfill, the effective abutment area is limited to the portion of the diaphragm above the soffit of the girders.

$$A_e = \begin{cases} h_{bw} \times w_{bw} & \text{Seat Abutments} \\ h_{dia} \times w_{dia} & \text{Diaphragm Abutments} \end{cases} \tag{7.45}$$

$h_{dia} = h_{dia}^{*}$ = Effective height if the diaphragm is not designed for full soil pressure (see Figure 7.14B).

$h_{dia} = h_{dia}^{**}$ = Effective height if the diaphragm is designed for full soil pressure (see Figure 7.14B).

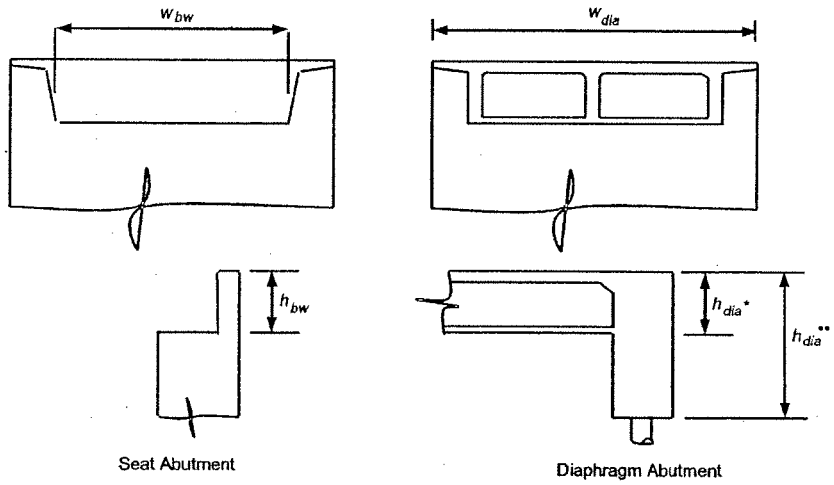


Figure 7.14B Effective Abutment Area

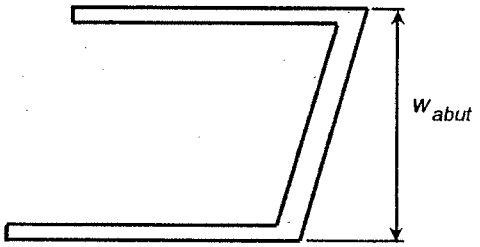


Figure 7.14C Effective Abutment Width for Skewed Bridges

The abutment displacement coefficient R_A shall be used in the assessment of the effectiveness of the abutment.

$$R_A = \Delta_D / \Delta_{eff}$$

where:

Δ_D = The longitudinal displacement demand at the abutment from elastic analysis.

Δ_{eff} = The effective longitudinal abutment displacement at idealized yield.

If $R_A \leq 2$ The elastic response is dominated by the abutments. The abutment stiffness is large relative to the stiffness of the bents or piers. The column displacement demands generated by the linear elastic model can be used directly to determine the displacement demand and capacity assessment of the bents or piers

If $R_A \geq 4$ The elastic model is insensitive to the abutment stiffness. The abutment contribution to the overall bridge response is small and the abutments are insignificant to the longitudinal seismic performance. The bents and piers will sustain significant deformation. The effective abutment stiffness K_{eff} in the elastic model shall be reduced to a minimum residual stiffness K_{res}, and the elastic analysis shall be repeated for revised column displacements. The residual spring has no relevance to the actual stiffness provided by the failed backwall or diaphragm but should suppress unrealistic response modes associated with a completely released end condition.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER

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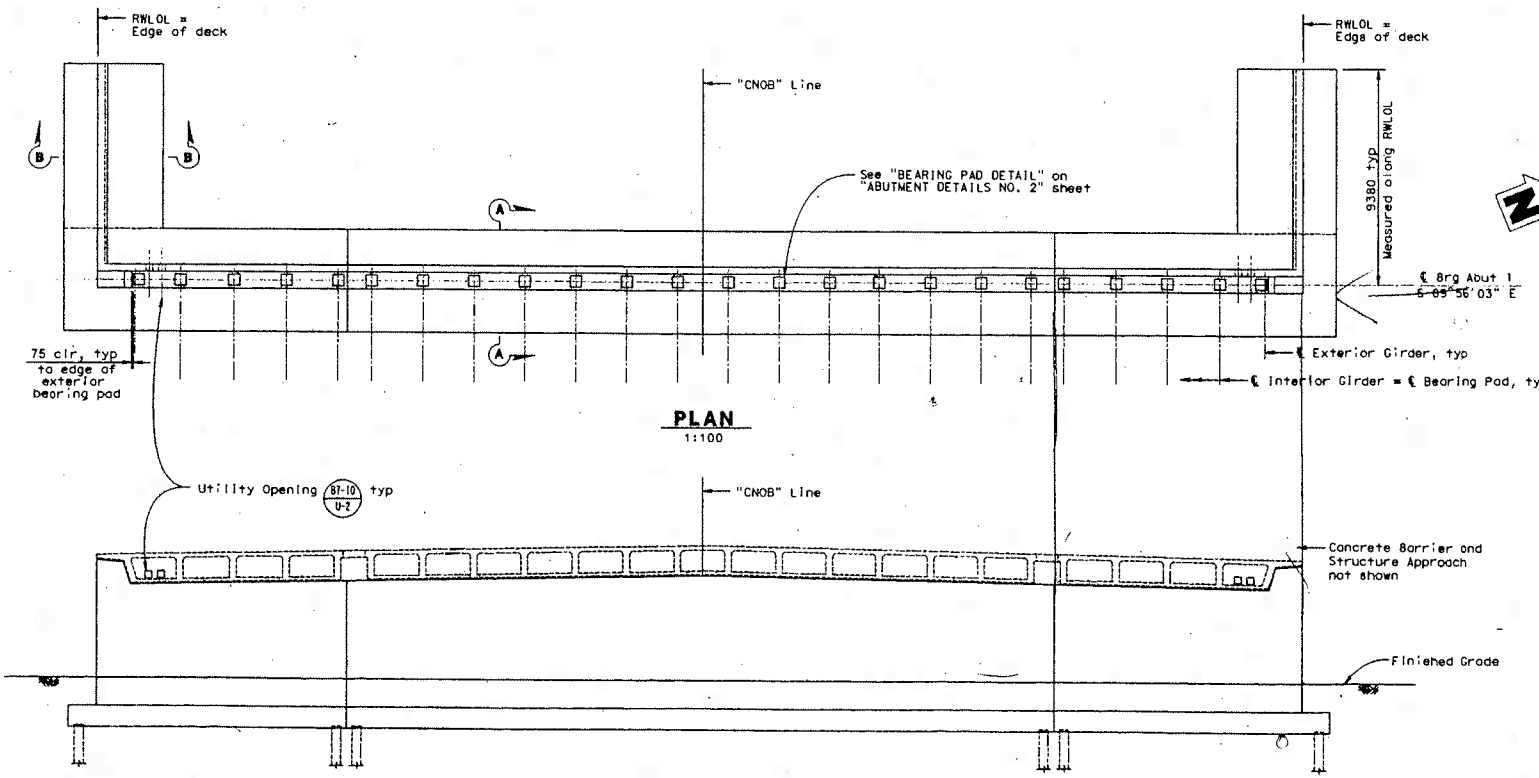
URS CORPORATION
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

Notes:

1. For footing and pile information, see "PILE LAYOUT" sheet.
2. For "SECTION A-A" see "ABUTMENT DETAILS NO. 1" sheet.
3. For "EXTERNAL KEY DETAIL" see "ABUTMENT DETAILS NO. 2" sheet.
4. For Return Wall details and "SECTION B-B" see "ABUTMENT DETAILS NO. 3" sheet.



PLAN
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ELEVATION
1:100

Note: All piles not shown.

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Emil Vergara		DESIGN	BY R. Nagarajah	CHECKED	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Walt Lafranchi	BRIDGE NO. 28-0395
DESIGN OVERSIGHT		DETAILS	BY L. Davis	CHECKED		PROJECT ENGINEER	KILOMETER POST 40.0
SIGN OFF DATE		QUANTITIES	BY	CHECKED		CU 04275 EA 228501	CENTURY BLVD UC ABUTMENT 1 L

DESIGN DETAIL SHEET METRIC REV. 3/1/98

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

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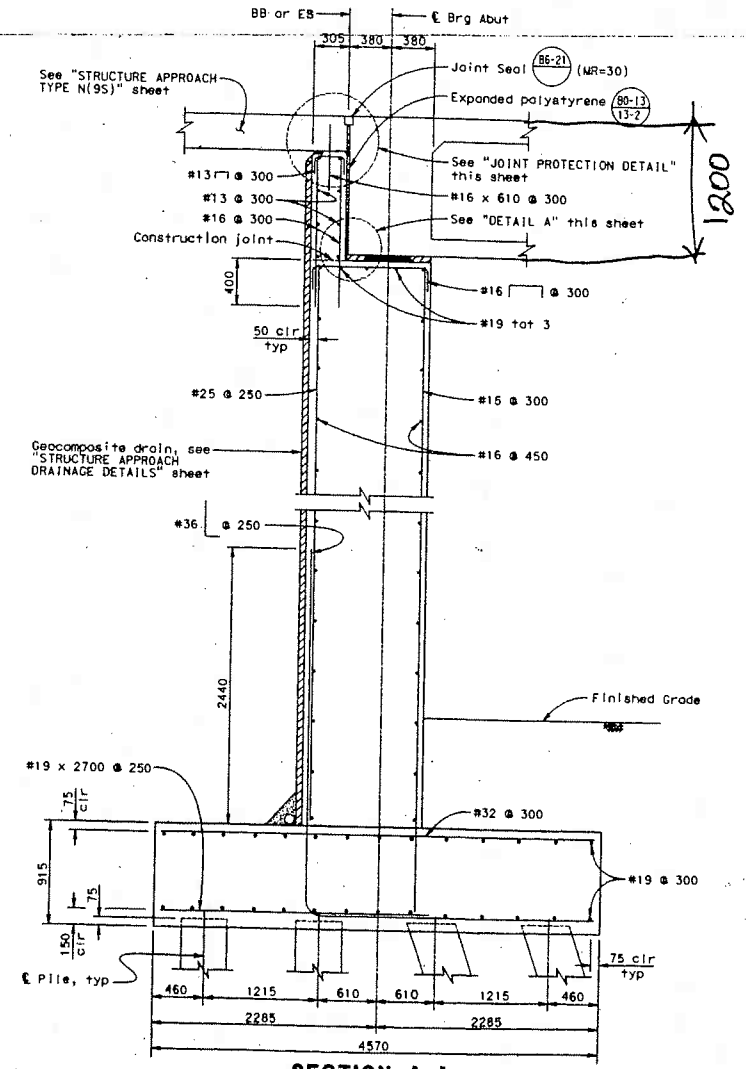
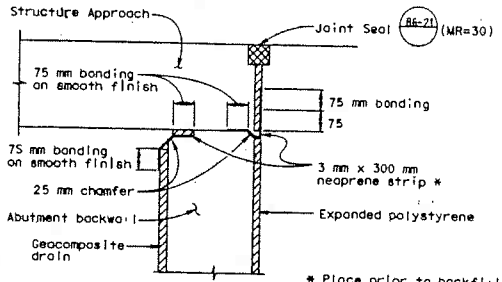
METRIC REV. 3/1/98



SECTION A-A

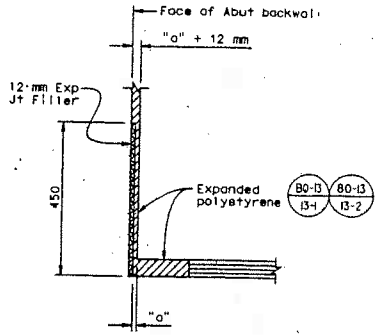
1120



* Place prior to backfilling the Abut backwall (Fold neoprene into chamfer)

JOINT PROTECTION DETAIL

No Scale



DETAIL "A"

No Scale

0157	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

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URS CORPORATION
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

DESIGN	BY R. Nagarajah	CHECKED
DETAILS	BY L. Davis	CHECKED
QUANTITIES	BY	CHECKED

PREPARED FOR THE STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

Walt LoFranchi
PROJECT ENGINEER

BRIDGE NO. 28-0395
KILOMETER POST 40.0

CENTURY BLVD UC (REPLACE)
ABUTMENT DETAILS NO. 1

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DATE PLOTTED => 10/18/2005 TIME PLOTTED => 11:54:01 AM

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

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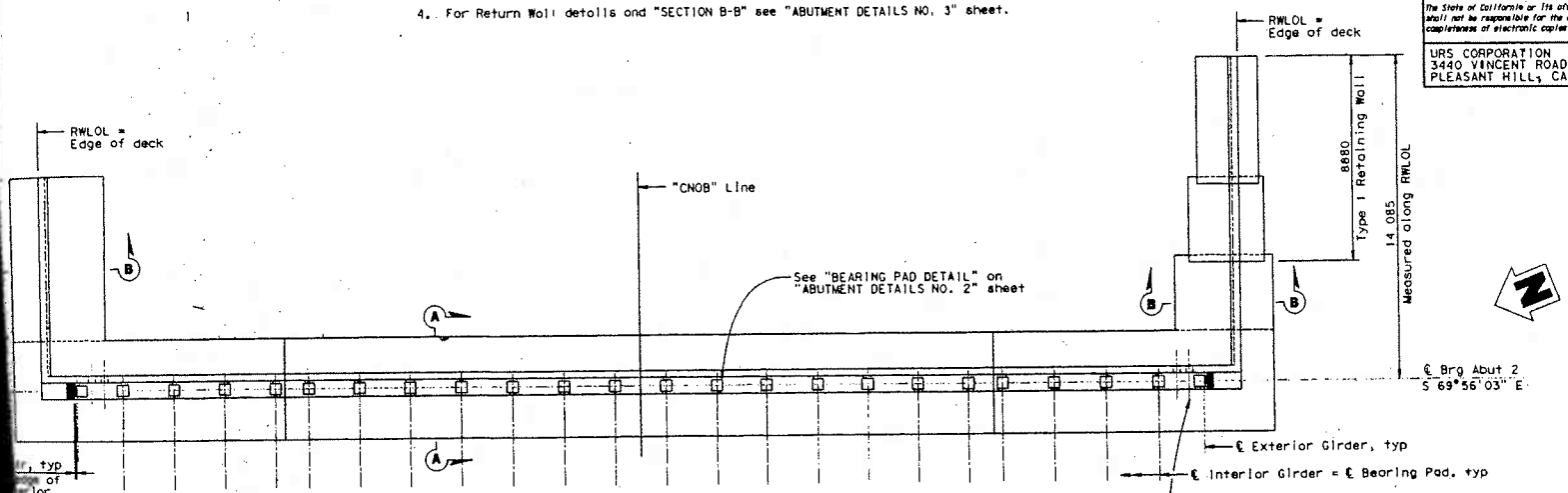
URS CORPORATION
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

Notes:

1. For footing and pile information, see "PILE LAYOUT" sheet.
2. For "SECTION A-A" see "ABUTMENT DETAILS NO. 1" sheet.
3. For "EXTERNAL KEY DETAIL" see "ABUTMENT DETAILS NO. 2" sheet.
4. For Return Wall details and "SECTION B-B" see "ABUTMENT DETAILS NO. 3" sheet.



PLAN
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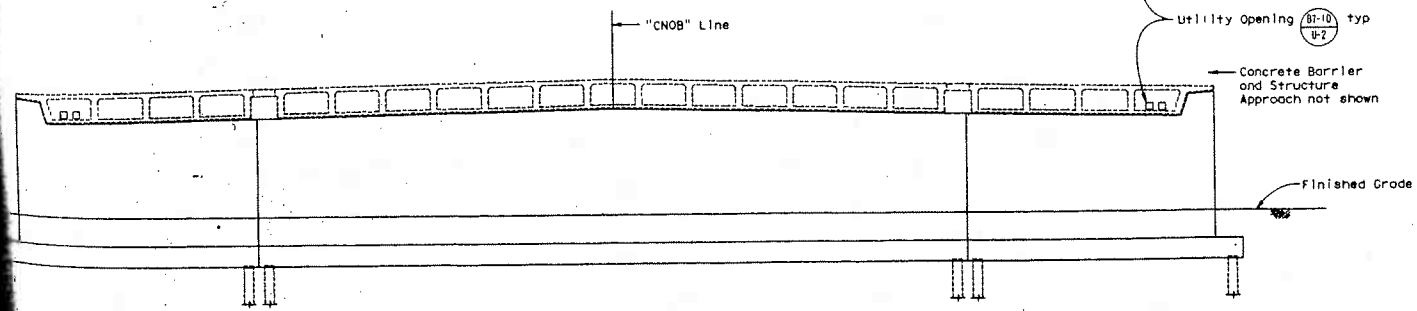

ELEVATION
1:100

Note: All piles not shown.

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Simila & ASZ

DESIGN	BY R. Nagarajah	CHECKED
DETAILS	BY L. Davis	CHECKED
QUANTITIES	BY	CHECKED

ORIGINAL SCALE IN MILLIMETERS 0 10 20 30 40 50 60 70 80 90 100

PREPARED FOR THE STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

Walt LaFranchi
PROJECT ENGINEER

CU 04275
EA 228501

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BRIDGE NO. 28-0395
KILOMETER POST 40.0

DIMENSIONS PRINTED BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY)

CENTURY BLVD UC (REPLACE)
ABUTMENT 2 LAYOUT

Appendix E

SHEET 25 OF

USERNAME => LDAVIS DATE PLOTTED => 10/18/2005 TIME PLOTTED => 11:52:49 AM

Appendix F
References

American Society for Testing and Materials (ASTM), 2000, v. 04.08 for ASTM test methods, Soil and Rock (1): D-420 to D-5779.

California Geological Survey (CGS), 2003, Fault investigation reports for development sites within Alquist-Priolo Earthquake Fault Zones in Northern California, 1974-2000, CGS CD 2003-01.

Ensoft, Inc., 2000, User's Manual, LPILE plus 4.0 for Windows, October.

FEMA, 1996, National Flood Insurance Program, (www.fema.gov).

Graymer, R.W., Jones, D.L., and Brabb, E.E., 1994, Preliminary geologic map of the Niles 7.5-minute quadrangle, Alameda County, California: U.S. Geological Survey Open-File Report 94-132, scale 1:24,000.

Knudsen, K.L., Sowers, J.M., Witter, R.C., Wentworth, C.M. and Helley, E.J., 2000, Preliminary maps of Quaternary deposits and liquefaction susceptibility, nine-county San Francisco Bay region: A digital database, U.S. Geological Survey, Open-File Report 00-444, 60 p.

Mualchin, L., 1996, California seismic hazard map 1996 based on maximum credible earthquakes (MCE), California Department of Transportation.

NCEER, (1998), "Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils", edited by Youd, T.L., and Idriss, I.M., Technical report NCEER-98-0022.

State of California, Department of Transportation, 1996, "Soil & Rock Logging Classification Manual".

State of California, Department of Transportation, "Guidelines for Structures Foundation Reports, Version 2.0", March 2006.

State of California, Department of Transportation, "Caltrans Memo to Designers 5-20, August 2004.

State of California, Department of Transportation, "Seismic Design Criteria, Version 1.4", June 2006.

State of California, Department of Transportation, "Standard Plans, Metric, July 2004.

Tokimatsu, A.M., Seed, H.B., 1987, Evaluation of Settlements in Sands Due to Earthquake Shaking, Journal of Geotechnical Engineering, Vol 133, No. 8, August.

U.S. Department of Transportation, Federal Highway Administration, 1998, " Design and Construction of Driven Pile Foundations" Workshop manual Volume I, Publication No. FHWA-HI-97-013, November.

U.S. Department of Transportation, Federal Highway Administration, 1998, " Design and Construction of Driven Pile Foundations" Workshop manual Volume II, Publication No. FHWA-HI-97-014, November.

U.S. Department of Transportation, Federal Highway Administration, 1999, " Drilled Shafts – Construction Procedures and Design Methods", Publication No. FHWA-IF-99-025, August.

U. S. Geological Survey, "Quaternary geology of Contra Costa County and surrounding parts of Alameda, Marin, Sonoma, Solano, Sacramento, and San Joaquin Counties, California", by E.J. Helley and R.W. Graymer, Open File Report 97-98, 1997.

Wills, C. J., 1991, The Antioch fault, Contra Costa County, California: Fault Evaluation Report FER-228, California Division of Mines and Geology, 28p., November 6.

Working Group for California Earthquake Probabilities, 2003, Summary of earthquake probabilities in the San Francisco Bay area, 2003-2032, US Geological Survey, Fact Sheet 039-03 6 p.

Appendix G

Caltrans Review Comments And Responses

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

[X] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 03/23/05

FILE: 04 (District) CC (County) 4 (Route) 23.7/26.8 (PM)

SUB CONSULTANT: URS
PRIME CONSULTANT: URS
GENERAL PLAN DATED: 03/04/05
Report Date: 03/07/05
Contract No.:
FDN PLAN DATED: 03/04/05

Century Blvd UC (Replace) (Structure Name)
04-228501 (EA Number)
28-0099R/L (Bridge Number)

Submittal (Check One): [ ] 1st [ ] 2nd [ ] 3rd [ ] 4th [X] Other: Type Selection

The following comments for the above referenced project are based on
(a) the Type Selection Report, dated 03/07/05, prepared by URS, and
(b) the Preliminary Foundation Investigation Report, dated 03/07/05, prepared by URS.

1. The seismic data are generally acceptable. We concur with the following data:
   (1) Controlling faults: Coast Ranges Sierran Block boundary zone (CRSB)
   (2) Style of fault: reverse
   (3) MCE: Mw=7.0
   (4) Distance from bridge to fault: about 6.25 km
   (5) Soil type: D
2. We concur that precast driven piles and CIDH piles are suitable foundation alternatives. Final foundation report should provide brief discussion regarding the selection of a particular pile type.
3. Please incorporate the field acceptance criteria currently used by Caltrans, Gates Formula, into Special Provision if driven piles are recommended in the final foundation report.
4. Please indicate potential need to use temporary casing due to possible caving to avoid potential construction claim if CIDH piles are recommended in the final foundation report, even though caving is not a major concern due to site mainly consisting of clay.
5. Consultant will perform further site investigation to evaluate the liquefaction of the layer of medium dense sand under groundwater level.

REGISTERED PROFESSIONAL ENGINEER
CAROLINE JINXIA CHEN
No. C 62498
Exp.
CALIFORNIA

[X] Special Funded Project (OSFP) [ ] Local Assistance Project (OSFP) [ ] OSCM P

Approval: Type Selection

OSFP/OSCM

Caroline Office of Geotechnical Design - West

cc: OGDs, Lab File Room (Sacramento) DES Specifications and Estimates (J.Stayton-4 copies) Structure Construction R.E. Pending File

Revised 05/04

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

☐ MR. EARL SEABERG, CHIEF, OSFP
☐ MR. VONG TOAN, CHIEF, OSCM
Attention:

DATE: 03/23/05

FILE:

04	CC	4	23.71/26.8
District	County	Route	PM

Centurr Blvd UC (Replace)
Structure Name

04-228501	28-0099R/L
EA Number	Bridge Number

6. LOTBs:

(1) If groundwater is not marked on the LOTB, a note should be added at the bottom of each boring to indicate whether groundwater was not encountered or not measured during exploration.
(2) As-built LOTBs: Please check out website http://www.dot.ca.gov/hq/esc/geotech/requests/asblotb.pdf to see sample as-built LOTB for the current format.

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	October 24, 2005
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	March 23, 2005		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 35% PS&E**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
	Report					
1		The seismic data generally acceptable. We concur with the following data: (1) Controlling faults: Coast Ranges Sierran Block boundary zone (CRSB) (2) Style of fault: reverse (3) MCE: Mw = 7.0 (4) Distance from bridge to fault: about 6.25 km (5) Soil type: D	Concur	A		A
2		We concur that precast driven pile and CIDH piles are suitable foundation alternatives. Final foundation report should provide brief discussion regarding the selection of a particular pile type	Report has been revised to include this.	A		A
3		Please incorporate the field acceptance criteria currently used by Caltrans, Gates Formula, into Special Provision if driven piles are recommended in the final foundation report	Report has been revised to include this.	A		A
4		Please indicate potential need to use temporary casing due to possible caving to avoid potential construction claim if CIDH piles are recommended in the final foundation report, even though caving is not a major concern due to site mainly consisting of clay.	CIDH pile are not recommended in the final foundation report	A		A
5		Consultant will perform further site investigation to evaluate the liquefaction of medium dense sand under ground water level.	Further site investigation is performed. Report has been revised to include this.	A		A
6	LOTB's	(1) If groundwater is not marked on the LOTB, a note should be added at the bottom of each boring to indicate whether ground water was not encountered or not measured during exploration.	Report has been revised to include this.	A		A

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	October 24, 2005
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	March 23, 2005		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 35% PS&E**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		(2) As-built LOTBs: Please check out website http://www.dot.ca.gov/hq/esc/geotech/requests/asblotb.pdf to see sample as-built LOTB for the current format.		A		A

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

ALREADY CC'D RAMASH

[x] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 12/14/05

FILE: 04 (District) CC (County) 4 (Route) 23.71/26.8 (PM)

SUB CONSULTANT: URS
PRIME CONSULTANT: URS
GENERAL PLAN DATED: 10/19/05
Report Date: 03/07/05
Contract No.:
FDN PLAN DATED: 10/19/05
Century Blvd UC (Replace) (Structure Name)
04-228501 (EA Number)
28-0395 (replace 28-0099RL) (Bridge Number)

Submittal (*Check One*): [X] 1st [ ] 2nd [ ] 3rd [ ] 4th [ ] Other: _____

Report:

1. Section 4.2: Report indicates that a piezometer was constructed in Boring B-20, which should be intended to measure groundwater table (GWT). But no GWT is shown on the log for Boring B-20. Please verify and revise.
2. Section 4.2: Report states that auger drilling was followed by rotary wash from certain depth for Borings B-20 and B-21. Appropriate symbols should be marked on the LOTBs accordingly.
3. Section 4.2: It appears GWT was also established using CPT based on this section and Section 5.3. Please mark it on LOTBs accordingly.
4. Section 5.2: Soil profile used for this structure is based on the same borings used for Utilities UC. Why they are not consistent? Please check and revise. Please include a column showing the elevation of top of each soil layer.
5. Table 4: M should be 7.0 or 7.25±0.25, not 7.5.
6. Section 7.7: A resistivity of less than 1000 ohms-cm itself does not indicate a corrosive site. Current Caltrans corrosion guidelines combine all four parameters to evaluate corrosion. Please comply with Section 5.5 of Caltrans Corrosion Guideline (2003) when evaluating a site to be corrosive to foundation elements or not. The Guideline is available at the following website: http://www.dot.ca.gov/hq/esc/ttsb/corrosion/CorrGuidelinesSept03.pdf.

REGISTERED PROFESSIONAL ENGINEER
CAROLINE JINXIA CHEN
No. C 62438
Exp. 9/30/07
CIVIL
STATE OF CALIFORNIA

[x] Special Funded Project (OSFP) [ ] Local Assistance Project (OSFP) [ ] OSCM Project

Approval: Type Selection

OSFP/OSCM

Caroline Chen
Office of Geotechnical Design - West

cc: OGDx, Lab File Room (Sacramento) DES Specifications and Estimates (JStayton-4 copies) Structure Construction R.E. Pending File

Revised 05/04

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

☐ MR. EARL SEABERG, CHIEF, OSFP
☐ MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 12/14/05

FILE:	04	CC	4	23.71/26.8
	District	County	Route	PM

Century Blvd UC (Replace)
Structure Name

04-228501	28-0395
EA Number	Bridge Number

7. Section 8.3, Table 5: Loadings presented on this table differs from Plans. For a compression design load of 625 kN (or nominal capacity of 1250 kN), the design pile length is a little shorter than required. Please check and revise. Pile type should specify the alternative used (e.g., Alt "X" or whatever recommended).
8. Section 8.3: What is the lateral load used to determine the pile tip?
9. Section 8.3: Passive resistance at abutment should be recommended in accordance with Caltrans Seismic Design Criteria (V1.3), Section 7.8.1.
10. Section 8.4: How long is considered sufficient for the waiting period? Please specify waiting period.
11. LOTBs:
    (1) Please add note to indicate the type of hammer used.
    (2) Some symbols of soils do not match the legend of earth materials. Please check all and revise.
    (3) Boring B-21: For soil at elevation about 11m, "Push" doesn't seem to be consistent with description of "stiff to very stiff". If it is meant to be punch core, "push" should be removed.
    (4) Location of borings should be presented as station and offset referencing to certain alignment line, not in the form of easting and northing.
    (5) Please pay attention to the presentation of LOTBs. Grids showing elevation on the LOTB sheets should not strike through the text describing soil properties or the area showing field/lab record.

Plans:

12. Sheet 1: Class 625 is recommended for this structure. The standard plan for Class 900 should not apply.
13. Pile Data Table presents loadings differing from foundation report.

General comments:

14. Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	August 8, 2006
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	December 14, 2005		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 65% PS&E**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
	Report					
1	Section 4.2	Report indicates that a piezometer was constructed in Boring B-20, which should be intended to measure ground water table (GWT). But no GWT is shown on the log for Boring B-20. Please verify and revise.	Agreed. GWT was measured on Jan 06, 2006 and has been reported.	A		A
2	Section 4.2	Report states that auger drilling was followed by rotary wash from certain depth for Borings B-20 and B-21. Appropriate symbols should be marked on the LOTBs accordingly.	Agreed. LOTBs have been revised accordingly.	A		A
3	Section 4.2	It appears GWT was also established using CPT based on this section and Section 5.3. Please mark on LOTB accordingly.	Agreed. LOTBs have been revised accordingly.	A		A
4	Section 5.2	Soil profile used for this structure is based on the same borings used for Utilities UC. Why they are not consistent? Please check and revise. Please include a column showing the elevation of top of each soil layer.	Agreed. The soil profile for the Utilities UC has been revised.	A		A
5	Table 4	M should be 7.0 or 7.25±0.25, not 7.5.	Agreed. Report has been corrected accordingly.	A		A

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	August 8, 2006
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	December 14, 2005		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 65% PS&E**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
6	Section 7.7	A resistivity of less than 1000 ohms-cm itself does not indicate a corrosive site. Current Caltrans corrosion guidelines combine all four parameters to evaluate corrosion. Please comply with Section 5.5 of Caltrans Corrosion Guideline (2003) when evaluating a site to be corrosive to foundation elements or not. The Guideline is available at the following website: http://www.dot.ca.gov/hq/esc/ttsb/corrosion/CorrGuidelinesSept03.pdf.	Agreed. Report has been revised accordingly.	A		A
7	Section 8.3, Table 5	Loadings presented on this table differs from Plans. For a compression design load of 625 kN (or nominal capacity of 1250 kN), the design pile length is a little shorter than required. Please check and revise. Pile type should be specify the alternative used (e.g., Alt "X" or whatever recommended).	Agreed. Report has been revised accordingly.	A		A
8	Section 8.3	What is the lateral load used to determine the pile tip?	Have been provided.	A		A
9	Section 8.3	Passive resistance at abutment should be recommended in accordance with Caltrans Seismic Design Criteria (V1.3), Section 7.8.1.	Agreed. Report has been revised accordingly.	A		A
10	Section 8.4	How long is considered sufficient for the waiting period? Please specify waiting period.	A 120 day waiting period is specified.	A		A
11	LOTBs:	(1) Please add note to indicate the type of hammer used.	Agreed. LOTBs have been revised accordingly.	A		A
		(2) Some symbols of soils do not much the legend of earth materials. Please check all and revise.	Agreed. LOTBs have been revised accordingly.	A		A

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	August 8, 2006
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	December 14, 2005		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 65% PS&E**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		(3) Boring B-21: For soil at elevation about 11 m, "Push" doesn't seem to be consistent with description of "stiff to very stiff". If it is meant to be punch core, "push" should be removed.	Agreed. These are locations where Shelby sample is collected. LOTBs have been revised accordingly.	A		A
		(4) Location of borings should be presented as station and offset referencing to certain alignment line, not in the form of easting and northing.	Have been provided.	A		A
		(5) Please pay attention to the presentation of LOTBs. Grids showing elevation on the LOTB sheets should not strike through the text describing soil properties or the area showing field/lab record.	LOTBs have been revised accordingly.	A		A
	Plans					
12	Sheet 1	Class 625 is recommended for this structure. The standard plan for class 900 should not apply.		A		A
13		Pile Data Table presents loadings differing from foundation report.		A		A
	General Comments					
14		Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.	Have been provided.	A		A
				A		A

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

[x] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 9/28/06

FILE: 04 (District) CC (County) 4 (Route) 23.71/26.8 (PM)

SUB CONSULTANT: URS Report Date: 8/8/06 Century Blvd UC (Replace) (Structure Name)
PRIME CONSULTANT: URS Contract No.:
GENERAL PLAN DATED: 7/28/06 FDN PLAN DATED: 7/28/06 04-228501 (EA Number) 28-0395 (replace 28-0099RL) (Bridge Number)

Submittal (*Check One*): [ ] 1st [X] 2nd [ ] 3rd [ ] 4th [ ] Other:

Report

1. Section 8.3, Passive resistance: What are the soil parameters based to compute the equivalent fluid pressure for the recommended passive resistance? The recommended value seems too high. Passive resistance at abutment should be recommended in accordance with Caltrans Seismic Design Criteria (V1.3), Section 7.8.1.
2. Section 8.4, settlement of embankment: Why is 120 day waiting period recommended? How much settlement is expected to complete during specified waiting period? Please indicate that settlement monitoring program is recommended.
3. LOTBs:
   (1) Please add location (station and offset) to the CPTs.
   (2) Please add note to indicate the type of hammer used.
   (3) Remove the curve lines that cross log of Borings B-20 and B-21 on their upper potion.

General comments

4. Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.

REGISTERED PROFESSIONAL ENGINEER
CAROLINE JINXIA CHEN
No. C 62438
Exp. 9/30/07
CIVIL
STATE OF CALIFORNIA

[x] Special Funded Project (OSFP) [ ] Local Assistance Project (OSFP) [ ] OSCM Project

Approval: C2 – Approved subject to verification

OSFP/OSCM

Caroline Chen
Office of Geotechnical Design - West

cc: OGDx, Lab File Room (Sacramento) DES Specifications and Estimates (JStayton-4 copies) Structure Construction Representative File

Revised 05/04

SR4(E) Widening Project Loveridge Road to Somersville Road – Century Boulevard Undercrossing - EA 228501

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	February 28, 2007
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	August 28, 2006		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 95% PS&E**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
	Report					
1	Section 8.3	What are the soil parameters based to compute the equivalent fluid pressure for the recommended passive resistance? The recommended values seems too high. Passive resistance at abutment should be recommended in accordance with Caltrans Seismic Design Criteria (V 1.3), Section 7.8.1.	Passive resistance at abutments were recommended in accordance with Caltrans Seismic Design Criteria (V 1.4), Section 7.8.1. The calculation procedure is provided in Appendix E.	A		A
2	Section 8.4	Embankment settlement: Why is 120 day waiting period recommended? How much settlement is expected to complete during specified waiting period? Please indicate that settlement monitoring program is recommended.	We expect that the 50% of the settlement to complete during the 120 day waiting period. The fill settlement may be monitored using a settlement monument.	A		A
3	LOTB's	(1) Please add location (station and offset) to the CPTs.	Agreed. LOTBs have been revised accordingly.	A		A
		(2) Please add note to indicate the type of hammer used.	Agreed. LOTBs have been revised accordingly.	A		A
		(3) Remove the curve lines that cross log of Borings B-20 and B-21 on their upper portion.	Agreed. LOTBs have been revised accordingly.	A		A

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	February 28, 2007
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	August 28, 2006		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 95% PS&E**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
	General					
4		Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.	Caltrans comments and responses to comments were provided in Appendix F with References in the previous submittals. In the final submission Caltrans comments and responses to comments are provided in Appendix G.	A		A

CONTRA COSTA TRANSPORTATION AUTHORITY

California Department of Transportation

#5

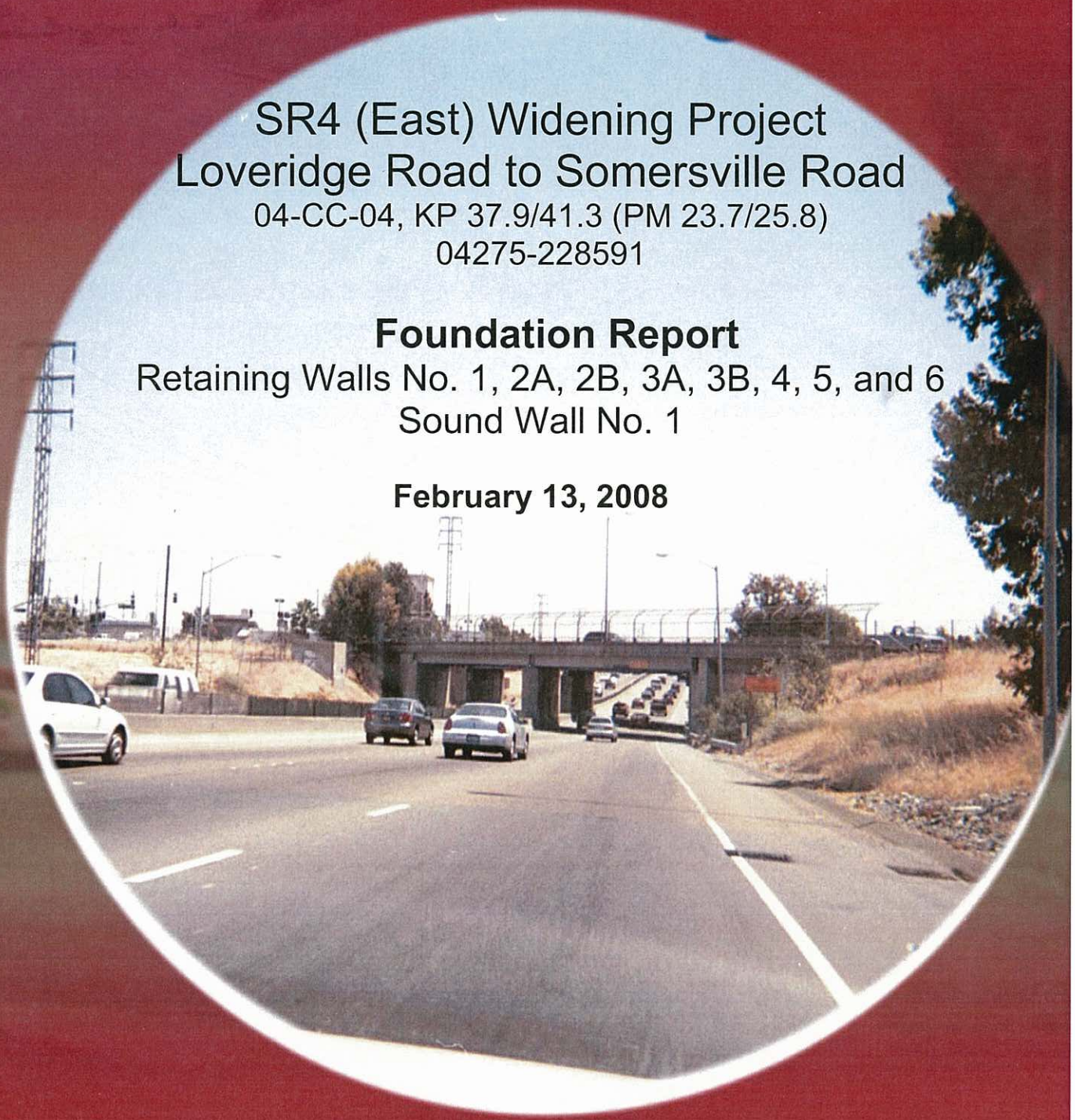
SR4 (East) Widening Project
Loveridge Road to Somersville Road

04-CC-04, KP 37.9/41.3 (PM 23.7/25.8)
04275-228591

Foundation Report

Retaining Walls No. 1, 2A, 2B, 3A, 3B, 4, 5, and 6
Sound Wall No. 1

February 13, 2008



URS

URS

February 13, 2008
Project No. 26814911

Ms. Susan Miller,
Project Director,
Contra Costa Transportation Authority,
3478 Buskirk Avenue, Suite 100
Pleasant Hill, CA 94523

Subject: **SR4 (East) Widening Project**
Loveridge Road to Somersville Road
Foundation Report:
Retaining Walls # 1, 2A, 2B, 3A, 3B, 4, 5, and 6 Sound Wall # 1

Dear Ms. Miller,

URS is pleased to provide you with this Foundation Report for Retaining Walls and Sound Wall for the subject project located in Antioch, California.

This report has been prepared in accordance with Caltrans guidelines for foundation reports, and supplements our final foundation report for retaining walls and sound wall dated November 13, 2007.

It has been our pleasure to be of service to Contra Costa Transportation Authority on this project. If you should have any questions, please contact the undersigned.

Sincerely,
URS CORPORATION

Asi Ooraikul, P.E
Project Engineer

REGISTERED PROFESSIONAL ENGINEER
ASI OORAIKUL
No C67750
Exp. 06/30/09
CIVIL
STATE OF CALIFORNIA

Said Salah-Mars, Ph.D., P.E.
Engineering Department Manager

Philip Meymand, Ph.D., G.E.
Project Manager

REGISTERED PROFESSIONAL ENGINEER
PHILIP J. MEYMAND
No. GE2596
Exp. 6-30-09
GEOTECHNICAL
STATE OF CALIFORNIA

Enclosure

URS Corporation
1333 Broadway, Suite 800
Oakland, CA 94612-1924
Tel: 510.893.3600
Fax: 510.874.3268

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The proposed State Route (SR) 4 (East) Widening Project - Loveridge Road to Somerville Road will widen SR4 from its current four lanes to an eight-lane facility from west of Loveridge Road (KP 37.9) to the Somersville Road Interchange (KP 41.3). This project is part of Contra Costa Transportation Authority's (CCTA's) overall plan to continue the widening of SR4 further into East County and is consistent with the Phase 1 Implementation Plan recommendation made in the SR4 (East) Railroad Avenue to SR160 Major Investment Study (MIS).

The proposed project will widen the freeway from two to four lanes providing three mixed-flow and one High Occupancy Vehicle (HOV) lanes in each direction. From SR242 to west of Loveridge Road, the above improvements have either been completed, or are under construction. The improvements will conform to the existing four-lane facility just before the Somersville Road overcrossing. Some of the significant features of this project include:

- Widening and reconstruction of the Loveridge Road interchange. The existing Loveridge Road Overcrossing and Camp Stoneman Road Underpass will be removed.
- Reconstruction of the eastbound diagonal on- and off-ramps at the Loveridge Interchange.
- Improvements at the intersection of Loveridge Road with California Avenue / North Park Boulevard to accommodate the projected traffic volumes and increase public safety.
- Reconstruction of the Century Boulevard undercrossing structure.
- Provisions in the freeway median and at the Loveridge Interchange to accommodate a future mass transit extension.
- Reconstruction of the storm water pump station located in the northwest corner of the Loveridge Interchange to accommodate new construction features.
- Construction of a number of retaining and sound walls.

The subjects of this foundation investigation report are the eight proposed Retaining Walls and one Sound Wall located along SR4 in Pittsburg and Antioch, California. Figure 1, Site and Boring Location Plans, shows the locations of these walls.

1.1 PURPOSE AND SCOPE OF THIS STUDY

This report presents the results of our geotechnical investigation and recommendations for the design of the eight proposed Retaining Walls and one Sound Wall as parts of the SR4 (East) Widening Project - Loveridge Road to Somersville Road. The proposed walls include Retaining Walls No. 1, 2A, 2B, 3A, 3B, 4, 5, and 6, and Sound Wall No. 1.

The scope of our study was to explore the subsurface conditions, perform laboratory testing and engineering analyses, and provide conclusions and recommendations for the geotechnical design of the retaining walls. In the course of our study, we reviewed various retaining wall options. The recommendations and opinions presented in this report are based on the results of the site-specific subsurface investigation, review of available information, as well as engineering judgment and experience.

1.2 PROJECT SCOPE OF WORK

The scope of work for this study includes:

- Site reconnaissance
- Review of logs of test borings (LOTBs), geologic maps, foundation reports, and other existing information
- Preparation of this preliminary report, which includes:
  - Description of site geology and evaluation of geologic hazards
  - Assessment of subsurface conditions based on available information
  - Development of seismic design criteria
  - Preliminary foundation recommendations for proposed structures
  - Construction considerations, and
  - Recommendations for additional geotechnical or geological studies.

The proposed SR4 Widening Project involves widening SR4 from its current four lanes to an eight-lane facility as discussed above. The widening plan requires construction of seven retaining walls to accommodate the proposed cut and fill along the existing SR4 alignment. The widening plan near Contra Costa Canal will also require a sound wall between an existing residential area and the proposed SR4 widening. The plans and profiles including typical cross sections of the proposed wall structures are shown in Appendix A, General Plan and Retaining Walls, of the Type Selection Report.

Based upon our review of various retaining wall options as part of the feasibility study, we recommend the following configuration for the design and construction of the proposed wall structures.

2.1 RETAINING WALL NO. 1

Retaining Wall No. 1 is proposed as a cantilever Type 1 retaining wall with Type 732A (Mod) concrete barrier. The retaining wall will begin at RW-1 LOL Station 10+07.300 and end at the Station 11+16.800 for a total length of 109.500 m. The approximate design heights of this wall are 1.80, 2.40, 3.00, and 3.60 m. The bottom of the wall footing ranges from the Elevation 13.800 m to 15.600 m. It will be constructed along the north side of the SR4 adjacent to the on-ramp from Loveridge Road between 11.569 m left of the Station 44+33.159 and 14.602 m left of the Station 45+42.717 of "LWN" Line.

2.2 RETAINING WALL NO. 2A

Retaining Wall No. 2A is proposed as a cantilever Type 1 retaining wall with Type 732A (Mod) concrete barriers. The retaining wall will begin at RW-2A LOL Station 10+70.956 and end at the Station 11+24.100 for a total length of 53.144 m. The approximate design heights of this wall are 2.40 and 3.00 m. The bottom of the wall footing ranges from the Elevation 14.000 m to 15.200 m. It will be constructed along the south side of the SR4 adjacent to the on-ramp from Loveridge Road between 16.857 m right of the Station 47 + 57.785 and 14.235 m right of the Station 48+09.776 of "LEN" Line.

2.3 RETAINING WALL NO. 2B

Retaining Wall No. 2B is proposed as a cantilever Type 1 retaining wall with Type 60D concrete barrier. The retaining wall will begin at RW-2B LOL Station 11+24.100 and end at the Station 13+71.690 for a total length of 247.590 m. The approximate design heights of this wall are 2.40, 3.00, 3.60, and 4.20 m. The bottom of the wall footing ranges from the Elevation 10.900 m to 14.000 m. It will be constructed along the south side of the SR4 adjacent to the on-ramp from Loveridge Road between 14.045 m right of the Station 48+09.776 and 9.162 m right of the Station 50+57.657 of "LEN" Line.

2.4 RETAINING WALL NO. 3A

Retaining Wall No. 3A is proposed as a cantilever Type 1 retaining wall with Type 60D concrete barrier. The retaining wall will begin at RW-3A LOL Station 9+17.923 and end at the Station 11+51.202 for a total length of 233.279 m. The approximate design heights of this wall range

from 1.80 to 8.50 m. Retaining Wall No. 3A will be supported on pile foundations from the Station 9+17.923 to 10+81.20 and on spread footings from the Station 10+81.20 to 11+51.202. An overhead sign, designated as Sign E, will be installed at the Station WB4 249+60 and will be supported on a pile foundation. Foundation details for Sign E are presented in the Retaining Wall No. 3A design plans. The bottom of the wall footing ranges from the Elevation 7.475 m to 12.720 m. It will be constructed along the north side of the SR4 adjacent to the off-ramp to Loveridge Road between 32.960 m left of the Station 248+71.263 and 21.245 m left of the Station 251+04.036 of "WB4" Line.

2.5 RETAINING WALL NO. 3B

Retaining Wall No. 3B is proposed as a mechanically stabilized earth (MSE) wall. The retaining wall will begin at RW-3B LOL Station 11+51.202 and end at the Station 19+31.855 for a total length of 780.653 m. The top section of this wall will have Type 732 (Mod) concrete barrier. Retaining Wall No. 3B includes a concrete retaining wall section with a utility undercrossing between the Station 18+88.217 and 19+02.903 RW-3B LOL. The approximate design heights of this wall range from 2.44 to 7.32 m with base width ranging from 2.44 to 8.00 m. The bottom of the leveling pad ranges from the Elevation 13.070 m to 17.950 m. It will be constructed along the north side of the SR4 between 21.435 m left of the Station 251+04.043 and 21.435 m left of the Station 258+83.810 of "WB4" Line.

2.6 RETAINING WALL NO. 4

Retaining Wall No. 4 is proposed as an MSE wall. The retaining wall will begin at RW-4 LOL Station 10+00.000 and end at the Station 16+96.791 for a total length of 696.791 m. A sound wall of 3.00 and 3.70 m high will be constructed at the top section of this wall from RW-4 LOL Station 10+00.000 to 15+10.880 with Type 732 (Mod) concrete barrier. Retaining Wall No. 4 includes a concrete retaining wall section with utility undercrossing between the Station 16+55.362 and 16+69.848 RW-4 LOL. The approximate design heights of this wall range from 2.44 to 6.10 m with base width ranging from 3.50 to 5.49 m. The bottom of the leveling pad ranges from the Elevation 14.850 m to 19.730 m. It will be constructed along the south side of the SR4 between 21.620 m right of the Station 251+80.125 and 21.436 m right of the Station 258+78.074 of "EB4" Line.

2.7 RETAINING WALL NO. 5

Retaining Wall No. 5 is proposed as an MSE wall with Type 732 (Mod) concrete barrier. The retaining wall will begin at RW-5 LOL Station 10+03.425 and end at the Station 19+00.225 for a total length of 896.800 m. An overhead sign, designated as CMS No. 2 sign, will be constructed adjacent to Retaining Wall No. 5 at the RW-5 LOL Station 10+99.098 and will be supported on a pile foundation. Foundation details for Sign CMS 2 are presented in the Retaining Wall No. 5 design plans. The approximate design heights of this wall range from 2.44 to 7.32 m with base width ranging from 2.44 to 8.00 m. The bottom of the leveling pad ranges from the Elevation 16.000 m to 19.050 m. It will be constructed along the north side of the SR4 between 21.435 m left of the Station 259+30.167 and 21.435 m left of the Station 268+26.256 of "WB4" Line.

2.8 RETAINING WALL NO. 6

Retaining Wall No. 6 is proposed as a cantilever Type 1 retaining wall with Type 732A (Mod) concrete barrier. The retaining wall will begin at RW-6 LOL Station 10+00.000 and end at the Station 11+16.800 for a total length of 116.800 m. The approximate design heights of this wall are 1.80, 2.40, 3.00, and 4.20 m. The bottom of the wall footing ranges from the Elevation 15.750 m to 18.200 m. It will be constructed along the north side of the SR4 adjacent to the Contra Costa Canal between 26.835 m left of the Station 268+23.827 of "WB4" Line and 32.414 m left of the Station 269+37.492 of "CNOB" Line.

2.9 SOUND WALL NO. 1

Sound Wall No. 1 will be constructed on a pile foundation system. The sound wall will begin at SW-1 LOL Station 10+00.000 and end at the Station 16+50.000 for a total length of 650.000 m. A sound wall will be constructed on top of Type 736SV (Mod) concrete barrier. It will be constructed along the south side of the SR4 between 21.543 m right of the Station 262+50.000 of "EB4" Line and 28.054 m right of the Station 269+00.000 of "CNOB" Line.

Table 1
Summary of Wall Configurations

Wall No.	Alignment	Beginning Station	End Station	Total Length (m)	Approximate Maximum Design Height (m)	Type
1	RW-1	10+07.300	11+16.800	109.500	3.60	1
2A	RW-2A	10+70.956	11+24.100	53.144	3.00	1
2B	RW-2B	11+24.100	13+71.690	247.590	4.20	1
3A	RW-3A	9+17.923	11+51.202	233.279	8.50	1
3B	RW-3B	11+51.202	19+31.855	780.653	7.32	MSE
4	RW-4	10+00.000	16+96.791	696.791	6.10	MSE/SW
5	RW-5	10+03.425	19+00.222	896.800	7.32	MSE
6	RW-6	10+00.000	11+16.800	116.800	4.20	1
SW-1	SW-1	10+00.000	16+50.000	650.000	-	SW

3.1 REGIONAL GEOLOGY

The proposed retaining walls are located near the boundary between the Central Valley and the Coast Range physiographic province, at the northern end of the Diablo Range. The Coast Ranges are characterized by north to northwest trending elongated mountain ranges and intervening valleys. The Franciscan Complex underlies the core of the Diablo Range, which is in fault contact with the Great Valley sediments of the Central Valley province to the east. Younger sedimentary deposits from Paleocene to Pleistocene in age (65 million to 0.1 million years old) are widely distributed along the margin of the Diablo range and along the foothills through which the SR4 alignment crosses and skirts around (Graymer, et al, 2002). These sedimentary rocks are in turn locally overlain by more recent alluvium and alluvial fan deposits and by bay mud deposits along the Sacramento River margin.

3.2 SITE GEOLOGY

The sediments in the project area are a combination of surficial deposits of Holocene to Pleistocene (recent to 2 million years old) alluvium, alluvial fan and terrace deposits consisting of medium dense to dense sandy gravel or gravelly sand that generally grades finer, and medium dense sand that fines upward to sandy or silty clay (USGS, OFR 97-98).

3.3 SEISMOTECTONIC SETTING

The SR4 project lies within a domain of north-northwest oriented right-lateral strike-slip faulting, the San Andreas fault system, that accommodates the majority of the plate motion between the Pacific and North American plates. In addition to the right-lateral strike-slip deformation, a component of compression oriented normal to the plate boundary is manifest as a series of folds and thrust faults, including the Coast Range-Sierran Block Boundary zone, oriented parallel and sub-parallel to the faults of the San Andreas system. In contrast, regional compression in the Mount Diablo region, within which the SR4 project is situated, has a more northerly orientation, which has resulted in a series of folds and thrusts that are at a distinct oblique angle to the main strike-slip faults.

The San Francisco Bay area is a region of relatively high seismic activity. This historical seismicity is associated with the active faults of the San Andreas system. During historical times there have been almost 8,000 earthquakes of Richter local magnitude (M_L) 2.0 or larger, of which 14 earthquakes were **M** 6.0 or greater. These include the 1836 M_L 6¼ event on the San Andreas fault; the 1868 M_L 6.8 event on the southern Hayward fault; the 1889 **M** 6¼ Collinsville earthquake, possibly on the Pittsburg-Kirby Hills fault; the 1898 M_L 6.7 'Mare Island' earthquake; the 1906 **M** 7.9 'Great San Francisco Earthquake' on the San Andreas fault; a 1911 M_L 6.6 event on the southern Calaveras fault; and the 1989 **M** 7.0 Loma Prieta event, located on a fault paralleling the Santa Cruz Mountains segment of the San Andreas fault.

URS conducted a geotechnical investigation for the proposed retaining wall and sound wall during the period of January 5 through January 24, and March 30 through 31, 2005. A total of 20 soil borings were drilled in the vicinity of the proposed wall structures to depths ranging from 2.13 m to 27.89 m. The borings were advanced using a rotary wash boring method with a 124-mm diameter drag bit. Ms. Shobhna Upadhyaya and Mr. Sathish Murugaiah, Engineers from our firm, supervised the drilling and logged the soil cuttings in accordance with the State of California, Department of Transportation (Caltrans) Soil & Rock Logging Classification Manual (1996).

The borings were drilled using a truck-mounted Diedrich D-120 rig equipped with a 63.5-kg automatic trip hammer. The drilling rig is owned and operated by Taber Consultants from West Sacramento, California. Soil samples were collected at 1.5 m intervals. A Modified California split-spoon drive sampler (50.8 mm fitted with four 101.6-mm long, 49-mm I.D. brass liners) was used to sample in clayey material. A 0.6-m long, 35-mm I.D., split-barrel SPT drive sampler was used to sample sandy materials. The samplers were driven using a 63.5-kg safety hammer dropping 762 mm.

A piezometer was installed in Boring B-10 upon completion of the drilling as shown on the log of boring (see Appendix A). Each boring was backfilled with cement grout, and the ground surface was restored to its initial elevation. Excess drill cuttings and fluid from the boring were contained in 55-gallon drums and were off-hauled for disposal.

All samples were carefully sealed, labeled, and transported to our Geotechnical Laboratory in Pleasant Hill, California for further visual examination and testing. Logs of the test borings were prepared based on the field logs, visual examination, and laboratory tests results, and are presented in Appendix A, Geotechnical Exploration and Sampling Program, of this report.

5.1 RETAINING WALL NO. 1

5.1.1 Site Conditions

Development of the freeway has resulted in the placement of fill embankments and cuts along the alignment. Original ground surface is relatively flat with the existing ground surface elevations ranging from about 16.7 to 17.4 m. The site is currently vegetated with sparse grasses and shrubs. This site is located between SR4 and California Avenue.

5.1.2 Subsurface Conditions

Subsurface conditions along the proposed alignment of the retaining wall, as determined from boring B-4, consist of about 1.7 m of fill overlying native soils of alluvium deposit to the depth explored. The fill consists predominantly of sandy lean clay. The alluvium consists predominantly of medium dense silty sand, and very stiff sandy silty lean clay. Groundwater was not encountered during the soil boring operation.

5.2 RETAINING WALL NO. 2A

5.2.1 Site Conditions

Development of the freeway, bridges, and on-ramps has resulted in the placement of fill embankments and cuts along the alignment. Original ground surface is relatively flat with the existing ground surface elevations ranging from about 14.9 to 16.7 m. The site is currently vegetated with sparse grasses and shrubs. This site is located between SR4 on-ramp and a motel.

5.2.2 Subsurface Conditions

Subsurface conditions along the proposed alignment of the retaining wall, as determined from borings B-10 and B-11, consist of about 1 to 2.6 m of fill overlying native soils of alluvium deposit to the depth explored. The fill consists predominantly of fat clay. The alluvium consists predominantly of very stiff lean clay, very stiff fat clay, and medium dense silty sand. Groundwater was encountered at a depth of 13.1 m below the existing ground surface (bgs) during soil boring operation at boring B-10. However, groundwater was not encountered in boring B-11 at the time of drilling.

5.3 RETAINING WALL NO. 2B

5.3.1 Site Conditions

Development of the freeway, bridges, and on-ramps has resulted in the placement of fill embankments and cuts along the alignment. Original ground surface is relatively flat with the existing ground surface elevations ranging from about 14.4 to 15.5 m. The site is currently vegetated with sparse grasses and shrubs. This site is located between SR4 on-ramp and a motel.

5.3.2 Subsurface Conditions

Subsurface conditions along the proposed alignment of the retaining wall, as determined from borings B-12 and B-13, consist of about 1.5 m of fill overlying native soils of alluvium deposit to the depth explored. The fill consists predominantly of fat clay. The alluvium consists mostly of stiff to very stiff fat clay with loose silty sand, stiff lean clay and loose to medium dense sandy silt layers. Groundwater was not encountered in borings B-12 and B-13 at the time of drilling.

5.4 RETAINING WALL NO. 3A

5.4.1 Site Conditions

Development of the freeway on-ramps has resulted in the placement of fill embankments and cuts along the alignment. Original ground surface is relatively flat with the existing ground surface elevations ranging from about 13.4 to 14.2 m. The site is currently vegetated with sparse grasses and shrubs. This site is located between SR4 and North park Boulevard.

5.4.2 Subsurface Conditions

Subsurface conditions along the proposed alignment of the retaining wall, as determined from borings B-9, B-12, B-13, and B-13A, consist of about 1.5 m of fill overlying native soils of alluvium deposit to the depth explored. The fill consists predominantly of fat clay. The alluvium consists mostly of stiff to very stiff fat clay with medium dense silty and clayey sand layers. Groundwater was not encountered in borings B-12, B-13, and B-13A at the time of drilling. Groundwater was not measured in boring B-9 at the time of drilling due to rotary wash drilling method.

5.5 RETAINING WALL NO. 3B

5.5.1 Site Conditions

Development of the freeway has resulted in the placement of fill embankments along the alignment. The existing ground surface elevations ranging from about 14.3 to 19.6 m. The site is currently vegetated with sparse grasses and shrubs. This site is located between SR4 and North park Boulevard.

5.5.2 Subsurface Conditions

Subsurface conditions along the proposed alignment of the retaining wall, as determined from borings B-13A, B-15, B-18, and B-21, consist of about 1.5 m of fill overlying native soils of alluvium deposit to the depth explored. The fill consists predominantly of fat clay. The alluvium consists mostly of stiff to very stiff fat/lean clay with loose silty sand, and loose to medium dense sandy silt layers. Groundwater was not encountered in borings B-13A, B-15 and B-18. Groundwater was encountered at a depth of 13.3 m below the existing ground surface in boring B-21 at the time of drilling.

5.6 RETAINING WALL NO. 4

5.6.1 Site Conditions

Development of the freeway, and bridges has resulted in the placement of fill embankments and cuts along the alignment. The existing ground surface elevations range from about 15.8 to 20.6 m. The site is currently vegetated with sparse grasses and shrubs.

5.6.2 Subsurface Conditions

Subsurface conditions along the proposed alignment of the retaining wall, as determined from borings B-14, B-16, B-17, B-19 and B-20, consist of about 1 to 3 m of fill overlying native soils of alluvium deposit to the depth explored. The fill consists of fat clay and lean clay. The alluvium consists of stiff to very stiff lean clay, loose to medium dense silty sand, and medium dense sandy silt. Groundwater was not encountered in the borings above at the time of drilling.

5.7 RETAINING WALL NO. 5

5.7.1 Site Conditions

Development of the freeway, and bridges has resulted in the placement of fill embankments and cuts along the alignment. Original ground surface is relatively flat with the existing ground surface elevations ranging from about 17.9 to 20.1 m. The site is currently vegetated with sparse grasses and shrubs.

5.7.2 Subsurface Conditions

Subsurface conditions along the proposed alignment of the retaining wall, as determined from borings B-21, B-22, B-23, B-24, B-25 and B-26, consist of about 1.2 to 2m of fill overlying native soils of alluvium deposit to the depth explored. The fill consists of predominantly stiff to very stiff fat clay. The alluvium consists of very stiff fat clay, very stiff to hard lean clay, medium dense clayey sand and medium dense sandy silt. Groundwater was not encountered in the borings above at the time of drilling.

5.8 RETAINING WALL NO. 6

5.8.1 Site Conditions

Development of the freeway has resulted in the placement of fill embankments and cuts along the alignment. The existing ground surface elevations range from about 20.3 to 20.7 meters. The site is currently vegetated with sparse grasses and shrubs.

5.8.2 Subsurface Conditions

Subsurface conditions along the proposed alignment of the retaining wall, as determined from borings B-26, B-27, and B-29, consist of about 1 to 2.5 m of fill overlying native soils consist of

alluvium to the depth of exploration. The fill consists of fat clay and lean clay with sand. The alluvium consists mostly of stiff to very stiff lean clay with medium dense to dense silty sand, medium dense to dense silt and stiff fat clay layers. Groundwater was not encountered in the borings above at the time of drilling.

5.9 SOUND WALL NO. 1

5.9.1 Site Conditions

Development of the freeway has resulted in the placement of fill embankments and cuts along the alignment. The existing ground surface elevations range from about 19.5 to 20.9 meters. The site is currently vegetated with sparse grasses and shrubs.

5.9.2 Subsurface Conditions

Subsurface conditions along the proposed alignment of the retaining wall, as determined from borings B-23, B-24, B-25 and B-27, consist of about 1 to 2.5 m of fill overlying native soils consist of alluvium to the depth of exploration. The fill consists of fat clay and lean clay with sand. The alluvium consists mostly of stiff to very stiff lean clay with medium dense to dense silty sand, medium dense to dense silt and stiff fat clay layers. Groundwater was not encountered in the borings above at the time of drilling.

5.10 GROUNDWATER CONDITIONS

Based on the results of the subsurface exploration, groundwater table was encountered at an elevation about 3.4 to 4 m during the field investigations conducted in January 2005 in the vicinity of the sites.

6.1 SEISMIC DESIGN METHODOLOGY

The seismic design methodology adopted for this project is based on the following current Caltrans standards:

1) Seismic Design Criteria (SDC), v 1.3, February 2004
2) Guidelines for Foundation Investigations and Reports, v 1.2, dated June 2002
3) California Seismic Hazard Map (Mualchin, 1996)

6.2 PEAK BEDROCK ACCELERATION

The closest mapped fault on the California Seismic Hazard Map 1996 is the Antioch fault, but the California Geological Survey does not consider this fault active. It had previously been mapped in 1976 as an Alquist-Priolo fault rupture zone, but more recent studies resulted in the fault no longer being classified as active (Wills, 1991). The next closest active faults to the SR4 project are the Coast Ranges Sierran Block boundary zone (CRSB) and the Greenville fault. The California Seismic Hazard Map (Mualchin, 1996) designates these faults with Maximum Credible Earthquake (MCE) magnitudes of 7.0 and 7.25, respectively. The locations of these faults and associated peak bedrock acceleration (PBA) contours were obtained from the California Seismic Hazard Map. The distance of the closest active faults to the site are 4.5 to 7.7 km for the CRSB and 6.5 to 9.0 km for the Greenville fault. Even if the Antioch fault were considered active, the ground motions would be lower than those from the CRSB due to the larger magnitude and reverse style of faulting for the CRSB.

The site is located near the 0.5 g PBA contour with the western end of the project slightly below 0.5g contour and the eastern end of the project slightly above the 0.5g contour. Because some of the project is above the 0.5g contour, we recommend using 0.6g as the design PBA.

Table 2
Seismic Source Parameters

Fault	Style of Faulting	MCE	Distance (km)	Near Field Effects?	Fault Type Effects?	Design PBA (g)
CRSB	Reverse	7.0	4.5 to 7.7	Yes	Yes	0.6
Greenville	Strike-slip	7.25	6.5 to 9.0	Yes	No	-

6.3 SITE SOIL PROFILE

Boring logs from the previous and current field explorations for the SR4 project were reviewed. Shear wave velocity measurements were not made for the project, so the Standard Penetration Test (SPT) resistance was used to evaluate the soil profile based on the guidelines given in SDC Table B.1. Accordingly, this site is classified as a stiff soil site or Soil Profile Type D.

6.4 STYLE OF FAULTING AND NEAR-FIELD SPECTRAL ACCELERATION

The controlling fault, CRSB, has 'reverse' mode of fault displacement, which is consistent with the technical report that accompanies the California Seismic Hazard Map (Mualchin, 1996). To verify the PBA estimated using the seismic hazard map, PBA was also determined using the attenuation relationship presented by Sadigh et al. (1997) using reverse style of faulting for CRSB as recommended by Caltrans Guidelines for Foundation Investigation and Reports, v 1.2, (2002). The calculated peak accelerations using this attenuation relationship are between 0.52g at the western end of the project and 0.65g at the eastern end of the project. We recommend using a PBA of 0.6 g for design. In addition, since the project site is less than 15 km from the nearest active fault, design spectral accelerations should be modified to account for near-fault effects as follows:

Period (sec)	Increase in Spectral Acceleration (%)
< 0.5	0
0.5 – 1.0	0 – 20 (determined by linear interpolation)
≥1	20

6.5 DESIGN ACCELERATION RESPONSE SPECTRUM

Based on Caltrans SDC (Version 1.3), the design seismic response spectrum can be estimated with spectral acceleration values generated by:

- Soil Profile Type D
- Maximum Credible Earthquake (MCE) Magnitude 7.25 ± 0.25
- Peak bedrock acceleration 0.6 g
- ARS increase for fault-type
- ARS increase for near-field effect

The Design Acceleration Response Spectrum (ARS) corresponding to Soil Type D, magnitude of controlling event 7.25 ± 0.25, and a PBA of 0.6 g was obtained from SDC Figure B.8 and modified to account for fault type effects and near field effects as described above. The Design Acceleration Response Spectra is attached as Figure 2, and the spectral values are provided in Table 3.

Table 3
Spectral acceleration values (PBA = 0.6 g, M = 7.5, Soil Type D)

T (Sec)	S_a* (g)	S_a** (g)	S_a*** (g)
0.00	0.60	0.60	0.60
0.01	0.60	0.60	0.60
0.02	0.60	0.60	0.60
0.03	0.60	0.60	0.60
0.04	0.60	0.60	0.60
0.05	0.60	0.60	0.60

T (Sec)	S_a* (g)	S_a** (g)	S_a*** (g)
0.10	1.14	1.14	1.14
0.13	1.34	1.34	1.34
0.15	1.43	1.43	1.43
0.20	1.55	1.55	1.55
0.25	1.57	1.57	1.57
0.30	1.57	1.57	1.57
0.35	1.56	1.56	1.56
0.38	1.55	1.55	1.55
0.50	1.47	1.47	1.47
0.63	1.35	1.42	1.42
0.75	1.23	1.35	1.35
0.88	1.12	1.29	1.29
1.00	1.00	1.20	1.20
1.13	0.89	1.07	1.06
1.25	0.80	0.96	0.95
1.38	0.70	0.84	0.85
1.50	0.64	0.77	0.77
1.63	0.58	0.69	0.70
1.75	0.53	0.63	0.63
1.88	0.50	0.59	0.58
2.00	0.45	0.54	0.53
2.13	0.41	0.49	0.49
2.25	0.38	0.45	0.45
2.38	0.35	0.42	0.42
2.50	0.32	0.39	0.39
2.63	0.31	0.37	0.36
2.75	0.28	0.34	0.34
2.88	0.27	0.32	0.31
3.00	0.25	0.30	0.29
3.13	0.23	0.28	0.27
3.25	0.21	0.26	0.26
3.38	0.20	0.24	0.24
3.50	0.20	0.24	0.23
3.63	0.18	0.22	0.22
3.75	0.17	0.21	0.20
3.88	0.16	0.20	0.19
4.00	0.15	0.18	0.17

*From ATC-32 **Modified for Near-field effects ***Modified to obtain a smooth curve

7.1 FAULT RUPTURE

No active faults have been mapped underlying the SR4 alignment between Loveridge Road and Sommersville Road. The project site is not within an Alquist-Priolo special studies zone (CGS, 2003). The potential for surface fault rupture at the site is therefore considered to be low and a Fault Rupture Investigation is not needed.

7.2 LIQUEFACTION

Liquefaction is a phenomenon in which a sudden increase in pore pressure due to strong earthquake shaking causes relatively loose, cohesionless soils below the groundwater table to undergo temporary but substantial loss of shear strength. Liquefaction can result in loss of foundation bearing capacity, differential settlements, and lateral spreading.

Based on a review of the liquefaction susceptibility map of the San Francisco Bay region (Knudsen et al., 2000), the alluvium underlying the SR4 project is classified as having "low" liquefaction susceptibility.

The data obtained from the boring logs were used to evaluate the potential for liquefaction at the site. The liquefaction evaluations followed the methods described by the NCEER (1998). From the boring logs, the recorded blow counts were standardized by correcting them as appropriate for overburden pressure, sampler type, rod length, borehole diameter, hammer type, and fines content. Based on the discussion in Section 6, the design earthquake used to evaluate liquefaction potential has a peak ground acceleration of 0.6g, with a maximum magnitude of 7.0. The recorded groundwater levels were used as the design groundwater level for calculating liquefaction potential.

Results of our analysis indicate that the potential for liquefaction is low.

8.1 DESIGN ASSUMPTIONS

The engineering analyses to develop the geotechnical design recommendations were based upon the results of the subsurface investigation and laboratory testing conducted as parts of this study. Logs of test borings and laboratory test results in the vicinity of each retaining wall and the sound wall were reviewed, and the subsurface conditions were evaluated to form the basis of the design for each wall.

8.2 CANTILEVER RETAINING WALLS

As discussed in Section 2 of this report, based on our feasibility analysis, we recommend Retaining Walls No. 1, 2A, 2B, 3A, and 6 be designed and constructed as Caltrans Type 1 Retaining Wall in accordance with Caltrans Standard Detail Sheet B3-1 dated July 1, 2004. URS performed engineering analyses to evaluate the geotechnical design recommendations for the cantilever retaining walls and the foundations according to the design assumptions as described above. The results of the engineering analyses and the geotechnical design recommendations for the cantilever retaining walls can be summarized as follows.

8.2.1 Lateral Earth Pressures

The proposed cantilever retaining walls should be designed to resist lateral earth pressures imposed by the adjacent backfill. Based upon the proposed finished grade, the soils behind the retaining walls will be horizontal backfill. Therefore, it is recommended that the walls be designed to resist a minimum equivalent fluid pressure of 5.6 kN/m^3. Surcharge loads such as vehicular traffic would apply additional loads to the walls. For design purposes, a surcharge pressure equivalent to active earth pressure due to 0.6 m of soil should be applied to account for traffic loads. A surcharge pressure of 3.18 kPa per linear meter of wall can be used for the design. This surcharge pressure should be uniformly distributed over the design height of walls.

The recommended pressures assume that no hydrostatic pressures will develop behind the retaining walls. The buildup of hydrostatic pressure behind the walls should be prevented by the inclusion of a positive drainage system. It is recommended that such a system consist of Pervious Backfill Material conforming to the requirements of Section 19-3 of the Caltrans Standard Specifications, latest edition, to a width of at least 0.3 m behind the cantilever retaining wall. Positive drainage for water collected in the backfill should be provided by means of drain pipe leading to a free draining outlet. As an alternative to the above drain system, the retaining wall may be fitted with weep holes. The weep holes should be fitted with filter cloth to reduce the loss of soil fines.

8.2.2 Foundation Design Recommendations

Spread Footing

Based upon the subsurface soil conditions along the proposed cantilever retaining wall locations, URS has performed foundation analyses for the proposed retaining wall structures. The proposed cantilever retaining walls with the design height up to 4.2 m may be supported on spread

footings in accordance with Caltrans Type 1 Wall. The cantilever retaining walls with the design height of more than 4.2 m should be supported on pile foundations.

The spread footing should be bearing on the stiff natural clay at the site or non-expansive engineered fill, as described in the Construction Considerations portion of this report. The spread footings can be designed using an allowable bearing pressure for dead load and live loads of 200 kPa (with a Factor of Safety of 3.0).

Based on the design of the proposed SR4 (E) Expansion, the loading condition for Retaining Walls No. 1, 2A, 2B, 3A, and 6 is consistent with the Case I loading per Caltrans Standard Detail Sheet B3-8 dated July 1, 2004. Case II and Case III loadings are not applicable to the design of the proposed expansion. Therefore, we recommend the following toe pressures for different heights of the cantilever retaining wall per Caltrans Standard Detail Sheet B3-1 (July 1, 2004):

Design height (m)	Toe pressure (kPa)
1.2	80
1.8	90
2.4	105
3.0	120
3.6	135
4.2	160

Resistance to lateral earth pressures can be developed by base friction mobilized along the bottom of footings and by passive earth pressures acting against undisturbed soil. We recommend using an allowable lateral sliding coefficient of 0.35 acting across the base area of the footing. The base sliding resistance may be combined with an allowable equivalent fluid passive pressure of 31.4 kN/m^3 acting against the sides of the footings. The upper 0.3 m of depth below the adjacent finished grade should be neglected when calculating the passive resistance.

Pile Foundation

As described in Section 2 of this report, Retaining Wall No. 3A will be partly supported on piles. The piles for that portion of the retaining wall derive the axial capacities from the skin friction. Based on the results of our foundation analyses, we recommend using 10.5-meter long Class 400 (Alternative X) Type driven piles. The pile capacities can be summarized as follows:

Pile Type	Pile Length	Nominal Capacity (kN)		Lateral Capacity (kN)	
		Compression	Tension	Fixed / Free Head @ 6 mm Deflection	Fixed / Free Head @ 25 mm Deflection
Class 400 Alt "X"	10.5 m	800	0	115 / 68	180 / 100

8.2.3 Slope Stability

Based on the anticipated cut and fill along the proposed cantilever retaining wall alignment, the maximum design height of Retaining Wall No. 3A is 8.5 m. This is considered the tallest design height among the proposed retaining walls. We performed the stability analyses to evaluate the global stability of this retaining wall at the end of construction, and under seismic condition using pseudo-static analysis. The end of construction case represents the condition immediately following construction when excess pore pressures have been induced by the construction, and not enough time has passed for them to dissipate. For this reason, undrained conditions exist for impervious clay soils, whereas drained strengths were used for granular soils. Strength results from laboratory unconfined compressive strength tests were used for the fine-grained soils, and the estimated friction angle was used for the granular soils.

Additional stability analyses were performed to evaluate the stability under seismic conditions. The analyses were performed using pseudo-static method with the horizontal seismic coefficient (k_h) of 0.3g.

The minimum required factor of safety for global stability is 1.3. The minimum (critical) factors of safety computed are summarized in the table below.

Wall Configuration	Native Soil around the Wall	Minimum Factor of Safety	
		End of Construction	Pseudo-static
Retaining Wall No. 3A with 8.5 m Design Height	See Appendix B	3.7	2.2

The calculated factors of safety all exceed the minimum required value of 1.3. A copy of our global slope stability calculations are presented in Appendix B, Results of Global Stability Analyses for Retaining Walls No. 3A, 3B and 5, of this report.

Retaining Walls No. 1, 2A, 2B, and 6 are lower in maximum height. Therefore, it is our opinion that the factors of safety will be higher than those of Retaining Wall No. 3A.

8.3 MECHANICALLY STABILIZED EMBANKMENT WALLS

As discussed in Section 2 of this report, based on our feasibility analysis, we recommend Retaining Walls No. 3B, 4, and 5 be designed and constructed as MSE walls.

As discussed in Section 2, Retaining Wall No. 4 includes a sound wall at the top section of this wall. This sound wall will induce additional lateral load to the underlying MSE wall section. The design recommendations for the MSE wall section of Retaining Wall No. 4 to accommodate this additional lateral load are discussed below.

In this system, the soil at the embankment is reinforced to increase the shear strength and provide a soil mass that acts essentially as a gravity wall with a vertical or nearly vertical face. Reinforcement can consist of any elements that provide tensile strength and pullout resistance. The system also includes elements placed on the embankment face, such as concrete panels, light gauge steel, or treated wood.

Based on the Caltrans Highway Design Manual (Section 210), embankment walls constructed using a soil reinforcement system can consist of State designed systems (which require special design), or of proprietary systems approved by the Caltrans Office of Structure Design. State designed systems could consist of MSE, which utilizes welded wire mat reinforcements and precast concrete face panels. Standard drawings illustrating this system are presented in the Caltrans Bridge Design Aids Manual. In addition, the manual presents tables which include the required welded wire mat density for various embankment heights, several loading conditions and different backfill materials.

Some of the approved proprietary earth retaining systems include:

- Reinforced Earth: this system utilizes steel strips as soil reinforcing elements, and precast concrete face panels; select granular backfill material is used for the reinforced earth volume
- Reinforced Soil Embankment: this system also utilizes welded wire mat soil reinforcement and precast concrete panels
- Welded Wire Walls: constructed using welded wire mat units which are both the soil reinforcement and the facing element
- Retained Earth: these walls are constructed using welded wire mesh as the soil reinforcement element and precast concrete face panels; select granular backfill is placed within the reinforced soil mass

It should be noted that this might constitute only a partial list of the systems that have been approved by the State.

URS performed engineering analyses to evaluate the geotechnical design recommendations for the MSE walls according to the design assumptions as described above. The results of the engineering analyses and the geotechnical design recommendations for the proposed MSE walls can be summarized as follows.

8.3.1 Materials

The embankments behind the MSE walls are planned to be constructed with horizontal slopes. The MSE walls should be constructed with compacted, relatively clean, granular imported material meeting the requirements of Caltrans Standard Specifications Section 19-3 and the following criteria:

- Particle size $\leq$150 mm
- Amount passing the 76 mm Sieve, 78 to 100%
- Amount passing the 0.074 mm (No. 200 Sieve) $\leq$ 15%
- Plasticity Index $<$ 6
- Sand equivalent $\geq$ 12

8.3.2 Lateral Earth Pressures

The MSE Retaining Walls should be designed to resist lateral earth pressures imposed by the adjacent backfill. It is recommended that the walls be designed to resist a minimum equivalent

fluid pressure of 6.5 kN/m^3 for a horizontal backfill. Surcharge loads such as vehicular traffic would apply additional loads to the walls. For design purposes, a surcharge pressure equivalent to 0.6 m of soil should be applied to account for traffic loads. A surcharge pressure of 3.8 kPa per linear meter of wall can be used for the design. This surcharge pressure should be uniformly distributed over the design height of walls.

The recommended pressures assume that no hydrostatic pressures will develop behind the retaining walls. The levels of groundwater encountered during our field investigation were well below the base of the planned MSE walls. Surface water will be diverted via proper surface drainage facilities.

8.3.3 MSE Stability

Internal Stability

It is recommended that the stability of the MSE walls be evaluated during design using the following parameters:

Engineering Property	Granular MSE Backfill	Native Soils around MSE Wall No.		
		3B	4	5
Friction Angle, ϕ (degrees)	34	Sand (SM) from El. 14.5 to 13 m: 35 degrees	0	0
Cohesion, c (kPa)	0	Fill (CL) to El. 14.5 m: 95 kPa Clay (CL) to El. 10 m: 80 kPa	Fill (CL) to El. 20 m: 95 kPa Clay (CL) to El. 13 m: 70 kPa	Fill (CL) to El. 17.5 m: 95 kPa Clay (CL) to El. 15 m: 70 kPa
Total density, γ (kN/m^3)	19.6	Fill (CL) to El. 14.5 m: 17 kN/m^3 Sand (SM) to El. 13 m: 17.5 kN/m^3 Clay (CL) to El. 10 m: 18.5 kN/m^3	Fill (CL) to El. 20 m: 17 kN/m^3 Clay (CL) to El. 13 m: 18.5 kN/m^3	Fill (CL) to El. 17.5 m: 17 kN/m^3 Clay (CL) to El. 15 m: 18.5 kN/m^3

We recommend that the walls be designed to achieve minimum stability safety factors of 1.5 for static and 1.1 for seismic conditions.

Global Stability

The global stability of the MSE walls was evaluated using a limit equilibrium method based on Morgenstern-Price's procedure. The global stability analyses of the MSE wall were performed using SLOPEW Computer Program. Based on our review of the geometry of the proposed MSE walls, Retaining Walls No. 3B and 5 are considered critical for global stability due to the

maximum design heights. Retaining Wall No. 4 is lower in maximum height. Therefore, it is our opinion that the factors of safety will be higher than those of Retaining Walls No. 3B and 5.

The global stability of the Retaining Walls No. 3B, and 5 were analyzed for the end of construction condition. The end of construction case represents the condition immediately following construction when excess pore pressures have been induced by the construction, and not enough time has passed for them to dissipate. For this reason, undrained conditions exist for impervious clay soils, whereas drained strengths were used for granular soils. Strength results from laboratory unconfined compressive strength tests were used for the fine-grained soils, and the estimated friction angle was used for the granular soils. It is our opinion that the end of construction represents the most critical loading condition.

Additional stability analyses were performed to evaluate the stability under seismic conditions. The analyses were performed using pseudo-static method with the horizontal seismic coefficient (k_h) of 0.3g.

The minimum required factor of safety for global stability is 1.3. The minimum (critical) factors of safety computed are summarized in the table below.

Retaining Wall No.	Minimum Calculated Factor of Safety	
	End-of-Construction	Pseudo-Static
3B	3.5	2.0
5	4.0	2.0

The calculated factors of safety all exceed the minimum required value of 1.3. A copy of our global slope stability calculations are presented in Appendix B, Results of Global Stability Analyses for Retaining Walls No. 3A, 3B and 5, of this report.

8.3.4 Bearing Capacity

Retaining Walls No. 3B and 5

Retaining Walls No. 3B and 5 can be designed using an allowable bearing pressure for dead load and live loads of 200 kPa (with a Factor of Safety of 3.0). The following table gives the maximum bearing pressures (in kPa) at the base of the MSE walls for different wall heights (m) and base widths (m) per Caltrans Bridge Design Aids (April 2005):

Maximum Bearing Pressures for MSE Wall Design for Retaining Walls No. 3B and 5 (kPa)

Wall Height (m) Base Width (m)	2.44	3.05	3.66	4.27	4.88	5.49	6.10	6.71	7.32
2.44	67.03	86.18	110.12						
3.05	62.24	76.61	95.76	119.70					
3.66	62.24	76.61	90.97	110.12	129.28	153.22			
4.27	57.46	71.82	86.18	105.34	119.70	143.64	162.79		
4.88		71.82	86.18	100.55	114.91	134.06	153.22	172.37	196.31
5.49			86.18	100.55	114.91	129.28	148.43	162.79	186.73
6.10				95.76	110.12	124.49	143.64	158.00	177.16
7.32								153.22	167.58
8.00									162.79

Resistance to lateral earth pressures can be developed by base friction mobilized along the bottom of the MSE base width. We recommend using an allowable lateral sliding coefficient of 0.35 acting across the base area of the footing.

As stated in Section 2, an overhead CMS No. 2 sign will be installed adjacent to the Retaining Wall No. 5 and will be supported on a pile foundation. Based on our engineering analysis, we recommend that the sign be supported on 1.6-m diameter cast-in-drilled-holes (CIDH) piers. The pier capacities can be summarized as follows:

Pile Type	Pile Length	Nominal Capacity (kN)		Lateral Capacity (kN)		
		Compression	Tension	Fixed / Free Head @ 6 mm Deflection	Fixed / Free Head @ 12.5 mm Deflection	Fixed / Free Head @ 25 mm Deflection
1.6-m diameter CIDH	7 m	600	0	495/210	760/265	1180/340

Retaining Wall No. 4

Retaining Wall No. 4 can be designed using an allowable bearing pressure for dead load and live loads of 200 kPa (with a Factor of Safety of 3.0). Retaining Wall No. 4 should be designed to accommodate the additional lateral load induced by the sound wall section in addition to the lateral earth pressure to the MSE wall section. This may be accomplished via two alternatives as follows:

Alternative 1

This Alternative 1 is designed to omit the drilled piers (as generally required by Caltrans) supporting the sound wall on top of the MSE wall. Omitting the drilled piers supporting the sound wall will avoid significant construction difficulties and result in significant cost savings.

The additional vertical and lateral loads from the sound wall are accounted for by extra reinforcement and an increase in the size of the sound wall footing. They will result in slightly larger maximum bearing pressures (see table below). However, the maximum bearing pressures do not exceed the allowable pressures for the proposed wall height. It is therefore recommended that this alternative be considered for construction.

We recommend that the MSE reinforcement be designed to resist this additional lateral load. The resulting overturning moment from this additional lateral load will slightly increase the bearing pressure at the sound wall footing and at the toe of the MSE wall section. Therefore, the reinforced concrete footing of the sound wall section should be widened to resist this overturning moment. Based on our analyses, we recommend increasing the width of the sound wall footing from the current design of 1800 mm to 3000 mm.

The maximum bearing pressures (in kPa) at the base of the MSE walls for different wall heights (m) and base widths (m) taking into account additional overturning pressure due to the lateral load component from the sound wall are presented in the table below.

Resistance to lateral earth pressures along the bottom of the MSE wall section can be developed by base friction mobilized along the base width. We recommend using an allowable lateral sliding coefficient of 0.35 acting across the base area of the footing.

Alternative 2

This alternative is presented to cover Caltrans requirement of providing a pier foundation for sound wall on top of MSE walls. The loads from the sound wall section are to be resisted by piers. However, the MSE wall section is also designed to resist additional overturning pressure from the sound wall as discussed in Alternative 1. The maximum bearing pressures (in kPa) at the base of the MSE walls for different wall heights (m) and base widths (m) are presented in the table below. The design recommendations for the pier foundation of this sound wall are presented in Section 8.5 of this report.

Resistance to lateral earth pressures along the bottom of the MSE wall section can be developed by base friction mobilized along the base width. We recommend using an allowable lateral sliding coefficient of 0.35 acting across the base area of the footing.

The general recommendations regarding the construction of the cast-in-place piers to support the sound wall section of Retaining Wall No. 4 are discussed in Section 9.5 of this report.

Maximum Bearing Pressures for MSE Wall Design for Retaining Wall No. 4 Alternatives 1 and 2 (kPa)

Wall Height (m) / Base Width (m)	2.44	3.05	3.66	4.27	4.88	5.49	6.10
2.44	86.18	110.12					
3.05	76.61	95.76	119.70				
3.66	76.61	90.97	110.12	129.28	153.22		
4.27	71.82	86.18	105.34	119.70	143.64	162.79	
4.88	71.82	86.18	100.55	114.91	134.06	153.22	172.37
5.49		86.18	100.55	114.91	129.28	148.43	162.79
6.10			95.76	110.12	124.49	143.64	158.00
6.71				110.12	124.49	138.85	153.22
7.32					124.49	138.85	153.22
7.92						134.06	148.43

8.3.5 Leveling Pad

In order to provide a uniform bearing pad and sliding resistance along the bottom of the MSE base width, we recommend soil be subexcavated to a depth of 0.3 m below the bottom of the leveling pad. The subexcavation should be backfilled with the same backfill material described in Section 8.3.1 "Materials" ($\phi = 34°$) used within the reinforced-soil block. The subexcavation area should extend laterally to at least 0.3 m on both sides of the leveling pad.

8.4 SETTLEMENT

URS performed engineering analyses to evaluate the settlement underneath the proposed retaining walls due to loads from the wall structures and the additional fill materials required to attain the proposed finished grade. The analyses were based on the results of the subsurface investigation program at each wall location, and the proposed cut and fill as shown on the proposed wall profiles in Appendix A of the Type Selection Report.

The settlement in the unsaturated layers above groundwater table is considered to be elastic compression. This settlement is expected to occur during construction. The long-term post-construction settlement will be due to consolidation of the deeper clayey soils below the groundwater table. The settlement from the sandy soils is considered negligible.

The total settlement of the MSE will be due to the settlement of the embankment itself and the settlement of the supporting soils. Given the composition and the degree of compaction of the embankment materials, it is anticipated that this settlement will occur during construction, and is considered negligible.

The long-term post-construction settlement of the MSE walls will be due to settlement in the supporting clayey soils below the groundwater table. The settlement from the sandy soils is considered negligible. The total settlements were estimated for the maximum wall heights.

The results of the settlement analyses can be summarized as follows:

Retaining Wall No.	Approximate Max. Wall Height (m)	Max. Fill Height (m)	Elastic Settlement (mm)	Long Term Consolidation Settlement (mm)
1	3.6	Cut/No New Fill	-	-
2A	3.0	1.6	10	Negligible
2B	4.2	Cut/No New Fill	-	-
3A	8.5	Mostly cut; less than 1.4m fill	Negligible	Negligible
3B	7.3	5	25	Negligible
4	6.1	3.6	20	5
5	7.3	5	25	5
6	4.2	3	15	5

8.5 PIER FOUNDATION FOR SOUND WALLS

8.5.1 Sound Wall at Retaining Wall No. 4

As discussed above, Retaining Wall No. 4 will have a sound wall section on top of the MSE wall section. However, if drilled pier foundations are required, they should be designed as follows:

The piers for the sound wall sections derive the axial capacities from the skin friction. The lateral pile capacities are developed from the compacted soils inside the MSE section.

Based on the results of our foundation analyses, we recommend using cast-in-place piers with 0.36-meter diameter, and 8 meters long. The allowable unit skin friction for the design is 5.6 kPa. The pile capacities can be summarized as follows:

Pile Type	Pile Length	Nominal Capacity (kN)		Lateral Capacity (kN)	
		Compression	Tension	Fixed / Free Head @ 6 mm Deflection	Fixed / Free Head @ 25 mm Deflection
0.36-m Diameter Cast-in-Place Pier	8 m	48	24	135 / 60	342 / 155

Based on the results of our engineering analyses, the lateral movements and lateral pressures from the embedded cast-in-place piers will not cause a detrimental effect on the MSE section of Retaining Wall No. 4.

Engineering recommendations for the construction of these cast-in-place piers will be discussed in Section 9 of this report.

8.5.2 Sound Wall No. 1

We recommend that Sound Wall No. 1 be designed and constructed in accordance with Case 2 Barrier Section as presented on Caltrans Standard Details No. 1, Plan No. B15-6, and dated April 28, 2005. The pile data for support of this Sound Wall are determined from Case 2 Pile Data table with H_e = 900 mm, Maximum H = 3759 mm, and ϕ = 30° minimum. The Pile Data table is presented on Caltrans Standard Details No. 3, Plan No. B15-8, and dated July 1, 2004.

8.6 eBART RETAINING WALL

This report does not address the eBART retaining walls proposed in the highway median in the vicinity of Century Boulevard. A separate report, by BART, will be prepared to address these walls.

8.7 CORROSIVITY

As part of our study, near surface soil samples were collected at eleven locations on the subject site. The samples were analyzed for corrosivity by V&A Consulting Engineers, Inc. The results of that testing are presented in Appendix C. The soil samples were analyzed for Redox, pH, resistivity, chloride and sulphate. The results of the sulfate, chloride and pH testing indicate the near surface site soil is considered noncorrosive to reinforced concrete retaining walls and sound walls in accordance with the Caltrans guidelines.

9.1 CONSTRUCTION CONSIDERATIONS FOR RETAINING WALLS AND SOUND WALL

Based upon our review of the existing information regarding the current site conditions, subsurface conditions, and the configurations of the proposed structures. Potential construction considerations for the proposed Retaining Walls and Sound Wall are expected to include the following issues:

9.1.1 Physical Conflicts

There may be potential conflicts between the locations of the spread footings or the pile foundations for the Retaining Walls and Sound Wall with the existing facilities such as utilities along the alignment of the proposed walls. The locations of the existing utility lines and other existing facilities in the vicinity of the proposed wall alignments should be confirmed, and the location conflicts should be evaluated.

9.1.2 Loading Conflicts

Physical conflicts, if they occurred, could generate potential for loading conflicts. This would be due to loads from the foundations of the proposed walls imposing additional loads on existing facilities that were not designed to resist these additional pressures. If physical conflicts were to occur, supplemental studies to relocate or strengthen the existing facilities in conflict would be necessary.

Based on our review of the existing underground utility lines in the footprint area of Retaining Wall No. 3B, several underground utility lines are located below the bottom of the wall footing. These utility lines are a 900-mm RCP sewer line located near Station 12+80, a 200-mm RCB sewer line located near Station 13+40, and three water lines located near Station 18+80. The 900-mm RCP pipe near Station 12+80 has steel casing to resist the imposing overburden pressure. The water lines near Station 18+80 have casings to protect the portion underneath the SR4. These casings will be extended below the wall footing. The 200-mm RCP pipe has no steel casing including the portion underneath the SR4. Based on the retaining wall design, the finished grade at the top of the MSE wall is approximately 8 inches higher than the top of the existing SR4 pavement section. It is our opinion that the minor increase in overburden pressure from the MSE wall section will not adversely affect the integrity of the pipe.

9.1.3 Groundwater

Based on the groundwater table encountered during the subsurface investigation program, it is anticipated that dewatering or other groundwater control measures may not be required during construction.

9.1.4 Expansive Subgrade Soil

Based on our findings from the subsurface exploration program, and the proposed foundation elevations of the wall structures, high plasticity clay was encountered near the footing elevations at Test Borings B-10, B-12, B-13, B-23, B-24, and B-27. This high plasticity clay may cause

shrinkage and swell due to changes in moisture contents. We recommend that this potentially expansive soil be subexcavated, and the areas be backfilled with non-expansive soils in accordance with Caltrans Standard Specifications Section 19. The retaining walls that may encounter this potentially expansive soil at the footing subgrade are Retaining Walls No. 2A, 2B, 3A (for spread footings), 3B, 6, and Sound Wall No. 1.

We recommend that the native subgrade soils along Retaining Walls No. 2A, 2B, 3A, and 6 be subexcavated to a depth of 1.2 m, and extend 0.3 m around the edges of the footings as shown on Figure 3, Typical Section: Expansive Soil Exclusion Zone, in accordance with Caltrans Guidelines for Foundation Investigations and Report Version 1.2, dated June 2002. For Retaining Wall 3B which is an MSE wall, the native subgrade soil should be subexcavated to a depth of 1.2 m, and extend 0.3 m around the edges of the leveling pad. These subexcavated areas should be backfill with non-expansive soils in accordance with Caltrans' requirements.

Sound Wall No. 1 will be supported on pile foundations. Therefore, excavation is not required.

9.2 EARTHWORK

9.2.1 General

All earthwork should be done according to the current Standard Specifications of Caltrans. Section 16, Clearing and Grubbing, and Section 19, Earthwork, of the Standard Specifications should be followed. Specific additions and modifications to those specification requirements are discussed in the following sections.

9.2.2 Site Preparation

Site preparation generally consists of clearing and grubbing the site prior to construction of the retaining walls. These recommendations should be used in conjunction with the specifications presented in Section 16 of the Caltrans Standard Specifications.

All deleterious material within the retaining walls areas should be removed prior to grading operations. Areas to be filled should be cleared of existing structures. Tree stumps and roots over 25 mm in diameter should be excavated. The resulting holes should be cleared of all loose soils and backfilled with engineered fill.

Areas to receive fills should be stripped to a sufficient depth to remove all surface vegetation, organic laden topsoil, and debris. It is estimated that stripping depths could vary between approximately 50mm to 100mm and the actual stripping depth should be determined in the field at the time of construction. Any stripped organic material should not be used as engineered fill. After the site has been properly stripped, the exposed surfaces in all areas to be filled should be scarified to a minimum depth of 150 mm and recompacted to the requirements for engineered fill.

Along the alignment of the MSE walls, the anticipated subgrade is generally stiff to very stiff clays and silts. Depending upon the time of year and other factors, these soils could experience pumping and rutting if subjected to construction equipment and traffic. Pumping is defined as temporary subgrade deflection and disturbance by excess pore water pressure generation. Rutting is defined as permanent deformation of the subgrade under wheel or track loads. Therefore, in

these areas, we recommend that construction equipment be kept off the excavation bottom and excavation be performed with equipment operated from outside of the excavation to minimize disturbance. In addition, the backhoe bucket used to excavate to final grade should be fitted with a smooth cutting surface to eliminate disturbing the subgrade soils.

Based on our findings from the subsurface investigation programs, medium dense silty sand may be encountered at the bottom of the footing or leveling pad. Any loose or soft materials should be subexcavated to firm ground and recompacted to the specified densities. If the subexcavated materials are considered unsuitable as backfill materials, the subexcavated areas should be backfilled with suitable import fills.

9.2.3 Backfill Materials for Retaining Walls

Backfill behind cantilever retaining walls should be well compacted and consist of non-expansive, relatively clean, granular material meeting the requirements of Caltrans Standard Specifications Section 19-3 and the following criteria:

- Particle size $\leq$ 75 mm
- Amount passing the 0.074 mm (No. 200 Sieve) $\leq$ 15%
- Plasticity Index $<$ 10
- Sand equivalent $\geq$ 20

Native materials that meet the criteria above may be used for backfill behind the cantilever retaining walls. The extent of the non-expansive fill materials should be in accordance with Caltrans' recommendations as shown on Figure 3.

9.2.4 Placement and Compaction of Fills

Subgrade preparation should consist of moisture conditioning the exposed subgrade and compacting to a minimum relative compaction of 95 percent in accordance with the provisions of Section 19-5 of the Standard Specifications. All embankment fill should be placed in thin lifts and compacted to a minimum of 95 percent relative compaction (ASTM D1557 or Caltrans 216, using the dry weight basis) in accordance with Sections 19-3, 19-5 and 19-6 of the Standard Specifications. It is recommended that the relative compaction be measured on the basis of dry density.

9.3 TEMPORARY CONSTRUCTION EXCAVATION

An excavation into the embankment fills will result in temporary near vertical unsupported soil faces several meters high. Safety standards set by Department of Labor, Occupational Safety and Health Administration (OSHA) limit the height of unshored vertical excavations to 1.5 m if construction personnel will be working in the excavations. The set of guidelines published by OSHA classifies soils in detail as either Type A, B or C. In general, Type A soils are stronger, Type B soils are intermediate, and Type C soils are weaker. OSHA provides recommendations of the maximum allowable slopes based on the soil type, depth, duration the excavation will remain opened, and types of soils exposed in the excavation. Based on the strength of the soil where temporary cuts will be made, the soils are considered to be OSHA Type A.

9.4 SHORING CONSIDERATIONS

Depending on the excavations required to construct the cantilever and MSE walls, shoring may be needed to retain the soils along the perimeter. Alternative shoring systems are discussed below.

9.4.1 Soldier Beam and Lagging

With the soldier beam and lagging system, soldier beams are first either driven or placed in predrilled holes filled with lean concrete. As excavation proceeds, the exposed soil face is covered with either timber lagging (with preservations) or steel plates. Voids behind the lagging should be immediately backfilled with lean concrete or sand-cement grout. Tiebacks may be installed into the soil behind the wall, if there are no physical conflicts with existing facilities, and preloaded to minimize ground movement and settlement.

This system may be problematic for the following reasons. First, cave-in of drilled holes for soldier piles could occur before lean concrete is placed. Second, it should be recognized that some settlement and lateral movement in the surrounding roadways could occur. The amount of settlement is a function of the workmanship of the installation of the system. Even if good workmanship is used, minor ground settlement and lateral ground movement is still anticipated adjacent to the shoring system. Both the ground settlement and the lateral movement are a function of the height of the excavation. Any voids created between the lagging or shoring and the native soils should be properly filled to minimize soil loss. Tiebacks should be properly stressed and monitored at the appropriate excavation levels.

9.4.2 Interlocking Sheet Piles

Consideration should be given to a shoring system which would consist of interlocking sheet piles temporarily driven below the below of the excavation to minimize cave-in of the soils behind the excavation. However, this system is more expensive than the soldier pile and lagging system. Furthermore, this system could be more problematic during installation since some very dense granular soils and hard clays may be encountered. Tiebacks may be required for this alternative. Ground movement of similar magnitude is also anticipated for this system.

9.4.3 Summary

Regardless of the shoring system selected, it is recommended that a representative of our firm review the shoring plan prior to its implementation. We should also be retained to monitor the installation procedures. Settlement of the surrounding area should be monitored with surveying techniques. It is recommended that a pre-construction survey be made to establish a base line for comparison of ongoing level readings during construction.

9.5 PIER FOUNDATION FOR SOUND WALLS AT RETAINING WALL NO. 4

As discussed above, Retaining Wall No. 4 will have a sound wall section on at the top of each retaining wall. This sound wall may be supported by a pier foundation if required by Caltrans.

To avoid damaging the grid reinforcement inside the MSE section during the installation of the cast-in-place piers, we recommend that steel casings of 0.35 m in inside diameter be installed at

the pier locations during the construction of the MSE section. The grid reinforcement layers should be installed around the steel casings with sufficient overlapped grid areas at the connections in accordance with the manufacturer's recommendations. MSE wall backfill soils around the steel casings should be compacted using compaction equipment that can access small areas such as jumping jack rammers. Backfill soils around the steel casing should be placed in thin lifts of not more than 150 mm in thickness.

Reinforced concrete sections of the pier will be cast inside the steel casing following the completion of the MSE wall construction. The steel casings will be left in place and become part of the pier foundation.

The opinions, conclusions and recommendations presented herein are based on subsurface information developed by URS Corporation. The recommendations presented in this report are based on the assumption that the soil and geologic conditions do not deviate substantially from those anticipated by the information contained in the existing logs of test borings. If any variations are encountered during construction, the Geotechnical Professional should be contacted so that supplemental recommendations can be made.

If existing facilities, utilities, soils/bedrock conditions, road/structure distress, slope distress or groundwater/seepage conditions other than those noted in this report are present on the site, then their presence was not known, or was not considered in the preparation of this report. Locating utilities and evaluating potential utility interference is outside the scope of this report. Individuals utilizing this report shall inform URS Corporation if they are aware of any additional facilities or site conditions so that their presence and impact upon the project (or vice-versa) can be properly evaluated and recommendations modified to address geotechnical issues as necessary.

The Geotechnical Professional shall be given the opportunity to review the final specifications and drawings to verify that those documents are consistent with the intent of the geotechnical recommendations.

Geotechnical issues may arise during construction that were not apparent at the time this report was prepared. The Geotechnical Professional should be retained during construction to review the soil conditions encountered and the construction procedures used. All earthwork, pile, and wall installation and testing should be completed under the direct observation of the Geotechnical Professional.

Specific review and investigation for environmental issues and subsurface environmental contamination were beyond the scope of our services.

The opinions and recommendations presented in this report were developed with the standard of care commonly used by other professionals practicing at the same time, within the same locality and under the same limitations. No other warranties are included, either expressed or implied, as to the professional advice included in this report.

American Society for Testing and Materials (ASTM), v. 04.08 for ASTM test methods, Soil and Rock (1): D-420 to D-5779, 2000.

California Geological Survey (CGS), 2003, Fault investigation reports for development sites within Alquist-Priolo Earthquake Fault Zones in Northern California, 1974-2000, CGS CD 2003-01.

FEMA, 1996, National Flood Insurance Program, (www.fema.gov).

Graymer, R.W., Jones, D.L., and Brabb, E.E., 1994, Preliminary geologic map of the Niles 7.5-minute quadrangle, Alameda County, California: U.S. Geological Survey Open-File Report 94-132, scale 1:24,000.

Knudsen, K.L., Sowers, J.M., Witter, R.C., Wentworth, C.M. and Helley, E.J., 2000, Preliminary maps of Quaternary deposits and liquefaction susceptibility, nine-county San Francisco Bay region: A digital database, U.S. Geological Survey, Open-File Report 00-444, 60 p.

Mualchin, L., 1996, California seismic hazard map 1996 based on maximum credible earthquakes (MCE), California Department of Transportation.

NCEER, 1998, "Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils", edited by Youd, T.L., and Idriss, I.M., Technical report NCEER-98-0022.

State of California, Department of Transportation, "Caltrans Memo to Designers 5-20, August 2004.

State of California, Department of Transportation, 2006, "Guidelines for Structures Foundation Reports, Version 2.0", March.

State of California, Department of Transportation, 2006, "Seismic Design Criteria, Version 1.4", June.

State of California, Department of Transportation, "Soil & Rock Logging Classification Manual", 1996.

Terzaghi, K., R.B. Peck, and G. Mesri, 1996, "Soil Mechanics in Engineering Practice," 3rd Edition, John Wiley & Sons, Inc.

Tokimatsu, A.M., Seed, H.B., 1987, Evaluation of Settlements in Sands Due to Earthquake Shaking, Journal of Geotechnical Engineering, Vol 133, No. 8, August.

Tomlinson, M. J., 1957, "The Adhesion of Piles Driven in Clay Soils," Proceedings of the 4th International Conference on Soil Mechanics and Foundation Engineering, Vol. 2, p. 67.

U.S. Army Corps of Engineers, 1992, "The Seismic Design of Waterfront Retaining Structures," ITL-92-11, November 1992.

U. S. Department of Transportation, Federal Highway Administration, 1998, " Design and Construction of Driven Pile Foundations" Workshop manual Volume I, Publication No. FHWA-HI-97-013, November.

U. S. Department of Transportation, Federal Highway Administration, 1998, " Design and Construction of Driven Pile Foundations" Workshop manual Volume II, Publication No. FHWA-HI-97-014, November.

Wills C. J., 1991, The Antioch Fault, Contra Costa, California: Fault Evaluation Report FER-228, California Division of Mines and Geology, 28p., November 6, 1991.

Working Group for California Earthquake Probabilities, 2003, Summary of earthquake probabilities in the San Francisco Bay area, 2003-2032, US Geological Survey, Fact Sheet 039-03, 6 p.

Figures

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

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Exp. 6/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

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	CHECKED BY	BR	06/06

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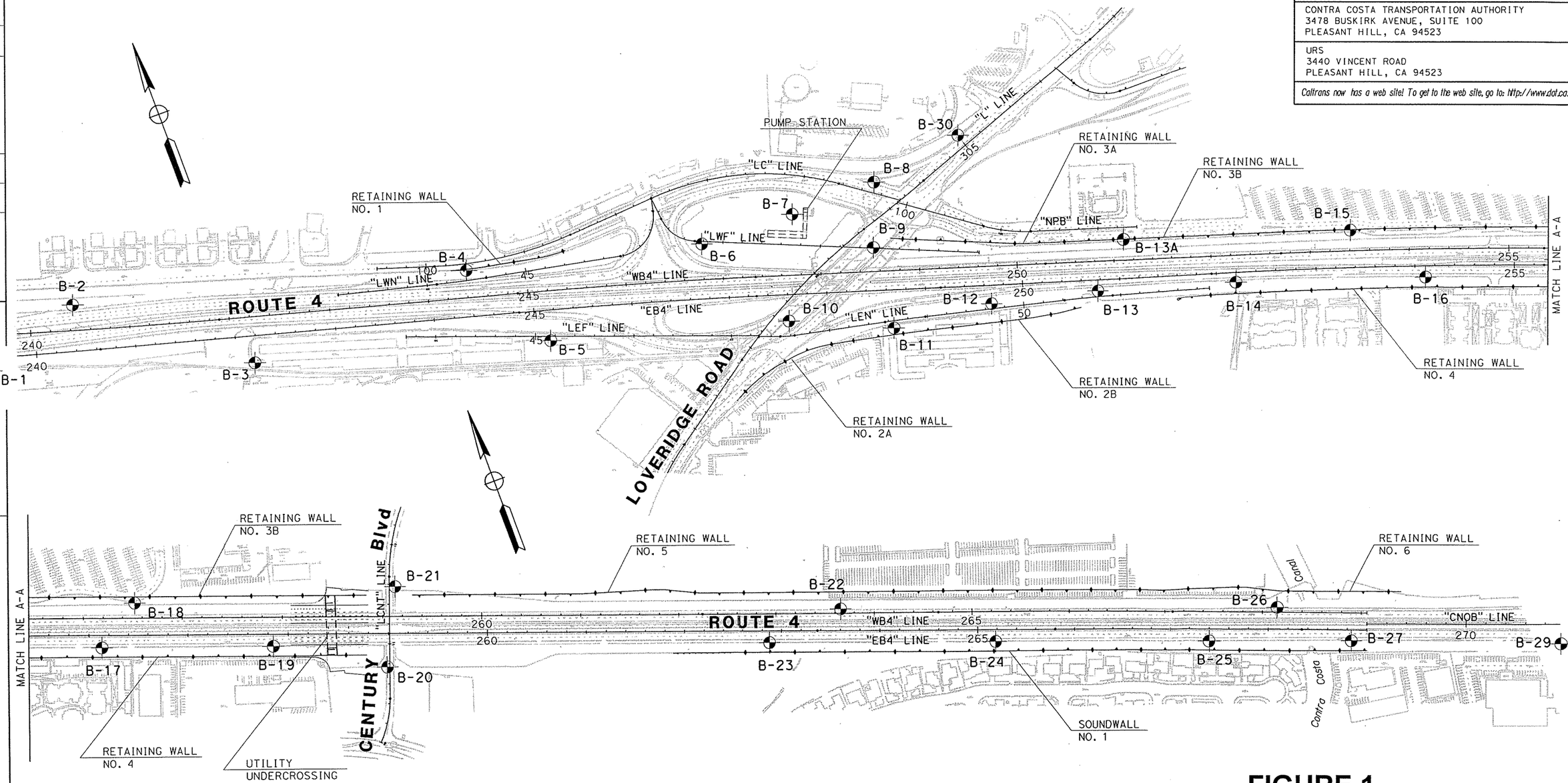
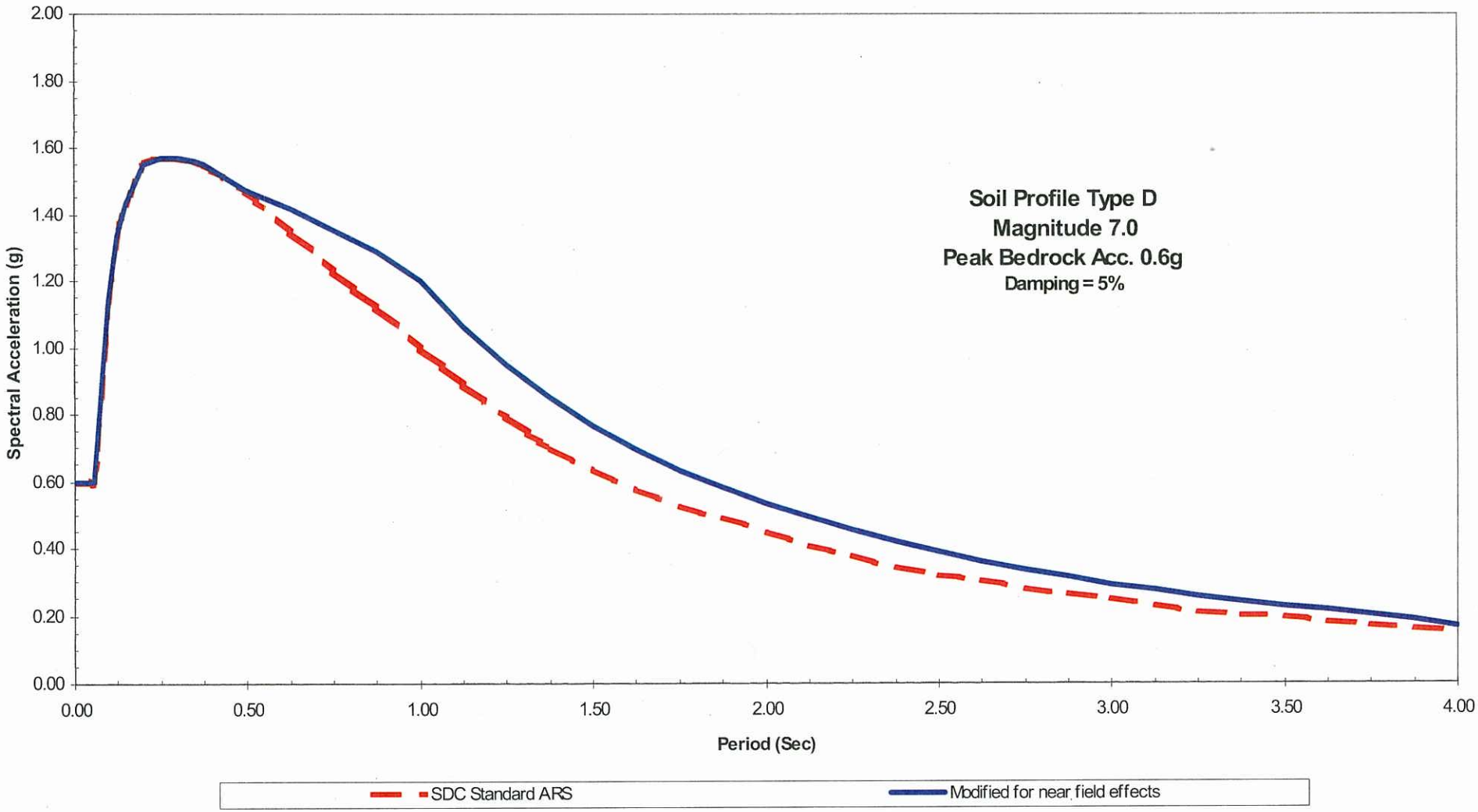


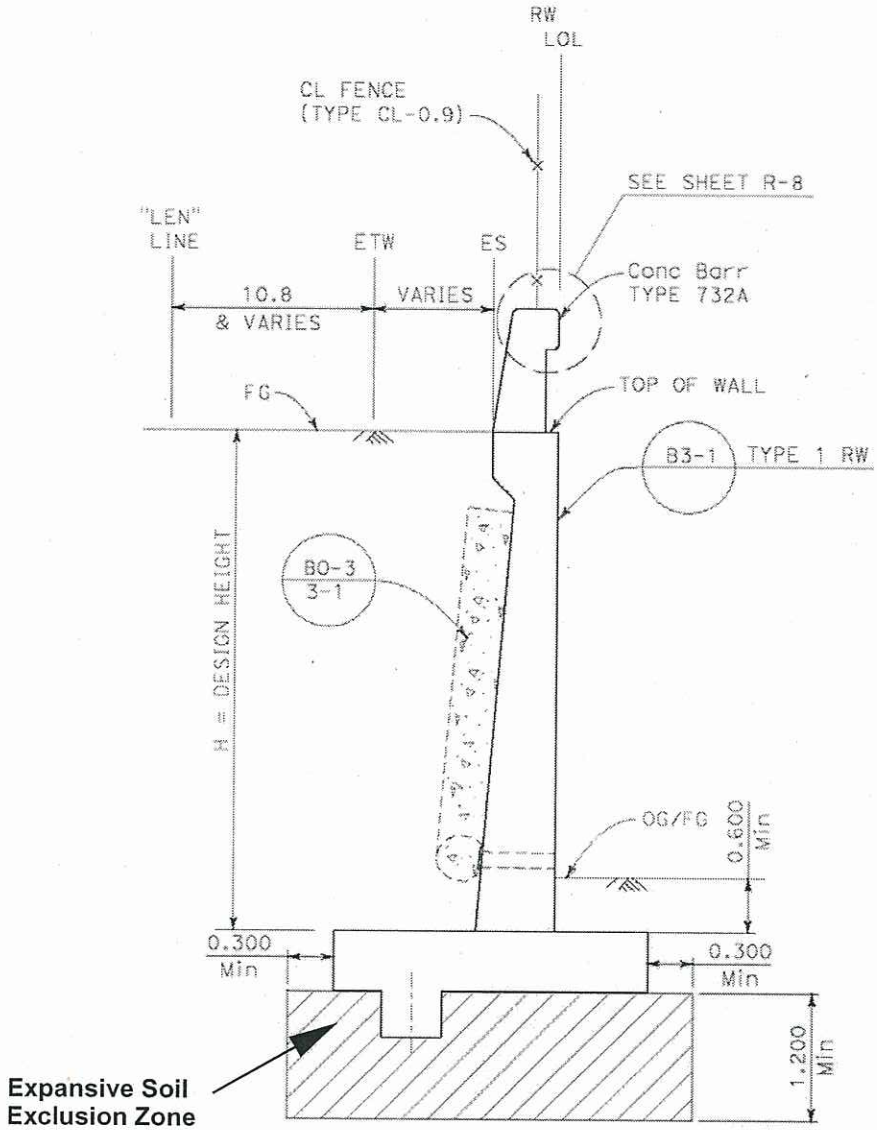
FIGURE 1

SITE AND BORING LOCATIONS

ALL DIMENSIONS ARE IN
METERS UNLESS OTHERWISE SHOWN



Project No. 26814911	SR 4 (EAST) WIDENING PROJECT LOVERIDGE TO SOMERSVILLE ROAD, Pittsburg CA	**Design Acceleration Response Spectra**	FIGURE 2
	URS		



TYPICAL SECTION

NO SCALE

URS	Project No. 26814911 SR4 (East) Widening Project Loveridge to Somersville Road, Pittsburg, California	Typical Section: Expansive Soil Exclusion Zone	Figure 3

Appendix A

Logs Of Test Borings

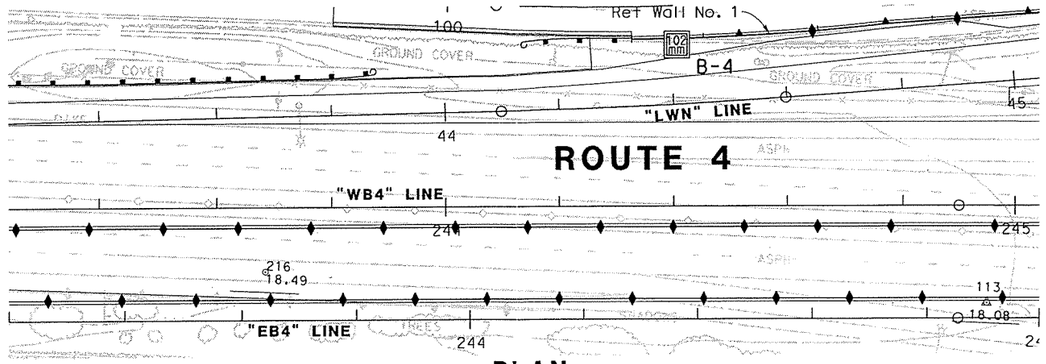
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



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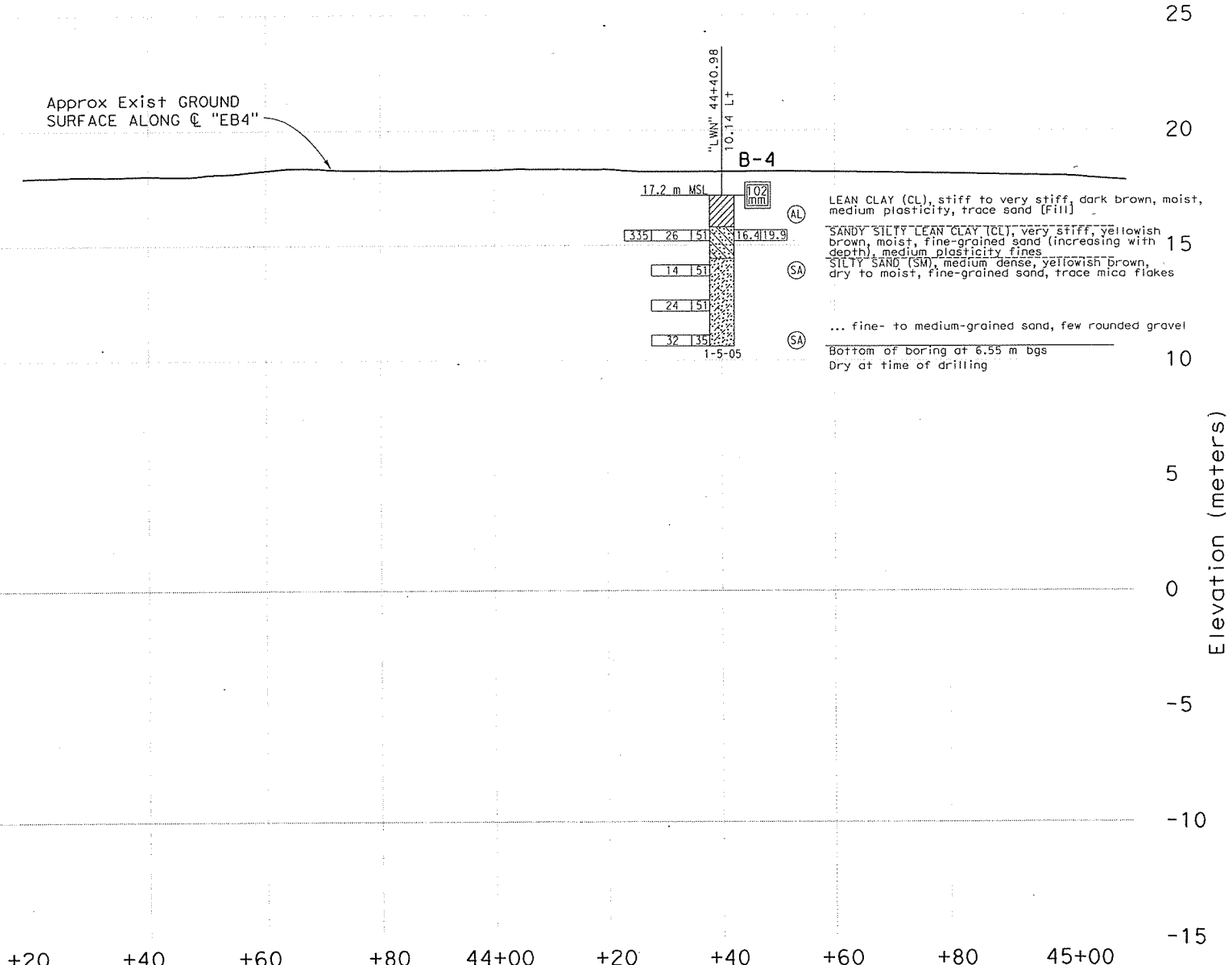

PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

R-12

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

Caltrans Metric

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04	CC	4	37.9/41.3		

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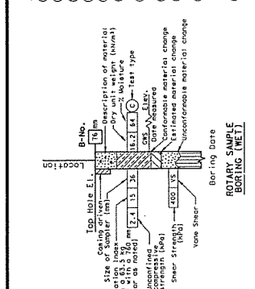
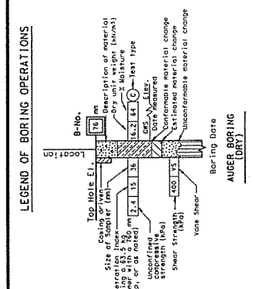
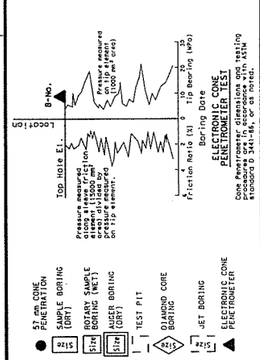
LEGEND OF BORING OPERATIONS

TEST TYPE
(A) Atterberg Limit (C) Corrosivity Test (CN) Consolidation (DS) Direct Shear (H) Hydrometer (MD) Wet Density (Lab Compaction Test) (R) Resistance R-value (SA) Sieve Analysis (SE) Swell/Settlement Test (UC) Unconsolidated Undrained Triaxial Compression Test (W) Wash Sieve







ST 76 mm CONE PENETRATION
SAMPLE BORING (DRY)
ROTARY SAMPLE BORING (WET)
AUGER BORING (DRY)
TEST PIT
DIAMOND CORE BORING
JET BORING
ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS

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

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. UPADHYAYA	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO.
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/05/05		PROJECT ENGINEER	KILOMETER POST 37.9/41.3

RETAINING WALL No. 1
LOG OF TEST BORINGS

CU 04275
EA 228591

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/31/05 · 7/28/06 · 8/03/06 · 2/28/07 · 10/25/07

SHEET 12 OF 19

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

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BENCH MARKS

BENCH MARK DATA
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EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

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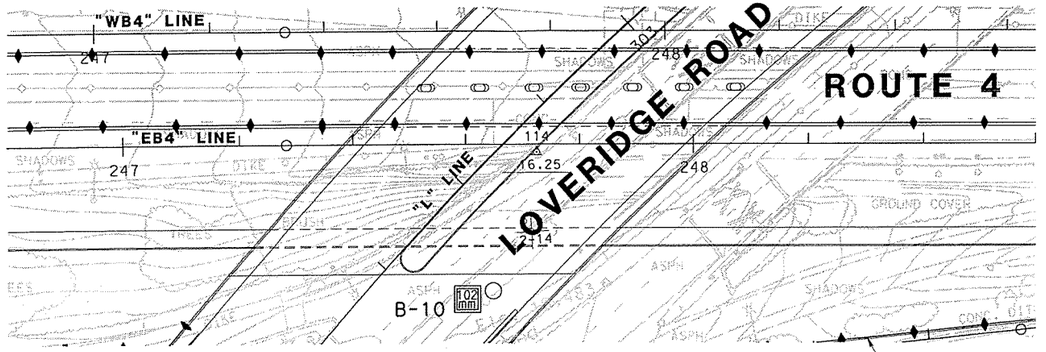
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



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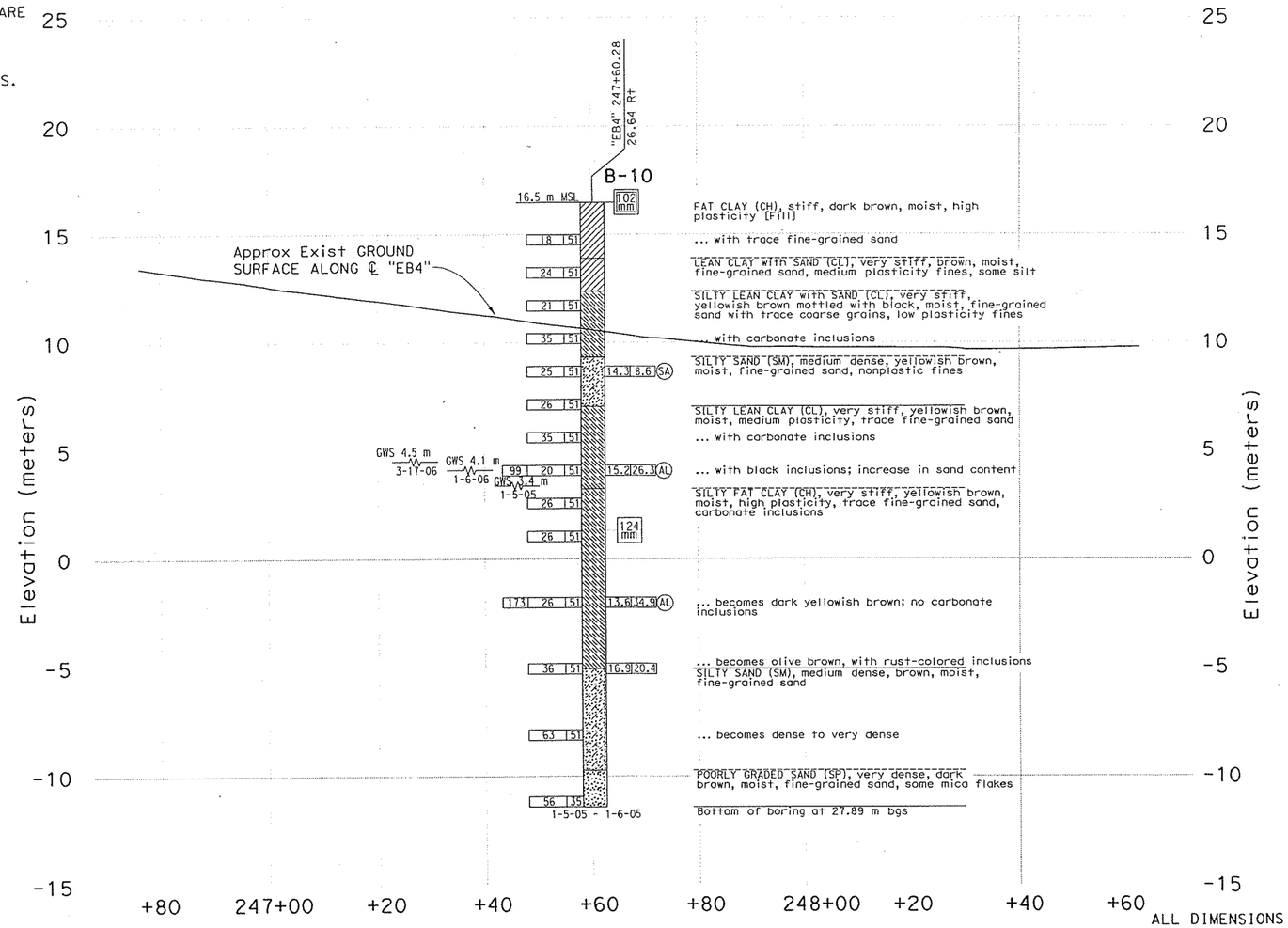

PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

R-13

NOTE:

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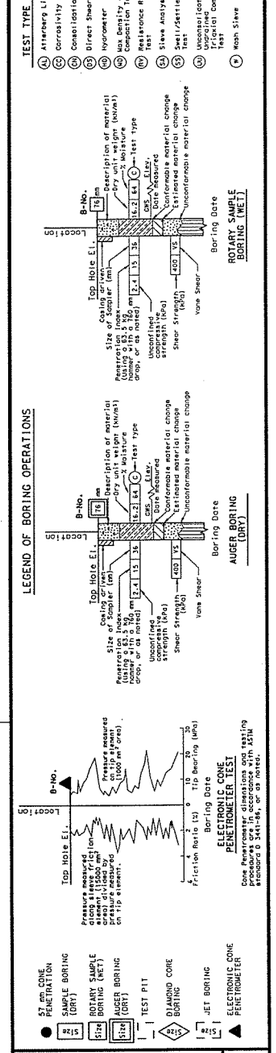
LEGEND OF BORING OPERATIONS



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BRIDGE NO.
KILOMETER POST 37.9/41.3

RETAINING WALL No. 2A
LOG OF TEST BORINGS No. 1 of 2

CU 04275
EA 228591

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

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SHEET 13 OF 19

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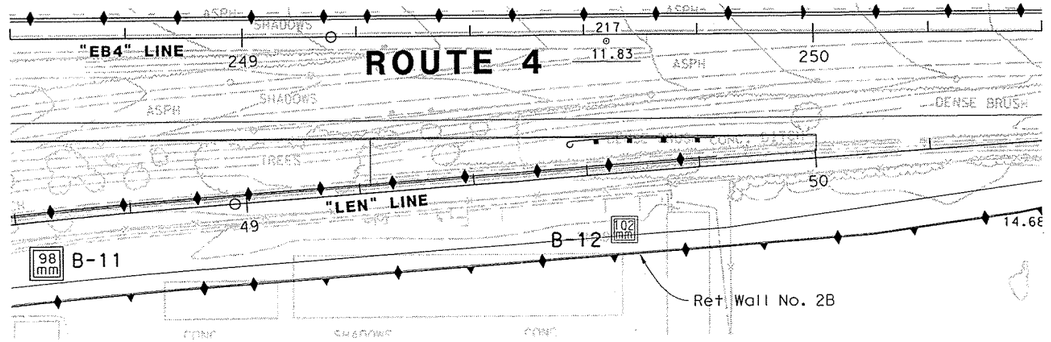
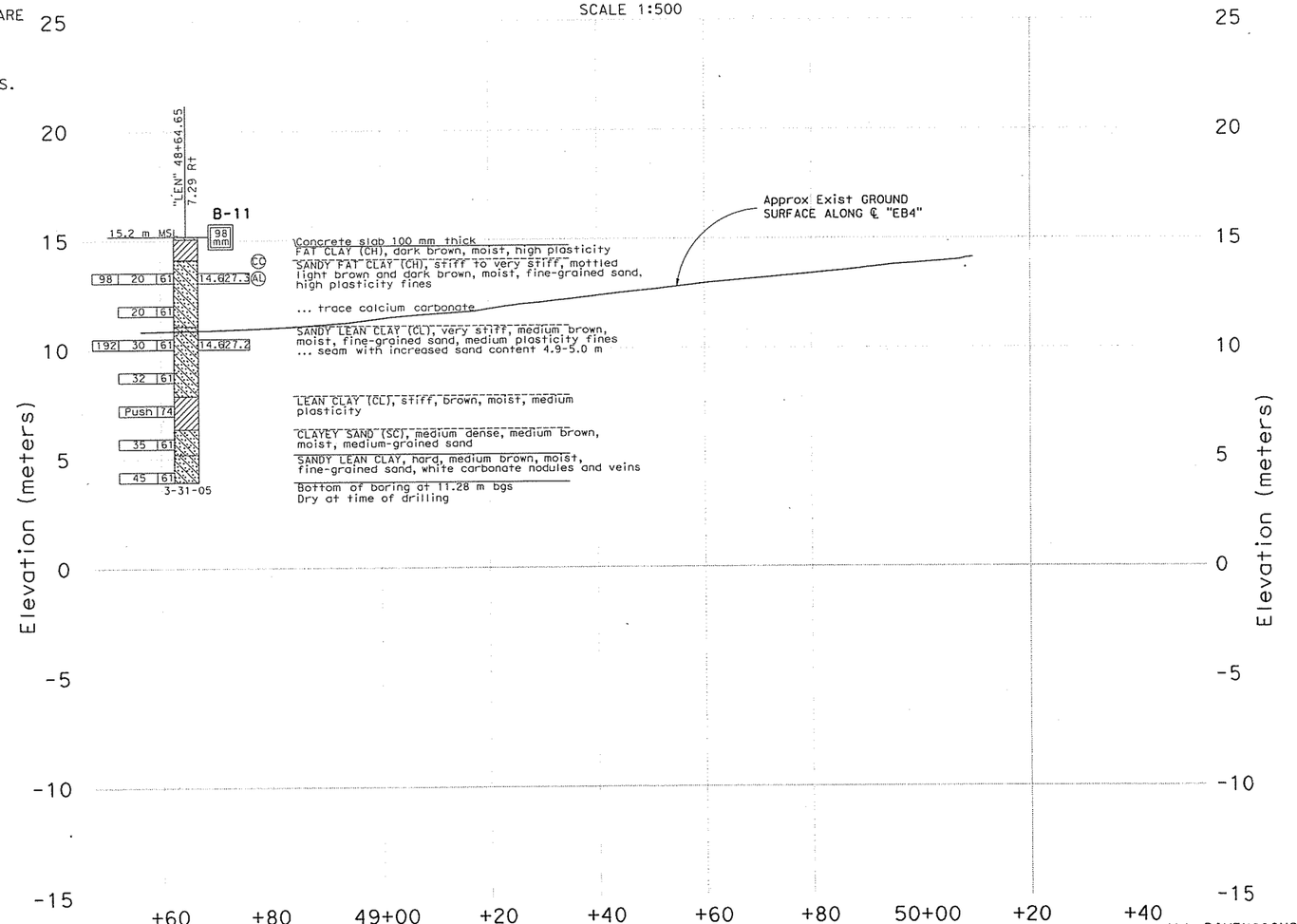


PLAN

SCALE 1:500



PROFILE VIEW

Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

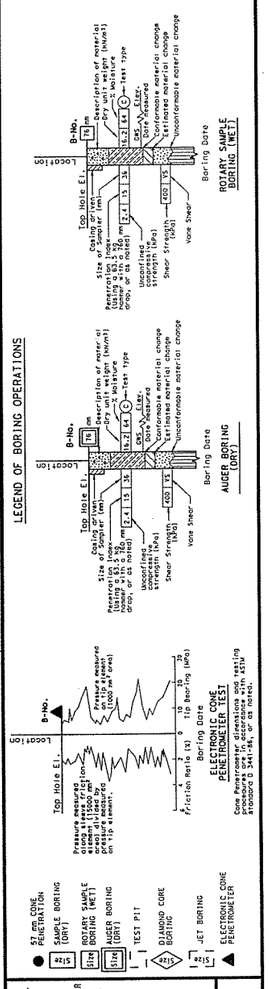
R-14

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

LEGEND OF BORING OPERATIONS

TEST TYPE
Atterberg Limit
Corrosivity Test
Consolidation
Direct Shear
Hydrometer
Max Density, Sieve & Moisture Content Test
Resistance R-Value Test
Sieve Analysis
Swell/Settlement Test
Triaxial Compressive Strength Test
Unconfined Compression Test
Unconsolidated Undrained Triaxial Compression Test
Wash Sieve



51 mm CONE PENETRATION
SAMPLE BORING (DRY)
ROTARY SAMPLE BORING (MET)
AUGER BORING (DRY)
TEST PIT
DIAMOND CORE BORING
JET BORING
ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS

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

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO.	RETAINING WALL No. 2A
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 013/31/05		PROJECT ENGINEER	KILOMETER POST 37.9/41.3	LOG OF TEST BORINGS No. 2 of 2

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228591

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/31/05 2/28/06 8/31/06 2/28/07 10/25/07

SHEET 14 OF 19

FILE => ...\r-14.dgn

USERNAME => Christina.Dalfen PLOTTED => 10/31/2007 TIME PLOTTED => 5:59:08 PM

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER ~~ENGINEER~~ DATE

REGISTERED PROFESSIONAL ENGINEER
Philip Meymand
No. 2596
Exp. 6/30/09
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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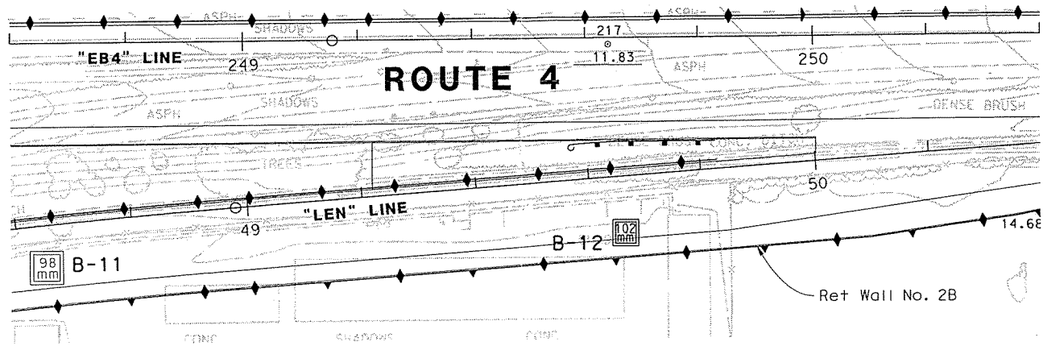
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

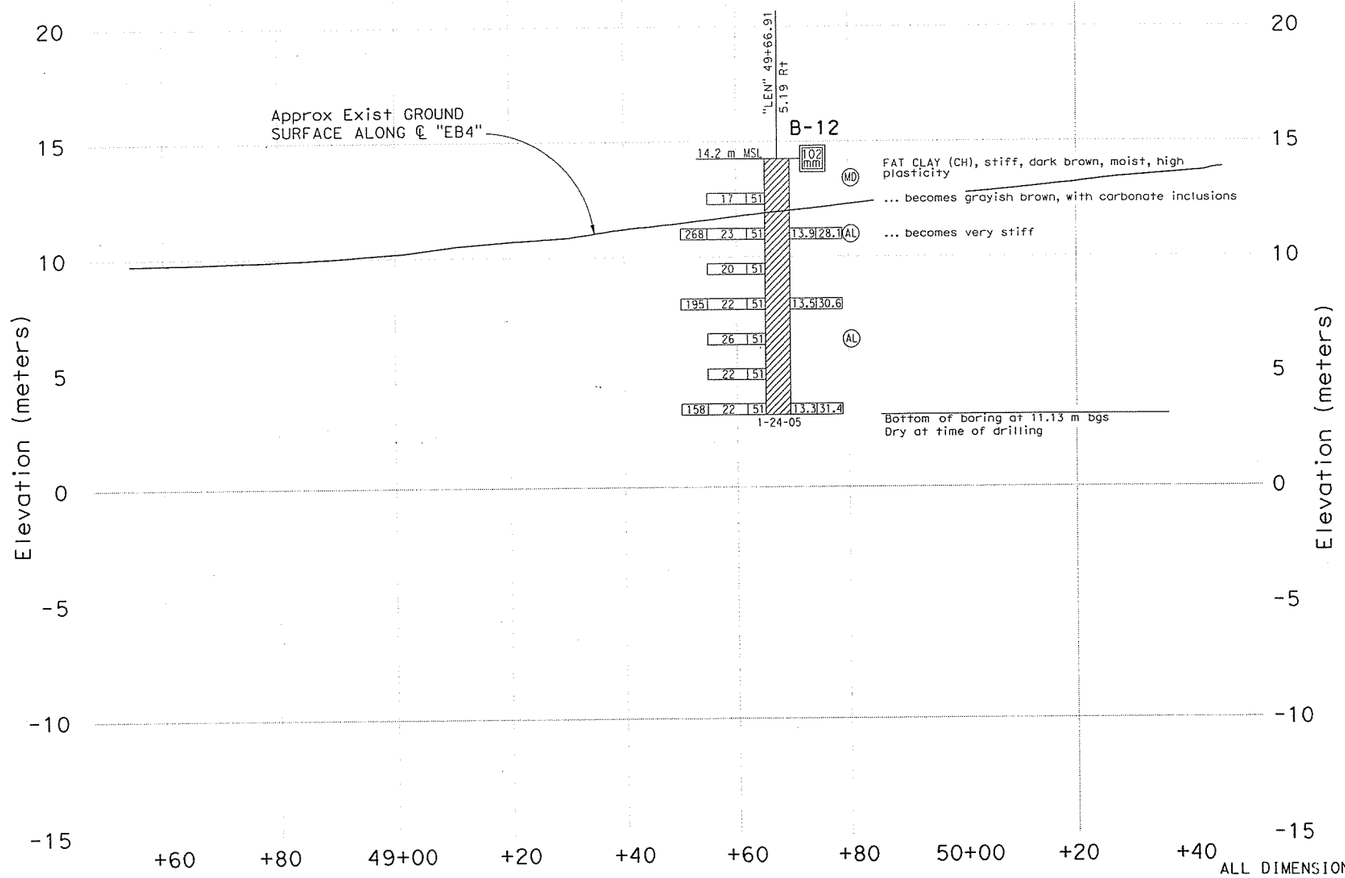
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

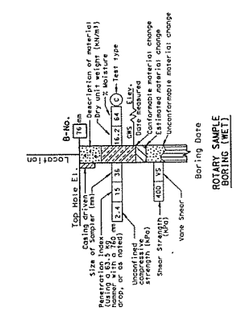
R-15

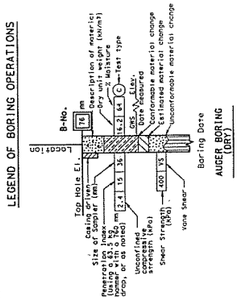
NOTE:

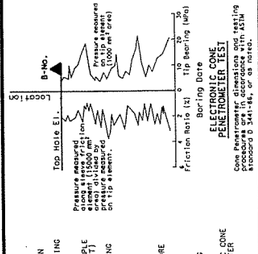
AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

LEGEND OF BORING OPERATIONS

TEST TYPE
Ⓐ Atterberg Limit
Ⓒ Corrosivity Test
Ⓒn Consolidation
Ⓓ Direct Shear
Ⓗ Hydrometer
Ⓜ Max. Density (Lab Compaction Test)
Ⓡ Resistance R-value Test
Ⓢ Sieve Analysis
Ⓣ Soil Pavement Test
Ⓤ Unconsolidated Undrained Compression Test
Ⓥ Wash Sieve







57 mm CONE PENETRATION
SAMPLE BORING (DRY)
ROTARY SAMPLE BORING (RCT)
AUGER BORING (DRY)
TEST PIT
DIAMOND CORE BORING
JET BORING
ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS
GRAVEL
SAND
SILT
CLAY
CLAYEY SILT
PEAT and/or ORGANIC MATTER
FILL MATERIAL
COBBLE
COHESIVE ROCK
SEDIMENTARY ROCK
METAMORPHIC
SANDY CLAY or CLAYEY SAND
SANDY SILT or SILTY SAND
SILTY CLAY

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/ft)	Granular	SPT N-Value (Blows/ft) (0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/24/05		PROJECT ENGINEER

BRIDGE NO.
KILOMETER POST: 37.9/41.3

RETAINING WALL No. 2B
LOG OF TEST BORINGS No. 1 of 2

CU 04275
EA 228591

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/31/05 | 1/20/06 | 8/31/06 | 2/20/07 | 10/25/07

SHEET 15 OF 19

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

FILE => ...\r-15.dgn

USERNAME => Christina\Desktop\PLOTTED => 10/31/2007 TIME PLOTTED => 5:59:12 PM

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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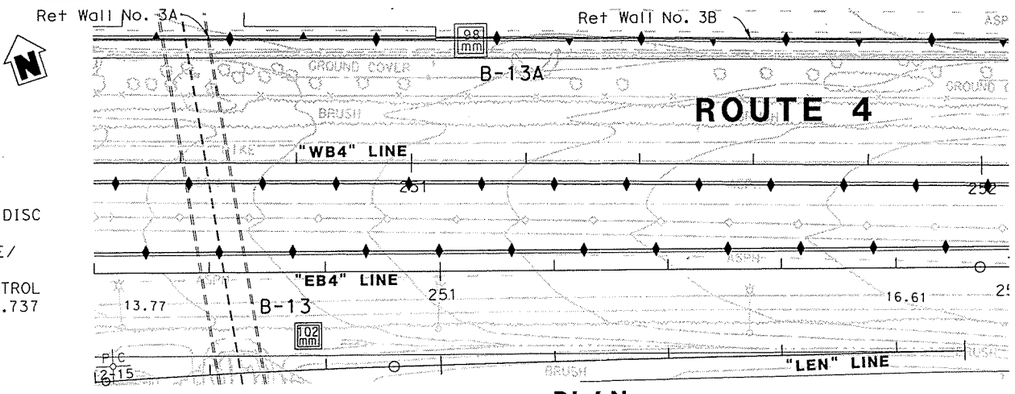
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

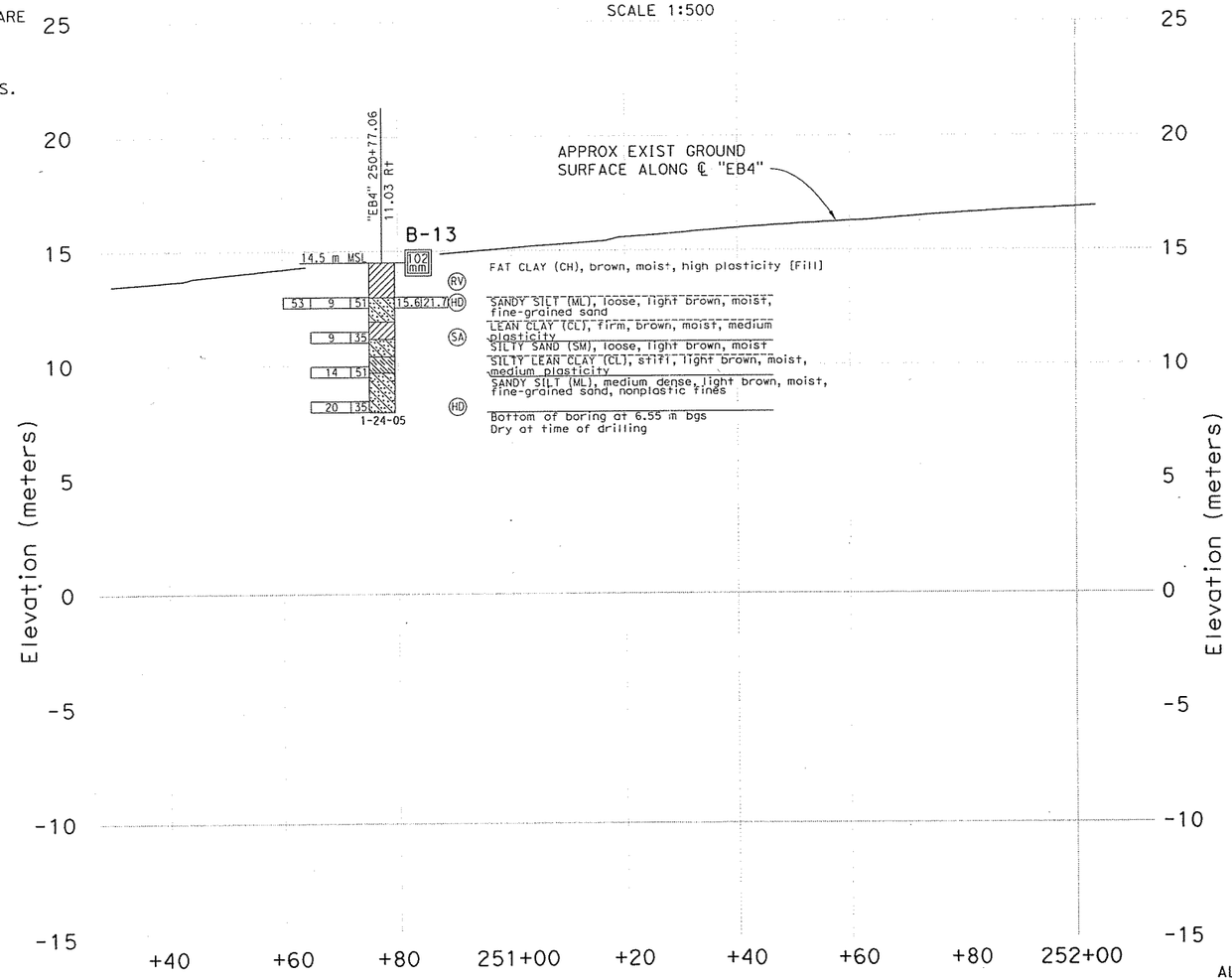
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

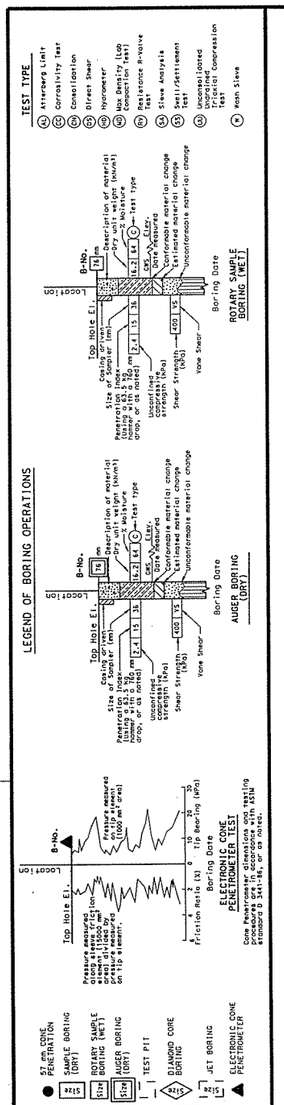
ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

R-16

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

LEGEND OF BORING OPERATIONS



CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

LEGEND OF EARTH MATERIALS
GRAVEL, SAND, SILT, CLAY, CLAYEY SILT, SANDY CLAY or CLAYEY SAND, SANDY SILT or SILTY SAND, SILTY CLAY, PEAT and/or ORGANIC MATTER, FILL MATERIAL, COBBLE, COHESIVE ROCK, SEDIMENTARY ROCK, METAMORPHIC

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
SIGN OFF DATE	CHECKED BY	N. MEYER	S. MURUGAIAH FIELD INVESTIGATION BY: DATE: 01/24/05
			H. BERGER PROJECT ENGINEER

BRIDGE NO.
KILOMETER POST 37.9/41.3

RETAINING WALL No. 2B
LOG OF TEST BORINGS No. 2 of 2

CU 04275
EA 228591

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

DISREGARD PRINTS BEARING EARLIER REVISION DATES →
REVISION DATES (PRELIMINARY STAGE ONLY): 10/17/05, 7/28/06, 8/03/06, 2/28/07, 10/25/07

SHEET 16 OF 19

FILE => ...\r-16.dgn

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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PLEASANT HILL, CA 94523

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USERNAME => Christina.Da6ie@ PLOTTED => 10/31/2007 TIME PLOTTED => 5:59:16 PM

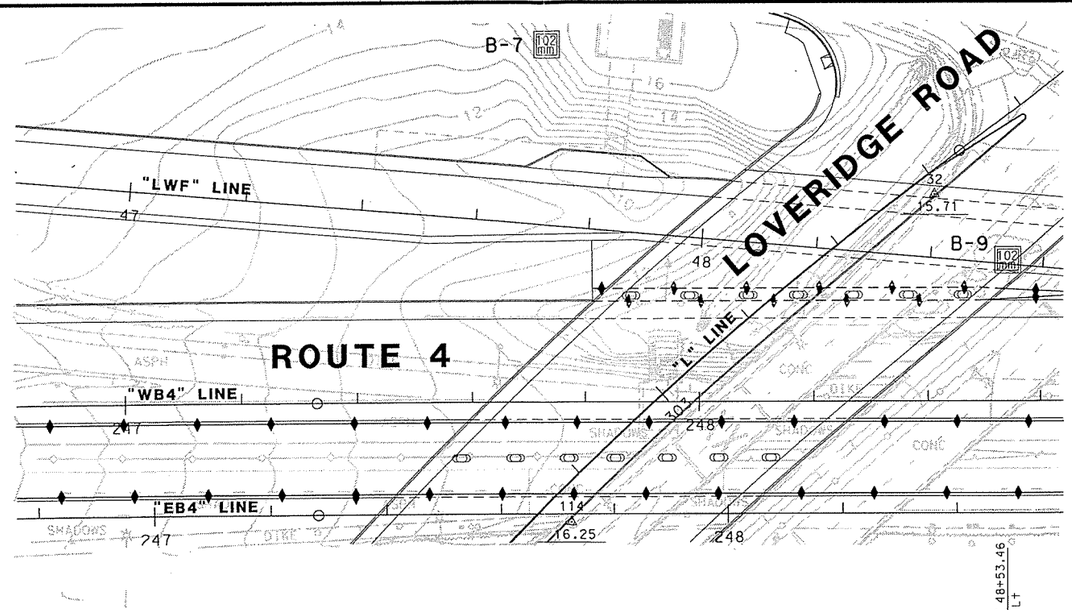
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

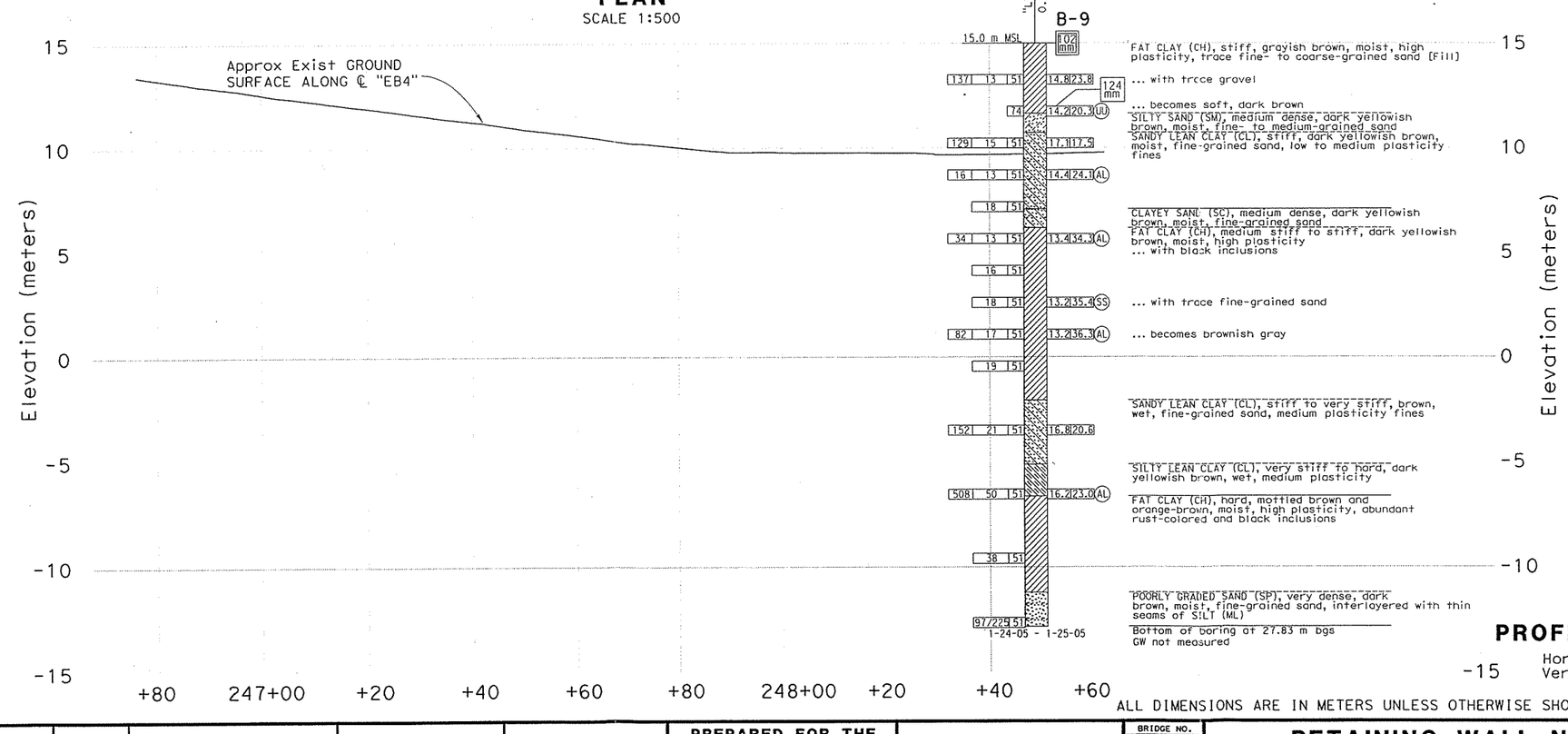
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
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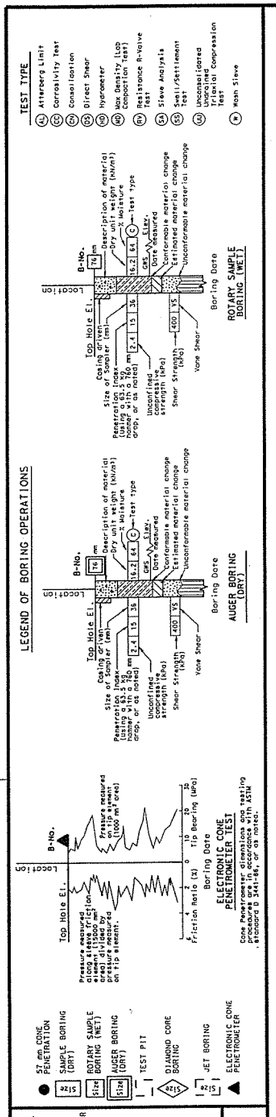
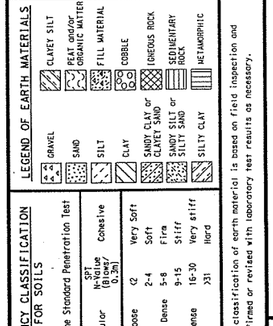
LEGEND OF BORING OPERATIONS





LEGEND OF EARTH MATERIALS

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/ 0.30m)	Granular	SPT N-Value (Blows/ 0.30m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO. 28-0394	RETAINING WALL No. 3A
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/25/05		PROJECT ENGINEER	KILOMETER POST 38.8	LOG OF TEST BORINGS 1 OF 3

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228591

FILE => ...\28-0023-z-11b01.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 05/00/01 | 10/25/01

SHEET 49 OF 66

USERNAME => Christina.Dacre@dot.ca.gov PLOTTED => 10/31/2007 TIME PLOTTED => 6:06:37 PM

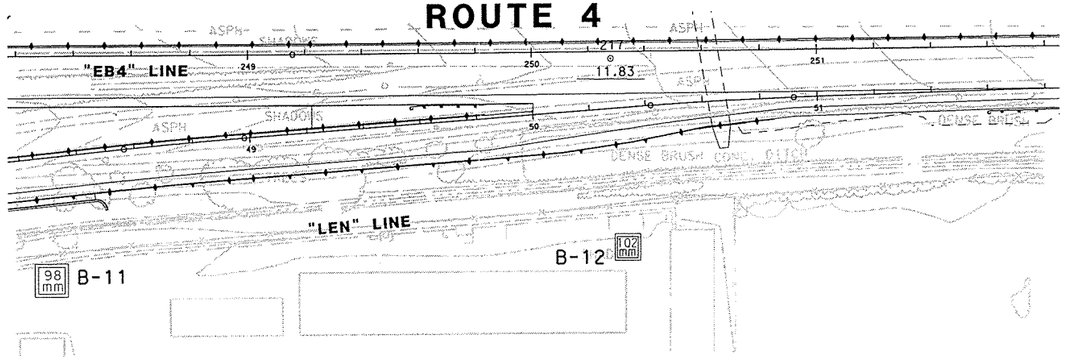
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

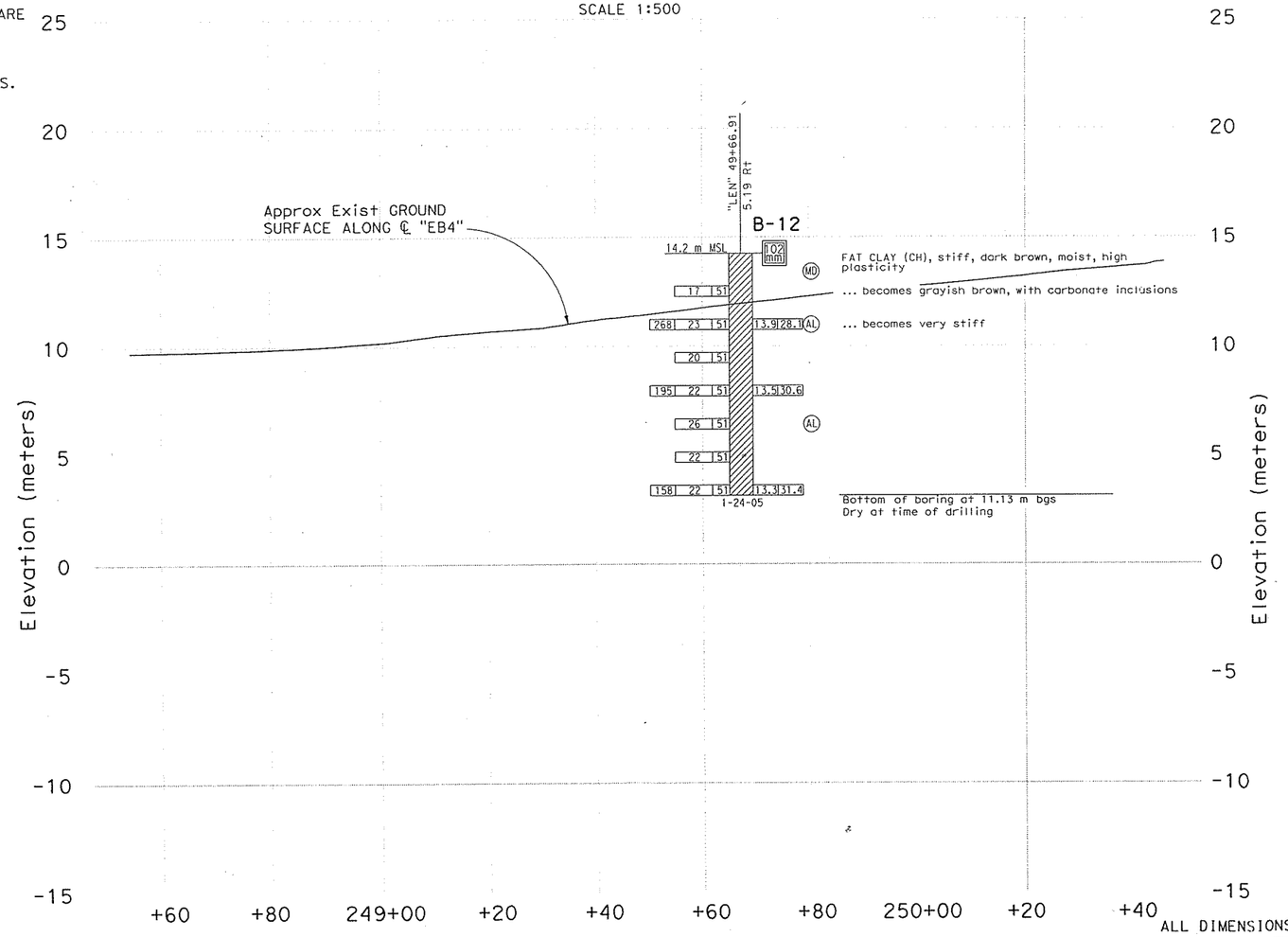
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



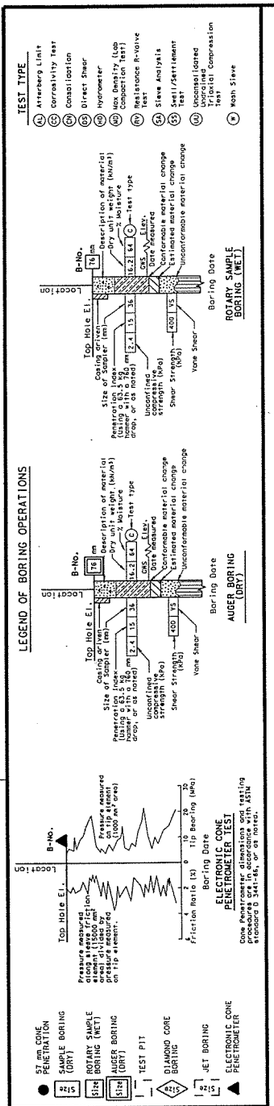
PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

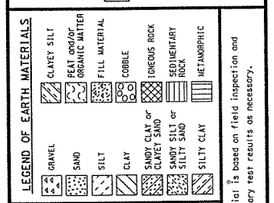
NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS



CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (blows/ 0.3m)	Granular	SPT N-Value (blows/ 0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
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		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/24/05		PROJECT ENGINEER

BRIDGE NO. 28-E0020
KILOMETER POST 37.9/41.3

RETAINING WALL No. 3A
LOG OF TEST BORINGS 2 OF 3

CU 04275
EA 228591

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 2/28/07 | 05/30/07 | 10/25/07

SHEET 50 OF 66

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

FILE => ...\28-0023-z-ltb02.dgn

USERNAME => Christina.Dacier PLOTTED => 10/31/2007 TIME PLOTTED => 6:06:39 PM

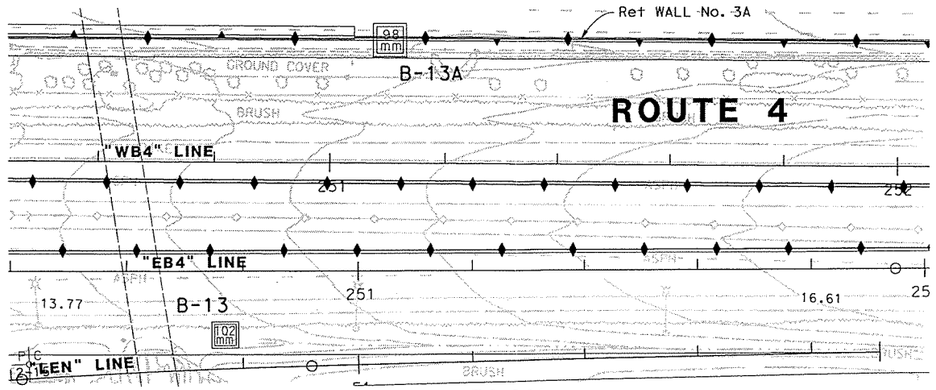
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

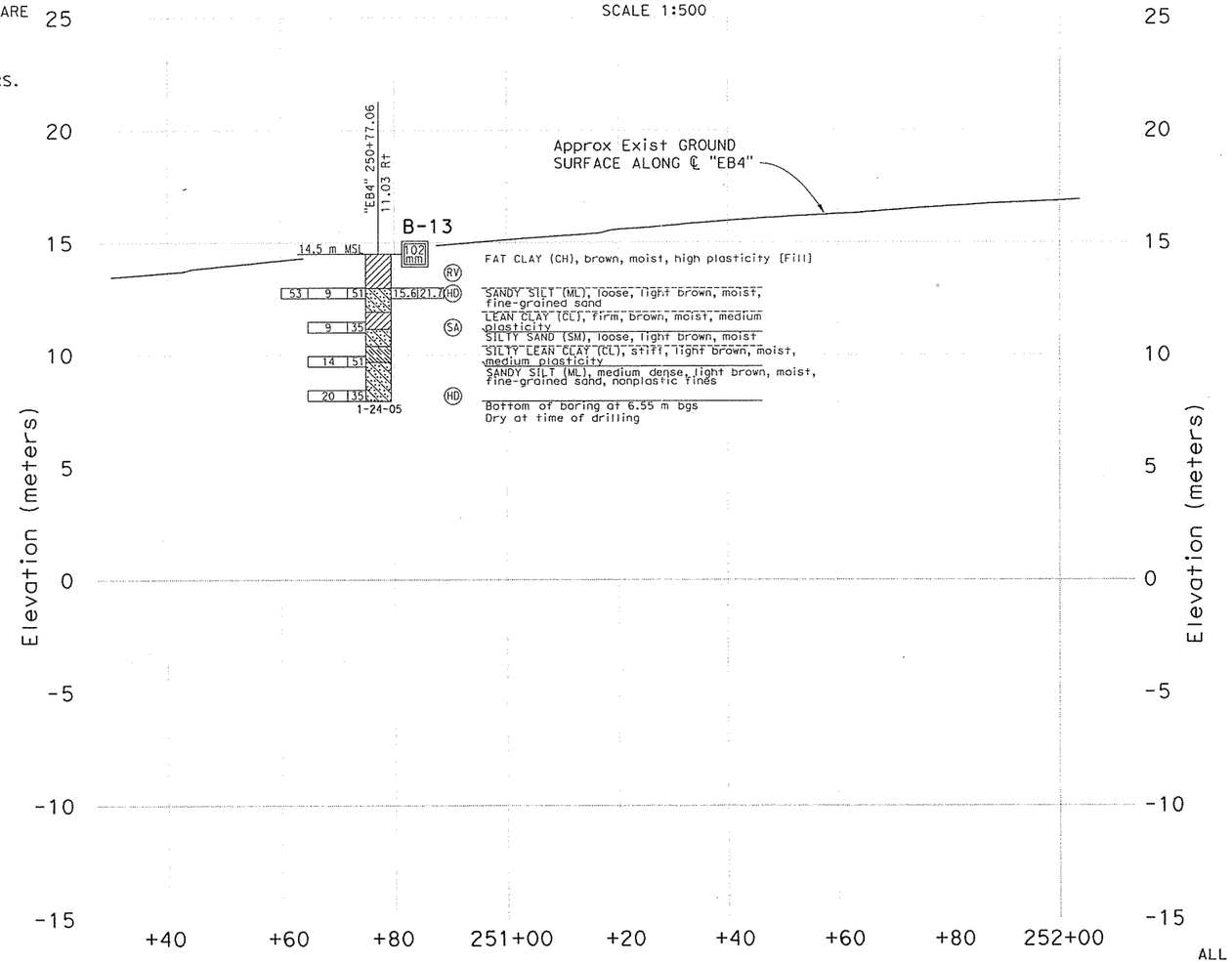
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



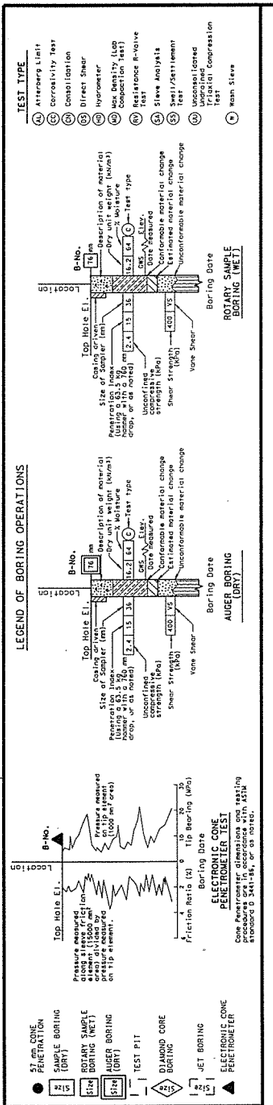
PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

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

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (blows/ft)	Granular	SPT N-Value (blows/0.3m)	Cohesive
0-4	Very Loose	12	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO.
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/24/05			PROJECT ENGINEER	KILOMETER POST 37.9/41.3

RETAINING WALL No. 3A
LOG OF TEST BORINGS 3 OF 3

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228591

FILE => ...\28-0023-z-ltb03.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 10/31/06 · 7/28/06 · 8/03/06 · 2/16/07 · 05/18/07 · 10/25/07

SHEET 51 OF 66

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER · Philip Meymand · No. 2596 · Exp. 6/30/09 · GEOTECHNICAL · STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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USERNAME => Christina.DeAtley@aecom.com PLOTTED => 10/31/2007 TIME PLOTTED => 6:06:41 PM

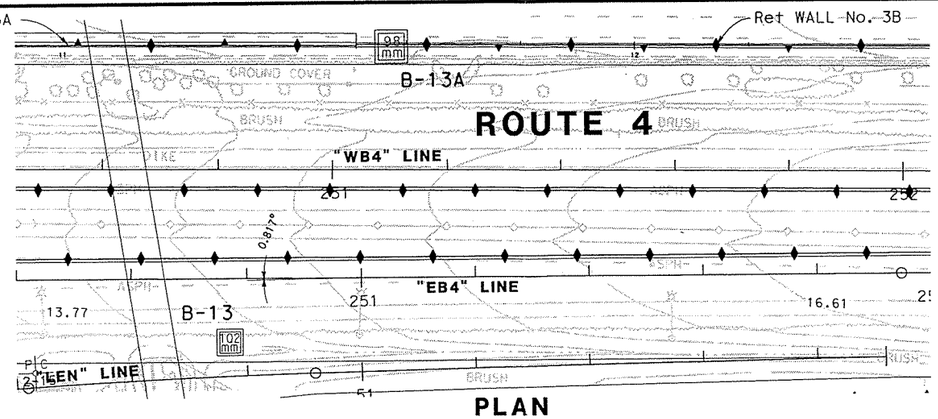
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

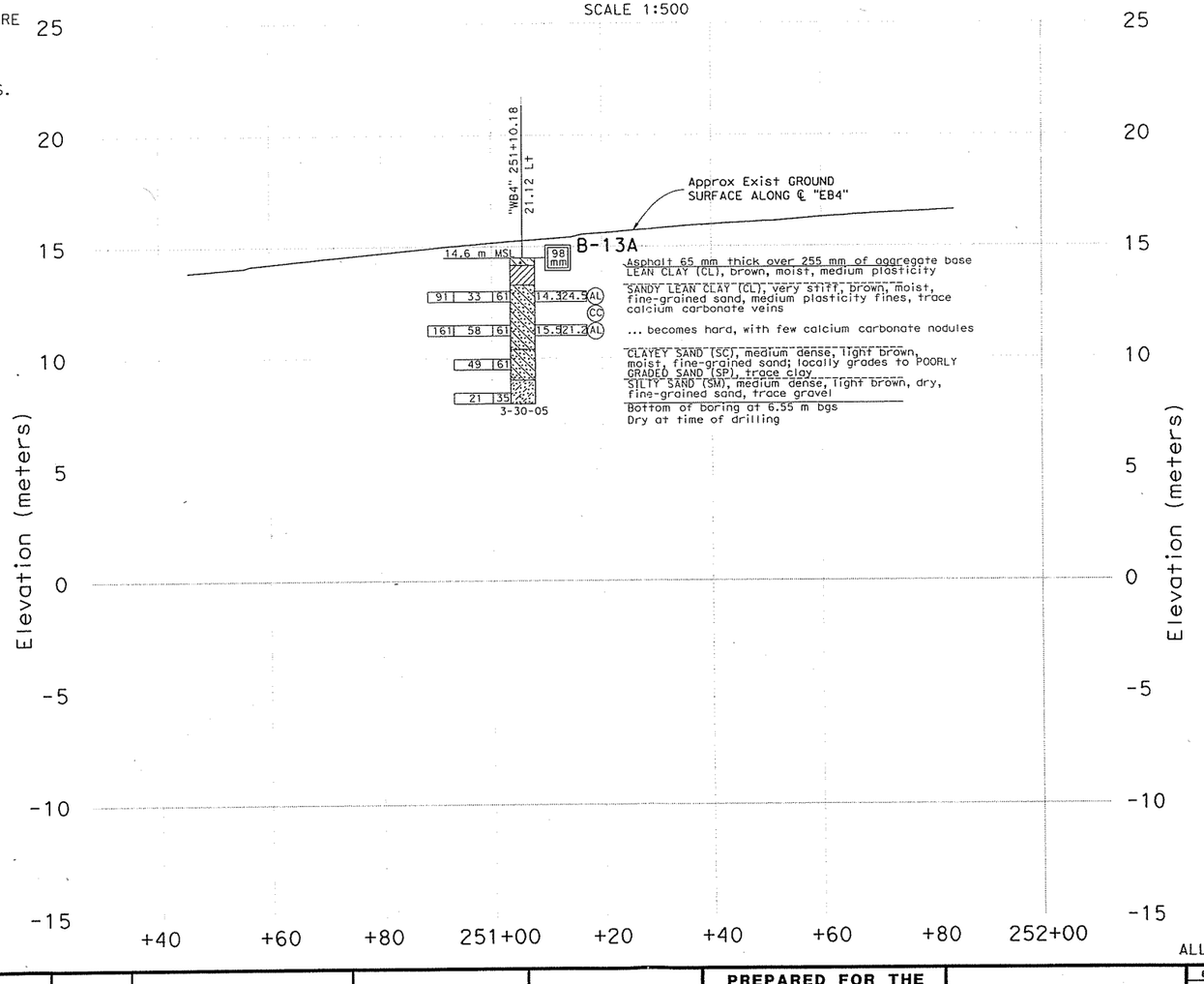
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



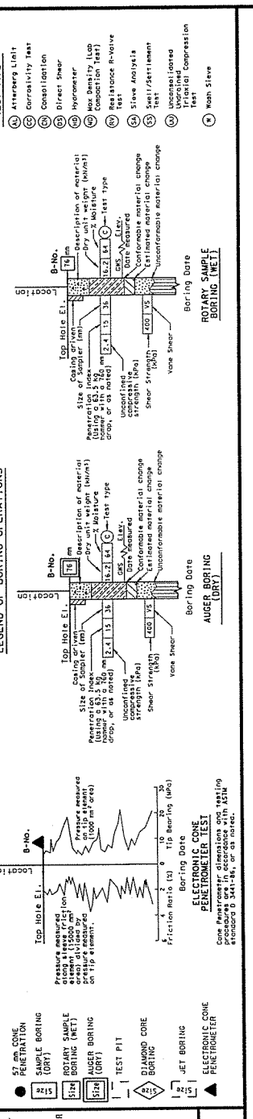
PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

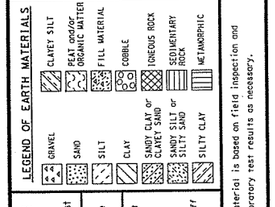
NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS



CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

SPT N-Value (Blows/ 0.3m)	Granular	SPT N-Value (Blows/ 0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>30	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE No. 28-E0020
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 03/30/05			PROJECT ENGINEER	KILOMETER POST 37.9/41.3

RETAINING WALL No. 3A AND 3B
LOG OF TEST BORINGS 1 OF 4

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228591

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 10/14/05 | 01/26/06 | 02/16/07 | 05/16/07 | 10/25/07

SHEET 52 OF 66

FILE => ...\28-0023-z-1tb04.dgn

USERNAME => Christina.Dacuyan PLOTTED => 10/31/2007 TIME PLOTTED => 6:06:42 PM

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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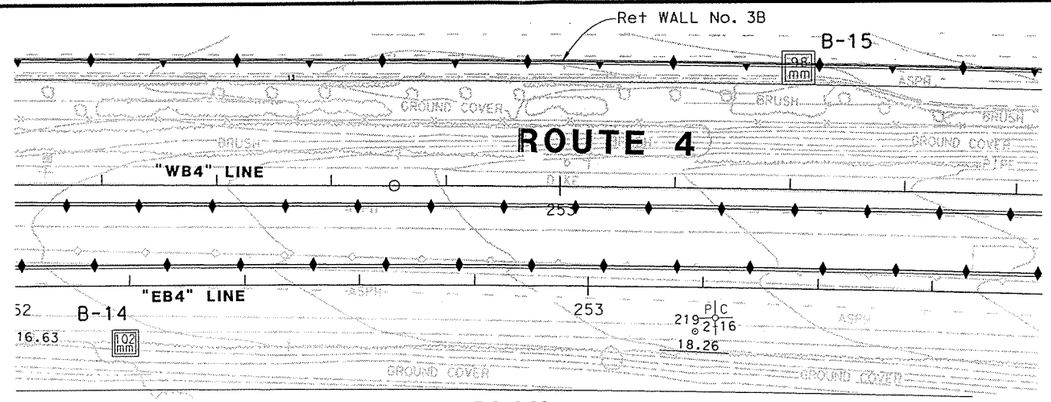
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

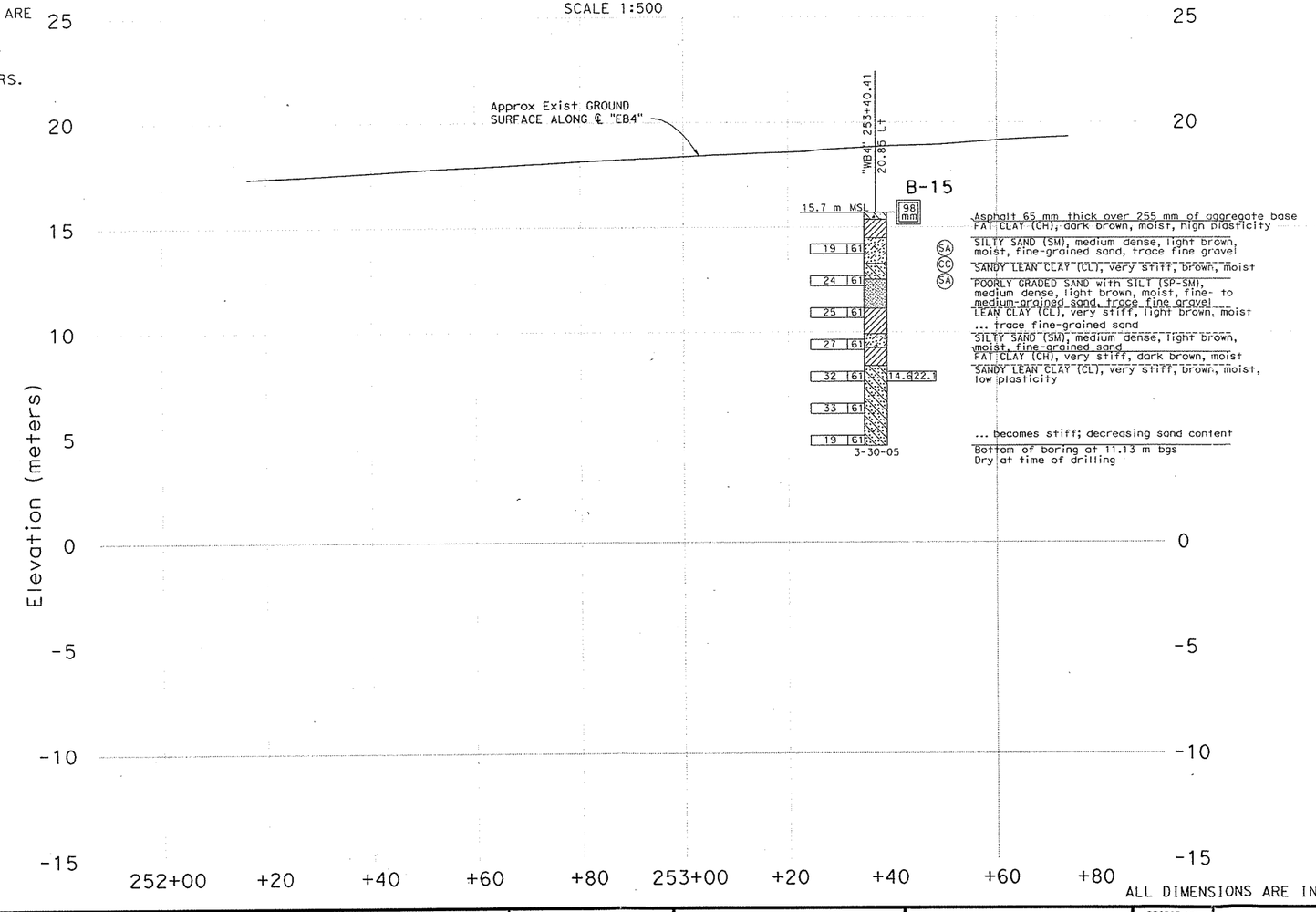
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



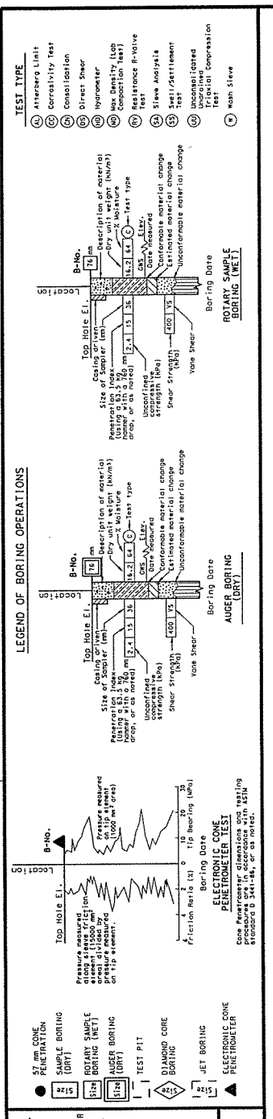
PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

LEGEND OF BORING OPERATIONS



CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/ 0.3m)	Granular	SPT N-Value (Blows/ 0.3m)	Cohesive
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11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>30	Hard

LEGEND OF EARTH MATERIALS

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

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 03/30/05		PROJECT ENGINEER

BRIDGE No.	RETAINING WALL No. 3B
28-E0021	LOG OF TEST BORINGS 2 OF 4
KILOMETER POST 37.9/41.3	

CU 04275
EA 228591

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 10/19/05 · 01/26/06 · 02/16/07 · 05/04/07 · 10/25/07

SHEET 53 OF 66

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

FILE => ...\28-0023-z-ltb05.dgn

USERNAME => Christina.DeRa PLOTTED => 10/31/2007 TIME PLOTTED => 6:06:44 PM

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

PLANS APPROVAL DATE

Philip Meymand No. 2596 Exp. 6/30/09 GEOTECHNICAL REGISTERED PROFESSIONAL ENGINEER STATE OF CALIFORNIA

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3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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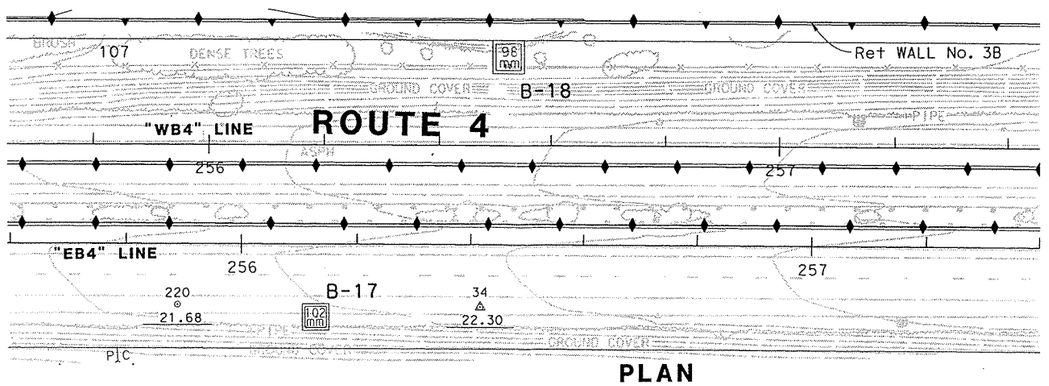
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

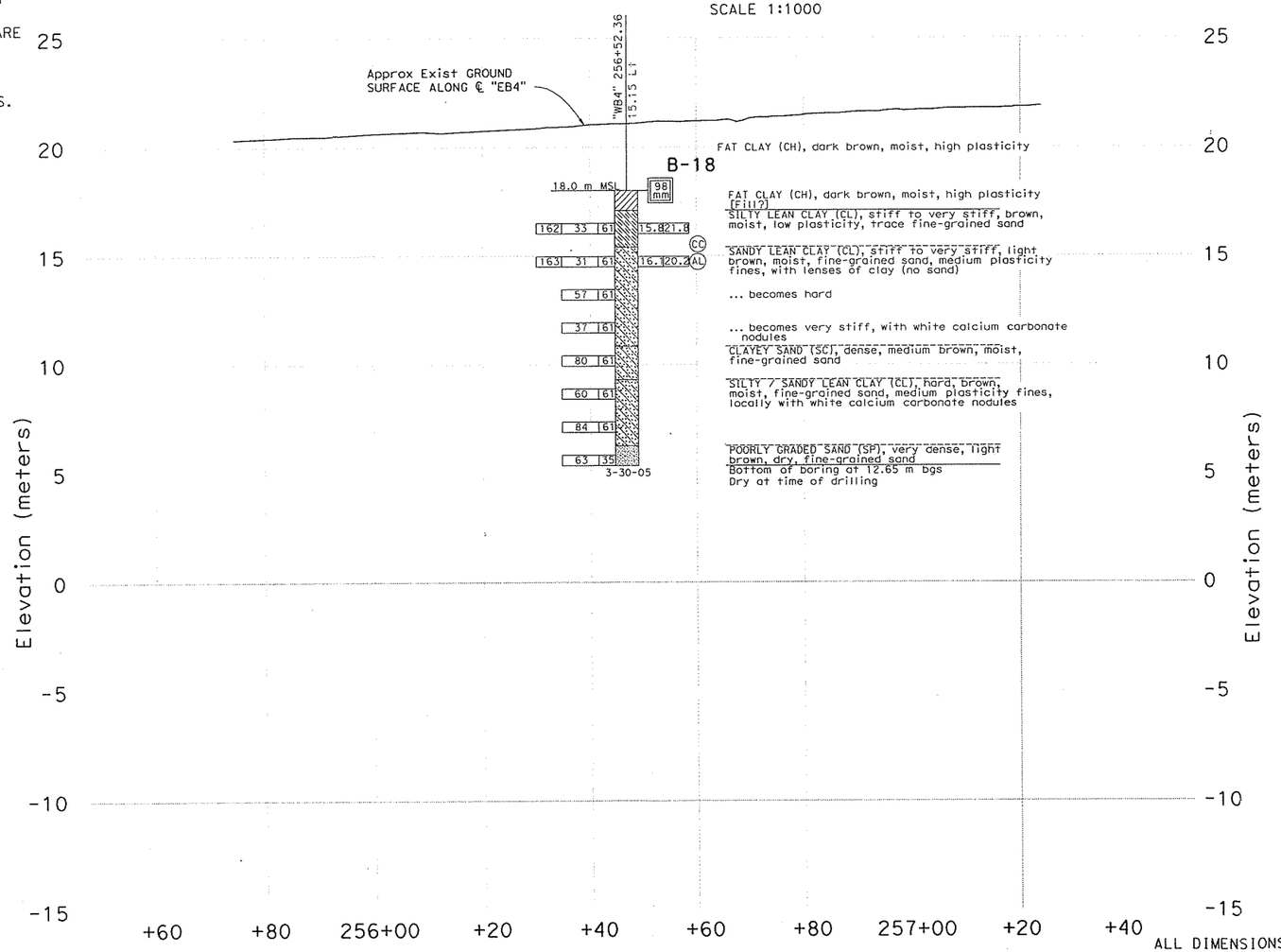
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:1000



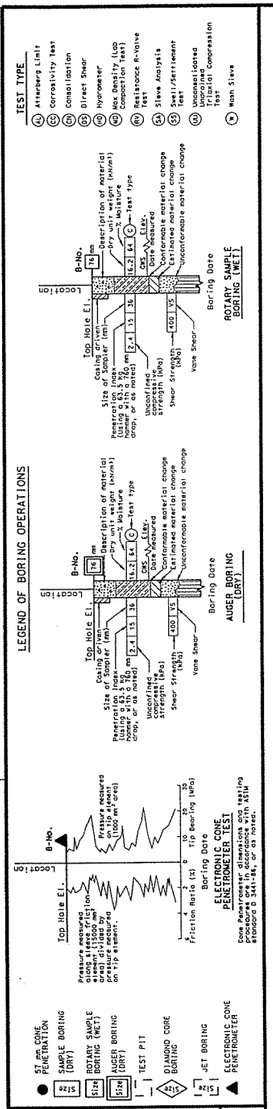
PROFILE VIEW
Horiz 1:500
Vert 1:125

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

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

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

SPT N-Value (Blows/0.30)	Granular	SPT N-Value (Blows/0.30)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>30	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE No. 28-E0021
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 03/30/05			PROJECT ENGINEER	KILOMETER POST 37.9/41.3

RETAINING WALL No. 3B
LOG OF TEST BORINGS 3 OF 4

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228591

FILE => ...\28-0023-z-ltb06.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 10/31/05 | 01/26/06 | 02/16/07 | 05/16/07 | 10/25/07

SHEET 54 OF 66

USERNAME => Christina_DeAcetis PLOTTED => 10/31/2007 TIME PLOTTED => 6:06:46 PM

BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

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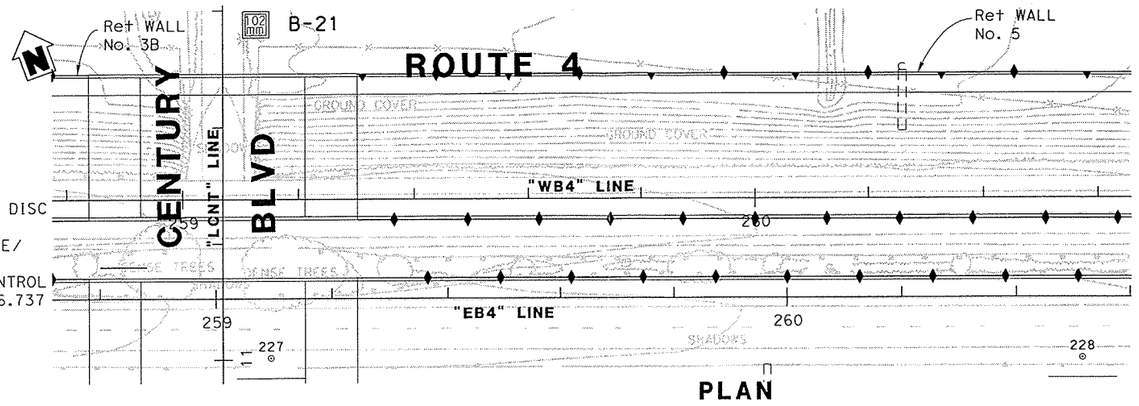
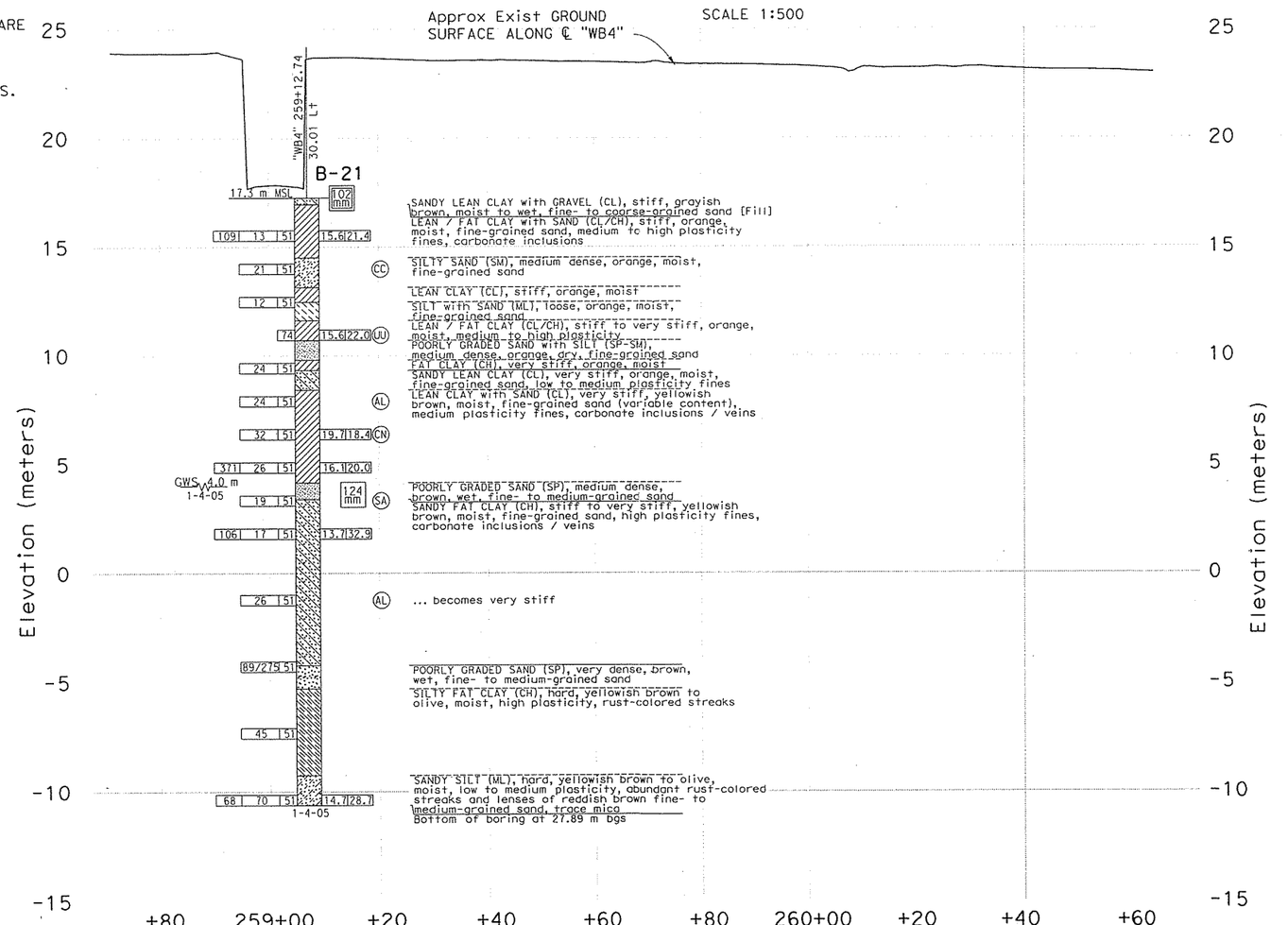


PLAN
SCALE 1:500



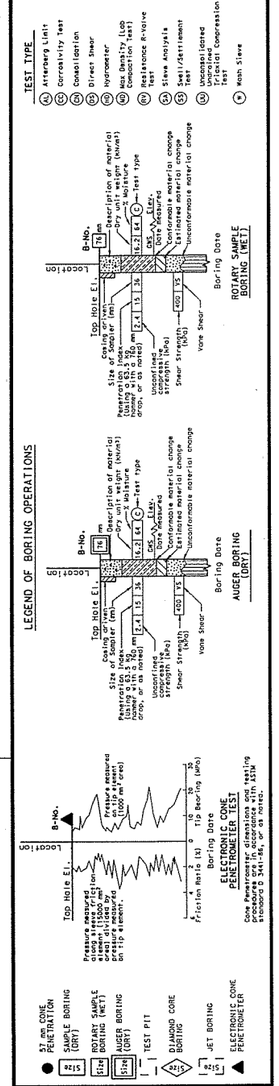
PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

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

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

SPT (N-Value) (Blows/0.3m)	Granular	SPT (N-Value) (Blows/0.3m)	Cohesive
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DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	P. RESPESS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/04/05		PROJECT ENGINEER

BRIDGE No. 28-E0021
KILOMETER POST 37.9/41.3

RETAINING WALL No. 3B
LOG OF TEST BORINGS 4 OF 4

CU 04275
EA 228591

DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES (PRELIMINARY STAGE ONLY): 10/24/06 | 01/29/06 | 02/16/07 | 05/18/07 | 10/25/07

SHEET 55 OF 66

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

FILE => ...\28-0023-z-ltb07.dgn

USERNAME => Christina.Dacanay
PLOTTED => 10/31/2007
TIME PLOTTED => 6:06:47 PM

BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

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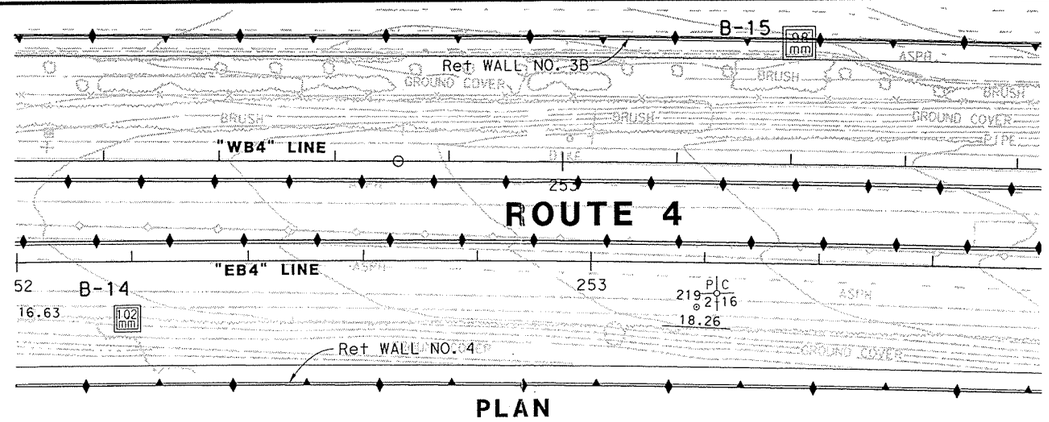
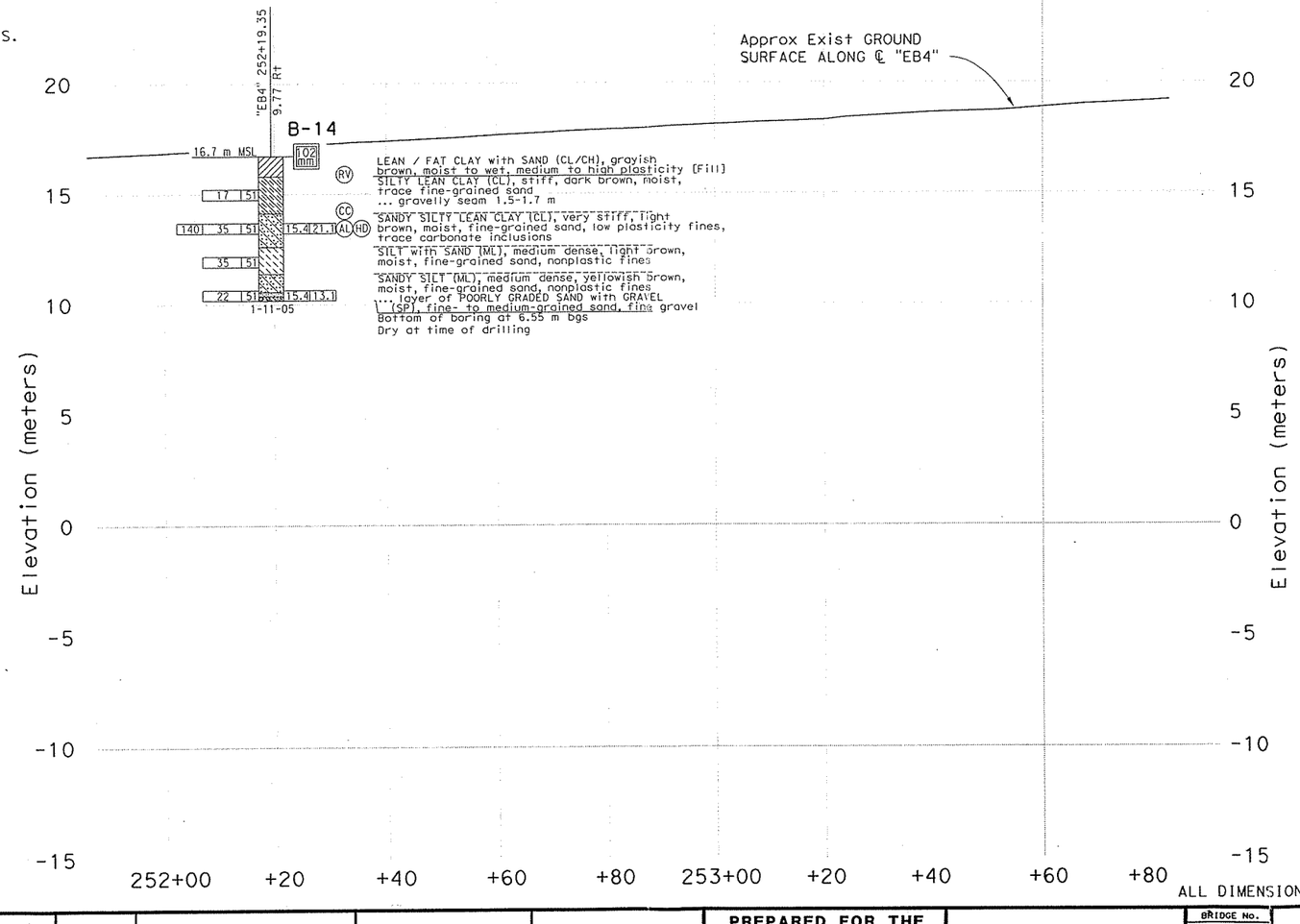


PLAN
SCALE 1:500

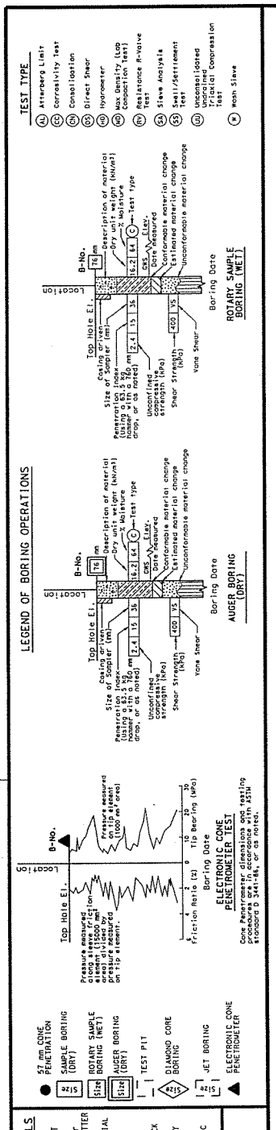


PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.



DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE No. 28-E0022	RETAINING WALL No. 4
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/11/05		PROJECT ENGINEER	KILOMETER POST 37.9/41.3	LOG OF TEST BORINGS 1 OF 5

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228591

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 10/17/05 01/26/06 02/16/07 05/08/07 10/25/07

SHEET 56 OF 66

FILE => ...\28-0023-z-ltb08.dgn

USERNAME => Christina.DeRee.PE.OTTED => 10/31/2007 TIME PLOTTED => 6:06:49 PM

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER DATE

Philip Meymand No. 2596 Exp. 6/30/09 GEOTECHNICAL STATE OF CALIFORNIA REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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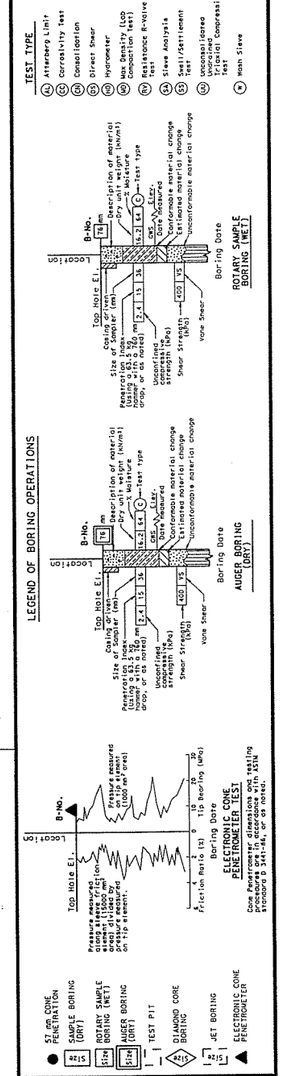


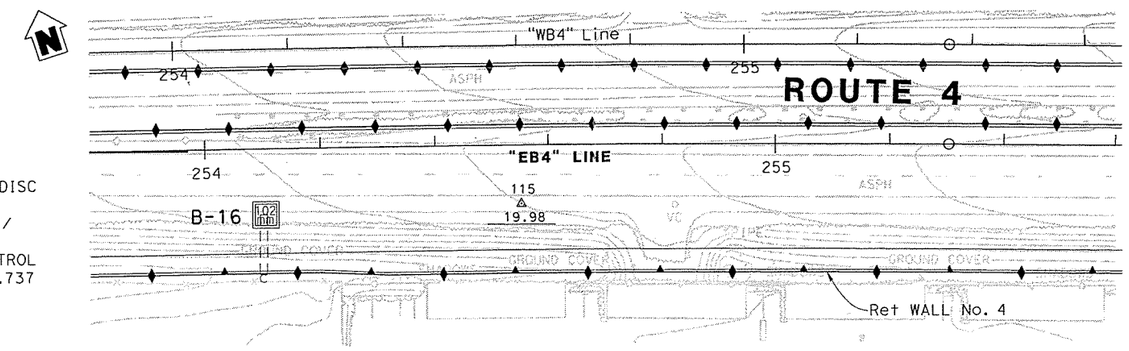
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

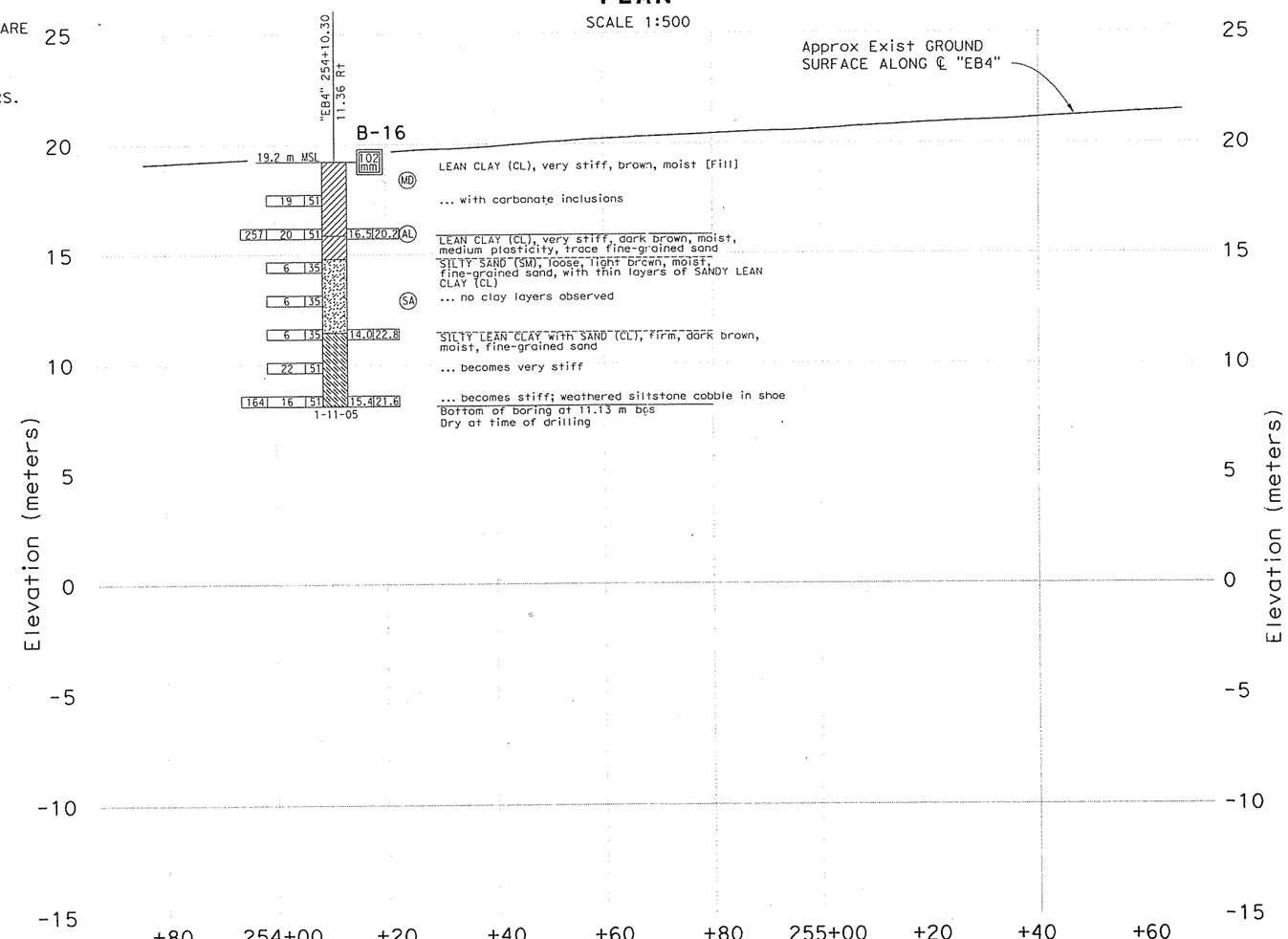
BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN

SCALE 1:500



PROFILE VIEW

Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE No. 28-E0022
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/11/05			PROJECT ENGINEER	KILOMETER POST 37.9/41.3

RETAINING WALL No. 4

LOG OF TEST BORINGS 2 OF 5

CU 04275
EA 228591

FILE => ...\28-0023-z-ltb09.dgn

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 10/17/05 | 01/20/06 | 02/16/07 | 05/04/07 | 10/25/07

SHEET 57 OF 66

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

USERNAME => Christina.Dacdac@dot.ca.gov — PLOTTED => 10/31/2007 — TIME PLOTTED => 6:06:51 PM

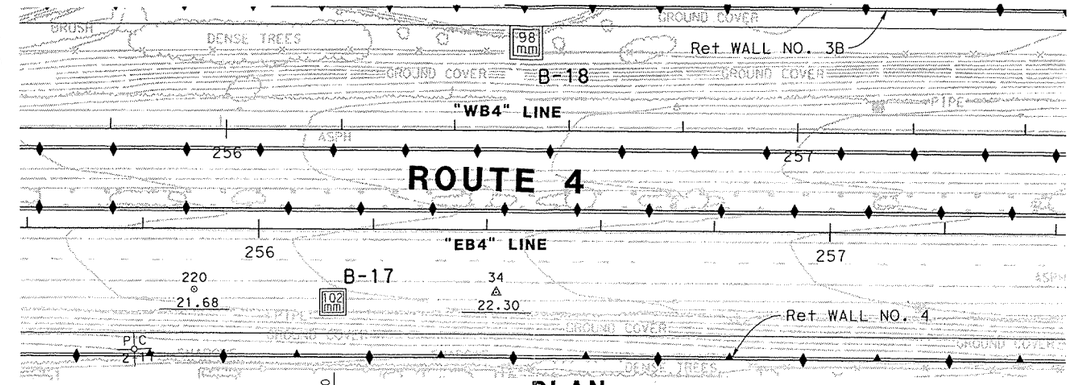
BENCH MARKS

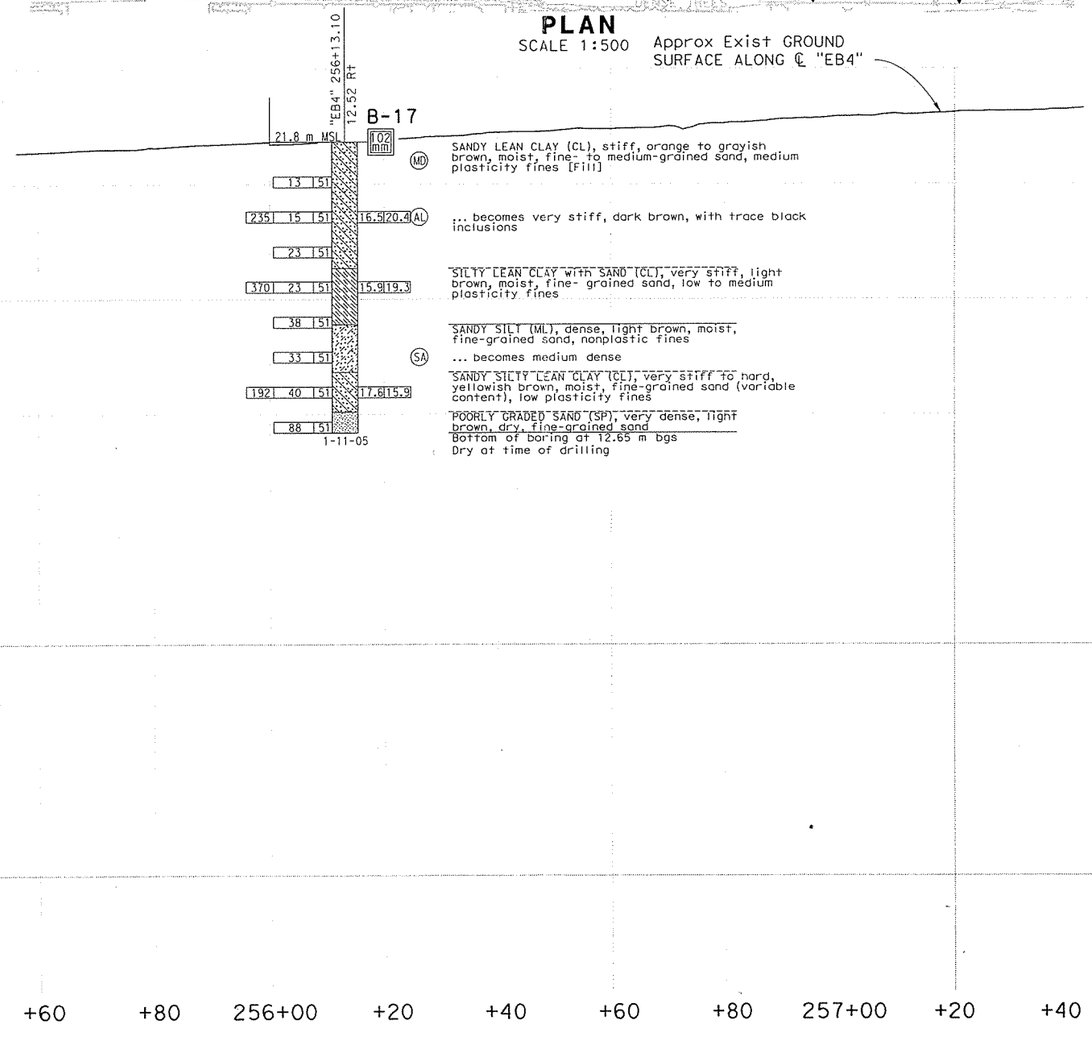
BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



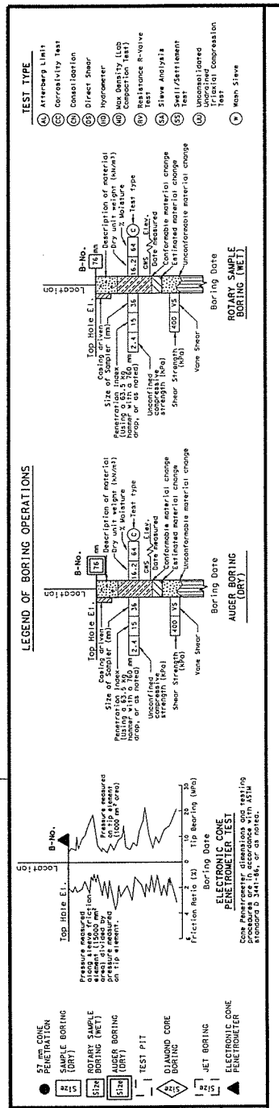


PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.



DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 03/30/05		PROJECT ENGINEER

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228591

FILE => ...\28-0023-z-ltb10.dgn

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

Caltrans Metric

REGISTERED GEOTECHNICAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

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3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

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3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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BRIDGE No.	28-E0022
KILOMETER POST	37.9/41.3

RETAINING WALL No. 4
LOG OF TEST BORINGS 3 OF 5

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 10/11/05 | 01/26/06 | 02/16/07 | 05/18/07 | 10/25/07

SHEET	OF
58	66

USERNAME => Christina.Dodge@dot.ca.gov PLOTTED => 10/31/2007 TIME PLOTTED => 6:06:52 PM

BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

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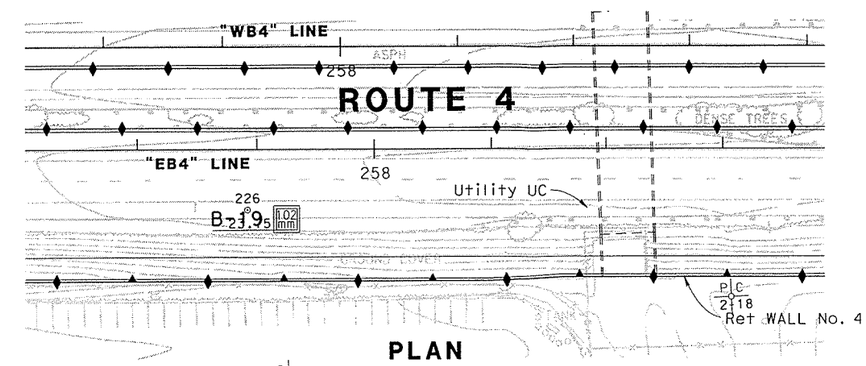
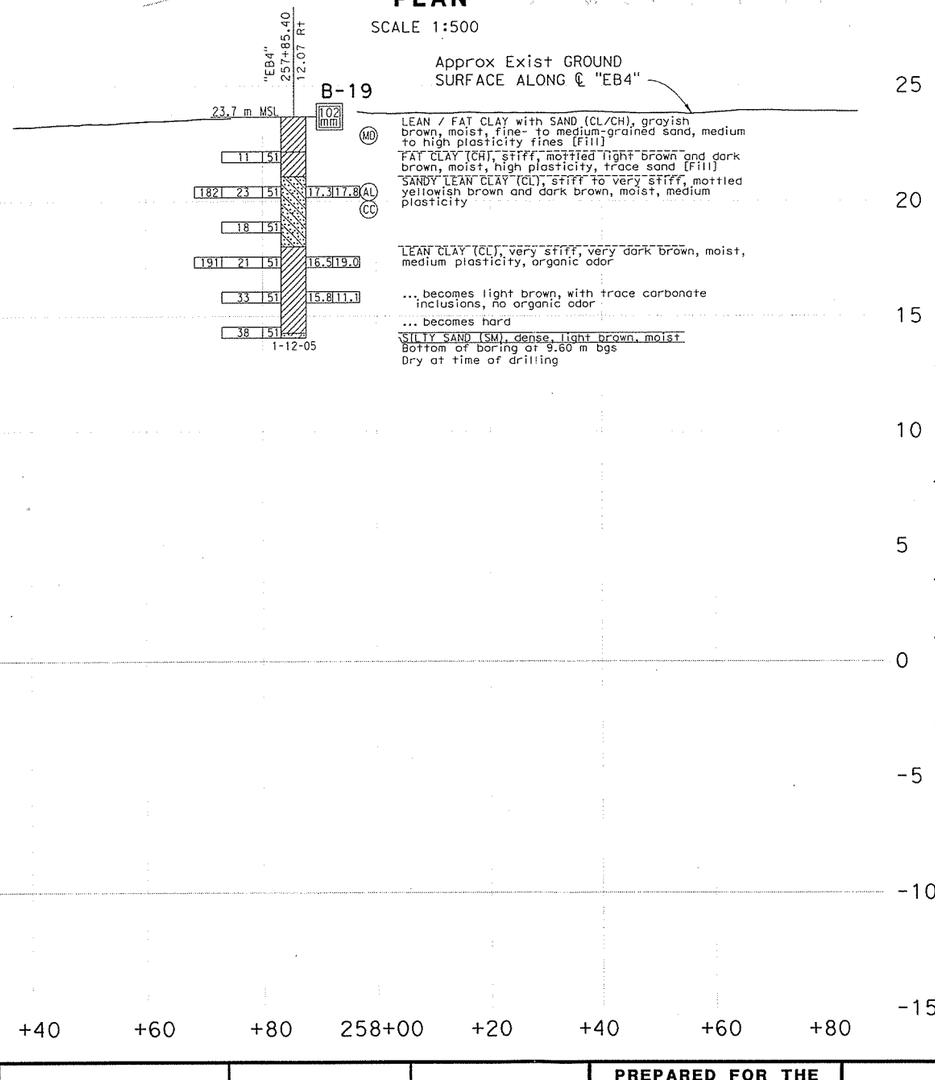


PLAN
SCALE 1:500



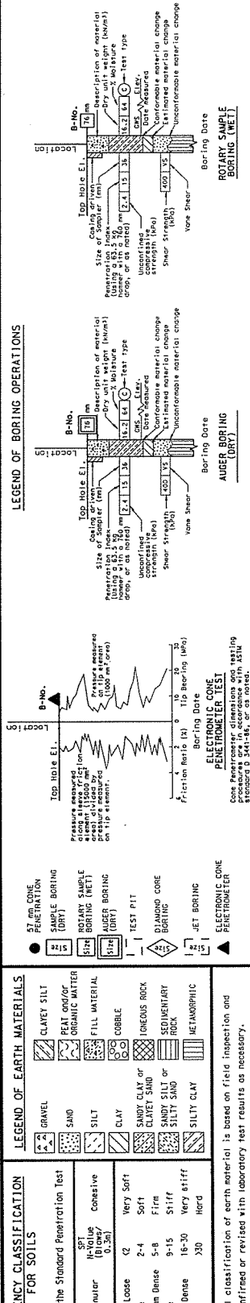
NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

LEGEND OF BORING OPERATIONS

TEST TYPE: Atterberg Limit; Corrosivity Test; Consolidation; Direct Shear; Hydrometer; Max Density (LCD Compaction Test); Resistance R-value Test; Sieve Analysis; Swell/Settlement Test; Unconsolidated Undrained Triaxial Compression Test; Wash Sieve



SPT PENETRATION RESISTANCE
SAMPLE BORING (DRY)
ROTARY SAMPLE BORING (WET)
AUGER BORING (DRY)
TEST PIT
DIAMOND CORE BORING
JET BORING
ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS

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

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>30	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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DESIGN OVERSIGHT / SIGN OFF DATE	DRAWN BY: C. SOMERA	S. MURUGAIAH		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER, PROJECT ENGINEER
	CHECKED BY: N. MEYER	FIELD INVESTIGATION BY: DATE: 01/12/05			BRIDGE No. 28-E0022; KILOMETER POST 37.9/41.3

RETAINING WALL No. 4
LOG OF TEST BORINGS 4 OF 5

CU 04275
EA 228591

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS: 0 10 20 30 40 50 60 70 80 90 100

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/14/05; 01/26/06; 02/16/07; 05/04/07; 10/25/07

SHEET 59 OF 66

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

FILE => ...\28-0023-z-ltb11.dgn

USERNAME => Christina_Somera

BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
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EASTING=1879751.30811
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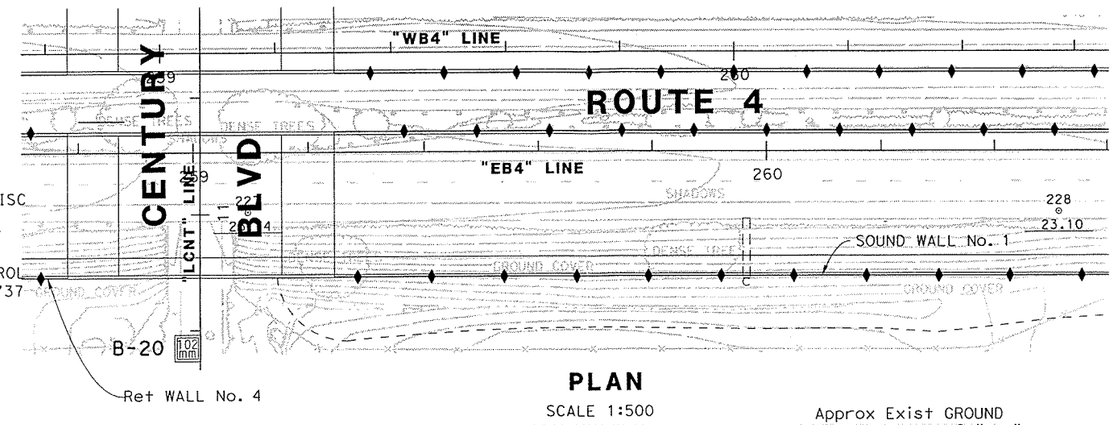
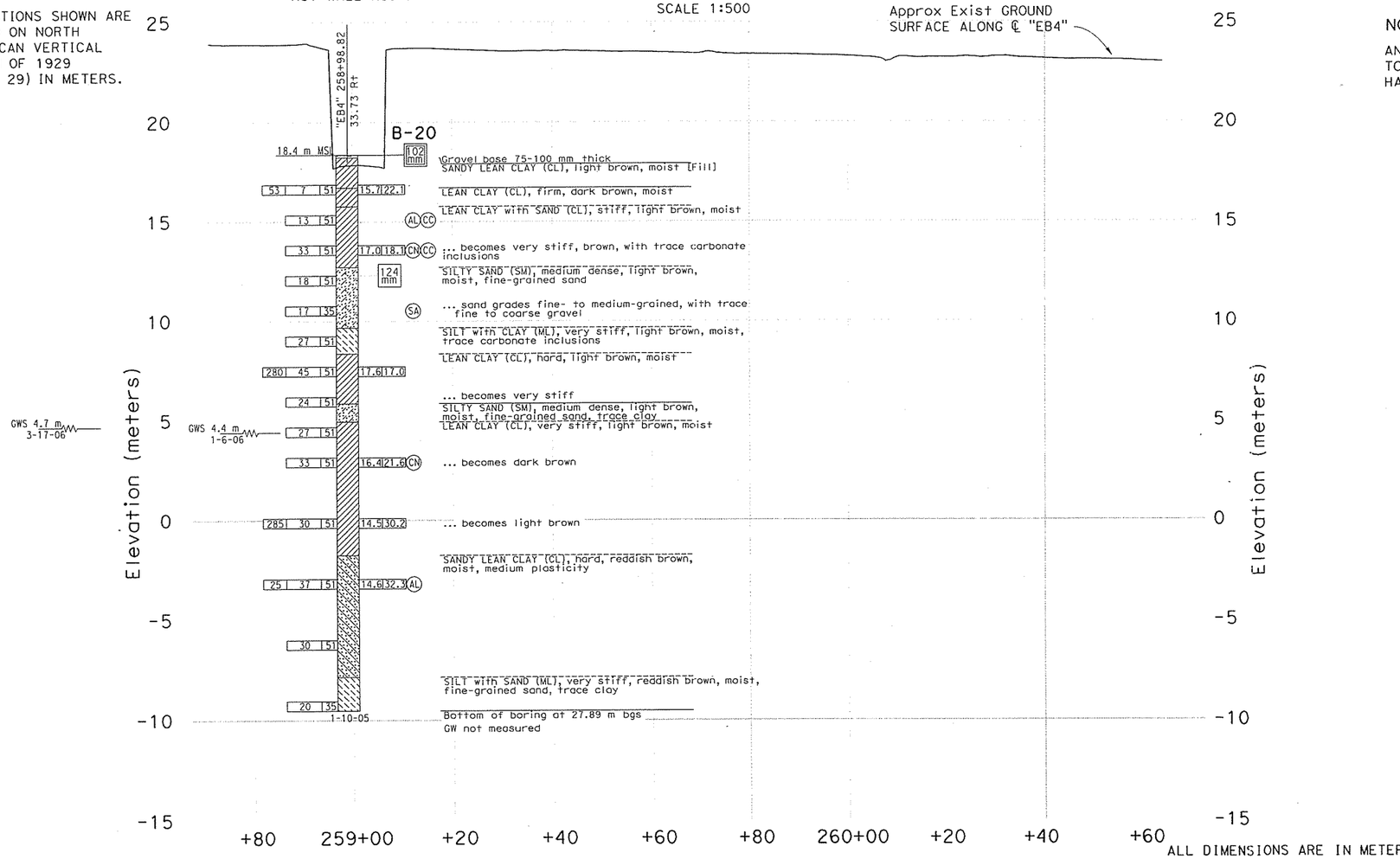
ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500

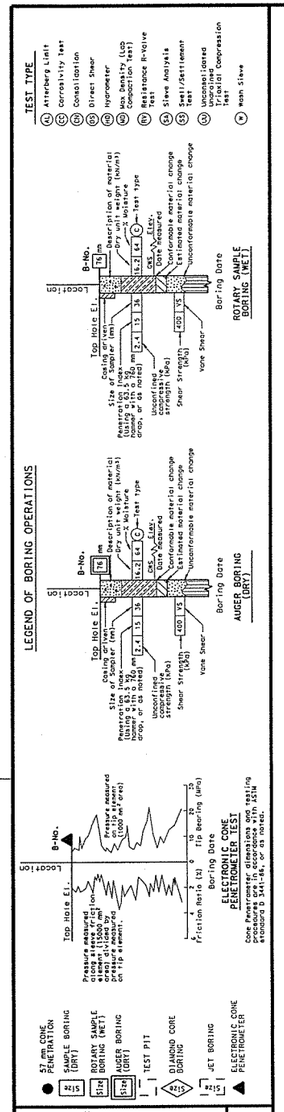


PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.



CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

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		>30	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

LEGEND OF EARTH MATERIALS
GRAVEL, SAND, SILT, CLAY, SANDY CLAY or CLAYEY SAND, SANDY SILT or SILTY SAND, SILTY CLAY, CLAYEY SILT, PEAT AND/OR ORGANIC MATTER, FILL MATERIAL, COBBLE, IGNEOUS ROCK, SEDIMENTARY ROCK, METAMORPHIC

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Weymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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DESIGN OVERSIGHT / SIGN OFF DATE	DRAWN BY: C. SOMERA	CHECKED BY: N. MEYER	S. MURUGAIAH — FIELD INVESTIGATION BY: — DATE: 01/10/05	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER — PROJECT ENGINEER

BRIDGE No. 28-E0022
KILOMETER POST 37.9/41.3

RETAINING WALL No. 4
LOG OF TEST BORINGS 5 OF 5

CU 04275
EA 228591

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 10/31/05 | 01/26/06 | 02/16/07 | 05/08/07 | 10/25/07

SHEET 60 OF 66

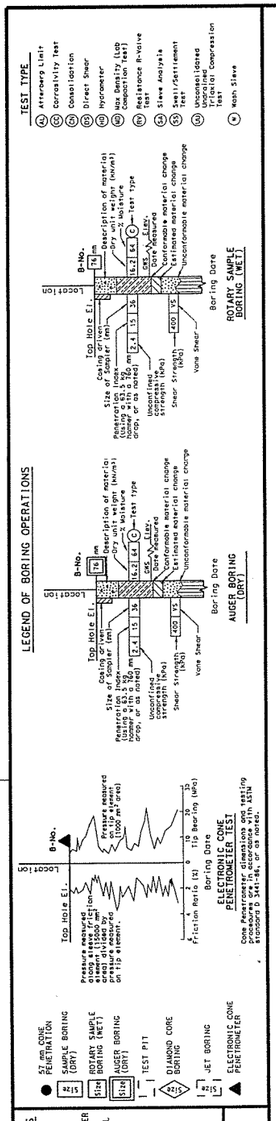
CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

FILE => ...\28-0023-z-ltb12.dgn

USERNAME => Christina.Dacheux

PLOTTED => 10/31/2007 TIME PLOTTED => 6:06:56 PM



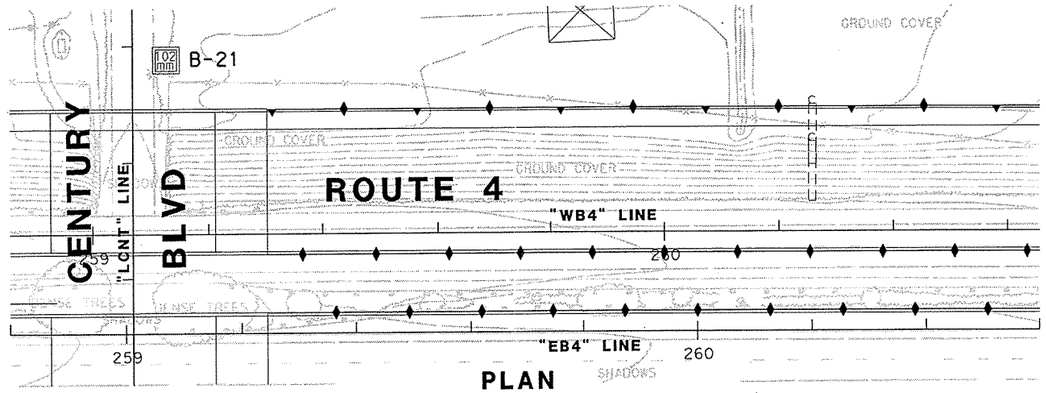
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

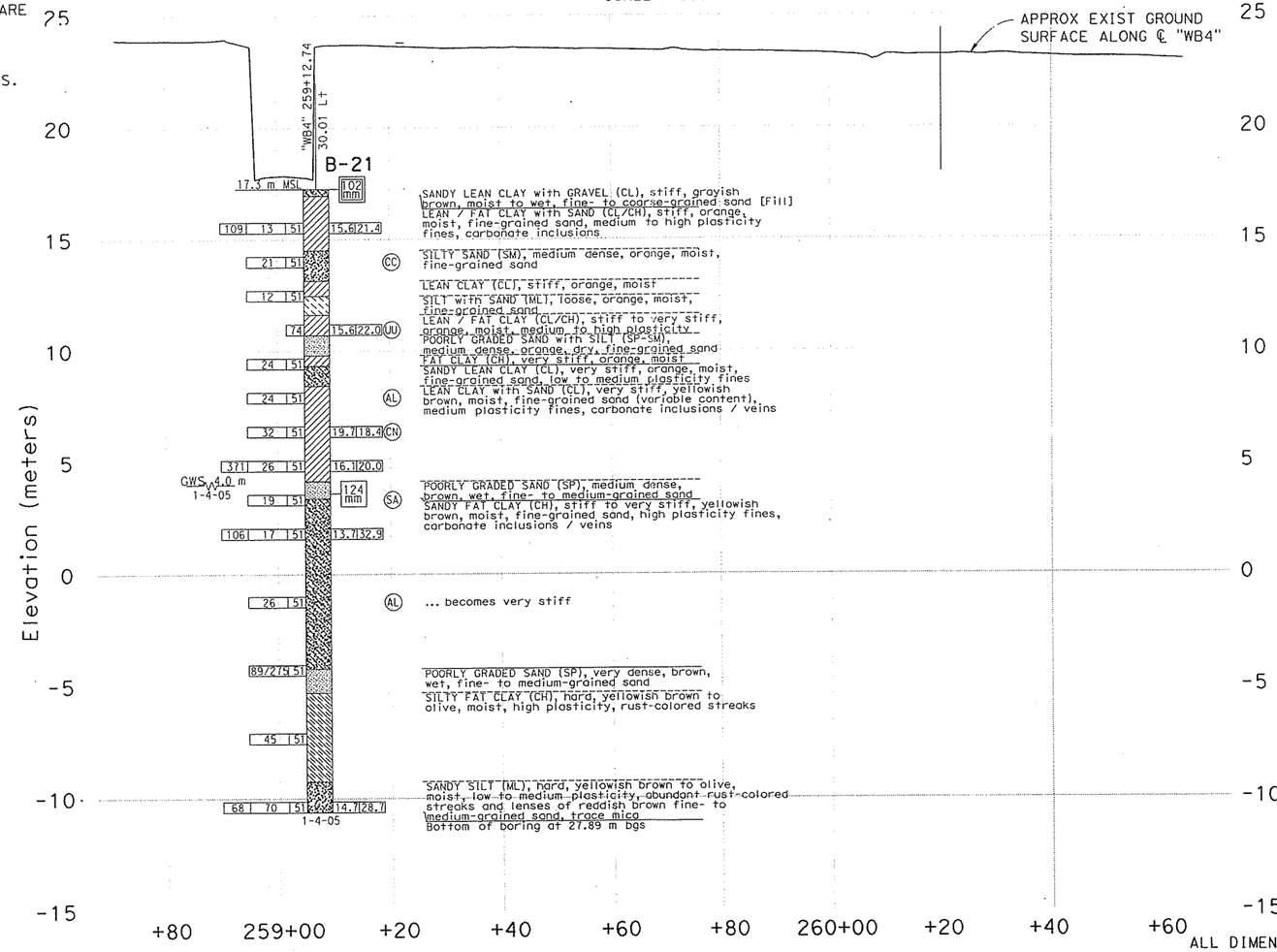
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	P. RESPESS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/04/05		PROJECT ENGINEER

BRIDGE NO. 28-E0023
KILOMETER POST 37.9/41.3

RETAINING WALL No. 5

LOG OF TEST BORINGS 1 OF 6

CU 04275
EA 228591

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/25/07

SHEET 60 OF 66

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

FILE => ...\28-0023-z-ltb13.dgn

USERNAME => Christina.Dacalos@dot.ca.gov TIME PLOTTED => 6:06:57 PM 10/31/2007

BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

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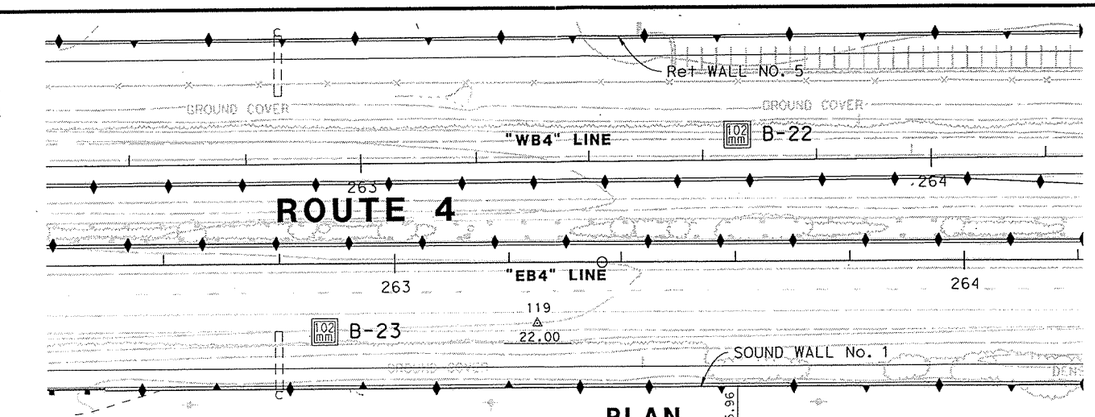
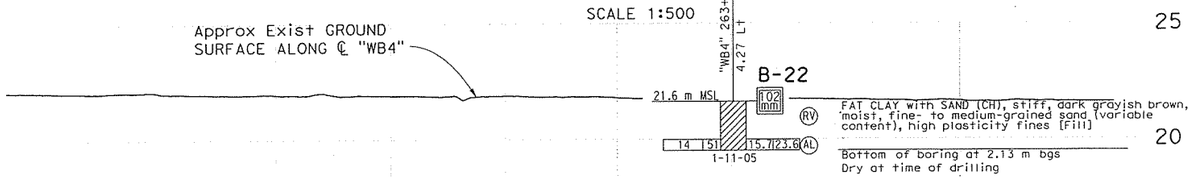
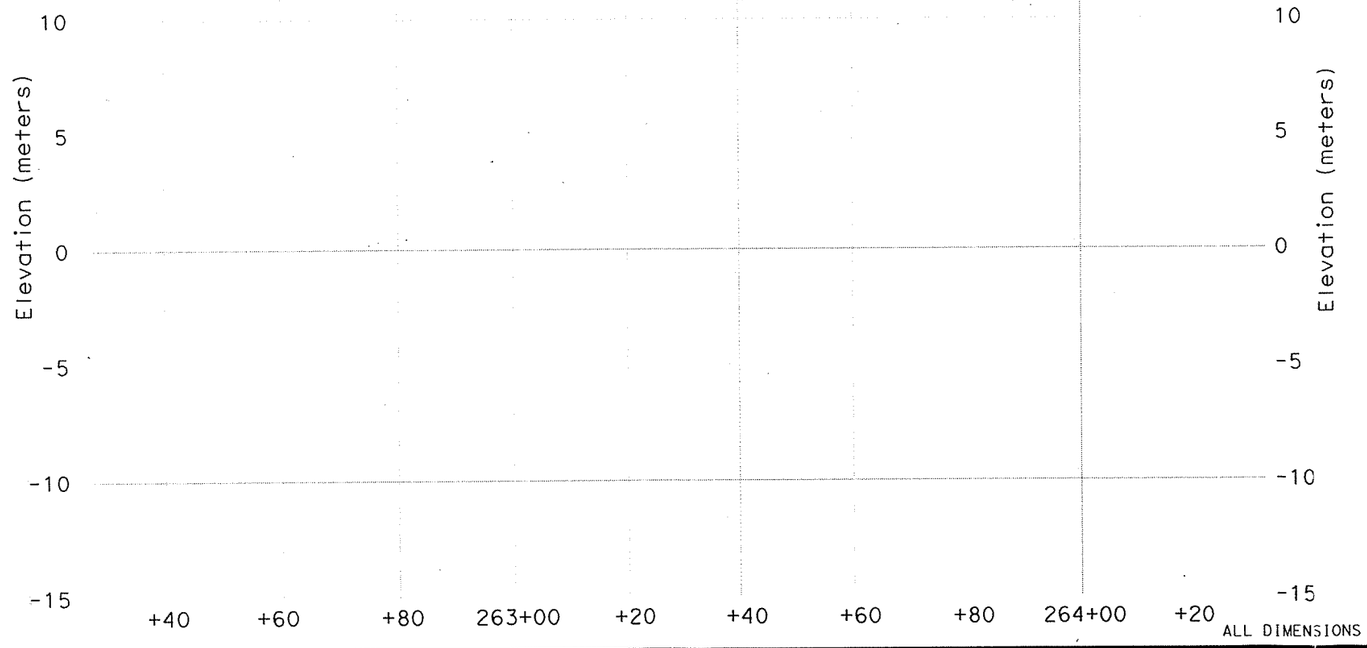
ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500





PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

Philip Meymand No. 2596 Exp. 6/30/09 GEOTECHNICAL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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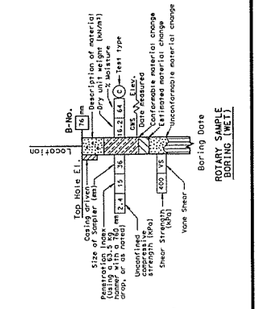
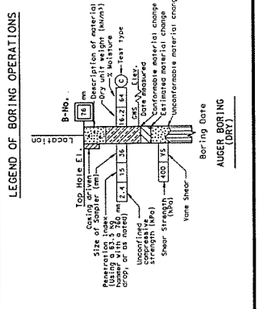
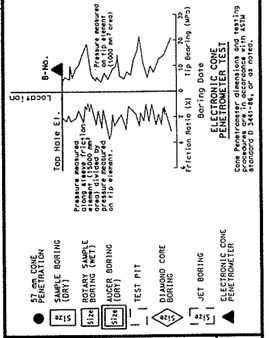
LEGEND OF BORING OPERATIONS

TEST TYPE
Ⓐ Atterberg Limits
Ⓒ Corrosivity Test
Ⓒn Consolidation
Ⓓ Direct Shear
Ⓗ Hydrometer
Ⓜ Max Density (Lab Compaction)
Ⓟ Permeameter Test
Ⓡ Resistance R-Value Test
Ⓢa Sieve Analysis
Ⓢt Swell/Settlement Test
Ⓤ Unconsolidated Undrained Triaxial Compression Test
Ⓚ Wash Sieve







● 57 mm CONE PENETRATION
SAMPLE BORING (DRY)
ROTARY SAMPLE BORING (WET)
AUGER BORING (DRY)
TEST PIT
DIAMOND CORE BORING
JET BORING
ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS
GRAVEL
SAND
SILT
CLAY
SANDY CLAY or CLAYEY SAND
SANDY SILT or SILTY SAND
SILTY CLAY
CLAYEY SILT
PEAT and/or ORGANIC MATTER
FILL MATERIAL
COBBLE
IGNEOUS ROCK
SEDIMENTARY ROCK
METAMORPHIC

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

Granular SPT N-Value (Blows/ft) (0.3m)		Cohesive SPT N-Value (Blows/ft) (0.3m)	
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>30	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE No. 28-E0023
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/11/05		PROJECT ENGINEER	KILOMETER POST 37.9/41.3

RETAINING WALL No. 5
LOG OF TEST BORINGS 2 OF 6

CU 04275
EA 228591

DISREGARD POINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY)										SHEET	OF
10/17/05	01/26/06	03/16/01	05/16/01	10/25/01						61	66

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

FILE => ...\28-0023-z-ltb14.dgn

USERNAME => Christina.Dacera PLOTTED => 10/31/2007 TIME PLOTTED => 6:07:01 PM

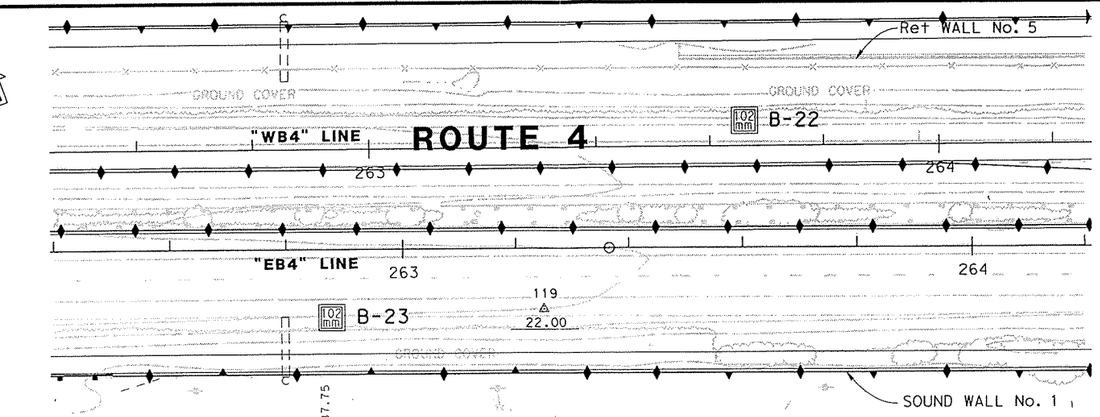
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

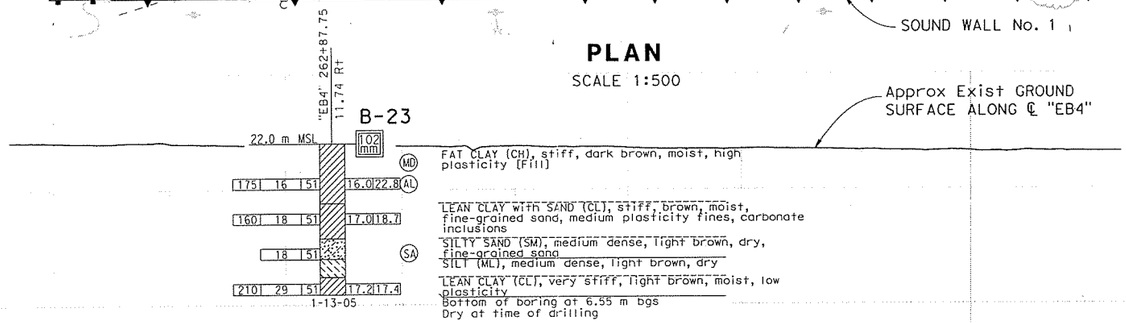
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.

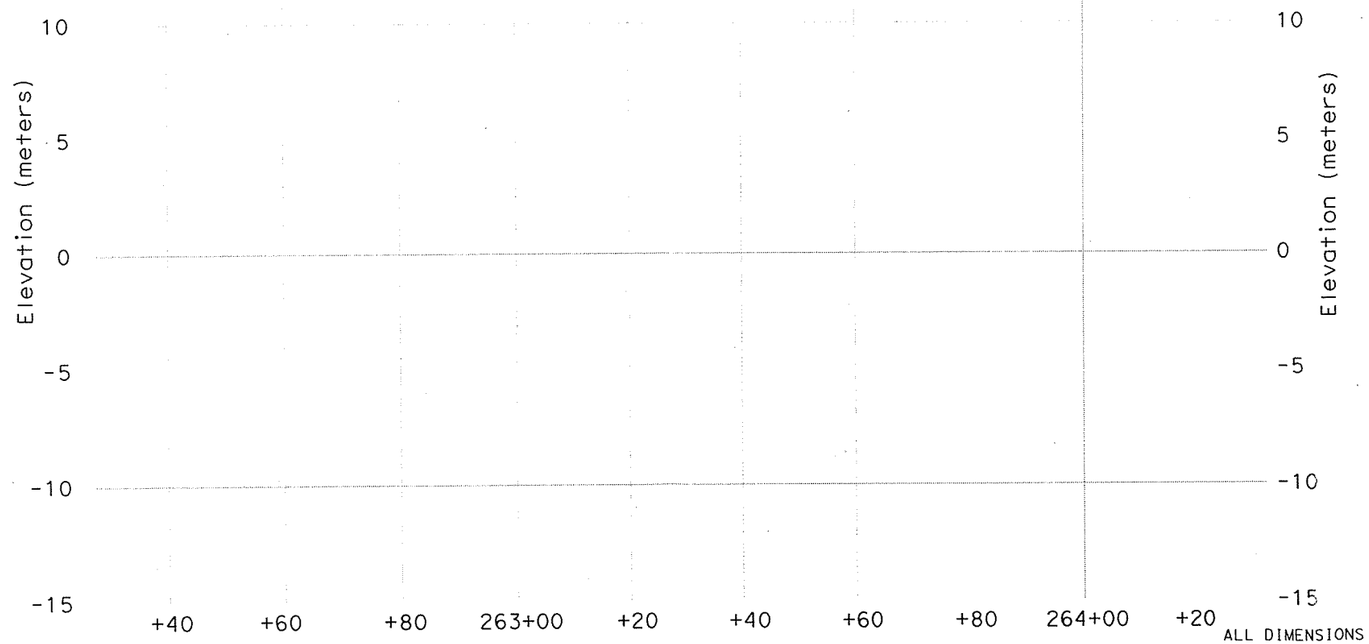


PLAN
SCALE 1:500



NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

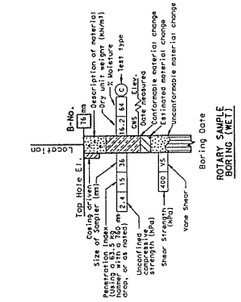


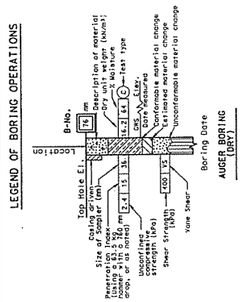
PROFILE VIEW
Horiz 1:500
Vert 1:125

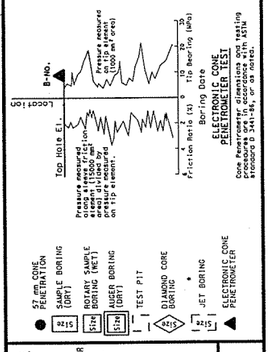
ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

LEGEND OF BORING OPERATIONS

TEST TYPE: Atterberg Limit; Corrosivity Test; Consolidation; Direct Shear; Hydrometer; Max Density (Lab Compaction Test); Permeability or Percolation Test; Sieve Analysis; Soil Settlement Test; Unconsolidated Undrained Triaxial Compression Test; Wash Sieve







62 mm CONE PENETRATION
SAMPLE BORING (DRY)
ROTARY SAMPLE BORING (WET)
AUGER BORING (DRY)
TEST PIT
DIAMOND CORE BORING
JET BORING
ELECTRONIC CONE PENETROMETER

Cone Penetrometer dimensions and testing procedures conform to current ASTM standard D 3441-94, or as noted.

LEGEND OF EARTH MATERIALS

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

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

Granular: SPT N-Value (Blows/0.3m)		Cohesive: SPT N-Value (Blows/0.3m)	
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>30	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE No. 28-E0023	RETAINING WALL No. 5
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/13/05		PROJECT ENGINEER	KILOMETER POST 37.9/41.3	LOG OF TEST BORINGS 3 OF 6

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228591

FILE => ...\28-0023-z-1tb15.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/31/05; 01/26/06; 02/16/07; 05/08/07; 10/25/07

SHEET 63 OF 66

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand, No. 2596, Exp. 6/30/09, GEOTECHNICAL, STATE OF CALIFORNIA

PLANS APPROVAL DATE

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USERNAME => Christina.DaGier PLOTTED => 10/31/2007 TIME PLOTTED => 6:07:03 PM

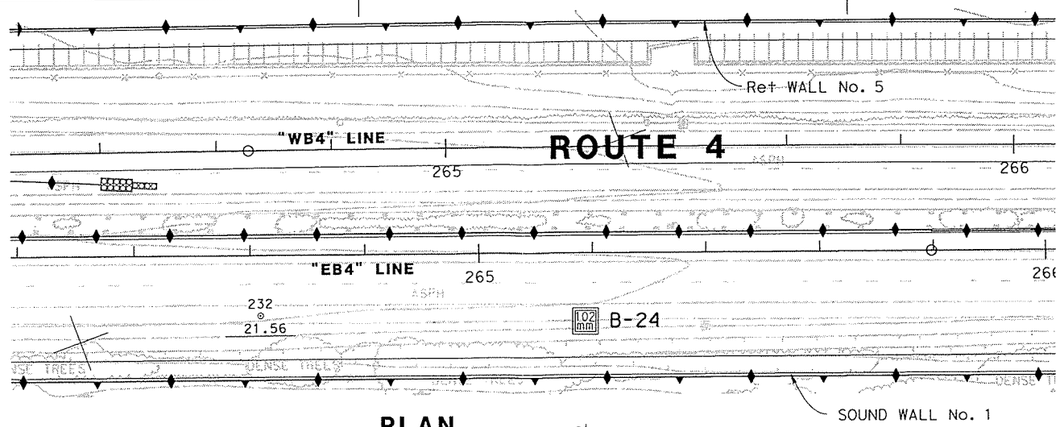
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



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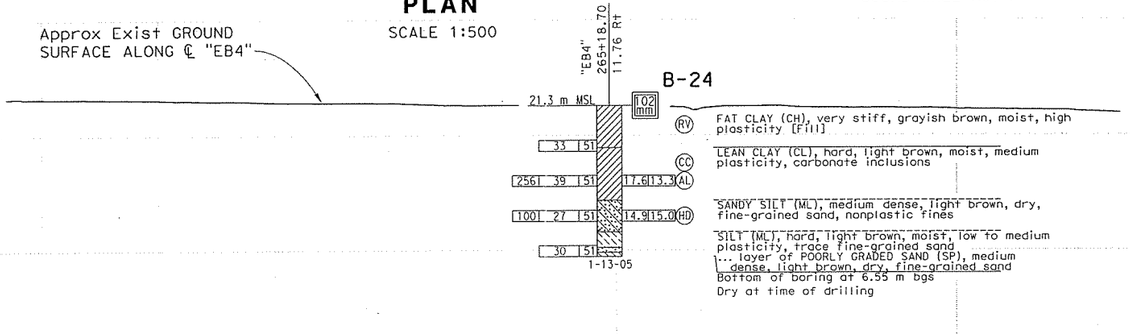
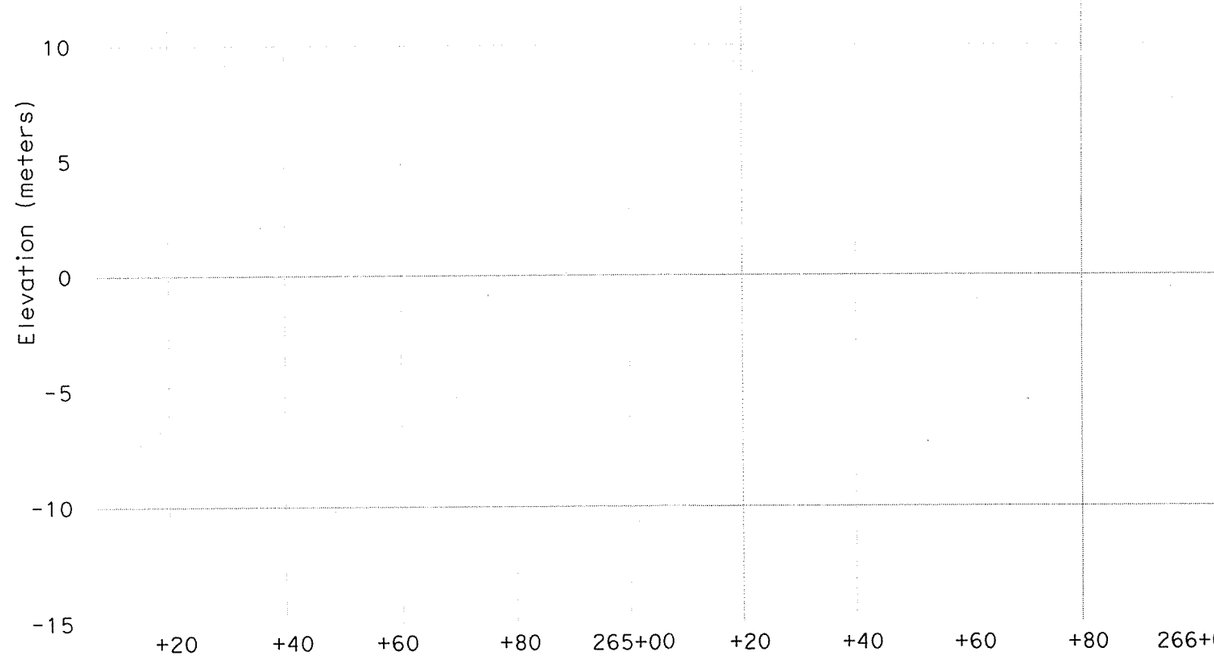




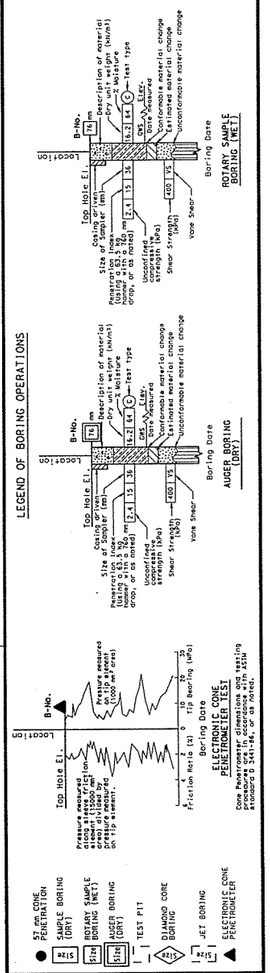
PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

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

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/ 0.305m)	Granular	SPT N-Value (Blows/ 0.305m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>30	Hard

NOTE: Visual classification of Earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

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PLEASANT HILL, CA 94523

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DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE No. 28-E0023	RETAINING WALL No. 5
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/13/05		PROJECT ENGINEER	KILOMETER POST 37.9/41.3	LOG OF TEST BORINGS 4 OF 6

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228591

FILE => ...\28-0023-z-ltb16.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)									SHEET	OF
10/31/05	01/26/06	02/16/07	05/10/07	10/25/07					64	66

USERNAME => Christina.Dadefa PLOTTED => 10/31/2007 TIME PLOTTED => 6:07:06 PM

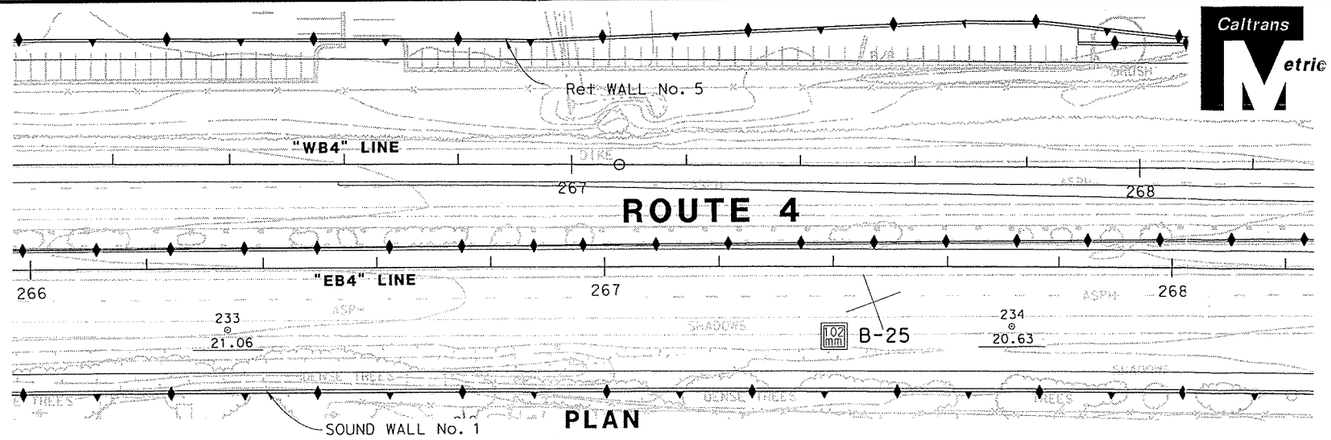
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



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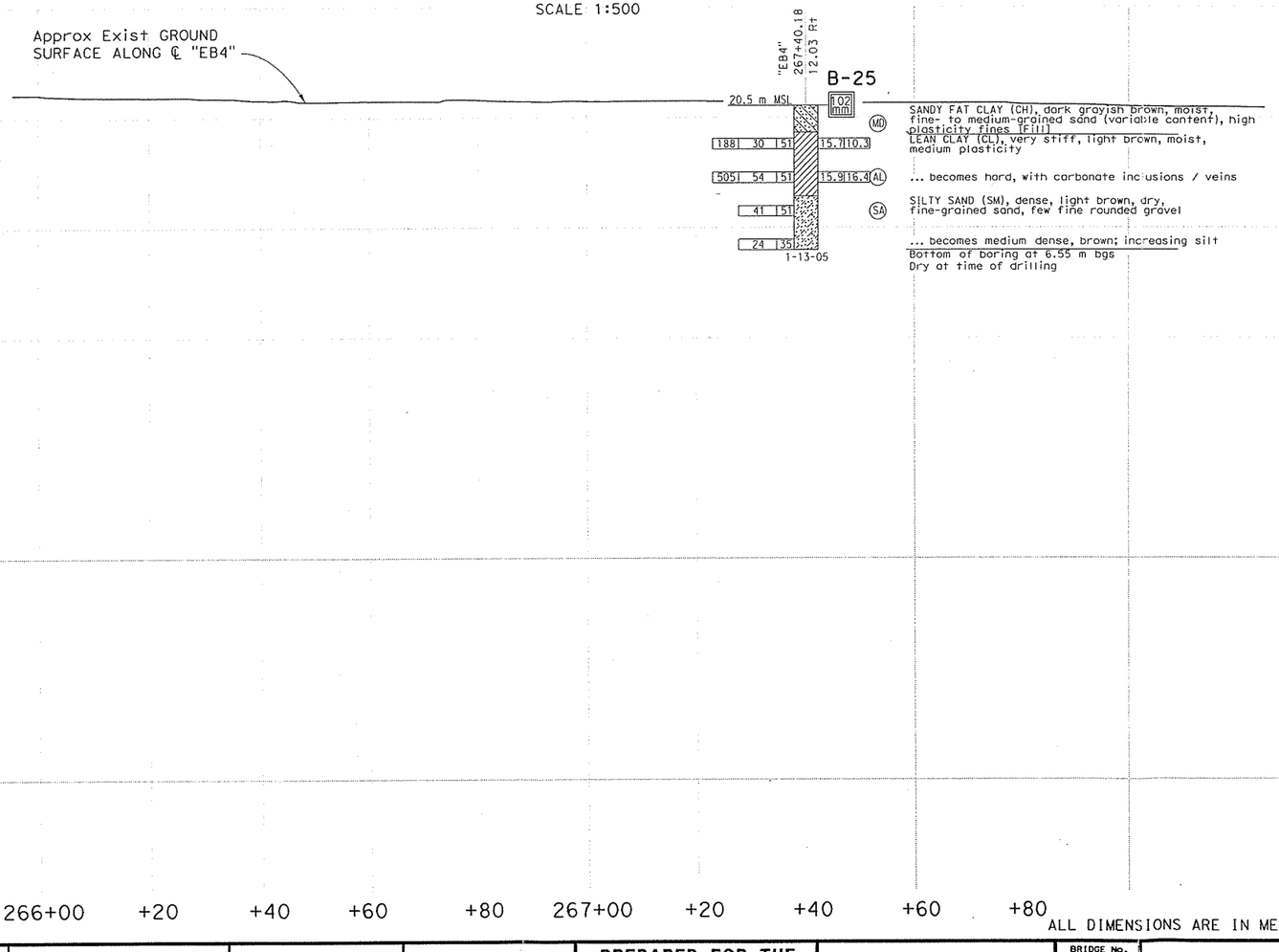

PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:
AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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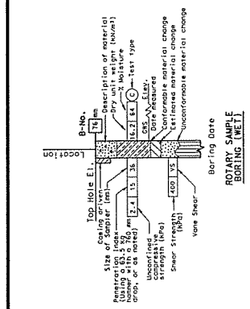
PLEASANT HILL, CA 94523

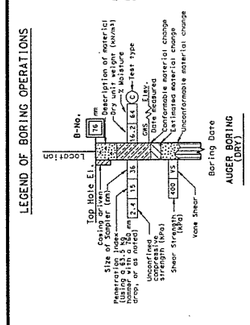
URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

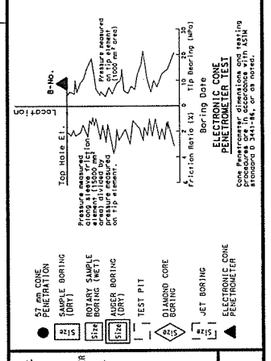
Caltrans now has a web site! To get to the web site, go to: http://www.dot.ca.gov

LEGEND OF BORING OPERATIONS

TEST TYPE:
Ⓐ Atterberg Limit
Ⓒ Corrosivity Test
Ⓒ Consolidation
Ⓓ Direct Shear
Ⓗ Hydrometer
Ⓟ Pore Pressure Dissipation Test
Ⓓ Dry Density, (Ldd Lbs/cu.ft.) Moisture (%)
Ⓡ Resistance R-Value Test
Ⓢ Sieve Analysis
Ⓢ Swell/Settlement Test
Ⓤ Unconsolidated Undrained Triaxial Compression Test
Ⓚ Wash Sieve







Cone Penetrometer dimensions and testing procedures conform to ASTM D 3441-94, or as noted.

LEGEND OF EARTH MATERIALS

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

57 mm CONE PENETRATION · SAMPLE BORING (DRY) · ROTARY SAMPLE BORING (WET) · AUGER BORING (DRY) · TEST PIT · DIAMOND CORE BORING · JET BORING · ELECTRONIC CONE PENETROMETER

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT (N-Value blows/0.3m)	Granular	SPT (N-Value blows/0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>30	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE No. 28-E0023	RETAINING WALL No. 5
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/13/05		PROJECT ENGINEER	KILOMETER POST 37.9/41.3	LOG OF TEST BORINGS 5 OF 6

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228591

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 10/17/05 · 01/26/06 · 02/14/07 · 05/30/07 · 10/25/07

SHEET 65 OF 66

FILE => ...\28-0023-z-ltb17.dgn

USERNAME => Christina.Dafferner PLOTTED => 10/31/2007 TIME PLOTTED => 6:07:10 PM

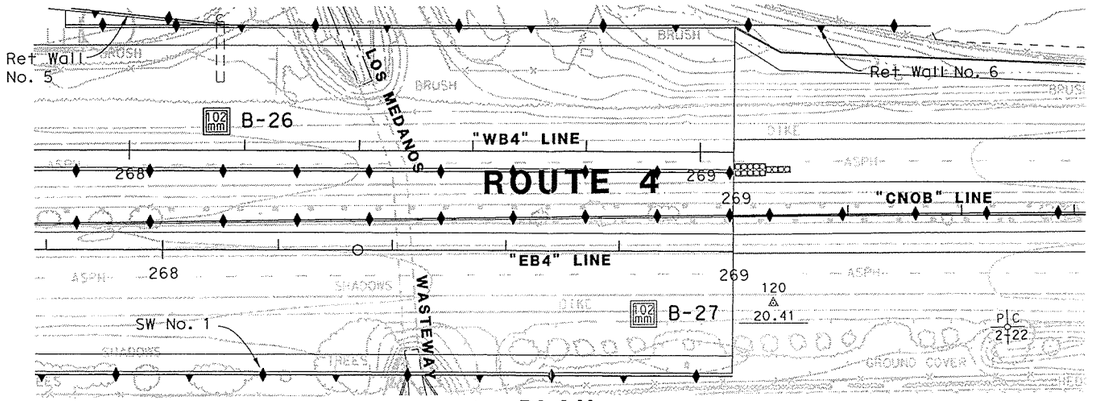
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

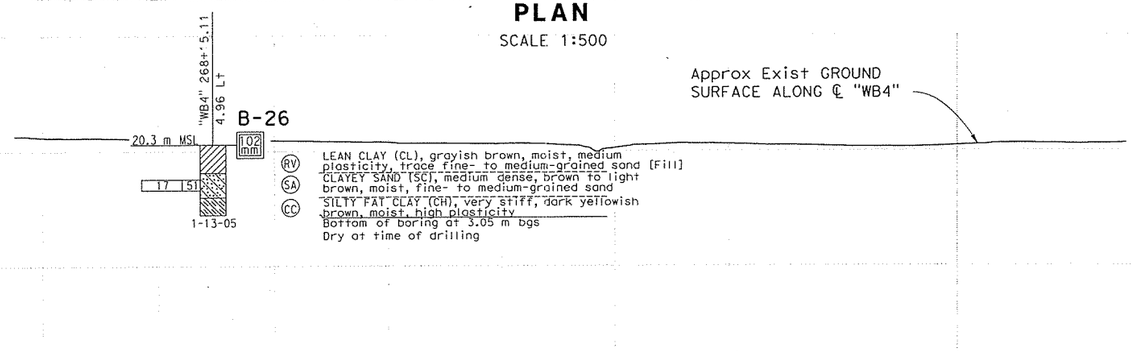
CONTROL & BENCHMARK
No. BART-185

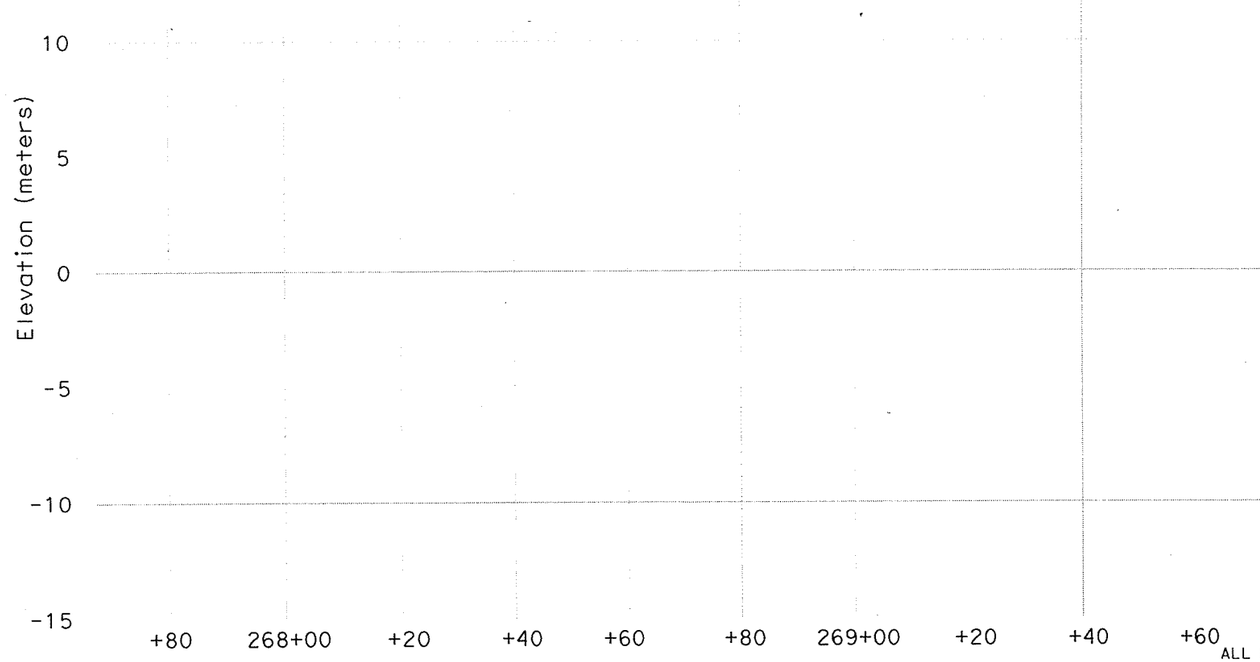
BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500





PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

R-17

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
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PLEASANT HILL, CA 94523

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3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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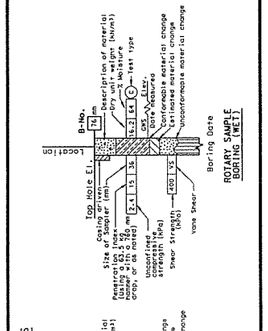
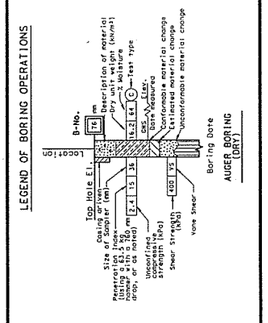
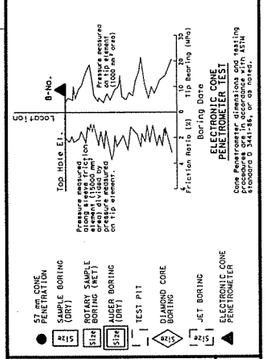
LEGEND OF BORING OPERATIONS

TEST TYPE
Atterberg Limits
Corrosivity Test
Consolidation
Direct Shear
Hydrometer
Max Density (Lab Compaction Test)
Resistance R-value
Sieve Analysis
Soil Settlement Test
Unconsolidated Undrained Triaxial Compression
Wash Sieve







PIEZOCONE PENETRATION
SAMPLE BORING (DRY)
ROTARY SAMPLE BORING (MET)
AUGER BORING (DRY)
TEST PIT
DIAMOND CORE BORING
JET BORING
ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS
GRAVEL
SAND
SILT
CLAY
SANDY CLAY or CLAYEY SAND
SANDY SILT or SILTY SAND
SILTY CLAY
CLAYEY SILT
PEAT and/or ORGANIC MATTER
FILL MATERIAL
COBBLE
IGNEOUS ROCK
SEDIMENTARY ROCK
METAMORPHIC

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/ 0.3m)	Granular	SPT N-Value (Blows/ 0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER PROJECT ENGINEER	BRIDGE NO.
SIGN OFF DATE	CHECKED BY	N. MEYER	DATE: 01/13/05			KILOMETER POST 37.9/41.3

RETAINING WALL No. 6

LOG OF TEST BORINGS No. 1 of 3

CU 04275
EA 228591

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 10/14/05 7/28/06 8/01/06 2/28/07 10/25/07

SHEET 17 OF 19

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

FILE => ...\r-17.dgn

USERNAME => Christina.Dolfie PLOTTED => 10/31/2007 TIME PLOTTED => 5:59:21 PM

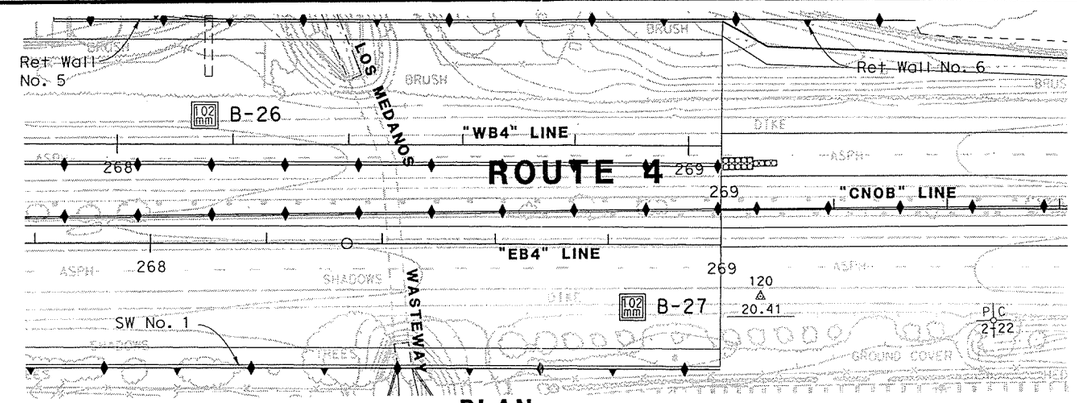
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

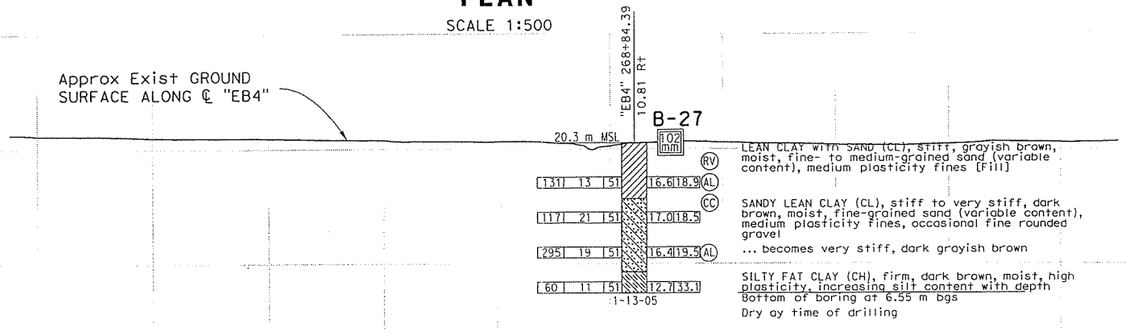
CONTROL & BENCHMARK
No. BART-185

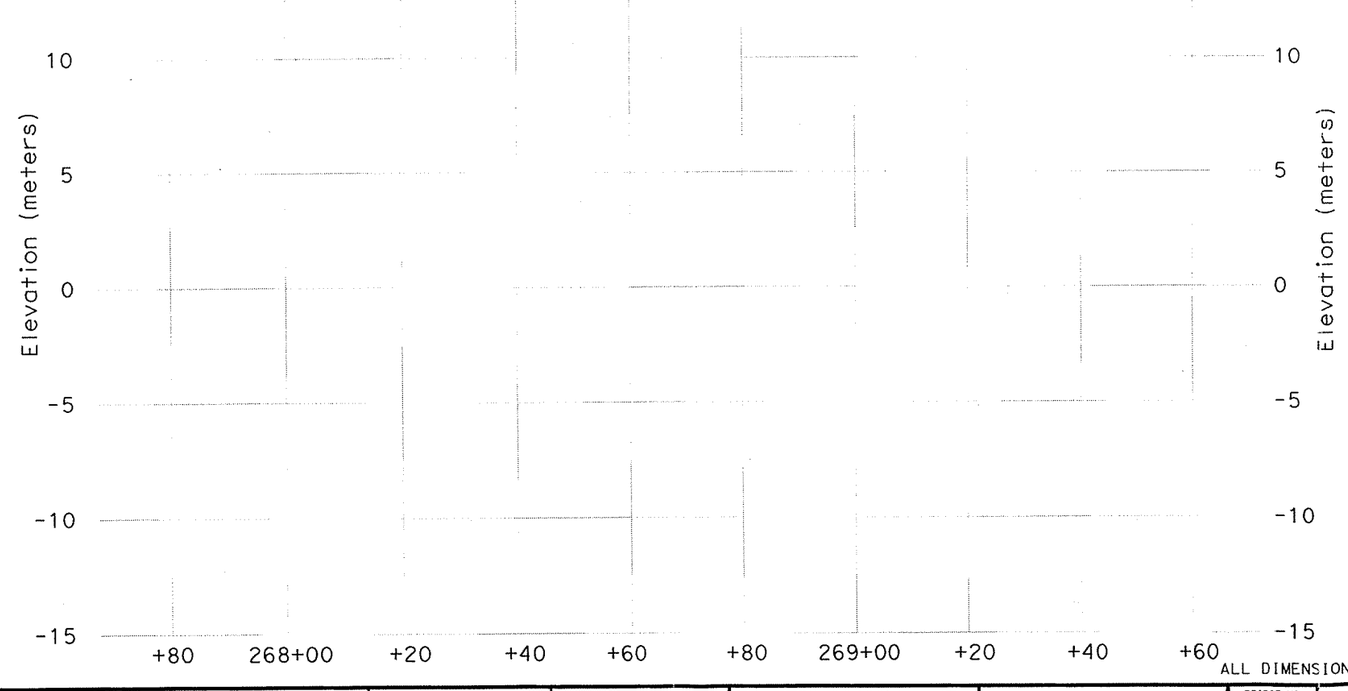
BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500





PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

R-18

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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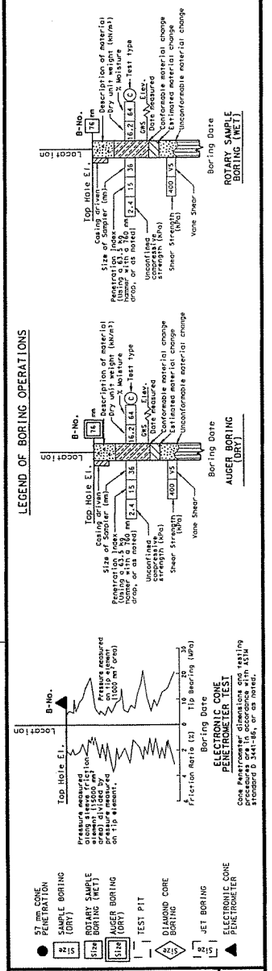
LEGEND OF BORING OPERATIONS

TEST TYPE: Atterberg Limit; Corrosivity Test; Consolidation; Direct Shear; Hydrometer; Max Density (Lab Compaction Test); Resistance R-Value Test; Sieve Analysis Test; Settlement Test; Unconsolidated Undrained Triaxial Compression Test; Wash Sieve



97 mm CONE PENETRATION | EARTH BORING (DRY) | ROTARY SAMPLE BORING (MET) | AUGER BORING (DRY) | TEST PIT | DIAMOND CORE BORING | JET BORING | ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS: GRAVEL; SAND; SILT; CLAY; CLAYEY SILT; PEAT and/or ORGANIC MATTER; FILL MATERIAL; COBBLE; IGNEOUS ROCK; SEDIMENTARY ROCK; METAMORPHIC; SANDY CLAY or CLAYEY SAND; CLAYEY SILT or SILTY SAND; SILTY CLAY

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/13/05		PROJECT ENGINEER

BRIDGE NO.
KILOMETER POST 37.9/41.3

RETAINING WALL No. 6

LOG OF TEST BORINGS No. 2 of 3

CU 04275
EA 228591

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/21/05; 7/27/06; 8/03/06; 2/28/07; 10/25/07

SHEET 18 OF 19

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

FILE => ...\r-18.dgn

USERNAME => Christina Dacalos PLOTTED => 10/31/2007 TIME PLOTTED => 5:59:25 PM

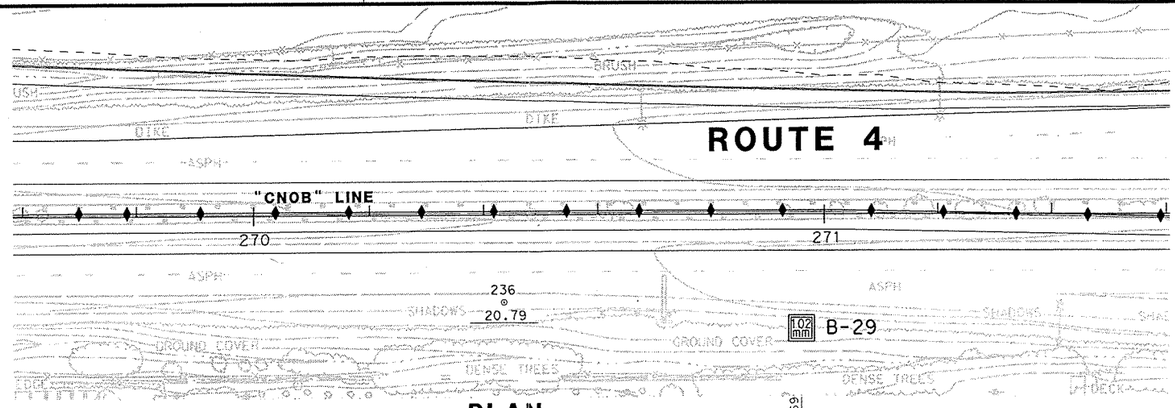
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

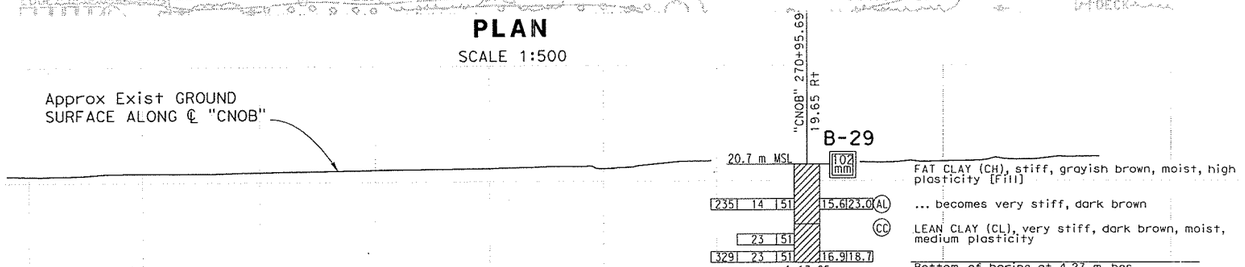
CONTROL & BENCHMARK
No. BART-185

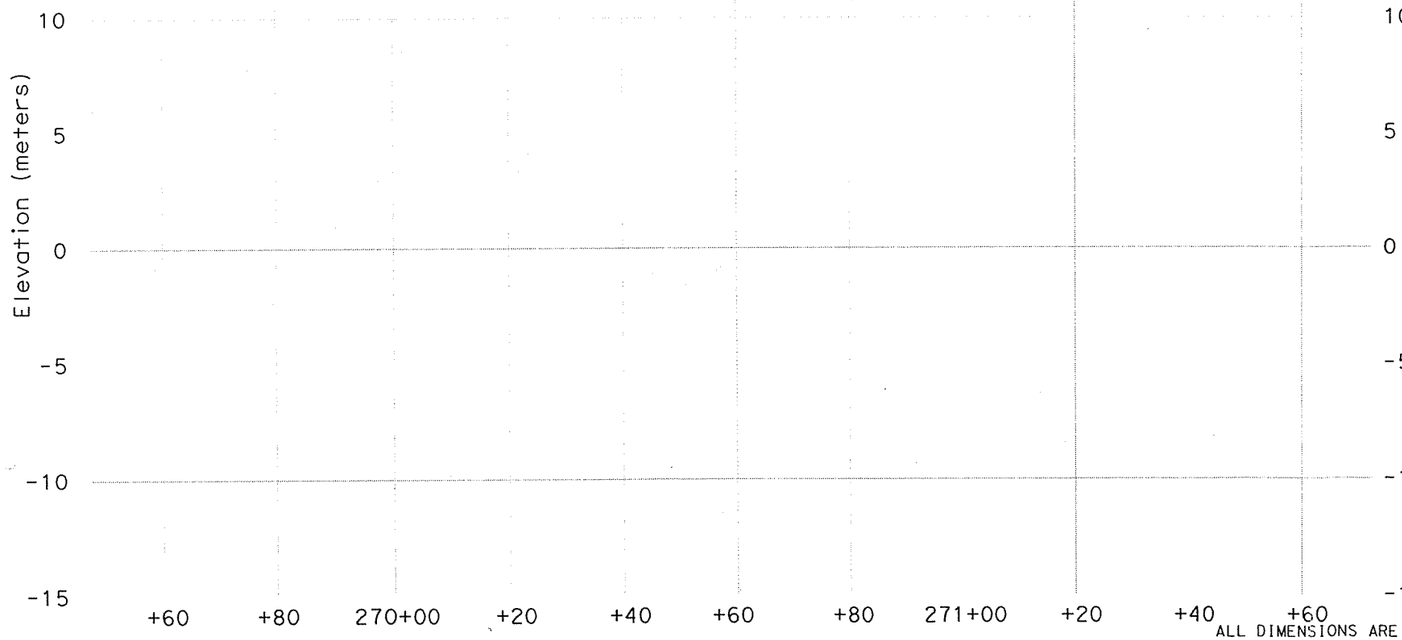
BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500





PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

R-19

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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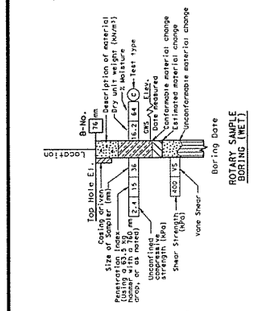
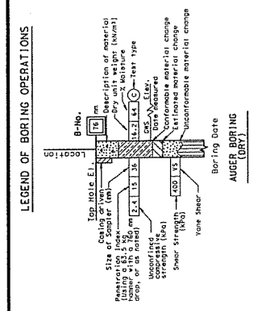
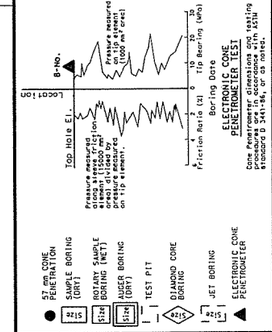
LEGEND OF BORING OPERATIONS

TEST TYPE
Atterberg Limit
Corrosivity Test
Consolidation
Direct Shear
Hydrometer
Max Density (Lab Compaction Test)
Resistance R-value Test
Sieve Analysis
Swell/Settlement Test
Unconsolidated Undrained Triaxial Compression
Wash Sieve







57 mm CONE PENETRATION
SAMPLE BORING (DRY)
ROTARY SAMPLE BORING (WET)
AUGER BORING (DRY)
TEST PIT
DIAMOND CORE BORING
JET BORING
ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS

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

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/ 0.3m)	Granular	SPT N-Value (Blows/ 0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO.	RETAINING WALL No. 6
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/13/05		PROJECT ENGINEER	KILOMETER POST 37.9/41.3	LOG OF TEST BORINGS No. 3 of 3

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228591

FILE => ...\r-19.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/14/05, 7/28/06, 8/31/06, 2/28/07, 10/25/07

SHEET 19 OF 19

USERNAME => Christina.DASHeaPLOTTED => 10/31/2007 TIME PLOTTED => 5:59:30 PM

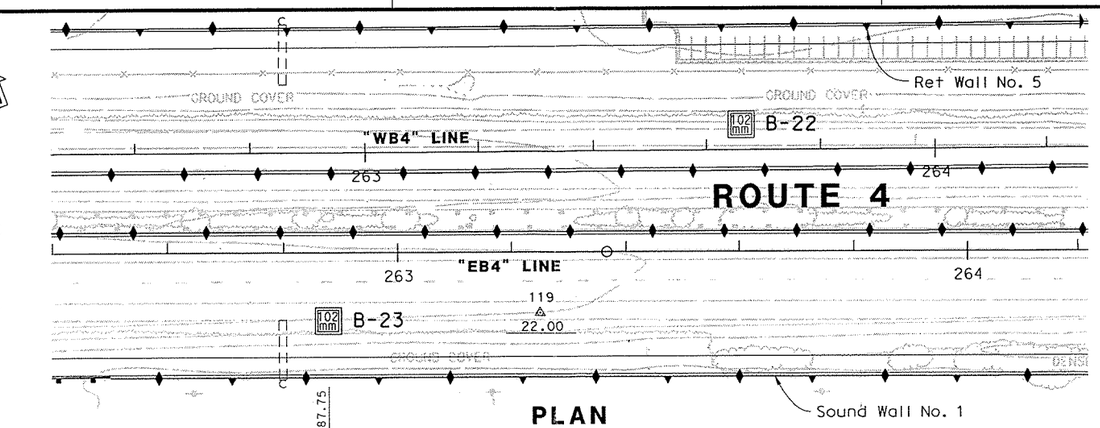
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

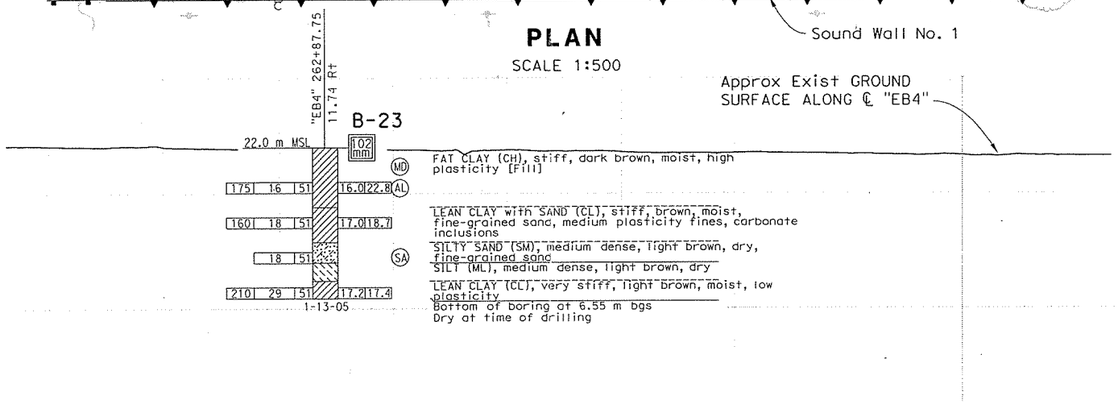
CONTROL & BENCHMARK
No. BART-185

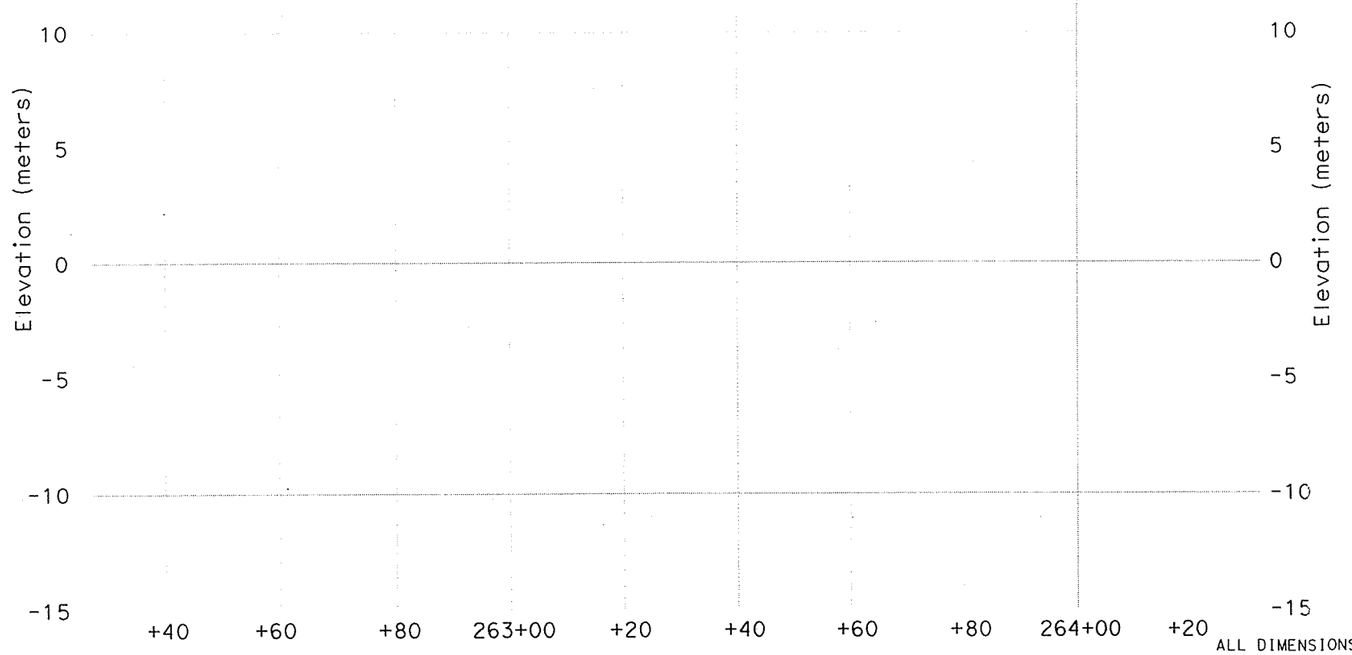
BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500





PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

SW-15

NOTE:
AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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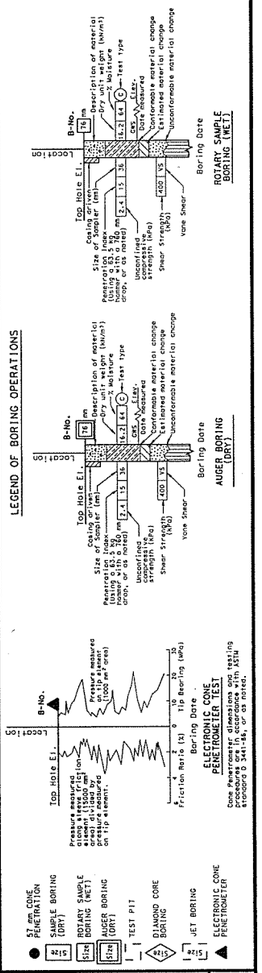
LEGEND OF BORING OPERATIONS

TEST TYPE: Atterberg Limit; Corrosivity Test; Consolidation; Direct Shear; Hydrometer; Max. Density (Lab Compaction Test); Resistance R-value; Sieve Analysis; Soil Pollutant Test; Unconsolidated Undrained Triaxial Compression Test; Wash Sieve



51 mm CORE PENETRATION
SAMPLE BORING (DRY)
ROTARY SAMPLE BORING (MET)
AUGER BORING (DRY)
TEST PIT
DIAMOND CORE BORING
JET BORING
ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS

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

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
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11-30	Medium Dense	5-8	Firm
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>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	N. MEYER	DATE: 01/13/05		

BRIDGE NO.
KILOMETER POST 37.9/41.3

SOUND WALL No. 1
LOG OF TEST BORINGS No. 1 of 4

CU 04275
EA 228591

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/31/07 | 7/28/06 | 3/23/06 | 2/28/01 | 10/25/01

SHEET 15 OF 18

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

FILE => ...\SW-15.dgn

USERNAME => ChristinaDaffer PLOTTED => 10/31/2007 TIME PLOTTED => 6:01:44 PM

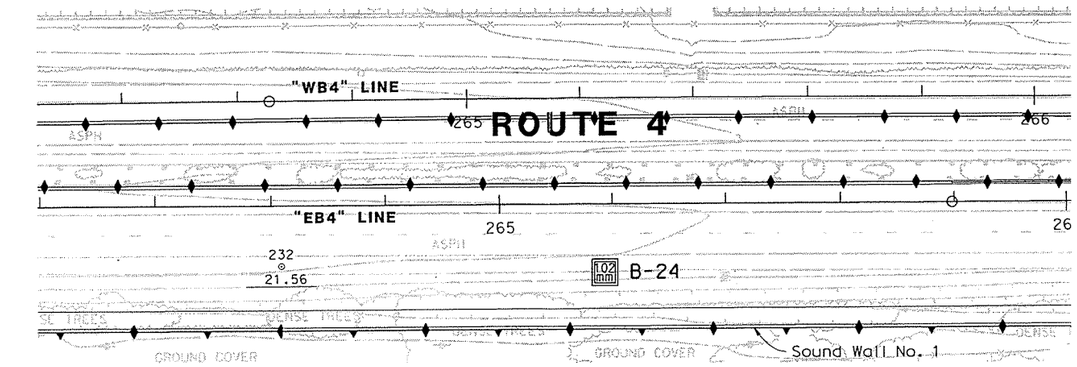
BENCH MARKS

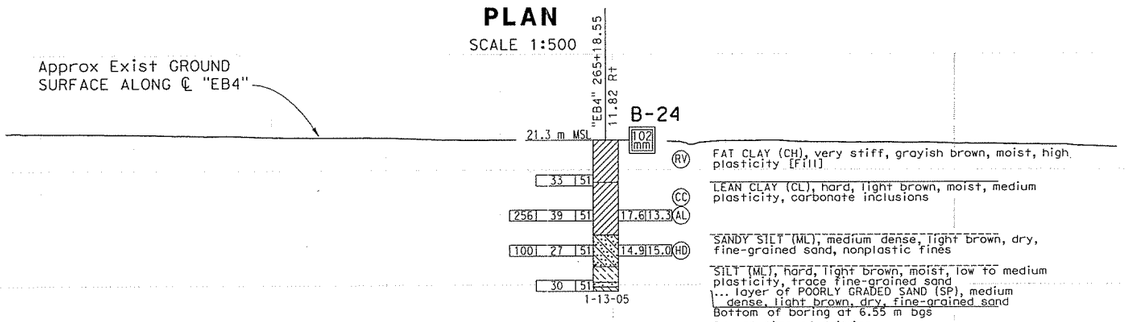
BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

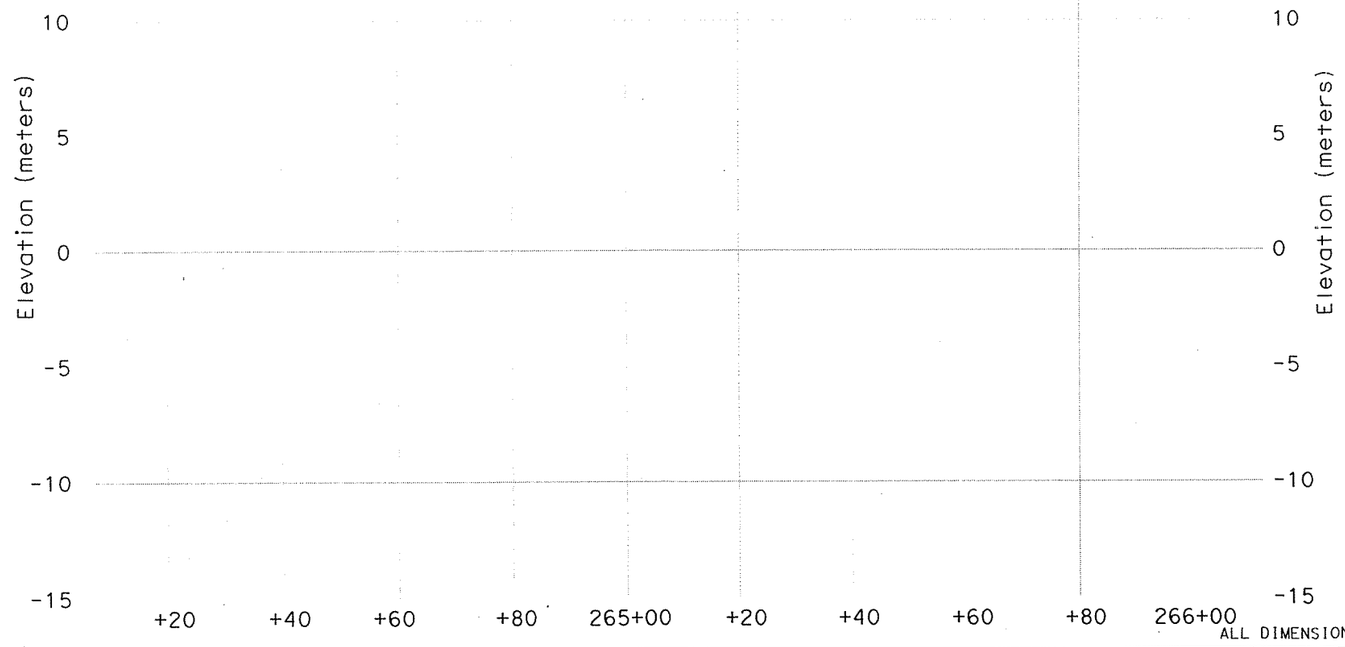
ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.





NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

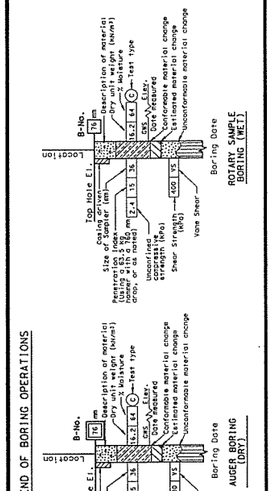


PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

SW-16

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

GRAVEL · SAND · SILT · CLAY · CLAYEY SILT · PEAT and/or ORGANIC MATTER · FILL MATERIAL · COBBLE · SANDY CLAY or CLAYEY SAND · SANDY SILT or SILTY SAND · SILTY CLAY · OREGOUS ROCK · SEDIMENTARY ROCK · METAMORPHIC

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT (blows/ 0.3m)	Granular	SPT (blows/ 0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

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	S. MURUGAIAH, FIELD INVESTIGATION BY: DATE: 01/13/05		

BRIDGE NO.
KILOMETER POST 37.9/41.3

SOUND WALL No. 1
LOG OF TEST BORINGS No. 2 of 4

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228591

DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES (PRELIMINARY STAGE ONLY): 10/31/06 | 7/28/06 | 8/30/06 | 2/28/01 | 10/25/01

SHEET 16 OF 18

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DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

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REGISTERED PROFESSIONAL ENGINEER — Philip Meymand No. 2596 Exp. 6/30/09 GEOTECHNICAL STATE OF CALIFORNIA

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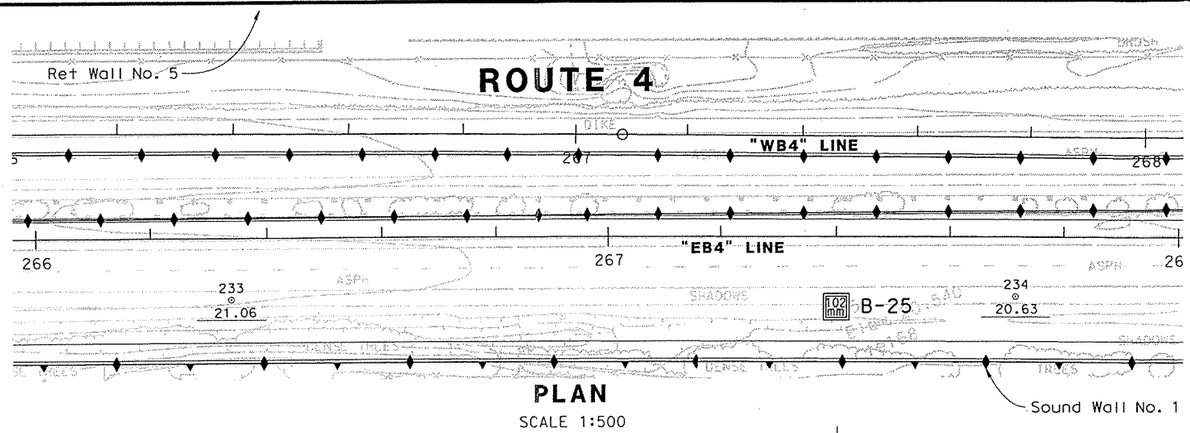
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



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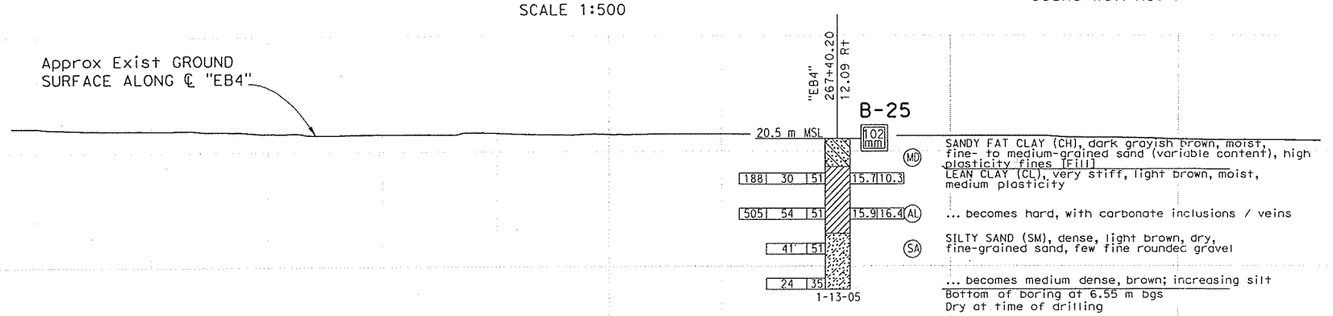
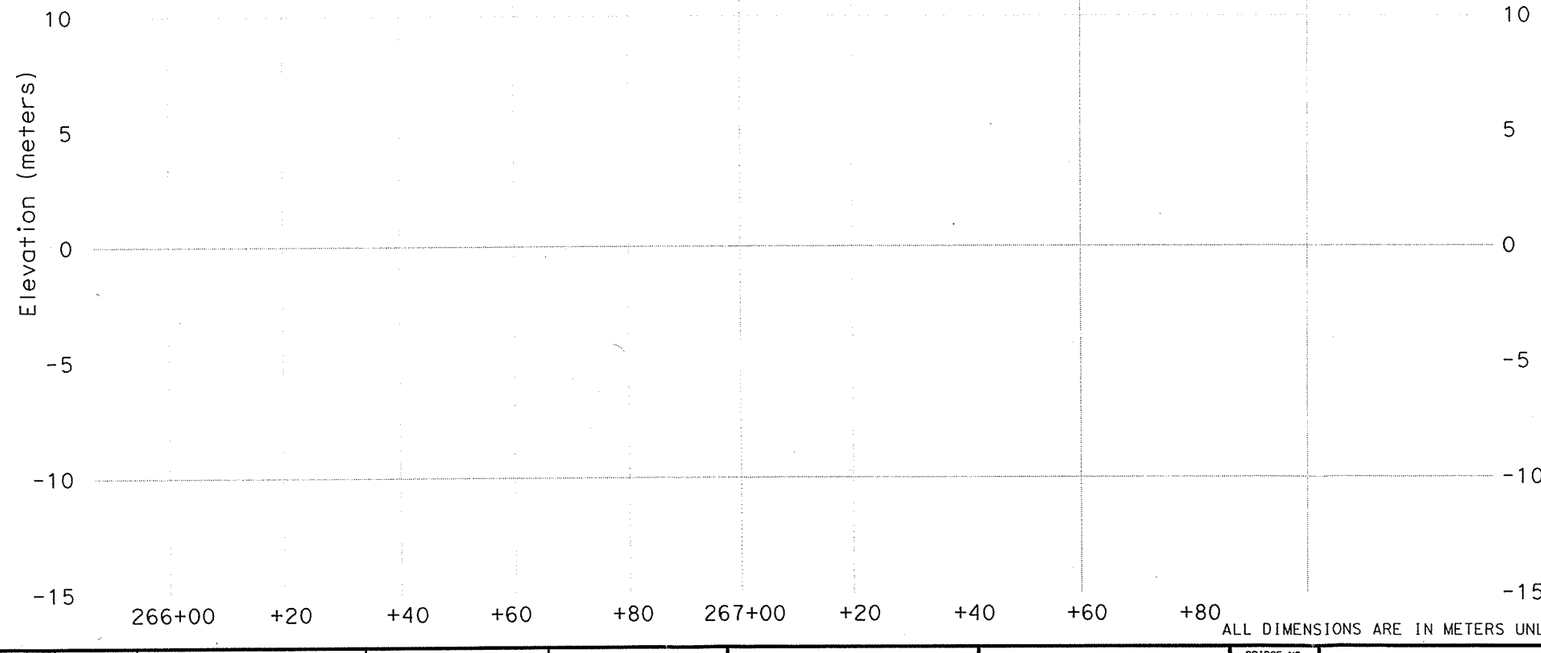


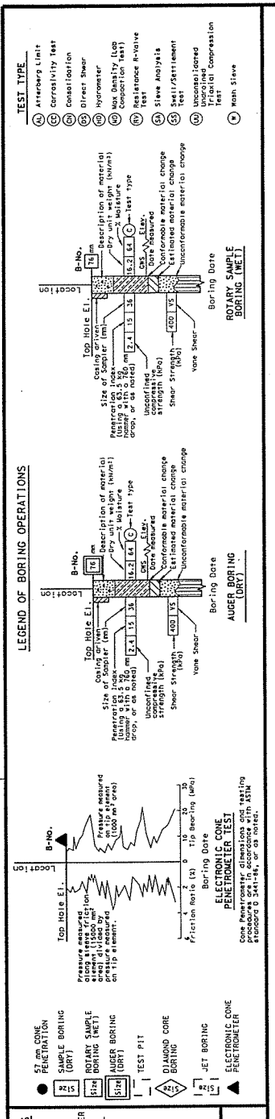
NOTE:
AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

SW-17



LEGEND OF EARTH MATERIALS
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SOUND WALL No. 1
LOG OF TEST BORINGS No. 3 of 4

CU 04275
EA 228591

DISREGARD PRINTS BEARING EARLIER REVISION DATES

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SHEET 17 OF 18

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

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BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
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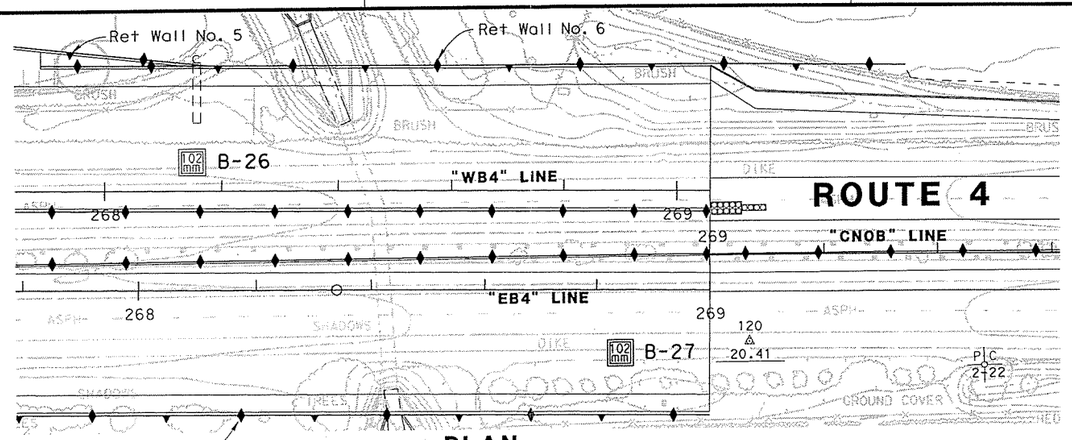

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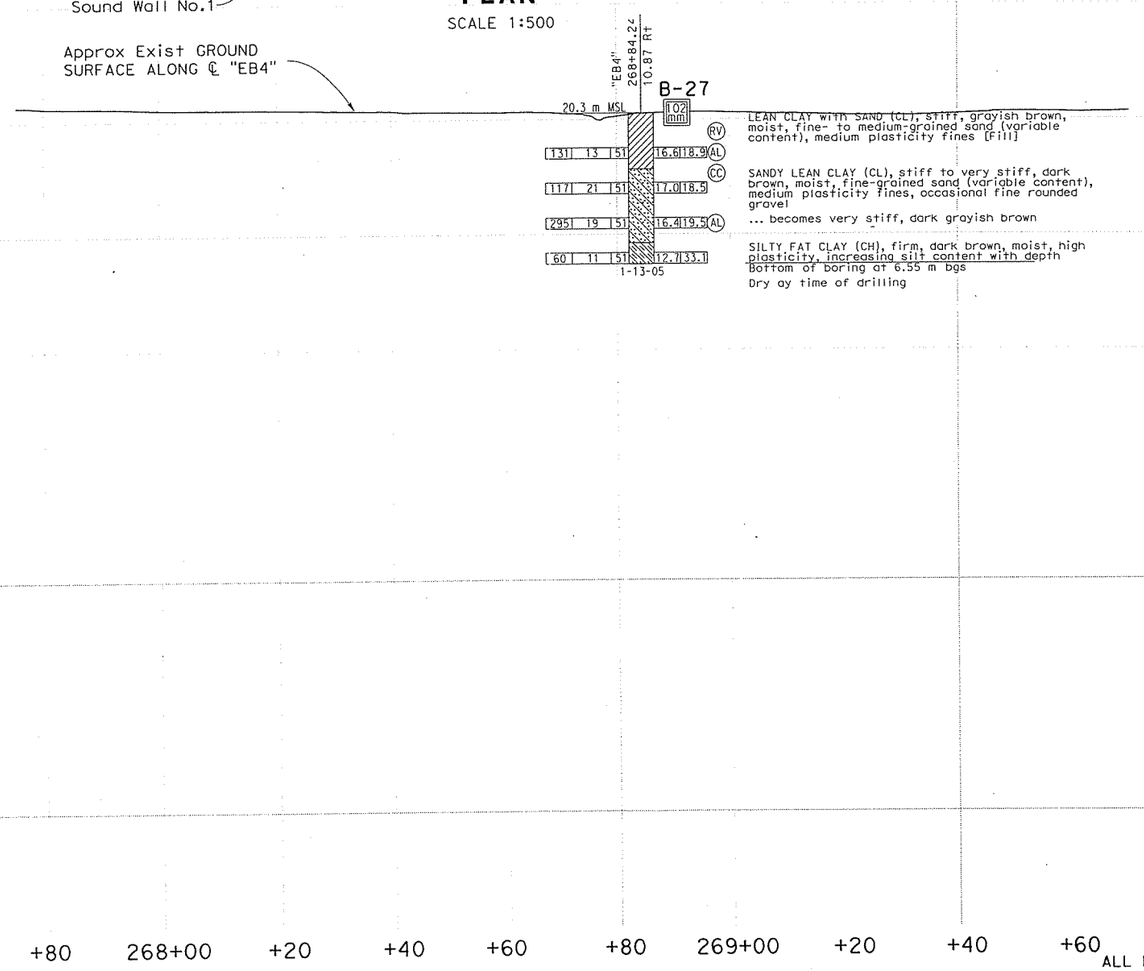
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

SW-18

NOTE:

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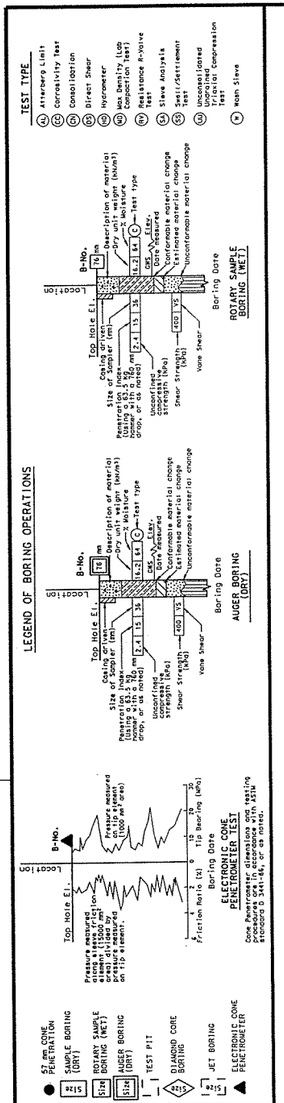
LEGEND OF BORING OPERATIONS



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BRIDGE NO.

KILOMETER POST 37.9/41.3

Ret WALL No. 6 AND SOUND WALL No. 1

LOG OF TEST BORINGS No. 4 of 4

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SHEET 18 OF 18

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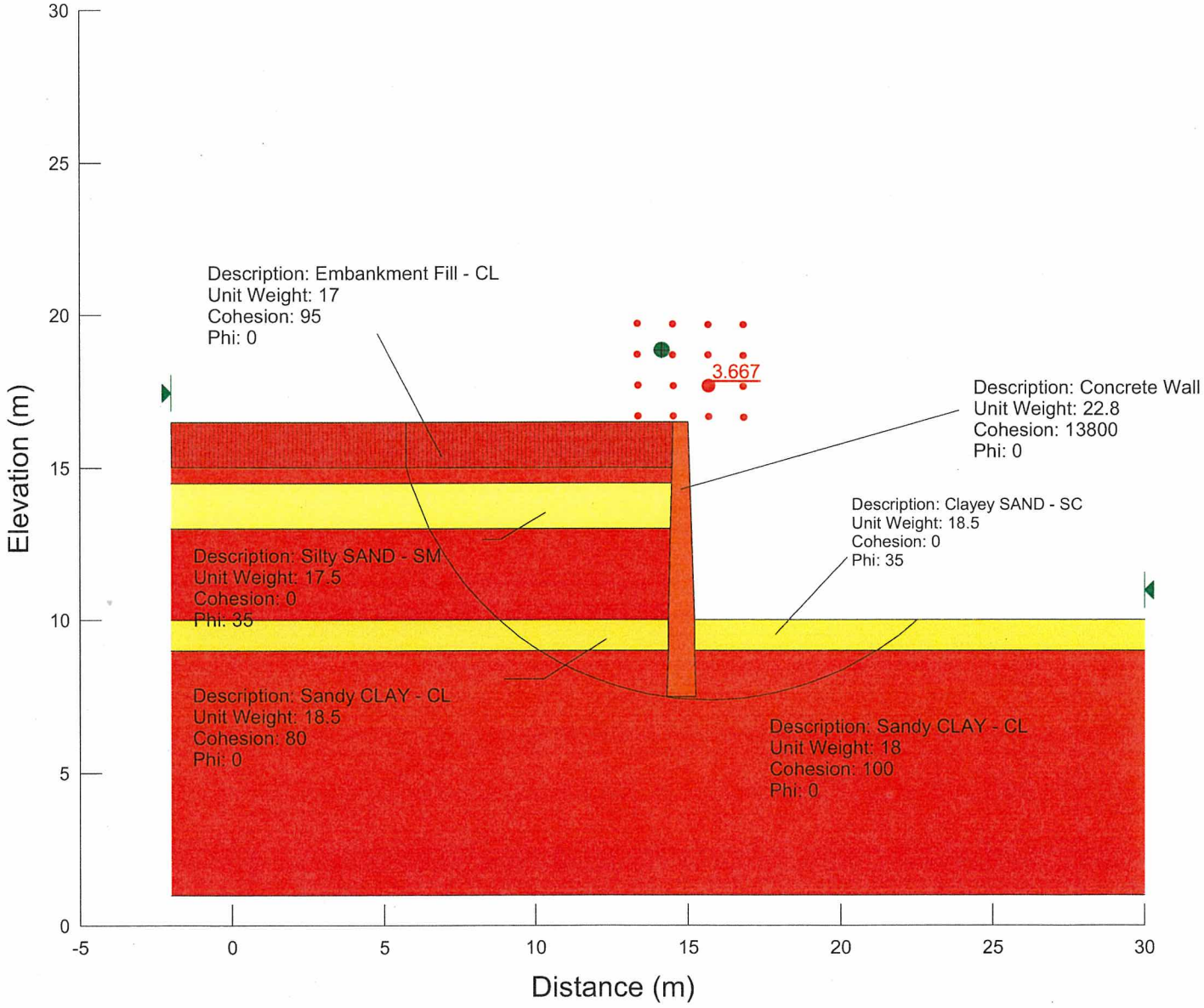
Appendix B

Results of Global Stability Analyses for Retaining Walls No. 3A, 3B, and 5

Description: Retaining Wall No. 3A (RW3A LOL Sta. 9+30, H=8.5m) End-of-Construction
Comments: SR4 Widening Project
File Name: RW3A_eoc.slz
Analysis Method: Morgenstern-Price
Tension Crack Option: Tension Crack Line
Seismic Coefficient: (none)



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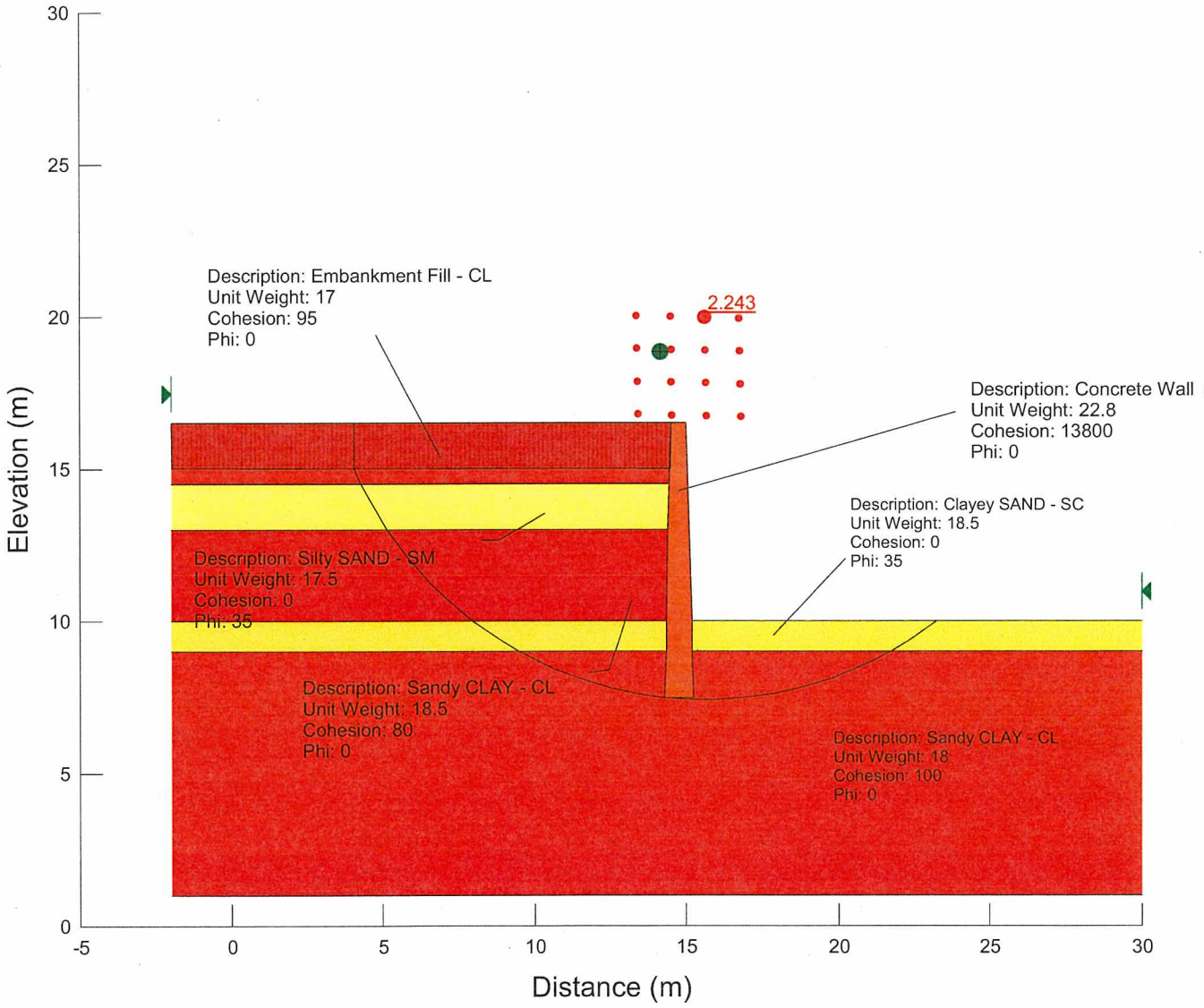
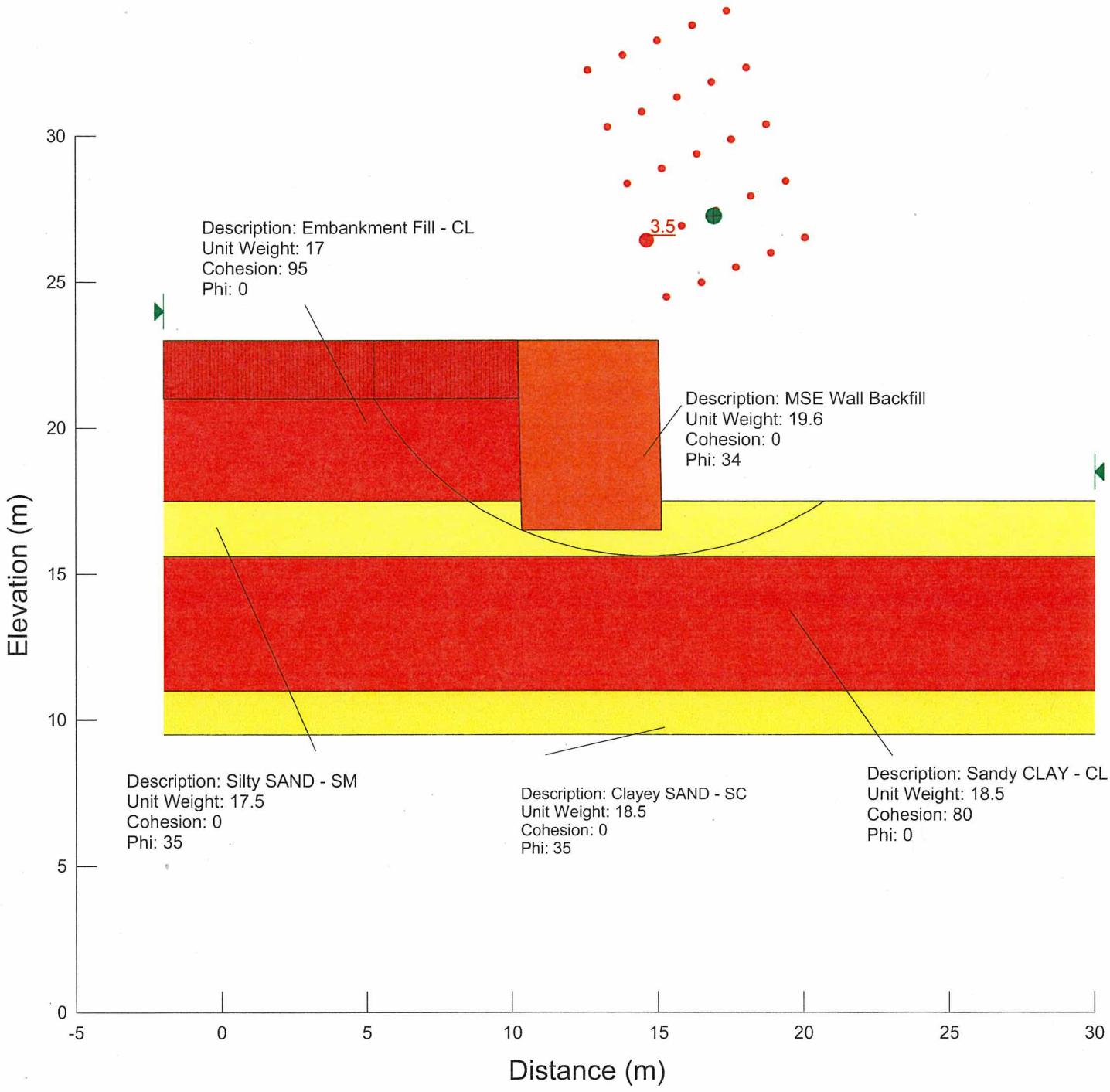
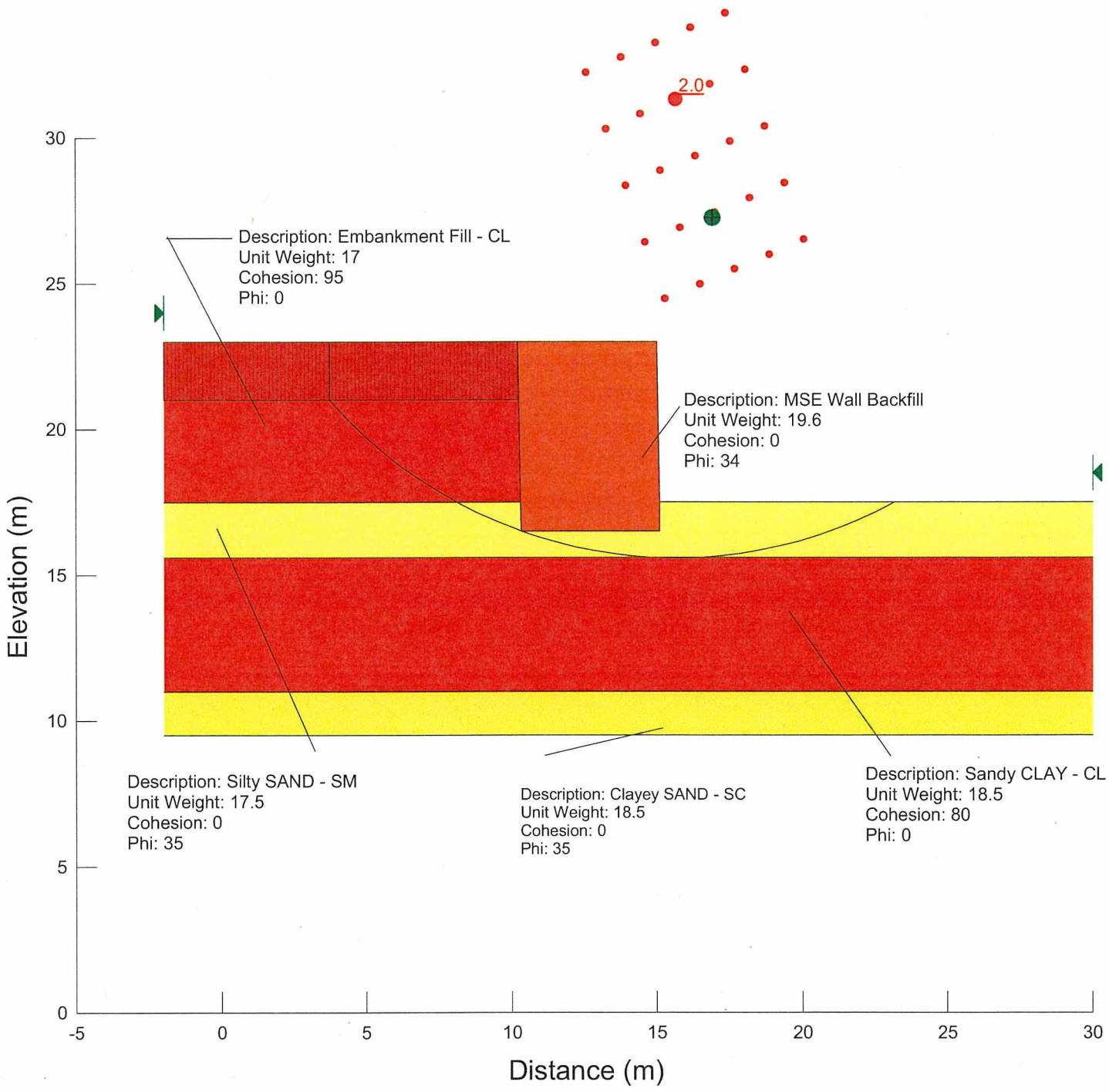
Comments: SR4 Widening Project
File Name: RW3A_pseudo.slz
Analysis Method: Morgenstern-Price
Tension Crack Option: Tension Crack Line
Seismic Coefficient: Horizontal



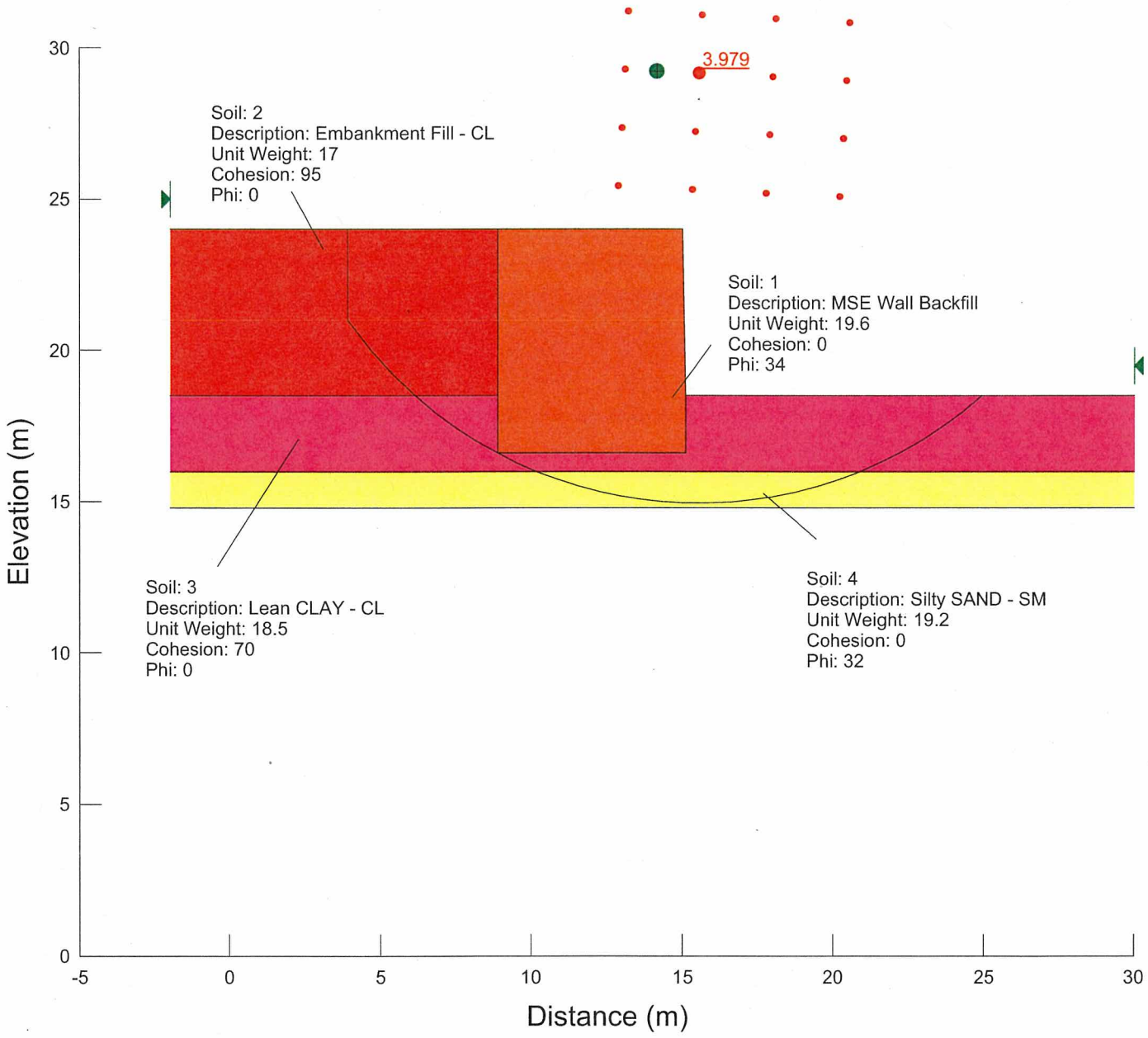
Description: Retaining Wall No. 3B (RW3 LOL Sta. 17+60, H=7.32m) End-of-Construction
Comments: SR4 Widening Project
File Name: RW3B17+54_eoc.slz
Analysis Method: Morgenstern-Price
Tension Crack Option: Tension Crack Line
Seismic Coefficient: (none)



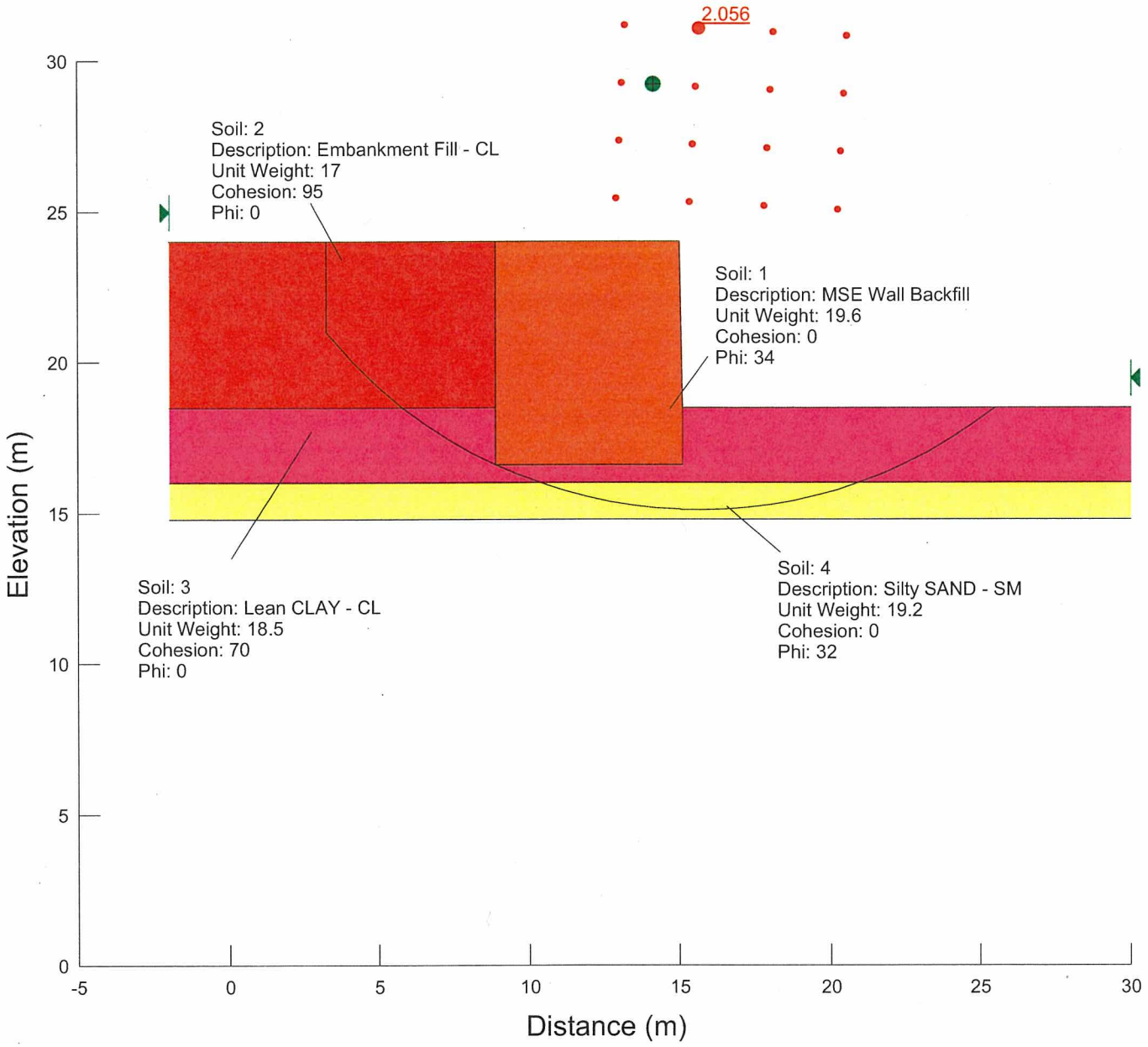
Description: Retaining Wall No. 3B (RW3 LOL Sta. 17+60, H=7.32m) Pseudo-static
Comments: SR4 Widening Project
File Name: RW3B17+60_pseudo.slz
Analysis Method: Morgenstern-Price
Tension Crack Option: Tension Crack Line
Seismic Coefficient: Horizontal



Description: Retaining Wall No. 5 (RW5 LOL Sta. 10+80, H=7.32m) End-of-Construction
Comments: SR4 Widening Project
File Name: RW5mod_eoc.slz
Analysis Method: Morgenstern-Price
Tension Crack Option: Tension Crack Line
Seismic Coefficient: (none)



Description: Retaining Wall No. 5 (RW5 LOL Sta. 10+80, H=7.32m) Pseudo-static k=0.3 g
Comments: SR4 Widening Project
File Name: RW5mod_pseudo.slz
Analysis Method: Morgenstern-Price
Tension Crack Option: Tension Crack Line
Seismic Coefficient: Horizontal



Appendix C
Corrosivity Test Results

STATE ROUTE 4 WIDENING PROJECT
WEST OF LOVERIDGE ROAD, PITTSBURG, CA
TO SOMERSVILLE ROAD, ANTIOCH, CA

RETAINING WALLS AND SOUNDWALLS
FOUNDATION INVESTIGATION REPORT

Prepared for:

URS CORPORATION
1333 Broadway, Suite 800
Oakland, CA 94612

Prepared By:

V&A CONSULTING ENGINEERS INC.
Lake Merritt Plaza
1999 Harrison Street, Suite 975
Oakland, CA 94612

October 2005

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CONCLUSIONS 1
RECOMMENDATIONS 2
Buried Reinforced Concrete Structures, Retaining Walls and Sound Walls 2
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TEST METHODS 3
In-Situ Soil Resistivity 3
Laboratory Analysis of Soil 8
TEST RESULTS AND DISCUSSION 8
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Laboratory Analysis of Soil Samples 10

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EXECUTIVE SUMMARY

V&A Consulting Engineers (V&A) was retained by URS Corporation to perform a Soil Corrosivity Investigation for the proposed State Route 4 Widening Project Between Loveridge Road in Pittsburg, CA to Somersville Road in Antioch, CA. The objective of this investigation is to measure various soil parameters and evaluate the results to determine the corrosivity of the soil to the proposed retaining walls and sound walls associated with the highway widening project. Corrosivity was determined on the project alignment to depths ranging from 0 to 6 meters below grade. In-situ soil resistivity was measured at the locations listed in Table 1. Soil borings analyzed for chemical analysis are listed in Table 2.

This report provides recommendations for corrosion control for the wall foundations and the soil and rock anchor systems. This foundation investigation is in accordance with Caltrans Corrosion Guidelines dated September 2003 (Guidelines).

The California Department of Transportation, Division of Engineering Services, Materials Engineering and Testing Services, Corrosion Technology Branch has published "Corrosion Guidelines" (Guidelines) to define corrosive soil. The Guidelines consider soil to be corrosive to structural elements (steel reinforced concrete) if one or more of the following conditions exist for water or soil samples:

> ***"Chloride concentration is 500 ppm (mg/kg) or greater, sulfate concentration is 2,000 (mg/kg) or greater or the pH is 5.5 or less."***

Based on the results of the chemical analysis of the soil borings analyzed for this project, the soil is determined to be *non-corrosive* in accordance with the Guidelines.

CONCLUSIONS

- The chloride ion concentration is less than 210 mg/kg for the soil borings analyzed.
- The sulfate ion concentration is less than 210 mg/kg for the soil borings analyzed.
- The pH of the soil is greater than 7.6 for the soil borings analyzed.
- The soil is considered to be *non-corrosive* to reinforced concrete retaining walls and sound walls in accordance with the Guidelines.
- The project alignment is not located within 300 meters of brackish or saltwater.

RECOMMENDATIONS

Based on the test data and review of the project requirements, specific recommendations for each structural foundation material alternative are listed below:

Buried Reinforced Concrete Structures, Retaining Walls and Sound Walls

Buried concrete structures should be constructed of durable concrete as described in Section 8.22 of the Caltrans Bridge Design Specifications and ACI Standards 201.2R and 222R. These recommendations include, but are not limited to, the following:

- The water/cement ratio should not exceed 0.50.
- A concrete cover of a minimum of 5 centimeters should be applied over all steel reinforcement.
- Salt-free sand and potable water free of organic matter, oil and salts should be used. Chloride ion concentration shall not exceed 50 ppm and sulfate ion concentration shall not exceed 50 ppm.

Soil and Rock Anchors (Tieback Anchors, Tiedown Anchors and Soil Nails)

The Caltrans Structure Reference Specifications provide the following recommendations for corrosion protection of anchors and nails.

The individual strands of anchor tendon, except for the bonded length, shall be fully coated with corrosion inhibiting grease and then encapsulated by a smooth HDPE or polypropylene sheath. The corrosion inhibiting grease shall fill all space between strand wires and shall encapsulate the strand giving an encasement diameter at least 0.12-mm greater than the diameter of the bare strand. The sheath shall be hot melt extruded onto the strand or shall be shop applied by an approved method that assures that all spaces between the sheath and the strand and between the strand wires are filled with corrosion inhibiting grease.

The soil nail shall be either a reinforcing bar encapsulated full length in a grouted corrugated plastic sheathing or an epoxy coated reinforcing bar partially encapsulated in a grouted corrugated plastic sheathing. The bar shall be centered in the sheathing and the space between the sheathing and the bar shall be filled with grout. The epoxy coating shall have a minimum thickness of 305 μm.

Mechanically Stabilized Embankment Backfill

Fast setting concrete backfill may need to be used when placing culverts in existing roadways. When using an admixture to decrease concrete curing time, only non-chloride admixtures should be considered. Slag aggregate should not be used in backfill due to high sulfate concentrations.

Backfill for metallic soil reinforcement and reinforced concrete structures shall meet the following requirements:

- Minimum resistivity greater than 1,500 Ohm-cm.
- Water soluble chloride ion concentration less than 500 mg/kg.
- Water soluble sulfate ion concentration less than 2,000 mg/kg.
- A pH between 5.5 and 10.

TEST METHODS

In attempting to predict corrosion problems associated with a particular type of structure prior to installation, it is necessary to investigate the soil conditions the structure will encounter. Since corrosion is an electrochemical process accompanied by current flow, the electrochemical characteristics of a soil are of primary importance when evaluating corrosivity. Test methods utilized during this investigation reflect the most practical methods of evaluating corrosivity.

In-Situ Soil Resistivity

Resistivity of the soil was determined at 11 locations on the project alignment for the sound wall and retaining wall locations. Figure 1 shows the project vicinity map. Figure 2 shows the in-situ soil resistivity and soil boring locations.

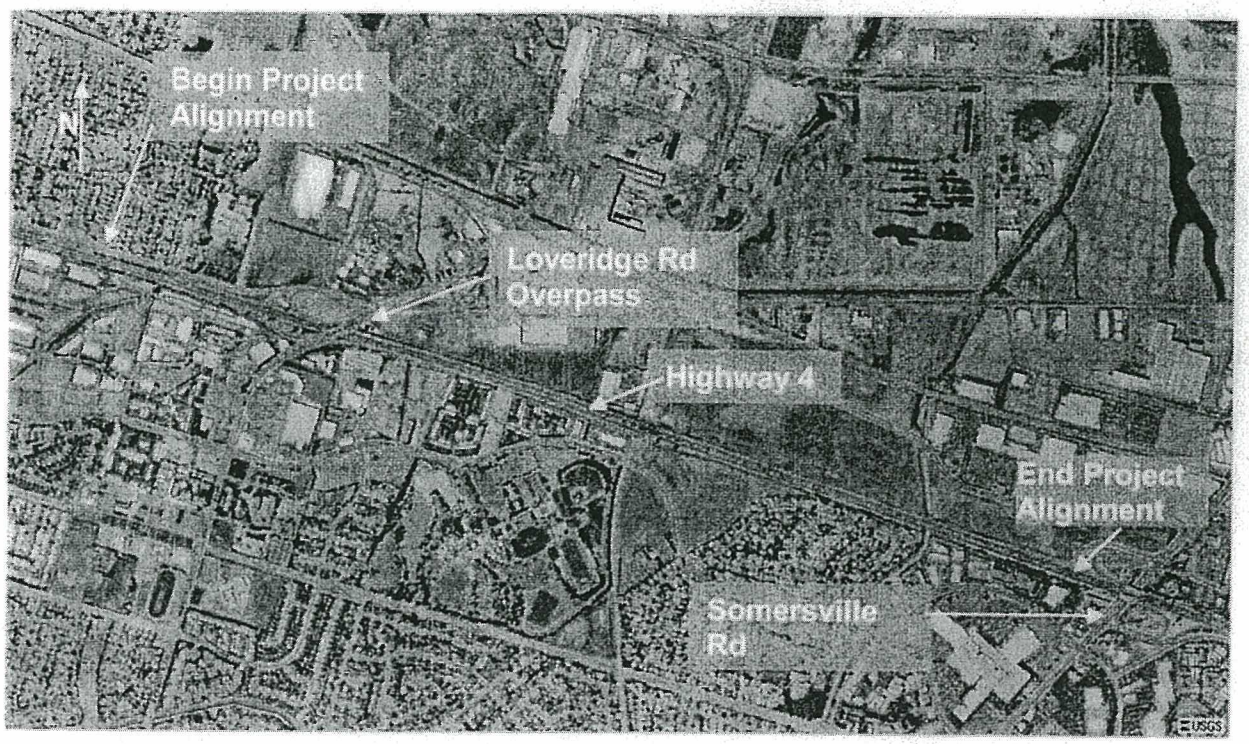
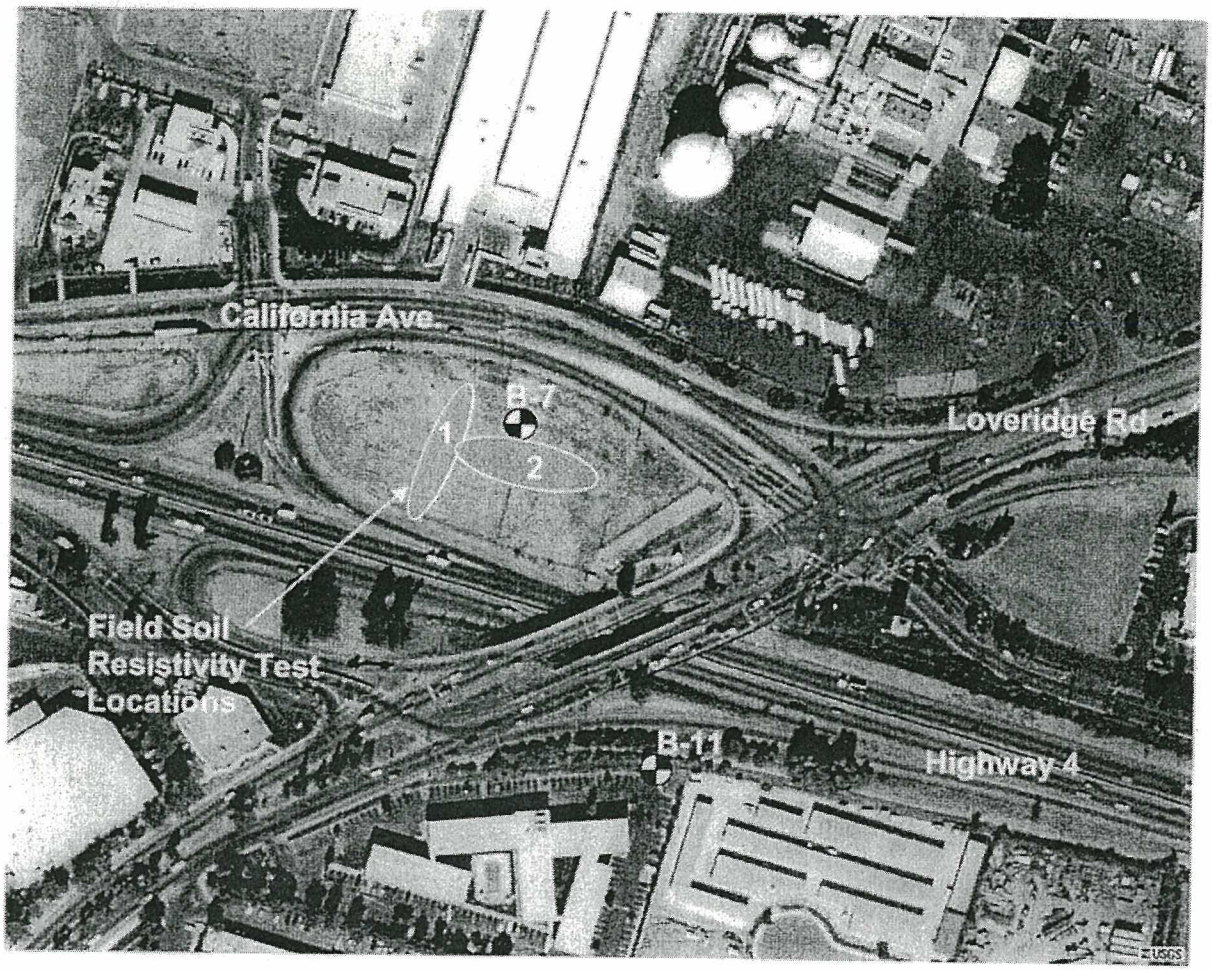


Figure 1 - Vicinity and Project Site Map[1]

[1] Map courtesy of the USGS TerraServer Team



In-Situ Soil Resistivity Location
Soil Boring Location

Figure 2 - Soil Resistivity Testing and Soil Sample Locations[2]

In-situ soil resistivity was determined using the Wenner 4-Electrode (Wenner) Method, with a Model 400 Soil Resistance Meter, manufactured by Nilsson Electrical Laboratory, Inc. The Wenner Method involves the use of four metal probes or electrodes, driven into the ground along a straight line, equidistant from each other, as shown in Figure 3.

[2] Map courtesy of the USGS TerraServer Team

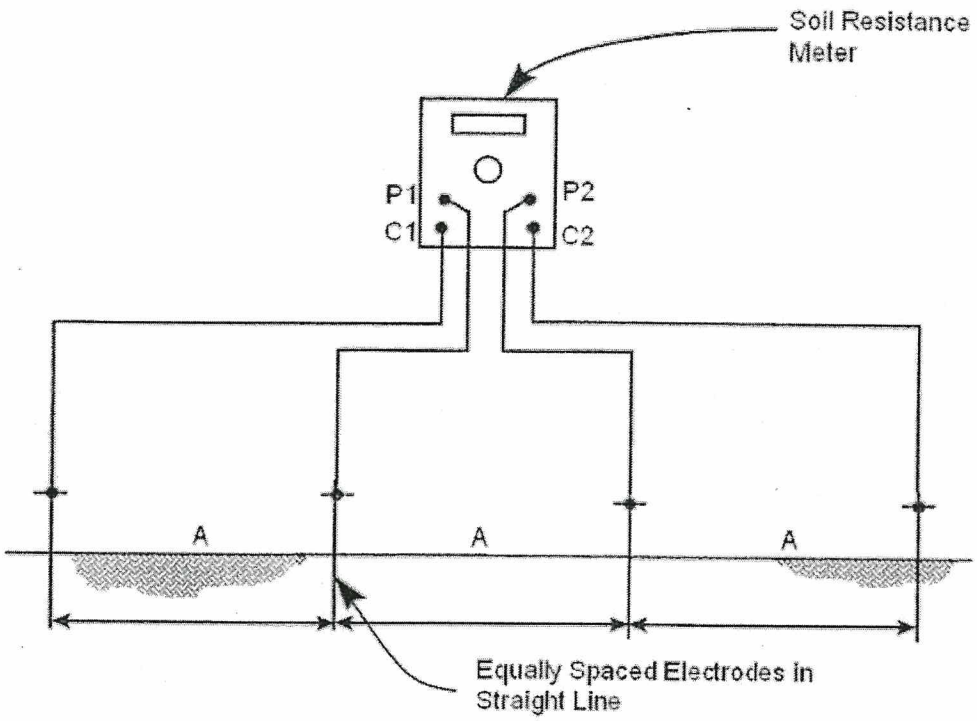


Figure 3 - Soil Resistivity Testing Using the Wenner 4-Electrode Method

An alternating current from the Soil Resistance Meter causes a current to flow through the soil between the outside electrodes, C1 and C2. Due to the resistance of the soil, the current creates a voltage gradient, which is proportional to the average resistance of the soil mass to a depth equal to the distance between electrodes. The voltage drop is then measured across pins, P1 and P2. Resistivity of the soil is then computed from the instrument reading according to the following formula:

$$\rho = 2 \cdot \pi \cdot A \cdot R$$

Where:

ρ	=	soil resistivity (ohm-cm)
A	=	distance between electrodes (cm)
R	=	soil resistance, instrument reading (ohms)
π	=	3.14 (approx.)

Soil resistance is measured with electrodes spaced at 1.5, 3, 4.5, and 6 meters. The resistivity values obtained represent the average resistivity of the soil to a depth equal to the electrode spacing. An additional method of calculating the soil resistivity using the data from the Wenner Method is the Barnes-Layer Resistivity Calculation. The Barnes Layer Calculation is used to determine the resistivity of the soil for each soil layer. While the Wenner Method at 3-meter electrode spacing will

consider all 3 meters of soil below the surface, the Barnes-Layer method will consider the resistivity of only the layer of soil between 1.5 and 3 meters below the surface. The calculations for this method are simplified by assuming the soil layers are a uniform thickness and parallel to the surface.

$$\rho_{b-a} = KR_{b-a} \qquad \text{and} \qquad \frac{1}{R_{b-a}} = \frac{1}{R_a} - \frac{1}{R_b}$$

Where:

ρ_{b-a}	=	Soil resistivity of layer depth b-a (ohm-cm)
a	=	Soil depth to top of layer (cm)
b	=	Soil depth to bottom of layer (cm)
R_a	=	Soil resistance read at depth a (ohms)
R_b	=	Soil resistance read at depth b (ohms)
R_{b-a}	=	Resistance of soil layer from a to b (cm)
K	=	Layer constant (cm)
	=	2 π (b-a)

Soil resistance is measured at electrode spacings of 1.5, 3, 4.5, and 6 meters. Barnes Layer resistivity is calculated for layers 0 to 1.5, 1.5 to 3, 3 to 4.5, and 4.5 to 6 meters below grade. The results of both methods are listed in Table 1.

To supplement the resistivity data obtained during field testing, soil borings were obtained from URS, for analysis of minimum soil resistivity using a soil box, as shown in Figure 4.

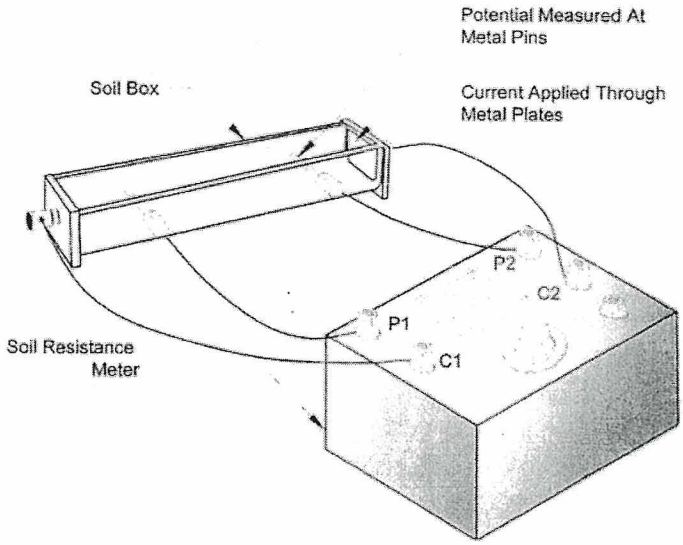


Figure 4 - Soil Resistivity Measurement Using the Soil Box Method

The soil box apparatus consists of a small plastic box with metal end plates. Dirt from the soil sample is tightly packed into the box and current is passed through the soil sample. The current

causes a voltage drop across the soil sample and soil resistivity is determined using the above referenced Soil Resistance Meter.

Soil samples were placed in the soil box and the soil resistivity was measured in the "as-received" state. Distilled water was added to the soil sample in 10-mL increments and the resistivity was measured after each watering. As the soil sample became more saturated, the soil resistivity decreased until the minimum soil resistivity was reached.

Laboratory Analysis of Soil

The soil samples with a minimum resistivity less than 1,000 ohm-cm were forwarded to Sequoia Analytical Laboratory in Sacramento, for water soluble chloride ion concentration, water soluble sulfate ion concentration and pH of the soil borings.

TEST RESULTS AND DISCUSSION

Data obtained during this investigation has been summarized in tabular form for analysis and presentation. Table 1 lists the results of the in-situ soil resistivity measurements conducted at the site. Table 2 lists the "as-received" and minimum soil resistivity for each sample collected as well as the chemical analysis of the sample. The locations of the soil samples and the in-situ resistivity test locations are shown on Figure 2.

In-Situ Soil Resistivity

Table 1 – Field Soil Resistivity Data

Station	Site	Depth (m)	Resistivity (ohm-cm)		Layer (m)	Station	Site	Depth (m)	Resistivity (ohm-cm)		Layer (m)
			At Depth	Layer					At Depth	Layer	
245 WB	1	1.5	2,585	2,585	0 – 1.5	266 EB	7	1.5	1,628	1,628	0 – 1.5
		3	2,107	1,777	1.5 – 3			3	1,130	865	1.5 – 3
		4.5	1,465	910	3 – 4.5			4.5	1,092	1,022	3 – 4.5
		6	919	434	4.5 – 6			6	1,187	1,611	4.5 – 6
251 EB	2	1.5	1,341	1,341	0 – 1.5	269 EB	8	1.5	1,149	1,149	0 – 1.5
		3	1,130	976	1.5 – 3			3	1,092	1,040	1.5 – 3
		4.5	1,120	1,102	3 – 4.5			4.5	1,207	1,528	3 – 4.5
		6	1,111	1,083	4.5 – 6			6	1,379	2,413	4.5 – 6
254 EB	3	1.5	1,053	1,053	0 – 1.5	269 WB	9	1.5	1,532	1,532	0 – 1.5
		3	785	626	1.5 – 3			3	1,092	848	1.5 – 3
		4.5	661	502	3 – 4.5			4.5	1,005	868	3 – 4.5
		6	613	503	4.5 – 6			6	766	447	4.5 – 6
254 WB	4	1.5	670	670	0 – 1.5	272 EB	10	1.5	1,724	1,724	0 – 1.5
		3	670	670	1.5 – 3			3	900	609	1.5 – 3
		4.5	776	1,131	3 – 4.5			4.5	776	608	3 – 4.5
		6	881	1,487	4.5 – 6			6	689	517	4.5 – 6
257 EB	5	1.5	1,053	1,053	0 – 1.5	272 WB	11	1.5	1,053	1,053	0 – 1.5
		3	823	676	1.5 – 3			3	823	676	1.5 – 3
		4.5	747	630	3 – 4.5			4.5	776	695	3 – 4.5
		6	728	676	4.5 – 6			6	651	440	4.5 – 6
257 WB	6	1.5	1,149	1,149	0 – 1.5						
		3	785	596	1.5 – 3						
		4.5	1,034	2,827	3 – 4.5						
		6	1,187	2,137	4.5 – 6						

Corrosion of a metal is an electro-chemical process and is accompanied by the flow of electric current. Resistivity is a measure of the ability of a soil to conduct an electric current and is an important parameter in consideration of corrosion data. Soil resistivity is primarily dependent upon the chemical content and moisture content of the soil mass. The greater the amount of chemical constituents present in the soil, the lower the resistivity will be. As moisture content increases, resistivity decreases until maximum solubility of dissolved chemicals is attained. Beyond this point, an increase in moisture content results in dilution of the chemical concentration and resistivity increases. The corrosion rate of

steel in soil normally increases as resistivity decreases. Therefore, in any particular group of soils, maximum corrosion will generally occur in the lowest resistivity areas.

Laboratory Analysis of Soil Samples

Table 2 – Soil Resistivity and Chemical Data

Sample	Depth (m)	Minimum Resistivity (ohm-cm)	pH	Chloride (mg/kg)*	Sulfate (mg/kg)*
B-11, 2-A	1.5	700	8.49	ND	ND
B-13A, 3-A	3	540	8.97	210	130
B-14	3	2,800	8.84	--	--
B-15, 3-A	3	670	8.53	ND	100
B-18, 3-A	3	760	9.09	ND	ND
B-19-3-A	3	1,200	8.68	--	--
B-20, 2 - 4	1	1,000	8.2	ND	ND
B-21, 2 - 2	1	2,300	7.6	-	-
B-24-3-A	3	870	8.79	ND	91
B-27-3-A	3	1,200	8.65	--	--
B-29-3-A	3	860	8.03	ND	110

* mg/kg – milligrams per kilogram

ND – Not Detected, below the detection level of 20 mg/kg.

Laboratory analysis was performed on soil borings provided to V&A. The testing included laboratory resistivity in the "as-found" and minimum (or saturated) condition. The minimum resistivity provides information about the soil during wet weather conditions. With the addition of distilled water to each sample, the minimum resistivity will decrease from the original "as-received" soil resistivity, in almost every instance. This decrease in soil resistivity, when saturated, indicates a possible influence from additional chemical constituents. This change can be attributed to the presence of chemicals in the "as-received" soil going into solution and providing a less resistive path for current flow.

A wide variety of soluble salts is typically found in soils. Two soils having the same resistivity may have significantly different corrosion characteristics, depending on the specific ions available. The major constituents that accelerate corrosion are chlorides, sulfates and the acidity (pH) of the soil. Chloride ions tend to break down otherwise protective surface deposits, and can result in corrosion of reinforcing steel in concrete structures. Sulfates in soil can be highly aggressive to portland

cement concrete by combining chemically with certain constituents of the concrete, principally tricalcium aluminate. This reaction is accompanied by expansion and eventual disruption of the concrete matrix.

Acidity, as indicated by the pH value, is another important factor of soil. The lower the pH (the more acidic the environment), the higher will be the corrosivity with respect to buried metallic and concrete structures. When in contact with portland cement concrete, acid will attack the exposed surface and be neutralized by the alkalinity of the concrete. As pH increases above 7 (the neutral value), conditions become increasingly more alkaline and passive to buried structures.

Appendix D

Response to Caltrans Review Comments

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

[X] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 12/14/05

FILE: 04 (District) CC (County) 4 (Route) 23.71/26.8 (PM)

SUB CONSULTANT: URS
PRIME CONSULTANT: URS
GENERAL PLAN DATED: 10/11/05 (structure Plan)
Report Date: 10/24/05
Contract No.:
FDN PLAN DATED: N/A
Structure Name: Ret Wall No 3A (Type I)
EA Number: 04-228501
Bridge Number: 28E - PEND

Submittal (*Check One*): [X] 1st [ ] 2nd [ ] 3rd [ ] 4th [ ] Other: Type Selection

Report

1. Section 5.4.2: Why was Boring B-13 not used to determine subsurface conditions?
2. Section 8.2.1: The controlling toe pressure should be determined per the latest Caltrans Standard Plans (July, 2004), and should be the maximum of the three loading conditions shown on the detail sheet, not from Case I. And since maximum design height is 5.5 m for the wall segments founded on spread footing, the unrelated information should be removed from the table.
3. Section 8.2.2: A minimum factor of safety of 3 should be used to determine the allowable pressure for load combination including dead and live loads. Revise allowable bearing capacity accordingly. If the allowable bearing capacity is not adequate for certain wall segments, pile foundation may be needed.
4. Section 8.2.2: The text states that 6-meter long pile are recommended, but the table right following the text specifies a length of 10.5 m. Please check and revise.
5. Section 8.2.2: A lateral sliding coefficient between 0.3 to 0.35 is more appropriate than 0.4 for the friction between concrete footing and stiff clay. Please revise.
6. Section 9.1.4: Please specify the depth of over excavation.
7. LOTBs:
   (1) Please add note to indicate the type of hammer used.
   (2) Location of borings should be presented as station and offset referencing to certain alignment line, not in the form of easting and northing.

REGISTERED PROFESSIONAL ENGINEER
CAROLINE JINXIA CHEN
No. C 62438
Exp. 9/30/07
CIVIL
STATE OF CALIFORNIA

[X] Special Funded Project (OSFP) [ ] Local Assistance Project (OSFP) [ ] OSCM Project

Approval: C3-Not Approved

OSFP/OSCM

Caroline Chen
Office of Geotechnical Design - West

cc: OGDx, Lab File Room (Sacramento) DES Specifications and Estimates (JStayton-4 copies) Structure Construction R.E. Pending File

Revised 05/04

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

☐ MR. EARL SEABERG, CHIEF, OSFP
☐ MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 12/14/05

FILE:

04	CC	4	23.71/26.8
District	County	Route	PM

Ret Wall No 3A (Type I)
Structure Name

04-228501	28E-PEND
EA Number	Bridge Number

(3) Please pay attention to the presentation of LOTBs. Grids showing elevation on the LOTB sheets should not strike through the text describing soil properties or the area showing field/lab record.

Plans

8. Sheet RW-5: Please show pile tip elevation for each wall segment. Pile layout plan should show pile spacing for each wall segment. The pile spacing shown for the first left segment (13 spaces @6878=20635) does not seem to be right.

General comments

9. Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.

SR4(E) Widening – Loveridge Road to Somersville road – EA 228501
Retaining Wall No 3A (Type I)

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	August 8, 2006
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	December 14, 2005		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 65% Retaining Wall No 3A (Type I)**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		Report				
1	**Section 5.4.2**	Why was Boring B-13 not used to determine the subsurface conditions?	Subsurface conditions will not be based on Borings B-12 and B-13.	A		A
2	**Section 8.2.1**	The controlling toe pressure should be determined per the latest Caltrans Standard Plans (July, 2004), and should be the maximum of the three loading conditions shown on the detail sheet, not from case I. And since maximum design height is 5.5 m for the wall segments founded on spread footing, the unrelated information should be removed from the table.	Will revise the toe pressures to reflect the maximum design height accordingly.	A		A
3	**Section 8.2.2**	A minimum factor of safety of 3 should be used to determine the allowable pressure for load combination including dead and live loads. Revise allowable bearing capacity accordingly. If the allowable bearing capacity is not adequate for certain wall segments, pile foundation may be needed.	Will perform supplemental analysis to revise the allowable bearing pressure using a Factor of Safety of 3.	A		A
4	**Section 8.2.2**	The text states that 6-meter long pile are recommended, but the table right following the text specifies a length of 10.5 m. Please check and revise.	The correct pile length is 10.5 m.	A		A
5	**Section 8.2.2**	A lateral sliding coefficient between 0.3 to 0.35 is more appropriate than 0.4 for the friction between concrete footing and stiff clay. Please revise.	Will revise the coefficient of base friction to 0.35.	A		A
6	**Section 9.1.4**	Please specify the depth of over excavation.	Subex depth for Retaining Wall 3A should be the same as 2A and 2B (1.2 m). Will revise the text to add 3A.	A		A
7		**LOBTs**				

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	August 8, 2006
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	December 14, 2005		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 65% Retaining Wall No 3A (Type I)**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		(1) Please add note to indicate the type of hammer used.	We concur and will address the comment in the next submittal.	A		A
		(2) Location of borings should be presented as station and offset referencing to certain alignment line, not in the form of easting and northing.	We concur and will address the comment in the next submittal.	A		A
		(3) Please pay attention to the presentation of LOTBs. Grids showing elevation on the LOTB sheets should not strike through the text describing soil properties or the area showing field/lab record.	We concur and will address the comment in the next submittal.	A		A
		Plans				
8		Sheet RW-5: Please show pile tip elevation for each wall segment. Pile layout plan should show pile spacing for each wall segment. The pile spacing shown for the first left segment (13 spaces @6878=20635) does not seem to be right.	We concur and will address the comment in the next submittal.	A		A
		General comments				
9		Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.	We concur and will attach our responses to Caltrans comments in the next submittal.	A		A

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

[x] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 12/14/05

FILE: 04 (District) CC (County) 4 (Route) 23.71/26.8 (PM)

SUB CONSULTANT: URS
PRIME CONSULTANT: URS
GENERAL PLAN DATED: 10/11/05 (structure Plan)
Report Date: 10/24/05
Contract No.:
FDN PLAN DATED: N/A
Ret Wall No 3B, 4 & 5 (MSE) (Structure Name)
04-228501 (EA Number)
28E - PEND (Bridge Number)

Submittal (*Check One*): [X] 1st [ ] 2nd [ ] 3rd [ ] 4th [ ] Other: Type Selection

Report

1. Section 8.3.4: What is the factor of safety used to determine the allowable bearing capacity for the load combination including dead and live load? A minimum factor of safety of 3 should be used to determine the allowable pressure for load combination including dead and live loads.
2. Section 8.5.1: What is the steel shell thickness? The nominal compression resistance shown on the table is different from the value shown on the Plans. Please check and revise. The value of nominal resistance should be rounded up to the nearest 50 kN and designed for accordingly.
3. Section 8.3.4: A lateral sliding coefficient between 0.3 to 0.35 is more appropriate than 0.4 for the friction between MSE backfill and stiff clay. Please revise.
4. Section 9.1.4: Please specify the depth of over excavation for Retaining Wall 3B.
5. LOTBs:
   (1) Please add note to indicate the type of hammer used.
   (2) Location of borings should be presented as station and offset referencing to certain alignment line, not in the form of easting and northing.
   (3) Please pay attention to the presentation of LOTBs. Grids showing elevation on the LOTB sheets should not strike through the text describing soil properties or the area showing field/lab record.

REGISTERED PROFESSIONAL ENGINEER
CAROLINE JINXIA CHEN
No. C 62438
Exp. 9/30/07
CIVIL
STATE OF CALIFORNIA

[x] Special Funded Project (OSFP) [ ] Local Assistance Project (OSFP) [ ] OSCM Project

Approval: C3-Not Approved

OSFP/OSCM

Caroline Chen
Office of Geotechnical Design - West

cc: OGDx, Lab File Room (Sacramento) DES Specifications and Estimates (JStayton-4 copies) Structure Construction R.E. Pending File

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

☐ MR. EARL SEABERG, CHIEF, OSFP
☐ MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 12/14/05

FILE:

04	CC	4	23.71/26.8
District	County	Route	PM

Ret Wall No 3B, 4 & 5 (MSE)
Structure Name

04-228501	28E-PEND
EA Number	Bridge Number

Plans

6. Sheet RW-23, Wall 4: Please show pile tip elevation for each wall segment. Pile type should be specified in the form of pile outside diameter by steel shell thickness. Pile length should be specified separately or just reflected by pile tip elevation. Nominal resistance should be rounded up to the nearest 50 kN.

General comments:

7. Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	August 8, 2006
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	December 14, 2005		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 65% Retaining Wall No 3B, 4 and 5**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		Report				
1	**Section 8.3.4**	What is the factor of safety used to determine the allowable bearing capacity for the load combination including dead and live loads? A minimum factor of safety of 3 should be used to determine the allowable pressure for load combination including dead and live loads.	Will perform supplemental analysis to revise the allowable bearing pressure using a Factor of Safety of 3.	A		A
2	**Section 8.5.1**	What is the steel shell thickness? The nominal compression resistance shown on the table is different form the value shown on the Plans. Please check and revise. The value of nominal resistance should be rounded up to the nearest 50 kN and designed for accordingly.	We concur and will address the comment in the next submittal.	A		A
3	**Section 8.3.4**	A lateral sliding coefficient between 0.3 to 0.35 is more appropriate than 0.4 for the friction between MSE backfill and stiff clay. Please revise.	Will revise the coefficient of base friction to 0.35.	A		A
7		**LOBTs**				
		(1) Please add note to indicate the type of hammer used.	We concur and will address the comment in the next submittal.	A		A
		(2) Location of borings should be presented as station and offset referencing to certain alignment line, not in the form of easting and northing.	We concur and will address the comment in the next submittal.	A		A
		(3) Please pay attention to the presentation of LOTBs. Grids showing elevation on the LOTB sheets should not strike through the text describing soil properties or the area showing field/lab record.	We concur and will address the comment in the next submittal.	A		A
		Plans				

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	August 8, 2006
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	December 14, 2005		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 65% Retaining Wall No 3B, 4 and 5**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
8	**Sheet RW-23, Wall 4**	Please show pile tip elevation for each wall segment. Pile type should be specified in the form of pile outside diameter by steel shell thickness. Pile length should be specified separately or just reflected by pile tip elevation. Nominal resistance should be rounded up to the nearest 50 kN.	We concur and will address the comment in the next submittal.	A		A
		General comments				
9		Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.	We concur and will attach our response to Caltrans comments in the next submittal.	A		A

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

[x] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 10/3/06

FILE: 04 (District) CC (County) 4 (Route) 23.71/26.8 (PM)

SUB CONSULTANT: URS
PRIME CONSULTANT: URS
GENERAL PLAN DATED: 8/1/06 (structure Plan)
Report Date: 10/24/05
Contract No.:
FDN PLAN DATED: 8/8/06
Retaining Wall No 3A (Type I) (Structure Name)
04-228501 (EA Number)
28 - E0020 (Bridge Number)

Submittal (*Check One*): [ ] 1st [X] 2nd [ ] 3rd [ ] 4th [ ] Other: Type Selection

Report

1. Sections 5.4.2 and 8.2.2 (Pile Data Table): Recommended piles tips are deeper than the boring depth of B-13A. Subsurface condition below the exploration depth of Boring B-13A but within pile tips and the zone required for pile capacity analysis should be described based on other borings that are deep enough and located close enough to the proposed wall, if available. Please include and refer to these borings. More subsurface exploration is required if no such borings are available. Recommended pile tips should be examined based on these borings.

Plans

2. Sheet RW-5, Pile Data Table: Please identify each wall segment with station, bottom of footing elevations, or any appropriate character.
3. Please include LOTBs for the borings commented above.

General comments

4. Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.

REGISTERED PROFESSIONAL ENGINEER
CAROLINE JINXIA CHEN
No. C 62438
Exp. 9/30/07
CIVIL
STATE OF CALIFORNIA

[x] Special Funded Project (OSFP) [ ] Local Assistance Project (OSFP) [ ] OSCM Project

Approval: C3- Not Approved

OSFP/OSCM

Caroline Chen
Office of Geotechnical Design - West

cc: OGDx, Lab File Room (Sacramento) DES Specifications and Estimates (JStayton-4 copies) Structure Construction R.E. Pending File

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	January 31, 2007
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	October 3, 2006		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 95% Retaining Wall No 3A (Type I)**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; C-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		Report				
1	**Sections 5.4.2 and 8.2.2**	Recommended pile tips are deeper than the boring depth of B-13A. Subsurface condition below the exploration depth of Boring B-13A but within pile tips and the zone required for pile capacity analysis should be described based on other borings that are deep enough and located close enough to the proposed wall, if available. Please include and refer to these borings. More subsurface exploration is required if no such borings are available. Recommended pile tips should be examined based on these borings.	Subsurface conditions were also developed based on B-12 and B-13. Reference to these two borings is included to Section 5.4.2 of the report. Subsurface conditions are consistent as previously described.	A		A
		Plans				
2	**Sheet RW-5**	Pile Data Table: Please identify each wall segment with station, bottom of footing elevations, or any appropriate character.	We concur. Response to comment is incorporated in the revised plan.	A		A
3		Please include LOTBs for the borings commented above.	LOTB for B-12 and B-13 were incorporated in the previous submittal.	A		A
		General comments				
4		Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.	We concur and will attach our responses to Caltrans comments in the next submittal.	A		A

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

[x] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 10/3/06

FILE: 04 (District) CC (County) 4 (Route) 23.71/26.8 (PM)

SUB CONSULTANT: URS
PRIME CONSULTANT: URS
GENERAL PLAN DATED: 8/1/06
Report Date: 8/8/2006
Contract No.:
FDN PLAN DATED: N/A
Structure Name: Retaining Wall #3B (MSE)
EA Number: 04-228501
Bridge Number: 28-E0021

Submittal (*Check One*): [ ] 1st [x] 2nd [ ] 3rd [ ] 4th [ ] Other:

Report

1. Section 8.3: One of the requirements specified by the Report for the backfill material is internal friction angle of not less than 34 degrees. How can this requirement be tested before construction?
2. Please address the impact of the proposed MSE wall on the existing underlying utilities, e.g., 900mm RCP Sewer near Station 12+80, 200 mm RCP Sewer near Station 13+40, and water lines near Station 18+80, and make remediation recommendations if necessary.

General comments

3. Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.

REGISTERED PROFESSIONAL ENGINEER
CAROLINE JINXIA CHEN
No. C 62438
Exp. 9/30/07
CIVIL
STATE OF CALIFORNIA

[x] Special Funded Project (OSFP) [ ] Local Assistance Project (OSFP) [ ] OSCM Project

Approval: C3 –Not Approved

OSFP/OSCM

Caroline Chen
Office of Geotechnical Design - West

cc: OGDx, Lab File Room (Sacramento) DES Specifications and Estimates (JStayton-4 copies) Structure Construction R.E. Pending File

Revised 05/04

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	January 31, 2007
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	October 3, 2006		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 95% Retaining Wall No 3B (MSE)**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		Report				
1	**Section 8.3**	One of the requirements specified by the Report for the backfill material is internal friction angle of not less than 34 degrees. How can this requirement be tested before construction?	We concur. Specify backfill material in accordance with Caltrans Standard Specifications.	A		A
2		Please address the impact of the proposed MSE wall on the existing underlying utilities, e.g., 900mm RCP Sewer near Station 12+80, 200RCP Sewer near Station 13+40, and water lines near Station 18+80, and make remediation recommendations if necessary.	We concur. Response to comment is incorporated in Section 9.1.2.	A		A
		General comments				
3		Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.	We concur and will attach our responses to Caltrans comments in the next submittal.	A		A

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

[x] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 12/28/06

FILE: 04 (District) CC (County) 4 (Route) 23.71/26.8 (PM)

SUB CONSULTANT: URS
PRIME CONSULTANT: URS
GENERAL PLAN DATED: 8/1/06
Report Date: 8/8/2006
Contract No.:
FDN PLAN DATED: 8/8/06
Structure Name: Retaining Wall #4 (MSE)
EA Number: 04-228501
Bridge Number: 28-E0022

Submittal (*Check One*): [X] 1st [ ] 2nd [ ] 3rd [ ] 4th [ ] Other:

Report

1. What is the bearing capacity recommended? Please specify it in the Report.
2. Is table showing maximum bearing pressure for Alternative 2 also applicable for Alternative 1? If so, change wording and table title accordingly.
3. Section 8.3: One of the requirements specified by the Report for the backfill material is internal friction angle of more than 34 degrees. How can this requirement tested before construction?
4. Section 8.5.1: The nominal capacity shown on Plans is 96 kN, and pile diameter 305 mm, which are inconsistent with those presented in the Report. Please check and revise.
5. Is the lateral pressure from embedded cast-in-place piles taken into consideration by the structure designer when designing the wall, especially the face panels and the reinforcements that connect to the influenced panels?
6. LOTBs:
   (1) Please add note that reads "Groundwater was not encountered" if so.
   (2) Boring B-20 has two groundwater labels. Remove the wrong one.

Plans

7. The system without piles, named Alternative 1 in the Report, is considered more cost effective and easier for construction and thus recommended by the Report. Why does Plans decide to choose the other alternative?

REGISTERED PROFESSIONAL ENGINEER
CAROLINE JINXIA CHEN
No. C 62438
Exp. 9/30/07
CIVIL
STATE OF CALIFORNIA

[x] Special Funded Project (OSFP) [ ] Local Assistance Project (OSFP) [ ] OSCM Project

Approval: C3 – Not Approved

OSFP/OSCM

Caroline Chen
Office of Geotechnical Design - West

cc: OGDx, Lab File Room (Sacramento) DES Specifications and Estimates (JStayton-4 copies) Structure Construction R.E. Pending File

Revised 05/04

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

[x] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 09/28/06

FILE:

04	CC	4	23.71/26.8
District	County	Route	PM

Retaining Wall #4 (MSE)
Structure Name

04-228501	28-E0022
EA Number	Bridge Number

8. Structure Plans shows an allowable bearing pressure of 200 kPa, which is not provided in the Report. Please refer to the above-related comment and revise accordingly.
9. Foundation Plan: Please show specified pile length in the Pile Data Table. Pile size shown differs from Report. Please check and revise accordingly.

General comments

10. Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	January 31, 2007
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	December 28, 2006		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 95% Retaining Wall No 4 (MSE)**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; C-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		Report				
1		What is the bearing capacity recommended? Please specify in the Report.	Bearing capacity for RW-4 is 200 kPa (as for RW-3B and RW-5). Response to comment is incorporated in Section 8.3.4.	A		A
2		Is table showing maximum bearing pressure for Alternative 2 also applicable for Alternative 1? If so, change wording and table title accordingly.	The table title is corrected.	A		A
* 3	**Section 8.3**	One of the requirements specified by the Report for the backfill material is internal friction angle of more than 34 degrees. How can this requirement be tested before construction?	We concur. Specify backfill material in accordance with Caltrans Standard Specifications.	A		A
4	**Section 8.5.1**	The nominal capacity shown on Plans is 96 kN, and pile diameter 305mm, which are inconsistent with those presented in the Report. Please check and revise.	We concur. Response to comment is incorporated in the revised plan.	A		A

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	January 31, 2007
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	December 28, 2006		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 95% Retaining Wall No 4 (MSE)**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; C-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
5		Is the lateral pressure from embedded cast-in-place piles taken into consideration by the structure designer when designing the wall, especially the face panels and the reinforcements that connect to the influenced panels?	Lateral pressure from embedded cast-in-place piles was taken into consideration by increasing the length of the soil reinforcement (weled-wire mat) as discussed in Section 8.3.4.	A		A
		LOTBs				
6		(1) Please add note that reads "Groundwater was not encountered" if so.	We concur. Response to comment is incorporated in the revised plan.	A		A
		(2) Boring B-20 has two groundwater levels. Remove the wrong one.	Additional groundwater level was read after the soil boring was completed.	A		A
		Plans				

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	January 31, 2007
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	December 28, 2006		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 95% Retaining Wall No 4 (MSE)**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; C-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
7		The system without piles, named Alternative 1 in the Report, is considered more cost effective and easier for construction and thus recommended by the Report. Why does Plans decide to choose the other alternative?	The system without piles requires that length of sound wall footing be lengthen to more than the typical Caltrans standard sound wall details. Caltrans requested to use Caltrans Standard with shorter base.	D		D
8		Structure plans shows an allowable bearing pressure of 200 kPa, which is not provided in the Report. Please refer to the above-related comment and revise accordingly.	See response to comment #1.	A		A
9		Foundation Plan: Please show specified pile length in the Pile Data Table. Pile size shown differs from Report. Please check and revise accordingly.	We concur. Response to comment is incorporated in the revised plan.	A		A
		General comments				
10		Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.	We concur and will attach our responses to Caltrans comments in the next submittal.	A		A

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

[x] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 10/3/06

FILE:

04	CC	4	23.71/26.8
District	County	Route	PM

SUB CONSULTANT: URS
PRIME CONSULTANT: URS
GENERAL PLAN DATED: 8/1/06
Report Date: 8/8/2006
Contract No.:
FDN PLAN DATED: N/A
Structure Name: Retaining Wall #5 (MSE)
EA Number: 04-228501
Bridge Number: 28-E0023

Submittal (*Check One*): [ ] 1st [x] 2nd [ ] 3rd [ ] 4th [ ] Other:

Report

1. Section 8.3: One of the requirements specified by the Report for the backfill material is internal friction angle of not less than 34 degrees. How can this requirement be tested before construction?
2. Foundation for CMS sign post: What are pile lateral capacity and lateral demand at 12.5 mm (0.5 inch) deflection at top of pile?

General comments

3. Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.

REGISTERED PROFESSIONAL ENGINEER
CAROLINE JINXIA CHEN
No. C 62438
Exp. 9/30/07
CIVIL
STATE OF CALIFORNIA

[x] Special Funded Project (OSFP) [ ] Local Assistance Project (OSFP) [ ] OSCM Project

Approval: C2 –Approved subject to verification

OSFP/OSCM

Caroline Chen
Office of Geotechnical Design - West

cc: OGDx, Lab File Room (Sacramento) DES Specifications and Estimates (JStayton-4 copies) Structure Construction R.E. Pending File

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	January 31, 2007
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	October 3, 2006		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 95% Retaining Wall No 5 (MSE)**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		Report				
1	**Section 8.3**	One of the requirements specified by the Report for the backfill material is internal friction angle of more than 34 degrees. How can this requirement be tested before construction?	We concur. Specify backfill material in accordance with Caltrans Standard Specifications.	A		A
2		Foundation for CMS sign post: What are pile lateral capacity and lateral demand at 12.5mm (0.5inch) deflection at top of pile?	Pile lateral capacity at 12.5 mm deflection at top of pile is provided Section 8.3.4.	A		A
		General comments				
3		Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.	We concur and will attach our responses to Caltrans comments in the next submittal.	A		A

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

[x] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 3/16/07

FILE: 04 (District) CC (County) 4 (Route) 23.71/26.8 (PM)

SUB CONSULTANT: URS
PRIME CONSULTANT: URS
GENERAL PLAN DATED: 2/16/07 (structure Plan)
Report Date: 2/28/07
Contract No.:
FDN PLAN DATED: 2/16/07

Retaining Wall No 3A (Type I) (Structure Name)
04-228501 (EA Number)
28 - E0020 (Bridge Number)

Submittal (*Check One*): [ ] 1st [ ] 2nd [X] 3rd [ ] 4th [ ] Other:

Report

1. Sections 5.4.2 and 8.2.2 (Pile Data Table): Recommended piles tips are deeper than the boring depth of B-12, B-13, and B-13A. Please include other borings that are deep enough and located close enough to the proposed wall, if available. More subsurface exploration is required if no such borings are available. Recommended pile tips should be examined based on these borings.
2. Section 5.4.2 mentioned that no groundwater was encountered in Boring B-13A. How about the other borings used to determine the site conditions?

Plans

3. Sheet RW-5, Pile Data Table: Please specify pile tip elevation for each particular bottom of footing elevation, or specify pile length instead of pile tip elevation for a segment of wall founded on step footings. Note that same pile tip elevation for footings with slightly different bottom elevations will lead to slightly different pile length, which will only cause unnecessary complication in pile fabrication and field identification.

General comments

4. Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.

REGISTERED PROFESSIONAL ENGINEER
CAROLINE JINXIA CHEN
No. C 62438
Exp. 9/30/07
CIVIL
STATE OF CALIFORNIA

[x] Special Funded Project (OSFP) [ ] Local Assistance Project (OSFP) [ ] OSCM Project

Approval: C3- Not Approved

OSFP/OSCM

Caroline Chen
Office of Geotechnical Design - West

cc: OGDx, Lab File Room (Sacramento) DES Specifications and Estimates (JStayton-4 copies) Structure Construction R.E. Pending File

Revised 05/04

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	May 10, 2007
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	March 16, 2007		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 95% Retaining Wall No 3A (Type I)**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		Report				
1	**Sections 5.4.2 and 8.2.2**	Recommended pile tips are deeper than the boring depth of B-12, B-13, and B-13A. Please include other borings that are deep enough and located close enough to the proposed wall, if available. More subsurface exploration is required if no such borings are available. Recommended pile tips should be examined based on these borings.	Subsurface conditions were also developed based on boring B-9 that extended to about the Elevation -12.83 m. Reference to this two boring is included to Section 5.4.2 of the report. Subsurface conditions are consistent as previously described.	A		A
2	**Section 5.4.2**	Section 5.4.2 mentioned that no groundwater was encountered in Boring B-13A. How about the other borings used to determine the site conditions?	Groundwater was not encountered in borings B-12, B-13, and B-13A at the time of drilling. Groundwater was not measured in boring B-9 due to rotary wash drilling method.	A		A

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	May 10, 2007
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	March 16, 2007		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 95% Retaining Wall No 3A (Type I)**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		Plans				
3	**Sheet RW-5**	Pile Data Table: Please specify pile tip elevation for each particular bottom of footing elevation, or specify pile length instead of pile tip elevation for a segment of wall founded on step footings. Note that same pile tip elevation for footings with slightly different bottom elevation will lead to slightly different pile length, which will only cause unnecessary complication in pile fabrication and field identification.	We concur and will specify pile tip elevations for each particular bottom of footing elevation. Response to comment is incorporated in the revised plan.	A		A
		General comments				
4		Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.	We concur and will attach our responses to Caltrans comments in the next submittal.	A		A

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

[x] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 3/16/07

FILE:

04	CC	4	23.71/26.8
District	County	Route	PM

SUB CONSULTANT: URS
PRIME CONSULTANT: URS
GENERAL PLAN DATED: 2/16/07
Report Date: 2/28/07
Contract No.:
FDN PLAN DATED: N/A

Retaining Wall #3B (MSE)
Structure Name

04-228501
EA Number

28-E0021
Bridge Number

Submittal (*Check One*): [ ] 1st [ ] 2nd [X] 3rd [ ] 4th [ ] Other:

1. Responses are acceptable.

REGISTERED PROFESSIONAL ENGINEER
CAROLINE JINXIA CHEN
No. C 62438
Exp. 9/30/07
CIVIL
STATE OF CALIFORNIA

[X] Special Funded Project (OSFP) [ ] Local Assistance Project (OSFP) [ ] OSCM Project

Approval: C1 – Approved

OSFP/OSCM

Caroline Chen
Office of Geotechnical Design - West

cc: OGDx, Lab File Room (Sacramento) DES Specifications and Estimates (JStayton-4 copies) Structure Construction R.E. Pending File

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

[x] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 3/16/07

FILE: 04 (District) CC (County) 4 (Route) 23.71/26.8 (PM)

SUB CONSULTANT: URS
PRIME CONSULTANT: URS
GENERAL PLAN DATED: 2/16/07
Report Date: 2/28/07
Contract No.:
FDN PLAN DATED: 2/16/07
Retaining Wall #4 (MSE) (Structure Name)
04-228501 (EA Number)
28-E0022 (Bridge Number)

Submittal (*Check One*): [ ] 1st [x] 2nd [ ] 3rd [ ] 4th [ ] Other:

Report

1. Section 8.3.4: Under Alternative 1 it is recommended to increase the length of the sound wall footing from the current design of 1800 mm to 3000 mm. Should "length" be "width"?
2. Section 8.5.1: The nominal capacity shown on Plans (98kN) is inconsistent with that presented in the Report (48kN). Please check and revise.

Plans

3. Foundation Plan: Pile type shown on Pile Data Table is CISS PP 350x600. Should "600" be "6.00"?

General comments

4. Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.

REGISTERED PROFESSIONAL ENGINEER
CAROLINE JINXIA CHEN
No. C 62438
Exp. 9/30/07
CIVIL
STATE OF CALIFORNIA

[x] Special Funded Project (OSFP) [ ] Local Assistance Project (OSFP) [ ] OSCM Project

Approval: C2 – Approved subject to verification

OSFP/OSCM

Caroline Chen
Office of Geotechnical Design - West

cc: OGDx, Lab File Room (Sacramento) DES Specifications and Estimates (JStayton-4 copies) Structure Construction R.E. Pending File

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	May 10, 2007
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	March 16, 2007		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to 95% Retaining Wall No 4 (MSE)**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		Report				
1	**Section 8.3.4**	Under Alternative 1 it is recommended to increase the length of the sound wall footing from the current design of 1800 mm to 3000 mm. Should "length" be "width"?	We concur. Response to comment is incorporated in Section 8.3.4.	A		A
2	**Section 8.5.1**	The minimal capacity shown on Plans (98kN) is inconsistent with that presented in the Report (48kN). Please check and revise.	The minimal capacity presented in the report is correct. Response to comment is incorporated in the revised plan.	A		A
		Plans				
3	**Foundation Plan**	Pile type shown on Pile Data Table is CISS PP 350x600. Should "600" be 6.00"?	We concur. Response to comment is incorporated in the revised plan.	A		A
		General comments				
4		Caltrans comments and responses to comments should be attached to the Report in the subsequent submittals.	We concur and will attach our responses to Caltrans comments in the next submittal.	A		A

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

[X] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 3/16/07

FILE:

04	CC	4	23.71/26.8
District	County	Route	PM

SUB CONSULTANT: URS
PRIME CONSULTANT: URS
GENERAL PLAN DATED: 2/16/07
Report Date: 2/28/07
Contract No.:
FDN PLAN DATED: N/A

Retaining Wall #5 (MSE)
Structure Name

04-228501
EA Number

28-E0023
Bridge Number

Submittal (*Check One*): [ ] 1st [ ] 2nd [X] 3rd [ ] 4th [ ] Other:

1. Responses are acceptable.

REGISTERED PROFESSIONAL ENGINEER
CAROLINE JIAXIA CHEN
No. C 62438
Exp. 9/30/07
CIVIL
STATE OF CALIFORNIA

[X] Special Fundec Project (OSFP) [ ] Local Assistance Project (OSFP) [ ] OSCM Project

Approval: C1 –Approved

OSFP/OSCM

Caroline Chen
Office of Geotechnical Design - West

cc: OGDx, Lab File Room (Sacramento) DES Specifications and Estimates (JStayton-4 copies) Structure Construction R.E. Pending File

Revised 05/04

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

[X] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 6/20/07

FILE: 04 (District) CC (County) 4 (Route) 23.71/26.8 (PM)

SUB CONSULTANT: URS
PRIME CONSULTANT: URS
GENERAL PLAN DATED: 5/10/07 (structure Plan)
Report Date: 5/10/07
Contract No.:
FDN PLAN DATED: 5/10/07

Retaining Wall No 3A (Type I) — Structure Name
04-228501 — EA Number
28 - E0020 — Bridge Number

Submittal (*Check One*): [ ] 1st [ ] 2nd [ ] 3rd [X] 4th [ ] Other:

Plans

1. Sheet RW-5: It seems there is typo in the text defining the first segment of the wall: "9+39+700" should be "9+39.700?"
2. The change of the pile data table does not address the previous comments to avoid slight difference in pile length which may cause unnecessary complication in pile fabrication and field identification. The pile length recommended in the Foundation Report for the entire wall is 10.5m. The pile length for each segment based on the pile tip elevation presented on the Plans sheet is 10.475, 10.575, 10.675, 10.575, 10.55, 10.59m, respectively. These values are in line with the foundation recommendation. But they complicate the pile fabrication by requiring manufacturer to produce piles with very slight difference, while they could and actually should be the same. Plans should specify the pile tip elevations in such a way that pile length will come up the same for all segments.

REGISTERED PROFESSIONAL ENGINEER
CAROLINE JINXIA CHEN
No. C 62438
Exp. 7/30/07
CIVIL
STATE OF CALIFORNIA

[X] Special Funded Project (OSFP) [ ] Local Assistance Project (OSFP) [ ] OSCM Project

Approval: C2- Approved subject to verification

OSFP/OSCM

Caroline Chen
Office of Geotechnical Design - West

cc: OGDx, Lab File Room (Sacramento) DES Specifications and Estimates (JStayton-4 copies) Structure Construction R.E. Pending File

Revised 05/04

SR4(E) Widening – Loveridge Road to Somersville Road – EA 228591
Retaining Wall No 3A (Type I)

Agency:	CALTRANS	**Responded By:**	URS
Review Unit:	Geotechnical	**Date Responded:**	November 9, 2007
Comments By:		**JRT Meeting Date:**	
Date Reviewed:	June 20, 2007		

TECHNICAL COMMENT REVIEW AND RESPONSE

Title:	Submittal: **Comments to Retaining Wall No 3A (Type I)**	

Revision Action Code: **A**-Will Comply; **B**-Consultant to Evaluate; **C**-Will Not Incorporate; **D**-CCTA to Evaluate

Item No.	Drawing or Page No.	Review Comments	Design Responses	Revision Action	JRT Disp.	Final Disp.
		Plans				
1	**Sheet RW-5**	It seems there is type in the text defining the first segment of the wall: "9+39+700" should be "9+39.700"?	We concur. Response to comment is incorporated in the revised plan.	A		A
2		The change of the pile data table does not address the previous comments to avoid slight difference in pile length which may cause unnecessary complication in pile fabrication and field identification. The pile length recommended in the Foundation Report for the entire wall is 10.5 m. The pile length for each segment based on the pile tip elevation presented on the Plans sheet is 10.475, 10.575, 10.675, 10.575, 10.55, 10.59m, respectively. These values are in line with the foundation recommendation. But they complicate the pile fabrication by requiring manufacturer to produce piles with very slight difference, while they could and actually should be the same. Plans should specify the pile tip elevations in such a way that pile length will come up the same for all segments.	We concur. Pile tip elevations in the pile data table on Sheet RW-5 were revised to main the pile length of 10.5 m.	A		A

FOUNDATION REPORT

EAST CONTRA COSTA TRANSIT DEVELOPMENT

eBART – Retaining Walls in the Median

Loveridge Interchange Project

(KP37.9-41.3)

PITTSBURG, CALIFORNIA

For

PGH WONG ENGINEERS

300 Lakeside Drive, 21st Floor

Oakland, California

PARIKH CONSULTANTS, INC.

1243 Alpine Road, Suite 110

Walnut Creek, CA 94596

(925) 933-6336

July 2008 Job No. 205124.10

PARIKH
Practicing in the Geosciences

Geotechnical ■
Environmental ■
Materials Testing ■
Construction Inspection ■

PGH WONG ENGINEERS
300 Lakeside Drive, 21st Floor
Oakland, CA 94612

July 16, 2008
Job No.: 205124.10

Attn.: Mr. Phil Smith

Sub: **Final Foundation Letter/Report- Retaining Walls in the Median for Loveridge Interchange Project; KP 37.9 to 41.3; Walls 1A & 1B and 2A & 2B.**
East Contra Costa County Transit Development (eBART)
Contra Costa County, California

Ref: Sheets RW-49, RW-50 and RW-51 by PGH Wong

Dear Mr. Smith:

We are hereby presenting our final foundation recommendations letter/report for the retaining walls for the e-BART structure in the median of Highway SR4 in Contra Costa County, California. Previously a design memo was presented (dated 3/3/08) and based on that we have received a copy of the comments via e-mail (dated 3/7/08) made by Caltrans Geotechnical Division. The comments were discussed with Caltrans on 3/12/08 and we were instructed by Caltrans to proceed with the revision of the report (e-mail dated 3/13/08). The Caltrans e-mails are attached to this report for reference. Subsequently, a type selection memo was presented (dated 3/25/08). A letter report (dated 5/8/08) was later presented, where our responses to the comments are incorporated into the report and the report was further modified to include additional recommendations as requested. Approval for the project was obtained based on the letter report (the approval document is attached). Subsequent to the approval, additional design recommendations were provided to Moffat and Nichol at their request (e-mail communications are attached). No additional site investigation was conducted for these walls.

This final letter report refers to the walls within the Loveridge Interchange project, more specifically for the walls at the Century OC and Utility OC. We were provided drawing nos. RW-49, RW-50 and RW-51, as typical sections by PGH Wong. We have used this information to base our recommendations.

Available Information:

1. Based on the borings at each of the bridge structure crossing locations the subsurface soil conditions are generally stiff lean clays. No specific borings are drilled along the wall alignment, however LOTB are available for the bridge structures.

2. The walls are buried and if there is provision for drainage it will be designed as drained condition. If there is no means of providing longitudinal drain and cleanouts within eBART hydrostatic pressures will be incorporated in the design.
3. We understand that the walls will be founded on compacted fill and the wall backfill will also be compacted structure backfill.

For the purposes of this report our recommendations are as follows:

Active Earth Pressure:	36 pcf (equivalent fluid pressure)
Passive Earth Pressure:	310 pcf (equivalent fluid pressure)
Allowable Bearing Capacity:	3000 psf
(the bearing capacity may be increased by 30 percent for seismic loads)	
Coefficient of Friction	0.4
Surcharge Load:	As appropriate for BART train loading condition

In lieu of the specific boring data at this time following assumptions and design recommendations are considered appropriate.

1. Overexcavate the subgrade beneath the wall footing to 2' depth and replace with Class 3 Aggregate Base Rock, compacted to 95% compaction. The extent of this overexcavation and replacement would be 2' on either side of the wall footing. This should provide the required design bearing value of 3000 psf for the wall footings.
2. The backfill for the wall (above the footings) should be structure backfill as per Caltrans standards.
3. The preference is to use drained earth pressures (weep holes with cleanouts), however considering the lack of relief locations and the need for future cleanouts may not be feasible. In such cases the wall pressures should account for hydrostatic pressures.

We hope the above information is sufficient for your present requirements. If you have any questions or comments, please contact us.

Please be advised that we are performing a professional service and that our conclusions are professional opinions only. All work done and all recommendations made are in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work.

Very truly yours,
PARIKH CONSULTANTS, INC.

Partha Sircar, Ph.D., P.E., C54619
Senior Engineer

Gary Parikh, P.E., G.E., 666
Project Manager

REGISTERED PROFESSIONAL ENGINEER
GAURANG R. PARIKH
No. 666
EXP. 12-31-09
GEOTECHNICAL
STATE OF CALIFORNIA

Attachments: Caltrans e-mails dated 3/7/08 and 3/13/08
Caltrans Review/Approval Document
Communications with Moffat & Nichol

E-MAIL DOCUMENT DATED 03/07/2008-COMMENTS FROM CALTRANS GEOTECHNICAL

From: Hooshmand Nikoui/D04/Caltrans/CAGov
To: Emil Vergara/HQ/Caltrans/CAGov@DOT 03/07/2008 03:54
Cc: PM Bonnita Chow/D04/Caltrans/CAGov@DOT, Sotero D Angeles/D04/Caltrans/CAGov@DOT, Tim Pokrywka/D04/Caltrans/CAGov@DOT,"Rut, Tom"<TRut@moffattnichol.com>,Walt_LaFranchi@URSCorp.com

Subject Re: EA04-228591: eBART Ret Wall Fnd Rept Ltr from Parikh.pdf - Adobe Reader (Document link: Emil Vergara)

Hi Emil,

Since the wall will be constructed on future compacted fill (I am assuming that is the reason no borings have been taken) the report should states at least the quality of the fill material by specifying values like maximum PI (plasticity Index), sand equivalent, minimum R-Value, etc. Not all fill materials can produce 3000 psf allowable bearing capacity after compaction. The amount of compaction directly below the footing should also be specify-normally 95% relative compaction. Also the type of backfill material should be specified. Normally we use structural backfill as per Caltrans Standard Pacifications or provide SSP for backfill material behind the wall in order to determine the active pressure. I believe the reason the report is so simplified is may be because the wall height is only 2 meter within its entire length.

So, I strongly recommend that the report be revised and information I mentioned above be included in the report to justify the design values.

Hooshmand

Gary Parikh

From: Hooshmand Nikoui [hooshmand_nikoui@dot.ca.gov]
Sent: Thursday, March 13, 2008 4:33 PM
To: gparikh@parikhnet.com
Cc: gparikh@parikhnet.com; Walt_LaFranchi@URSCorp.com; Rut, Tom; Tim Pokrywka; Sotero D Angeles; Bonnita Chow
Subject: Re: Rte 4 eBART- retaining walls

Attachments: pic28435.jpg

pic28435.jpg (4 KB)

I am in agreement with all items specified in your e mail. Please proceed with the revision of your report.

Thanks,

Hooshamnd Nikoui, Chief
Branch A-GDW
510-286-4811

"Gary Parikh" <gparikh@parikhnet.com>
03/13/2008 09:51 AM
Please respond to <gparikh@parikhnet.com>

To "'Hooshmand Nikoui'" <hooshmand_nikoui@dot.ca.gov>
cc <gparikh@parikhnet.com>
Subject Rte 4 eBART- retaining walls

Hello Hooshmand:
Based on our discussions yesterday afternoon, I would like to summarize the conclusions so that the designers can proceed while we revise the report/memo for the retaining walls.

Available Information:

There are no borings along the proposed wall alignment. However there are borings done by URS for the bridge structures for the highway (which are used for the eBART foundations also). These however do not extend the entire length of the walls.
The final plans and specs need to proceed expeditiously and there is no time for field exploration, testing, analyses and report.
The walls are buried and there would not be any means to provide drained backfill for the walls, to provide longitudinal drain and cleanouts within eBART. Therefore hydrostatic pressures will be incorporated in the design

Based on this the following has been discussed with you and you are in general agreement:

1. Overexcavate the subgrade beneath the wall footing to 2' depth and replace with Class 3 Aggregate Base Rock, compacted to 95% compaction. The extent of this overexcavation and replacement would be 2' on either side of the wall footing. This should allow us to use a 3000 psf bearing value.
2. The backfill for the wall (above the footings)should be structure backfill as per Caltrans standards.
3. The preference is to use drained earth pressures (weep holes with cleanouts), however considering the lack of relief locations and the need for future cleanouts it is not feasible.
4. The wall pressures should account for hydrostatic pressures.

As timing is the issue please let us know via email that this is OK to proceed with. These items should be included in the plans and specs.

Gary Parikh, P.E., G. E.
President
(Embedded image moved to file: pic28435.jpg) PARIKH Consultants, Inc.
356 S. Milpitas Boulevard
Milpitas, California 95035
(408) 945-1011 Tel
(408) 945-1012 Fax
gparikh@parikhnet.com

GEOTECHNICAL CONSULTANT SUBMITTAL REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

[X] MR. EARL SEABERG, CHIEF, OSFP
[ ] MR. VONG TOAN, CHIEF, OSCM
Attention: Emil Vergara

DATE: 07/08/08

FILE: 04 (District) CC (County) 4 (Route) 37.9/41.3 (KP)

SUB CONSULTANT: PARIKH Report Date: 05/08/2008
PRIME CONSULTANT: PGH Wong Eng. Contract No.:
GENERAL PLAN DATED: FDN PLAN DATED:

eBART Retaining Walls (Structure Name)
228591 (EA Number) 28-PEND1 (Bridge Number)

Submittal (*Check One*): [ ] 1st [X] 2nd [ ] 3rd [ ] 4th [ ] Other:

The following comments for the above referenced project are based on:

- Foundation Report update by Parikh Consultants dated May 8, 2008
- General Plans by PGH Wong Engineering

The updated report addresses our previous comments that were transmitted to you via e-mail dated 03/07/2008.

We have no further comments

APPROVED BY: H. Vikoui

REGISTERED PROFESSIONAL ENGINEER
ALI K. KADDOURA
No. C55710
Exp. 12-31-08
CIVIL
STATE OF CALIFORNIA

[X] Special Funded Project (OSFP) [ ] Local Assistance Project (OSFP) [ ] OSCM Project

Approval: (C2) Approved subject to OSFP verification

OSFP/OSCM

Ali Kaddoura
Office of Geotechnical Design - West

cc: OGDx, Lab File Room (Sacramento) DES Specifications and Estimates (JStayton-4 copies) Structure Construction R.E. Pending File

Revised 05/04

Partha Sircar

From: "Partha Sircar" <psircar@parikhnet.com>
To: "Kattula, Basil" <bkattula@moffattnichol.com>
Cc: "David Wang" <dwang@parikhnet.com>
Sent: Monday, July 14, 2008 5:23 PM
Subject: Re: e-Bart retaining walls sliding coefficient of friction

Basil:

Under seismic loading conditions, the allowablebearing capacity may be raised by 30 percent, e.g. to 3900 psf.

Partha

----- Original Message -----
From: Kattula, Basil
To: Partha Sircar
Sent: Monday, July 14, 2008 11:39 AM
Subject: RE: e-Bart retaining walls sliding coefficient of friction

Partha:
During our phone conversation earlier today, I asked you if can take any increase in the allowable soil bearing pressure for the e-Bart retaining wall design when the imposed loads are due to a combination of soil lateral loads and seismic loads. Your letter report of March 3, 2008 specified a value of 3000 PSF, would appreciate your answer,
Thanks,

Basil T. Kattula, S.E.
Moffatt & Nichol
600 University Street, Suite 610
Seattle, WA. 98101
Phone: (206)-622-0222
Fax: (206)-622-4764

From: Partha Sircar [mailto:psircar@parikhnet.com]
Sent: Monday, June 23, 2008 1:28 PM
To: Kattula, Basil
Cc: Gary Parikh; David Wang
Subject: Re: e-Bart retaining walls sliding coefficient of friction

We recommend a **coefficient of friction of 0.4** based on the compacted fill uon which the the retaining wall is founded.

Partha Sircar
Senior Engineer
Parikh Consultants

----- Original Message -----
From: Kattula, Basil
To: psircar@parikhnet.com
Cc: Hancock, Rodney
Sent: Monday, June 23, 2008 11:51 AM
Subject: e-Bart retaining walls sliding coefficient of friction

Dear Mr. Sircar:
Per our phone conversation earlier today, we are looking for the coefficient of friction for the design of the e-Bart retaining walls (Your job No 205124.10), the letter report dated March 3 2008 specifies the retaining wall design parameters except the sliding coefficient of friction, your help will be highly appreciated,
Thanks,

Basil T. Kattula, S.E.
Moffatt & Nichol
600 University Street, Suite 610

CONTRA COSTA TRANSPORTATION AUTHORITY

California Department of Transportation

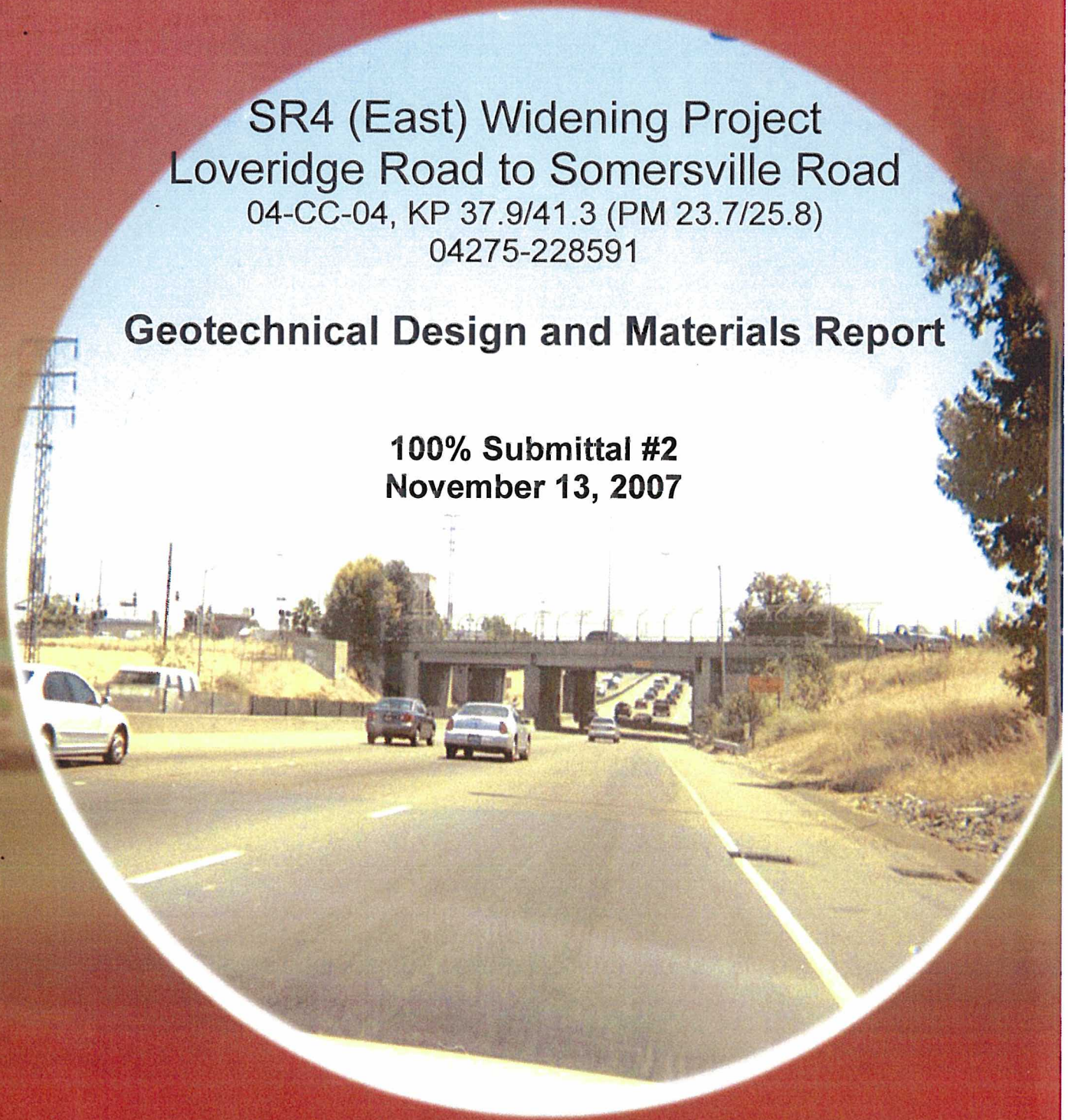
Caltrans

SR4 (East) Widening Project
Loveridge Road to Somersville Road

04-CC-04, KP 37.9/41.3 (PM 23.7/25.8)
04275-228591

Geotechnical Design and Materials Report

100% Submittal #2
November 13, 2007



URS

URS

November 09, 2007
Project No. 26814911

Ms. Susan Miller,
Project Director,
Contra Costa Transportation Authority,
3478 Buskirk Avenue, Suite 100
Pleasant Hill, CA 94523

Subject: **SR4 (East) Widening Project**
Loveridge Road to Somersville Road
Geotechnical Design and Materials Report

Dear Ms. Miller,

URS is pleased to provide you with this Geotechnical Design and Materials Report for the subject project located in Antioch, California.

This report has been prepared in accordance with Caltrans guidelines for materials reports, and supplements our geotechnical design and materials report (100% Submittal) for this project dated March 2, 2007.

It has been our pleasure to be of service to Contra Costa Transportation Authority on this project. If you should have any questions, please contact the undersigned.

Sincerely,
URS CORPORATION

Philip Meymand, Ph.D., G.E.
Project Manager

REGISTERED PROFESSIONAL ENGINEER
PHILIP J. MEYMAND
No. GE 2596
Exp.
GEOTECHNICAL
STATE OF CALIFORNIA

Said Salah-Mars, Ph.D., P.E.
Engineering Division Manager

Enclosure

URS Corporation
1333 Broadway, Suite 800
Oakland, CA 94612-1924
Tel: 510.893.3600
Fax: 510.874.3268

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CCTA	Contra Costa Transportation Authority
CGS	California Geological Survey
CHP	California Highway Patrol
HOV	High-Occupancy Vehicle
LOTB	log of test borings
MIS	Major Investment Study
M_L	local magnitude
Project	State Route (SR) 4 (East) Widening Project - Loveridge Road to Somersville Road
UC	Unconfined compression

Presented in this Geotechnical Design and Materials Report are the results of our geotechnical investigation for the proposed State Route 4 (East) widening between Loveridge and Somersville Roads (KP 37.8 to KP 42.0). The project location is shown on the attached vicinity map, Plate 1. The general project plan layout is presented on Plate 2.

The proposed State Route (SR) 4 (East) Widening Project - Loveridge Road to Somersville Road (the Project) will widen SR4 from its current four lanes to an eight-lane facility from west of Loveridge Road (KP 37.9) to the Somersville Road Interchange (KP 41.3). This Project is part of the Contra Costa Transportation Authority's (CCTA's) overall plan to continue the widening of SR4 further into East County and is consistent with the Phase 1 Implementation Plan recommendation made in the SR4 (east) Railroad Ave. to SR 160 Major Investment Study (MIS). Funding for the project will be from Measure C, Measure J, STIP, TCRP, and ITIP funds.

1.1 PURPOSE OF THIS STUDY

The purpose of this Geotechnical Design and Materials Report is to document existing subsurface and groundwater conditions, make preliminary recommendations for structural pavement design, corrosion protection of subsurface structures and utilities, earthwork construction and grading factors, foundation support for existing drainage culverts to be modified, foundation support for new overhead sign structures, and specifications (standard and special provisions).

1.2 SCOPE OF WORK

The scope of work for this study includes:

- Site Reconnaissance
- Review of available As-Built Information
- Review of available logs of test borings (LOTBs), geologic maps, and foundation reports
- Preparation of this Materials Report including:
  - Description of site geology and evaluation of seismic hazards
  - Assessment of subsurface and groundwater conditions
  - Preliminary earthwork recommendations
  - Preliminary foundation recommendations for culverts and overhead sign structures
  - Seismic Design Criteria
  - Seismic and Geologic Hazards
  - Pavement design recommendations
  - Corrosion engineering and corrosion protection recommendations
  - Recommendations for additional geotechnical of geological studies

This report is being submitted at the 100% project design level and should be considered as a final Geotechnical Design and Materials report for the project, unless there will be comments or design changes that would need to be addressed in the report.

The existing freeway is a four-lane divided highway with two mixed-flow lanes in each direction. The freeway is at grade west of Loveridge Road and descends beneath the Loveridge Overcrossing structures and returns to grade to the east where the freeway spans a utility corridor and the Century Boulevard Undercrossing Structure. The Loveridge Overcrossing structures consist of two two-span steel girder bridges: an easterly Camp Stoneman Road Underpass and a westerly Loveridge Road Overcrossing Structure. The existing Century Boulevard Undercrossing is a single span structure.

The proposed project will widen the freeway from two to four lanes providing three mixed-flow and one High Occupancy Vehicle (HOV) lane in each direction. From SR 242 to west of Loveridge Road, the above improvements have either been completed, or are under construction. The improvements will conform to the existing four lane facility just before the Somersville Road Overcrossing. Some of the significant features of this project include:

- The Loveridge Road interchange will be widened and reconstructed to accommodate two left turn lanes, two through traveled lanes, shoulders sufficient for bicycles, and a sidewalk in each direction of travel. The existing Loveridge Road Overcrossing and Camp Stoneman Road Underpass will be removed.
- At the Loveridge Interchange, the eastbound diagonal on-and off-ramps will be reconstructed but the eastbound loop on-ramp eliminated. The westbound on- and off-ramps will be reconstructed at their current location maintaining the existing buttonhook configuration.
- California Avenue and North Park Boulevard will be shifted north to accommodate the freeway widening and new ramp configurations, and the intersection of Loveridge Road with California Ave/North Park Boulevard will be improved to accommodate the projected traffic volumes and increase public safety.
- The Century Boulevard Undercrossing structure will be reconstructed with two-span structures and lowering of the profile of Century Boulevard to meet vertical clearance requirements. The replaced structure will accommodate planned widening of Century Boulevard to provide two through lanes in each direction.
- California Avenue and North Park Boulevard will be shifted north to accommodate the freeway widening and new ramp configurations, and the intersection of Loveridge Road with California Ave/North Park Boulevard will be improved to accommodate the projected traffic volumes and increase public safety.
- The Century Boulevard Undercrossing structure will be reconstructed with two-span structures and lowering of the profile of Century Boulevard to meet vertical clearance requirements. The replaced structure will accommodate planned widening of Century Boulevard to provide two through lanes in each direction.
- The utilities undercrossing structure west of Century Boulevard will be lengthened to accommodate the widened freeway.
- Provisions in the freeway median and at the Loveridge Interchange will be made to accommodate a future mass transit extension.

- The storm water pump station located in the northwest corner of the Loveridge Interchange will be relocated further west to accommodate new construction features.
- Two existing drainage culverts (Kirker Creek and Los Medanos Waste Way) will be modified to accommodate the freeway widening. A previously existing culvert for Old Kirker Creek was abandoned and sealed during construction of the new Kirker Creek culvert.

The project will also include provisions for ramp metering with HOV preferential lanes and California Highway Patrol (CHP) enforcement areas. A number of retaining and sound walls will be constructed to minimize the impact of right of way and to reduce noise impact to the neighborhood. This freeway widening is anticipated to accommodate forecasted traffic through year 2030.

Preliminary Foundation Reports covering the modifications, replacements, and/or new construction of the following structures proposed for this project will be issued under separate cover: Loveridge Road Overcrossing Widen (Bridge No. 28-96 R/L), Century Boulevard Undercrossing Widen (Bridge No. 28-99 R/L), Retaining Wall Nos. 1 2A 2B 3A 3B 4 5 and Sound Wall 1, Utilities Undercrossing Bridge No. 28-105, and Loveridge Undercrossing Pumping Plant (Replace).

This materials report addresses the following: Design of structural pavement sections, earthwork construction (cuts, fills and material sources), earthwork grading factors, construction considerations, recommended material specifications (standard and special provisions), modifications to two drainage culverts (Kirker Creek and Los Medanos Waste Way) to accommodate the freeway widening, corrosion investigation, and overhead sign structures.

The following reports by URS are pertinent to this study:

- URS 2/28/07, Final Foundation Report, Loveridge Road Overcrossing (Widen), Bridge No. 28 – 96 R/L.
- URS 2/28/07, Final Foundation Report, Century Boulevard Undercrossing (Widen), B ridge No. 28-99 R/L.
- URS 2/27/07, Final Foundation Report, Utilities Undercrossing (Widen) Bridge No. 28-105.
- URS 2/27/07, Final Foundation Report, Retaining Wall Nos. 1, 2A, 2B, 3A, 3B, 4, 5, 6 and Sound Wall No.1.

We also reviewed as-built drawings for two existing culverts, the Kirker Creek and the Los Medanos Waste Way.

4.1 CLIMATE

The northern California climate is considered moderate. The project site is more than 20 miles inland and not susceptible to the relatively cold summers on the Pacific coast. Winters are mild with temperatures generally ranging from 3 to 11 degrees C. Summer temperatures vary from 14 to 30 degrees C.

The average annual precipitation is about 60 mm generally occurring during the months of December through March.

4.2 TOPOGRAPHY AND DRAINAGE

The existing topography along the current freeway alignment is relatively level generally ranging in elevation from a low of about 18.5 m to a high of about 23.7 m. The exception occurs at the Loveridge Road Overcrossing where the freeway drops in elevation from about 18.5 m to a low of about 9.8 m. The freeway is near the existing grade west of Loveridge Road and drops through the afore-mentioned cut under Loveridge Road. East of Loveridge Road to the east end of the project, the freeway varies from being essentially at grade to being up to 3 to 4 m in fill above the adjacent grades. Side slopes on either side of the freeway vary in height from 0 to 4 m. Currently, drainage in the Loveridge Road area is being pumped from a pump station located under the interchange. That pump station will be demolished and replaced with a new pump station which will accommodate the drainage for the new interchange.

4.3 MAN-MADE AND NATURAL FEATURES OF ENGINEERING AND CONSTRUCTION SIGNIFICANCE

No natural features were judged to be applicable to this project. Man-made features that could affect the construction of this project are existing drainage culverts, a utility culvert, and other existing utilities. Three drainage culverts are discussed in Section 9.7 of this report. A utility culvert is considered a utilities bridge crossing, which is covered in a separate report, as discussed in Section 3.0 of this report. Other existing utilities that could affect the construction of this project are not part of the scope of this study.

5.1 REGIONAL GEOLOGY

The Loveridge to Somersville Road Widening Project is located near the boundary between the Central Valley and the Coast Range physiographic province, at the northern end of the Diablo Range. The Coast Ranges are characterized by north to northwest trending elongated mountain ranges and intervening valleys. It is presumed that the Franciscan Complex, which is in fault contact with the Great Valley sediments of the Central Valley province to the east, is the basement bedrock that underlies all of Contra Costa County (USGS, 1997).

Younger sedimentary deposits from Paleocene to Pleistocene in age (65 million to 0.01 million years old or myo) are widely distributed along the margin of the Diablo Range and along the foothills through which the SR 4 alignment crosses and skirts around (Graymer, et al, 2002). The higher slopes to the immediate south and southeast of the project area correspond with the northern extension of the Pliocene-age (2-7 myo) Tulare Formation. Materials of this formation are described as poorly consolidated, non-marine sandstone, siltstone, and conglomerate, with some tuff (volcanic ash deposits) included.

Other formations to the south include the Pliocene Lawlor Tuff, the Miocene (7-26 myo) Neroly and Cierbo Sandstones, the Ecocene (38-54 myo) Markley Formation, and the division D sandstone member of the Paleocene (54-65 myo) Meganos Formation (USGS, 1994).

More recent alluvial fan deposits eroded from the Diablo Range to the south, and alluvium and bay mud deposits along the Sacramento River margin in turn locally overlie these sedimentary rocks.

5.2 SITE GEOLOGY

The sediments in the project area are a combination of surficial deposits of Holocene to Pleistocene (recent to 2 myo) alluvium, alluvial fan and terrace deposits consisting of medium dense to dense sandy gravel or gravelly sand that generally grades finer, and medium dense sand that fines upward to sandy or silty clay (USGS, OFR 97-98).

5.3 SEISMOTECTONIC SETTING

The SR 4 project lies within a domain of north-northwest oriented right-lateral strike-slip faulting, the San Andreas fault system, that accommodates the majority of the plate motion between the Pacific and North American plates. In addition to the right-lateral strike-slip deformation, a component of compression oriented normal to the plate boundary is manifest as a series of folds and thrust faults, including the Coast Range-Sierran Block Boundary zone, oriented parallel and sub-parallel to the faults of the San Andreas system. In contrast, regional compression in the Mount Diablo region, within which the SR 4 project is situated, has a more northerly orientation, which has resulted in a series of folds and thrusts that are at a distinct oblique angle to the main strike-slip faults.

The San Francisco Bay area is a region of relatively high seismic activity. This historical seismicity is associated with the active faults of the San Andreas system. During historical times there have been almost 8,000 earthquakes of Richter local magnitude (M_L) 2.0 or larger, of which 14 earthquakes were M 6.0 or greater. These include the 1836 M_L 6¼ event on the San

Andreas fault; the 1868 M_L 6.8 event on the southern Hayward fault; the 1889 M 6¼ Collinsville earthquake, possibly on the Pittsburg-Kirby Hills fault; the 1898 M_L 6.7 'Mare Island' earthquake; the 1906 M 7.9 'Great San Francisco Earthquake' on the San Andreas fault; a 1911 M_L 6.6 event on the southern Calaveras fault; and the 1989 M 7.0 Loma Prieta event, located on a fault paralleling the Santa Cruz Mountains segment of the San Andreas fault.

The field investigation for the proposed improvement of SR4 from Loveridge Road to the Somersville interchange includes drilling of 30 borings at selected locations to depths ranging 2.1 m to 27.9 m bellow the existing ground surface. The boring locations, profiles and boring logs (LOTBs) are presented in Appendix A.

This field exploration program included four rotary wash borings to a depth of 27.9 m at the Loveridge Road Overcrossing, and the Century Boulevard Undercrossing, eleven solid stem auger borings to a depth of 6.55 m to 12.65 m along retaining walls/sound walls and at the utility crossing bridge, one solid stem auger boring to a depth of 15.7 m at the pump station, and six solid stem auger borings to a depth of 2.13 m to 3.05 m for pavement design purposes. While seventeen borings were drilled using a truck-mounted Diedrich D-120 rig equipped with a 63.5 kg automatic trip hammer, five borings were drilled using a track-mounted Diedrich D-120 rig equipped with a 63.5 kg automatic trip hammer. Rotary wash borings were advanced using 124 mm drag bit and solid stem auger borings were advanced using 102 mm auger/ fishtail bit.

Taber Consultants from West Sacramento, California performed the drilling of the rotary wash borings. One of our engineers supervised the drilling and logged the borings in accordance with the Caltrans Soil & Rock Logging Classification Manual (1996).

The borings were generally sampled at 1.5 m intervals. A Modified California split-spoon drive sampler (50.8 mm fitted with four 101.6 mm long, 49 mm ID, brass liners) was used to sample in clayey material. A 0.6 m long split barrel SPT drive sampler (35 mm ID) was used to sample granular materials. As noted above, all samplers were driven using a 63.5 kg safety hammer dropping 762 mm. The blow counts required to drive the sampler for the each 0.3 m were recorded and presented on the Log of Test Borings (LOTBs), Appendix A. All samples were carefully sealed, labeled, and transported to our soil Geotechnical Laboratory in Pleasant Hill, California for review and testing. The boring locations, and relevant details are summarized in Table 1.

On completion of the drilling, piezometers were constructed in Borings B-10 and B-20 as shown on the boring log and the ground surface was restored to its initial elevation. On completion of the drilling, Borings were backfilled with cement grout, and the ground surface was restored to its initial elevation. Excess drill cuttings and fluid from the boring were contained in 55-gallon drums and were hauled off for disposal.

The LOTBs obtained from the subsurface investigation are provided in Appendix A. The laboratory test methods and results are presented in Appendix B and are also shown on the LOTB drawings (Appendix A) at the corresponding sample locations.

Table 1
Summary of Borings

Type of Structure	Boring No.	Location (NAD 1983) N	Location (NAD 1983) E	Boring Depth (m)	Ground Surface Elevation (m) [NGVD 1929]	Ground Water Elevation (m)
Loveridge Overcrossing	B-9	668673.9	1880024.1	27.83	15.00	-
	B-10	668633.8	1879918.4	27.89	16.50	3.4
Century Blvd. Undercrossing	B-20	668264.6	1880993.8	27.89	18.40	-
	B-21	668337.7	1881029.2	27.89	17.30	4.0
Pump Station	B-7	668733.8	1879958.7	15.70	14.10	3.4
Utility Undercrossing	B-19	668323.9	1880894.5	9.60	23.70	-
	B-20	668264.6	1880993.8	27.89	18.40	-
	B-21	668337.7	1881029.2	27.89	17.30	4.0
Culvert Extension	B-3	668783.0	1879397.5	6.55	18.7	-
	B-13	668553.0	1880225.2	6.55	14.50	-
	B-25	667996.8	1881791.5	6.55	20.50	-
	B-26	668004.7	1881868.1	3.05	20.30	-
	B-27	667947.5	1881926.9	6.55	20.30	-
Retaining Wall 1	B-4	668796.6	1879628.2	6.55	17.20	-
Retaining Wall 2A	B-10	668633.8	1879918.4	27.89	16.50	3.4
	B-11	668590.3	1880015.6	11.28	15.30	-
Retaining Wall 2B	B-12	668578.8	1880117.8	11.13	14.20	-
	B-13	668553.0	1880225.2	6.55	14.50	-
Retaining Wall 3A	B-13A	668592.9	1880267.3	6.55	14.60	-
Retaining Wall 3B	B-13A	668592.9	1880267.3	6.55	14.60	-
	B-15	668522.5	1880487.4	11.13	14.90	-
	B-18	668413.1	188.0779.5	12.65	17.90	-
	B-21	668337.7	1881029.2	27.89	17.30	4.0
Retaining Wall 4	B-14	668512.5	1880361.4	6.55	16.70	-
	B-16	668452.0	1880542.6	11.13	19.20	-
	B-17	668382.6	1880732.5	12.65	21.80	-
	B-19	668323.9	1880894.5	9.60	23.70	-
	B-20	668264.6	1880993.8	27.89	18.40	-
Retaining Wall 5	B-22	668158.4	1881446.2	2.13	21.60	-
	B-23	668151.8	1881366.5	6.55	22.00	-
	B-24	668072.8	1881583.5	6.55	21.30	-
	B-25	667996.8	1881791.5	6.55	20.50	-
	B-26	668004.7	1881868.1	3.05	20.30	-
Retaining Wall 6	B-26	668004.7	1881868.1	3.05	20.30	-
	B-27	667947.5	1881926.9	6.55	20.30	-
	B-29	667872.2	1882124.8	4.27	20.70	-
Sound Wall No 1	B-23	668151.8	1881366.5	6.55	22.00	-
	B-24	668072.8	1881583.5	6.55	21.30	-
	B-25	667996.8	1881791.5	6.55	20.50	-
	B-27	667947.5	1881926.9	6.55	20.30	-
Pavement Design	B-1	668871.4	1879147.5	3.96	19.60	-
	B-2	668901.7	1879245.9	2.13	19.10	-
	B-5	668700.4	1879683.1	2.13	17.80	-
	B-6	668738.1	1879861.2	2.13	14.30	-
	B-8	668735.5	1880047.5	2.13	14.60	-
	B-22	668158.4	1881446.2	2.13	21.60	-
	B-26	668004.7	1881868.1	3.05	20.30	-
	B-29	667872.2	1882124.8	4.27	20.70	-
	B-30	668750.1	1880143.9	2.13	14.00	-

7.1 IN-SITU TESTING

In-situ testing of this investigation incorporated recording the number of blow counts required to advance the sampler through each 300mm interval of driving. As discussed in Section 5.1, modified California split-spoon drive sampler (50.8 mm fitted with four 101.6 mm long, 49 mm ID, brass liners) or standard California split-spoon sampler (63.5 mm fitted with four 101.6 mm long, 61.7 mm ID, brass liners) or 0.6 m long split barrel SPT drive sampler (35 mm ID) were driven into the subsurface soil under the impact of a 63.5 kg safety hammer falling through 762 mm to obtain the samples. Based on previous experience, the blow counts for the modified and standard California Samplers can be taken as equivalent blow count of the Standard penetration Test in similar soils by multiplying the modified California Sampler blow count by 0.8 and standard California sampler by 0.7.

7.2 LABORATORY TESTING

Laboratory soil tests were performed on soil samples recovered from field exploration to evaluate their engineering properties. The tests were performed in accordance with the ASTM Standards for Testing. The following tests were performed:

- Water content (ASTM Test Method D2216)
- Dry unit weight (ASTM Test Method D2937)
- Atterberg limits (ASTM Test Method D4318)
- Particle size distribution analysis (Gradation) (ASTM Test Method D422)
- Unconfined compression (UC) (ASTM Test Method D2166)
- Unconsolidated undrained triaxial (UU) (ASTM Test Method D2850)
- One-dimensional consolidation (ASTM Test Method D2216)
- One-dimensional swell/settlement potential (ASTM Test Method D4546)
- Laboratory compaction test (ASTM Test Method D1557-B)
- Resistance R-Value and expansion pressure test (Cal Test 301)

In general, the in situ water contents of the clayey soils are in the order of 10% to 36% and of the sandy soils are in the order of 8% to 20%. The in situ dry unit weights of the soils are in the order of 13kN/m^3 to 17.5kN/m^3. Results of the laboratory tests are presented in Appendix B, and are also shown on the LOTB sheets (Appendix B) at the corresponding sample locations.

8.1 EXISTING SLOPE STABILITY

Cut and fill slopes along the proposed project alignment generally vary from 1 to 3 meters in height, are covered with brush grasses and shrubs. The slopes are inclined at about 2:1 (horizontal to vertical) and they appear to be stable with no visible signs of distress.

8.2 SUBSURFACE SOIL CONDITIONS

The construction of the existing roadway resulted in placement of fill varying in thickness from about 0.6 m to 5.5 m. Fill was encountered in all but one boring (Boring 12) and consisted generally of silty clay of moderate to high plasticity. The average fill thickness in the borings is about 1.8 m. The fill soils are generally of a stiff consistency. Soils underlying the fill are interbedded silty clay (ranging from stiff to very stiff) and silty sand of medium dense consistency. In one boring (Boring 15) a layer of loose sandy silt was encountered underlying 1.5 m of fill. That layer is 1.1 m thick and is underlain by interbedded stiff clay and medium dense silty sand. The sand encountered in the borings increases in consistence to dense and very dense with depth. Engineering parameters of the soils encountered in the borings are presented in Appendix A (LOTBs) and in Appendix B (Laboratory test results). Location-specific soil conditions and engineering parameters for project structures are presented in the accompanying Final foundation reports, and for minor structures not addressed in the foundation reports they are discussed later in this report.

Typical soil parameters based on the field exploration and laboratory testing are presented in the Table 2 below.

Table 2
Typical Soil Parameters

Soil Type	Layer Thickness (m)	Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (deg)
Fill	3.0	19.0	50	0
Clay	3.0	19.0	70	0
Clayey Sand / Sandy Clay	3.5	19.0	0	33
Clay	5.5	19.3	50	0
Clay	6.0	18.5	100	0
Clay	3.0	19.3	120	0
Hard Silt	4.0	19.0	0	40

8.3 WATER

8.3.1 Surface Water

Surface water generally follows the relatively flat topography over most of the project and drains away from the site and mostly into the Kirker Creek, Old Kirker Creek, and Los Medanos Waste Way. In the low lying area of the Loveridge Road interchange, the surface water is collected and routed into a pump station for disposition.

8.3.2 Scour

Scour is not directly applicable to the roadway widening project. However, there are three existing culverts that will be modified to accommodate the project. During the design of the modifications of the culverts scour will be addressed as required.

8.3.3 Erosion

The Rincon clay soils, which cover part of the project area, are classified as having a moderately to severe hazard of erosion (USDA, 1972). However, the applicability of erosion to the project will be limited to new cut and fill slopes which are of relatively low height. Any exposed cut or fill slopes will be protected from erosion by appropriate measures such as hydro-seeding or planting of vegetation. Creek bank erosion of the three waterways crossing the project area is not part of the scope of this investigation.

8.3.4 Groundwater

Groundwater was encountered at the time of drilling in three of our borings at depth below the existing ground surface ranging from 10.7 m to 13.3 m. In those borings the groundwater elevation at the time of drilling ranged from El. 3.4 to 4.0 m (NGVD 1929). In addition, piezometer casings were installed in Borings 10 and 20, both to a depth of 27.9 m below existing ground. The bottoms of the piezometers are at El. –9.5 and -11.5 (NGVD 1929) respectively. The purpose of the piezometers is to evaluate potential groundwater level fluctuations over an annual cycle.

8.4 SEISMIC AND GEOLOGIC HAZARDS

8.4.1 Liquefaction

Liquefaction is a phenomenon in which a sudden increase in pore pressure due to strong earthquake shaking causes relatively loose, cohesionless soils below the water table to undergo temporary but substantial loss of shear strength. Liquefaction can result in loss of foundation bearing capacity, differential settlements, and lateral spreading. Based on a review of the liquefaction susceptibility map of the San Francisco Bay region (Knudsen et al., 2000), the alluvium underlying the SR 4 Loveridge to Somersville Road Widening project is classified as having a "low" liquefaction susceptibility.

The data obtained from the boring logs were used to evaluate the potential for liquefaction at the site. The liquefaction evaluations followed the methods described by the NCEER (1998). From the boring logs, the recorded blow counts were standardized by correcting them as appropriate for overburden pressure, sampler type, rod length, borehole diameter, hammer type, and fines content. The design earthquake used to evaluate liquefaction potential has a peak ground acceleration of 0.6g, with a maximum magnitude of 7.0. The recorded groundwater levels were used as the design groundwater level for calculating liquefaction potential. Results of our analysis indicate that the potential for liquefaction at this site is negligible.

8.4.2 Fault Rupture

No active faults have been mapped underlying the SR 4 alignment between Loveridge Road and Somersville Road. The project site is not within a Alquist-Priolo special studies zones (CGS, 2003). The potential for surface fault rupture at the site is therefore considered to be low.

8.4.3 Ground Subsidence/Heave

Due to the relatively dense/stiff character of the underlying alluvium, the potential for ground subsidence and heave is considered to be low.

8.4.4 Flood

FEMA flood zone maps (http://www.esri.com/hazards/ makemap.html) indicate that the site is located outside of the 100- and 500-year flood plain. Therefore the potential for flooding hazard is considered to be very small.

8.4.5 Corrosion

The soils along the project alignment were tested for corrosion properties by V&A Consulting Engineers, Inc. Their draft report is presented in Appendix C. A summary of the V&A Consulting Engineers' conclusions is presented below:

- The chloride ion concentration of the site soils is less than 500 mg/kg.
- The sulfate ion concentration of the site soils is less than 2,000 mg/kg.
- The pH of the soil samples analyzed ranged from 7.1 to 9.1.
- The site soils are considered to be *non-corrosive* to steel reinforcement in buried reinforced concrete.
- Water samples from Kirker Creek and Los Medanos Wasteway are considered to be *non-corrosive.*

9.1 PAVEMENT DESIGN RECOMMENDATIONS

9.1.1 Laboratory Testing

9.1.1.1 General

Laboratory testing on samples of proposed subgrade materials and materials to be used for fill (i.e., materials from proposed cuts), consisted of index property and classification tests, R-Value tests, and strength tests for lime treated soils. All laboratory tests are described and test results are presented in Appendix B.

9.1.1.2 R-Value Tests

A summary of the R-Value test results is presented in Table 3.

Table 3
Summary of R-Value Test Results

Boring Number	Depth of Sample (m)	Existing TOB Elevation (m)	Boring Coordinates (NGVD 1929)	R- Value
1	0.6 –1.5	19.6	N668871.4 E1879147.5	20
2	0.6 – 1.5	19.1	N 668901.1 E1879245.9	13
5	0.6 – 1.5	17.8	N668700.4 E1879683.1	7
13	0.6 – 1.5	14.5	N668553.0 E1880225.2	6
14	0.6 – 1.5	16.7	N668512.5 E1880361.4	9
22	0.6 – 1.5	21.6	N668158.4 E1881446.2	6
24	0.6 – 1.5	21.3	N668072.8 E1881583.5	7
26	0.6 – 1.5	20.3	N668004.7 E1881868.1	18
27	0.6 – 1.5	20.3	N667947.58 E1881926.9	22

After evaluating all test results along the proposed alignment, it was concluded that the soils to be used for fill and the soils present at proposed subgrade locations are primarily Silty Clays with moderate to high plasticity. The pavement designs for the project were therefore based on an R-Value equal to 6.

9.1.1.3 Lime Treatment

Due to the relatively high plasticity of subgrade and fill soils underlying the proposed pavement, and the requirement for lime treating soil with R-Values less than 10 for standard Caltrans

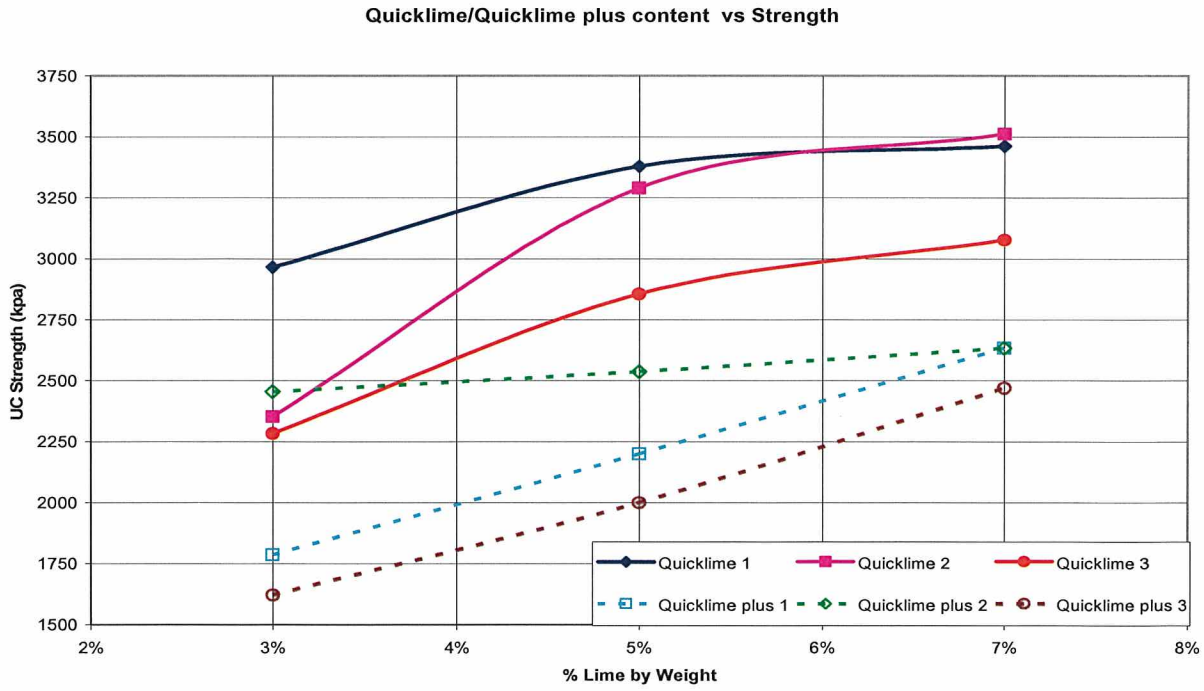
Portland Cement Pavement (PCC), lime treatment of the subgrade was recommended. All soils underlying new pavements, shoulders, and medians will be lime treated to a depth of 415 mm.

In order to verify that site soils are suitable for lime treatment and to determine the optimum lime content to be used, composite soil bulk samples were collected in the proposed cut area, and tests were performed in accordance with California Test 373, "Unconfined Compressive Strength of Lime Treated Soils and Aggregates". Two different additives; Quicklime and Quicklime Plus were used. Quicklime (or lime) is often used with lean clays or fat clays to reduce plasticity and swelling potential, as well as increase the workability and R-value. Quicklime Plus is a preblended mixture of one half Quicklime and one half portland cement (pozzolans), often used where soils range from clays to sands; this mixture also accelerates high early strengths in the treated subgrade soils. The testing program consisted of mixing three samples with quicklime and another three sample with quicklime plus at percentages by weight varying from 3 to 7 percent.

We assumed a required minimum 7 day compressive strength of 2750 kPa for the remolded samples with Quicklime or Quicklime Plus. The detail results of the laboratory tests are presented in Appendix B. The laboratory test results are summarized in the Table 4.

Table 4
Lime Content vs. Strength

Batch number	PI	3%		5%		7%	
		Quicklime	Quicklime plus	Quicklime	Quicklime plus	Quicklime	Quicklime plus
1	28	2965	1786	3378	2199	3461	2634
2	28	2351	2455	3289	2537	3509	2634
3	27	2282	1620	2854	1999	3075	2468



The results of the tests on the lime treated soil samples indicate that the site soils are suitable for quicklime treatment and that the optimum lime content is 5 % by weight. Thus, we recommend that the site subgrade soils be treated with 5 % quicklime. Furthermore, we recommend that the Contractor retain a testing laboratory to verify the recommended percentage of Quicklime Plus during construction. However, Quicklime Plus (lime/cement mix) is at this time not accepted for use within Caltrans Right-of-Way. Therefore, should not be recommended as an option should soil types change during construction.

9.1.2 Mainline Pavement Recommendations

9.1.2.1 New Traveled Way

After several interactions with CCTA and Caltrans recommendations for new main line pavement were developed and the type of new pavement was chosen to be the Standard Caltrans PCC section. The design traffic indexes were developed by URS and approved by Caltrans and CCTA prior to the start of pavement design. The recommended design traffic index for outer lanes (Lanes 2, 3, and 4 and auxiliary lanes) is 14.5 and for the inner or median lane (Lane 1) is 12.5. However, in accordance with Caltrans requirements for PCC pavements with three or more lanes in one direction a constant structural pavement section is to be used across all lanes. Thus, the standard PCC pavement for R-Values less than 10 and TI greater than 14 applies. The following pavement section is recommended:

285 mm PCC (Portland Cement Concrete)

150 mm ACB (Asphalt Concrete Base)

415 mm LTS (Lime Treated Subbase)

As discussed with Caltrans during several project meetings, ACB was recommended instead of LCB due to constructability issues. ACB can be placed in lifts thinner than the minimum thickness for LCB (Lean Concrete Base). This ability also covers the requirement of using ACB instead of LCB in desert environments where large temperature differentials can occur (although this project is not in a desert environment per say, large temperature differentials can occur). It will also be important in the discussion later in this report dealing with new PCC sections on top of existing pavements.

The recommended new PCC sections will be placed where all existing pavement will be removed (Station EB4 235+70 to 250+00, eastbound and Station WB4 235+84 to 251+60 and StationWB4 254+20 to 256+00 westbound). New PCC pavements will also be placed in the new traffic lanes along the remainder of the project alignment adjacent to the existing pavement sections to remain in place as discussed in Section 9.1.2.3.

The 415 mm LTS layer underlying the PCC pavement section is not required on top of the planned MSE walls.

9.1.2.2 New Shoulders

Except adjacent to proposed MSE (Mechanically Stabilized Embankment) walls, the thickness of the new inside and outside shoulder sections will match the thickness of the adjacent traveled way lane thickness. However, instead of 285 mm of PCC the shoulder surface sections will

consist of 285 mm of AC. The purpose of the matching shoulder thickness is to simplify future widening of the freeway when only the 285 mm of AC would have to be removed and replaced with 285 mm of PCC.

Adjacent to proposed MSE walls the thickness of the new shoulders will match the thickness of the standard structural PCC pavement traveled way sections. At the time of this writing the composition of new shoulders was still under negotiation between Designers, CCTA, and Caltrans.

9.1.2.3 Existing Pavements To Remain

Existing main line pavements will remain in place from Stations EB4 250+00 to 268+40 (eastbound) and Stations WB4 251+60 to 254+20 and 256+00 to 268+40 (westbound). Most of the pavements in the existing traveled way consist of 30 mm of OGAC (open-graded Asphalt Concrete), 76 mm of AC (Asphalt Concrete), 200 mm of PCC, 100 mm of CTB (Cement Treated Base, and 250 mm of IBM (Imported Base Material). The pavements to remain will be ground down to remove 30 mm of the OGAC, which has no equivalent strength value. Our analyses indicate that the remaining existing pavement components retain at least an equivalent strength (in terms of equivalent gravel factor) as compared to the standard pavement components underlying 285 mm of PCC.

We have calculated the average vertical differences or gaps in the traveled way (after the removal of the OGAC) between FG (Design finished grade) and OG (Original grade assumed at the top of the existing pavement). The thickness of the gaps at 20-meter station intervals is presented in Tables 5 and 6 for the east and westbound directions, respectively. The thickness of the gaps varies from 0.013 m to 0.475 m in the eastbound direction and from 0.05 m to 0.33 m in the westbound direction. Thus, the new structural pavement section in the salvaged pavement areas will consist of the remaining components of the existing pavement (cold-planed by 30 mm), and ACB filling gaps of varying thickness as shown in Tables 5 and 6, underlying 285 mm of PCC.

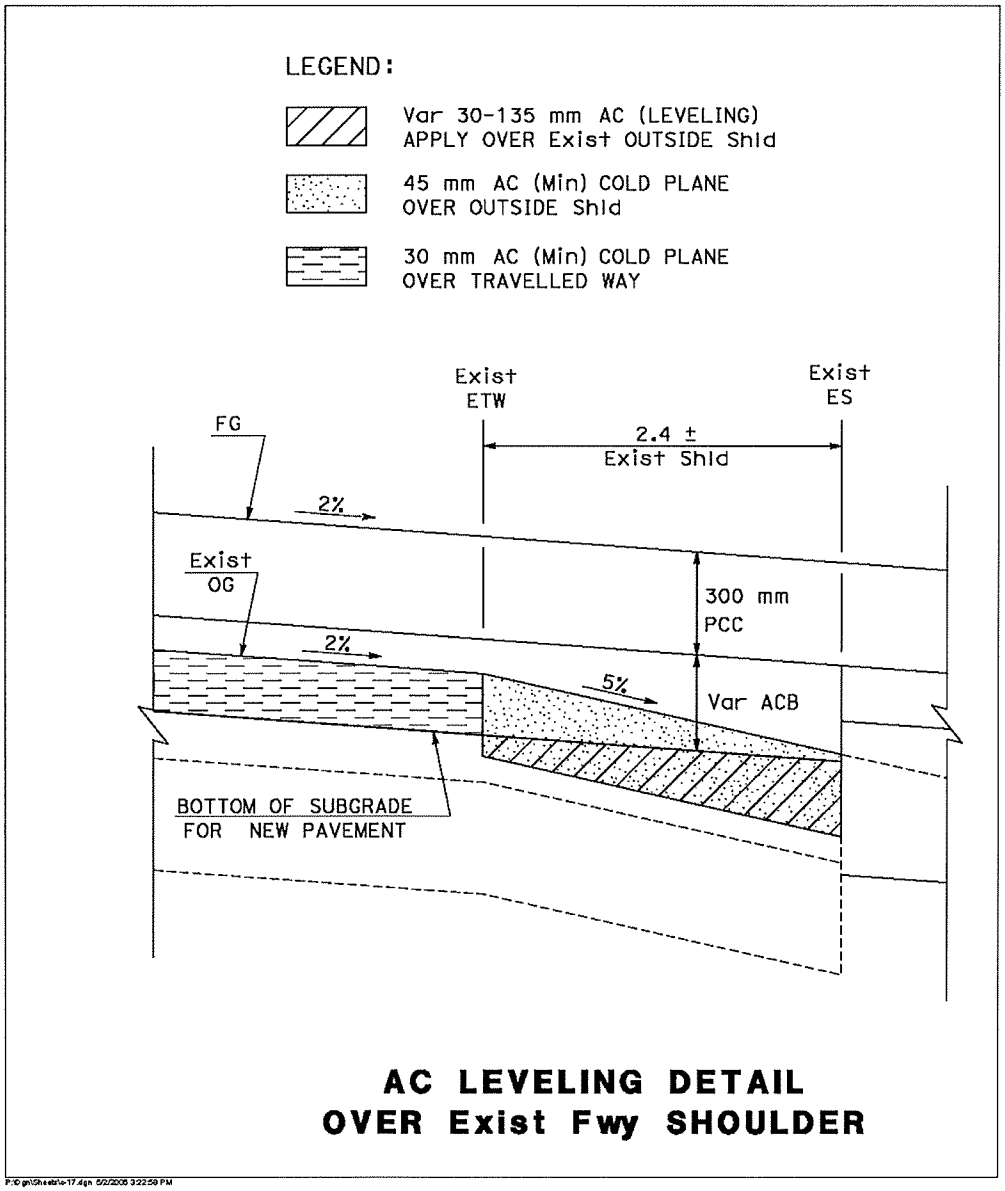
The layouts of the proposed new traveled way pavements and traveled way pavements over salvaged pavements are presented in the project Layout Sheets L – 1 through L – 15. Typical pavement cross-sections, stationing, and details are presented in the Typical Cross-Section Sheets X-1 through X-16.

9.1.2.4 Existing Shoulders

Shoulders adjacent to pavements remaining in place will also remain. The cross slopes for existing and new traveled way pavements are 2%. The existing outside shoulders have a 5% cross slope. While the existing traveled way pavements will be ground down by 30 mm to remove the OGAC, the existing outside shoulders will be ground down a total of 45 mm (see AC Leveling Detail, page 9.5). The bottom of the 45 mm grind will be at a 5% slope. In order to provide a continuous 2% bottom surface across the new subgrades, an AC leveling course will be placed over the ground down outside shoulders. The top of the AC leveling course will coincide with the bottom of the ground down existing traveled way pavement. Column G of Tables 5 and 6 presents the average thickness of the required AC leveling course. The combined surfaces will then be ready to receive the ACB gap filler.

9.1.3 Recommended Pavements for Ramps, Loveridge Road, and Local Streets

Flexible pavement sections are recommended for new eastbound and westbound on and off ramps at Loveridge Road, the portion of Loveridge Road affected by the project, and the portions of local streets, affected by the project. The recommended pavement sections for each are presented in Table 7. As per Caltrans policy, asphalt-treated permeable base and open-graded asphalt concrete layers are not required to be included in flexible structural pavements for ramps, and local streets. We have evaluated whether or not it is feasible to provide lime-treatment under the flexible pavement proposed for on- and off-ramps. The reduction in total pavement thickness when replacing the AS layer with LTS is insignificant. It was, therefore, concluded that providing LTS under flexible ramp pavements was not economically feasible.



AC LEVELING DETAIL
OVER Exist Fwy SHOULDER

Table 5
Route 4 – EB4 ACB Thickness

STATION	Gap Between EB SR4 FG and OG			Thickness of Cold plane Over Exist Inside Shld and Traveled Way	Thickness of Cold Plane Over Exist Outside shld	Total Gap Between FG and Cold plane Surface	Thickness of AC leveling Over Exist Outside Shld	PCC Thickness	ACB Thickness
	Over Exist Inside Shld (A)	Over Exist Traveled way (B)	Over Exist Outside Shld (C)	(D)	(E)	(F=B+ D)	(G)	(H)	(I=F-H)
	AVG (m)	AVG (m)	AVG (m)	AVG (m)	AVG (m)	AVG (m)	AVG (m)	m	m
250+00	0.000	0.428	0.472	0.030	0.045	0.458	0.075	0.285	0.173
250+20	0.000	0.533	0.597	0.030	0.045	0.563	0.075	0.285	0.278
250+40	0.000	0.633	0.635	0.030	0.045	0.663	0.075	0.285	0.378
250+60	0.000	0.618	0.665	0.030	0.045	0.648	0.075	0.285	0.363
250+80	0.000	0.653	0.680	0.030	0.045	0.683	0.075	0.285	0.398
251+00	0.000	0.653	0.668	0.030	0.045	0.683	0.075	0.285	0.398
251+20	0.000	0.648	0.682	0.030	0.045	0.678	0.075	0.285	0.393
251+40	0.000	0.683	0.735	0.030	0.045	0.713	0.075	0.285	0.428
251+60	0.000	0.710	0.727	0.030	0.045	0.740	0.075	0.285	0.455
251+80	0.000	0.703	0.738	0.030	0.045	0.733	0.075	0.285	0.448
252+00	0.000	0.730	0.760	0.030	0.045	0.760	0.075	0.285	0.475
252+20	0.000	0.745	0.780	0.030	0.045	0.775	0.075	0.285	0.490
252+40	0.000	0.737	0.820	0.030	0.045	0.767	0.075	0.285	0.482
252+60	0.000	0.690	0.757	0.030	0.045	0.720	0.075	0.285	0.435
252+80	0.000	0.697	0.725	0.030	0.045	0.727	0.075	0.285	0.442
253+00	0.000	0.697	0.703	0.030	0.045	0.727	0.075	0.285	0.442
253+20	0.000	0.700	0.673	0.030	0.045	0.730	0.075	0.285	0.445
253+40	0.000	0.663	0.692	0.030	0.045	0.693	0.075	0.285	0.408
253+60	0.000	0.602	0.635	0.030	0.045	0.632	0.075	0.285	0.347
253+80	0.613	0.615	0.635	0.030	0.045	0.645	0.075	0.285	0.360
254+00	0.607	0.585	0.613	0.030	0.045	0.615	0.075	0.285	0.330
254+20	0.560	0.507	0.565	0.030	0.045	0.537	0.075	0.285	0.252
254+40	0.545	0.468	0.513	0.030	0.045	0.498	0.075	0.285	0.213
254+60	0.475	0.437	0.422	0.030	0.045	0.467	0.075	0.285	0.182
254+80	0.462	0.383	0.408	0.030	0.045	0.413	0.075	0.285	0.128
255+00	0.463	0.365	0.377	0.030	0.045	0.395	0.075	0.285	0.110
255+20	0.435	0.372	0.385	0.030	0.045	0.402	0.075	0.285	0.117
255+40	0.427	0.353	0.357	0.030	0.045	0.383	0.075	0.285	0.098
255+60	0.428	0.337	0.310	0.030	0.045	0.367	0.075	0.285	0.082
255+80	0.442	0.355	0.342	0.030	0.045	0.385	0.075	0.285	0.100
256+00	0.430	0.343	0.345	0.030	0.045	0.373	0.075	0.285	0.088
256+20	0.412	0.317	0.328	0.030	0.045	0.347	0.075	0.285	0.062
256+40	0.377	0.303	0.317	0.030	0.045	0.333	0.075	0.285	0.048
256+60	0.385	0.283	0.277	0.030	0.045	0.313	0.075	0.285	0.028
256+80	0.400	0.322	0.317	0.030	0.045	0.352	0.075	0.285	0.067
257+00	0.433	0.350	0.357	0.030	0.045	0.380	0.075	0.285	0.095
257+20	0.458	0.353	0.345	0.030	0.045	0.383	0.075	0.285	0.098
257+40	0.467	0.373	0.360	0.030	0.045	0.403	0.075	0.285	0.118
257+60	0.417	0.350	0.335	0.030	0.045	0.380	0.075	0.285	0.095
257+80	0.435	0.345	0.308	0.030	0.045	0.375	0.075	0.285	0.090
258+00	0.385	0.285	0.283	0.030	0.045	0.315	0.075	0.285	0.030
258+20	0.405	0.317	0.307	0.030	0.045	0.347	0.075	0.285	0.062
258+40	0.400	0.332	0.352	0.030	0.045	0.362	0.075	0.285	0.077
258+60	0.352	0.295	0.367	0.030	0.045	0.325	0.075	0.285	0.040
258+80	0.445	0.382	0.447	0.030	0.045	0.412	0.075	0.285	0.127
259+00	Century Blvd Bridge								
259+20	Century Blvd Bridge								
259+40	0.577	0.498	0.508	0.030	0.045	0.528	0.075	0.285	0.243
259+60	0.530	0.468	0.480	0.030	0.045	0.498	0.075	0.285	0.213
259+80	0.528	0.427	0.430	0.030	0.045	0.457	0.075	0.285	0.172
260+00	0.517	0.430	0.435	0.030	0.045	0.460	0.075	0.285	0.175
260+20	0.472	0.408	0.413	0.030	0.045	0.438	0.075	0.285	0.153
260+40	0.433	0.368	0.393	0.030	0.045	0.398	0.075	0.285	0.113
260+60	0.433	0.333	0.347	0.030	0.045	0.363	0.075	0.285	0.078
260+80	0.437	0.325	0.325	0.030	0.045	0.355	0.075	0.285	0.070
261+00	0.437	0.338	0.317	0.030	0.045	0.368	0.075	0.285	0.083
261+20	0.448	0.367	0.333	0.030	0.045	0.397	0.075	0.285	0.112
261+40	0.442	0.362	0.342	0.030	0.045	0.392	0.075	0.285	0.107
261+60	0.463	0.368	0.332	0.030	0.045	0.398	0.075	0.285	0.113
261+80	0.503	0.392	0.335	0.030	0.045	0.422	0.075	0.285	0.137
262+00	0.517	0.417	0.370	0.030	0.045	0.447	0.075	0.285	0.162
262+20	0.510	0.398	0.398	0.030	0.045	0.428	0.075	0.285	0.143
262+40	0.485	0.382	0.378	0.030	0.045	0.412	0.075	0.285	0.127
262+60	0.483	0.367	0.355	0.030	0.045	0.397	0.075	0.285	0.112
262+80	0.497	0.403	0.420	0.030	0.045	0.433	0.075	0.285	0.148
263+00	0.508	0.407	0.412	0.030	0.045	0.437	0.075	0.285	0.152
263+20	0.497	0.393	0.388	0.030	0.045	0.423	0.075	0.285	0.138
263+40	0.502	0.428	0.420	0.030	0.045	0.458	0.075	0.285	0.173
263+60	0.507	0.417	0.433	0.030	0.045	0.447	0.075	0.285	0.162
263+80	0.520	0.435	0.447	0.030	0.045	0.465	0.075	0.285	0.180
264+00	0.512	0.435	0.452	0.030	0.045	0.465	0.075	0.285	0.180
264+20	0.558	0.437	0.427	0.030	0.045	0.467	0.075	0.285	0.182
264+40	0.530	0.390	0.377	0.030	0.045	0.420	0.075	0.285	0.135
264+60	0.522	0.383	0.388	0.030	0.045	0.413	0.075	0.285	0.128
264+80	0.498	0.405	0.452	0.030	0.045	0.435	0.075	0.285	0.150
265+00	0.458	0.370	0.398	0.030	0.045	0.400	0.075	0.285	0.115
265+20	0.440	0.343	0.362	0.030	0.045	0.373	0.075	0.285	0.088
265+40	0.440	0.332	0.330	0.030	0.045	0.362	0.075	0.285	0.077
265+60	0.462	0.345	0.320	0.030	0.045	0.375	0.075	0.285	0.090
265+80	0.465	0.343	0.335	0.030	0.045	0.373	0.075	0.285	0.088
266+00	0.473	0.353	0.358	0.030	0.045	0.383	0.075	0.285	0.098
266+20	0.505	0.387	0.387	0.030	0.045	0.417	0.075	0.285	0.132
266+40	0.500	0.385	0.397	0.030	0.045	0.415	0.075	0.285	0.130
266+60	0.507	0.398	0.383	0.030	0.045	0.428	0.075	0.285	0.143
266+80	0.545	0.438	0.447	0.030	0.045	0.468	0.075	0.285	0.183
267+00	0.527	0.387	0.368	0.030	0.045	0.417	0.075	0.285	0.132
267+20	0.488	0.350	0.322	0.030	0.045	0.380	0.075	0.285	0.095
267+40	0.512	0.365	0.332	0.030	0.045	0.395	0.075	0.285	0.110
267+60	0.460	0.323	0.302	0.030	0.045	0.353	0.075	0.285	0.068
267+80	0.433	0.293	0.278	0.030	0.045	0.323	0.075	0.285	0.038
268+00	0.392	0.255	0.217	0.045	0.045	0.300	0.075	0.285	0.015
268+20	0.355	0.240	0.253	0.045	0.045	0.285	0.075	0.285	0.000
268+40	0.385	0.260	0.213	0.040	0.045	0.300	0.075	0.285	0.015

Table 6
Route 4 – WB4 ACB Thickness

STATION	Gap Between WB SR4 FG and OG			Thickness of Cold plane Over Exist inside Shld and Traveled Way	Thickness of Cold Plane Over Exist Outside shld	Total Gap Between FG and Cold plane Surface	Thickness of AC Leveling Over Exist Outside Shld	PCC Thickness	ACB Thickness
	Over Exist Inside Shld	Over Exist Traveled way	Over Exist Outside Shld						
	(A)	(B)	(C)	(D)	(E)	(F=B+ D)	(G)	(H)	(I=F-H)
	AVG (m)	AVG (m)	AVG (m)	AVG (m)	AVG (m)	AVG (m)	AVG (m)	m	m
251+60	0.37	0.33	0.00	0.03	0.045	0.36	0.08	0.285	0.08
251+80	0.41	0.40	0.00	0.03	0.045	0.43	0.08	0.285	0.15
252+00	0.51	0.51	0.00	0.03	0.045	0.54	0.08	0.285	0.26
252+20	0.55	0.53	0.00	0.03	0.045	0.56	0.08	0.285	0.27
252+40	0.46	0.52	0.00	0.03	0.045	0.55	0.08	0.285	0.27
252+60	0.46	0.55	0.00	0.03	0.045	0.58	0.08	0.285	0.29
252+80	0.43	0.54	0.00	0.03	0.045	0.57	0.08	0.285	0.28
253+00	0.45	0.58	0.00	0.03	0.045	0.61	0.08	0.285	0.32
253+20	0.45	0.60	0.00	0.03	0.045	0.63	0.08	0.285	0.35
253+40	0.41	0.56	0.00	0.03	0.045	0.59	0.08	0.285	0.31
253+60	0.40	0.58	0.00	0.03	0.045	0.61	0.08	0.285	0.32
253+80	0.35	0.54	0.00	0.03	0.045	0.57	0.08	0.285	0.28
254+00	0.32	0.50	0.00	0.03	0.045	0.53	0.08	0.285	0.25
254+20	0.29	0.44	0.00	0.03	0.045	0.47	0.08	0.285	0.19
256+00	0.25	0.37	0.53	0.03	0.045	0.40	0.08	0.285	0.12
256+20	0.24	0.32	0.48	0.03	0.045	0.35	0.08	0.285	0.07
256+40	0.32	0.35	0.45	0.03	0.045	0.38	0.08	0.285	0.10
256+60	0.34	0.38	0.47	0.03	0.045	0.41	0.08	0.285	0.12
256+80	0.38	0.38	0.46	0.03	0.045	0.41	0.08	0.285	0.12
257+00	0.38	0.37	0.46	0.03	0.045	0.40	0.08	0.285	0.12
257+20	0.39	0.41	0.48	0.03	0.045	0.44	0.08	0.285	0.15
257+40	0.43	0.44	0.55	0.03	0.045	0.47	0.08	0.285	0.19
257+60	0.44	0.44	0.51	0.03	0.045	0.47	0.08	0.285	0.18
257+80	0.43	0.41	0.49	0.03	0.045	0.44	0.08	0.285	0.16
258+00	0.39	0.39	0.48	0.03	0.045	0.42	0.08	0.285	0.14
258+20	0.35	0.37	0.48	0.03	0.045	0.40	0.08	0.285	0.12
258+40	0.35	0.39	0.51	0.03	0.045	0.42	0.08	0.285	0.13
258+60	0.34	0.37	0.50	0.03	0.045	0.40	0.08	0.285	0.11
258+80	0.46	0.44	0.59	0.03	0.045	0.47	0.08	0.285	0.18
259+00	Century Blvd Bridge								
259+20	Century Blvd Bridge								
259+40	0.45	0.51	0.63	0.03	0.045	0.54	0.08	0.285	0.25
259+60	0.46	0.48	0.58	0.03	0.045	0.51	0.08	0.285	0.23
259+80	0.49	0.48	0.60	0.03	0.045	0.51	0.08	0.285	0.23
260+00	0.44	0.45	0.56	0.03	0.045	0.48	0.08	0.285	0.19
260+20	0.42	0.43	0.56	0.03	0.045	0.46	0.08	0.285	0.18
260+40	0.37	0.38	0.49	0.03	0.045	0.41	0.08	0.285	0.13
260+60	0.37	0.37	0.49	0.03	0.045	0.40	0.08	0.285	0.12
260+80	0.41	0.39	0.50	0.03	0.045	0.42	0.08	0.285	0.14
261+00	0.40	0.40	0.51	0.03	0.045	0.43	0.08	0.285	0.15
261+20	0.37	0.37	0.47	0.03	0.045	0.40	0.08	0.285	0.12
261+40	0.35	0.37	0.46	0.03	0.045	0.40	0.08	0.285	0.11
261+60	0.42	0.40	0.47	0.03	0.045	0.43	0.08	0.285	0.14
261+80	0.45	0.42	0.51	0.03	0.045	0.45	0.08	0.285	0.16
262+00	0.45	0.44	0.53	0.03	0.045	0.47	0.08	0.285	0.19
262+20	0.44	0.44	0.53	0.03	0.045	0.47	0.08	0.285	0.18
262+40	0.44	0.42	0.50	0.03	0.045	0.45	0.08	0.285	0.17
262+60	0.46	0.41	0.50	0.03	0.045	0.44	0.08	0.285	0.16
262+80	0.44	0.43	0.53	0.03	0.045	0.46	0.08	0.285	0.17
263+00	0.44	0.40	0.50	0.03	0.045	0.43	0.08	0.285	0.14
263+20	0.44	0.42	0.50	0.03	0.045	0.45	0.08	0.285	0.16
263+40	0.46	0.50	0.56	0.03	0.045	0.53	0.08	0.285	0.24
263+60	0.46	0.49	0.58	0.03	0.045	0.52	0.08	0.285	0.24
263+80	0.43	0.46	0.56	0.03	0.045	0.49	0.08	0.285	0.20
264+00	0.43	0.45	0.54	0.03	0.045	0.48	0.08	0.285	0.20
264+20	0.45	0.44	0.52	0.03	0.045	0.47	0.08	0.285	0.18
264+40	0.44	0.41	0.52	0.03	0.045	0.44	0.08	0.285	0.16
264+60	0.39	0.37	0.50	0.03	0.045	0.40	0.08	0.285	0.12
264+80	0.39	0.37	0.46	0.03	0.045	0.40	0.08	0.285	0.11
265+00	0.41	0.39	0.47	0.03	0.045	0.42	0.08	0.285	0.13
265+20	0.40	0.40	0.50	0.03	0.045	0.43	0.08	0.285	0.14
265+40	0.41	0.39	0.48	0.03	0.045	0.42	0.08	0.285	0.14
265+60	0.41	0.39	0.48	0.03	0.045	0.42	0.08	0.285	0.13
265+80	0.43	0.43	0.54	0.03	0.045	0.46	0.08	0.285	0.17
266+00	0.41	0.43	0.57	0.03	0.045	0.46	0.08	0.285	0.18
266+20	0.42	0.45	0.56	0.03	0.045	0.48	0.08	0.285	0.19
266+40	0.43	0.45	0.55	0.03	0.045	0.48	0.08	0.285	0.19
266+60	0.49	0.47	0.57	0.03	0.045	0.50	0.08	0.285	0.22
266+80	0.57	0.54	0.58	0.03	0.045	0.57	0.08	0.285	0.28
267+00	0.52	0.47	0.54	0.03	0.045	0.50	0.08	0.285	0.22
267+20	0.44	0.39	0.48	0.03	0.045	0.42	0.08	0.285	0.14
267+40	0.43	0.38	0.50	0.03	0.045	0.41	0.08	0.285	0.13
267+60	0.37	0.36	0.47	0.03	0.045	0.39	0.08	0.285	0.11
267+80	0.38	0.33	0.43	0.03	0.045	0.36	0.08	0.285	0.08
268+00	0.30	0.27	0.38	0.03	0.045	0.30	0.08	0.285	0.01
268+20	0.29	0.28	0.38	0.03	0.045	0.31	0.08	0.285	0.03
268+40	0.30	0.33	0.42	0.03	0.045	0.36	0.08	0.285	0.08

Table 7
Recommended Flexible Pavement Sections
Ramps And Local Roads

Location	R-Value	TI	AC (mm)	AB (mm)	AS (mm)
Ramps	6	10	150	240	380
Loveridge Road	6	9.5	140	240	355
Local Streets	6	8.5	125	205	320

Legend:
AC – Asphalt Concrete
AB – Aggregate Base Rock
AS – Aggregate Sub-Base Rock

The above-recommended pavement sections are based on traffic indexes developed by URS and approved by CCTA and Caltrans and an R-Value of 6 representing the moderately plastic clay soils encountered during the field investigation. Details, stationing, and typical cross-sections for the recommended pavement sections for the new east and west bound on and off ramps at Loveridge Road are presented in Figures X-9 and X-10. In Figures X-11 though X-13 details, stationing, and typical cross-sections for Loveridge Road are presented. Figure X-14 presents the details, stationing, and typical cross-sections for California Avenue, and Figures X-15 and X-16 present the same for North Park Boulevard. The areas to be paved are also shown on the layout plans, Sheets L-1 through L-15.

The recommended structural pavement sections presented in Table 7 will be constructed in the areas where existing pavements on California Avenue and North Park Boulevard will either be removed or where the streets will be realigned. In transition areas where existing street pavements will be salvaged between the existing and new construction 50mm thick AC overlays will be placed.

9.1.4 Removal of Existing Edge Drains

In areas where the existing mainline pavements will be salvaged, removal of existing edge drains will be required as indicated on the typical cross-section plans Sheets X-5 through X-7, Details B, and D through F. The typical cross-section of the existing edge drains is shown in Detail C, Sheet X-5. Edge drain components to be removed consist of AC pavement, 80 mm plastic pipe (and existing drain outlets), treated permeable materials, and filter fabric. The excavated areas are to be backfilled with asphalt concrete base materials prior to placing new PCC pavement.

9.2 CORROSION PROTECTION RECOMMENDATIONS

The results of corrosion tests performed on the site soils indicate that the onsite soils are not corrosive. Details of corrosion tests and their evaluation are presented in Appendix C.

9.3 EARTHWORK

At this time, total cuts on the project are estimated to result in about 174,400 cubic meters (bank yards). Total fill, including retaining wall and MSE wall backfill will require about 72,300 cubic meters (bank yards). Bank yards are defined as in-place material for cuts and compacted-in-place for fills.

9.4 GRADING FACTOR

The average in situ dry density of samples obtained and tested from our borings is 15.9 kN/m^3. The average dry density at 95 % relative compaction calculated from compaction tests (ASTM D-1557) is 18.27 kN/m^3. Thus, compacted fill will be denser than the excavated natural material. At 95 % compaction the ratio between in situ bank yards and compacted fill bank yards would be 0.87. For fill to be compacted to 90 % relative compaction the grading factor would increase to 0.92.

9.5 SPECIFICATIONS

9.5.1 General

All earthwork should be done according to the current Standard Specifications of Caltrans. Section 16, Clearing and Grubbing, and Section 19, Earthwork, of the Standard Specifications should be followed. Specific additions and modifications to those specification requirements are discussed in the following sections.

9.5.2 Site Preparation

Site preparation generally consists of clearing and grubbing the site prior to fill placement or construction of structural pavement sections, or other appurtenant structures; these recommendations should be used in conjunction with the specifications presented in Section 16 of the Caltrans Standard Specifications.

All deleterious material within the areas to be graded should be removed prior to grading operations. Areas to be filled should be cleared of existing structures. Tree stumps and roots over 25 mm in diameter should be excavated. The resulting holes should be cleared of all loose soils and backfilled with engineered fill.

Areas to receive fills should be stripped to a sufficient depth to remove all surface vegetation, organic laden topsoil, and debris. It is estimated that stripping depths could vary between approximately 50mm to 100mm and the actual stripping depth should be determined in the field at the time of construction. Any stripped organic material should not be used as engineered fill. After the site has been properly stripped, the exposed surfaces in all areas to be filled should be scarified to a minimum depth of 150mm and recompacted to the requirements for engineered fill.

Along some areas of the project alignment, the anticipated subgrade is generally stiff to very stiff clays and silts. Depending upon the time of year and other factors, these soils could experience pumping and rutting if subjected to construction equipment and traffic. Pumping is defined as temporary subgrade deflection and disturbance by excess pore water pressure generation. Rutting is defined as permanent deformation of the subgrade under wheel or track loads. Such areas

cannot be defined in advance. It will be the Contractor's responsibility to minimize such areas by providing adequate area drainage during grading. Therefore, in these areas, we recommend that construction equipment be kept off the excavation bottom and excavation be performed with equipment operated from outside of the excavation to minimize disturbance. In addition, the backhoe bucket used to excavate to final grade should be fitted with a smooth cutting surface to eliminate disturbing the subgrade soils.

9.5.3 Placement and Compaction of Fills

Subgrade preparation should consist of moisture conditioning the exposed subgrade and compacting to a minimum relative compaction of 95 percent in accordance with the provisions of Section 19-5 of the Standard Specifications. All embankment fill should be placed in thin lifts and compacted to a minimum of 95 percent relative compaction (ASTM D1557 or Caltrans 216, using the dry weight basis) in accordance with Sections 19-3, 19-5 and 19-6 of the Standard Specifications. It is recommended that the relative compaction be measured on the basis of dry density.

9.6 OVERHEAD SIGN STRUCTURES

9.6.1 General

There are ten overhead sign structures proposed in this project along the shoulders on both sides of the proposed SR4. Eight signs will be regular overhead signs (B, D, E, F, G, H, I, and J), and two will be change message signs (CMS) that have to be relocated. We understand that pile foundation consisting of vertically reinforced Cast-in-Drilled-Hole (CIDH) piles with a pile diameter of 1,524 mm and pile depth of 7.6 m is to be used for regular over head sign structures; and pile foundation consisting of vertically reinforced CIDH piles with a pile diameter of 1524 mm and pile depth of 7.0 m is to be used for CMS signs. Based on the Caltrans guidelines (ATC-32), deflection at the top of the CIDH piles should be within 25 mm. Based on the lateral deflection at the head and the tip of the pile the lateral capacities of the structures are determined and tabulated in Table 8. The plan locations of all signs and sign details are shown on the Sign Plans, Sheets S-1 through S-19 and SD-1 through SD-17.

Table 8
Proposed Overhead Sign Structure Data Table

Sign	Station	Ref. Line	Sign Plan	Sign Detail	Ref. Boring	CIDH Piles		Lateral Capacity (kN)	
						Dia. (mm)	Depth (m)	Free Head @ 6mm Deflection	Free Head @ 25 mm Deflection
B	240+00	EB4 (FEBT)	S-5	SD-1	B1, B2 & B4	1524	7.6	240	570
D	243+27	EB4 (FEBT)	S-6	SD-1	B3 & B4	1524	7.6	250	570
E	249+60	WB4 (FWBT)	S-10	SD-2	See Retaining Wall Plans (Retaining Wall 3A) for Sign Foundation Details				
F	254+10	EB4 (FEBT)	S-11	SD-2	B15, B16 & B17	1524	7.6	220	460
G	258+60	WB4 (FWBT)	S-13	SD-3	B19 & B20	1524	7.6	160	500
CMS 1	259+97	EB4 (FEBT)	S-13	SD-10	B19, B20 & B21	1220	5.5	96	135*
CMS 2	260+26	WB4 (FWBT)	S-13	SD-10	See Retaining Wall Plans (Retaining Wall 5) for Sign Foundation Details				
H	262+80	WB4 (FWBT)	S-14	SD-3	B19, B20, B21, B22 and B23	1524	7.6	190	430
I	262+80	EB4 (FEBT)	S-14	SD-4	B19, B20, B21, B22 & B23	1524	7.6	190	430
J	268+16	WB4 (FWBT)	S-16	SD-4	B25, B26, & B27	1524	7.6	200	550

* Capacity for 23 mm deflection.

Caltrans standard specifications for " Cast-In-Place Concrete Piling" should be followed. Existence of sand and gravel layers may cause localized hard drilling and ravelling or caving. It may require additional drilling and cleaning effort and may increase the volume of the concrete for the piles. The expected maximum pile tip elevation is about 8.4 m at Overhead sign C. The boring B-4 (about 420 m east) located near this location did not encounter ground water up to the elevation of 10.65 m. However the ground water table is found to be at the elevations of 3.4 m – 4.0 m in the vicinity of this site and ground water level may fluctuate and perched water condition may be encountered. It is prudent to make the contractor aware of these conditions so that he takes appropriate steps to comply with standards and maintain the integrity of the CIDH piles. All pile excavations should be observed by the geotechnical engineer prior to the placement of the reinforcement and concrete so that if conditions differ from those anticipated, appropriate recommendations can be made.

9.6.2 Overhead Sign B at Station 240+00

This overhead sign will be built along the eastbound lanes of the SR4 at station 240+00. The results of the subsurface investigations (Borings B-1, B-2 and B-4) in the vicinity of the sign

indicate that the underlying native soils consist of alluvium to the maximum explored depth. The alluvium is composed of predominately stiff to very stiff lean clay and medium dense silty sand. Ground water was not encountered in borings B-1, B-2 and B-4, however groundwater was encountered at an elevation about 3.4 to 4 m during the subsequent field investigations conducted in January 2005 in the vicinity of the site.

9.6.3 Overhead Sign D at Station 243+27

This overhead sign will be built along the eastbound lanes of the SR4 at station 243+27. Results of the subsurface investigations (Borings B-3 and B-4) in the vicinity of the sign indicate that the underlying native soils consist of alluvium to the maximum explored depth. The alluvium is composed of predominately stiff to very stiff lean clay and medium dense silty sand. Ground water was not encountered in borings B-3 and B-4, however groundwater was encountered at an elevation about 3.4 to 4 m during the subsequent field investigations conducted in January 2005 in the vicinity of the site.

9.6.4 Overhead Sign E at station 249+60

This overhead sign will be built along the westbound lanes of the SR4 at station 249+60. This sign will be immediately adjacent to retaining wall 3A. Results of the subsurface investigations (Borings B-12) in the vicinity of the sign indicate that the underlying native soils consist of alluvium to the maximum explored depth. The alluvium is composed of predominately stiff to very stiff fat clay. Ground water was not encountered in boring B-12, however groundwater was encountered at an elevation about 3.4 to 4 m during the subsequent field investigations conducted in January 2005 in the vicinity of the site. The foundation details will be provided in the retaining wall report.

9.6.5 Overhead Sign F at Station 254+10

This overhead sign will be built along the eastbound lanes of the SR4 at station 254+10. Results of the subsurface investigations (Borings B-15, B-16 and B-17) in the vicinity of the sign indicate that the underlying native soils consist of alluvium to the maximum explored depth. The alluvium is composed of predominately stiff to very stiff lean clay and loose silty sand. Ground water was not encountered in borings B-15, B-16 and B-17, however groundwater was encountered at an elevation about 3.4 to 4 m during the subsequent field investigations conducted in January 2005 in the vicinity of the site.

9.6.6 Overhead Sign G at Station 258+60

This overhead sign will be built along the westbound lanes of the SR4 at station 258+60. Construction of the roadway embankment resulted in the placement of fill near the Century Boulevard Undercrossing. Results of the subsurface investigations (Borings B-19 and B-20) in the vicinity of the sign indicate that the underlying native soils consist of alluvium to the maximum explored depth. The alluvium is composed of predominately stiff to very stiff sandy and silty clay with layers of medium dense silty sand. Groundwater was encountered at an elevation about 4 m during the subsequent field investigations conducted in January 2005 in the vicinity of the site.

9.6.7 Overhead Sign CMS 1 at Station 259+97

This overhead sign will be built along the eastbound lanes of the SR4 at station 259+97. Construction of the roadway embankment resulted in the placement of fill near the Century Boulevard Undercrossing. Results of the subsurface investigations (Borings B-19, B-20 and B-21) in the vicinity of the sign indicate that the underlying native soils consist of alluvium to the maximum explored depth. The alluvium is composed of predominately stiff to very stiff sandy and silty clay with layers of medium dense silty sand. Groundwater was encountered at an elevation about 4 m during the subsequent field investigations conducted in January 2005 in the vicinity of the site.

9.6.8 Overhead Sign CMS 2 at station 260+26

This overhead sign will be built along the westbound lanes of the SR4 at station 260+26. This sign will be immediately adjacent to retaining wall 5. The foundation details will be provided in the retaining wall report.

9.6.9 Overhead Sign H at Station 262+80

This overhead sign will be built along the westbound lanes of the SR4 at station 262+80. Results of the subsurface investigations (Borings B-19, B-20, B-21, B-22 and B-23) in the vicinity of the sign indicate that the underlying native soils consist of alluvium to the maximum explored depth. The alluvium is composed of predominately stiff to very stiff sandy and silty clay with layers of medium dense silty sand. Groundwater was encountered at an elevation about 4 m during the subsequent field investigations conducted in January 2005 in the vicinity of the site.

9.6.10 Overhead Sign I at Station 262+80

This overhead sign will be built along the eastbound lanes of the SR4 at station 262+80. Results of the subsurface investigations (Borings B-19, B-20, B-21, B-22 and B-23) in the vicinity of the sign indicate that the underlying native soils consist of alluvium to the maximum explored depth. The alluvium is composed of predominately stiff to very stiff sandy and silty clay with layers of medium dense silty sand. Groundwater was encountered at an elevation about 4 m during the subsequent field investigations conducted in January 2005 in the vicinity of the site.

9.6.11 Overhead Sign J at Station 268+16

This overhead sign will be built along the westbound lanes of the SR4 at station 268+16. Soil conditions near this overhead sign are indicated in three borings (Borings B-26, B-27 and B-25). Fill was encountered varying in thickness from 1.2 to 2.4 m. The fill generally consisted of stiff and very stiff lean clay with some sand. The fill was underlain by stiff and very stiff sandy lean clay and medium dense clayey sand to the bottom of Borings B- 26 and 27. Dense silty sand underlying the natural clay was encountered in Boring B-25. Groundwater was not encountered in the borings. However, groundwater was encountered in other areas of the project varying in elevation from 3.5 to 4.0 m.

9.7 CULVERTS

9.7.1 General

Three existing drainage culverts (Kirker Creek, Old Kirker Creek, and Los Medanos Waste Way) will be modified to accommodate the widening of SR4.

9.7.2 Kirker Creek RCB Extension

The Kirker Creek Culvert is located at station 242+20 as shown in Layout Sheet L-2.

Subsurface information in the vicinity of the existing Kirker Creek Culvert is indicated in Boring B-3 near the south end of the culvert. Subsurface conditions at the south end of the culvert consist of very stiff to hard silty fat clay with trace of sand. The clay soils become stiff at a depth of 3 m below gound surface and the clay becomes sandy and lean at a depth of 5.6 m to the bottom of Boring 3 at a depth of 6.55 m bgs. Subsurface soils near the north end of the culvert, as indicated in Boring B-4 consist of 1.4 m of fill (stiff to very stiff lean clay with trace of sand), underlain by a 1.2 m thick layer of very stiff sandy clay and medium dense silty sand to the bottom of the boring at 6.55 m bgs. No groundwater was encountered in the borings, although groundwater was encountered elsewhere on the project varying in elevation from 3.5 to 4.0 m. The details of the Kirker Creek RCB extension are shown on the Drainage Details Plans, Sheets DD-21 through DD-24.

9.7.3 Old Kirker Creek RCB Replacement

The Old Kirker Creek RCB to be replaced is located near Station 250+60 as shown on Layout Sheet L-6. The construction details are shown on the Drainage Details Plans, Sheets DD-25 through DD-30.

Subsurface conditions near the south end of the Old Kirker Creek RCB are indicated in Borings 13 and consist of clay fill to a depth of 1.5m underlain by interbedded loose Sandy Silt, firm lean Clay, loose Silty Sand, and medium dense Sandy Silt to the bottom of Boring 13 at 6.55 m bgs. At the north end of the culvert the sub-surface soils consist of very stiff Sandy Lean Clay to a depth of 4 m underlain by medium dense Clayey and Silty Sand to the bottom of Boring 13A at 6.55 m bgs. Groundwater was not encountered in the borings. However, groundwater was encountered in other areas of the project varying in elevation from 3.5 to 4.0 m.

9.7.4 Los Medanos Waste Way RCB Extension

The Los Medanos Waste Way Culvert is located at station 268+42 as shown in Layout L-12. It is a 47.5 m long standard 2.44 x 2.13 Reinforced Box culvert. Construction details of the extension are shown on the Drainage Details Plans, Sheets DD-33 through DD-35.

Soil conditions near the Los Medanos Waste Way are indicated in three borings (B- 25, 26 and 27). Fill was encountered varying in thickness from 1.2 to 2.4 m. The fill generally consisted of stiff and very stiff lean clay with some sand. The fill was underlain by stiff and very stiff sandy lean clay and medium dense clayey sand to the bottom of Borings B- 26 and 27. Dense silty sand underlying the natural clay was encountered in Boring B-25. Groundwater was not encountered

in the borings. However, groundwater was encountered in other areas of the project varying in elevation from 3.5 to 4.0 m.

9.7.5 UPI Pipe Line Crossing

USS-POSCO Industries (UPI) has two nonpotable waterlines (450 mm and 600 mm) crossing SR4 at approximately Sta WB4 244+30, west of Loveridge Road. The lines are 1.8 m centers in a 3 m easement and are very shallow. According to the UPI's records, the 450 mm line was installed in 1940 and the 600 mm was installed in 1951. The lines are on gravity flow supply water from the Contra Costa Canal to the UPI plant. UPI runs a 24/7/365 operation and cannot run without canal water. Therefore, it is imperative for the pipelines to remain in place during freeway widening construction.

At the location of the UPI pipelines crossing it is planned to construct a reinforced PCC section to span over the pipelines as shown on Sheets W-2 and W-3. To protect the existing pipelines, the pipes will be exposed and backfilled with concrete within the Caltrans right of way.

9.8 DETENTION BASIN

We understand that a detention basin is to be constructed next to the pump station near the Loveridge Road Overcrossing. The bottom of the basin is expected to be at an elevation of 12.7 m, and it has dimensions of 73 m x 22 m. The basin will be constructed by excavating the native soil to a depth of 1.0 m to 3.3 m, and constructing an embankment around the perimeter of the basin. The height of the embankment will be 1 m to 2.2 m above existing grade. The basin will impound a maximum depth of water of 2.8 m.

Excavation recommendations: We understand that the bottom of the excavation will be at an elevation of 12.7 m which is above the design ground water level. Therefore construction dewatering is not anticipated to be required. Planned side slopes are anticipated to be generally 2.5H:1V or flatter. Such slopes are expected to be appropriately stable. The bottom of the excavation, excavation slopes and foundations for embankments should be scarified and compacted to at least 95% relative compaction (CTM 216) per Caltrans specifications.

Embankment Construction: Embankments will be constructed as shown on Drawings DWQ-1 to DWQ-2. Native soil is expected to be suitable for the embankment fill. Fill should be placed to at least 95% relative compaction (CTM 216) per Caltrans specifications, placed in uniform lifts not exceeding 200 mm in uncompacted thickness, and brought to uniform moisture content prior to compacting.

Liners: Since a permeable sand layer is expected at the bottom of the excavation, a liner system is recommended. We recommend using a Bentomat CL GeoSynthetic Clay Liner (GCL) manufactured by Cetco Lining Technologies, or equivalent. 300 mm thick native soil cover should be placed over the GCL and compacted to at least 95% relative compaction (CTM 216) per Caltrans specifications. Anchor trenches should be used to hold the GCL in place. The construction procedure of the anchor trenches will be provided in the plans and specifications. The GCL should be installed in accordance with the recommendations provided by the manufacturer.

The opinions, conclusions, and recommendations presented herein are based on subsurface information developed by URS and others. The recommendations presented in this report are based on the assumption that the soil and geologic conditions do not deviate substantially from those anticipated by the information contained in the existing logs of test borings. If any variations are encountered during construction, the Geotechnical Professional should be contacted so that supplemental recommendations can be made.

If existing facilities, utilities, soils/bedrock conditions, road/structure distress, slope distress or groundwater/seepage conditions other than those noted in this report are present on the site, then their presence was not known, or was not considered in the preparation of this report. Locating utilities and evaluating potential utility interference is outside the scope of this report. Individuals utilizing this report shall inform URS Corporation if they are aware of any additional facilities or site conditions so that their presence and impact upon the project (or vice-versa) can be properly evaluated and recommendations modified to address geotechnical issues as necessary.

The Geotechnical Professional shall be given the opportunity to review the final specifications and drawings to verify that those documents are consistent with the intent of the geotechnical recommendations.

Geotechnical issues may arise during construction that were not apparent at the time this report was prepared. The Geotechnical Professional should be retained during construction to review the soil conditions encountered and the construction procedures used. All earthwork, pile and wall installation and testing should be completed under the direct observation of the Geotechnical Professional.

Specific review and investigation for environmental issues and subsurface environmental contamination were beyond the scope of our services.

The opinions and recommendations presented in this report were developed with the standard of care commonly used by other professionals practicing at the same time, within the same locality and under the same limitations. No other warranties are included, either express or implied, as to the professional advice included in this report.

American Society for Testing and Materials (ASTM), v. 04.08 for ASTM test methods, Soil and Rock (1): D-420 to D-5779, 2000.

California Geological Survey (CGS), 2003, Fault investigation reports for development sites within Alquist-Priolo Earthquake Fault Zones in Northern California, 1974-2000, CGS CD 2003-01.

FEMA, 1996, National Flood Insurance Program, (www.fema.gov).

Graymer, R.W., Jones, D.L., and Brabb, E.E., 1994, Preliminary geologic map of the Niles 7.5-minute quadrangle, Alameda County, California: U.S. Geological Survey Open-File Report 94-132, scale 1:24,000.

Knudsen, K.L., Sowers, J.M., Witter, R.C., Wentworth, C.M. and Helley, E.J., 2000, Preliminary maps of Quaternary deposits and liquefaction susceptibility, nine-county San Francisco Bay region: A digital database, U.S. Geological Survey, Open-File Report 00-444, 60 p.

NCEER, (1998), "Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils", edited by Youd, T.L., and Idriss, I.M., Technical report NCEER-98-0022.

State of California, Department of Transportation, "Caltrans Memo to Designers 5-20, August 2004.

State of California, Department of Transportation, "Guidelines for Foundation Investigations and Reports", September 2000.

State of California, Department of Transportation, "Soil & Rock Logging Classification Manual", 1996.

Tokimatsu, A.M., Seed, H.B., 1987, Evaluation of Settlements in Sands Due to Earthquake Shaking, Journal of Geotechnical Engineering, Vol. 133, No. 8, August.

U.S. Department of Agriculture, Natural Resources Conservation Service, "Soil Survey of Contra Costa County, California", September 1977.

U. S. Geological Survey, Quaternary geology of Contra Costa County and surrounding parts of Alameda, Marin, Sonoma, Solano, Sacramento, and San Joaquin Counties, California", by E.J. Helley and R.W. Graymer, Open File Report 97-98, 1997.

U.S. Geological Survey, Preliminary Geologic Map Emphasizing Bedrock Formations in Contra Costa County, California: A Digital Database", compiled by R.W. Graymer, D.L. Jones, E.E. Brabb, Open File Report 94-622, 1:75,000, 1994.

Working Group for California Earthquake Probabilities, 2003, Summary of earthquake probabilities in the San Francisco Bay area, 2003-2032, US Geological Survey, Fact Sheet 039-03 6 p.

Plates and Layout Sheets

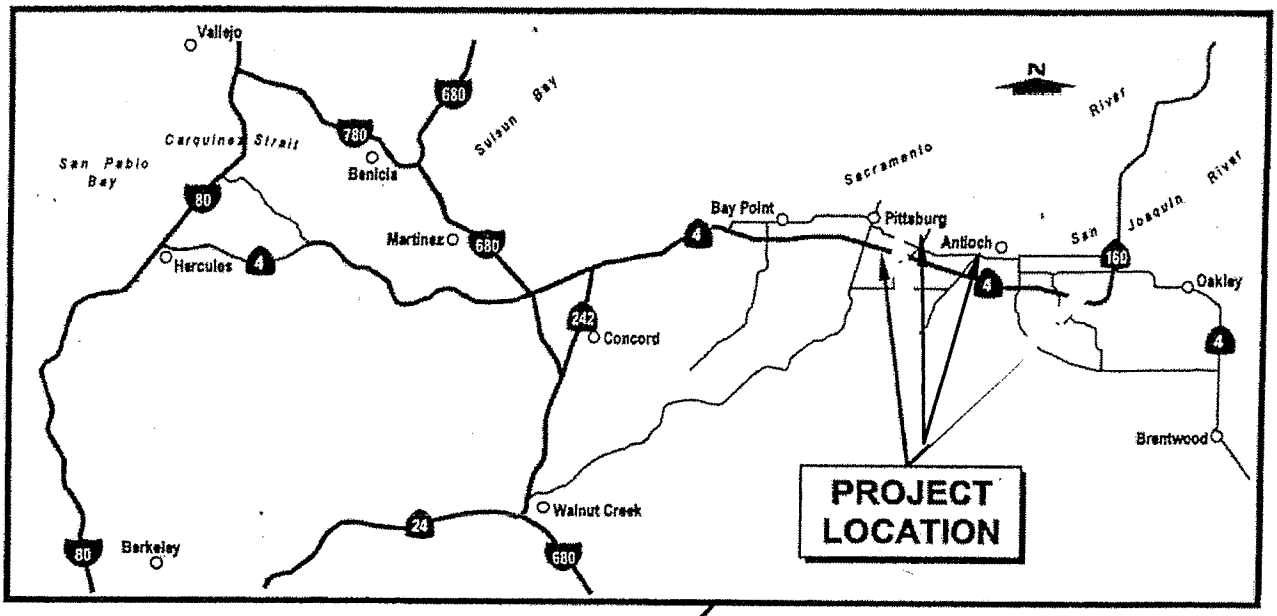
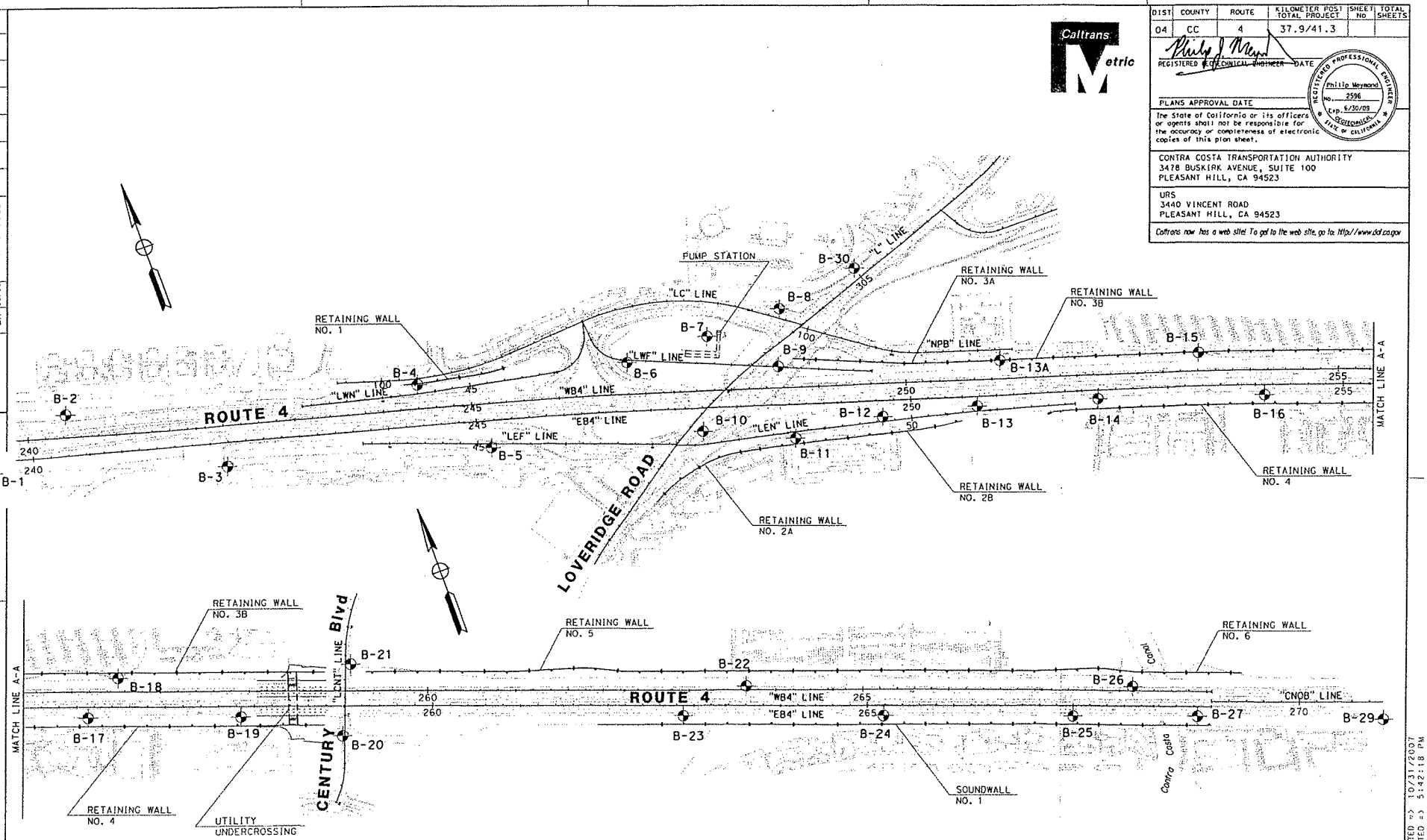


PLATE 1

STATE ROUTE 4 (EAST) WIDENING PROJECT: LOVERIDGE TO SOMERSVILLE ROAD
04-CC-4, KP 37.9 - KP 41.3

PROJECT LOCATION MAP



SITE AND BORING LOCATIONS

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PLATE 2

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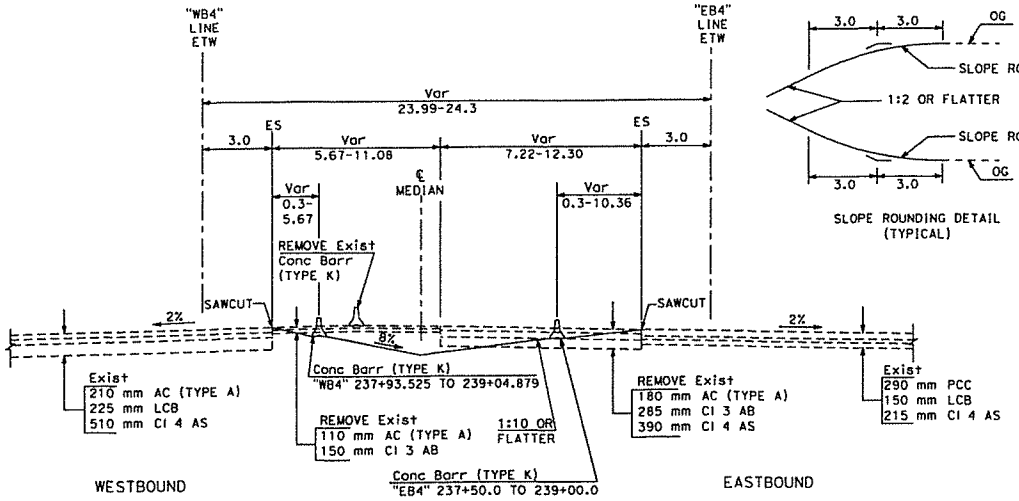
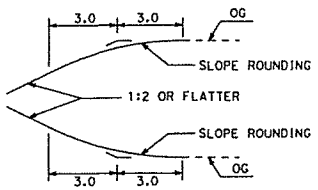
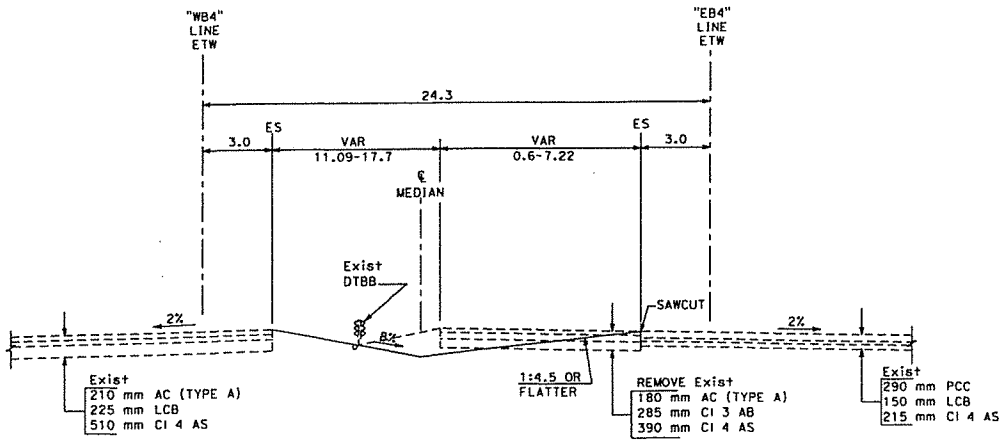


ROUTE 4

STA "WB4" 237+93.356 TO 239+04.879
STA "EB4" 237+88.538 TO 238+83.196



SLOPE ROUNDING DETAIL (TYPICAL)



ROUTE 4

STA "WB4" 235+84.258 TO 237+93.356
STA "EB4" 235+79.000 TO 237+88.600

ABBREVIATIONS:

GB	GRADE BREAK
CTB	CEMENT TREATED BASE
IBM	IMPORTED BASE MATERIAL
LTS	LIME TREATED SUBGRADE
Barr	BARRIER
eBART	BAY AREA RAPID TRANSIT
HMA	HOT MIX ASPHALT

NOTES:

1. DIMENSIONS OF STRUCTURAL SECTIONS ARE SUBJECT TO TOLERANCES SPECIFIED IN THE STANDARD SPECIFICATIONS.
2. SUPERELEVATION AS SHOWN OR AS DIRECTED BY THE ENGINEER.
3. EXTEND SUBBASE MATERIAL TO FILL SLOPE WHENEVER FILL SLOPE IS STEEPER THAN 1V:4H.
4. PLACE 60 mm (Min) HMA (TYPE A) UNDER DIKES AND CONCRETE BARRIERS. EXTEND TOP LAYER OF HMA PLACED ON SHOULDER UNDER DIKES AND BARRIER WITH NO JOINT AT THE EDGE OF SHOULDER.
5. FOR LOCATIONS AND LIMITS OF HMA DIKES AND CURBS SEE LAYOUT AND SUMMARY OF QUANTITY SHEETS.
6. FOR LOCATIONS, LIMITS AND DETAILS OF NEW SOUND WALLS, RETAINING WALLS, AND APPROACH WALLS, SEE STRUCTURE PLANS.
7. A PRIME COAT OF LIQUID ASPHALT SHALL BE APPLIED TO THE AREAS OF AGGREGATE AND AGGREGATE SUBBASE TO BE SURFACED WITH LESS THAN 135 mm OF HMA PAVEMENT.
8. THE SUBGRADE THICKNESS AND CROSS SLOPE SHOULD BE KEPT CONSTANT UNDER TRAVELED WAY AND SHOULDERS. THE THICKNESS OF HMA SHOULD BE ADJUSTED TO ACCOUNT FOR CHANGE IN CROSS SLOPE IN SHOULDERS.
9. WHERE SHOWN ON LAYOUT PLANS, EXISTING PAVEMENT SHALL BE LEFT IN PLACE AND USED AS A BASE MATERIAL UNDER THE NEW PAVEMENT.
10. WHERE EXISTING PAVEMENT IS BEING LEFT IN PLACE AND OVERLAID BY PCC SLAB, EXISTING EDGE DRAIN PIPES AND ASSOCIATED PERMEABLE MATERIAL SHALL BE REMOVED AND BACKFILLED WITH HOT MIX ASPHALT BASE, AS SHOWN ON DETAIL "C" ON SHEET X-5.
11. FOR HMA BASE LEVELING INFORMATION IN AREAS WHERE Exist PAVEMENT IS LEFT IN PLACE, SEE CONSTRUCTION DETAILS SHEET C-17.
12. FOR VARIABLE THICKNESS OF HMA INFORMATION IN AREAS WHERE Exist PAVEMENT LEFT IN PLACE, SEE CONSTRUCTION DETAILS SHEET C-17.
13. FOR HMA OVERLAY CONFORM DETAILS, REFER TO Sht C-15.
14. SEE CONSTRUCTION DETAILS SHEETS FOR LIMITS OF eBART CONCRETE BARRIER AND RETAINING WALLS.
15. FOR MEDIAN TREATMENT ALONG CALIFORNIA Ave AND LOVERIDGE Rd, SEE CONSTRUCTION DETAIL Sht C-31.
16. A CURING COMPOUND SHALL BE APPLIED TO THE AREAS OF EXISTING ASPHALT CONCRETE PAVEMENT AND ASPHALT CONCRETE BASE TO BE SURFACED WITH CONCRETE PAVEMENT.
17. PRIOR TO PLACEMENT OF HMA OVERLAYS, LOCALIZED FAILURES OF Exist PAVEMENT SHALL BE REPAIRED BY DIGGING OUT THE Exist FAILED PAVEMENT TO A Min DEPTH OF 150 mm OR THE DEPTH OF Exist AC PAVEMENT, WHICHEVER IS LESS, AND REPLACE WITH FULL DEPTH HMA. ALL CRACKS WIDER THAN 5 mm SHALL BE SEALED.

TYPICAL CROSS SECTIONS

NO SCALE

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

X-1

DIST	COUNTY	ROUTE	KILOMETER TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

B. RAZEGHI No. C-52725 Exp. 12-31-08 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

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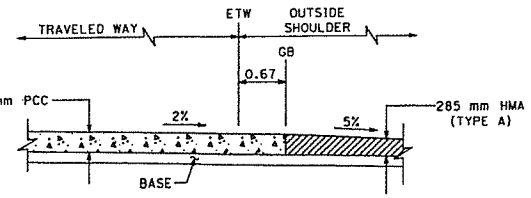
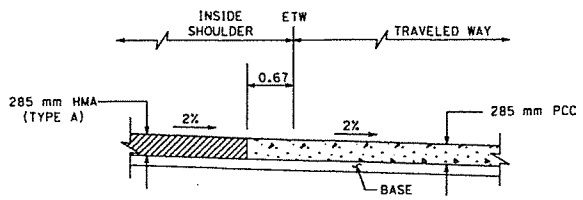


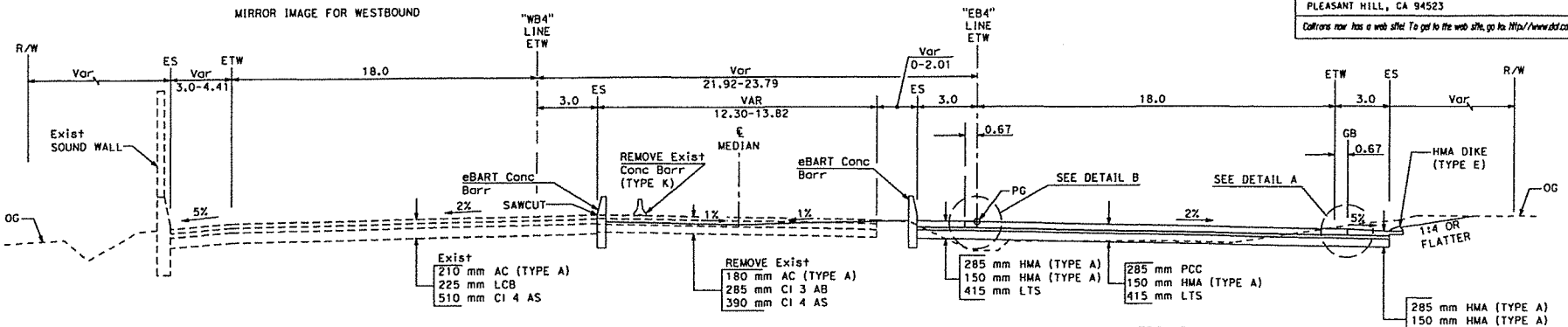
DETAIL A

MIRROR IMAGE FOR WESTBOUND



DETAIL B

MIRROR IMAGE FOR WESTBOUND



WESTBOUND

ROUTE 4

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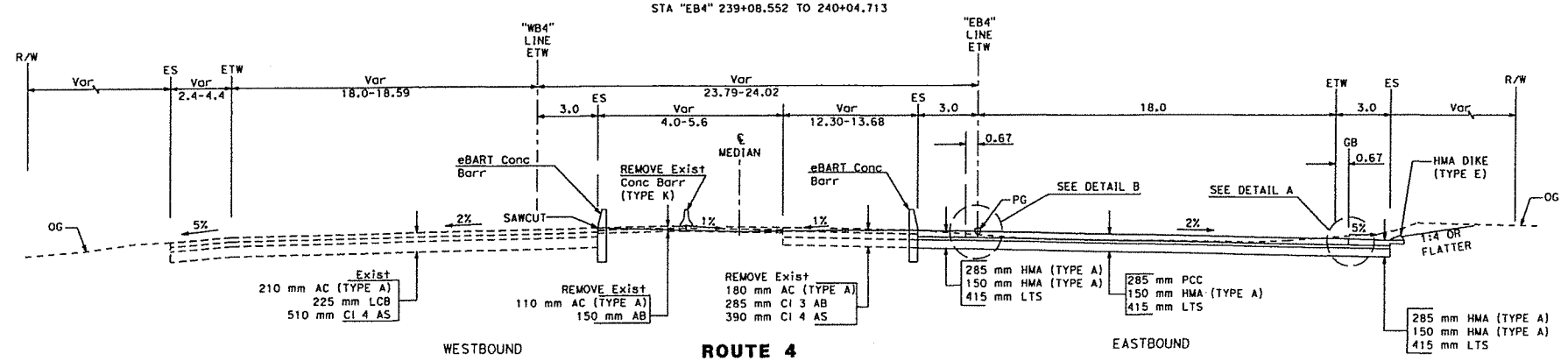
STA "EB4" 239+08.552 TO 240+04.713

EASTBOUND



WESTBOUND

ROUTE 4

STA "WB4" 239+04.879 TO 239+13.455
STA "EB4" 238+83.196 TO 239+08.552

EASTBOUND

TYPICAL CROSS SECTIONS

NO SCALE

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

X-2

DIST	COUNTY	ROUTE	KILOMETER TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

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REGISTERED PROFESSIONAL ENGINEER — B. RAZEGHI — No. C-52725 — Exp. 12-31-08 — CIVIL — STATE OF CALIFORNIA

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EA 228591

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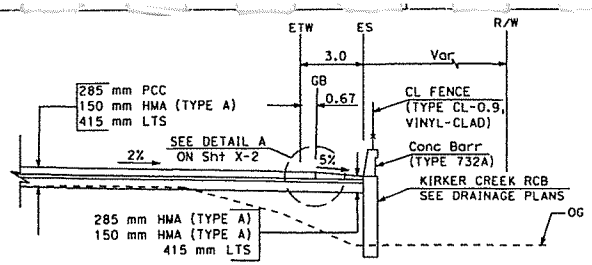
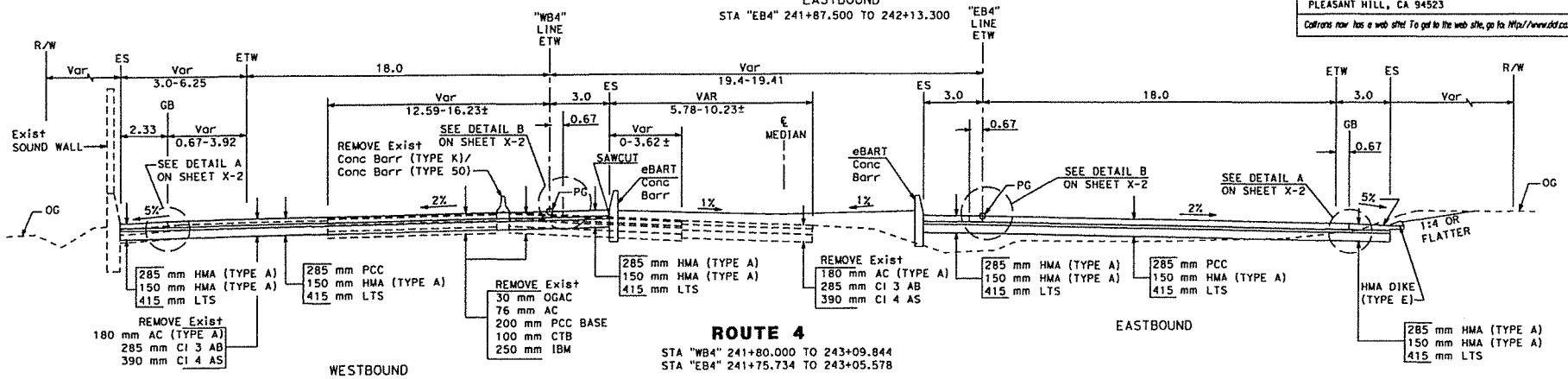


EASTBOUND

STA "EB4" 241+87.500 TO 242+13.300



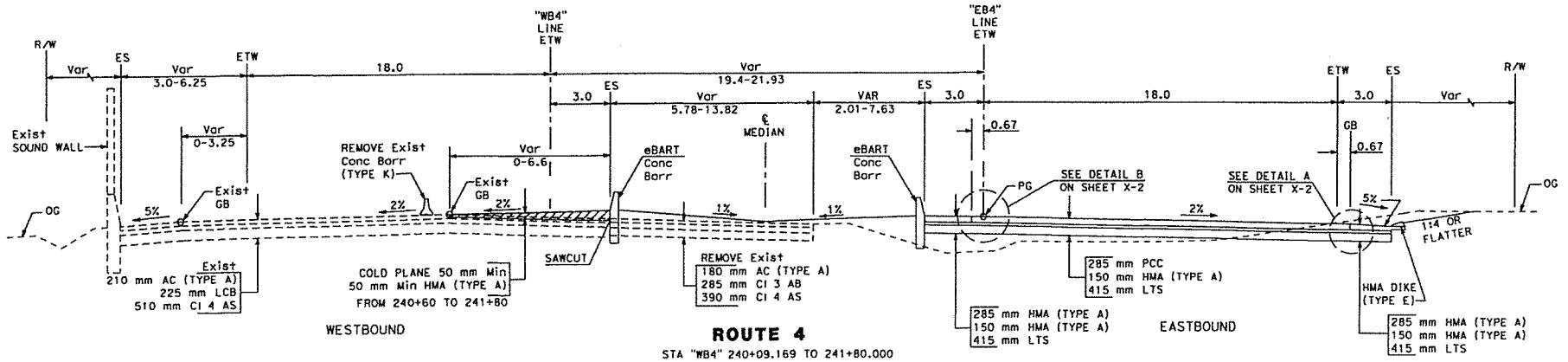
WESTBOUND

EASTBOUND

ROUTE 4

STA "WB4" 241+80.000 TO 243+09.844

STA "EB4" 241+75.734 TO 243+05.578



WESTBOUND

EASTBOUND

ROUTE 4

STA "WB4" 240+09.169 TO 241+80.000

STA "EB4" 240+04.713 TO 241+75.734

TYPICAL CROSS SECTIONS

NO SCALE

ALL DIMENSIONS ARE IN
METERS UNLESS OTHERWISE SHOWN

X-3

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

B. RAZEGHI — No. C-52725 — Exp. 12-31-08 — CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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DATE	REVISED BY	DATE REVISED
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FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE X-1.

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER TOTAL PROJECT	FEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

B. RAZEGHI C-52725 EXP. 12-31-08 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

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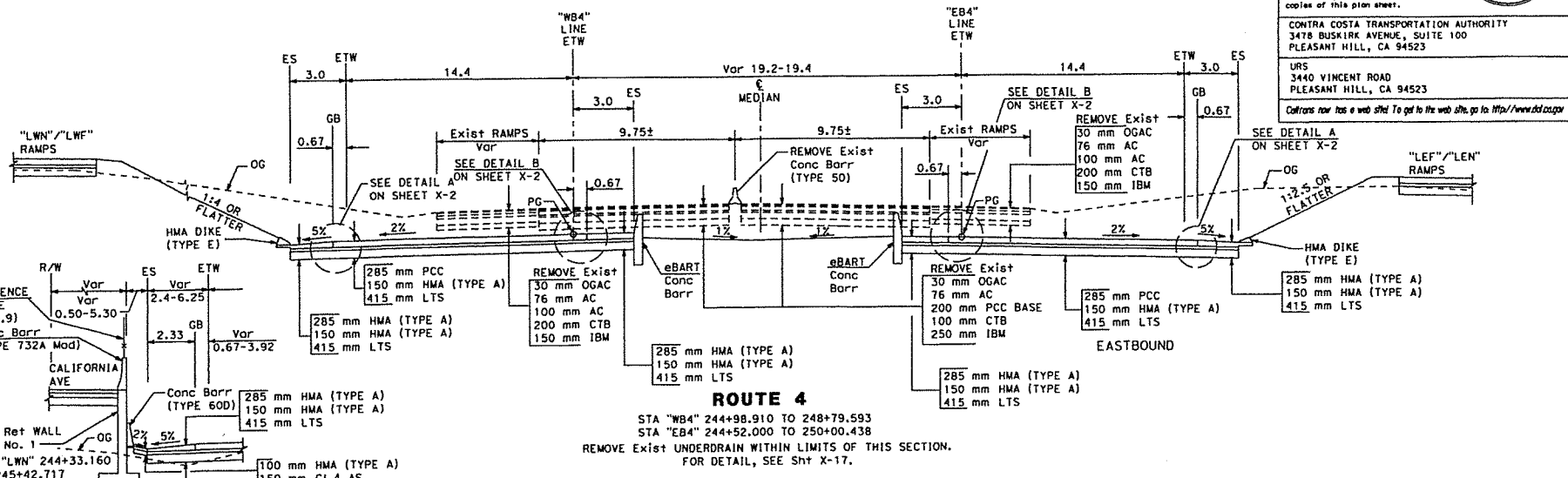
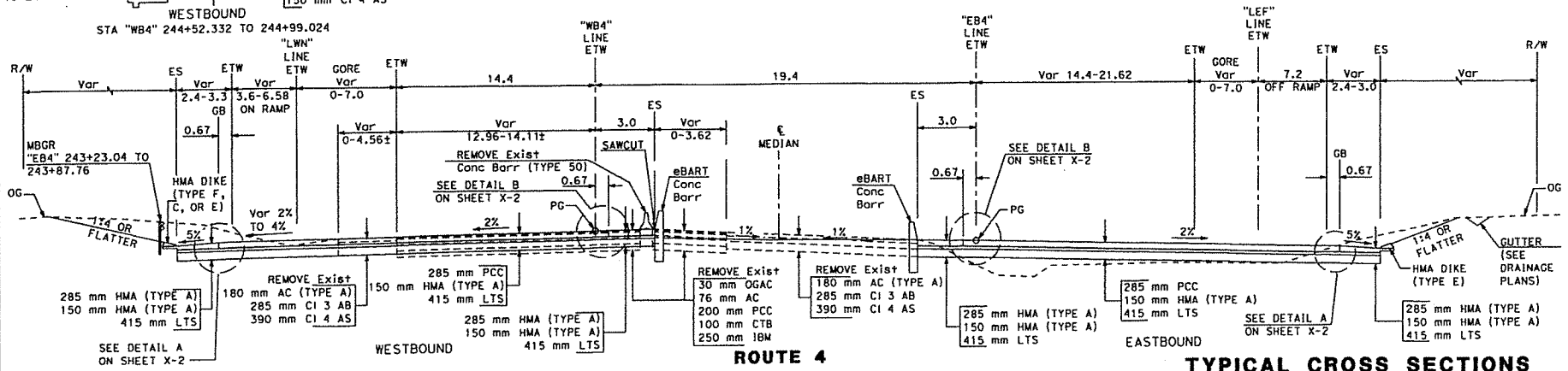


ROUTE 4

STA "WB4" 244+98.910 TO 248+79.593
STA "EB4" 244+52.000 TO 250+00.438

REMOVE Exist UNDERDRAIN WITHIN LIMITS OF THIS SECTION.
FOR DETAIL, SEE Sht X-17.



ROUTE 4

STA "WB4" 243+09.844 TO 244+98.910
STA "EB4" 243+05.578 TO 244+52.000

TYPICAL CROSS SECTIONS

NO SCALE

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X-4

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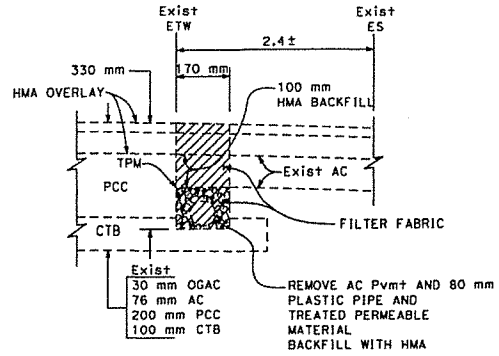
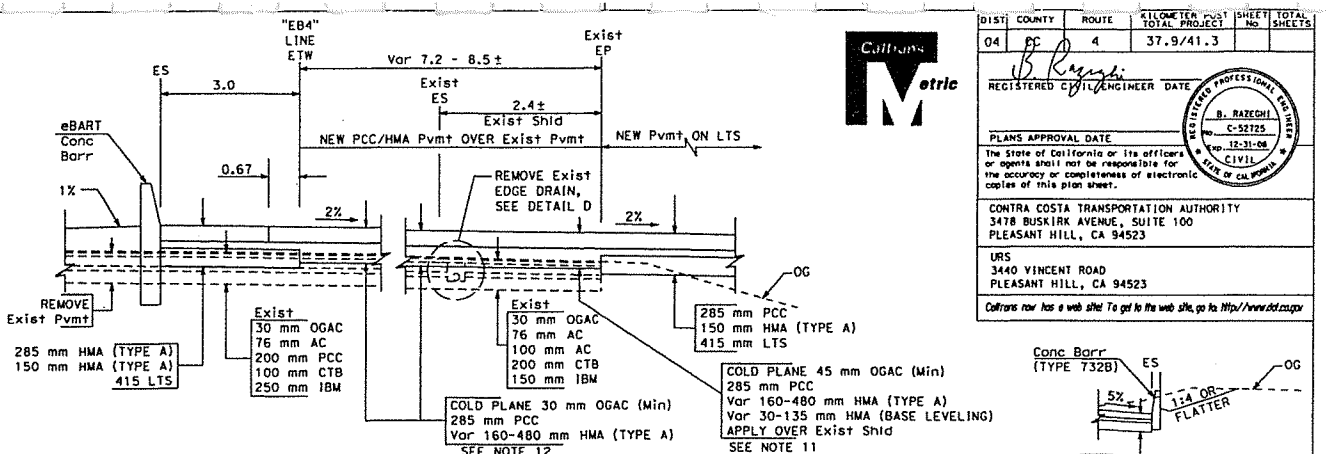


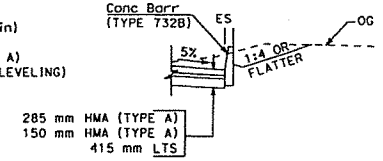
REMOVE Exist EDGE DRAIN

DETAIL D



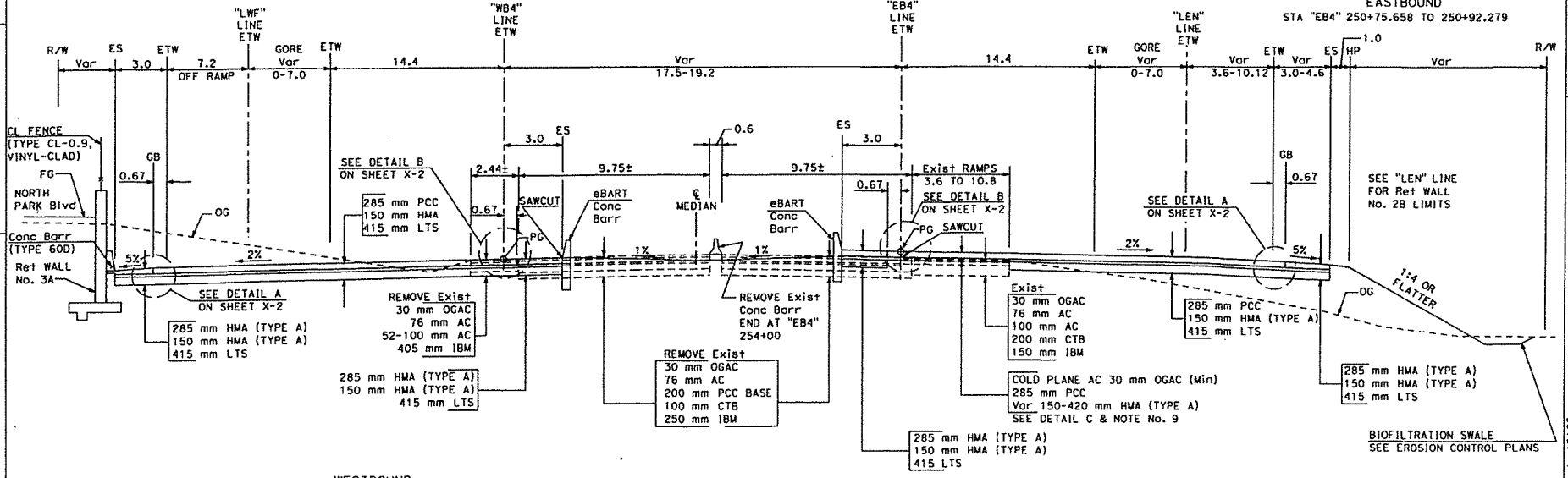
DETAIL C

STA "EB4" 250+00.000 TO 253+06.000



EASTBOUND

STA "EB4" 250+75.658 TO 250+92.279



WESTBOUND

EASTBOUND

ROUTE 4

STA "WB4" 248+79.594 TO 249+61.598
STA "EB4" 250+00.438 TO 251+92.000
FOR REMOVE Exist UNDERDRAIN DETAIL, SEE Sht X-16.

TYPICAL CROSS SECTIONS

NO SCALE

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

X-5

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

B. RAZEGHI C-52725 12-31-08 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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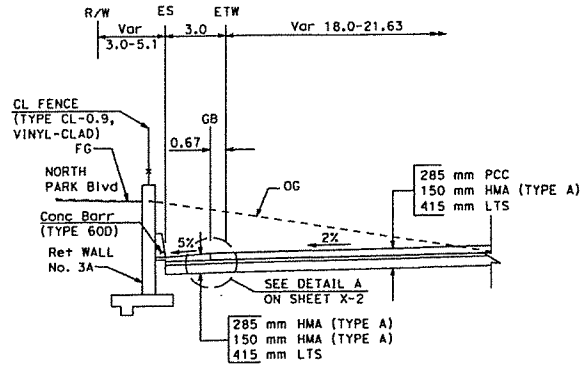
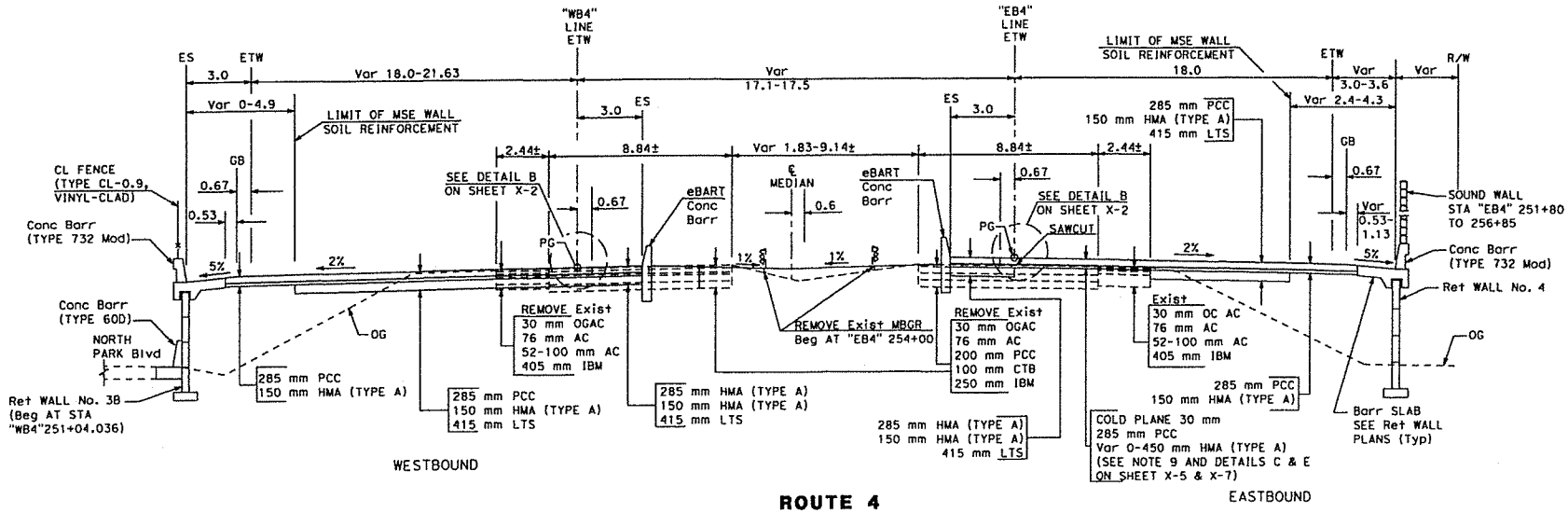


ROUTE 4

STA "WB4" 249+61.598 TO 251+04.036



ROUTE 4

STA "WB4" 249+61.598 TO 256+00.000
STA "EB4" 251+92.000 TO 256+00.000

TYPICAL CROSS SECTIONS

NO SCALE

ALL DIMENSIONS ARE IN
METERS UNLESS OTHERWISE SHOWN

X-6

DIST	COUNTY	ROUTE	KILOMETER TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

B. RAZEGHI
No. C-52725
EXP. 12-31-06
CIVIL
STATE OF CALIFORNIA

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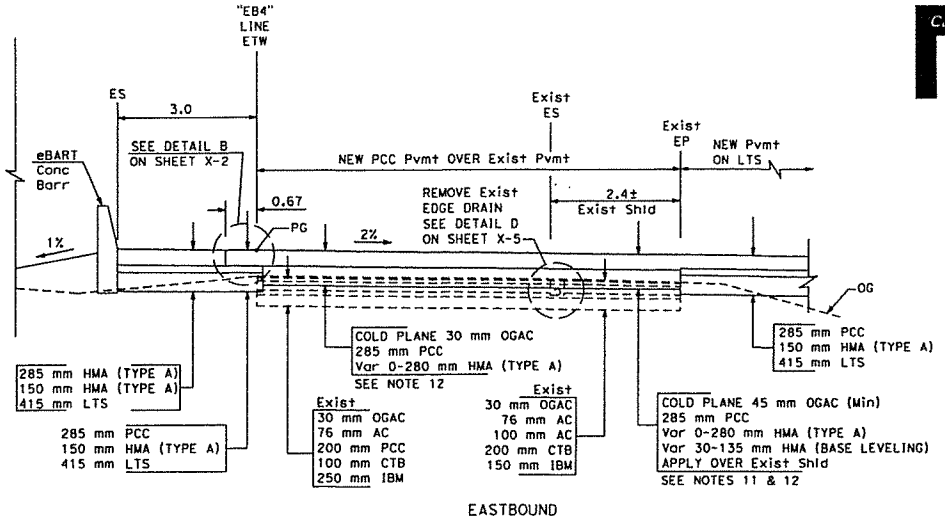
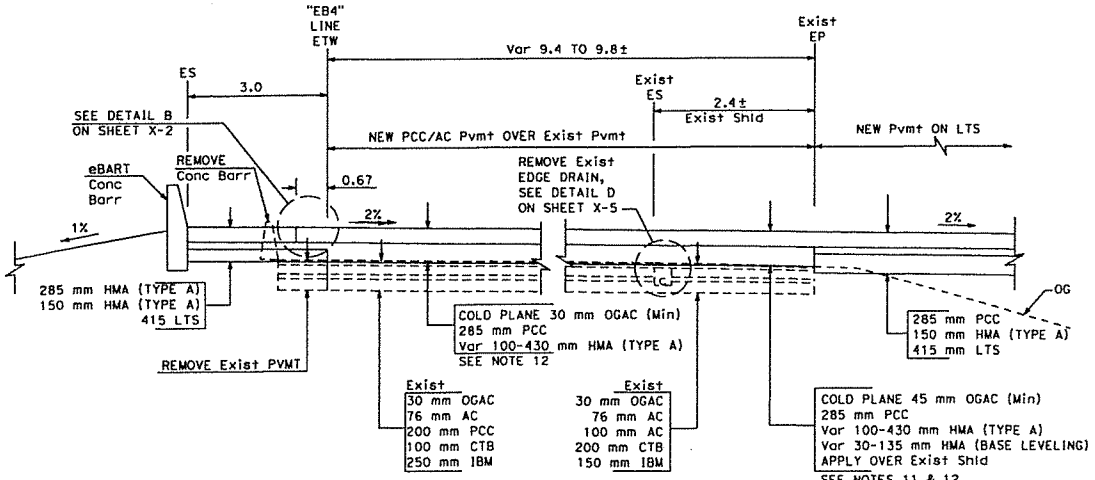


EASTBOUND

DETAIL F

STA "EB4" 255+30 TO 256+00



DETAIL E

STA "EB4" 253+06 TO 255+30

TYPICAL CROSS SECTIONS

NO SCALE

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

X-7

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

B. RAZEGHI C-52725 12-31-08 CIVIL STATE OF CALIFORNIA

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DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

B. RAZEGHI — No. C-52725 — Exp. 12-31-06 — CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

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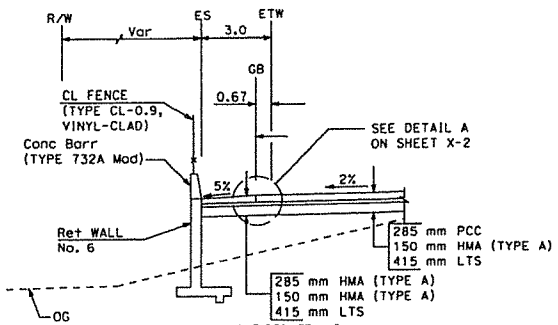
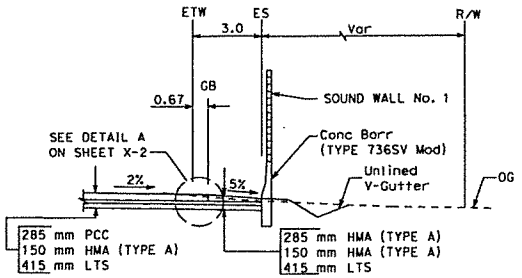
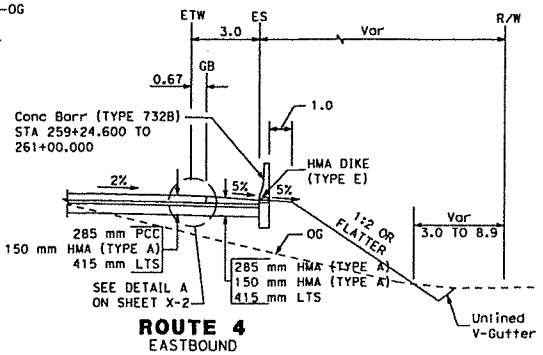


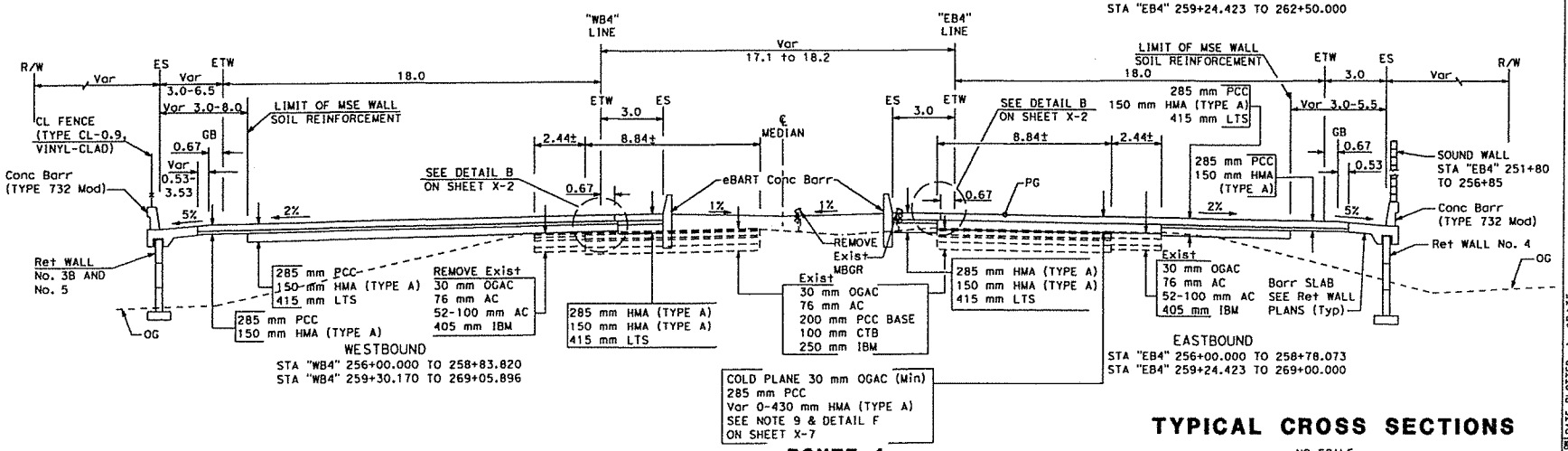
ROUTE 4
WESTBOUND
STA "WB4" 268+26.256 TO 269+05.896



ROUTE 4
EASTBOUND
STA "EB4" 262+50.000 TO 269+00.000



ROUTE 4
EASTBOUND
STA "EB4" 259+24.423 TO 262+50.000



ROUTE 4

WESTBOUND
STA "WB4" 256+00.000 TO 258+83.820
STA "WB4" 259+30.170 TO 269+05.896

EASTBOUND
STA "EB4" 256+00.000 TO 258+78.073
STA "EB4" 259+24.423 TO 269+00.000

TYPICAL CROSS SECTIONS

NO SCALE

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

X-8

REVISED BY	DATE REVISED
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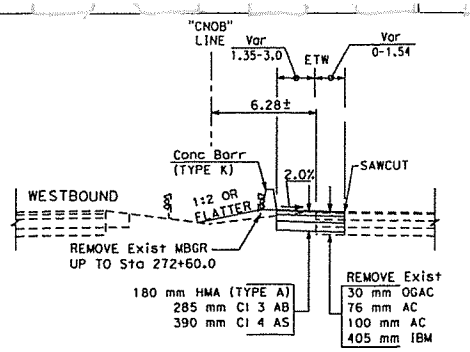
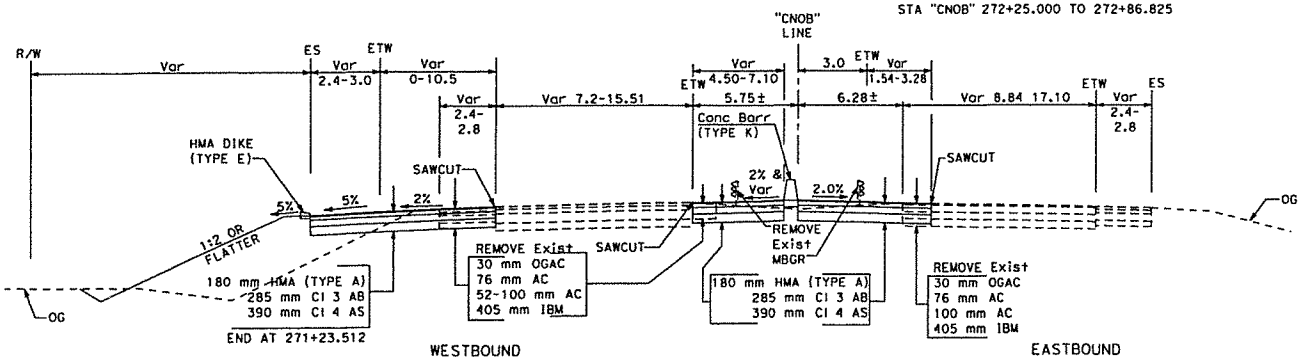


ROUTE 4

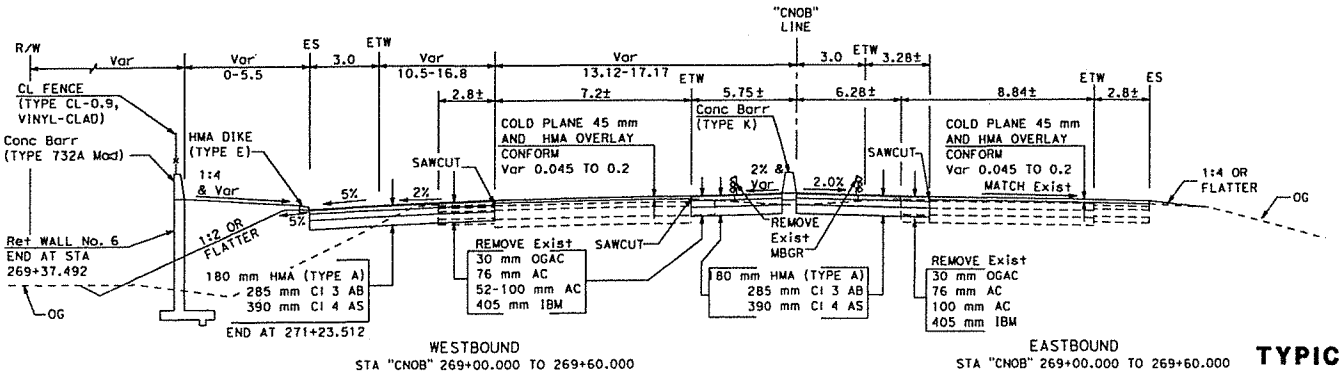
EASTBOUND
STA "CNOB" 272+25.000 TO 272+86.825



WESTBOUND
STA "CNOB" 269+00.000 TO 272+25.000

EASTBOUND
STA "CNOB" 269+00.000 TO 272+25.000

ROUTE 4



WESTBOUND
STA "CNOB" 269+00.000 TO 269+60.000

EASTBOUND
STA "CNOB" 269+00.000 TO 269+60.000

ROUTE 4

TYPICAL CROSS SECTIONS

NO SCALE

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

X-9

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

B. RAZEGHI No. C-52725 12-31-08 CIVIL STATE OF CALIFORNIA

PLANS APPROVAL DATE

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EA 228591

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DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

B. RAZEGHI C-52725 Exp. 12-31-08 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

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EAJ	03/05		
CHECKED BY	DATE		
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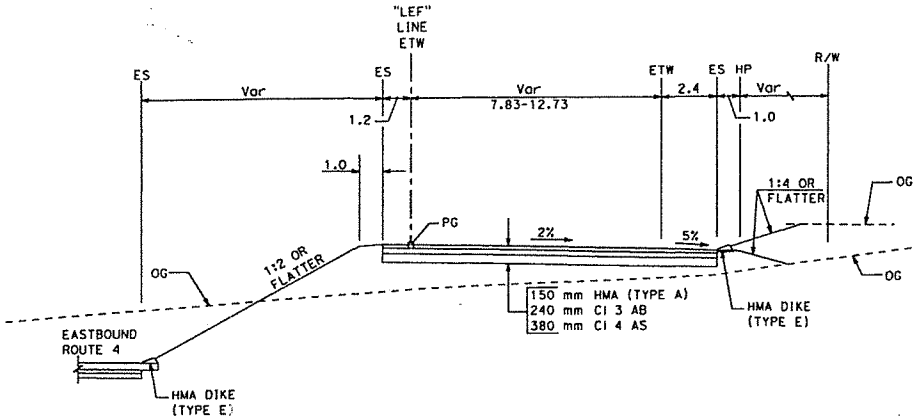
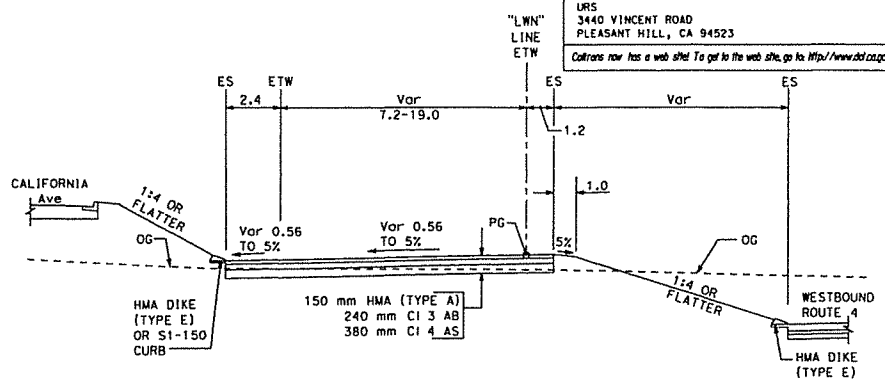


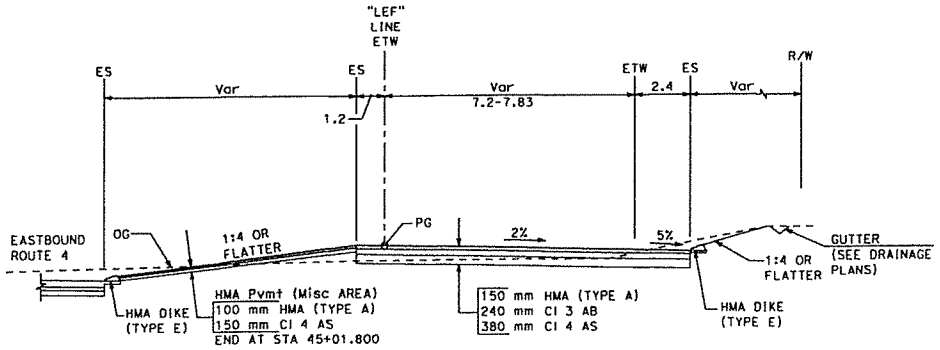
EASTBOUND ROUTE 4 LOVERIDGE ROAD OFF-RAMP

STA "LEF" 45+01.825 TO 46+74.108



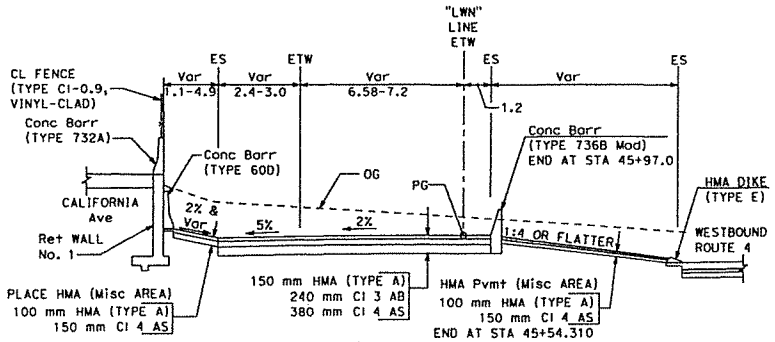
WESTBOUND ROUTE 4 LOVERIDGE ROAD ON-RAMP

STA "LWN" 45+42.734 TO 46+54.273



EASTBOUND ROUTE 4 LOVERIDGE ROAD OFF-RAMP

STA "LEF" 44+52.196 TO 45+01.827



WESTBOUND ROUTE 4 LOVERIDGE ROAD ON-RAMP

STA "LWN" 44+99.028 TO 45+42.734

TYPICAL CROSS SECTIONS

NO SCALE

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X-10

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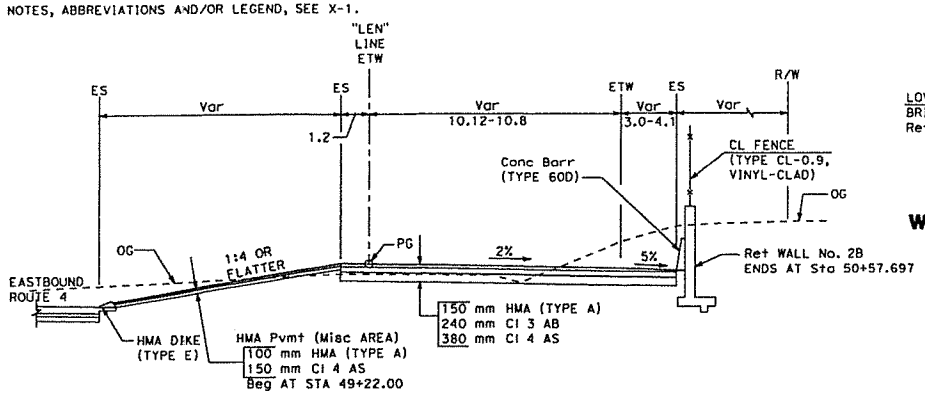
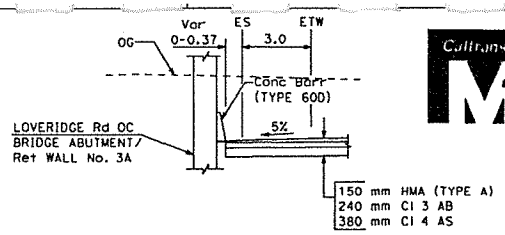


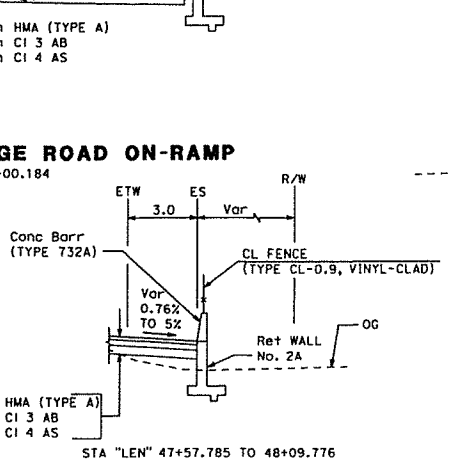
EASTBOUND ROUTE 4 LOVERIDGE ROAD ON-RAMP

STA "LEN" 49+75.000 TO 50+00.184

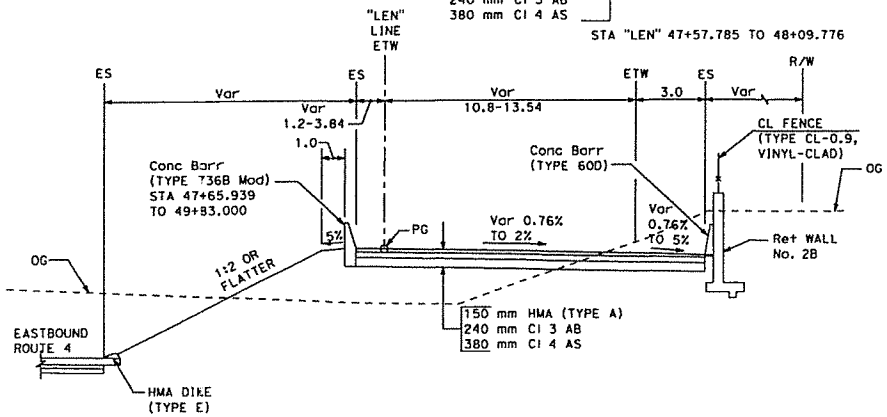


WESTBOUND ROUTE 4 LOVERIDGE ROAD OFF-RAMP

STA "LWF" 48+04.080 TO 48+79.398

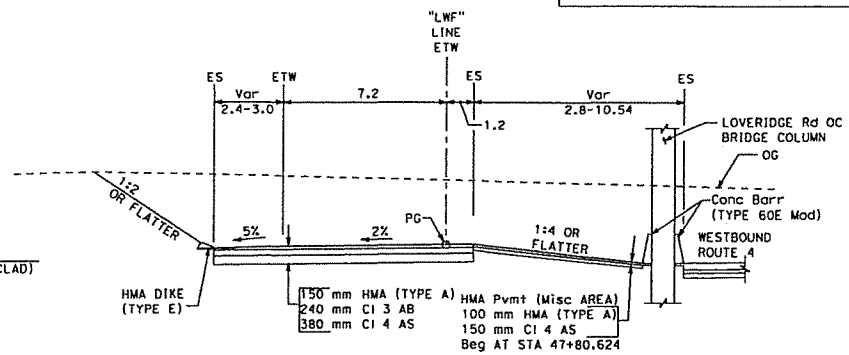


STA "LEN" 47+57.785 TO 48+09.776



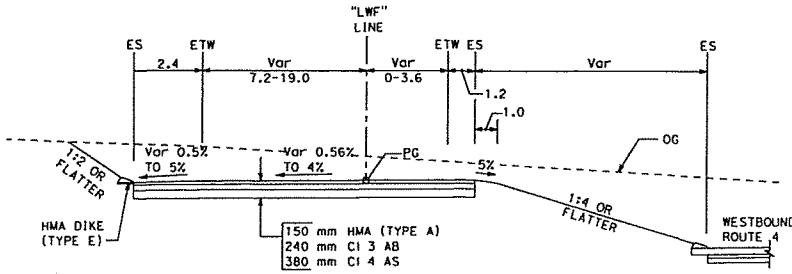
EASTBOUND ROUTE 4 LOVERIDGE ROAD ON-RAMP

STA "LEN" 47+63.975 TO 49+75.000



WESTBOUND ROUTE 4 LOVERIDGE ROAD OFF-RAMP

STA "LWF" 47+88.000 TO 48+79.398



WESTBOUND ROUTE 4 LOVERIDGE ROAD OFF-RAMP

STA "LWF" 46+23.784 TO 47+88.000

TYPICAL CROSS SECTIONS

NO SCALE

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

X-11

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — B. RAZEGHI — No. C-52725 — Exp. 12-31-08 — CIVIL — STATE OF CALIFORNIA — DATE

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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CU 04275 | EA 228591

FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE X-1.

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

B. RAZEGHI, No. C-52725, Exp. 12-31-08, CIVIL, REGISTERED PROFESSIONAL ENGINEER, STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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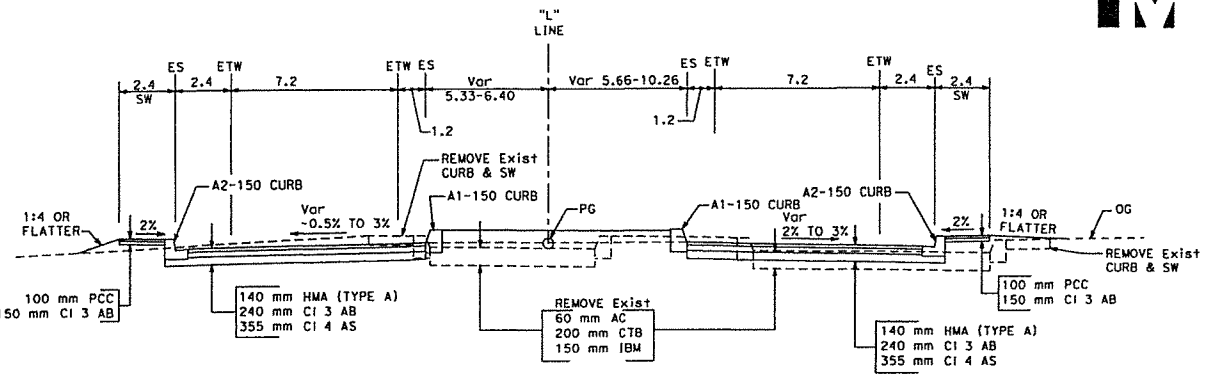
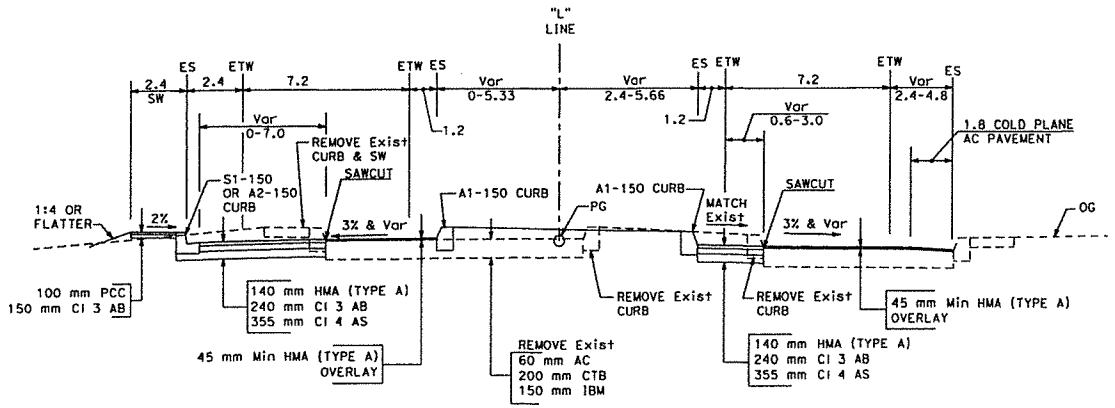


SOUTHBOUND
STA "L" 301+45.000 TO 301+69.691

NORTHBOUND
STA "L" 301+45.000 TO 302+07.684

LOVERIDGE ROAD



SOUTHBOUND
STA "L" 300+60.000 TO 301+45.000

NORTHBOUND
STA "L" 300+60.000 TO 301+45.000

LOVERIDGE ROAD

TYPICAL CROSS SECTIONS

NO SCALE

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

X-12

REVISED BY	DATE	CALCULATED/ DESIGNED BY	DESIGN OVERSIGHT	STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
DATE REVISED	03/05	EAJ	SOTERO ANGELES	Caltrans
	03/05	BR		
		CHECKED BY		

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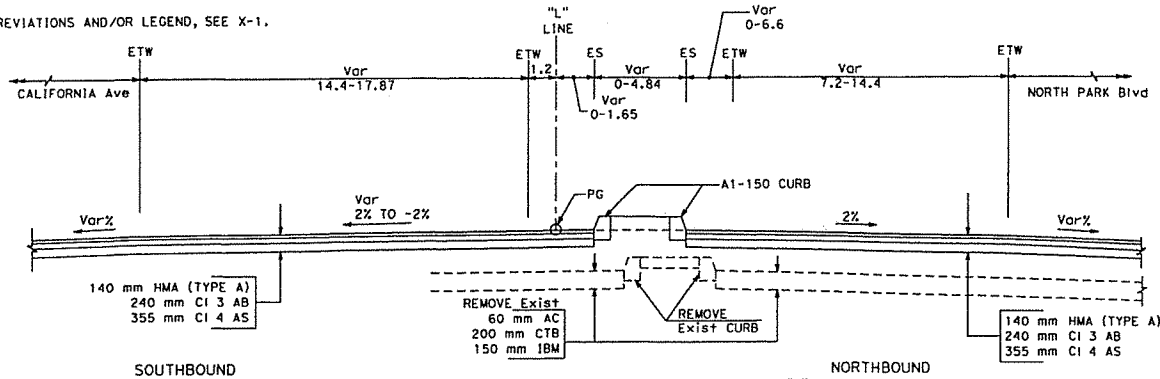
CU 04275

EA 228591

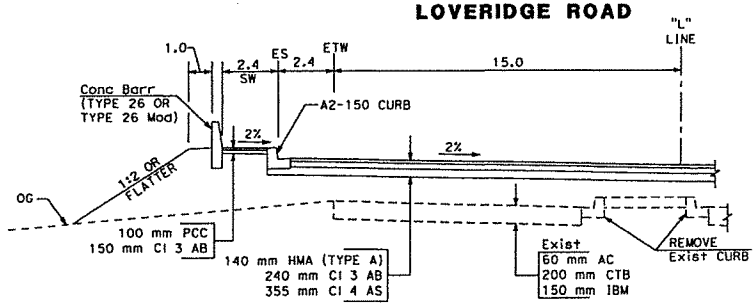
FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE X-1.



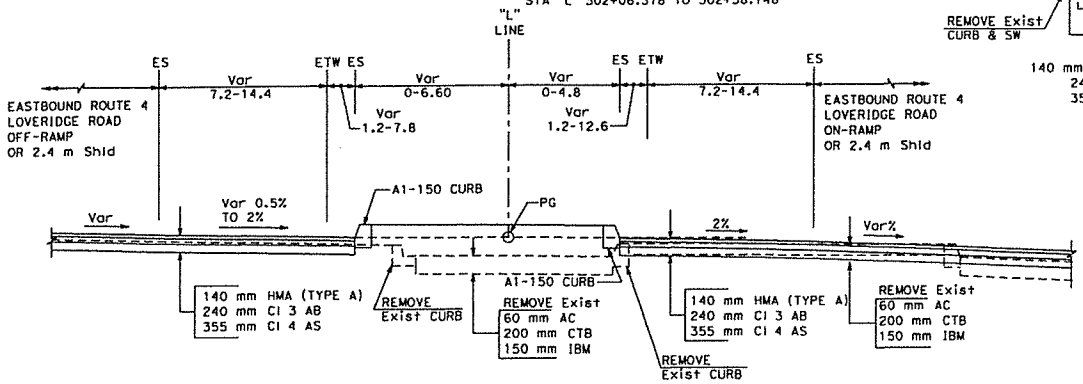
SOUTHBOUND
STA "L" 303+60.435 TO 304+28.724

NORTHBOUND
STA "L" 303+91.357 TO 304+60.459

LOVERIDGE ROAD



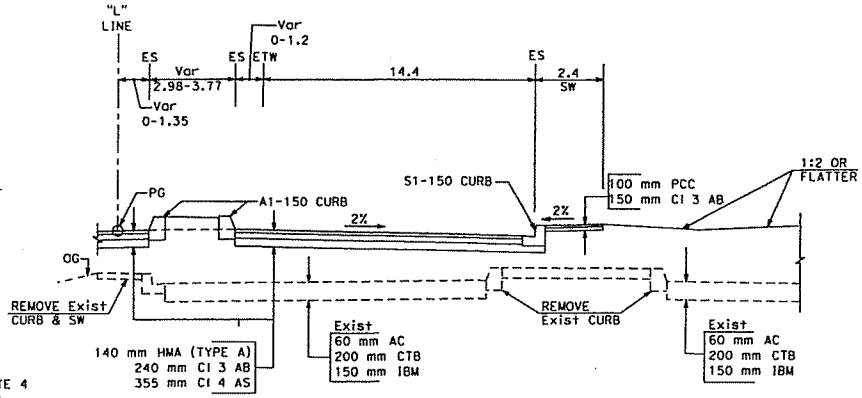
SOUTHBOUND
STA "L" 302+06.378 TO 302+38.748



SOUTHBOUND
STA "L" 301+69.691 TO 302+23.095

NORTHBOUND
STA "L" 302+07.684 TO 302+59.747

LOVERIDGE ROAD



LOVERIDGE ROAD
STA "L" 303+56.891 TO 303+91.357

TYPICAL CROSS SECTIONS

NO SCALE

X-13

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

B. RAZEGHI No. C-52725 Exp. 12-31-08 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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DESIGN OVERSIGHT: SOTERO ANGELES

CALCULATED/DESIGNED BY: EAJ 03/05

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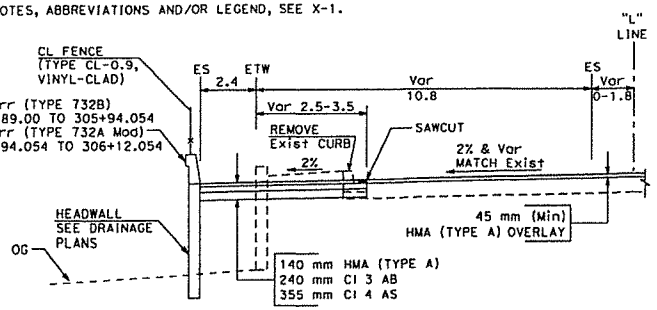
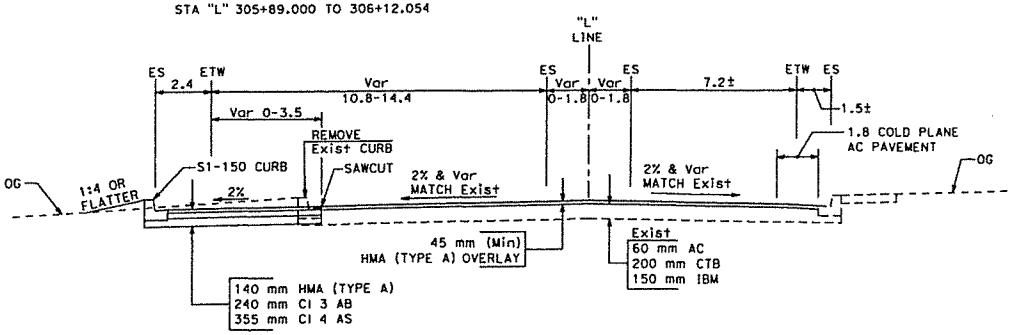
CU 04275

EA 228591

FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE X-1.



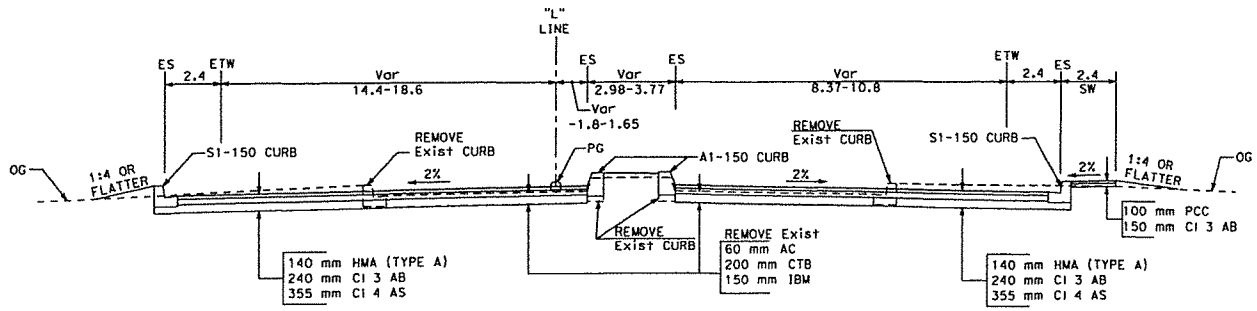
SOUTHBOUND
STA "L" 305+89.000 TO 306+12.054



SOUTHBOUND
STA "L" 305+10.000 TO 306+49.360

NORTHBOUND
STA "L" 305+10.000 TO 305+94.687

LOVERIDGE ROAD



SOUTHBOUND
STA "L" 304+28.724 TO 305+10.000

NORTHBOUND
STA "L" 304+60.459 TO 305+10.000

LOVERIDGE ROAD

TYPICAL CROSS SECTIONS

NO SCALE

ALL DIMENSIONS ARE IN
METERS UNLESS OTHERWISE SHOWN

X-14

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

B. RAZEGHI
C-52725
12-31-08
CIVIL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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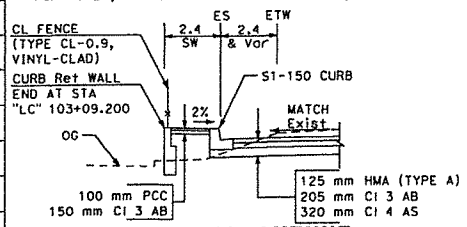
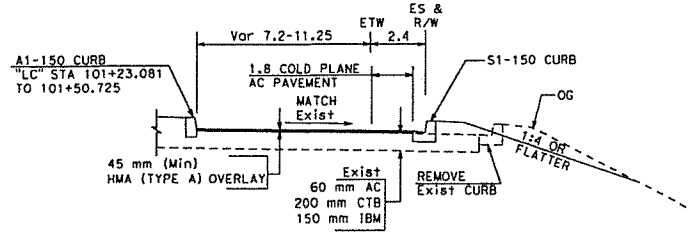
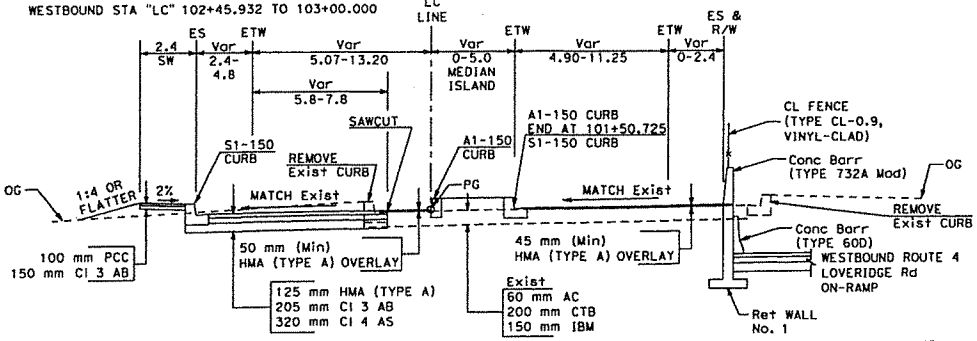


CALIFORNIA AVENUE

WESTBOUND STA "LC" 100+90.000 TO 101+10.000
WESTBOUND STA "LC" 102+45.932 TO 103+00.000

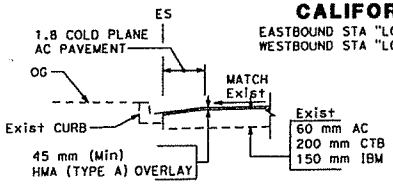


EASTBOUND STA "LC" 101+38.918 TO 103+00.000



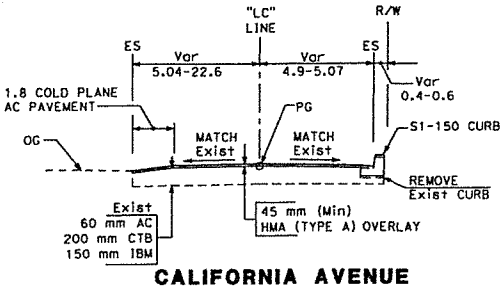
CALIFORNIA AVENUE

EASTBOUND STA "LC" 100+32.050 TO 103+00.000
WESTBOUND STA "LC" 100+74.164 TO 103+00.000



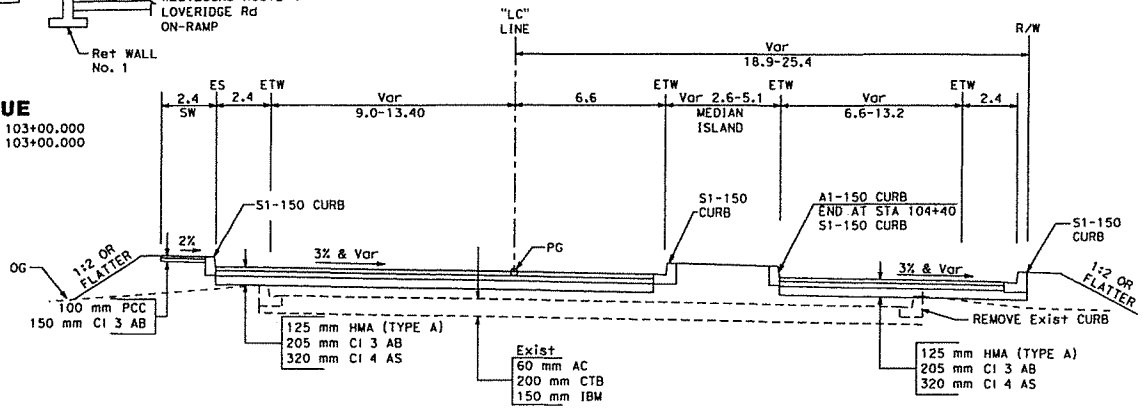
CALIFORNIA AVENUE

WESTBOUND STA "LC" 100+45.797 TO 100+74.164



CALIFORNIA AVENUE

EASTBOUND STA "LC" 99+80.000 TO 100+32.050
WESTBOUND STA "LC" 99+80.000 TO 100+74.164



CALIFORNIA AVENUE

EASTBOUND STA "LC" 103+00.000 TO 104+37.343
WESTBOUND STA "LC" 103+00.000 TO 104+77.268

TYPICAL CROSS SECTIONS

NO SCALE

ALL DIMENSIONS ARE IN
METERS UNLESS OTHERWISE SHOWN

X-15

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER — B. RAZEGHI — NO. C-52725 — EXP. 12-31-08 — CIVIL — STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
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PLEASANT HILL, CA 94523

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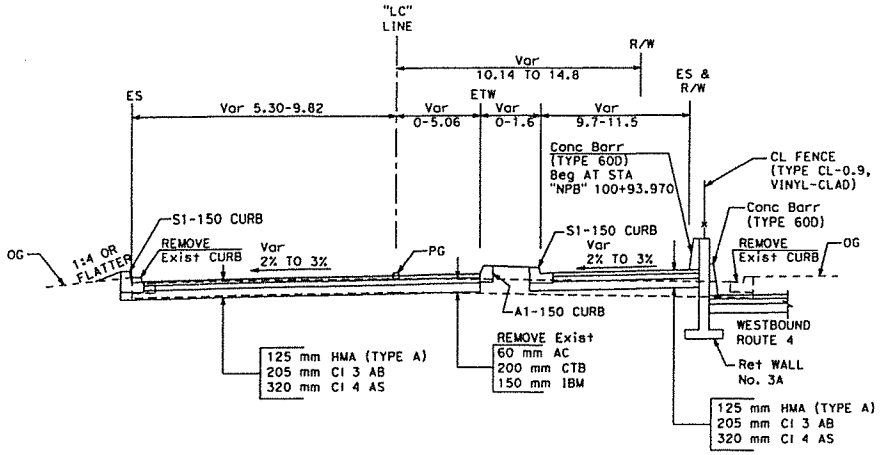
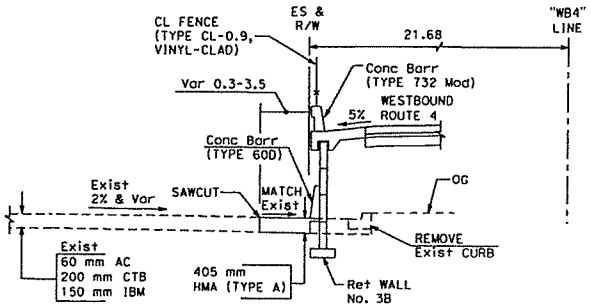


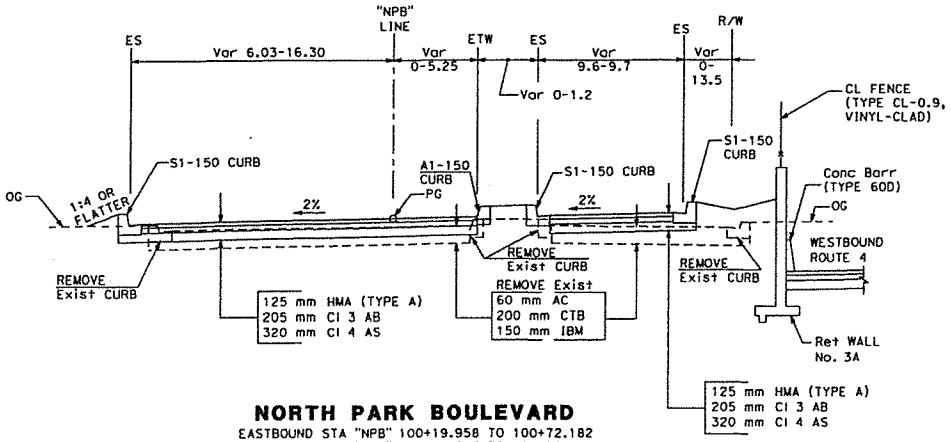
NORTH PARK BOULEVARD

STA "NPB" 100+72.182 TO 101+42.548



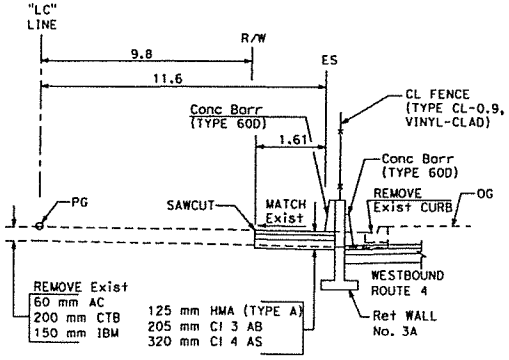
NORTH PARK BOULEVARD

STA "WB4" 251+04.057 TO 256+42.901



NORTH PARK BOULEVARD

EASTBOUND STA "NPB" 100+19.958 TO 100+72.182
WESTBOUND STA "NPB" 100+36.695 TO 100+72.182



NORTH PARK BOULEVARD

STA "NPB" 101+42.548 TO 102+19.243

TYPICAL CROSS SECTIONS

NO SCALE

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

X-16

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

B. RAZEGHI C-52725 12-31-08 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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EAJ	03/05	BR	03/05
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LAST REVISION DATE PLOTTED => $DATE
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FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE X-1.

DIST	COUNTY	ROUTE	TOTAL PROJECT MILEAGE	PHASE No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER _____ DATE _____

D. RAZEGHI C-52725 12-31-06 CIVIL STATE OF CALIFORNIA

PLANS APPROVAL DATE _____

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PLEASANT HILL, CA 94523

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3440 VINCENI ROAD
PLEASANT HILL, CA 94523

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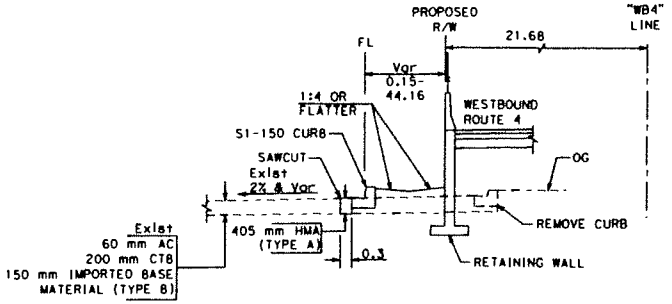
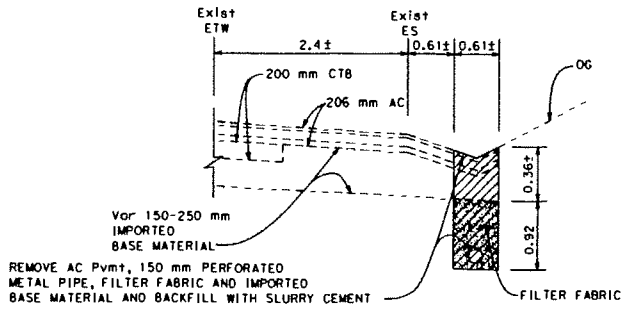


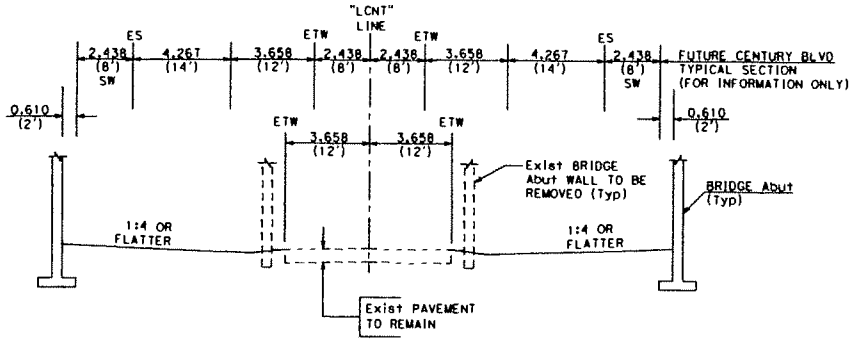
NORTH PARK BOULEVARD

STA "WB4" 256+42.901 TO 256+82.835



REMOVE Exist UNDERDRAIN

STA "EB4" 247+50 TO 250+50
STA "WB4" 247+50 TO 250+50 (MIRROR)



CENTURY BOULEVARD

STA "LCNT" 10+89.044 TO 11+42.914

TYPICAL CROSS SECTIONS

NO SCALE

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

X-17

LAST REVISION DATE PLOTTED => 00-00-00 TIME PLOTTED => 0:TIME

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CURVE DATA						
No.	R	Δ	T	L	NORTHING	EASTING
①	6010.000	2°16'37"	121.186	242.338	674644.3956	1880852.2943
②	6000.000	2°16'37"	120.987	241.941	674621.1390	1880972.1627

ABBREVIATIONS:

TCE	TEMPORARY CONSTRUCTION EASEMENT
Barr	BARRIER
HMA	HOT MIX ASPHALT
MVP	MAINTENANCE VEHICLE PULLOUT
PUE	PUBLIC UTILITY EASEMENT
CMS	CHANGEABLE MESSAGE SIGN
UPI	USS-POSCO INDUSTRIES
eBART	BAY AREA RAPID TRANSIT
PG&E	PACIFIC GAS AND ELECTRIC
w/	WITH

LEGEND:

- (No.) CURVE ALIGNMENT DATA
- REMOVE BASE AND SURFACING
- HMA OVERLAY CONFORM (SEE Sht C-15)
- HMA PAVEMENT (MISCELLANEOUS AREA)
- OVERHEAD SIGN No.
- Exist PAVEMENT TO BE COLD PLANED AND USED AS BASE FOR PCC/HMA PAVING
- OVERHEAD SIGN
- BRIDGE COLUMN
- IRRIGATION CROSSOVER
- ABANDON WATER WELL

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER _____ DATE _____

PLANS APPROVAL DATE _____

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B. RAZEGHI No. C-52725 12-31-08 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

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3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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DATE	REVISED BY	DATE REVISED
06/06	EAJ	09/07

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STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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"W84" +93.525 8.674 Rt
Beg Conc Barr (TYPE K)

Exist DT88 TO REMAIN

"W84" LINE

SAWCUT

S 72°11'40" E 441.946

Conc Barr (TYPE K)

REMOVE Conc Barr (TYPE K)

Exist SOUND WALL TO REMAIN

"W84" +04.879 3.533 Rt
END Conc Barr (TYPE K)
Beg eBART Conc Barr

"W84" 239+47.948 BC

eBART Conc Barr

ROUTE 4

7.20

"E84" LINE

S 72°11'40" E 521.537

Beg REMOVE BASE AND SURFACING Lt "E84" 235+79.000

"E84" +50.0 13.363 Lt
Beg Conc Barr (TYPE K)

"E84" +88.6
8.058 Lt

SAWCUT

REMOVE CRASH CUSHION

Conc Barr (TYPE K)

"E84" 238+21.537 BC

eBART Conc Barr

+T2.028
END HMA DIKE (TYPE E)
Beg HMA DIKE (TYPE C)

REMOVE FENCE

HMA DIKE (TYPE E)

REMOVE RAILROAD TRACKS

"E84" +00 3.533 Lt
END Conc Barr (TYPE K)
Beg eBART Conc Barr

+90.751
END HMA DIKE (TYPE C)
Beg HMA DIKE (TYPE F)

MBGR TYPE 16B
w/ ALTERNATIVE FLARED TERMINAL SYSTEM

"E84" 240+15.06
1.80 Rt ABANDON WATER WELL

+03.000
END HMA DIKE (TYPE F)
Beg HMA DIKE (TYPE E)

SIGN (8)

+83.196 CONFORM Beg HMA DIKE (TYPE E)

SEE SHEET L-2

NOTES:

1. FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.
2. COORDINATES, DISTANCES AND BEARINGS SHOWN ARE BASED ON CALIFORNIA COORDINATE SYSTEM ZONE 3. THE HORIZONTAL DATUM IS NAD 1983 WITH A 1986 ADJUSTMENT. TO OBTAIN GROUND DISTANCES, MULTIPLY GRID DISTANCES BY 1.0000639. THE VERTICAL DATUM IS NGVD 1929.
3. FOR LIMITS OF METAL BEAM GUARD RAIL, CHAIN LINK FENCE, CONCRETE BARRIERS AND REMOVE ITEMS, SEE SUMMARY OF QUANTITY SHEETS.
4. FOR DESIGN GEOMETRY INFORMATION OF CITY STREETS SEE CONSTRUCTION DETAILS PLANS.
5. REMOVE RAILROAD TRACKS SHALL INCLUDE TIES, BALLAST, AND OTHER ASSOCIATED ITEMS. FOR LIMITS OF REMOVAL, SEE QUANTITY SHEETS.
6. SEE CONSTRUCTION DETAILS SHEETS FOR IRRIGATION CROSSOVER LOCATIONS NOT SHOWN ON LAYOUT PLANS.
7. MARKERS TYPE OM-3 SHALL BE PLACED IN FRONT OF FLARED GUARDRAIL END TREATMENTS. SEE PD PLANS FOR DETAILS.
8. SEE CONSTRUCTION DETAILS SHEETS FOR LOCATION AND LIMITS OF eBART CONCRETE BARRIERS AND RETAINING WALLS.

LAYOUT

SCALE 1:500

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

L-1

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => @USER
DGN FILE => @REQUEST

CU 04275

EA 228591

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

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

CURVE DATA						
No.	R	Δ	T	L	NORTHING	EASTING
①	6010.000	2°18'37"	121.186	242.338	674644.3956	1880852.2943
②	6000.000	2°18'37"	120.987	241.941	674621.1390	1880972.1627

DIST	COUNTY	ROUTE	KILOMETER TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER B. RAZEGHI No. C-52725 Exp. 12-31-08 CIVIL STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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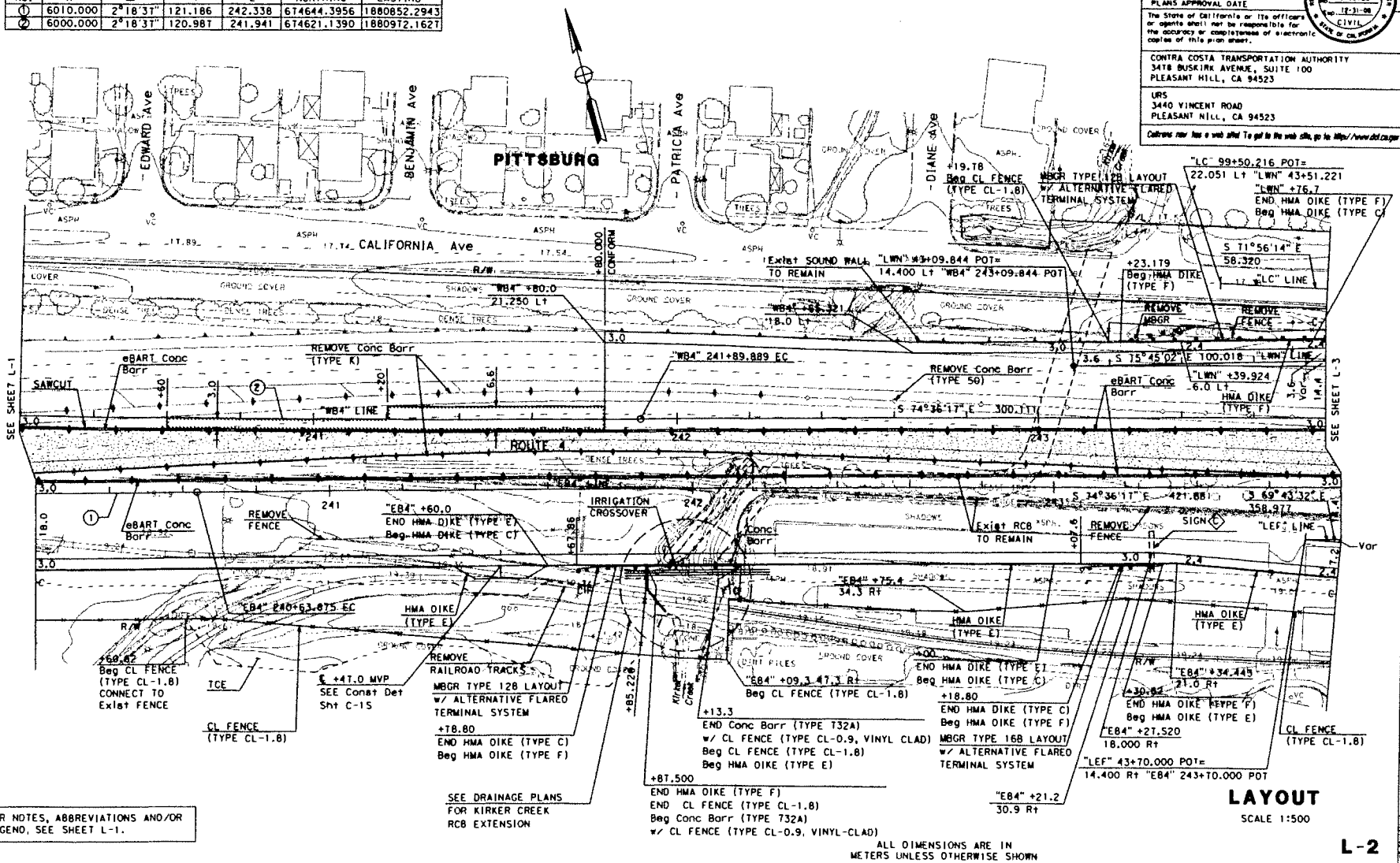


FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET L-1.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

LAYOUT

SCALE 1:500

L-2

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

DESIGN OVERSIGHT: SOTERO ANGELES

CALCULATED/DESIGNED BY: EAJ DATE 06/06 REVISED BY

CHECKED BY: BR 09/07 DATE REVISED

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => $USER
DGN FILE => $REQUEST

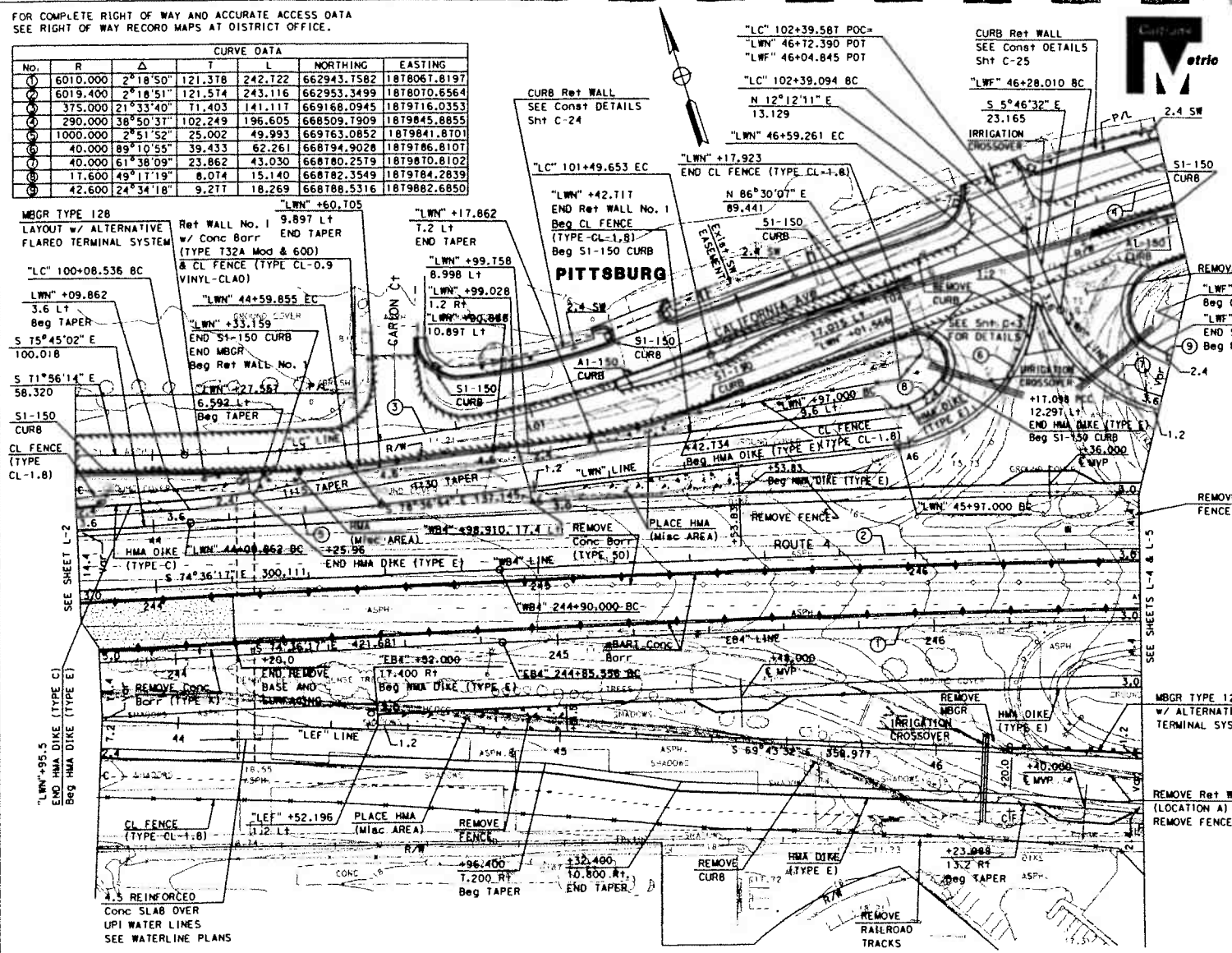
CU 04275

EA 228591

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

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

CURVE DATA						
No.	R	Δ	T	L	NORTHING	EASTING
①	6010.000	2°18'50"	121.378	242.722	662943.7582	1878067.8197
②	6019.400	2°18'51"	121.574	243.116	662953.3499	1878070.6564
③	375.000	21°33'40"	71.403	141.111	669168.0945	1879716.0353
④	290.000	38°50'37"	102.249	196.605	668509.7909	1879845.8855
⑤	1000.000	2°51'52"	25.002	49.993	669763.0852	1879841.8701
⑥	40.000	89°10'55"	39.433	62.261	668794.9028	1879786.8107
⑦	40.000	61°38'09"	23.862	43.030	668780.2579	1879870.8102
⑧	17.600	49°17'19"	8.074	15.140	668782.3549	1879784.2839
⑨	42.600	24°34'18"	9.277	18.269	668788.5316	1879882.6850



FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET L-1.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

LAYOUT

SCALE 1:500

L-3

DIST	COUNTY	ROUTE	TOTAL PROJECT	NO	SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

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PLEASANT HILL, CA 94523

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DATE	REVISED BY	DATE	REVISED BY
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STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

SOTERO ANGELES

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

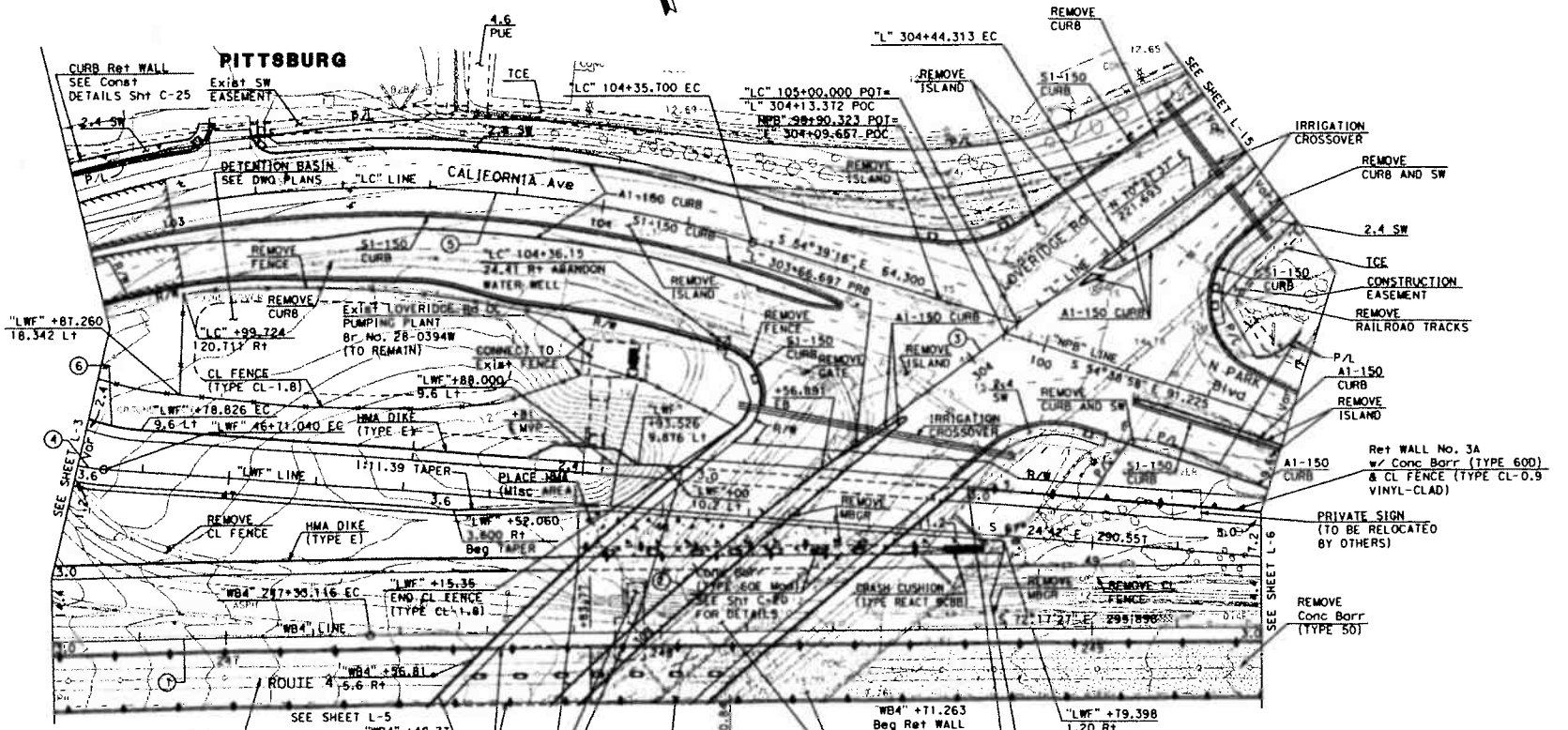
USERNAME =› %USER
DGN FILE =› %REQUEST

CU 04275 | EA 228591

LAST REVISION 00-00-00 | DATE PLOTTED =› %DATE | TIME PLOTTED =› %TIME

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

CURVE DATA						
No.	R	Δ	T	L	NORTHING	EASTING
①	6019.400	2°18'51"	121.574	243.116	662953.3499	1878070.6564
②	615.800	16°54'25"	91.521	181.712	668108.5628	1880211.6153
③	2800.000	1°35'18"	38.810	77.616	671358.0763	1879158.8324
④	40.000	61°38'09"	23.862	43.030	668780.2579	1879870.8102
⑤	290.000	38°50'37"	102.249	196.605	668509.7909	1879845.8855
⑥	42.600	24°34'18"	9.277	18.269	668788.5316	1879682.6850



FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET L-1.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

LAYOUT

SCALE 1:500

L-4

DESIGN OVERSIGHT	CALCULATED/ DESIGNED BY	CHECKED BY	DATE	REVISED BY	DATE REVISED
SOTERO ANGELES	EAJ	BR	06/06		09/07

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

DIST	COUNTY	ROUTE	TOTAL PROJECT	TOT SHEETS
04	CC	4	37.9/41.3	

REGISTERED CIVIL ENGINEER B. RAZEGHI DATE

PLANS APPROVAL DATE

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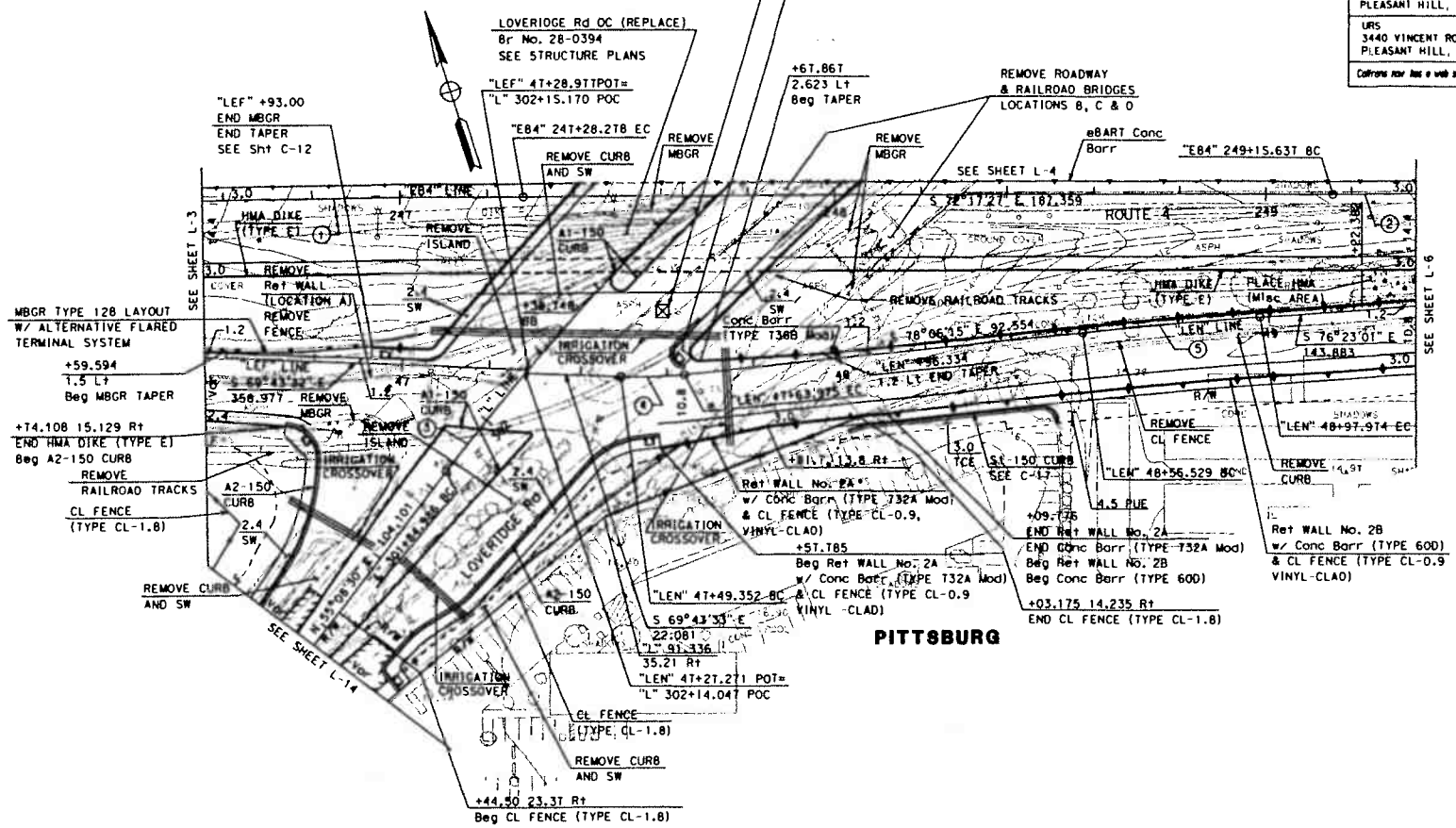
USERNAME => $USER
DGN FILE => $REQUEST

CU 04275 EA 228591

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

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

CURVE DATA						
No.	R	Δ	T	L	NORTHING	EASTING
1	6010.000	2°18'50"	121.378	242.722	662943.7582	1878067.8197
2	19000.000	0°50'31"	139.593	279.181	686711.6055	1885854.0020
3	615.800	16°54'25"	91.521	181.712	668108.5628	1880211.6153
4	100.000	8°22'42"	7.325	14.623	668716.0627	1879939.2493
5	1380.000	1°43'15"	20.724	41.445	667248.7685	1879724.7406



FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET L-1.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

LAYOUT

SCALE 1:500

L-5

04	CC	4	37.9/41.3

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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USERNAME => $USER
DGN FILE => $REQUEST

CU 04275

EA 228591

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

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

CURVE DATA						
No.	R	Δ	T	L	NORTHING	EASTING
①	19000.000	0°50'31"	139.593	279.181	686711.6055	1885854.0020
②	6009.905	3°11'54"	167.789	335.491	662777.6479	1878597.2119
③	160.000	17°38'28"	24.828	49.263	668785.6581	1880229.5621
④	1356.000	2°06'52"	25.024	50.042	667238.2208	1879870.2295
⑤	19014.400	0°18'05"	50.051	100.101	650241.2095	1875082.6730
⑥	85000.000	0°09'47"	120.997	241.994	749569.5484	1906039.4405

DIST	COUNTY	ROUTE	TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

B. RAZEGHI C-52725 12-31-08 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

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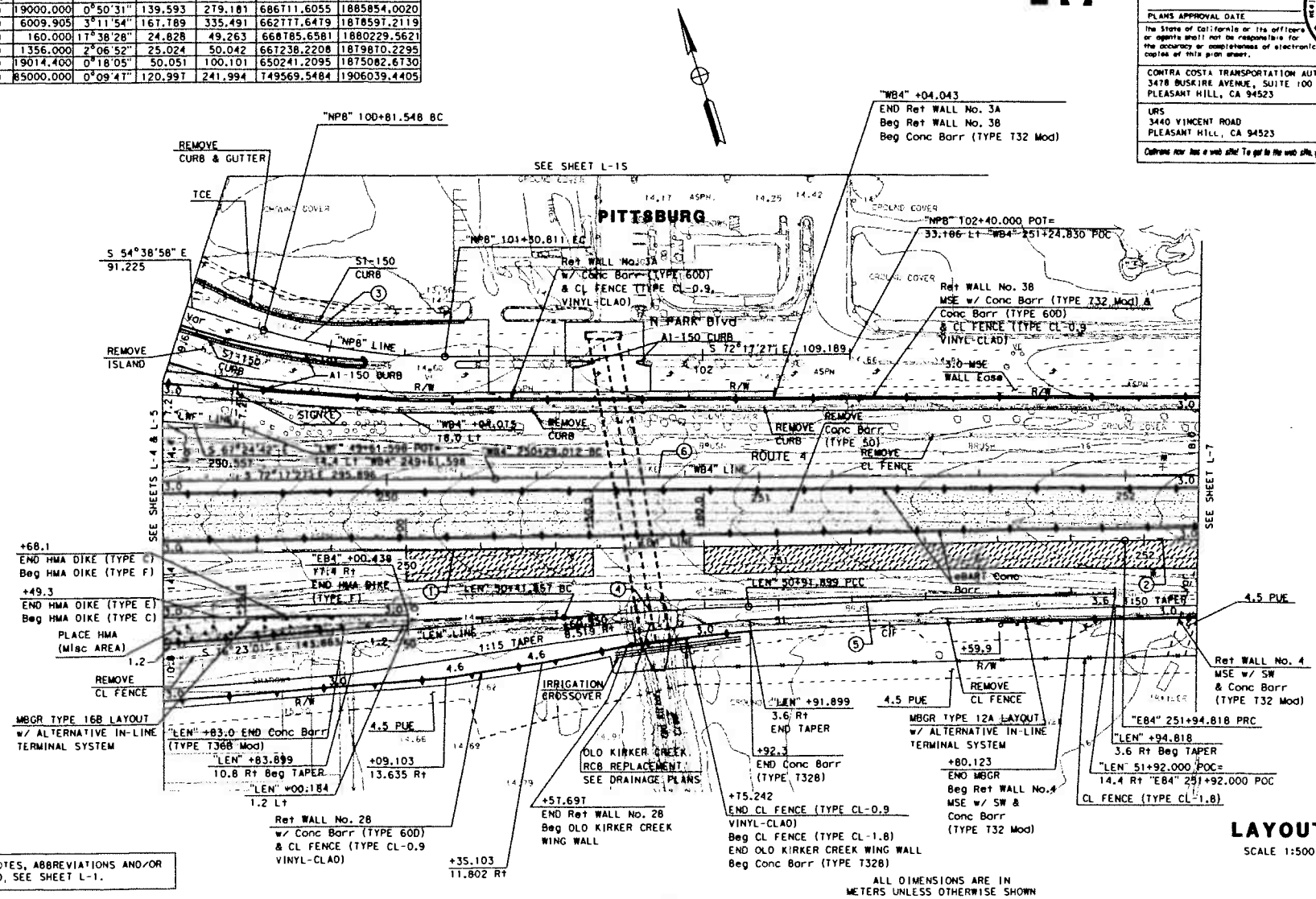
SOTERO ANGELES	EAJ	06/06	BR	09/07
	CHECKED BY			

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION



FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET L-1.

LAYOUT

SCALE 1:500

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

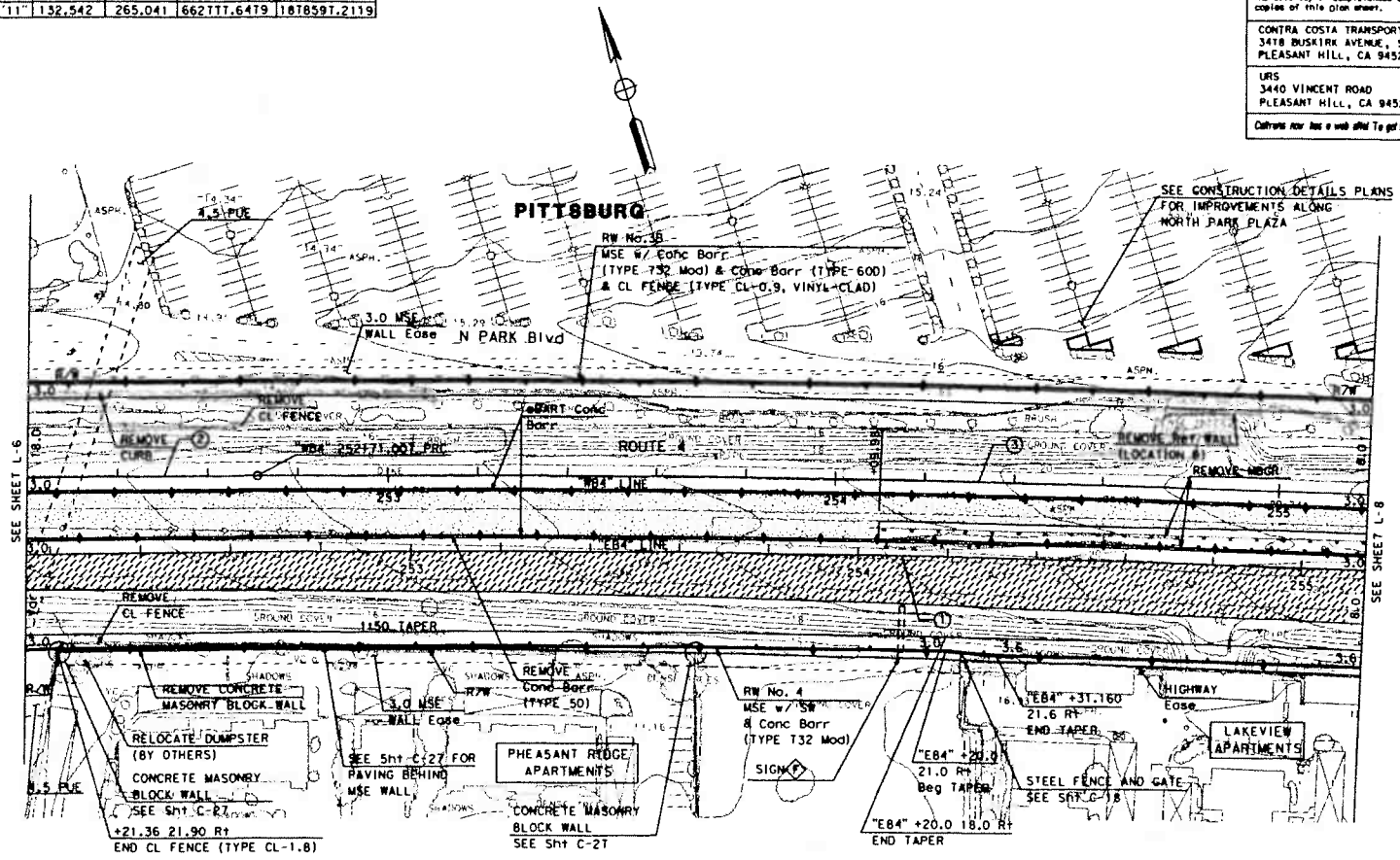
L-6

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40	USERNAME => &USER DGN FILE => &REQUEST	CU 04275	EA 228591

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

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

CURVE DATA						
No.	R	Δ	T	L	NORTHING	EASTING
1	6009.905	3°11'54"	167.789	335.491	662777.6479	1878597.2119
2	85000.000	0°09'47"	120.997	241.994	749569.5484	1906039.4405
3	6026.973	2°31'11"	132.542	265.041	662777.6479	1878597.2119



FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET L-1.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

LAYOUT

SCALE 1:500

L-7

DIST	COUNTY	ROUTE	FILE/TOTAL PROJECT	SHEET NO.	TOT SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER B. RAZEGHI No. C-52725 Exp. 12-11-06 CIVIL STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
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STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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USERNAME => $USER
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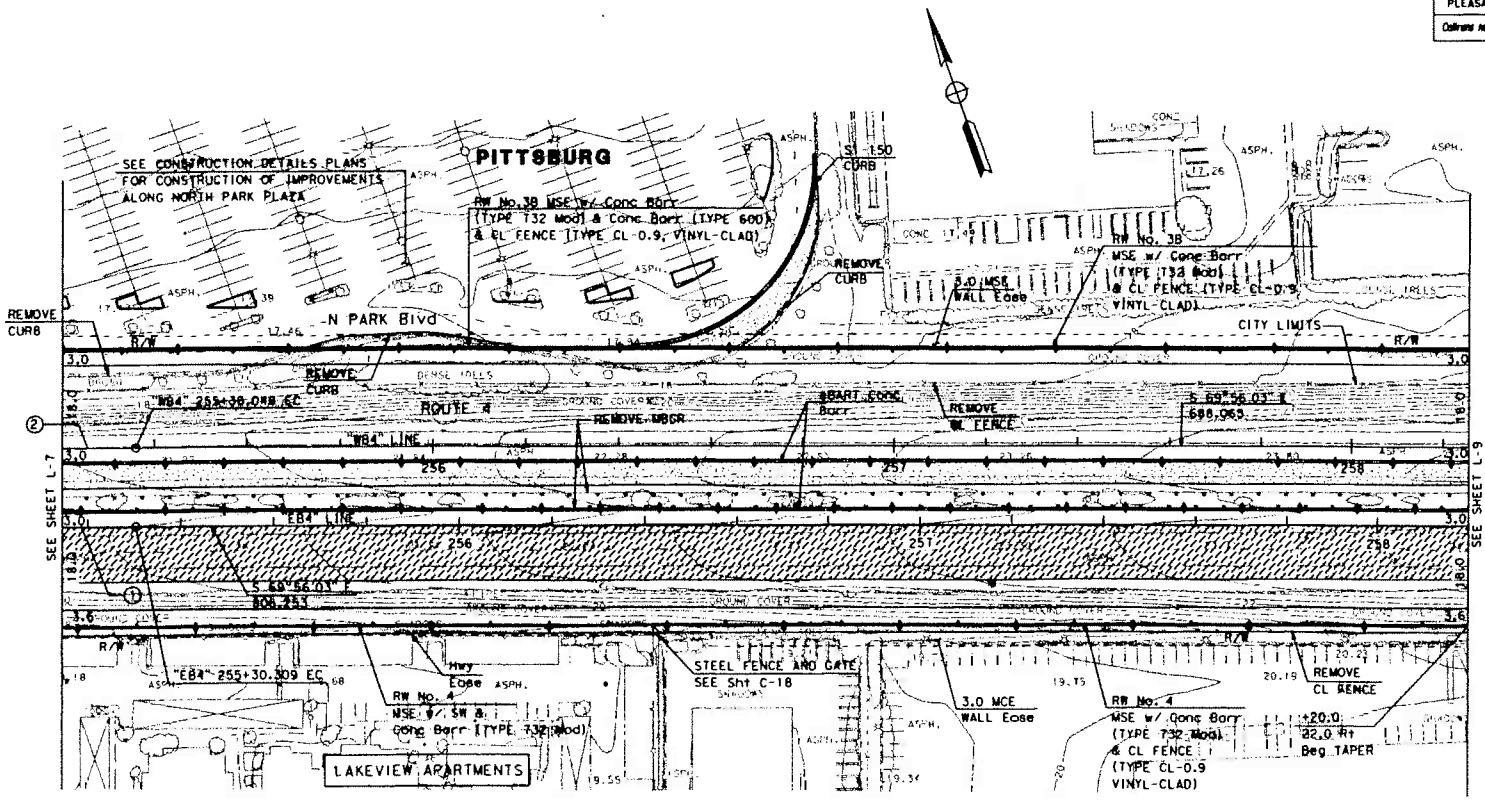
EA 228591

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

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

CURVE DATA						
No.	R	Δ	T	L	NORTHING	EASTING
①	6009.905	3°11'54"	167.789	335.491	662777.6479	1878597.2119
②	6026.973	2°31'11"	132.542	265.041	662777.6479	1878597.2119



FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET L-1.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

LAYOUT

SCALE 1:500

L-8

DIST	COUNTY	ROUTE	KILOMETER TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER B. RAZEGHI No. C-52725 Exp. 12-31-08 CIVIL STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
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LAST REVISION 00-00-00 DATE PLOTTED => $DATE TIME PLOTTED => $TIME

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

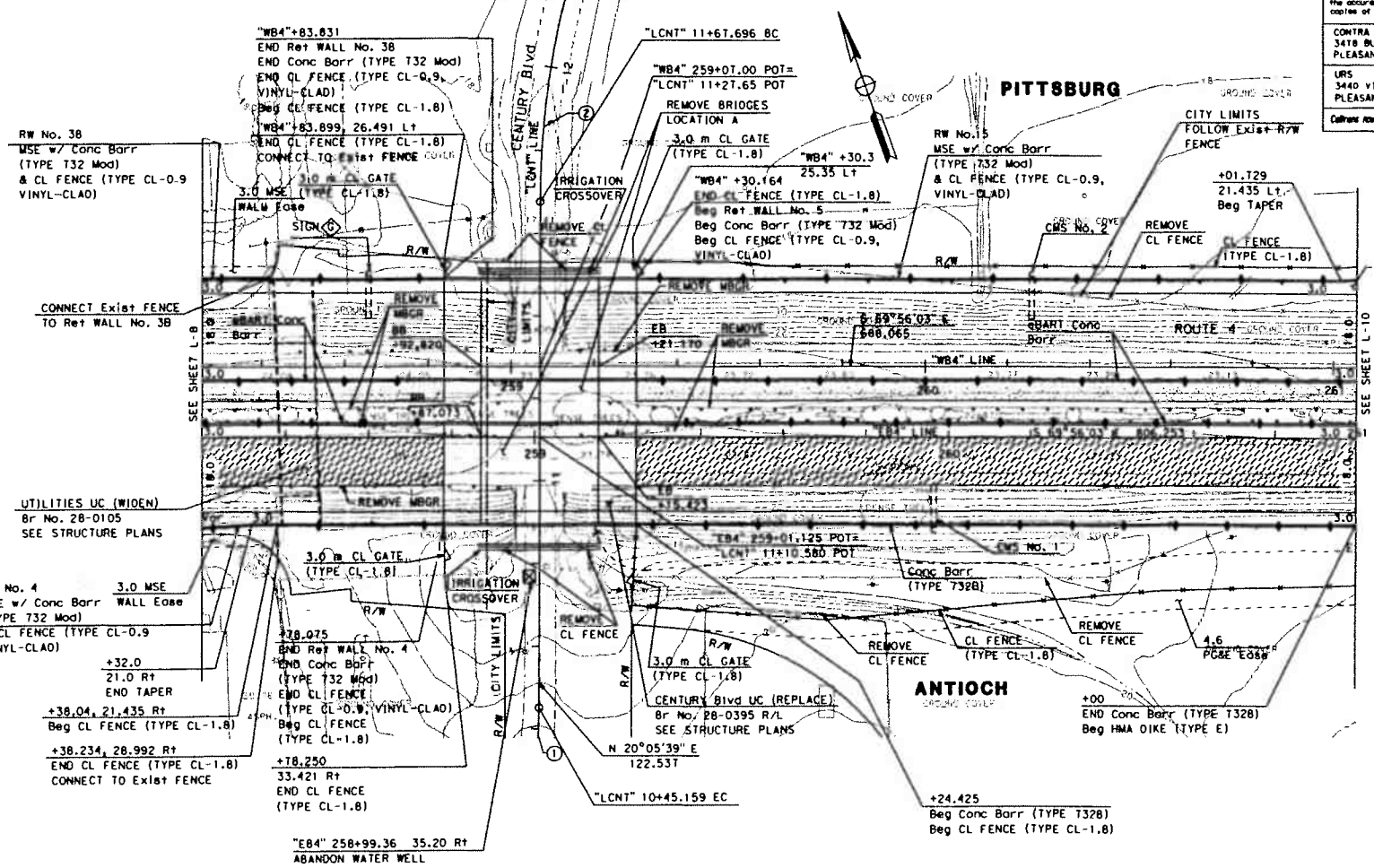
USERNAME => $USER
DGN FILE => $REQUEST

CU 04275

EA 228591

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

CURVE DATA						
No.	R	Δ	T	L	NORTHING	EASTING
①	106.680	24°15'15"	22.923	45.159	668270.6934	1880884.9612
②	205.727	27°51'01"	51.008	100.000	668278.4385	1881220.4514



FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET L-1.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

LAYOUT

SCALE 1:500

L-9

04	CC	4	37.9/41.3

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CALCULATED/DESIGNED BY: EAJ DATE 06/06 REVISED BY

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

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => $USER
DGN FILE => $REQUEST

CU 04275

EA 228591

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

CURVE DATA						
No.	R	Δ	T	L	NORTHING	EASTING
①	61000.000	0°13'42"	121.538	243.077	725443.3911	1902345.5169
②	28000.000	0°29'38"	120.693	241.384	694503.0917	1890918.1119

DISTRICT	COUNTY	ROUTE	TOTAL PROJECT
04	CC	4	37.9/41.3

REGISTERED CIVIL ENGINEER B. RAZEGHI DATE

PLANS APPROVAL DATE

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B. RAZEGHI C-52725 12-31-08 CIVIL STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
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PLEASANT HILL, CA 94523

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3440 VINCENT ROAD
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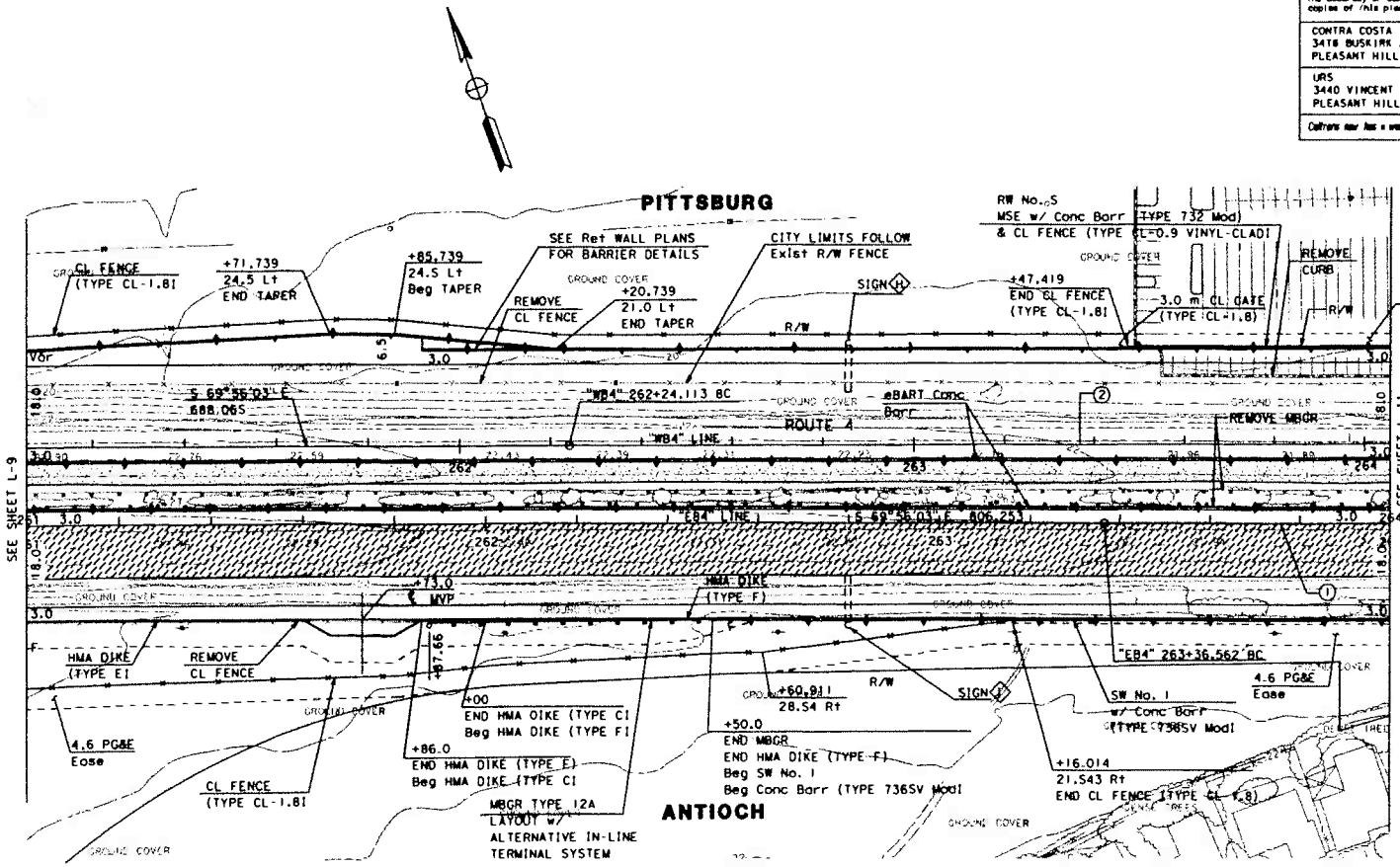
DATE	REVISED BY	DATE REVISED
EAJ	06/06	09/07
BR		

CALCULATED/DESIGNED BY
CHECKED BY

DESIGN OVERSIGHT
SOTERO ANGELES

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans



FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET L-1.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

LAYOUT

SCALE 1:500

L-10

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => $USER
DGN FILE => $REQUEST

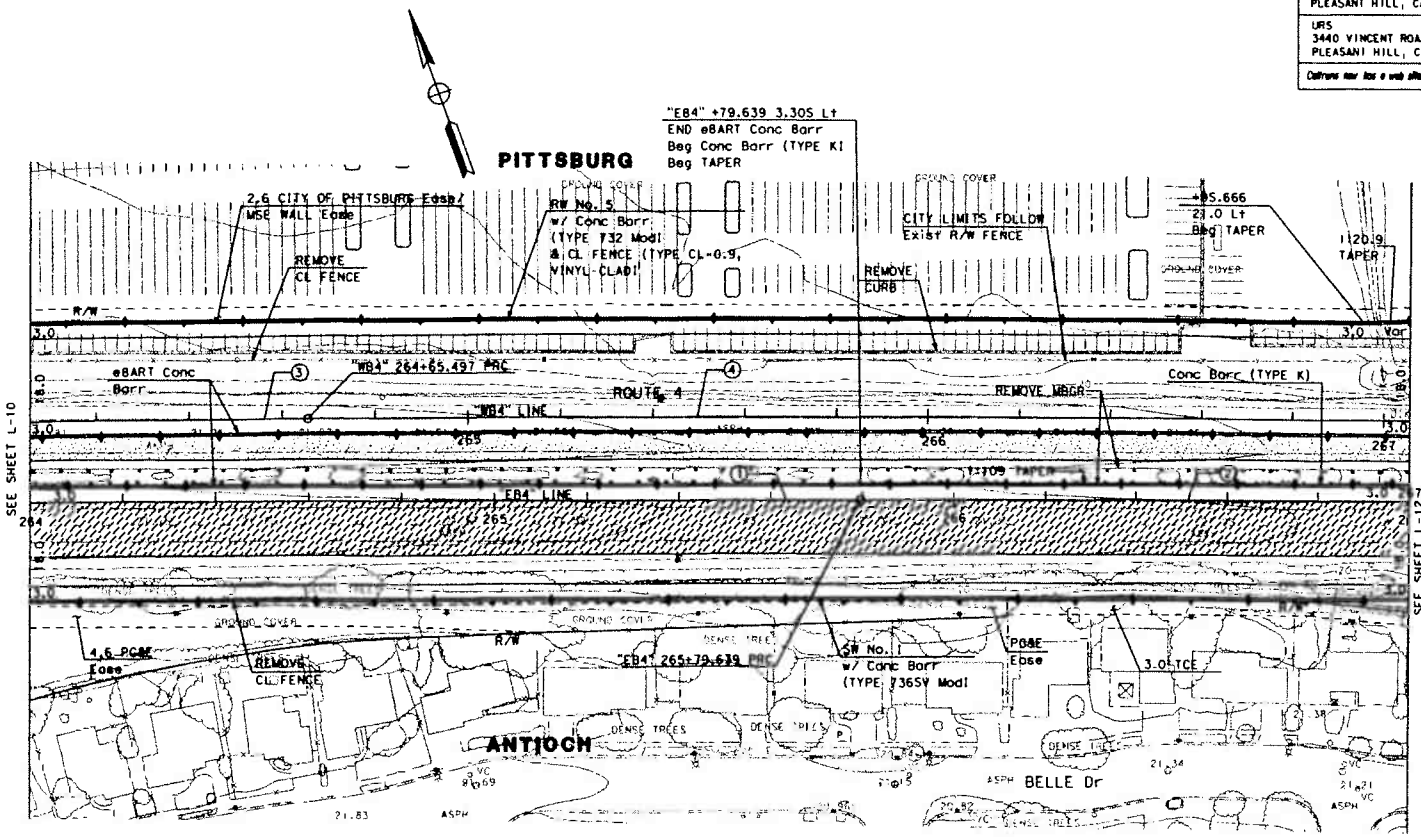
CU 0427S

EA 228591

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

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

CURVE DATA						
No.	R	Δ	T	L	NORTHING	EASTING
1	61000.000	0°13'42"	121.538	243.077	725443.3911	1902345.5169
2	20000.000	0°43'42"	127.117	254.230	649249.9958	1874857.9469
3	28000.000	0°29'38"	120.693	241.384	694503.0917	1890918.1119
4	14000.000	0°59'38"	121.435	242.865	654929.7542	1876848.6070



FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET L-1.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

LAYOUT

SCALE 1:500

L-11

DIST	COUNTY	ROUTE	KILOMETER TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER B. RAZEGHI C-52725 Exp. 12-31-08 CIVIL STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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CALCULATED/DESIGNED BY: EAJ DATE 06/06 REVISED BY

CHECKED BY: BR 09/07 DATE REVISED

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

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => $USER
DGN FILE => $REQUEST

CU 0427S

EA 228591

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

CURVE DATA						
No.	R	Δ	T	L	NORTHING	EASTING
①	20000.000	0°43'42"	127.117	254.230	649249.9958	1874857.9469

Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOT SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

B. RAZEGHI C-52725 Exp. 12-31-08 CIVIL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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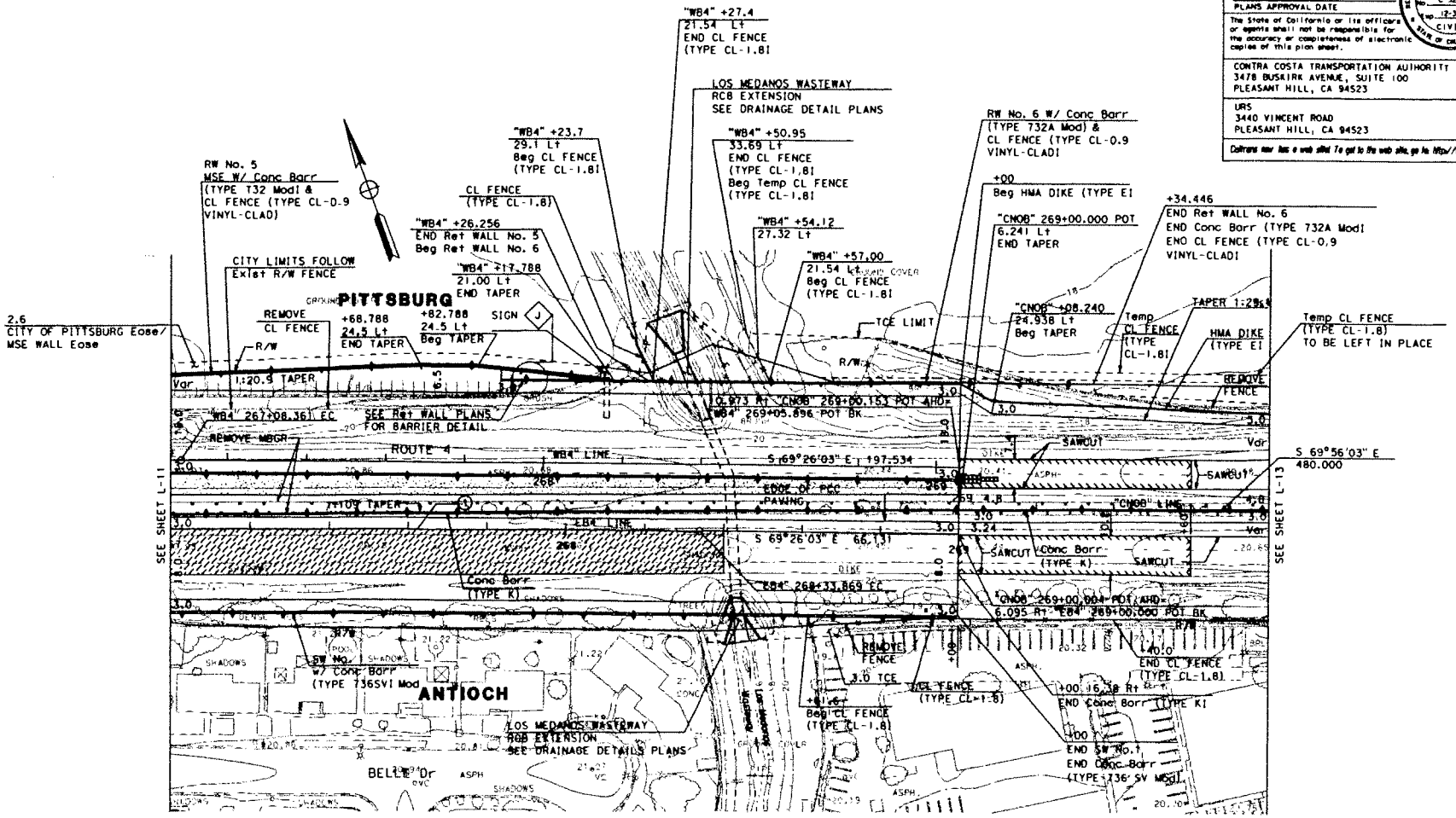

FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET L-1.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

LAYOUT

SCALE 1:500

L-12

DATE	BY	REVISED BY	DATE REVISED
06/06	EAJ	BR	09/07

CALCULATED/DESIGNED BY
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DESIGN OVERSIGHT
SOTERO ANGELES

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USERNAME => @USER
DGN FILE => @REQUEST

CU 04275 | EA 228591

DATE PLOTTED => @DATE
TIME PLOTTED => @TIME
DATE REVISED 00-00-00

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

DIST	COUNTY	ROUTE	KILOPOST TOTAL PROJECT	SHEET TOTAL SHEETS
04	CC	4	37.9/41.3	

REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
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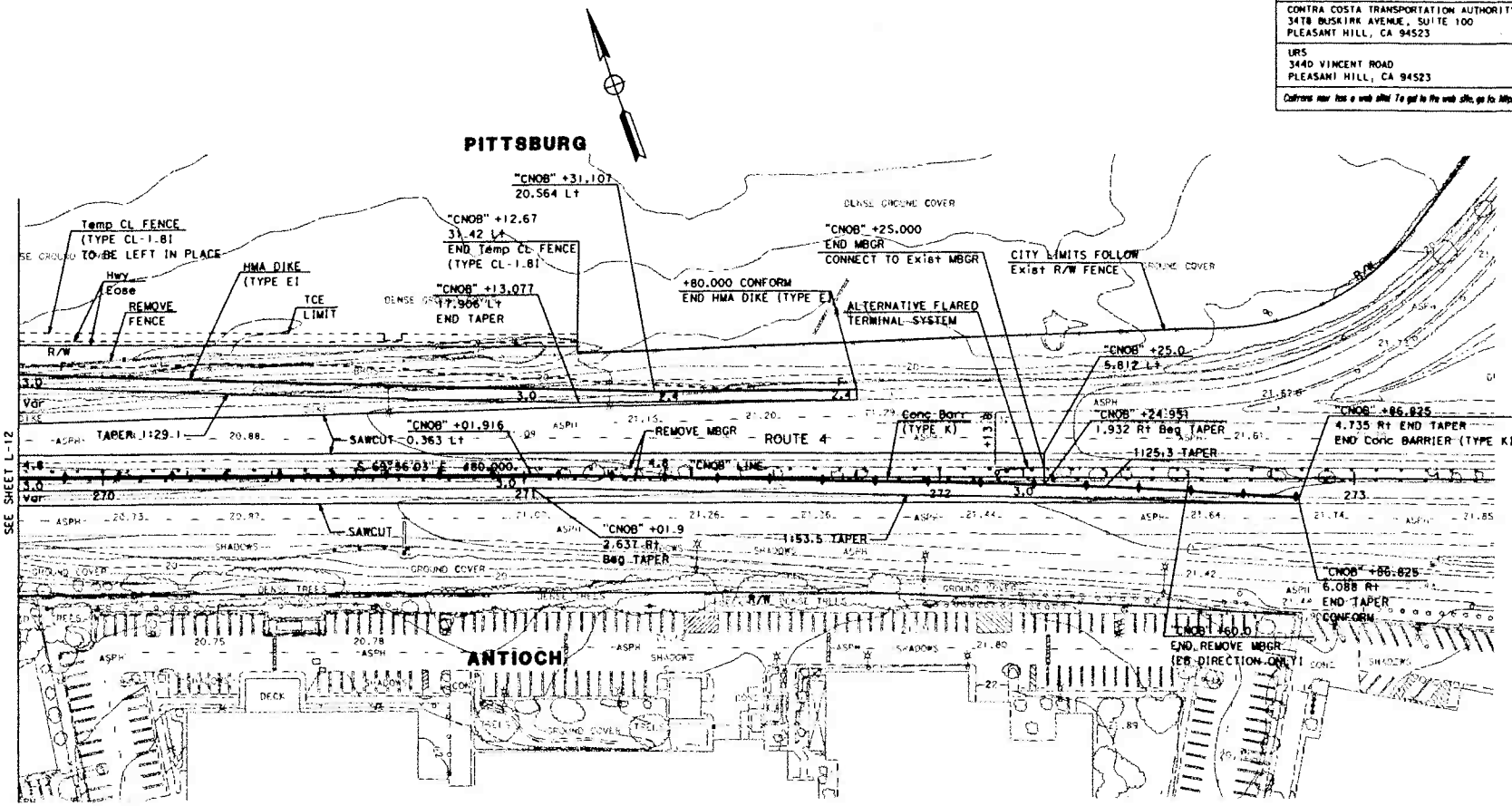
SOTERO ANGELES	EAJ	08/06		
	CHECKED BY			
	BR	09/07		

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

SEE SHEET L-12



LAYOUT
SCALE 1:500

L-13

FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET L-1.

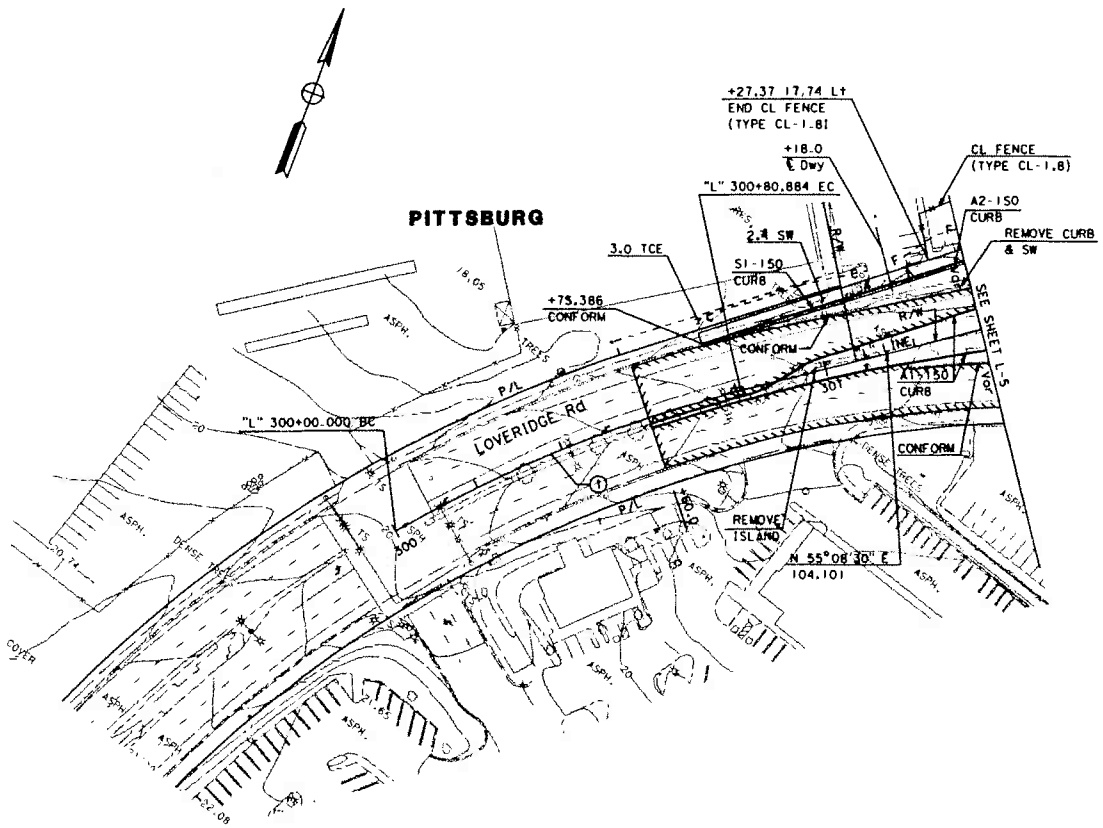
ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS (0 10 20 30 40)	USERNAME => @USER DGN FILE => @REQUEST	CU 0427S	EA 228591

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

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

CURVE DATA						
No.	R	Δ	T	L	NORTHING	EASTING
①	292.900	15°49'20"	40.701	80.884	668314.0251	1879941.6399



FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET L-1.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

LAYOUT

SCALE 1:500

L-14

04	EC	4	37.9/41.3	

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER B. RAZEGHI No. C-52725 Exp. 12-31-08 CIVIL STATE OF CALIFORNIA

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

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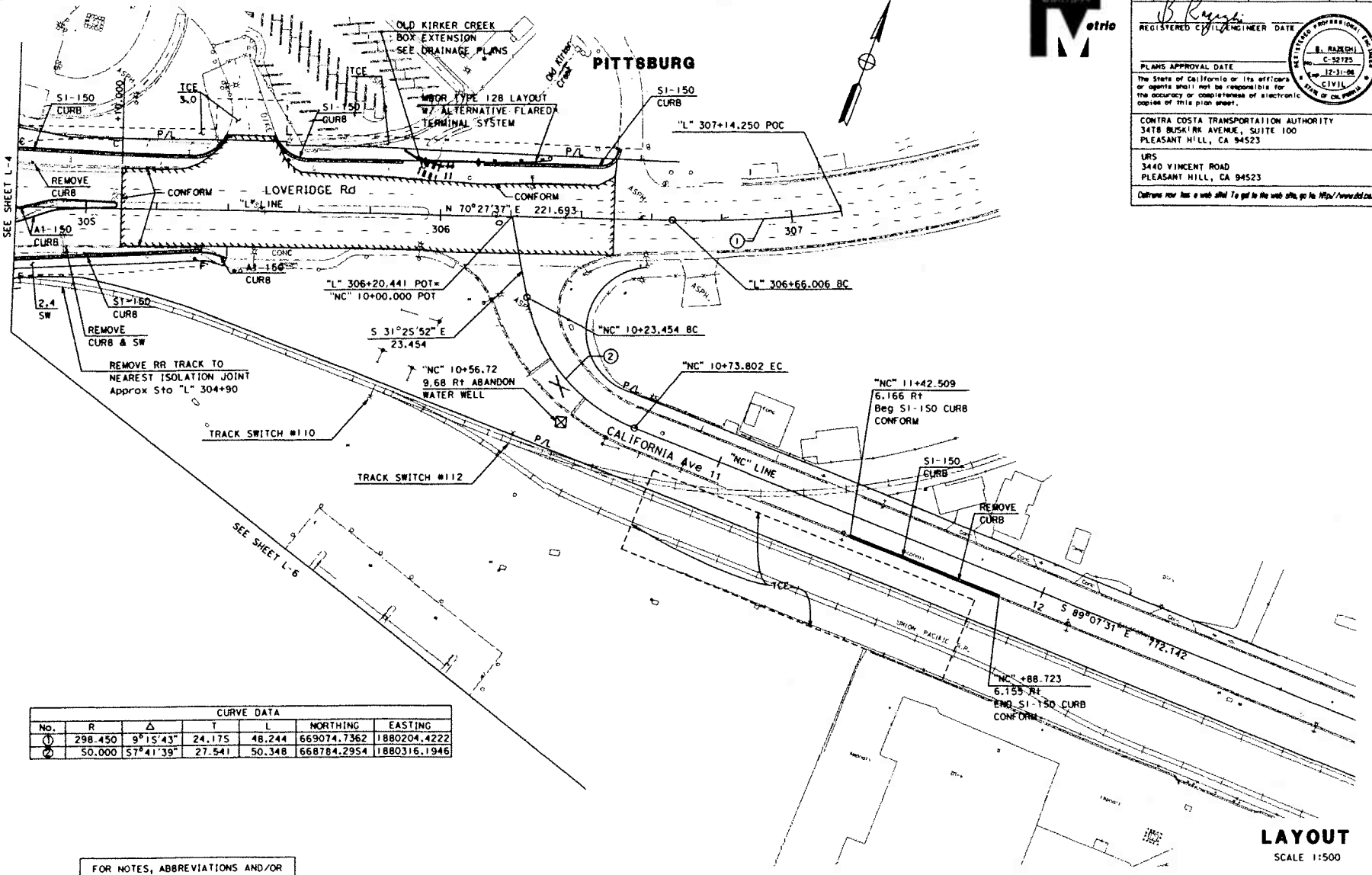
USERNAME => $USER
DGN FILE => $REQUEST

CU 04275

EA 228591

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



CURVE DATA						
No.	R	Δ	T	L	NORTHING	EASTING
①	298.450	9°15'43"	24.175	48.244	669074.7362	1880204.4222
②	50.000	57°41'39"	27.541	50.348	668784.2954	1880316.1946

FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET L-1.

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LAYOUT

SCALE 1:500

L-15

04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER DATE

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DESIGN OVERSIGHT: SOTERO ANGELES
CALCULATED/DESIGNED BY: EAJ 06/06
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CU 0427S

EA 228S91

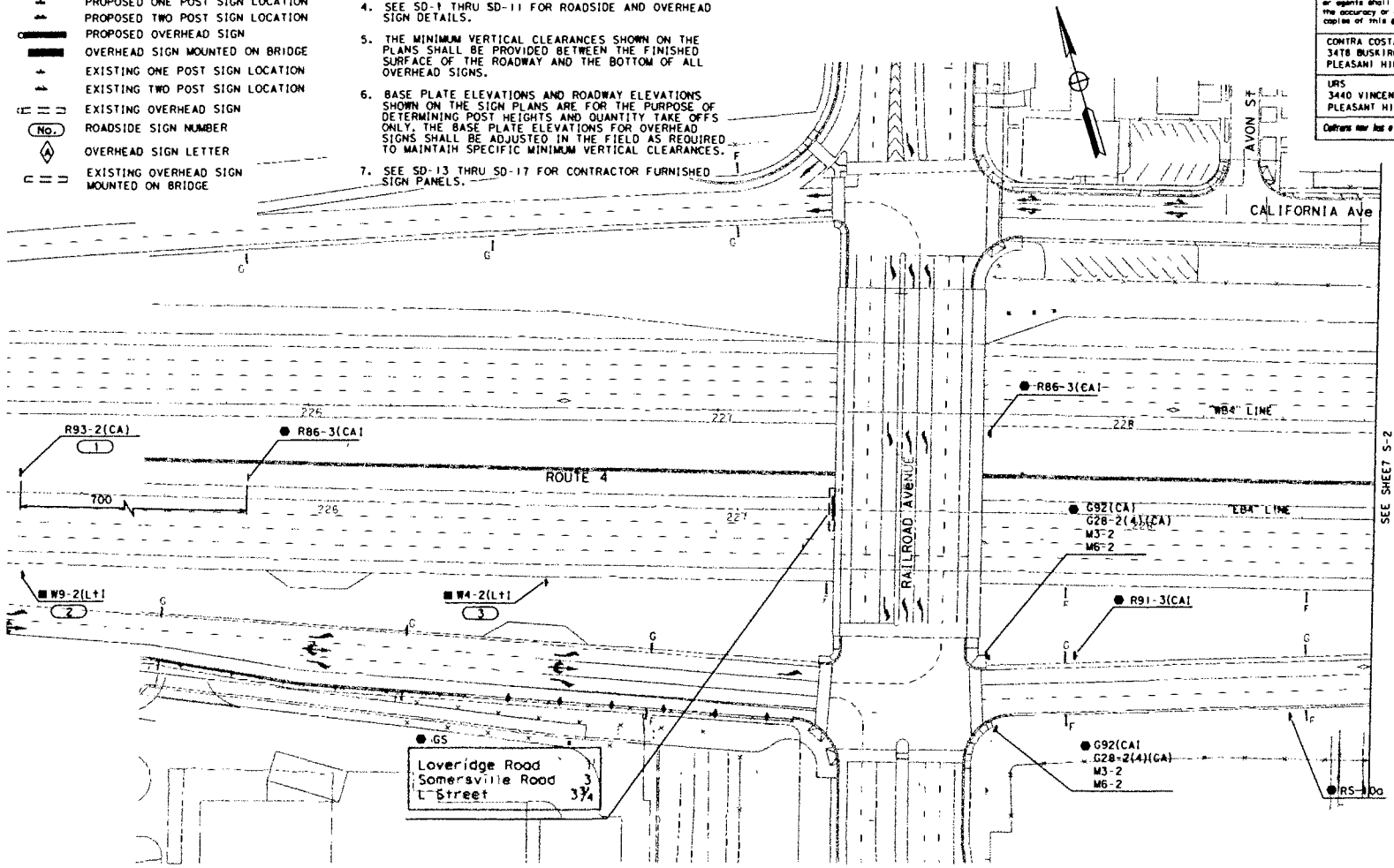
LAST REVISION | DATE PLOTTED => $DATE | TIME PLOTTED => $TIME
00-00-00

LEGEND:

- * REPLACE SIGN PANEL ONLY
- ▲ RELOCATE ROADSIDE SIGN
- ● EXISTING SIGN TO REMAIN
- ■ REMOVE ROADSIDE SIGN
- PROPOSED ONE POST SIGN LOCATION
- PROPOSED TWO POST SIGN LOCATION
- PROPOSED OVERHEAD SIGN
- OVERHEAD SIGN MOUNTED ON BRIDGE
- EXISTING ONE POST SIGN LOCATION
- EXISTING TWO POST SIGN LOCATION
- EXISTING OVERHEAD SIGN
- (No.) ROADSIDE SIGN NUMBER
- (A) OVERHEAD SIGN LETTER
- EXISTING OVERHEAD SIGN MOUNTED ON BRIDGE

GENERAL NOTES:

1. EXACT LOCATION AND POSITION OF ROADSIDE SIGNS SHALL BE DETERMINED BY THE ENGINEER.
2. POST SIZE AND LENGTH GIVEN ARE APPROXIMATE. EXACT SIZE AND LENGTH TO BE DETERMINED BY THE ENGINEER.
3. ALL ROADSIDE SIGNS TO BE MOUNTED ON 54S WOOD POSTS, UNLESS OTHERWISE INDICATED.
4. SEE SD-1 THRU SD-11 FOR ROADSIDE AND OVERHEAD SIGN DETAILS.
5. THE MINIMUM VERTICAL CLEARANCES SHOWN ON THE PLANS SHALL BE PROVIDED BETWEEN THE FINISHED SURFACE OF THE ROADWAY AND THE BOTTOM OF ALL OVERHEAD SIGNS.
6. BASE PLATE ELEVATIONS AND ROADWAY ELEVATIONS SHOWN ON THE SIGN PLANS ARE FOR THE PURPOSE OF DETERMINING POST HEIGHTS AND QUANTITY TAKE OFFS ONLY. THE BASE PLATE ELEVATIONS FOR OVERHEAD SIGNS SHALL BE ADJUSTED IN THE FIELD AS REQUIRED TO MAINTAIN SPECIFIC MINIMUM VERTICAL CLEARANCES.
7. SEE SD-13 THRU SD-17 FOR CONTRACTOR FURNISHED SIGN PANELS.



DIST	COUNTY	ROUTE	KILOMETER TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER DATE

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REGISTERED PROFESSIONAL ENGINEER B. RAZEGHI No. C-52725 Exp. 12-31-06 CIVIL STATE OF CALIFORNIA

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SIGN PLAN

SCALE 1:500

S-1

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Caltrans

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FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET S-1.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

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REGISTERED PROFESSIONAL ENGINEER B. RAZEGHI No. C-52725 Exp. 12-31-08 CIVIL STATE OF CALIFORNIA

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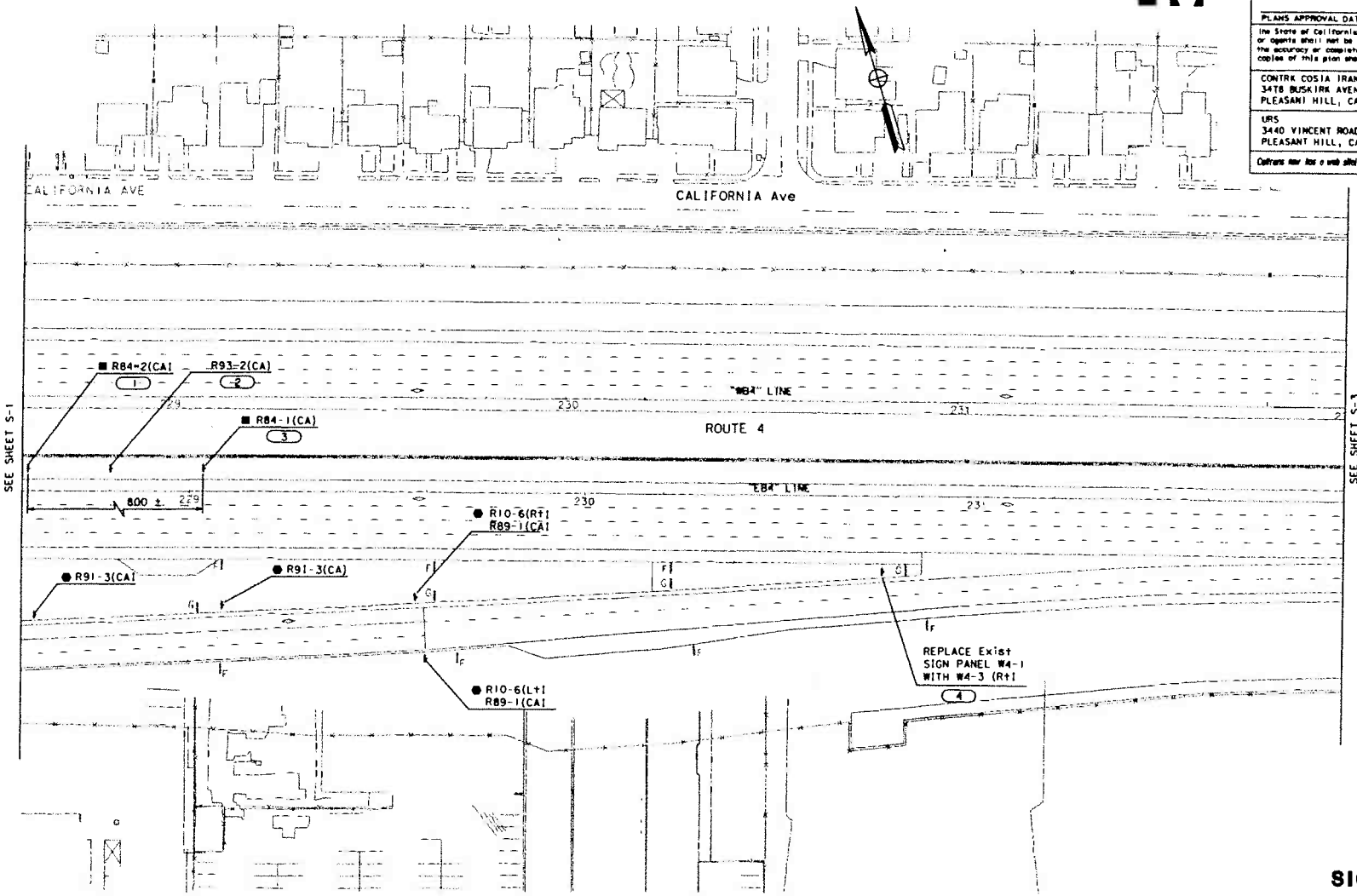

SIGN PLAN

SCALE 1:500

S-2

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FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

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CALCULATED/DESIGNED BY: EAJ DATE 06/06

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DATE REVISED

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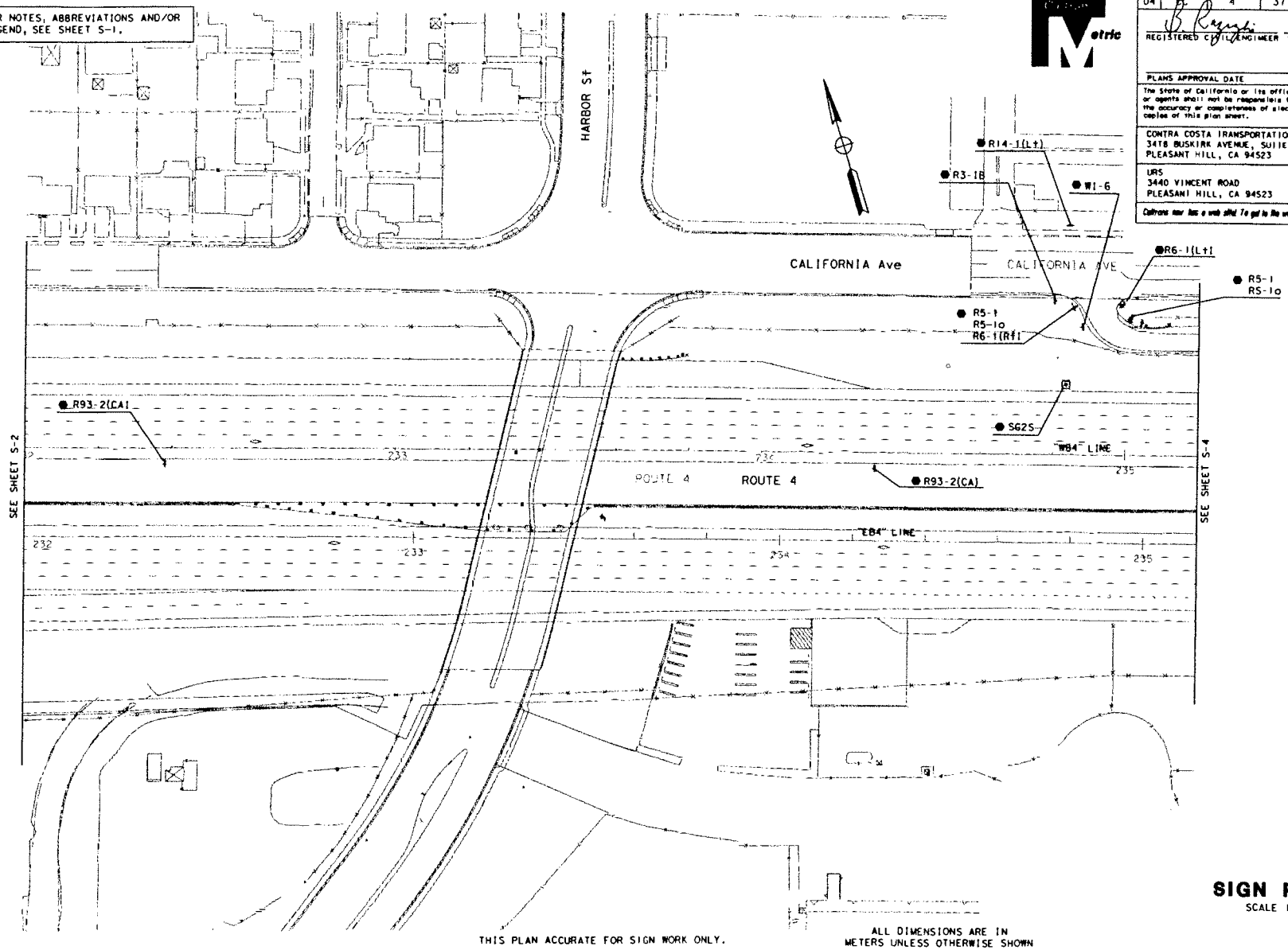
DATE PLOTTED => $DATE
TIME PLOTTED => $TIME



DIST	COUNTY	ROUTE	KILOMETER TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER B. RAZEGHI DATE

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SOTERO ANGELES	EAJ	06/06		
	BR	09/07		
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STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
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SIGN PLAN

SCALE 1:500

S-3

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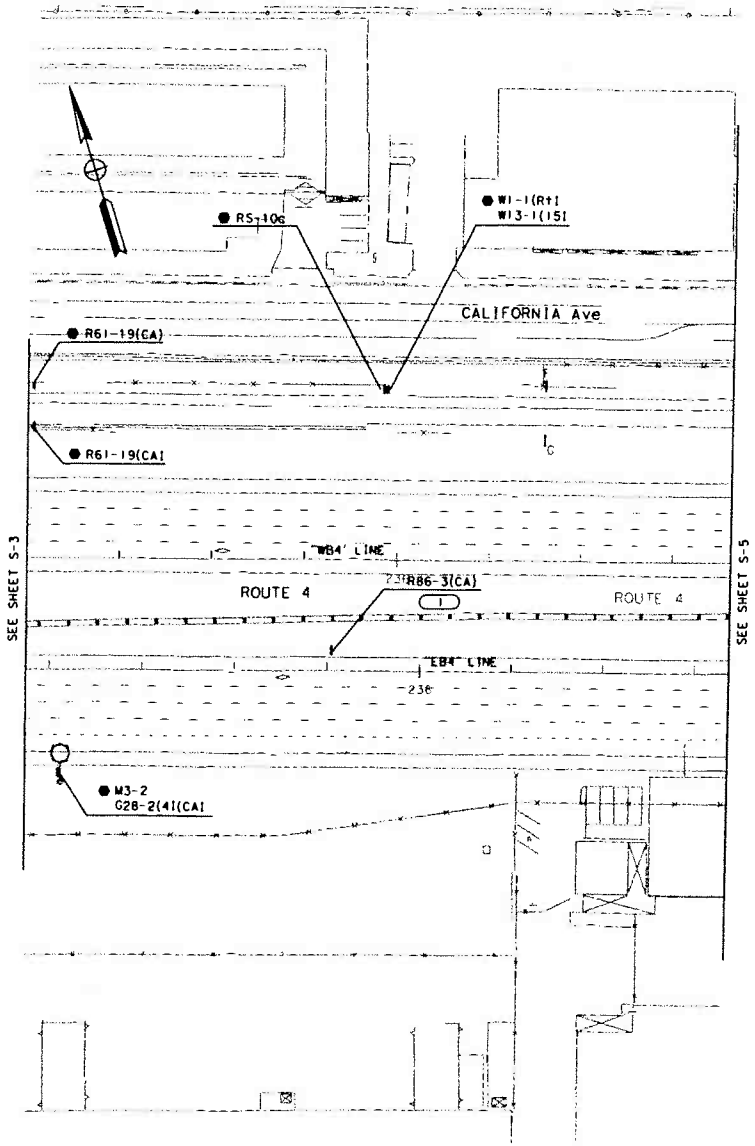
DGN FILE => @REQUEST

CU 0427S

EA 228591

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

FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET S-1.



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SIGN PLAN

SCALE 1:500

S-4

DIST	COUNTY	ROUTE	TOTAL PROJECT	NO	SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER B. Razeghi DATE

B. RAZEGHI C-52725 12-31-08 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

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EA 228591

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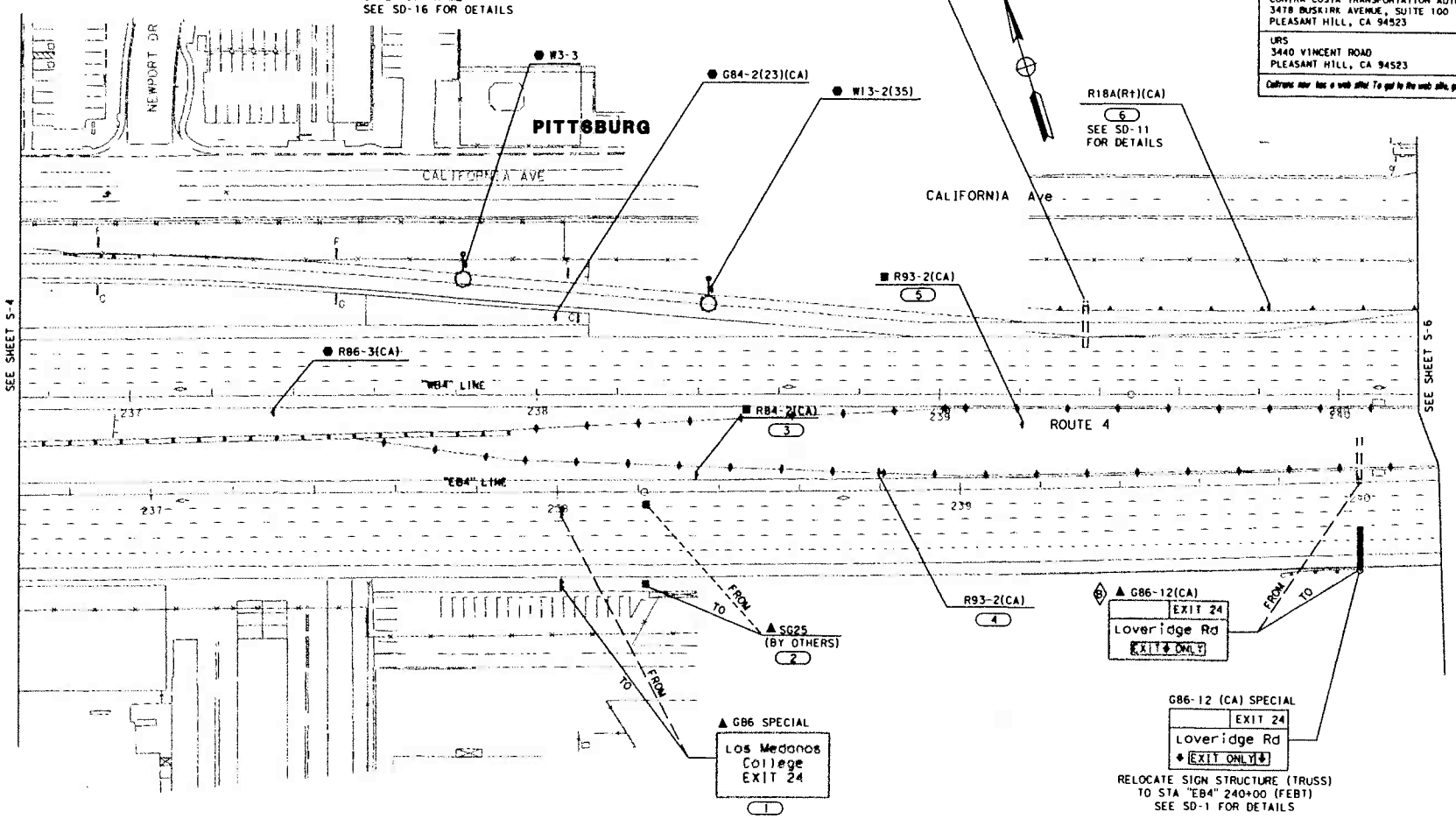
FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET S-1.



SIGN PLAN

SCALE 1:500

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S-5

DIST	COUNTY	ROUTE	TOTAL PROJECT	NO	SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

B. RAZEGHI C-52725 12-31-08 CIVIL

PLANS APPROVAL DATE

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DESIGN OVERSIGHT
SOTERO ANGELES

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USERNAME => %USER
DGN FILE => %REQUEST

CU 04275

EA 228591

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

FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET S-1.

DIST	COUNTY	ROUTE	KILOMETER TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

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REGISTERED PROFESSIONAL ENGINEER B. RAZEGHI C-52725 Exp. 12-31-08 CIVIL STATE OF CALIFORNIA

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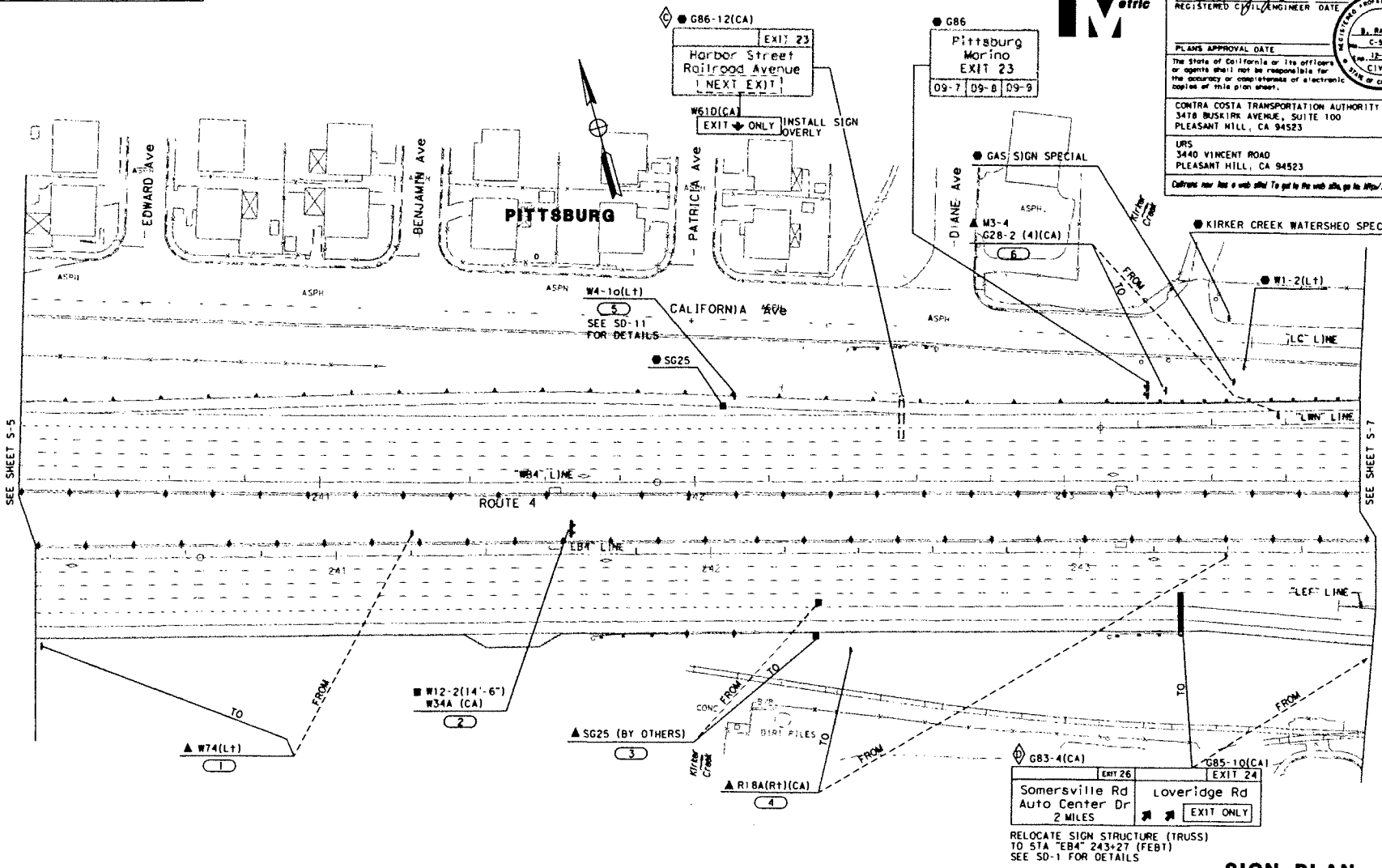

RELOCATE SIGN STRUCTURE (TRUSS) TO STA "EB4" 243+27 (FEBT) SEE SD-1 FOR DETAILS

SIGN PLAN

SCALE 1:500

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S-6

CALCULATED/DESIGNED BY	EAJ	DATE 06/06	REVISED BY
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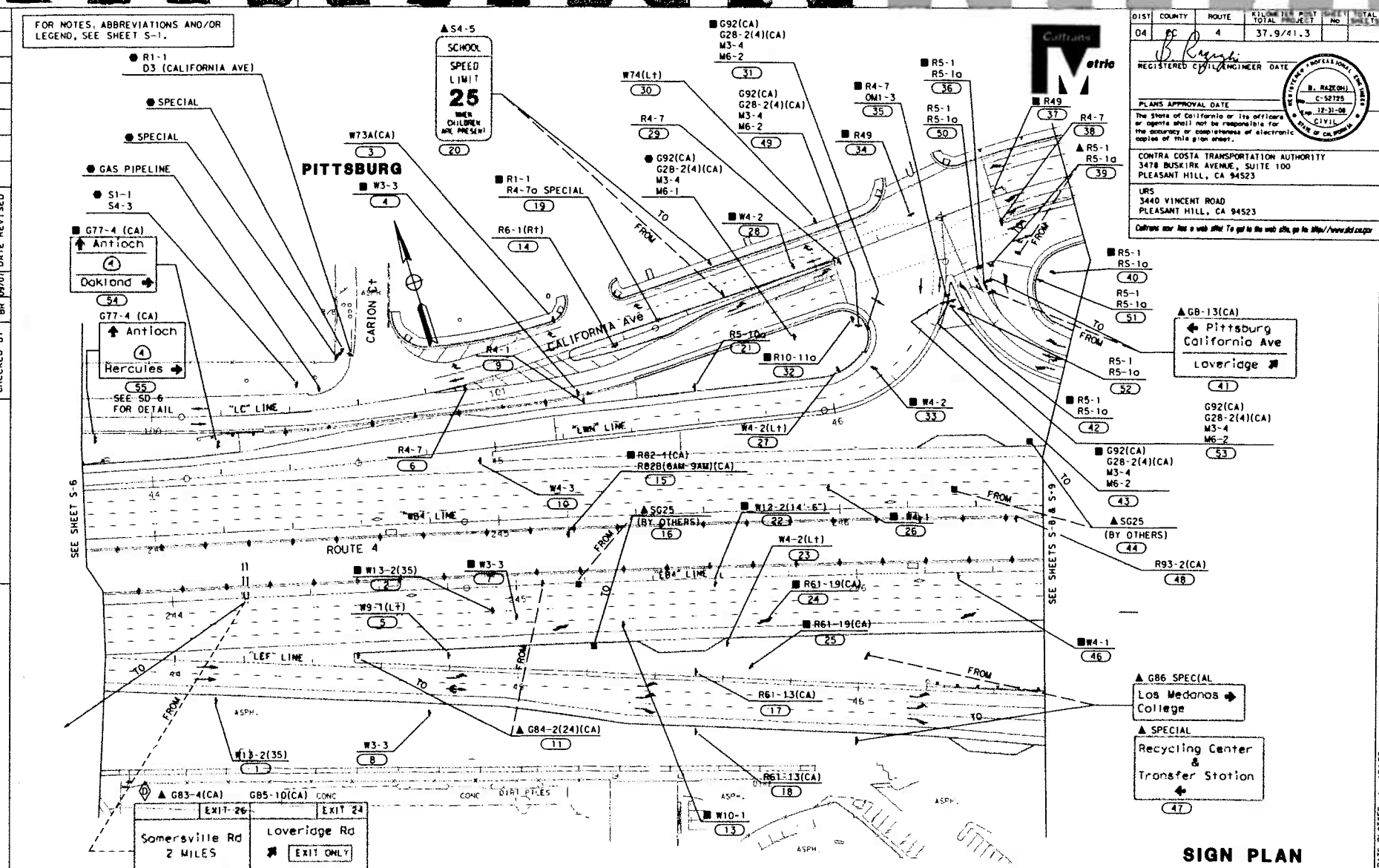
DGN FILE => $REQUEST

CU 04275

EA 228591

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



DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

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USERNAME => $USER
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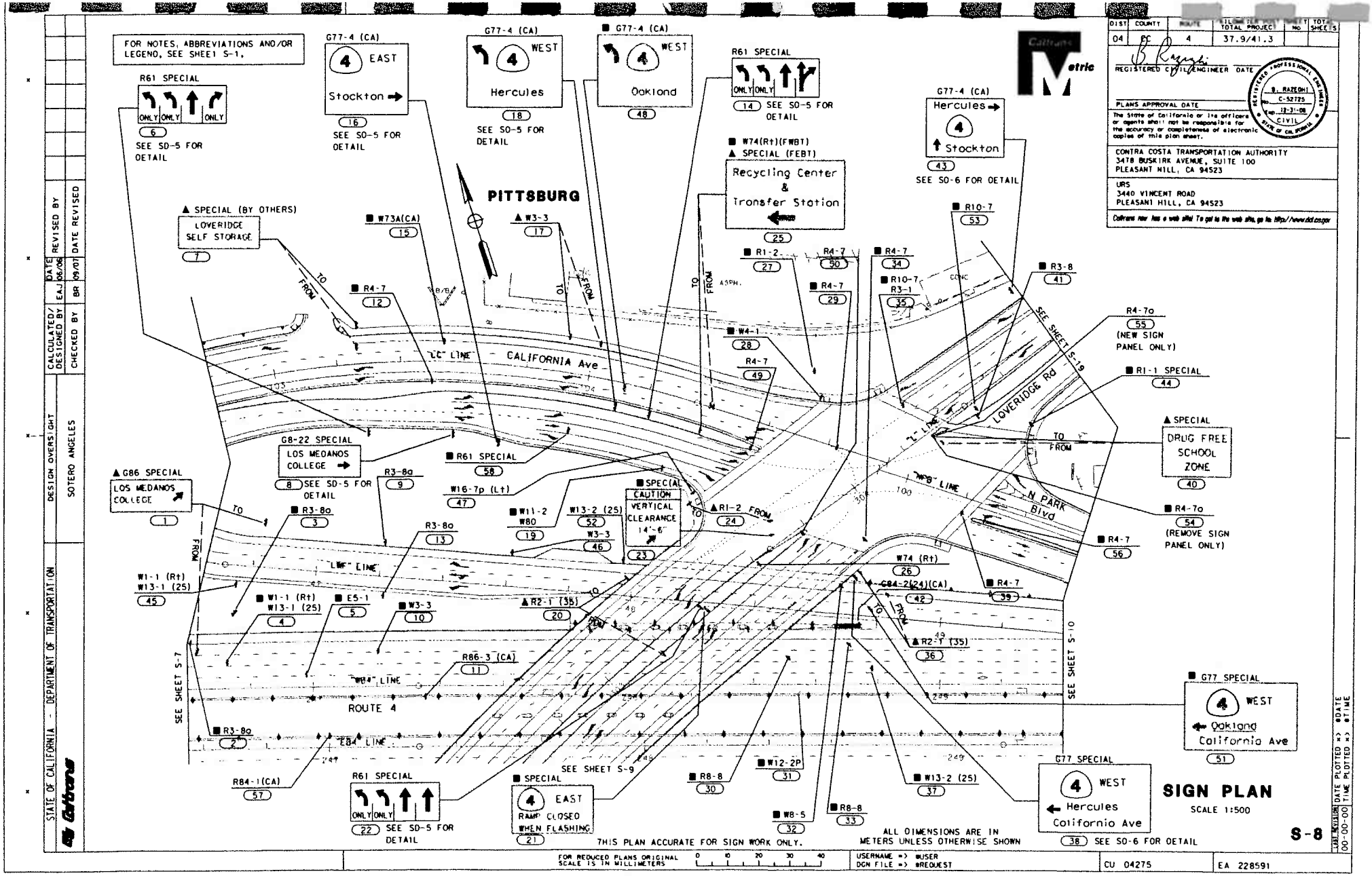
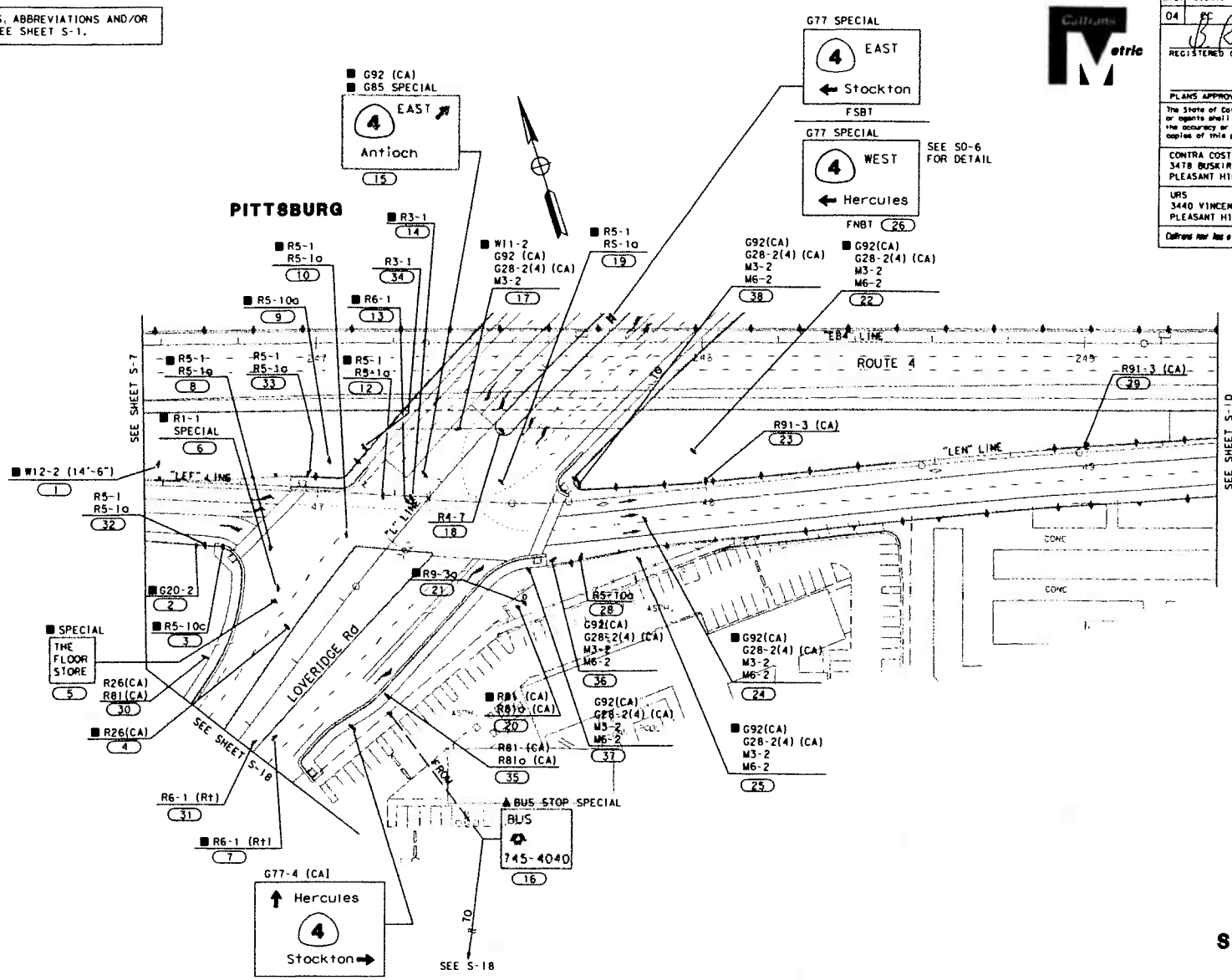
EA 228591

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


FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET S-1.
R61 SPECIAL
ONLY ONLY ONLY
6
SEE SD-5 FOR DETAIL
G77-4 (CA)
4 EAST
Stockton
16
SEE SD-5 FOR DETAIL
G77-4 (CA)
4 WEST
Hercules
18
SEE SD-5 FOR DETAIL
G77-4 (CA)
4 WEST
Oakland
48
R61 SPECIAL
ONLY ONLY
14
SEE SD-5 FOR DETAIL
G77-4 (CA)
Hercules
4
Stockton
43
SEE SD-6 FOR DETAIL
W74(Rt)(FWBT)
SPECIAL (FEBT)
Recycling Center & Transfer Station
25
PITTSBURG
SPECIAL (BY OTHERS)
LOVERIDGE SELF STORAGE
7
W73A(CA)
15
W3-3
17
R1-2
27
R4-7
50
R4-7
34
R10-7
53
R3-8
41
R4-7
12
R4-7
29
R10-7
R3-1
35
W4-1
28
R4-7
49
R4-7a
55
(NEW SIGN PANEL ONLY)
R1-1 SPECIAL
44
SEE SHEET S-19
LOVERIDGE Rd
"LC" LINE
CALIFORNIA Ave
TO
FROM
G8-22 SPECIAL
LOS MEDANOS COLLEGE
8
SEE SD-5 FOR DETAIL
R61 SPECIAL
58
SPECIAL
DRUG FREE SCHOOL ZONE
40
G86 SPECIAL
LOS MEDANOS COLLEGE
1
R3-8a
9
W16-7p (Lt)
47
SPECIAL
CAUTION VERTICAL CLEARANCE 14'-6"
23
R1-2
24
"NPB" LINE
N PARK Blvd
R4-7a
54
(REMOVE SIGN PANEL ONLY)
R3-8a
3
R3-8a
13
W11-2
W80
19
W13-2 (25)
52
W3-3
46
R4-7
56
"LWF" LINE
W74 (Rt)
26
W1-1 (Rt)
W13-1 (25)
45
W1-1 (Rt)
W13-1 (25)
4
E5-1
5
W3-3
10
R2-1 (35)
20
G84-2(24)(CA)
42
R4-7
39
R2-1 (35)
36
R86-3 (CA)
11
"W84" LINE
ROUTE 4
SEE SHEET S-7
SEE SHEET S-10
G77 SPECIAL
4 WEST
Oakland
California Ave
51
R3-8a
2
"E84" LINE
R84-1(CA)
57
R61 SPECIAL
ONLY ONLY
22
SEE SD-5 FOR DETAIL
SPECIAL
4 EAST
RAMP CLOSED WHEN FLASHING
21
SEE SHEET S-9
R8-8
30
W12-2P
31
W13-2 (25)
37
W8-5
32
R8-8
33
G77 SPECIAL
4 WEST
Hercules
California Ave
38
SEE SD-6 FOR DETAIL
THIS PLAN ACCURATE FOR SIGN WORK ONLY.
ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN
SIGN PLAN
SCALE 1:500
S-8
FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS
0 10 20 30 40
USERNAME => $USER
DGN FILE => $REQUEST
CU 04275
EA 228591
DATE PLOTTED => $DATE
TIME PLOTTED => $TIME
LAST REVISION 00-00-00
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans
DESIGN OVERSIGHT
SOTERO ANGELES
CALCULATED/DESIGNED BY EAJ
CHECKED BY BR
DATE 06/06
09/07
REVISED BY
DATE REVISED
DIST 04
COUNTY CC
ROUTE 4
FILEMETER POST TOTAL PROJECT 37.9/41.3
SHEET NO.
TOTAL SHEETS
REGISTERED CIVIL ENGINEER DATE
PLANS APPROVAL DATE
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.
CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523
URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523
Caltrans now has a web site! To get to the web site, go to: http://www.dot.ca.gov

FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET S-1.



THIS PLAN ACCURATE FOR SIGN WORK ONLY.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

SIGN PLAN

SCALE 1:500

S-9

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER B. RAZEGHI C-52725 Exp. 12-31-08 CIVIL STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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CALCULATED/DESIGNED BY	DATE	REVISED BY	DATE REVISED
EAJ	06/06		
CHECKED BY	BR	09/07	

DESIGN OVERSIGHT: SOTERO ANGELES

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

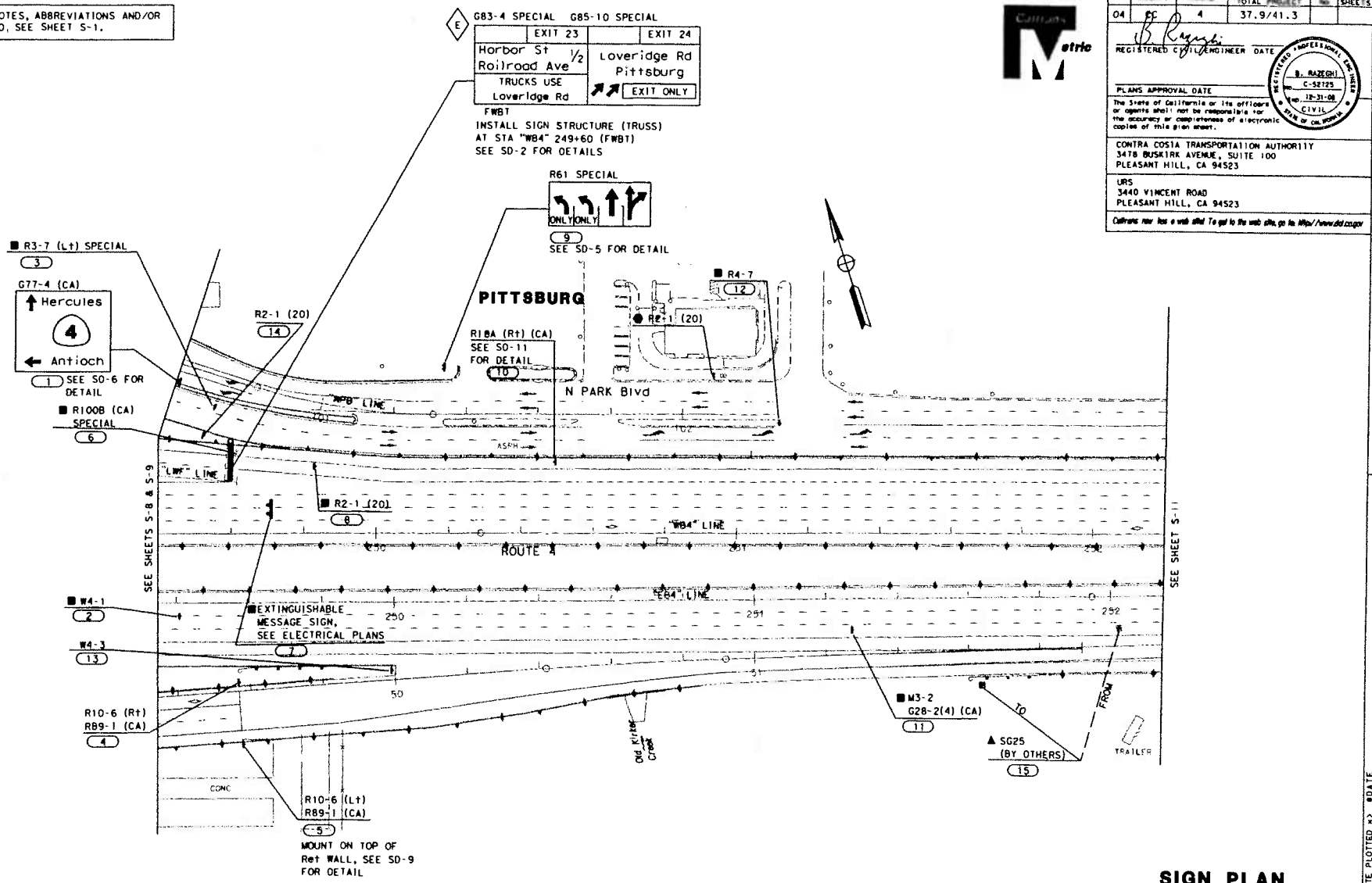
USERNAME => $USER
DGN FILE => $REQUEST

CU 04275

EA 228591

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

FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET S-1.



DIST	COUNTY	ROUTE	TOTAL PROJECT	TOTAL SHEETS
04	CC	4	37.9/41.3	

REGISTERED CIVIL ENGINEER — DATE

B. RAZEGHI C-52125 12-31-08 CIVIL

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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DATE REVISED	REVISED BY
06/06	EAJ
09/07	BR

CALCULATED/DESIGNED BY
CHECKED BY

DESIGN OVERSIGHT
SOTERO ANGELES

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

SIGN PLAN

SCALE 1:500

S-10

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FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => @USER
DGN FILE => @REQUEST

CU 04275

EA 228591

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

FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET S-1.

DIST	COUNTY	ROUTE	KILO TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

B. RAZEGHI C-52725 12-31-08 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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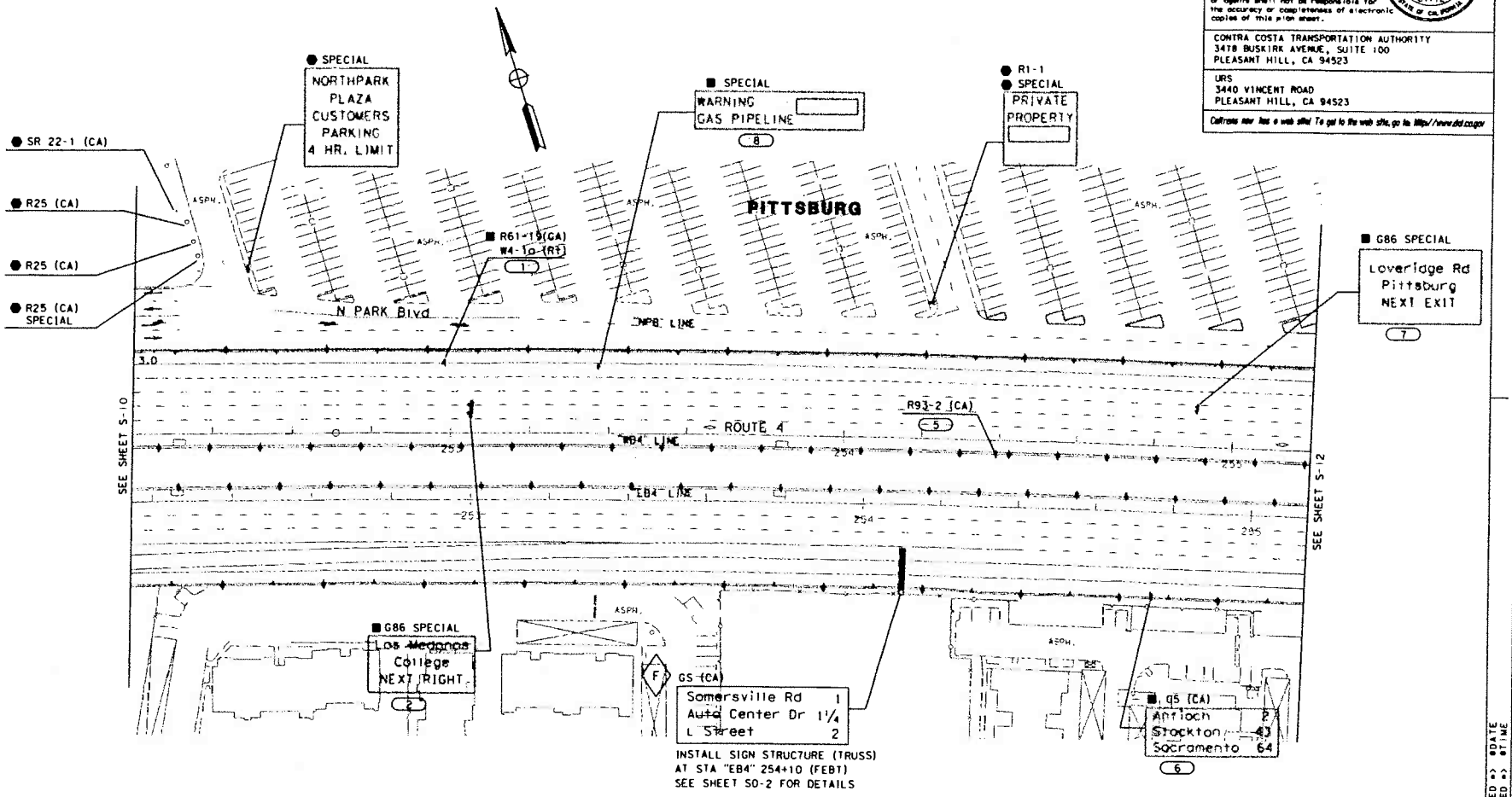
DATE	REVISED BY	DATE REVISED
EAJ 08/06	BR 09/07	

CALCULATED/DESIGNED BY
CHECKED BY

DESIGN OVERSIGHT
SOTERO ANGELES

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans



INSTALL SIGN STRUCTURE (TRUSS)
AT STA "EB4" 254+10 (FEBT)
SEE SHEET SO-2 FOR DETAILS

SIGN PLAN

SCALE 1:500

S-11

THIS PLAN ACCURATE FOR SIGN WORK ONLY.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => @USER
DGN FILE => @REQUEST

CU 04275

EA 228591

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

FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET S-1.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER B. RAZEGHI No. C-52725 Exp. 12-31-08 CIVIL STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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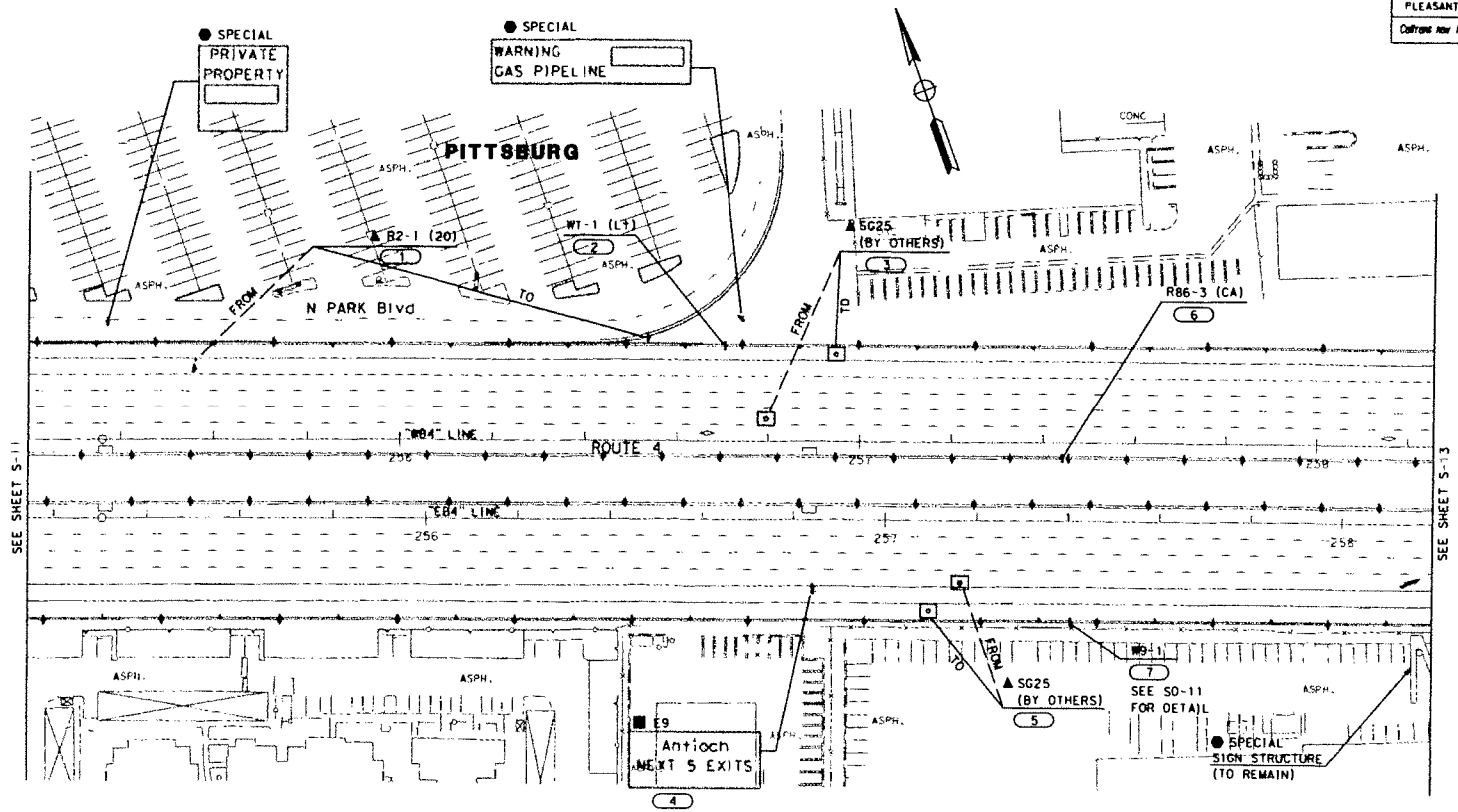


SIGN PLAN

SCALE 1:500

S-12

THIS PLAN ACCURATE FOR SIGN WORK ONLY.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => $USER
DGN FILE => $REQUEST

CU 04275

EA 228591

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

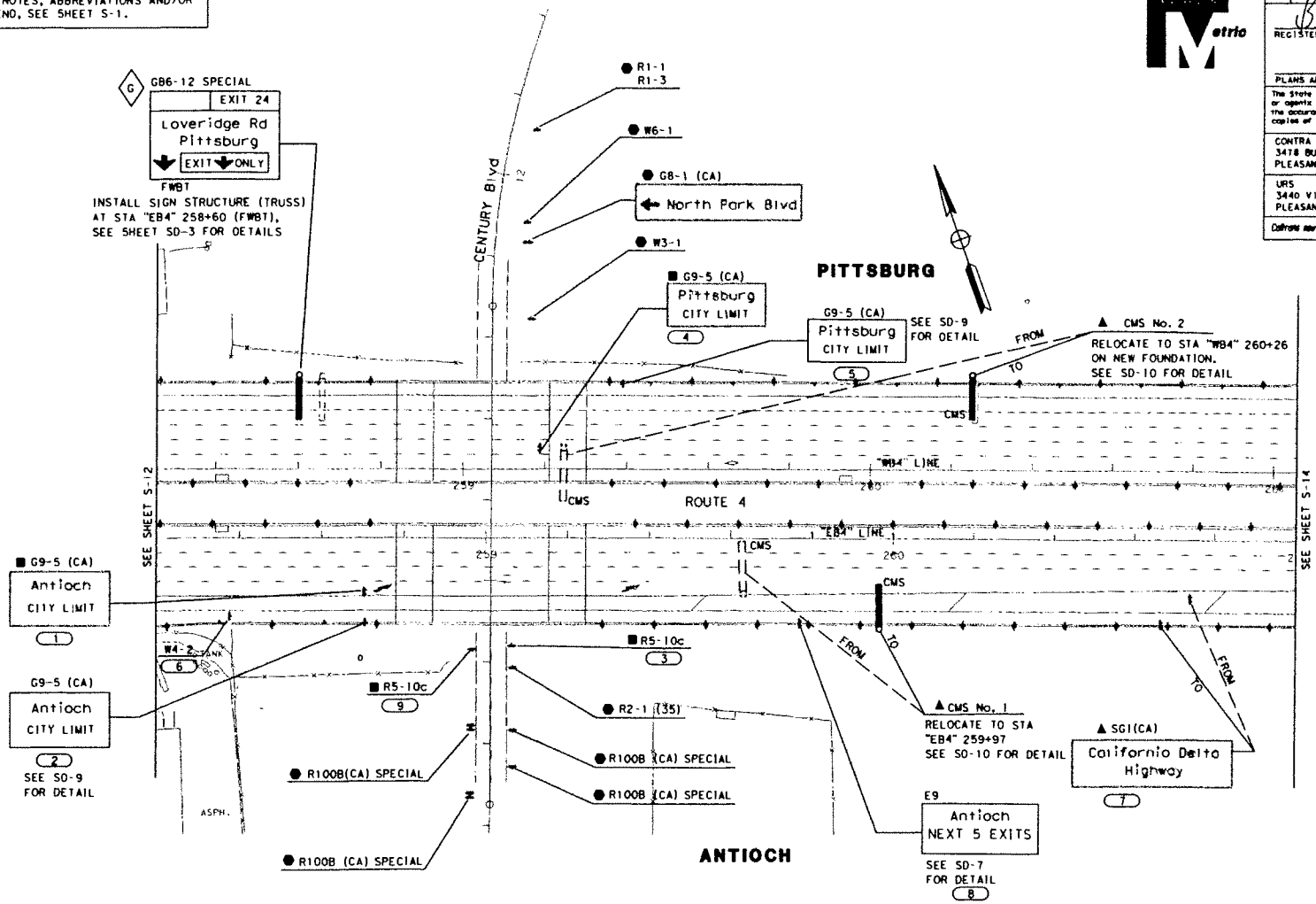
DESIGN OVERSIGHT: SOTERO ANGELES

CALCULATED/DESIGNED BY: EAJ DATE 06/06 REVISED BY

CHECKED BY: BR 09/07 DATE REVISED

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

FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET S-1.



SIGN PLAN

SCALE 1:500

S-13

THIS PLAN ACCURATE FOR SIGN WORK ONLY.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER B. RAZEGHI No. C-52725 Exp. 12-31-08 CIVIL STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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DESIGN OVERSIGHT: SOTERO ANGELES

CALCULATED/DESIGNED BY: EAJ DATE: 06/06 REVISED BY

CHECKED BY: BR 09/07 DATE REVISED

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => $USER
DGN FILE => $REQUEST

CU 04275

EA 228591

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

FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET S-1.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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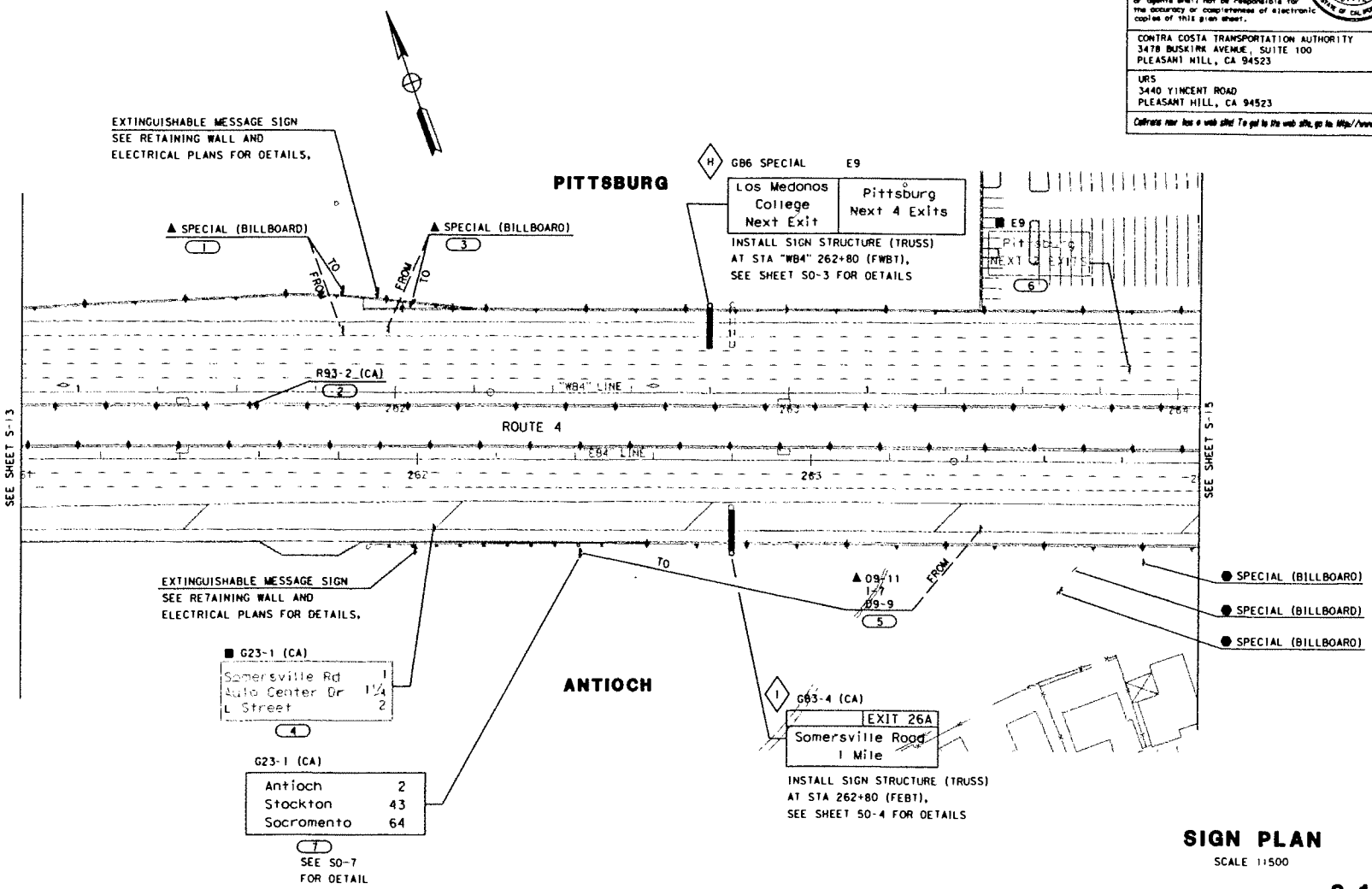

SIGN PLAN

SCALE 1:500

S-14

THIS PLAN ACCURATE FOR SIGN WORK ONLY.

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STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

DESIGN OVERSIGHT: SOTERO ANGELES

CALCULATED/DESIGNED BY: EAJ DATE: 06/06 REVISED BY

CHECKED BY: BR 09/07 DATE REVISED

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => @USER
DGN FILE => @REQUEST

CU 04275

EA 228591

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

FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET S-T.

DIST	COUNTY	ROUTE	TOTAL PROJECT	NO	SHEETS
04	CC	4	3T.9/41.3		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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B. RAZEGHI C-52725 12-31-08 CIVIL STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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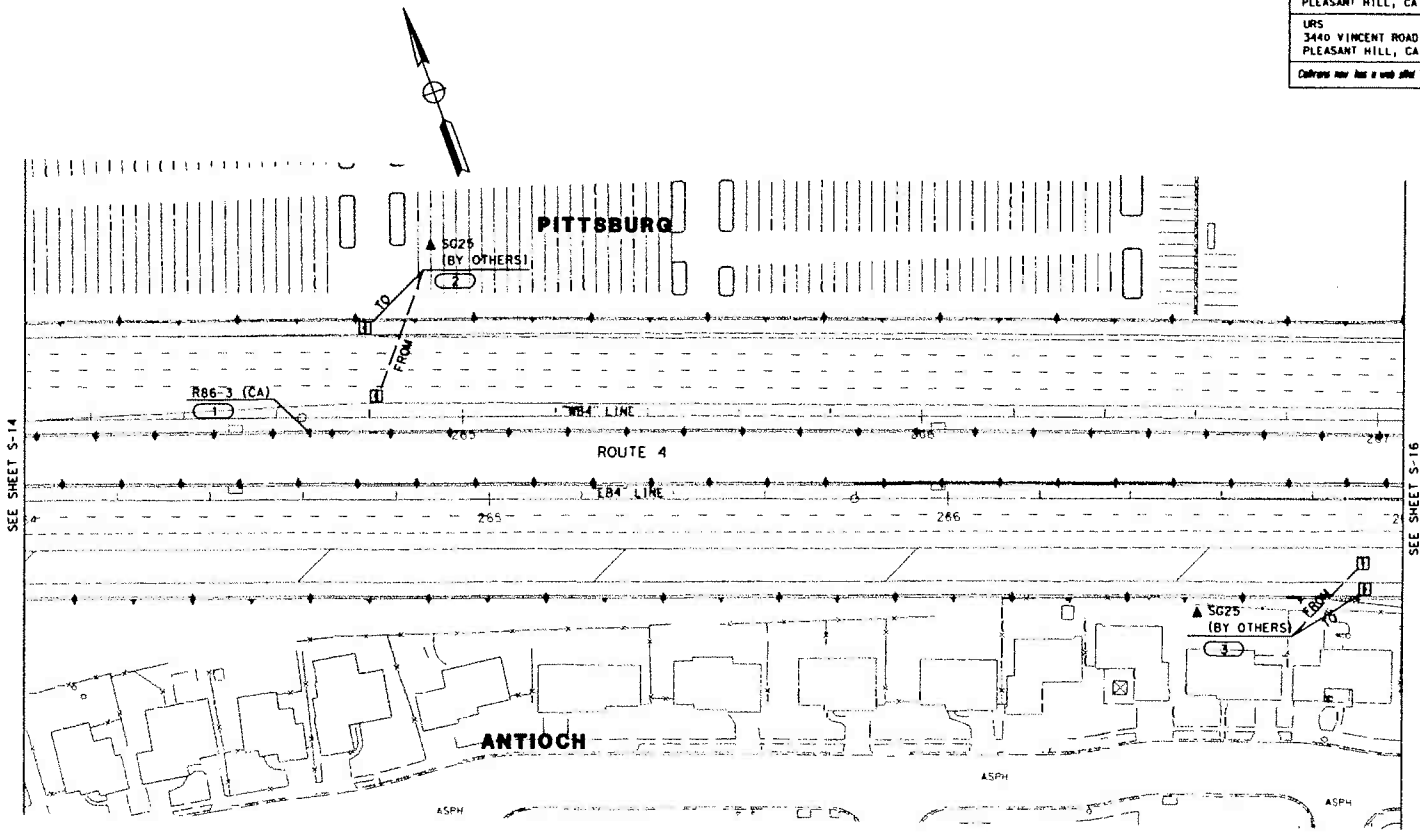

SIGN PLAN

SCALE 1:1500

S-15

THIS PLAN ACCURATE FOR SIGN WORK ONLY.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => $USER
DGN FILE => $REQUEST

CU 04275

EA 228591

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

DESIGN OVERSIGHT
SOTERO ANGELES

CALCULATED/DESIGNED BY
CHECKED BY
EAJ
BR

DATE REVISED BY
06/06
09/07

DATE REVISED

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

FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET S-1.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER B. RAZEGHI No. C-52125 Exp. 12-31-08 CIVIL STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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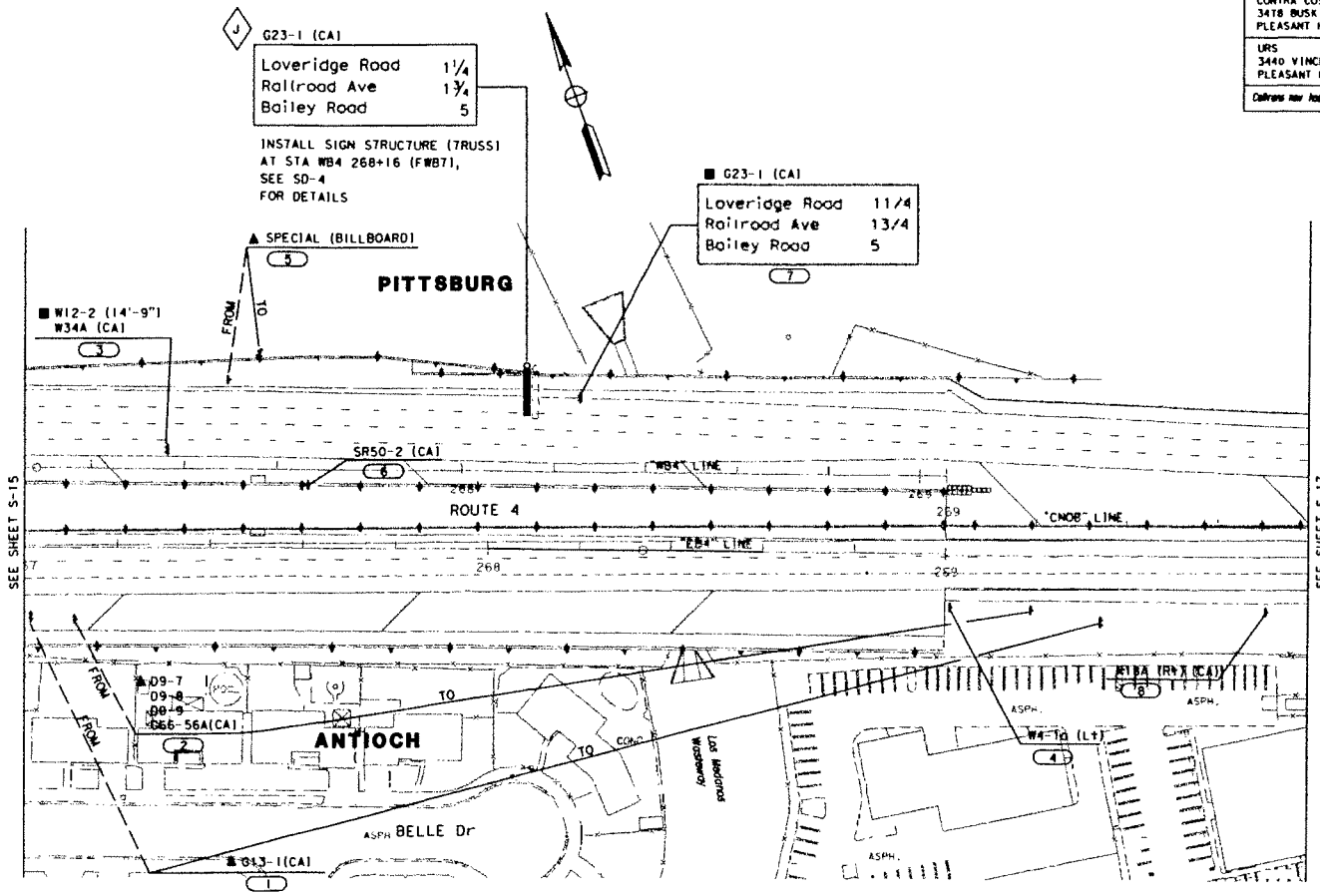

SIGN PLAN

SCALE 1:500

S-16

THIS PLAN ACCURATE FOR SIGN WORK ONLY.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

DESIGN OVERSIGHT: SOTERO ANGELES

CALCULATED/DESIGNED BY: EAJ DATE 06/06 REVISED BY

CHECKED BY: BR 09/07 DATE REVISED

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => $USER
DGN FILE => $REQUEST

CU 04275

EA 228591

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

FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET S-1.

DIST	COUNTY	ROUTE	TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER — B. RAZEGHI — C-52725 — 12-31-08 — CIVIL — STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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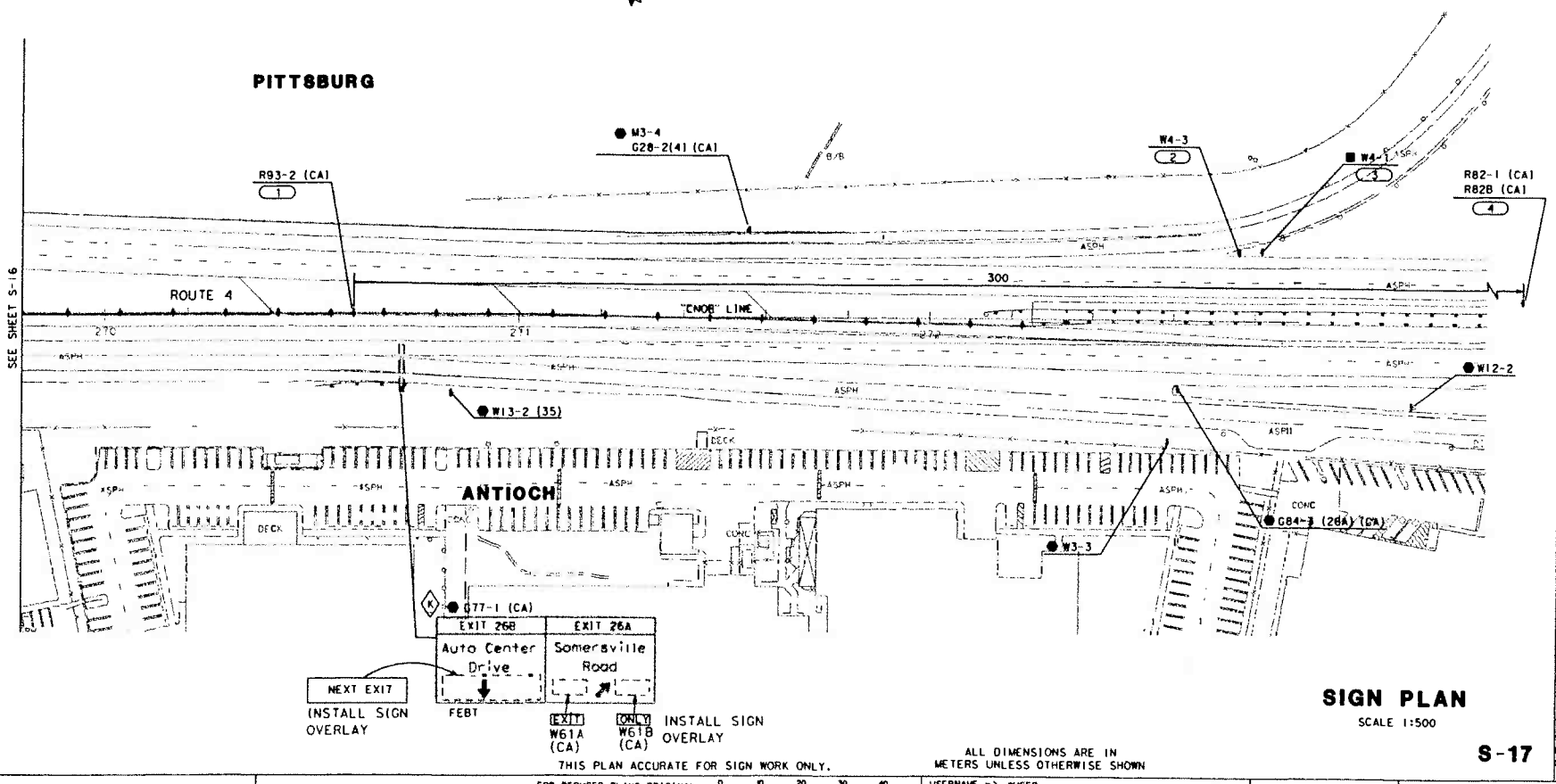
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION — Caltrans

DESIGN OVERSIGHT — SOTERO ANGELES

CALCULATED/DESIGNED BY — E.A.J. — DATE 06/06

CHECKED BY — BR — DATE 09/07

REVISED BY — DATE REVISED



SIGN PLAN

SCALE 1:500

S-17

THIS PLAN ACCURATE FOR SIGN WORK ONLY.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

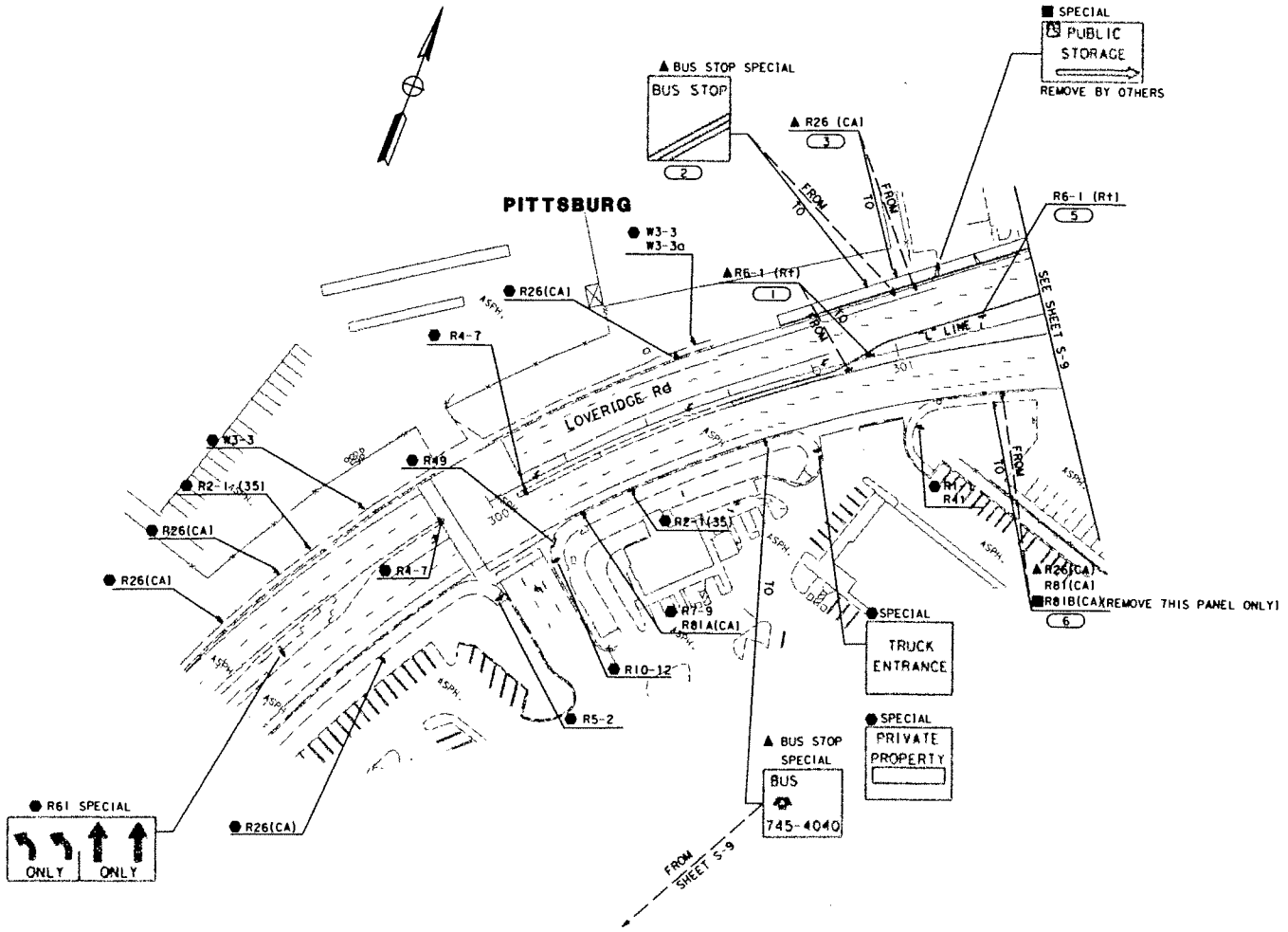
USERNAME => @USER
DGN FILE => @REQUEST

CU 04275

EA 228591

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

FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET S-1.



THIS PLAN ACCURATE FOR SIGN WORK ONLY.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

SIGN PLAN

SCALE 1:500

S-18

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER B. Razeghi DATE

B. RAZEGHI C-52725 12-31-08 CIVIL STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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DATE REVISED	REVISED BY
05/07	BR
06/06	EAJ

CALCULATED/DESIGNED BY: EAJ
CHECKED BY: BR

DESIGN OVERSIGHT: SOTERO ANGELES

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => @USER
OGN FILE => @REQUEST

CU 04275

EA 228591

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

FOR NOTES, ABBREVIATIONS AND/OR LEGEND, SEE SHEET S-1.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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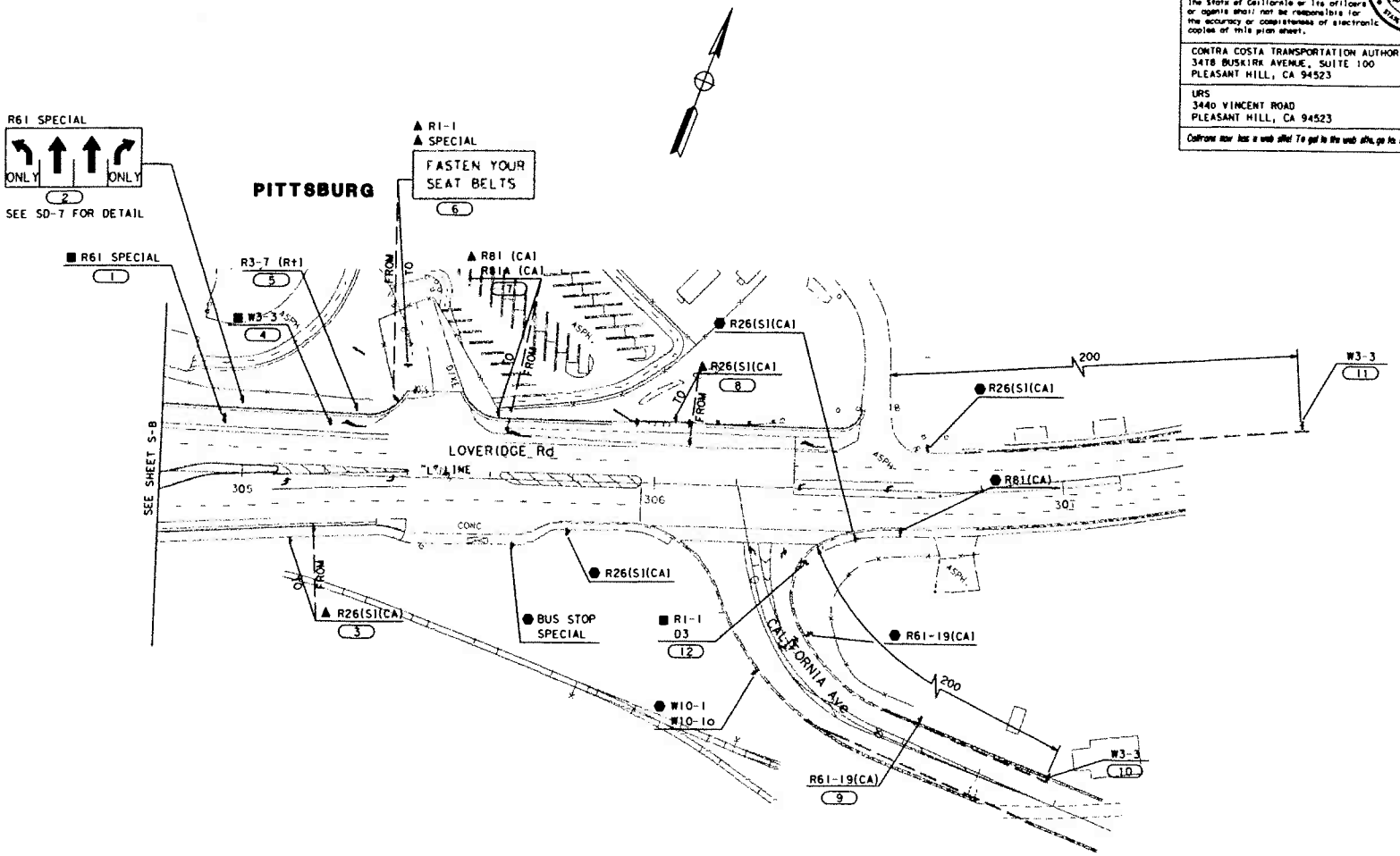
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

DESIGN OVERSIGHT: SOTERO ANGELES

CALCULATED/DESIGNED BY: EAJ — DATE REVISED: 06/06
CHECKED BY: BR — DATE REVISED: 09/07



SIGN PLAN

SCALE 1:500

S-19

THIS PLAN ACCURATE FOR SIGN WORK ONLY.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

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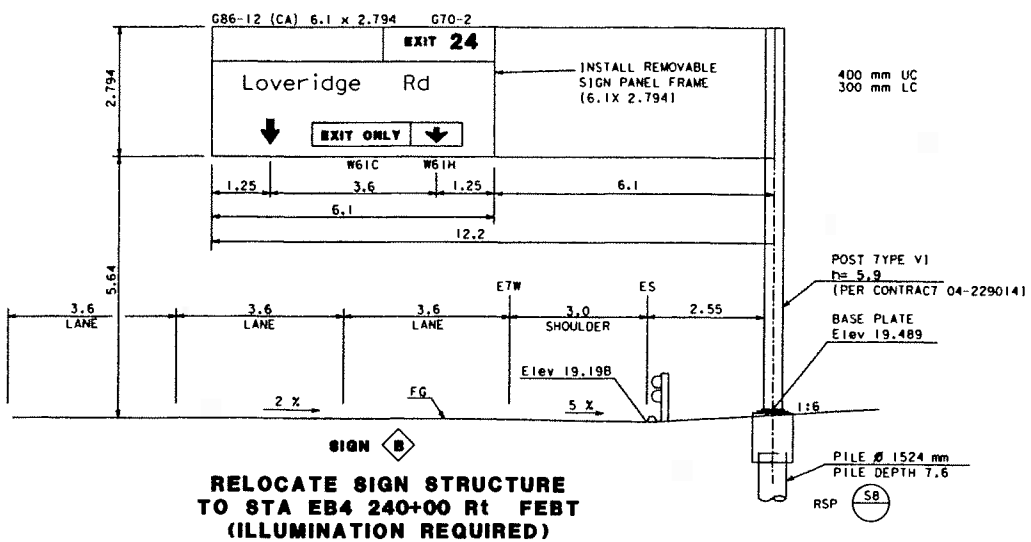
DGN FILE => @REQUEST

CU 04275

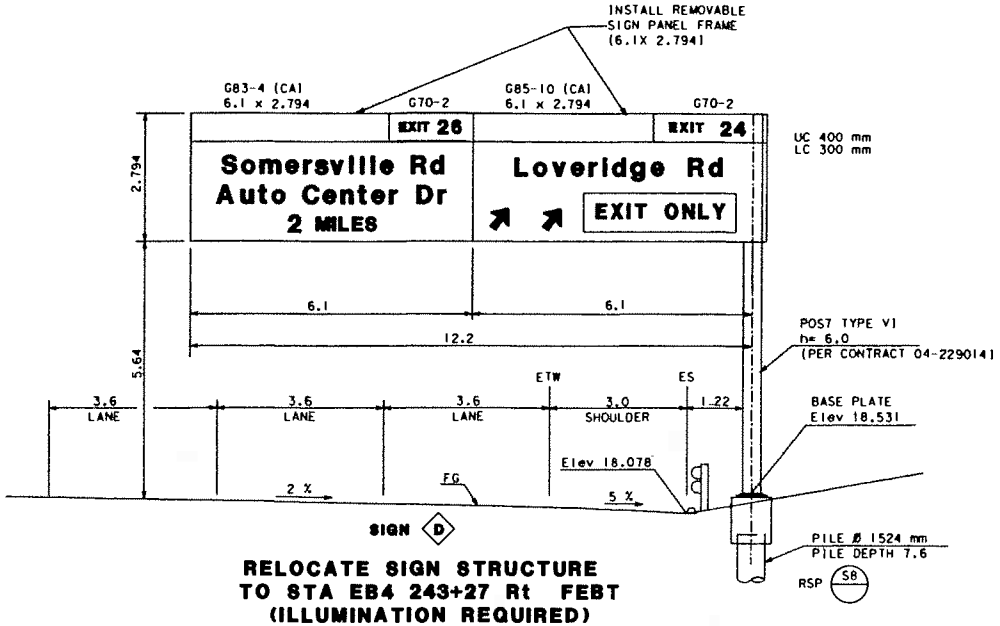
EA 228591

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



SIGN B

RELOCATE SIGN STRUCTURE TO STA EB4 240+00 Rt FEBT (ILLUMINATION REQUIRED)



SIGN D

RELOCATE SIGN STRUCTURE TO STA EB4 243+27 Rt FEBT (ILLUMINATION REQUIRED)

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

SIGN DETAILS

NO SCALE

SD-1

DIST	COUNTY	ROUTE	TOTAL PROJECT	NO	SHEETS
04	CC	4	3T.9/4\.3		

REGISTERED CIVIL ENGINEER DATE

B. RAZEGHI C-52725 12-31-08 CIVIL STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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DESIGN OVERSIGHT	CALCULATED/ DESIGNED BY	DATE	REVISED BY	DATE REVISED
SOTERO ANGELES	EAJ	08/06	BR	09/07
	CHECKED BY			

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Caltrans

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => &USER
DGN FILE => &REQUEST

CU 04275

EA 228591

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

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

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B. RAZEGHI C-52785 12-31-08 CIVIL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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DATE	REVISED BY	DATE	REVISED
EAJ	06/08	BR	09/07

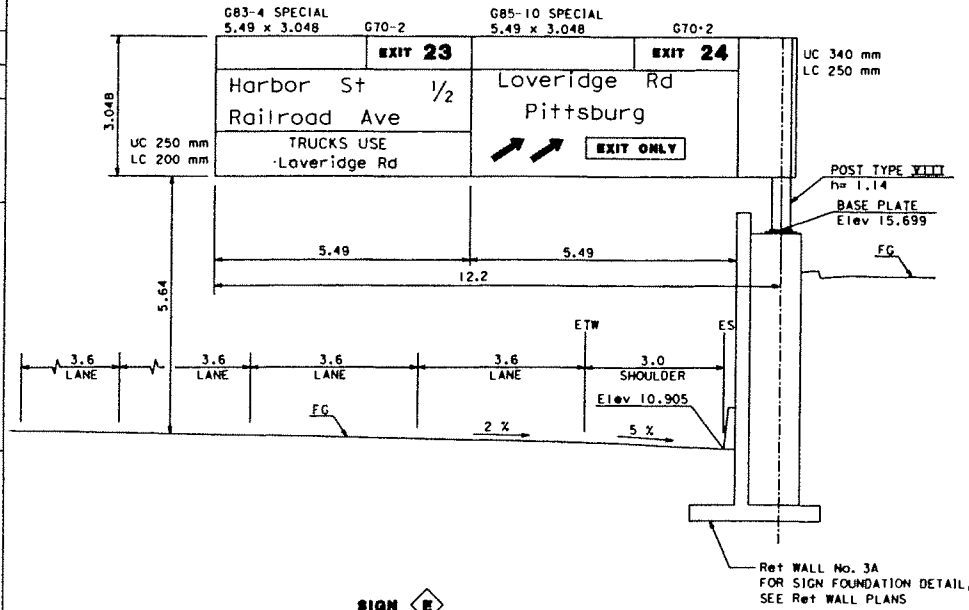
CALCULATED/DESIGNED BY — CHECKED BY

DESIGN OVERSIGHT

SOTERO ANGELES

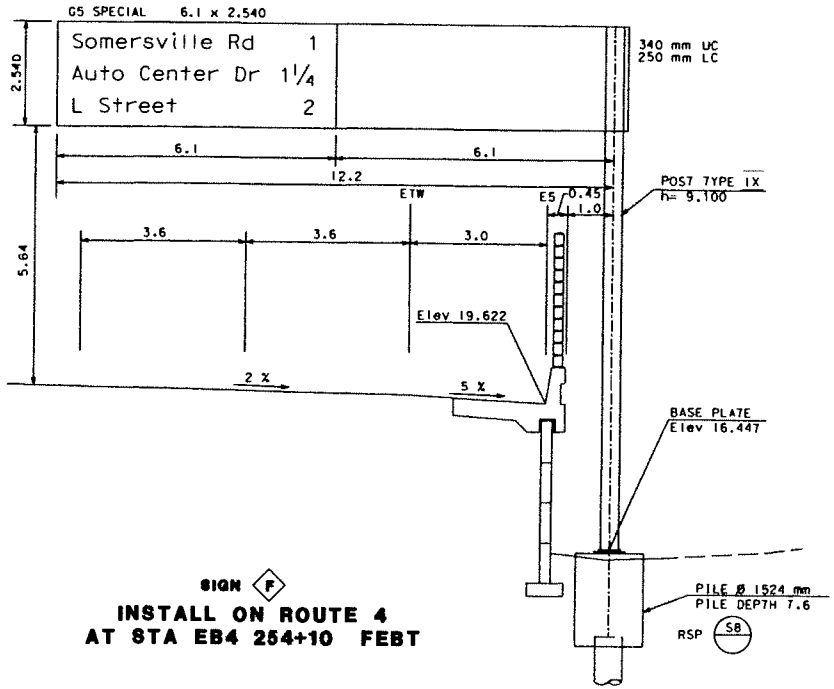
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans



SIGN E

INSTALL ON ROUTE 4
AT STA WB4 249+60 Lt FWBT
(ILLUMINATION REQUIRED)



SIGN F

INSTALL ON ROUTE 4
AT STA EB4 254+10 FEBT

SIGN DETAILS

NO SCALE

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

SD-2

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => @USER
DGN FILE => @REQUEST

CU 04275

EA 228591

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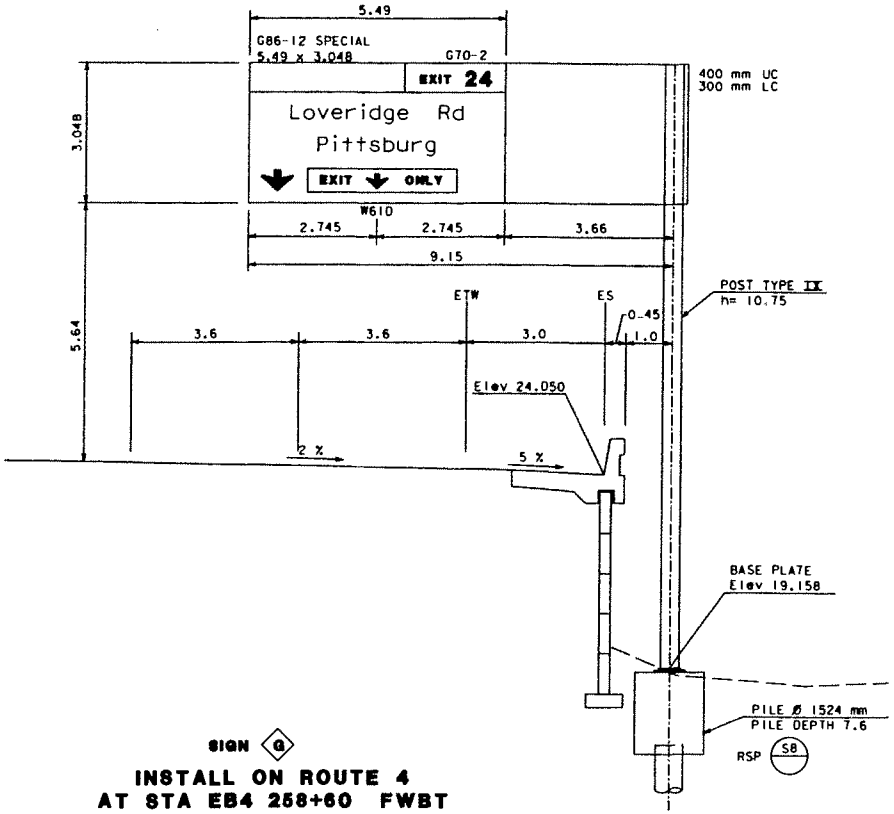
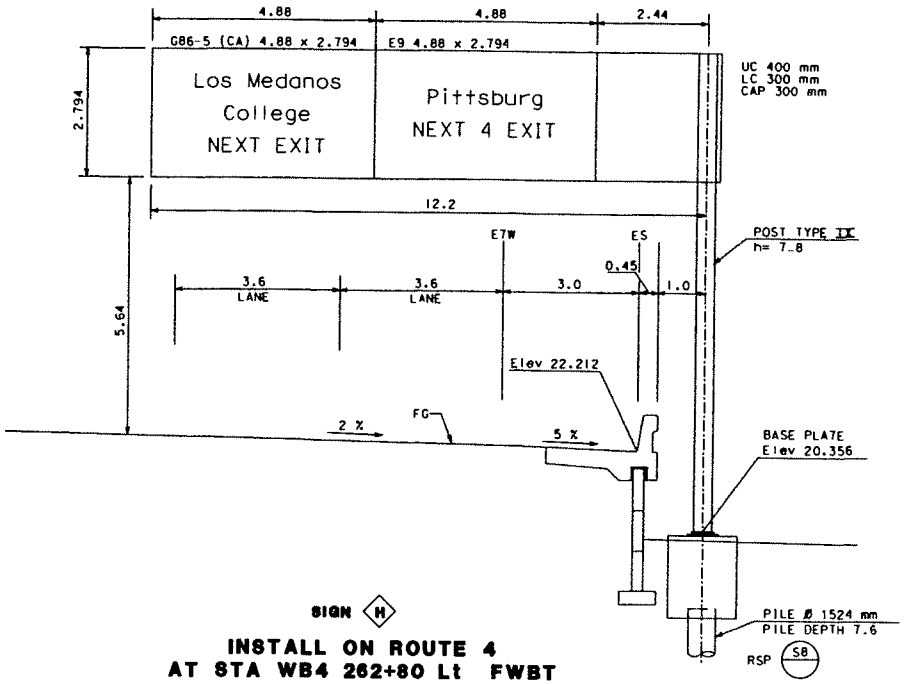
00-00-00 TIME PLOTTED => @TIME



SIGN G

INSTALL ON ROUTE 4
AT STA EB4 258+60 FWBT
(ILLUMINATION REQUIRED)



SIGN H

INSTALL ON ROUTE 4
AT STA WB4 262+80 Lt FWBT

SIGN DETAILS

NO SCALE

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

SD-3

DIST	COUNTY	ROUTE	KILOMETER TOTAL PROJECT	No.	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER B. RAZGHI DATE

PLANS APPROVAL DATE

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B. RAZGHI No. C-52725 Exp. 12-31-08 CIVIL STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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EAJ 06/06
BR 09/07
DATE REVISED

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USERNAME => &USER
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CU 04275

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LAST REVISION 00-00-00 DATE PLOTTED => &DATE
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DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

B. RAZEGHI, No. C-52725, Exp. 12-31-08, CIVIL, STATE OF CALIFORNIA

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CONTRA COSTA TRANSPORTATION AUTHORITY
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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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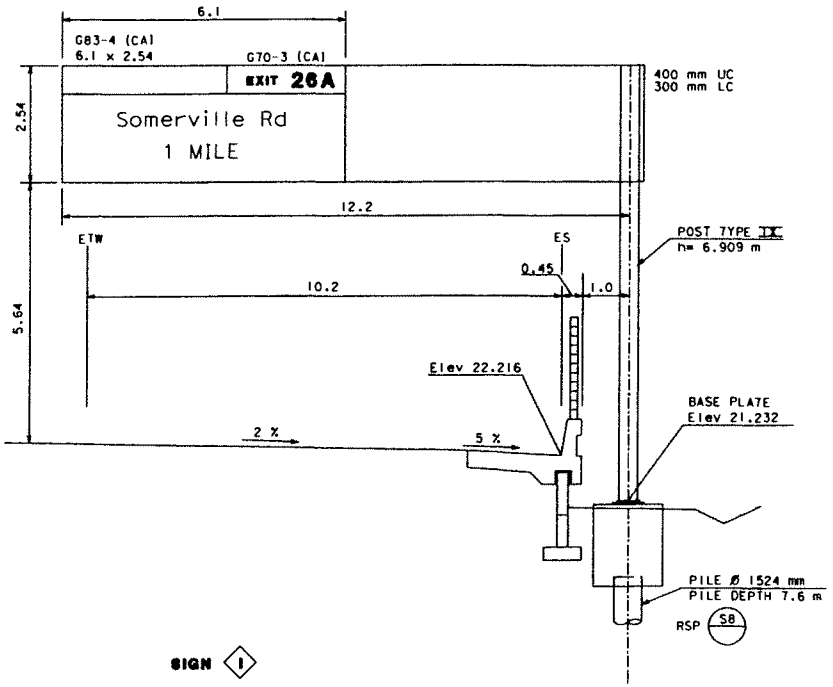
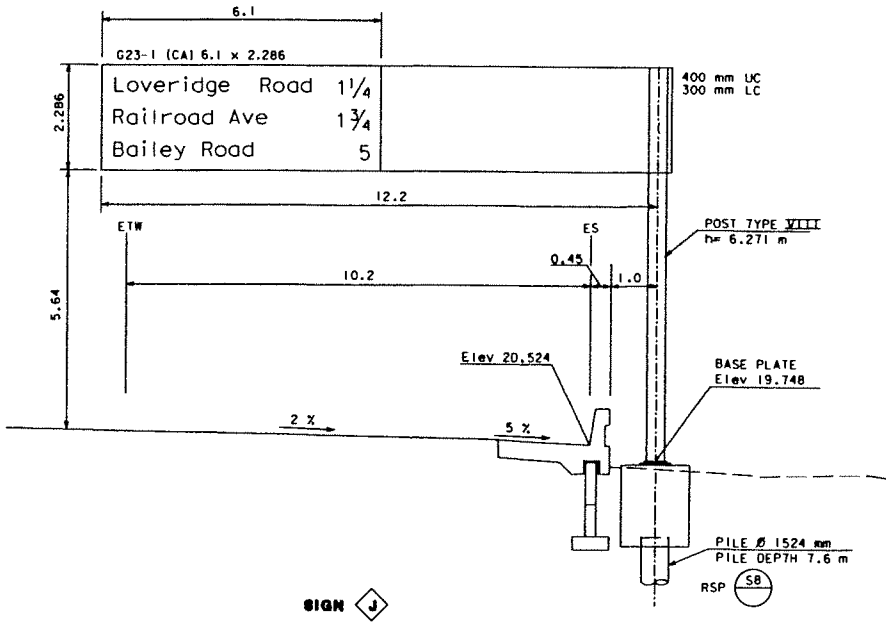


SIGN I

INSTALL SIGN STRUCTURE (TRUSS)
AT STA EB4 262+80 (FEBT)



SIGN J

INSTALL SIGN STRUCTURE (TRUSS)
AT STA WB4 268+16 (FWBT)

SIGN DETAILS

NO SCALE

SD-4

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

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USERNAME => &USER
DGN FILE => &REQUEST

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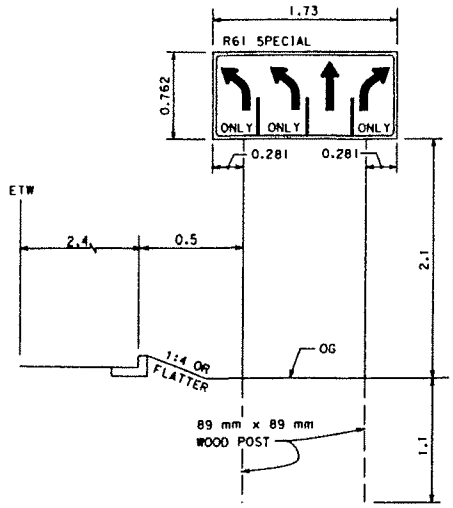
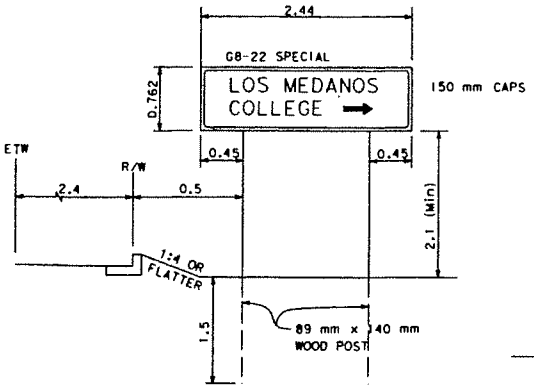
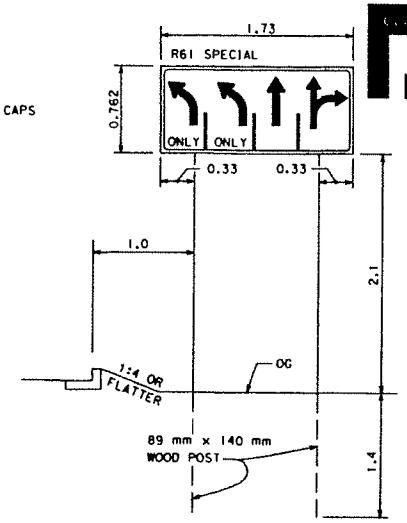


FOR ARROWS SIZE, PANEL BACKGROUND AND OTHER DETAILS, REFER TO R61-28 & R61-34 IN CALTRANS STANDARD SIGN DETAILS

SIGN 6 OF SHEET S-8 ON CALIFORNIA Ave FEBT

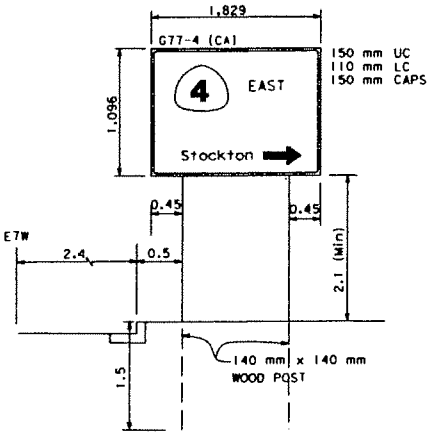


SIGN 8 OF SHEET S-8 ON CALIFORNIA Ave FWBT

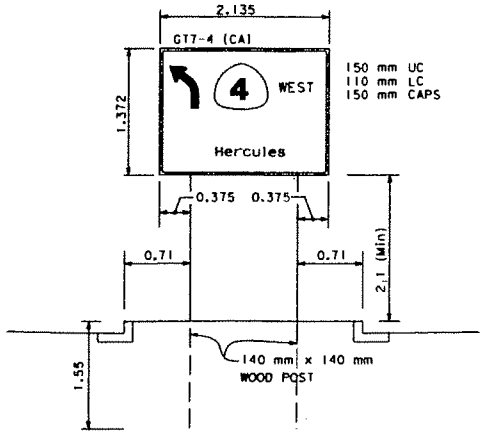


FOR ARROWS SIZE, PANEL BACKGROUND AND OTHER DETAILS, REFER TO R61-28 & R61-34 IN CALTRANS STANDARD SIGN DETAILS

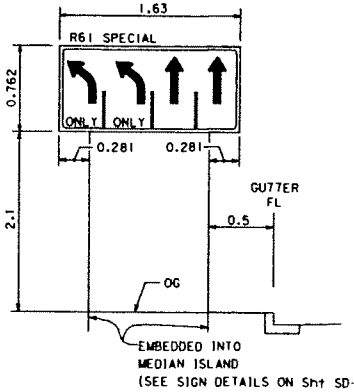
SIGN 14 OF SHEET S-8 ON CALIFORNIA Ave & SIGN 9 OF SHEET S-10 ON N PARK Blvd FWBT



SIGN 16 ON SHEET S-8 ON CALIFORNIA Ave FEBT



SIGN 18 OF SHEET S-8 ON CALIFORNIA Ave FWBT



FOR ARROWS SIZE, PANEL BACKGROUND AND OTHER DETAILS, REFER TO R61-13 & R61-28 IN CALTRANS STANDARD SIGN DETAILS

SIGN 22 OF SHEET S-8 ON LOVERIDGE Rd FSBT

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

SIGN DETAILS

NO SCALE

SD-5

DIST	COUNTY	ROUTE	TILLAGE TOTAL PROJECT	NET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER — B. RAZEGHI — No. C-52725 — Exp. 12-31-08 — CIVIL — STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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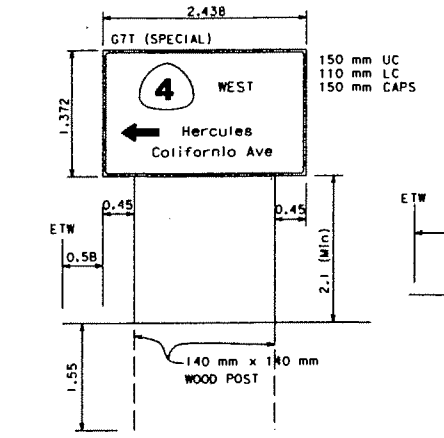
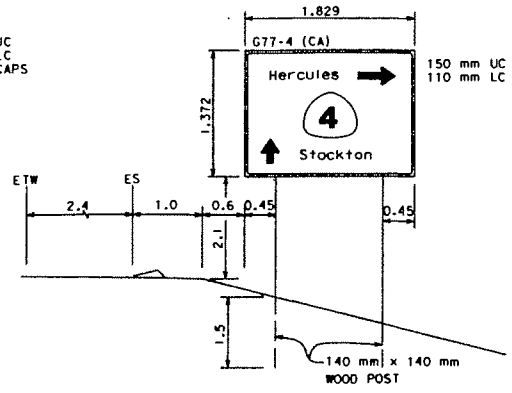
CU 04275

EA 228591

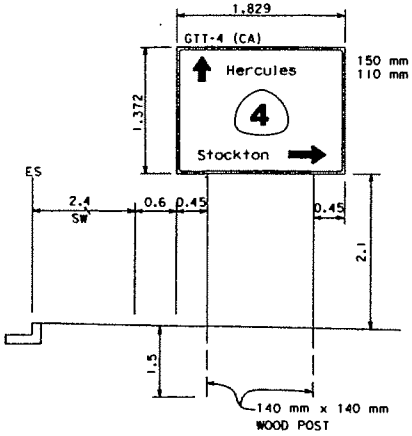
LAST REVISION 00-00-00
DATE PLOTTED => &DATE
TIME PLOTTED => &TIME



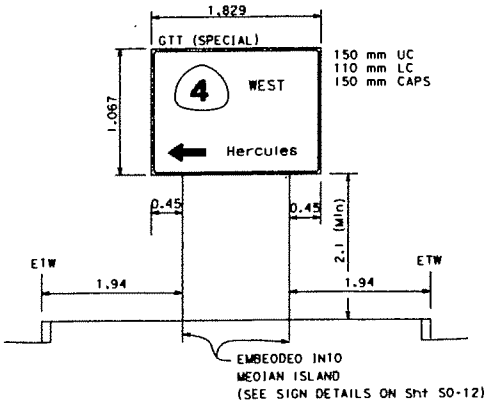
SIGN 38 OF SHEET S-8 ON LOVERIDGE Rd FNBT



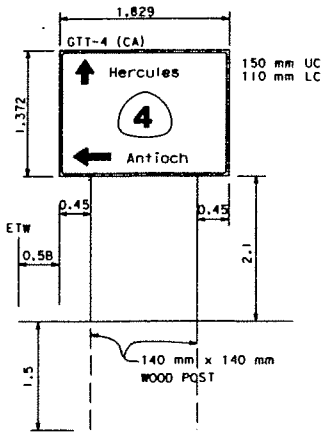
SIGN 43 OF SHEET S-8 ON LOVERIDGE Rd FSBT



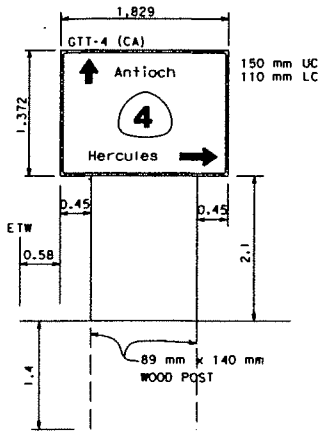
SIGN 11 OF SHEET S-9 ON LOVERIDGE Rd FNBT



SIGN 26 OF SHEET S-9 ON LOVERIDGE Rd FNBT (PANEL FSBT NOT SHOWN)



SIGN 1 OF SHEET S-10 ON NORTH PARK Blvd FWBT



SIGN 55 OF SHEET S-7 ON CALIFORNIA Ave FEBT

SIGN DETAILS

NO SCALE

SD-6

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	3T.9/41.3		

REGISTERED CIVIL ENGINEER B. RAZEGHI DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER B. RAZEGHI No. C-52125 Exp. 12-31-08 CIVIL STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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EAJ	06/06		
CHECKED BY			
BR	09/07		

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

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

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DGN FILE => #REQUEST

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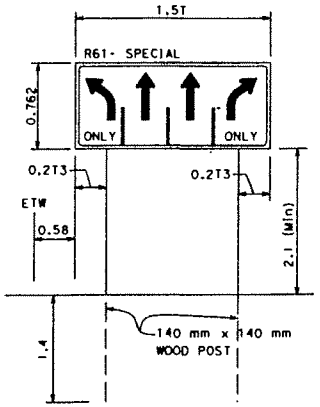
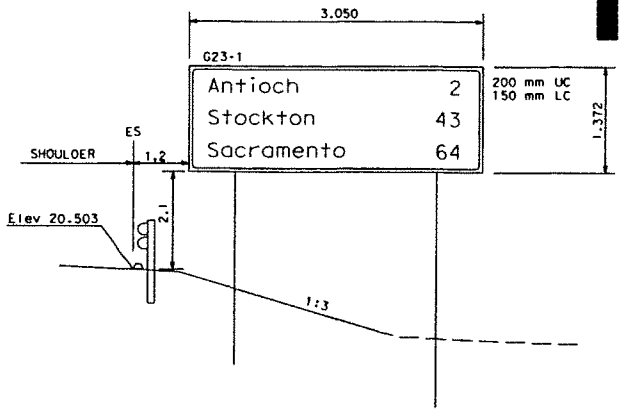
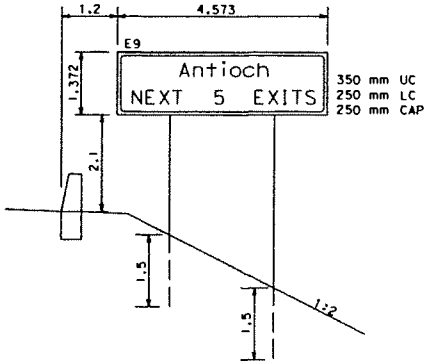
EA 22B591



SIGN 2 OF SHEET S-19
ON LOVERIDGE Rd FWBT



SIGN 7 ON SHEET S-14



SIGN 8 ON SHEET S-13

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	3T.9/41.3		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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SIGN DETAILS

NO SCALE

SD-7

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DGN FILE => $REQUEST

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EA 22B591

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DIST	COUNTY	ROUTE	KILOMETER TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	3T.9/41.3		

REGISTERED CIVIL ENGINEER DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
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PLEASANT HILL, CA 94523

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3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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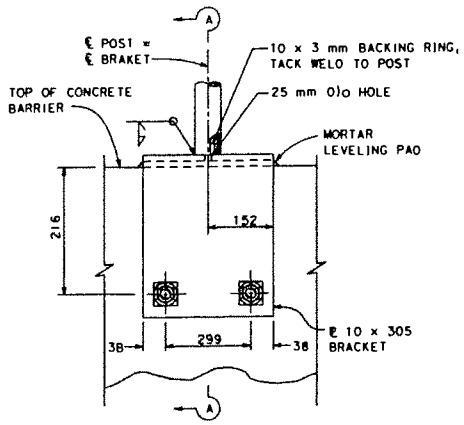
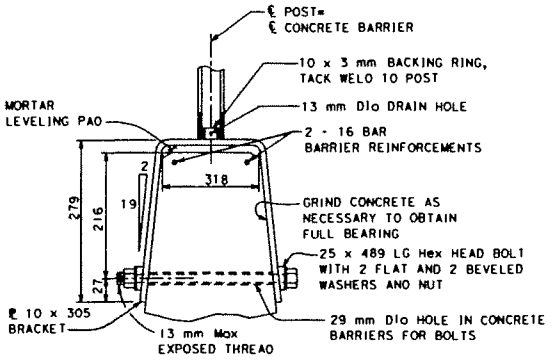


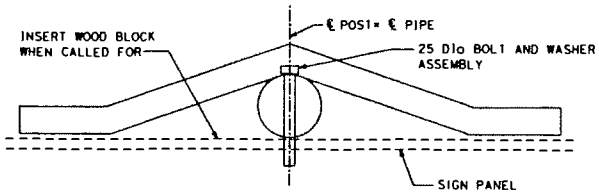
ELEVATION

MOUNTING BRACKET

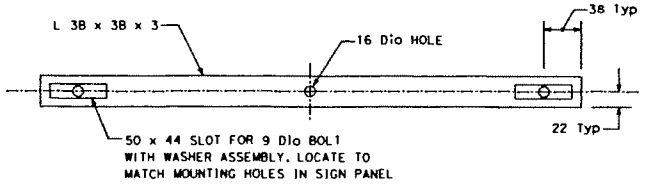


SECTION A-A

BASE PLATE AND ANCHORAGE DETAILS



PLAN

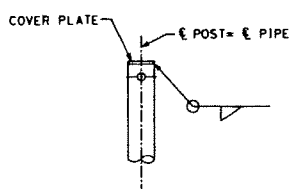


ELEVATION

BACK BRACE DETAILS

NOTES:

1. FOR DETAILS NOT SHOWN SEE STANDARD PLANS
2. WASHER ASSEMBLY CONSISTS OF TWO FLAT WASHERS, NUT, FIBER WASHER AND JAM NUT.
3. ALL SIGN PANELS ARE STATE FURNISHED.
4. ALL STEEL GALVANIZED AFTER FABRICATION.
5. FOR LOCATION OF SIGNS AND CONCRETE BARRIER DETAILS SEE PROJECT PLANS.



TOP OF POST DETAIL

SIGN POST MOUNTING ON CONCRETE BARRIER IN FREEWAY MEDIAN

1. SIGN 6 OF SHEET S-12
2. SIGN 2 OF SHEET S-14
3. SIGN 1 OF SHEET S-15
4. SIGN 6 OF SHEET S-16
5. SIGN 1 OF SHEET S-17

SIGN DETAILS

NO SCALE

SD-8

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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EA 228591

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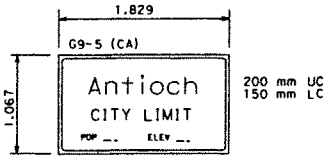
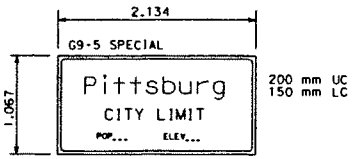
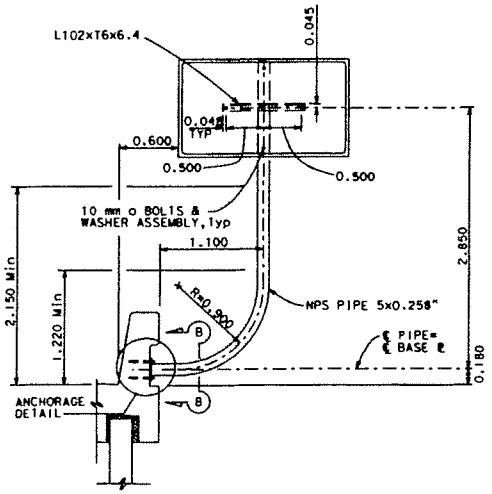


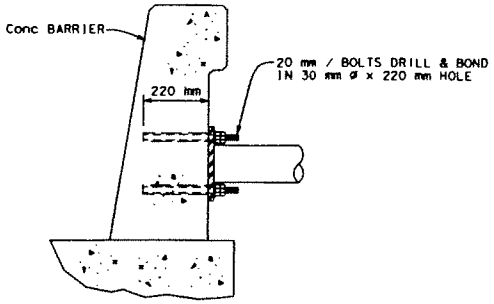
SIGN 2 OF SHEET S-13



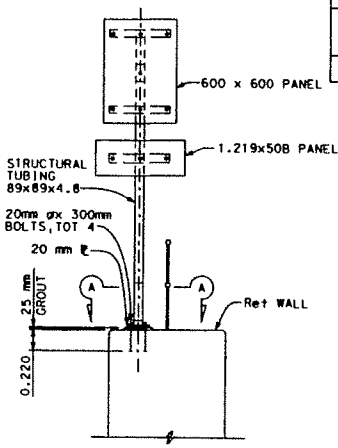
SIGN 5 OF SHEET S-13



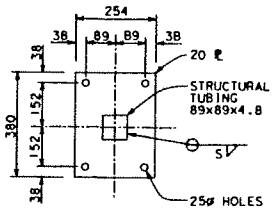
SIGN 2 & 5 OF SHEET S-13 ON ROUTE 4 FEBT



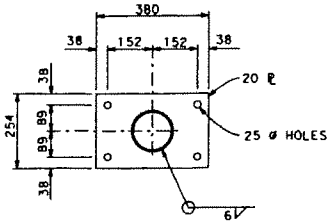
ANCHORAGE DETAIL



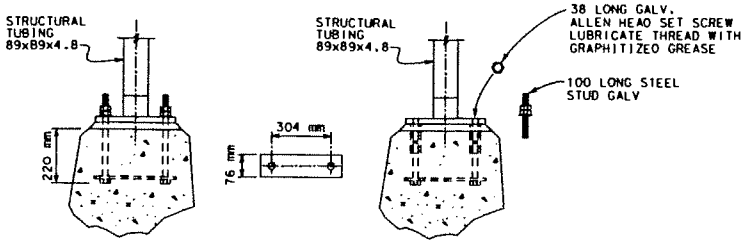
SIGN No. 5 OF SHEET S-10



SECTION A-A
(DIMENSIONS SHOWN IN mm)



SECTION B-B
(DIMENSIONS SHOWN IN mm)



CIP BOLT ANCHORAGE ALTERNATIVES

NOTES:

1. ALL STEEL SHALL BE GALVANIZED AFTER FABRICATION.
2. WASHER ASSEMBLY CONSISTS OF FLAT AND FIBER WASHERS, NUT AND JAM NUT.

SIGN DETAILS

NO SCALE

SD-9

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	31.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

B. RAZEGHI No. C-52725 Exp. 12-31-08 CIVIL STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
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DGN FILE => @REQUEST

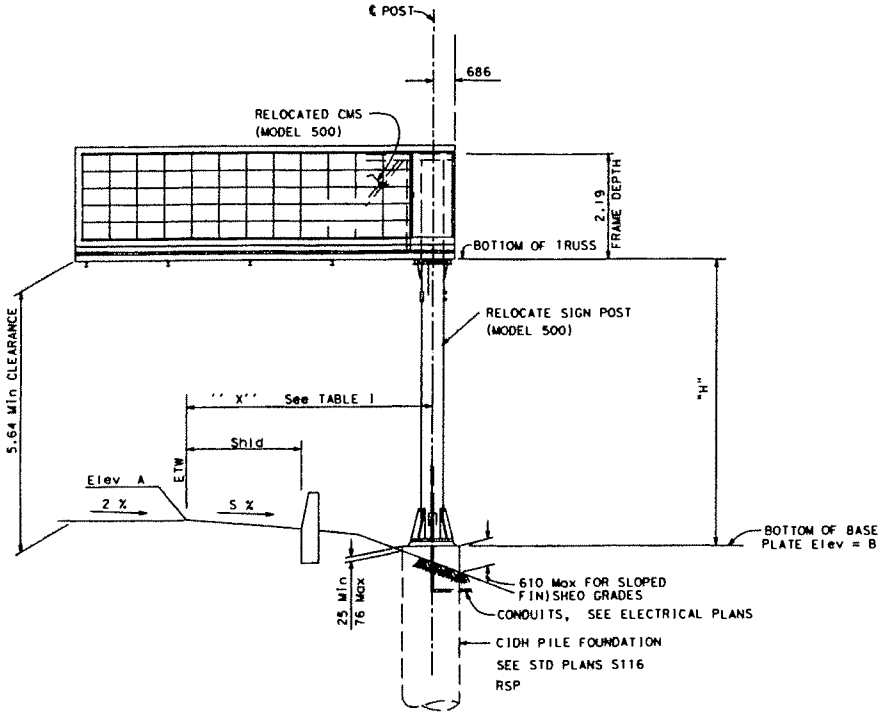
CU 042T5

EA 228591

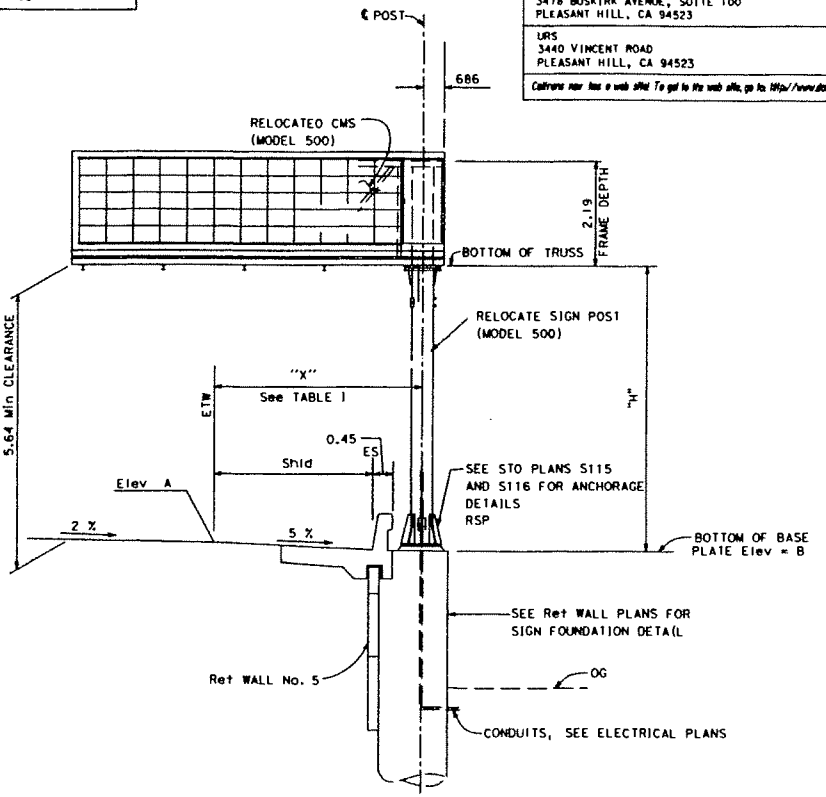
LAST REVISION 00-00-00 DATE PLOTTED => @DATE TIME PLOTTED => @TIME

TABLE I

CMS No.	STATION	ROUTE	ORIENTATION	X	"H"	Elev A	Elev B	QUANTITIES: RELOCATE CMS (Eo)	QUANTITIES: 1524 Olo CIOH PILE (m)
1	259+9T	04	FEBT	5.0	-	23.623	23.46T	1	T.O
2	260+20	04	FWBT	4.4 ±	-	23.4B9	23.333	1	
TOTAL								2	T.O



ELEVATION
RELOCATED CMS No. 1 FEBT
AT STA EB4 259+97



ELEVATION
RELOCATED CMS No. 2 FWBT
AT STA WB4 260+26

SIGN DETAILS

NO SCALE

SD-10

ALL DIMENSIONS ARE IN
METERS UNLESS OTHERWISE SHOWN

DIST	COUNTY	ROUTE	KILOMETER TOTAL PROJECT	SHEET No	TOT SHEETS
04	CC	4	3T.9/41.3		

REGISTERED CIVIL ENGINEER — DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER — B. RAJEGHI — C-52725 — 12-31-08 — CIVIL — STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

DESIGN OVERSIGHT: SOTERO ANGELES

CALCULATED/DESIGNED BY: EAJ — DATE REVISED: 06/08
CHECKED BY: BR — DATE REVISED: 09/07

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TIME PLOTTED => @TIME

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

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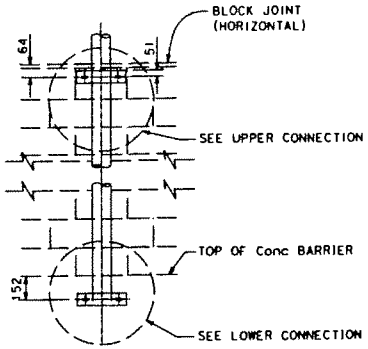
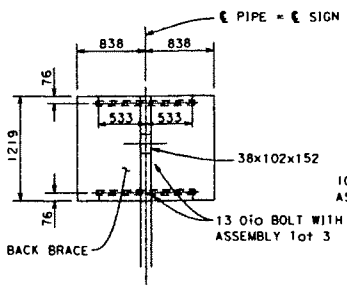
DGN FILE => @REQUEST

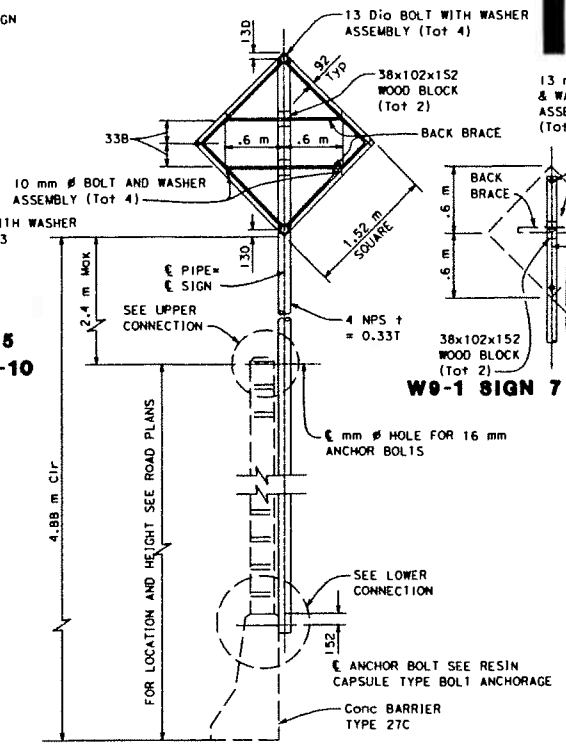
CU 04275 | EA 228591



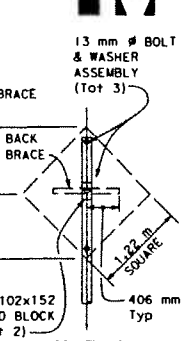
PART SIDE ELEVATION



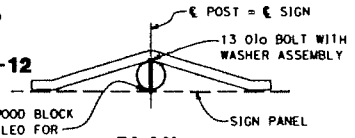
R18A(Rt) (CA) SIGN 6 ON S-5
R18A (Rt) (CA) SIGN 10 ON S-10
ELEVATION



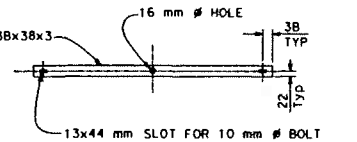
ELEVATION W4-1a (Lt) SIGN 5 ON S-6



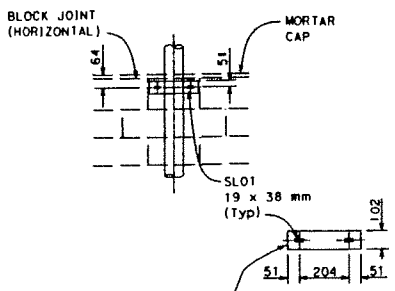
W9-1 SIGN 7 ON S-12



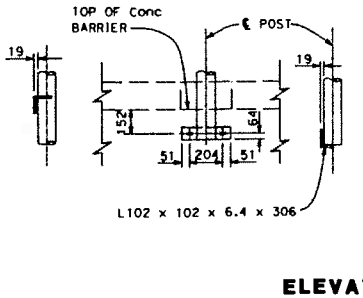
PLAN



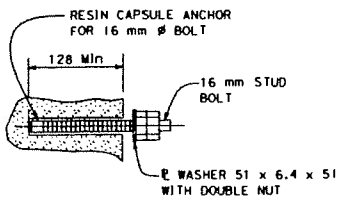
ELEVATION
BACK BRACE DETAILS



UPPER CONNECTION

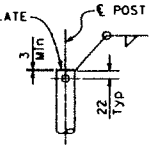


LOWER CONNECTION



RESIN CAPSULE TYPE BOLT ANCHORAGE

NOTE:
RESIN CAPSULE ANCHORAGE IS SUBJECT TO APPROVAL OF ENGINEER. INSTALLATION PROCEDURES SHALL COMPLY WITH MANUFACTURER'S INSTRUCTIONS.



TOP OF POST DETAIL

NOTES:
1. FOR DETAILS NOT SHOWN SEE STANDARD PLANS.
2. DAMAGED SOUNDWALL BLOCKS WILL BE REPLACED IN KIND.
3. ALL STEEL SHALL TO BE GALVANIZED AFTER FABRICATION.
4. WASHER ASSEMBLY CONSISTS OF TWO OVERSIZE WASHERS, TWO FIBER WASHERS, NUT AND JAM NUT.
5. SIGN PANELS SHALL BE FURNISHED BY THE CONTRACTOR.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

SIGN DETAILS

NO SCALE

SD-11

STANDARD PLAN SHEET No.
DETAIL No.

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

04	CC	4	3T.9/41.3

REGISTERED CIVIL ENGINEER — DATE
PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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DATE REVISED BY	DATE REVISED
EAJ 06/06	BR 09/07

CALCULATED/DESIGNED BY
CHECKED BY

DESIGN OVERSIGHT
SOTERO ANGELES

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => $USER
DGN FILE => $REQUEST

CU 042T5 | EA 228591

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

DIST	COUNTY	ROUTE	KILOMETER POST / TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	3T.9/41.3		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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URS CORPORATION
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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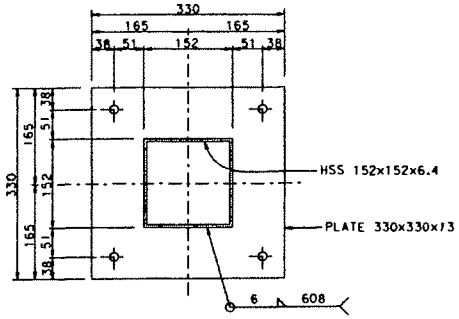
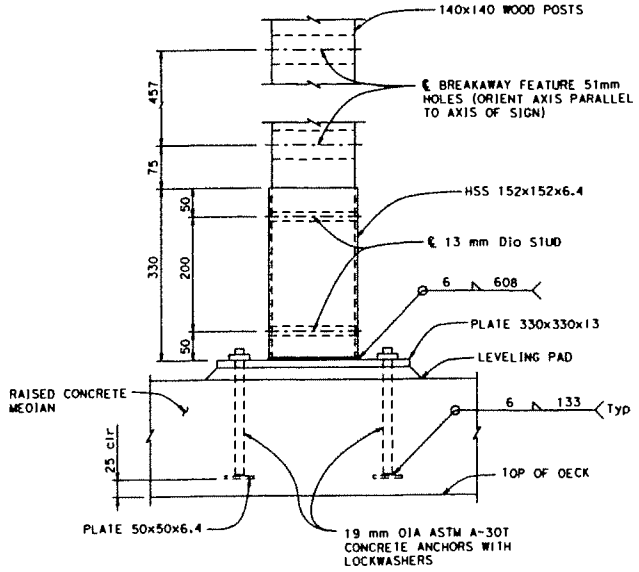
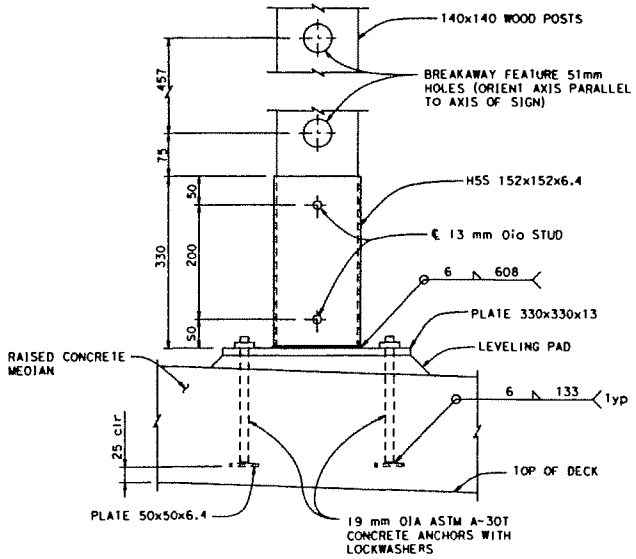


PLAN



ELEVATION



SIDE VIEW

SIGN DETAILS

NO SCALE

SD-12

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => #USER#
DGN FILE => #FILE#

CU 04275

EA 228591

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

DATE	REVISED BY	DATE REVISED
12-07	SD	AD 12-07

CALCULATED/DESIGNED BY
CHECKED BY

DESIGN OVERSIGHT

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Appendix A
Logs of Test Borings

BENCH MARKS

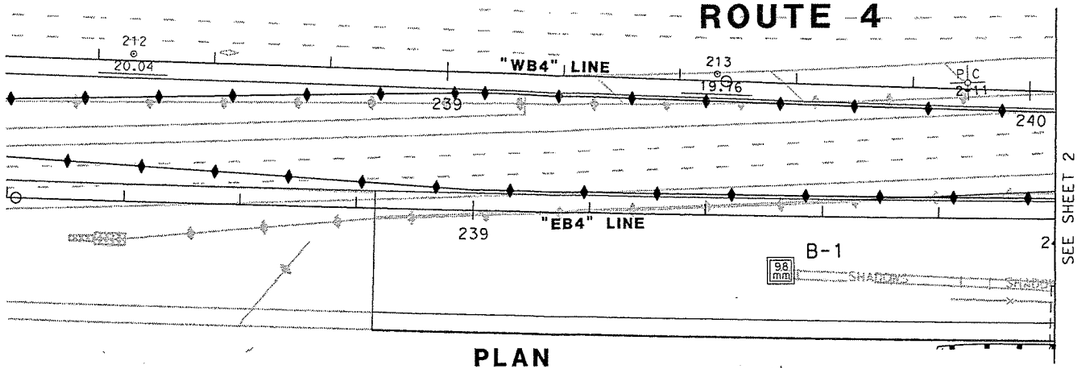
BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

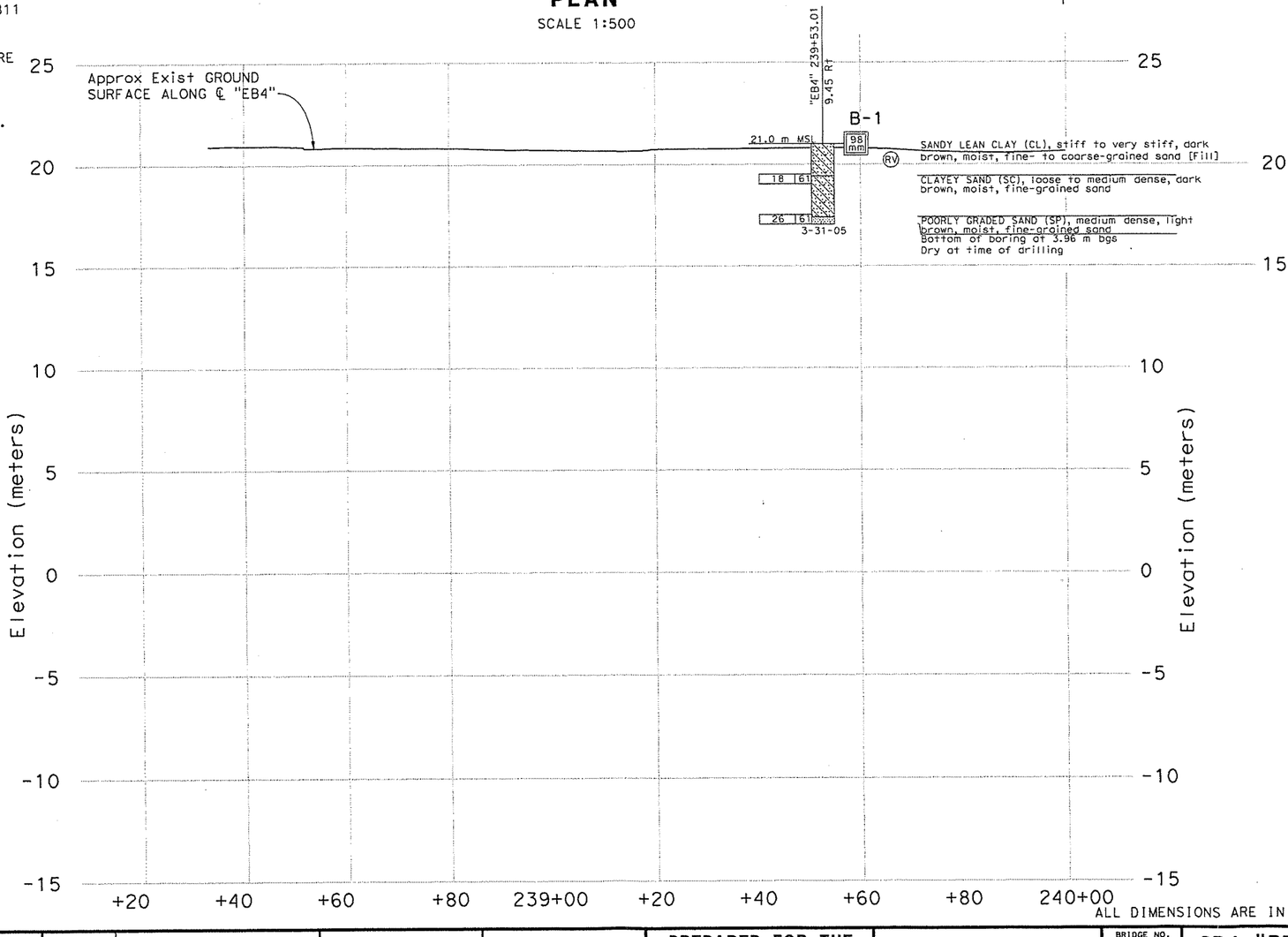
ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.

ROUTE 4



PLAN

SCALE 1:500



PROFILE VIEW

Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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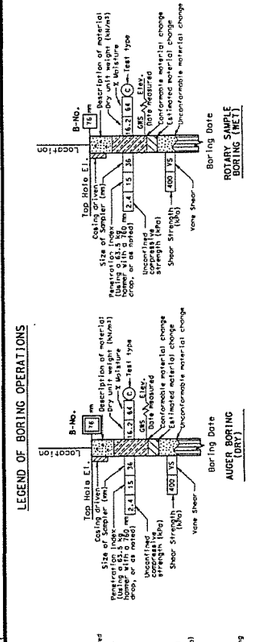
LEGEND OF BORING OPERATIONS

TEST TYPE
A Atterberg Limits
C Corrosivity Test
CN Consolidation
DS Direct Shear
H Hydrometer
M Moisture Density (Lab Compaction Test)
R Resistance R-Value Test
SA Sieve Analysis
SW Swell/Settlement Test
U Unconsolidated Undrained Triaxial Compression Test
W Wash Sieve



LEGEND OF EARTH MATERIALS

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

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 03/31/05

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

H. BERGER
PROJECT ENGINEER

BRIDGE NO.
KILOMETER POST 37.9/41.3

SR4 "EB4" LINE STA 238+20 TO 240+00

LOG OF TEST BORINGS

CU 04275
EA 228501

FILE => ...\b-01.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES

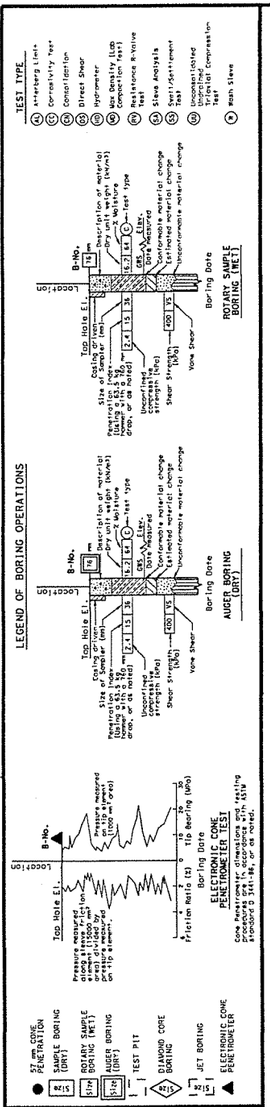
REVISION DATES (PRELIMINARY STAGE ONLY): 10/11/05 7/28/06 8/03/06 2/28/07 10/25/07

SHEET 1 OF 30

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

USERNAME => Christina,JBaffa PLOTTED => 11/7/2007 TIME PLOTTED => 3:51:56 PM



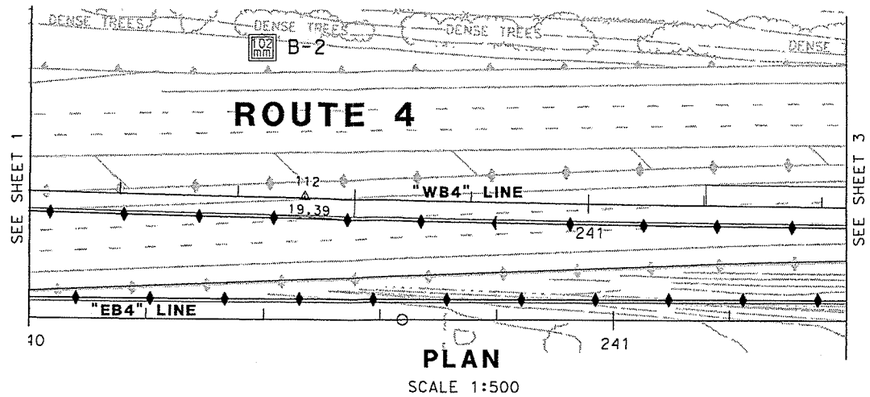
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

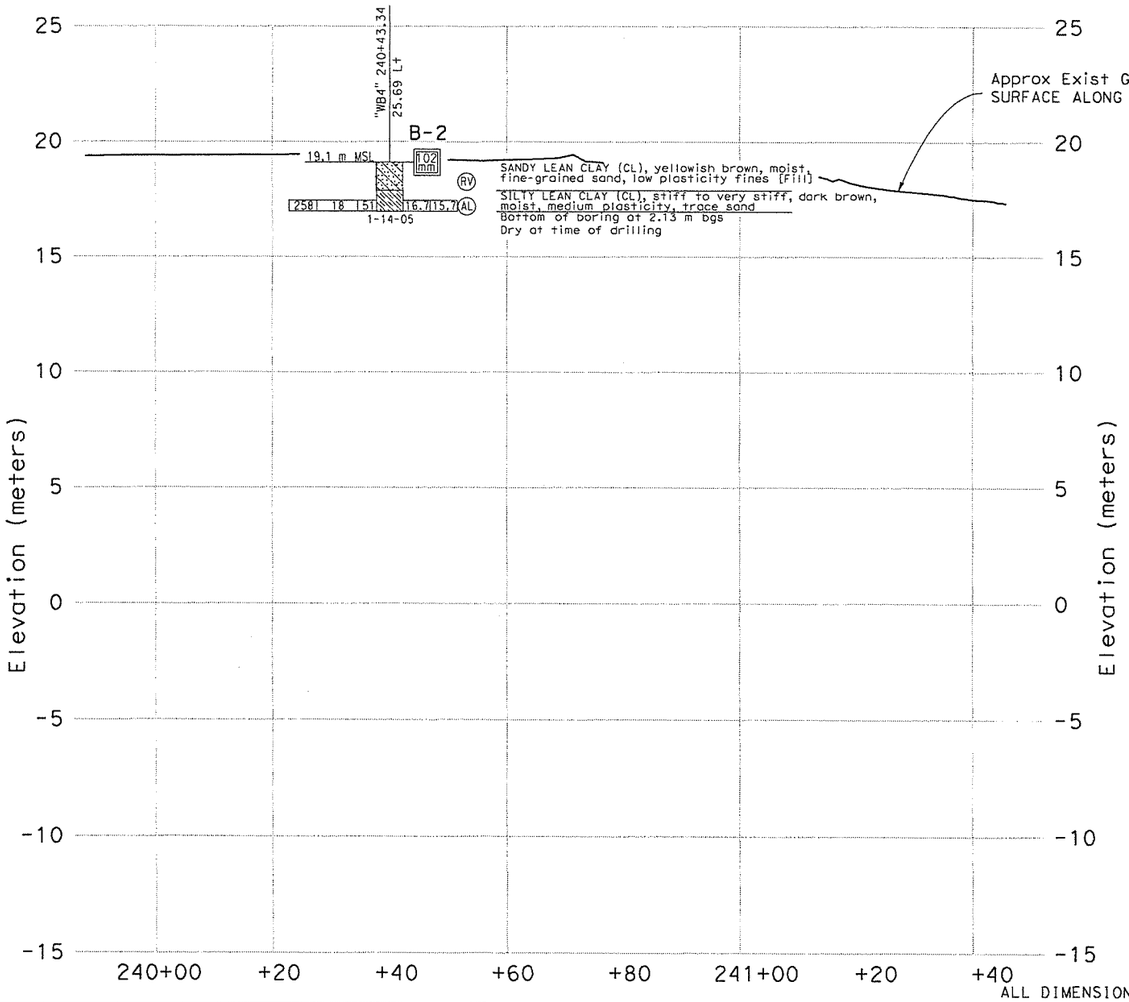
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Weymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO.	SR4 "EB4" LINE STA 240+00 TO 241+40
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/14/05		PROJECT ENGINEER	KILOMETER POST 37.9/41.3	LOG OF TEST BORINGS

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228501

FILE => ...\b-02.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 10/17/05 | 2/28/06 | 8/03/06 | 2/28/07 | 10/25/07

SHEET 2 OF 30

USERNAME => Christina Dobbe PLOTTED => 11/7/2007 TIME PLOTTED => 3:52:00 PM

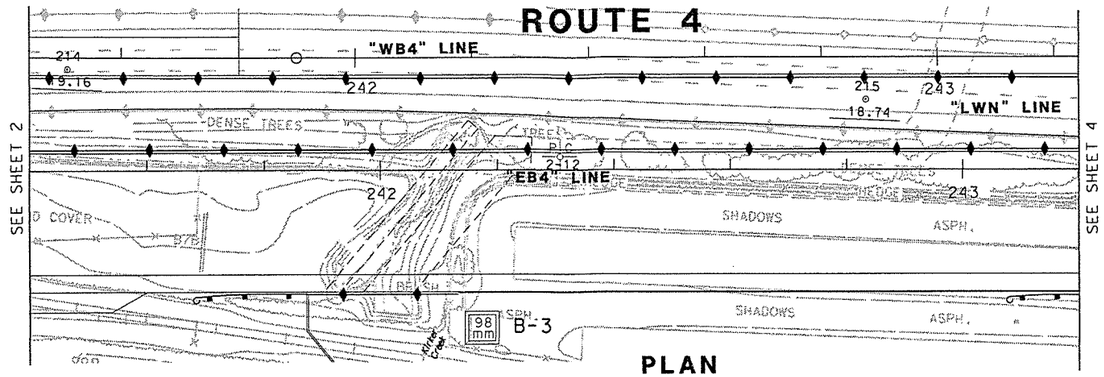
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

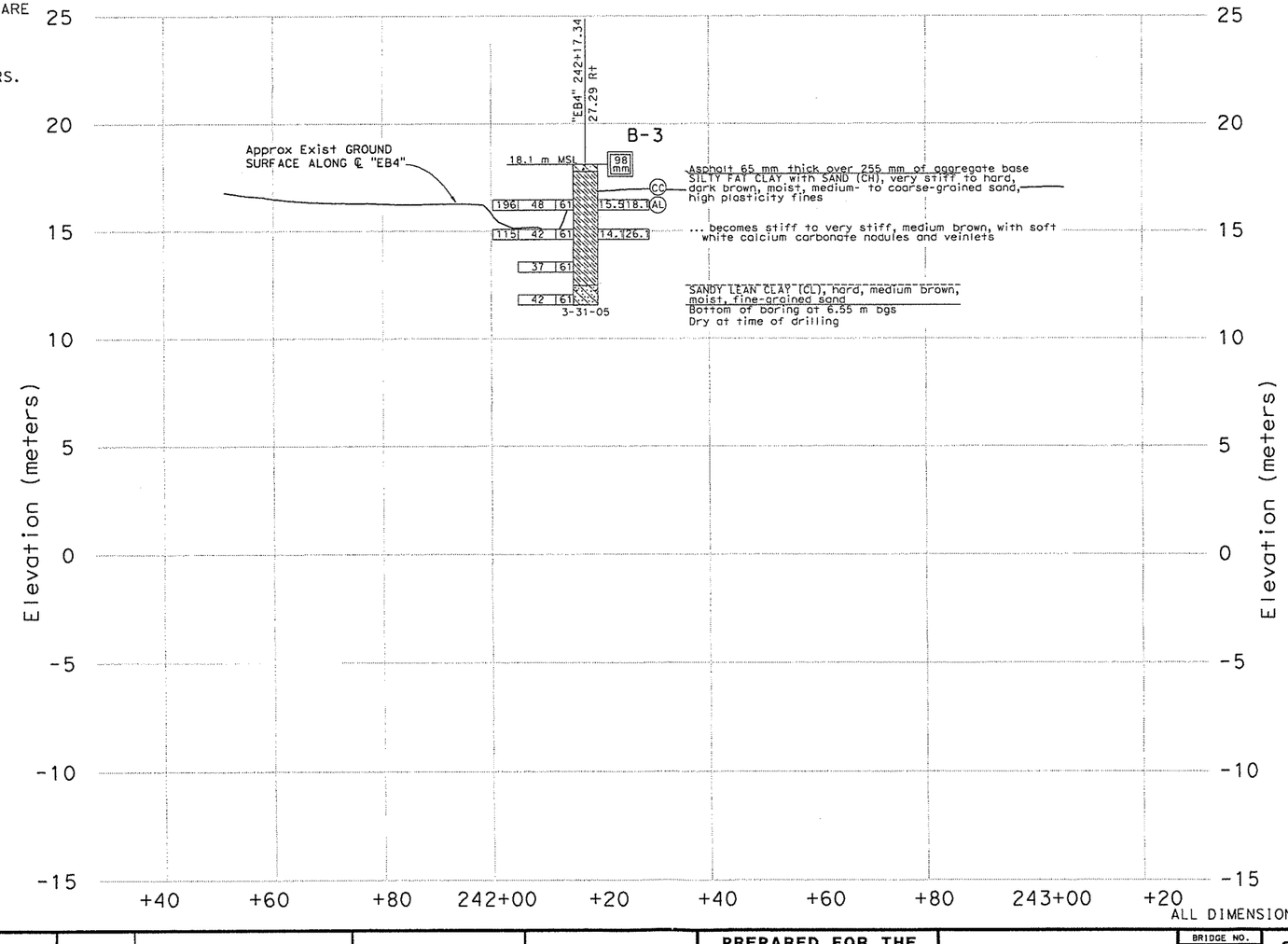
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



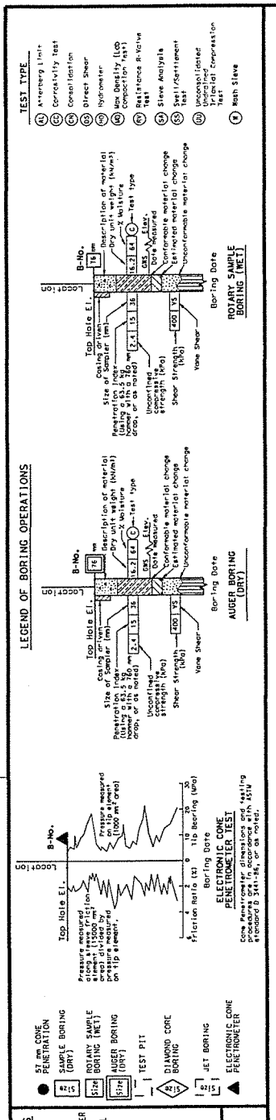
PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

LEGEND OF BORING OPERATIONS



CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
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11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

LEGEND OF EARTH MATERIALS
GRAVEL, SAND, SILT, CLAY, SANDY CLAY or CLAYEY SAND, SANDY SILT or SILTY SAND, SILTY CLAY, CLAYEY SILT, PEAT and/or ORGANIC MATTER, FILL MATERIAL, COBBLE, IGNEOUS ROCK, SEDIMENTARY ROCK, METAMORPHIC

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 03/31/05		PROJECT ENGINEER

BRIDGE NO.
KILOMETER POST 37.9/41.3

SR4 "EB4" LINE STA 241+40 TO 243+20
LOG OF TEST BORINGS

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)
ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100
CU 04275
EA 228501
FILE => ...\b-03.dgn
DISREGARD PRINTS BEARING EARLIER REVISION DATES →
REVISION DATES (PRELIMINARY STAGE ONLY): 10/17/05 | 3/28/06 | 8/23/06 | 2/28/07 | 10/25/07
SHEET 3 OF 30

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymond — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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USERNAME => Christina.Graeff PLOTTED => 11/7/2007 TIME PLOTTED => 3:52:04 PM

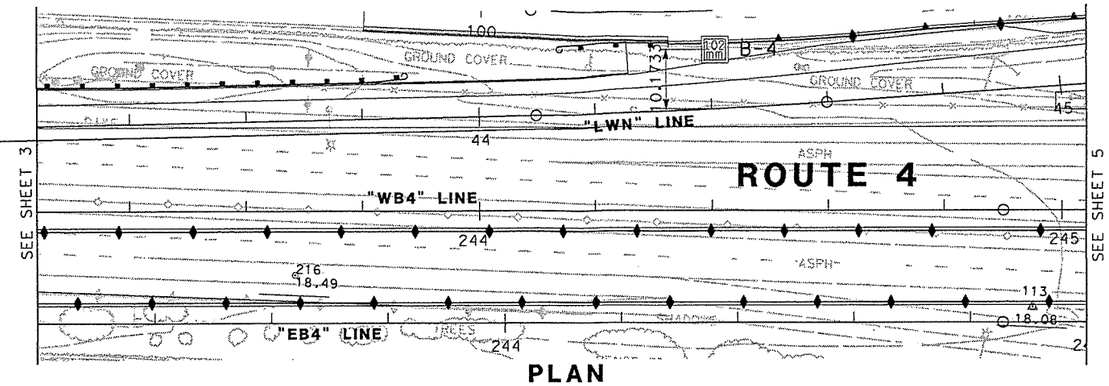
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

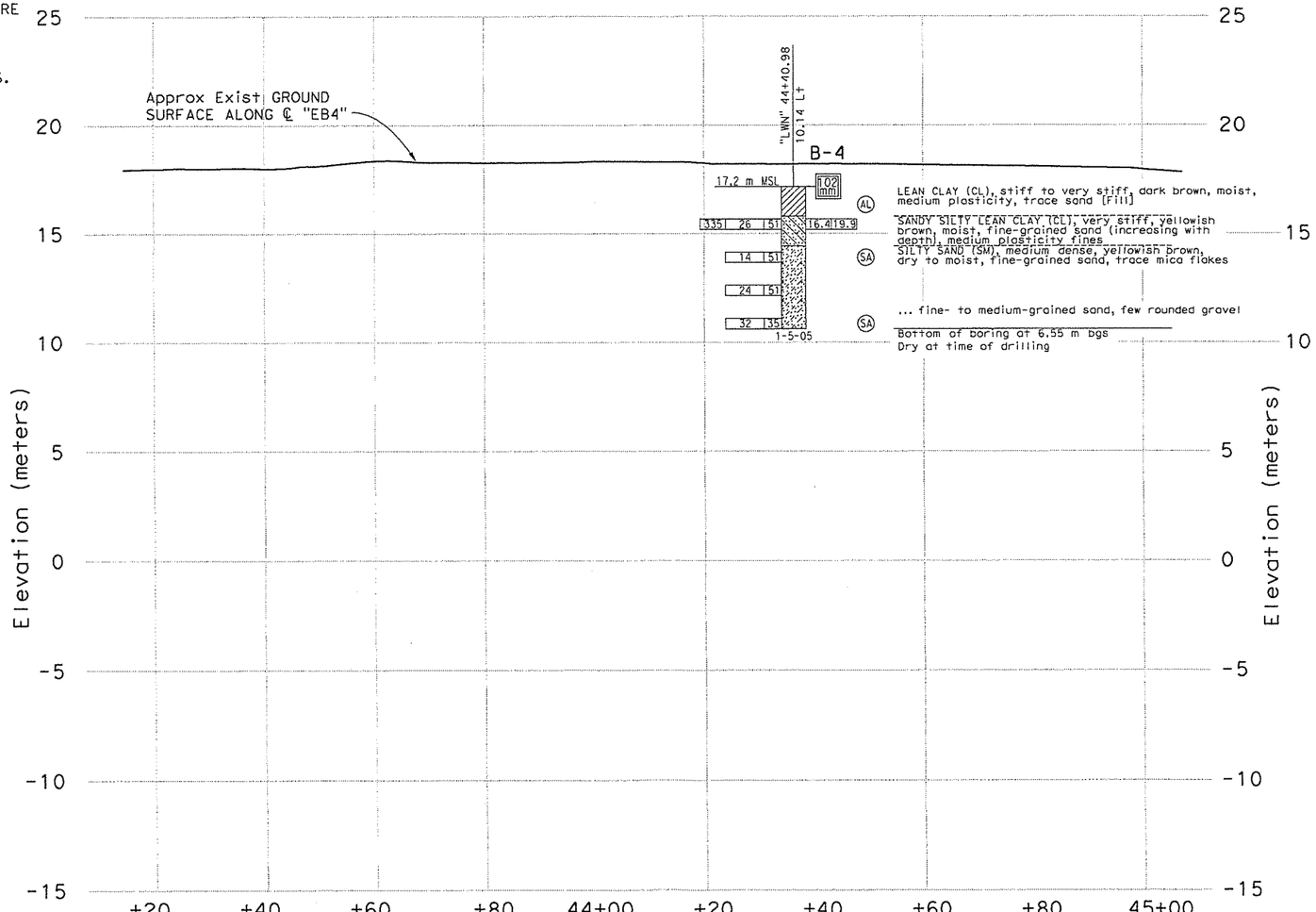
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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LEGEND OF BORING OPERATIONS

TEST TYPE
A Atterberg Limits
C Corrosivity Test
D Consolidation
DS Direct Shear
H Hydrometer
M Mpt Density Test (ASTM D1557)
R Rebound & R-Value Test
SA Sieve Analysis
SE Settlement Test
U Unconsolidated Undrained Triaxial Compression Test
W Wash Sieve

ROTARY SAMPLE BORING (MET)
AUGER BORING (DIST)
ELECTRONIC CONE PENETROMETER TEST

LEGEND OF EARTH MATERIALS
GRAVEL, SAND, SILT, CLAY, SANDY CLAY or CLAYEY SAND, SANDY SILT or SILTY SAND, SILTY CLAY, CLAYEY SILT, PEAT and/or ORGANIC MATTER, FILL MATERIAL, COBBLE, IGNEOUS ROCK, SEDIMENTARY ROCK, METAMORPHIC

57 mm CONE PENETRATION SAMPLE BORING (DIST)
ROTARY SAMPLE BORING (MET)
AUGER BORING (DIST)
TEST PIT
DIAMOND CORE BORING
JET BORING
ELECTRONIC CONE PENETROMETER

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. UPADHYAYA	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO.	SR4 "EB4" LINE STA 243+20 TO 245+00
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/05/05		PROJECT ENGINEER	KILOMETER POST 37.9/41.3	LOG OF TEST BORINGS

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228501

FILE => ...\b-04.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 10/17/05, 7/28/06, 8/30/06, 2/28/07, 10/25/07

SHEET 4 OF 30

USERNAME => Christina_Dafler@dot.ca.gov PLOTTED => 11/7/2007 TIME PLOTTED => 3:52:08 PM

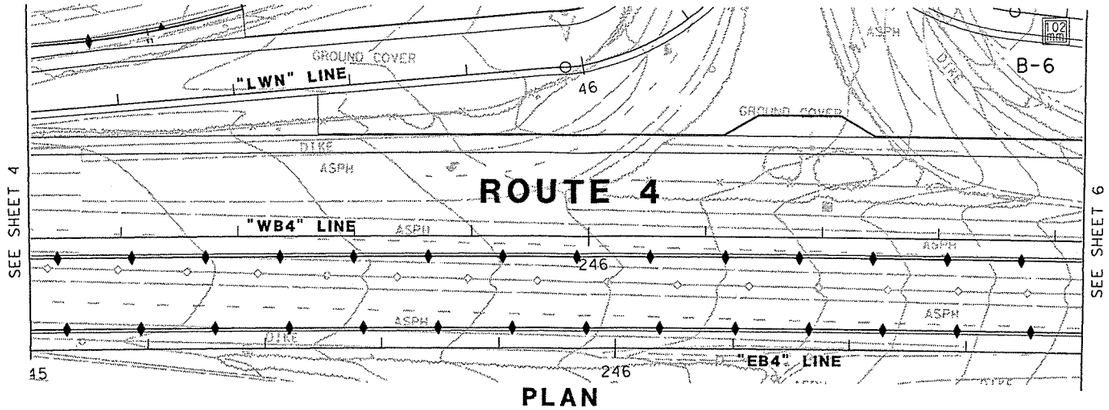
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

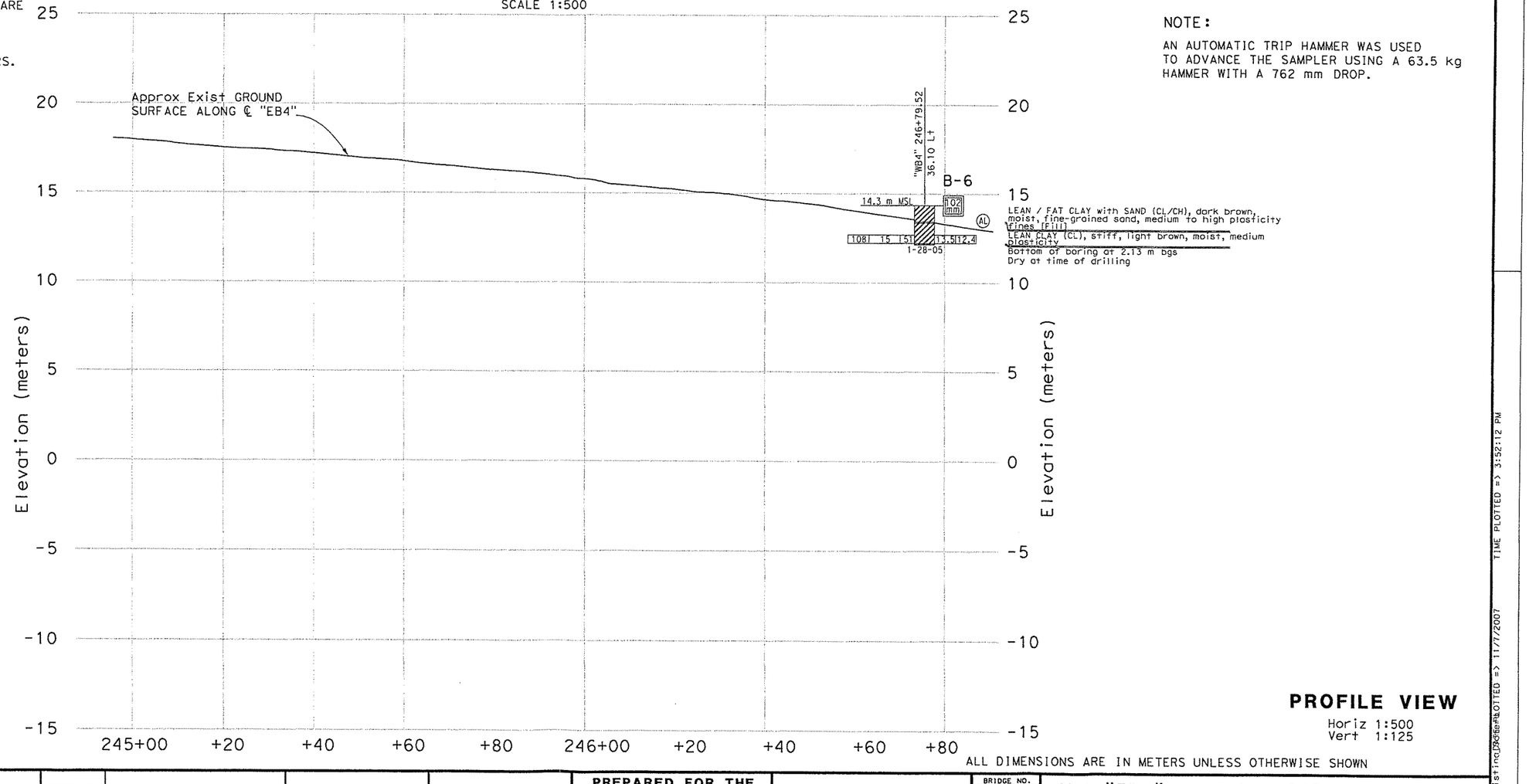
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Weymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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PLEASANT HILL, CA 94523

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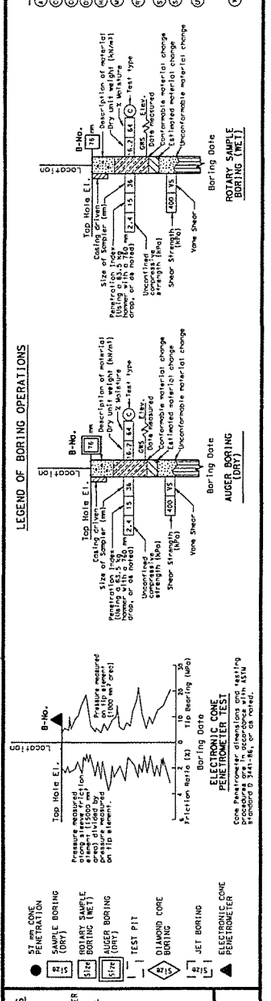
LEGEND OF BORING OPERATIONS

TEST TYPE
(A) Atterberg Limits (CR) Corrosivity Test (CO) Consolidation (DS) Direct Shear (HY) Hydrometer (MD) Max Density, Optimum Moisture (R) Resistance R-Value test (SA) Sieve Analysis (SE) Sand Equivalent test (UC) Unconsolidated Undrained Triaxial Compression Test (V) Wash Sieve



SPT with CORE BARREL SAMPLE BORING (DRY) | ROTARY SAMPLE BORING (RB) | AUGER BORING (DRY) | TEST PIT | DIAMOND CORE BORING | JET BORING | ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS

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

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/ft)	Granular	SPT N-Value (Blows/ft)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
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>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO.	SR4 "EB4" LINE STA 245+00 TO 246+80
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/28/05		PROJECT ENGINEER	KILOMETER POST 37.9/41.3	LOG OF TEST BORINGS

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228501

DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES (PRELIMINARY STAGE ONLY) 10/17/05 | 7/28/06 | 8/28/06 | 2/28/07 | 10/25/07

SHEET 5 OF 30

FILE => ...\b-05.dgn

USERNAME => Christine.Dao@pb.com PLOTTED => 11/7/2007 TIME PLOTTED => 3:52:12 PM

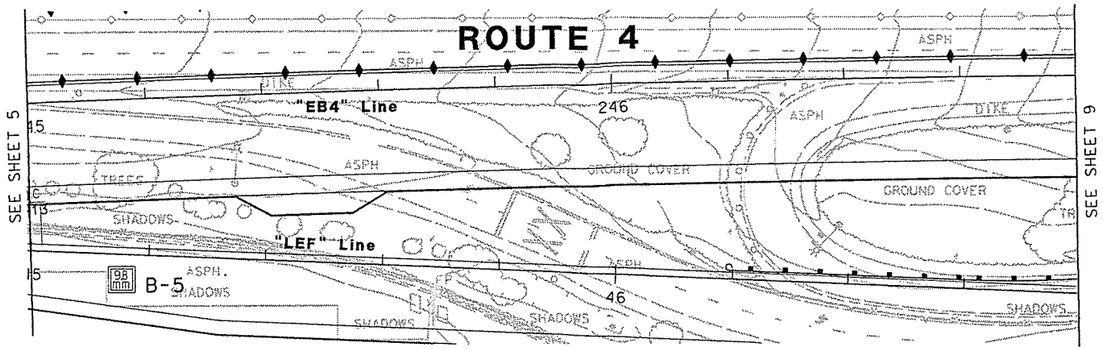
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

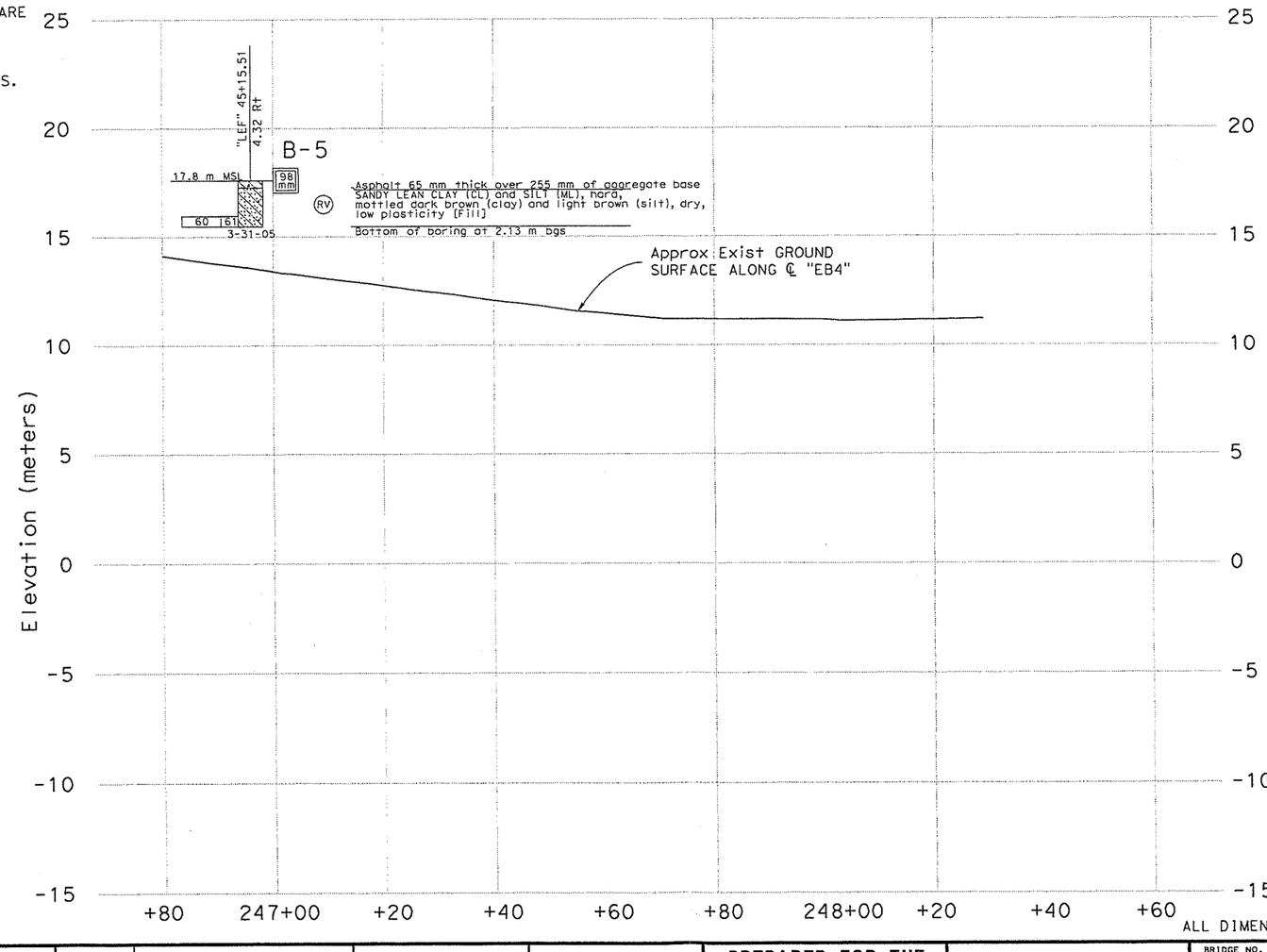
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

PROFILE VIEW
Horiz 1:500
Vert 1:125

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

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3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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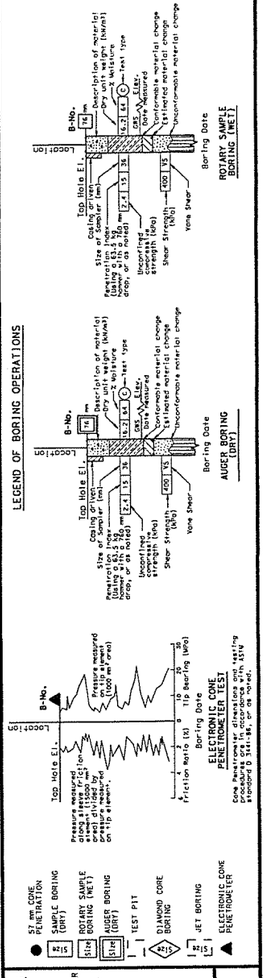
LEGEND OF BORING OPERATIONS

TEST TYPE
(A) Atterberg Limit (B) Corrosivity Test (C) Consolidation (D) Direct Shear (E) Hydrometer (F) Max Density (Lab Compaction Test) (G) Resistance R-value (H) Sieve Analysis (I) Soil Pollutement Test (J) Unconsolidated Undrained Triaxial Compression Test (K) Wash Sieve



SAMPLE BORING (DBT) · ROTARY SAMPLE BORING (MET) · AUGER BORING (DBT) · TEST PIT · DIAMOND CORE BORING · JET BORING · ELECTRONIC CONE PENETROMETER

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
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31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

LEGEND OF EARTH MATERIALS

GRAVEL · SAND · SILT · CLAY · SANDY CLAY or CLAYEY SAND · CLAYEY SILT or SILTY SAND · SILTY CLAY · CLAYEY SILT · PEAT and/or ORGANIC MATTER · TILL MATERIAL · COBBLE · CONCRETE · ROCK · SEDIMENTARY ROCK · METAMORPHIC

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. UPADHYAYA	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/06/05		PROJECT ENGINEER

BRIDGE NO. —
KILOMETER POST 37.9/41.3

SR4 "EB4" LINE STA 246+80 TO 248+60
LOG OF TEST BORINGS

CU 04275
EA 228501

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/31/05 · 7/28/06 · 8/23/06 · 2/23/07 · 10/25/07

SHEET 6 OF 30

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

FILE => ...\b-06.dgn

USERNAME => Christine.Doherty PLOTTED => 11/7/2007 TIME PLOTTED => 3:52:17 PM

BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
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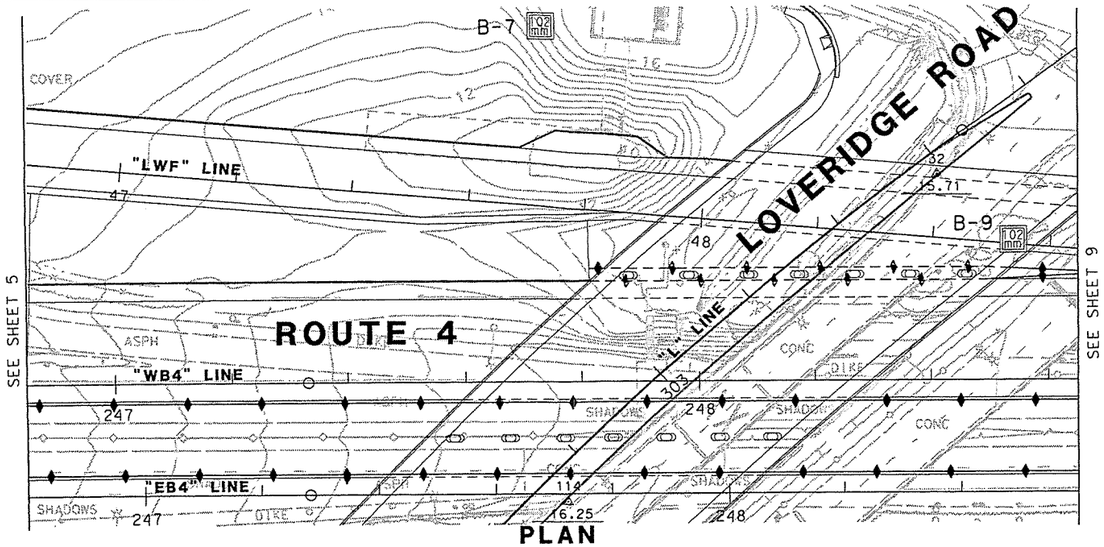
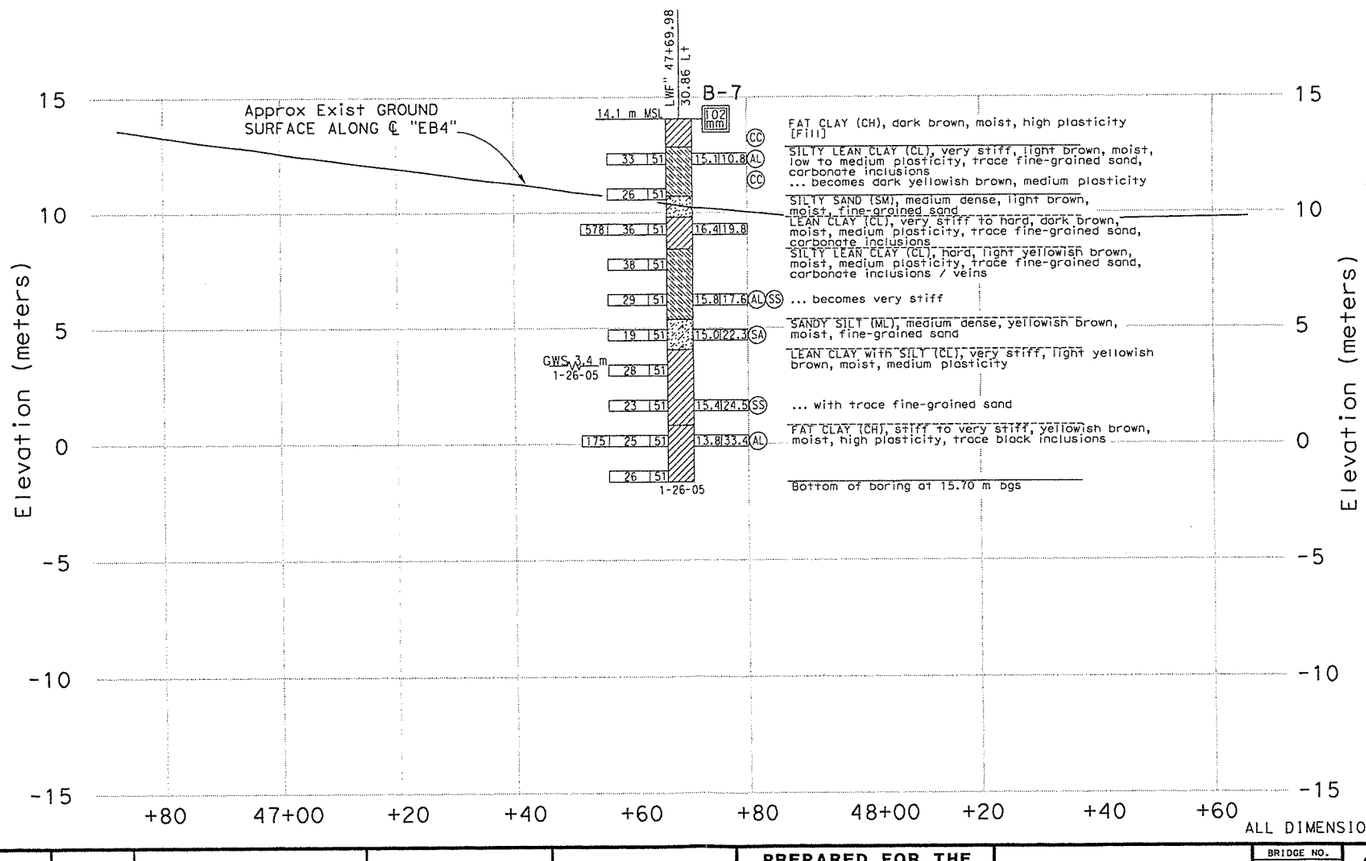
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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PLEASANT HILL, CA 94523

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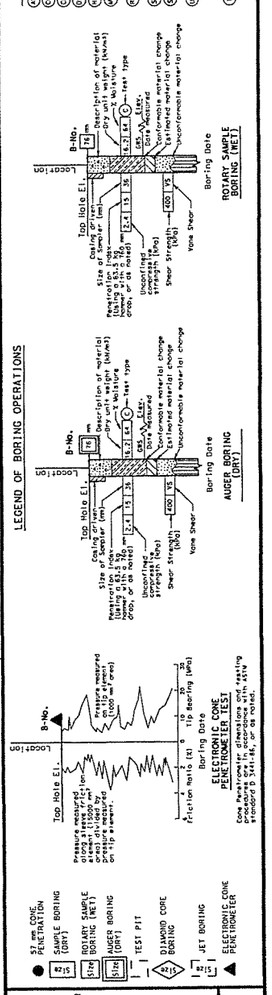
LEGEND OF BORING OPERATIONS

TEST TYPE: Atterberg Limits; Corrosivity Test; Consolidation; Direct Shear; Hydrometer; Wet Density (Lab Compaction Test); Resilience R-Value Test; Sieve Analysis; Swell/Settlement Test; Unconsolidated Undrained Triaxial Compression Test; Wash Sieve



LEGEND OF EARTH MATERIALS: GRAVEL; SAND; SILT; CLAY; SANDY CLAY or CLAYEY SAND; SANDY SILT or SILTY SAND; SILTY CLAY; CLAYEY SILT; PEAT and/or ORGANIC MATTER; FILL MATERIAL; COBBLE; IGNEOUS ROCK; SEDIMENTARY ROCK; METAMORPHIC

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
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31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO.	SR4 "EB4" LINE STA 246+80 TO 248+60
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/26/05		PROJECT ENGINEER	KILOMETER POST 37.9/41.3	LOG OF TEST BORINGS

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228501

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/17/05; 3/28/06; 8/03/06; 2/28/07; 10/25/07

SHEET 7 OF 30

FILE => ...\b-07.dgn

USERNAME => ChristinaJ@dot.ca.gov TIME PLOTTED => 11/7/2007 3:52:21 PM

BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

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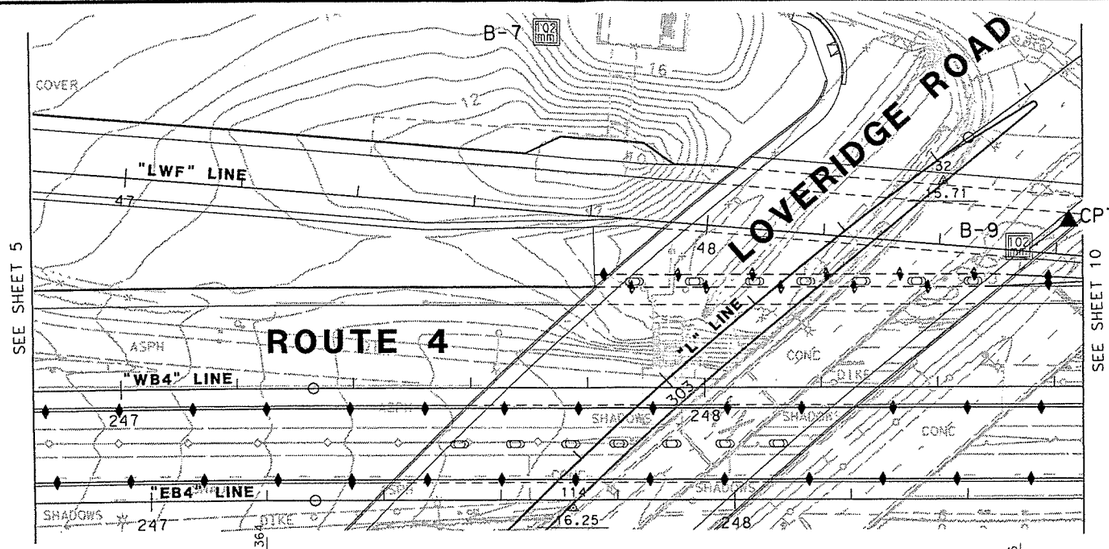
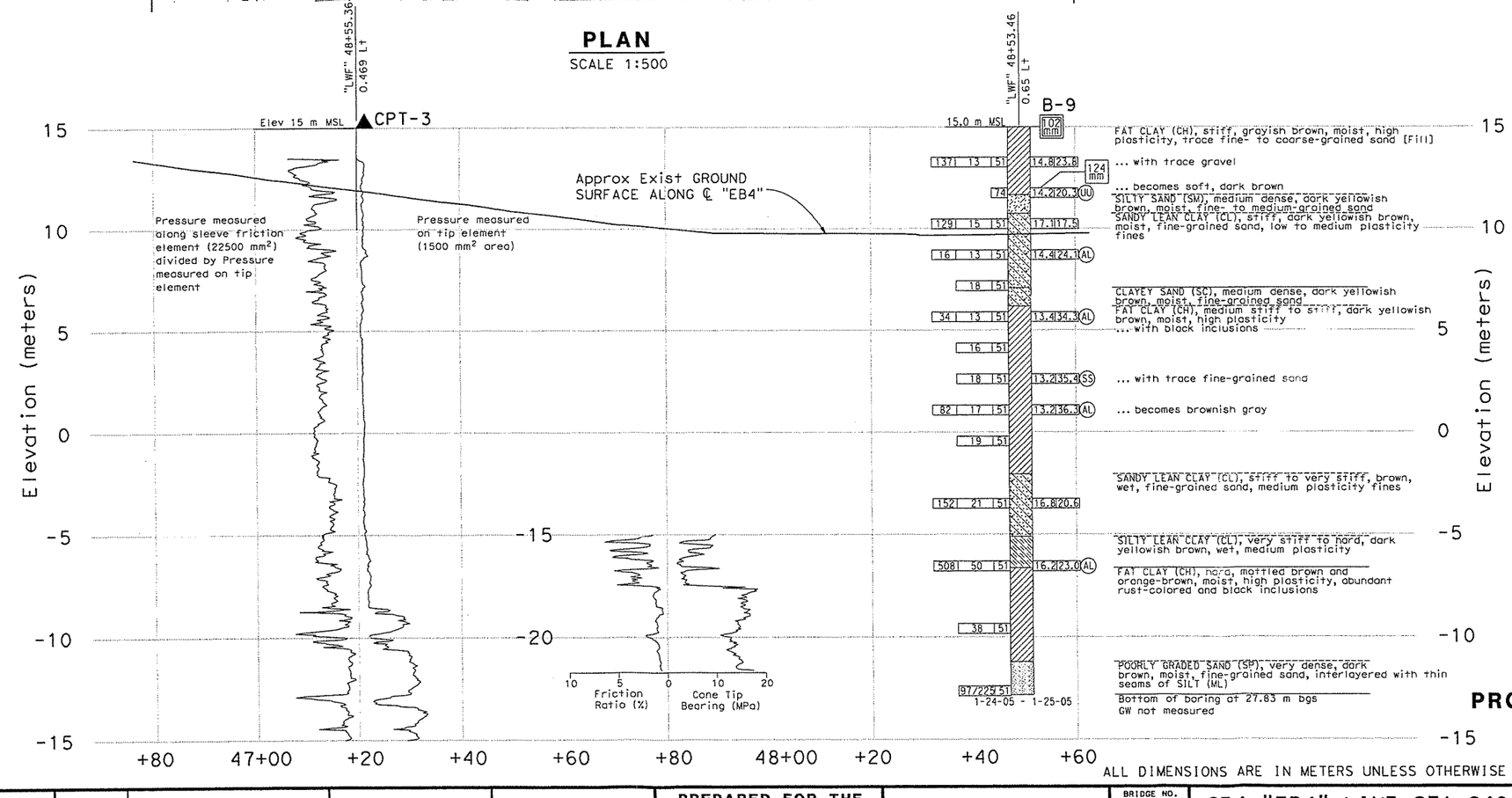


PLAN
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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URS
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PLEASANT HILL, CA 94523

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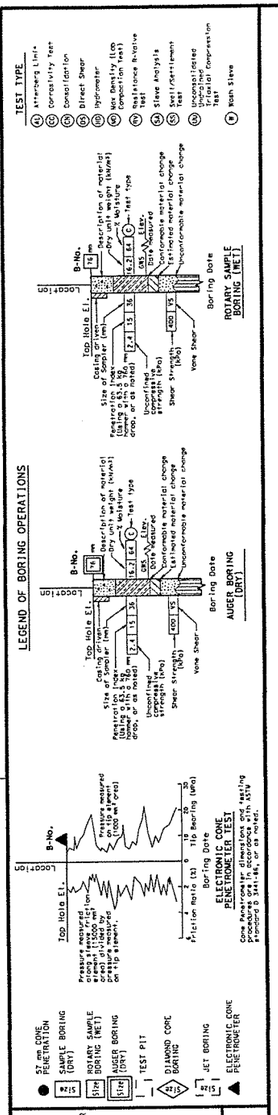
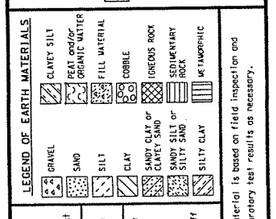
LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS



CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT Value (Blows/0.3m)	Granular	Cohesive
0-4	Very Loose	Very Soft
5-10	Loose	Soft
11-30	Medium Dense	Firm
31-50	Dense	Stiff
>50	Very Dense	Very stiff
		Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	N. MEYER	DATE: 01/25/05		

BRIDGE NO.
KILOMETER POST 37.9/41.3

SR4 "EB4" LINE STA 246+80 TO 248+60

LOG OF TEST BORINGS

CU 04275
EA 228501

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/17/05 | 7/28/06 | 8/30/06 | 2/28/07 | 10/25/01

SHEET 8 OF 30

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

FILE => ...\b-08.dgn

USERNAME => Christina.DeGee PLOTTED => 11/7/2007 TIME PLOTTED => 3:52:26 PM

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

PLANS APPROVAL DATE

Philip Meymand No. 2596 Exp. 6/30/09 GEOTECHNICAL — REGISTERED PROFESSIONAL ENGINEER — 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.

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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

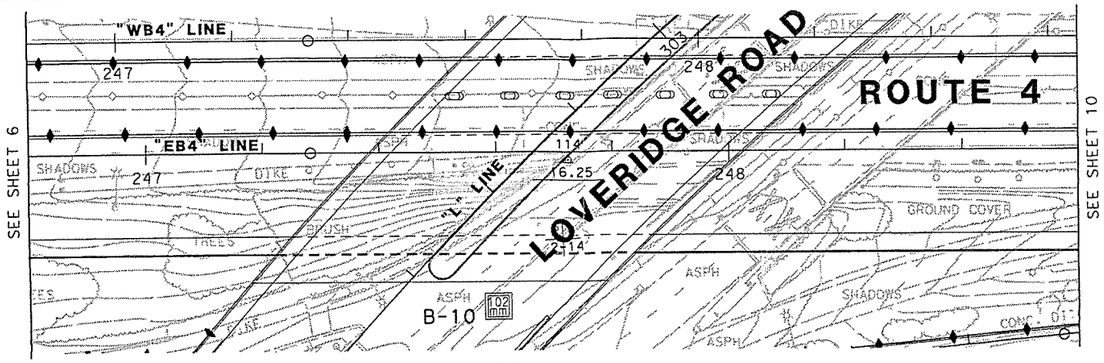
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

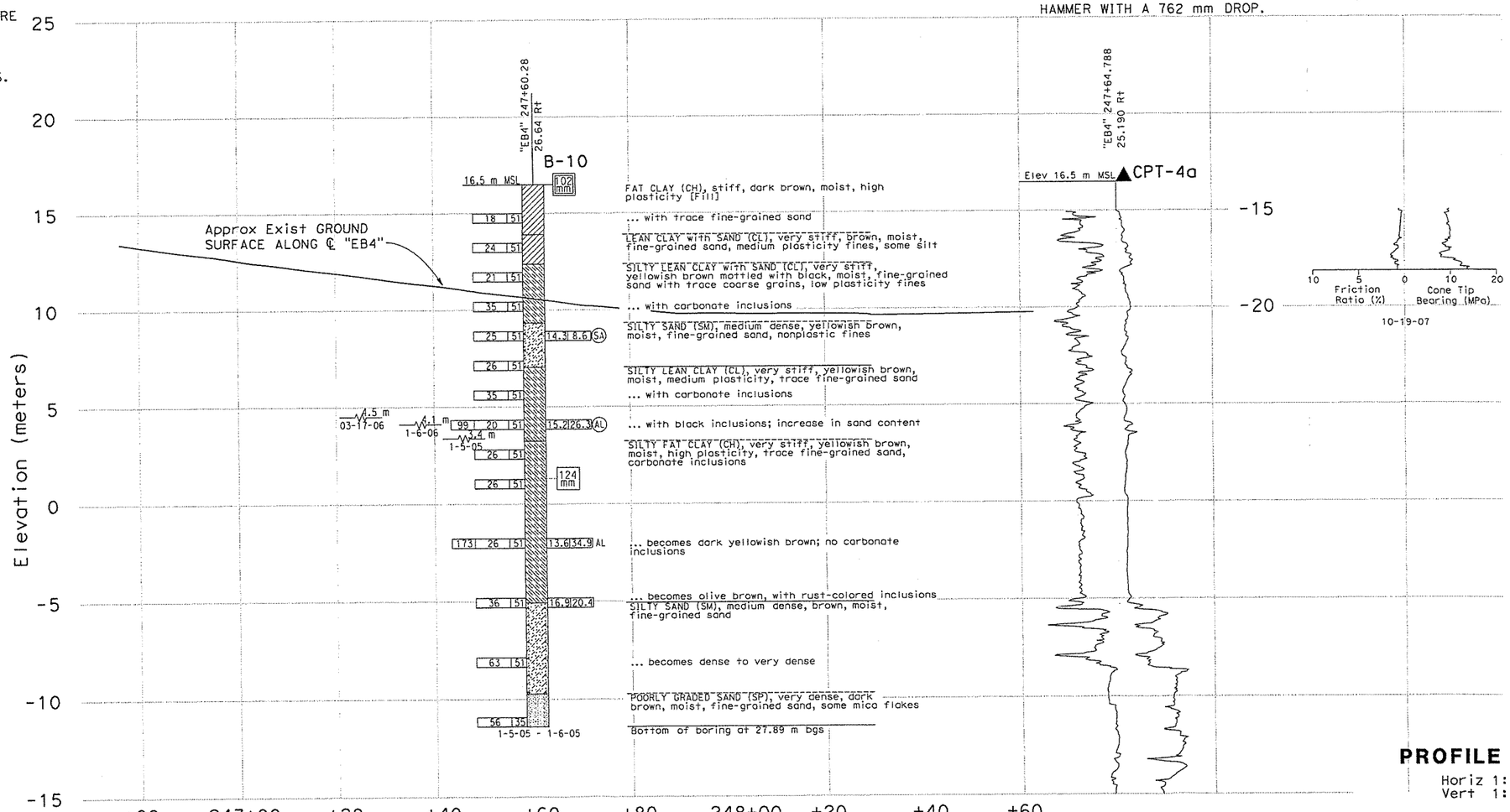
ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

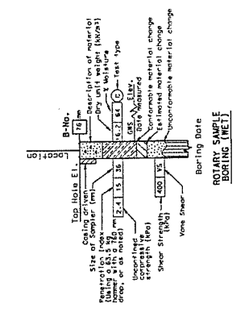


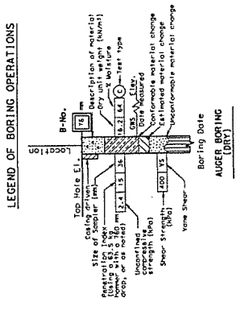
PROFILE VIEW
Horiz 1:500
Vert 1:125

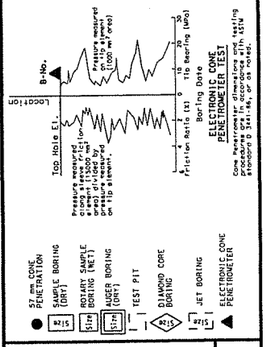
ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

LEGEND OF BORING OPERATIONS

TEST TYPE
Ⓐ Atterberg Limit
Ⓒ Consolidation
Ⓓ Direct Shear
Ⓗ Hydrometer
Ⓜ Moisture Density (Unit Weight) Compaction Test
Ⓡ Resistance R-Value Test
Ⓢ Sieve Analysis
Ⓣ Shear Test
Ⓤ Unconsolidated Undrained Triaxial Compression Test
Ⓦ Wash Sieve







Pressure measured during stabilization period (after pore pressure has dissipated) on tip element.

Cone Penetrometer dimensions and testing procedure conform to ASTM standard D 3441-94, or as noted.

● 57 mm CONE PENETRATION
SAMPLE BORING (DRY)
ROTARY SAMPLE BORING (WET)
AUGER BORING (DRY)
TEST PIT
DIAMOND CORE BORING
JET BORING
ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS
GRAVEL
SAND
SILT
CLAY
SANDY CLAY or CLAYEY SAND
SANDY SILT or SILTY SAND
SILTY CLAY
CLAYEY SILT
PEAT and/or ORGANIC MATTER
FILL MATERIAL
COBBLE
IGNEOUS ROCK
SEDIMENTARY ROCK
METAMORPHIC

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/ 0.3m)	Granular	SPT N-Value (Blows/ 0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. UPADHYAYA
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY:
			DATE: 01/06/05

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

H. BERGER
PROJECT ENGINEER

BRIDGE NO.
KILOMETER POST 37.9/41.3

SR4 "EB4" LINE STA 246+80 TO 248+60
LOG OF TEST BORINGS

CU 04275
EA 228501

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/27/05 | 12/28/06 | 8/03/06 | 2/28/07 | 10/25/07

SHEET 9 OF 30

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

FILE => ...\b-09.dgn

USERNAME => Christina.Coffee@dot.ca.gov TIME PLOTTED => 3:52:30 PM DATE PLOTTED => 11/7/2007

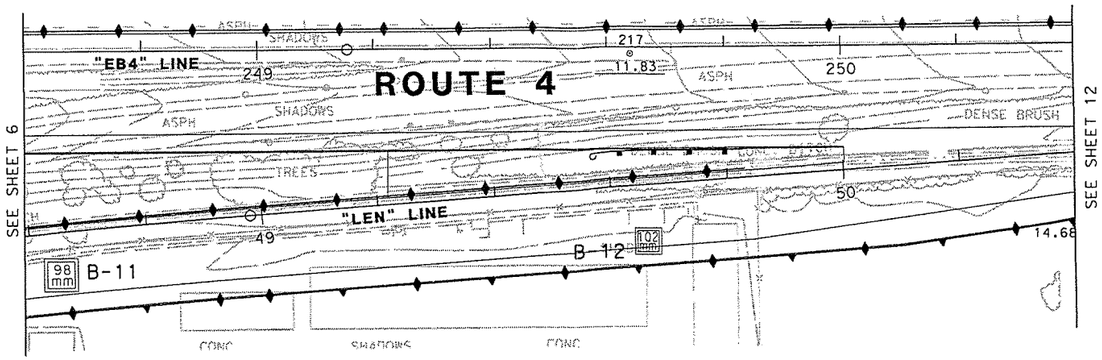
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

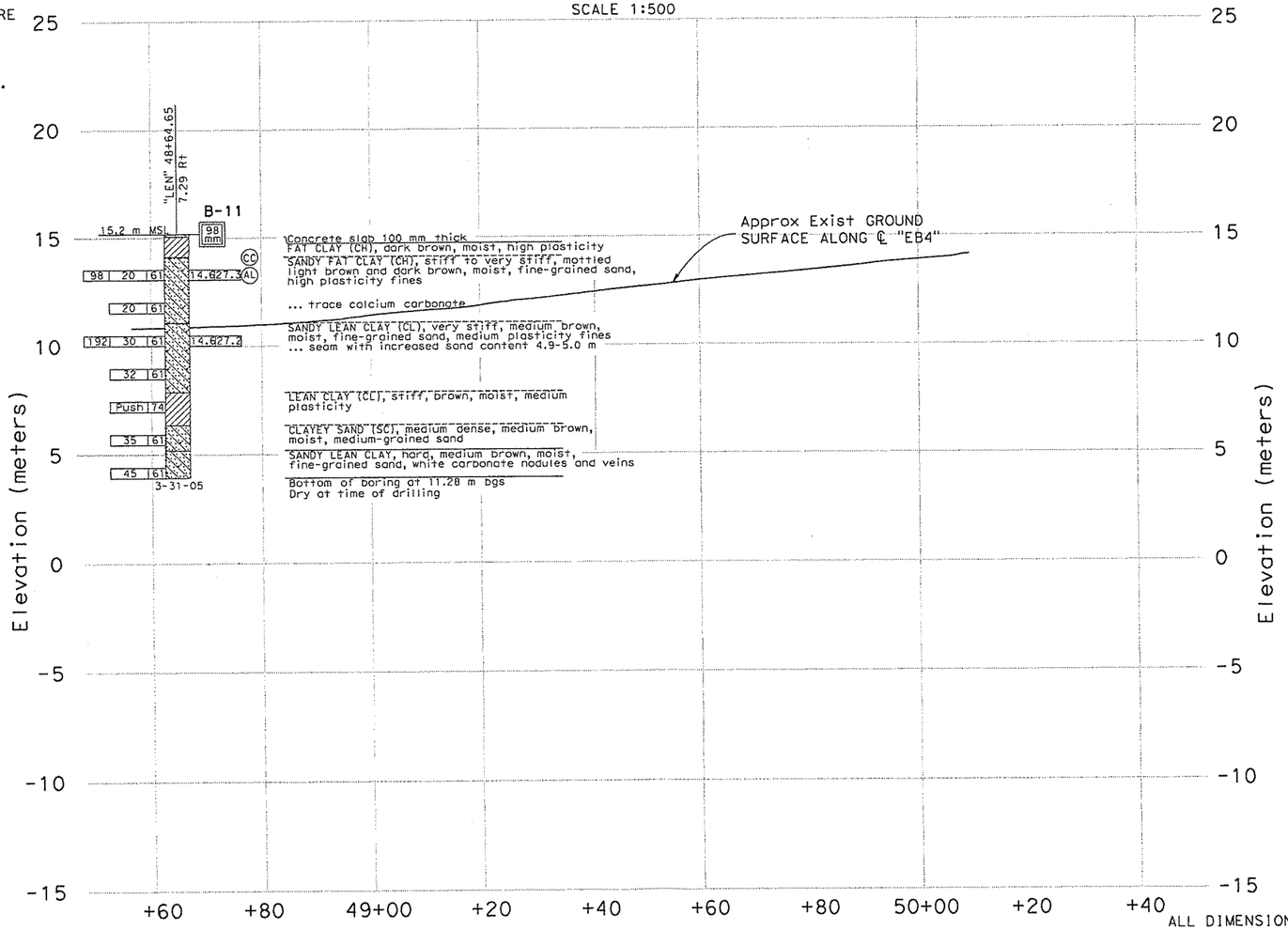
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER _____ DATE _____

Philip Meymand No. 2596 Exp. 6/30/09 GEOTECHNICAL REGISTERED PROFESSIONAL ENGINEER STATE OF CALIFORNIA

PLANS APPROVAL DATE

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3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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LEGEND OF BORING OPERATIONS

TEST TYPE
A Atterberg Limits
C Corrosivity Test
CN Consolidation
DS Direct Shear
H Hydrometer
M Mix Density Lab (Compaction Test)
R Resistance R-Value
SA Sieve Analysis
SE Sand Equivalent Test
U Unconsolidated Undrained Triaxial Compression Test
W Wash Sieve

ROTARY SAMPLE BORING (MET)
AUGER BORING (DRY)
Boring Date
Top Hole El.
Vane Shear
Shear Strength (psf)
Unconfined Compressive Strength (tsf)
Penetration (no. of blows per 0.3m (12") or 0.46m (18") drop, or as noted)
Description of material
Dry unit weight (kN/m³)
Moisture content (%)
Test type
Data Measured
Interbedded material change
Unconformable material change
Location
B-No.

ELECTRONIC CONE PENETROMETER TEST
Cone Penetrometer Test performed using direct push procedure in accordance with ASTM standard D 3441, as revised.
Pressure measured on tip sleeve (tsf)
Pressure measured on tip sleeve (1500 psi) (1500 psi)
Pressure measured on tip sleeve (1500 psi)
Tip Bearing (kPa)
Friction Ratio (%)
Boring Date
Top Hole El.
Location
B-No.

PT. MTN. CORE PENETRATION
SAMPLE BORING (DRY)
ROTARY SAMPLE BORING (MET)
AUGER BORING (DRY)
TEST PIT
DIAMOND CORE BORING
JET BORING
ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS
GRAVEL
SAND
SILT
CLAY
SANDY CLAY or CLAYEY SAND
SANDY SILT or SILTY SAND
SILTY CLAY
CLAYEY SILT
PEAT and/or ORGANIC MATTER
FILL MATERIAL
COBBLE
IGNEOUS ROCK
SEDIMENTARY ROCK
METAMORPHIC

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
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>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 03/31/05		PROJECT ENGINEER

BRIDGE NO.
KILOMETER POST 37.9/41.3

SR4 "EB4" LINE STA 248+60 TO 250+40
LOG OF TEST BORINGS

CU 04275
EA 228501

DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES (PRELIMINARY STAGE ONLY): 10/31/05 | 7/28/06 | 8/28/06 | 2/28/07 | 10/25/07

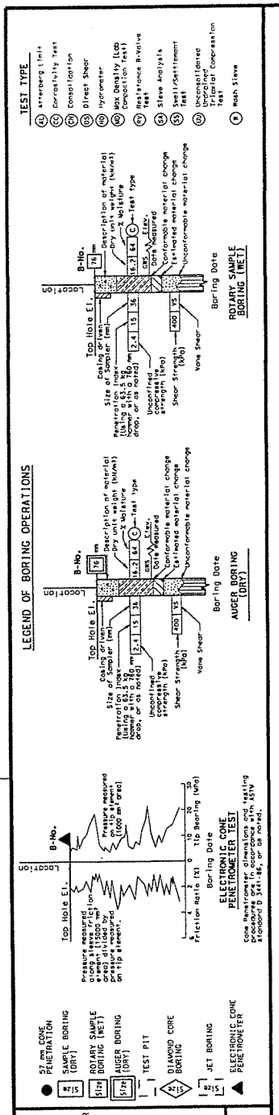
SHEET 10 OF 30

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

FILE => ...\b-10.dgn

USERNAME => Christina\Profile PLOTTED => 11/7/2007 TIME PLOTTED => 3:52:35 PM



BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
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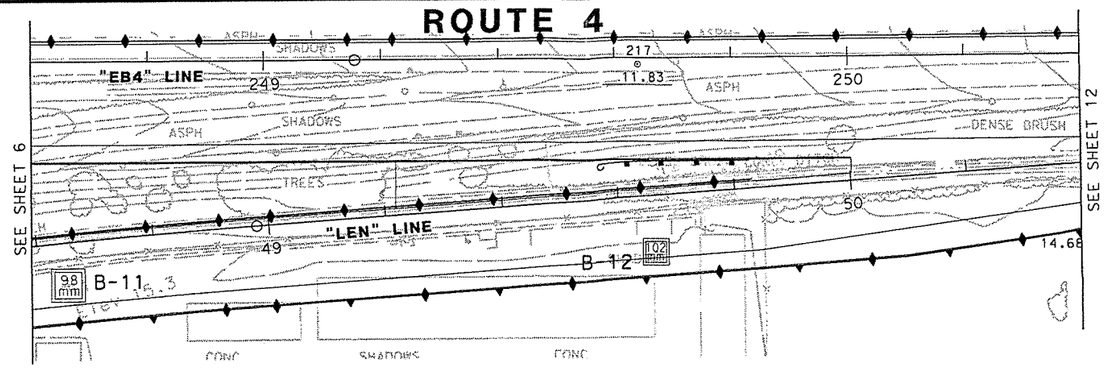
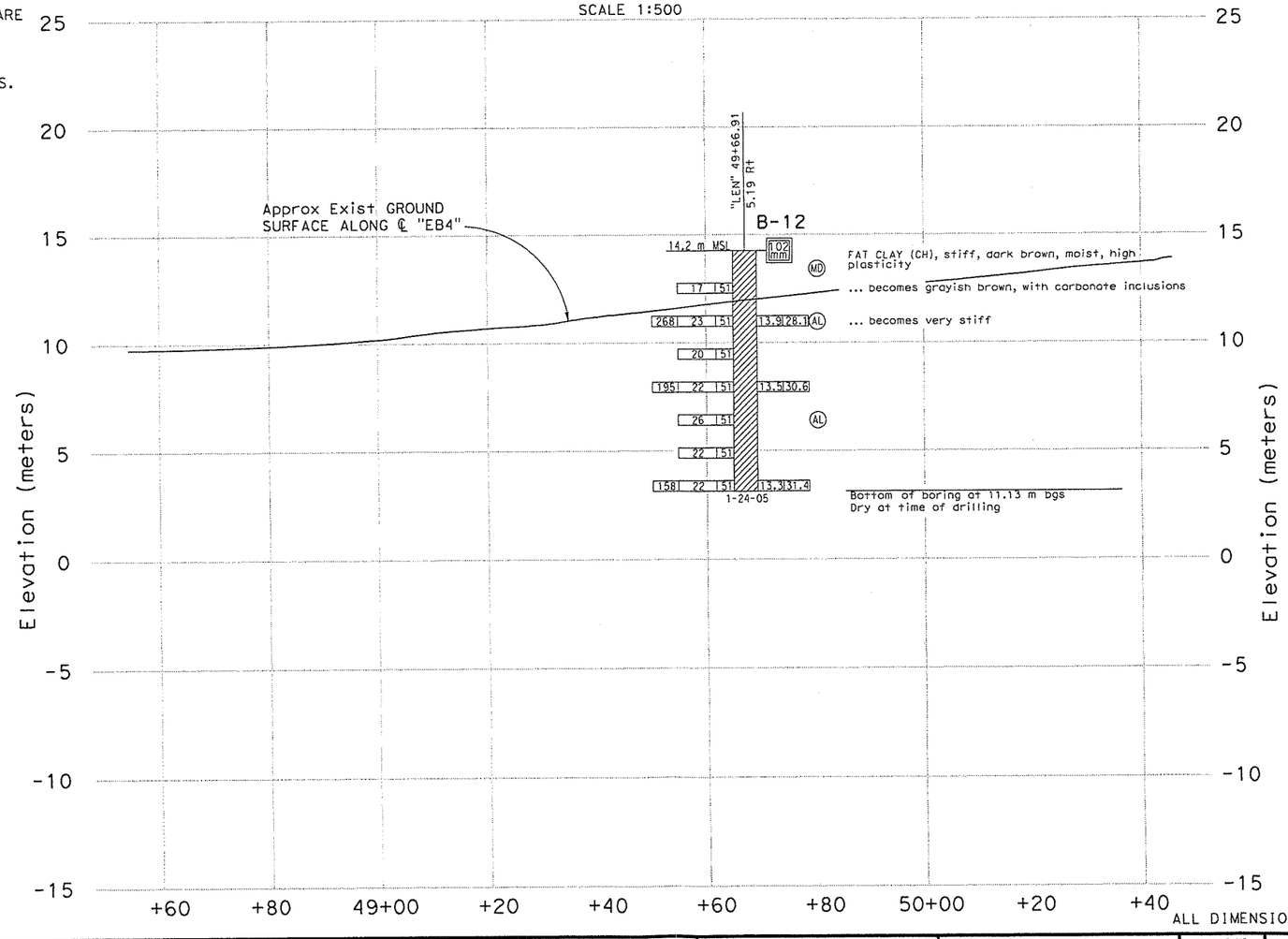
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

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URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/24/05		PROJECT ENGINEER

BRIDGE NO.
KILOMETER POST 37.9/41.3

SR4 "EB4" LINE STA 248+60 TO 250+40
LOG OF TEST BORINGS

CU 04275
EA 228501

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 10/11/05 | 7/28/06 | 8/31/06 | 2/28/07 | 10/25/07

SHEET 11 OF 30

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

FILE => ...\b-11.dgn

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

USERNAME => Christina.Dacre PLOTTED => 11/7/2007 TIME PLOTTED => 3:56:17 PM

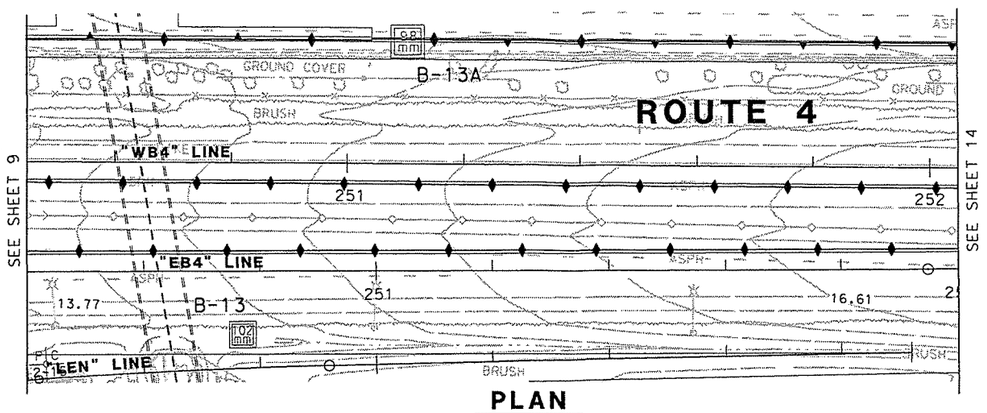
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

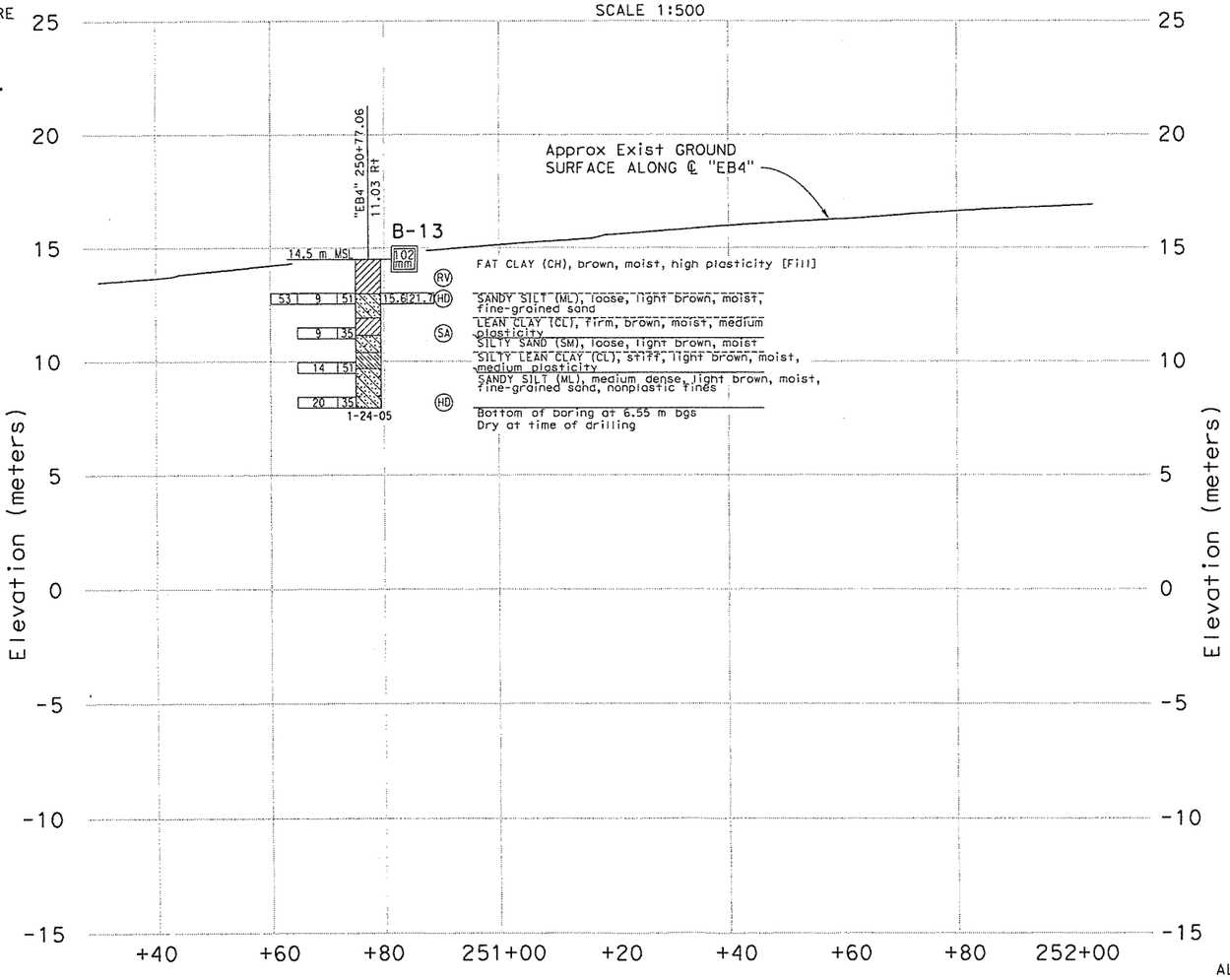
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



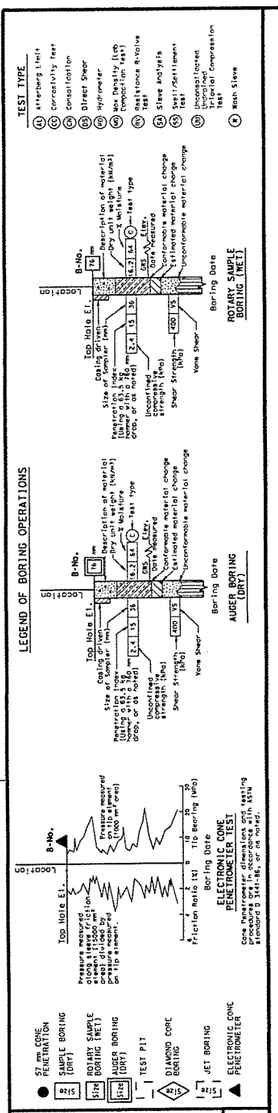
PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

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

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
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NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/24/05		PROJECT ENGINEER

BRIDGE NO. | KILOMETER POST 37.9/41.3

SR4 "EB4" LINE STA 250+40 TO 252+00
LOG OF TEST BORINGS

CU 04275
EA 228501

FILE => ...\b-12.dgn

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/31/05 · 7/28/06 · 8/28/06 · 2/28/07 · 10/25/07

SHEET 12 OF 30

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

USERNAME => c:\christine\DGN\PLOTTED => 11/7/2007 TIME PLOTTED => 3:56:21 PM

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER _____ DATE _____

REGISTERED PROFESSIONAL ENGINEER · Philip Meymand · No. 2596 · Exp. 6/30/09 · GEOTECHNICAL · STATE OF CALIFORNIA

PLANS APPROVAL DATE _____

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URS
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PLEASANT HILL, CA 94523

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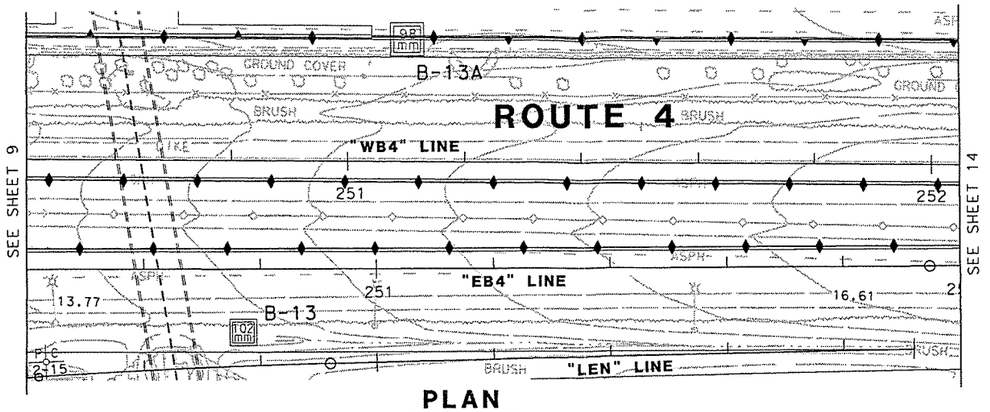
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

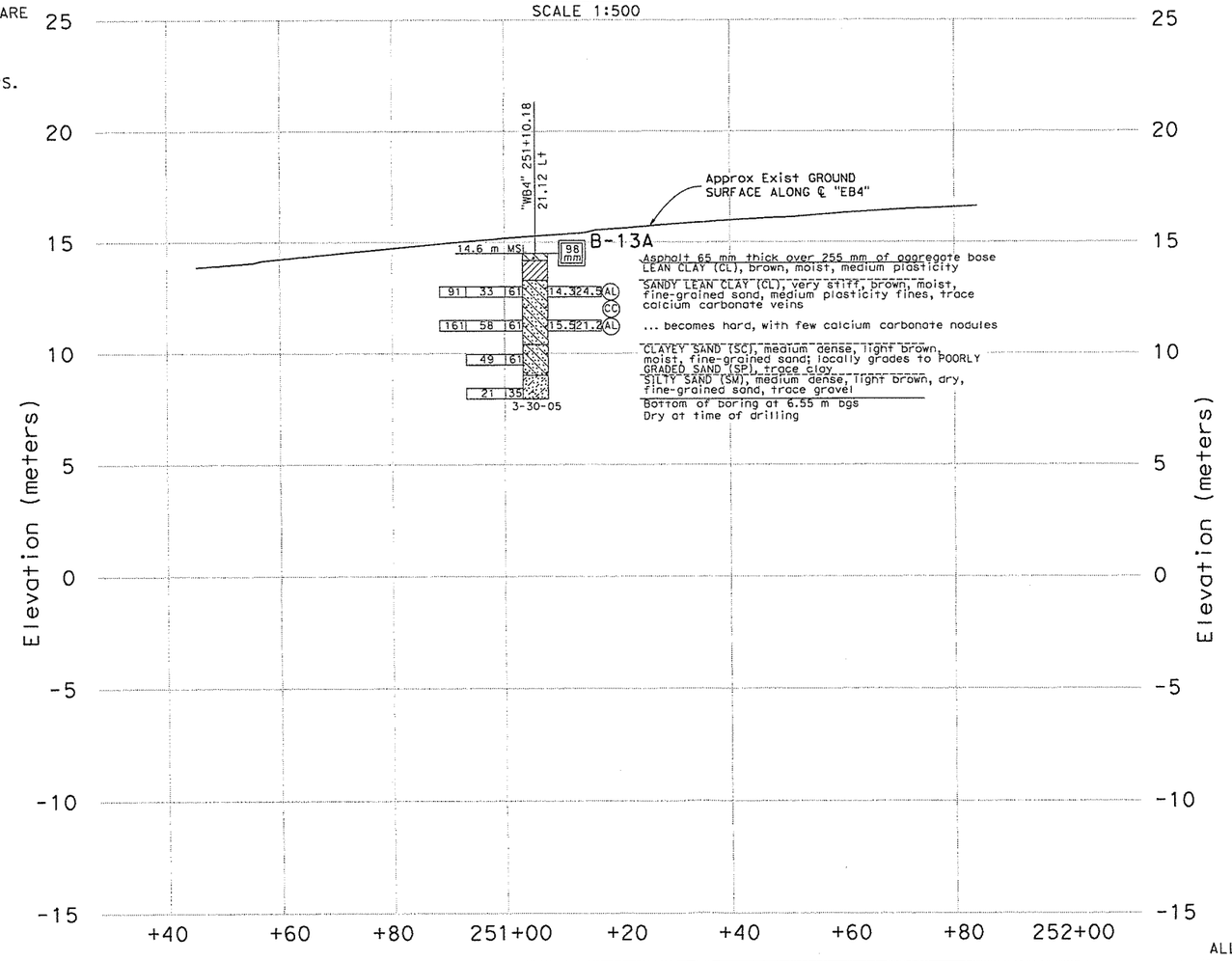
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500

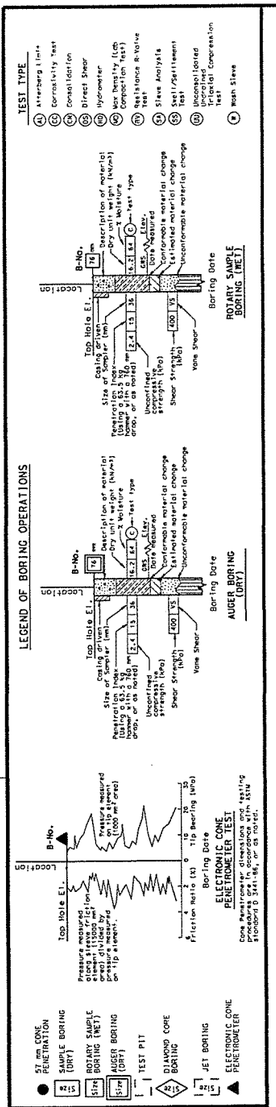


PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.



DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO.	SR4 "EB4" LINE STA 250+40 TO 252+00
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 03/30/05		PROJECT ENGINEER	KILOMETER POST 37.9/41.3	LOG OF TEST BORINGS

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)
ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100
CU 04275
EA 228501
FILE => ...\b-13.dgn
DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES (PRELIMINARY STAGE ONLY): 10/17/05 3/28/06 8/31/06 3/28/07 10/25/07
SHEET 13 OF 30

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand No. 2596 Exp. 6/30/09 GEOTECHNICAL STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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USERNAME => Christina.Dafle PLOTTED => 11/7/2007 TIME PLOTTED => 3:56:25 PM

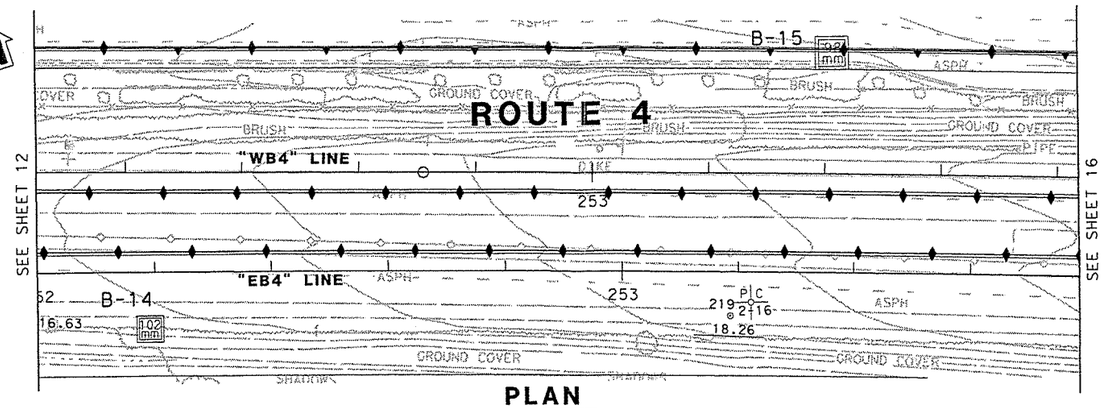
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

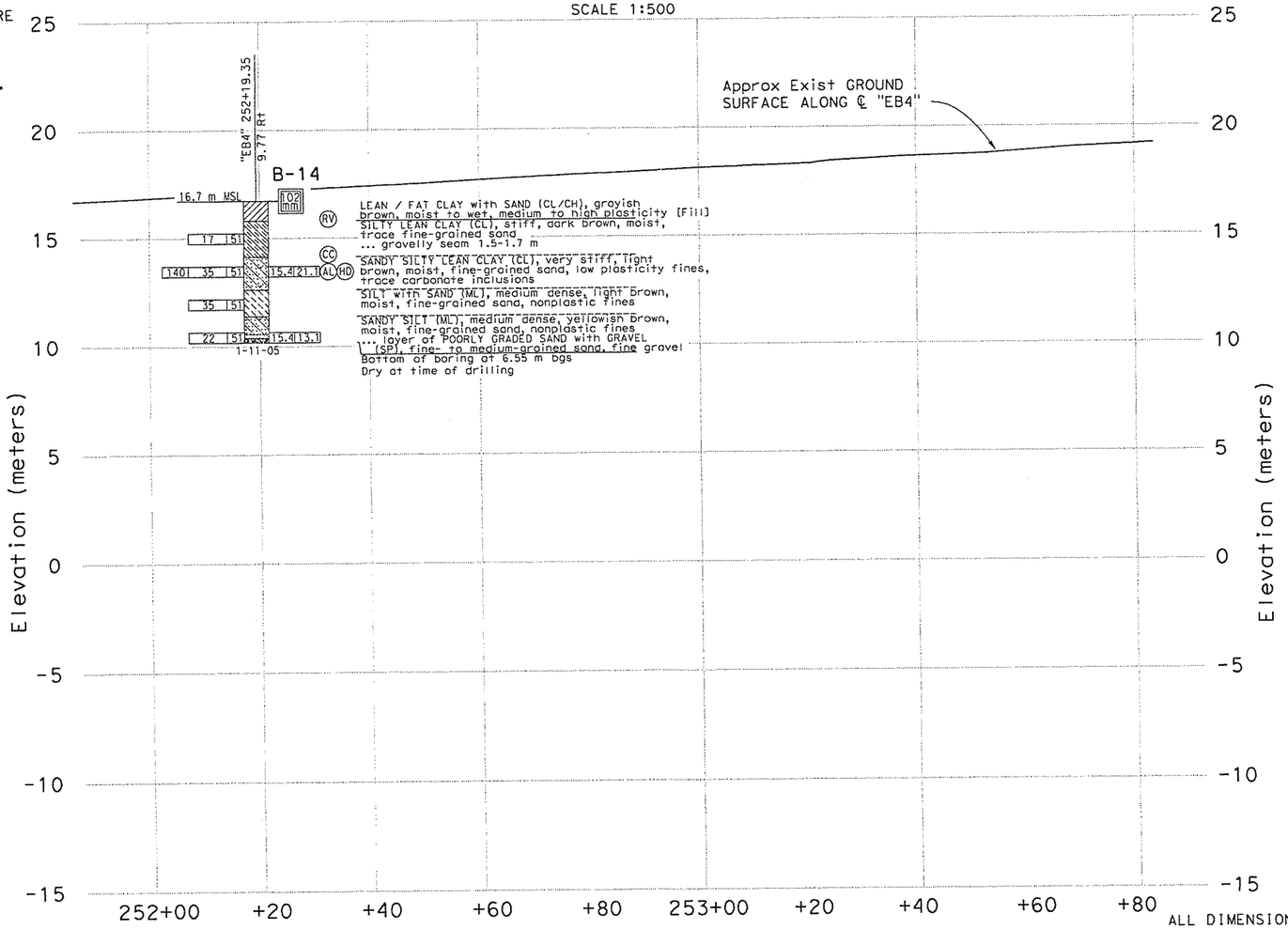
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

Philip Meymand No. 2596 Exp. 6/30/09 GEOTECHNICAL — REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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LEGEND OF BORING OPERATIONS

TEST TYPE
(A) Atterberg Limits (B) Corrosivity Test (C) Consolidation (D) Direct Shear (E) Hydrometer (F) Max Density (LCD Compaction Test) (G) Resistance R-value (H) Sieve Analysis (I) Spell/Pettibone Test (J) Unconsolidated Undrained Triaxial Compression Test (K) Wash Sieve

ROTARY SAMPLE BORING (MET)
AUGER BORING (DRY)
ELECTRONIC CONE PENETROMETER TEST
Cone Penetrometer Operations and testing procedures will be in accordance with ASTM D-3441 latest revision.

SPT 51 mm O.D. SPLIT BARREL — CALIFORNIA SAMPLER — SAMPLE BORING (DRY) — ROTARY SAMPLE BORING (MET) — AUGER BORING (DRY) — TEST PIT — DIAMOND CORE BORING — JET BORING — ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS
GRAVEL, SAND, SILT, CLAY, SANDY CLAY or CLAYEY SAND, SANDY SILT or SILTY SAND, SILTY CLAY, CLAYEY SILT, PEAT and/or ORGANIC MATTER, FILL MATERIAL, COBBLE, IGNEOUS ROCK, SEDIMENTARY ROCK, METAMORPHIC

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/11/05		PROJECT ENGINEER

BRIDGE NO.
KILOMETER POST 37.9/41.3

SR4 "EB4" LINE STA 252+00 TO 253+80
LOG OF TEST BORINGS

CU 04275
EA 228501

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/31/05, 7/28/06, 8/31/06, 2/28/07, 10/25/07

SHEET 14 OF 30

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

FILE => ...\b-14.dgn

USERNAME => Christina DATE PLOTTED => 11/1/2007 TIME PLOTTED => 3:56:30 PM

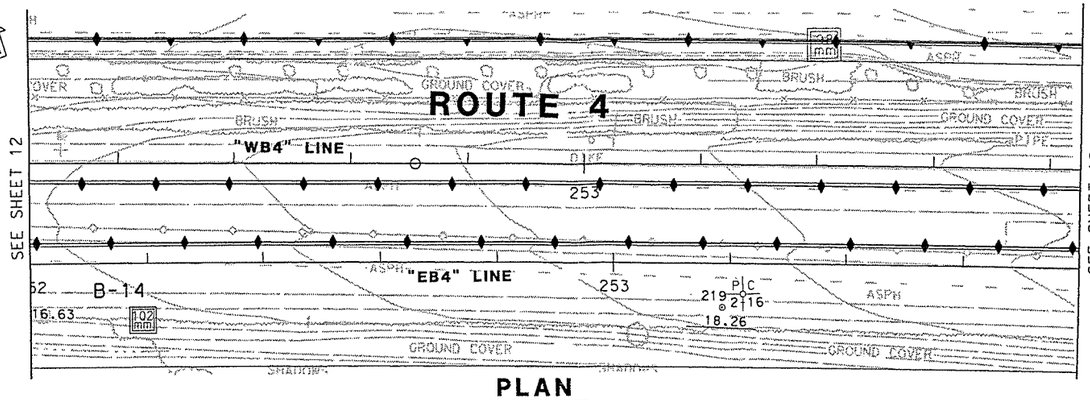
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

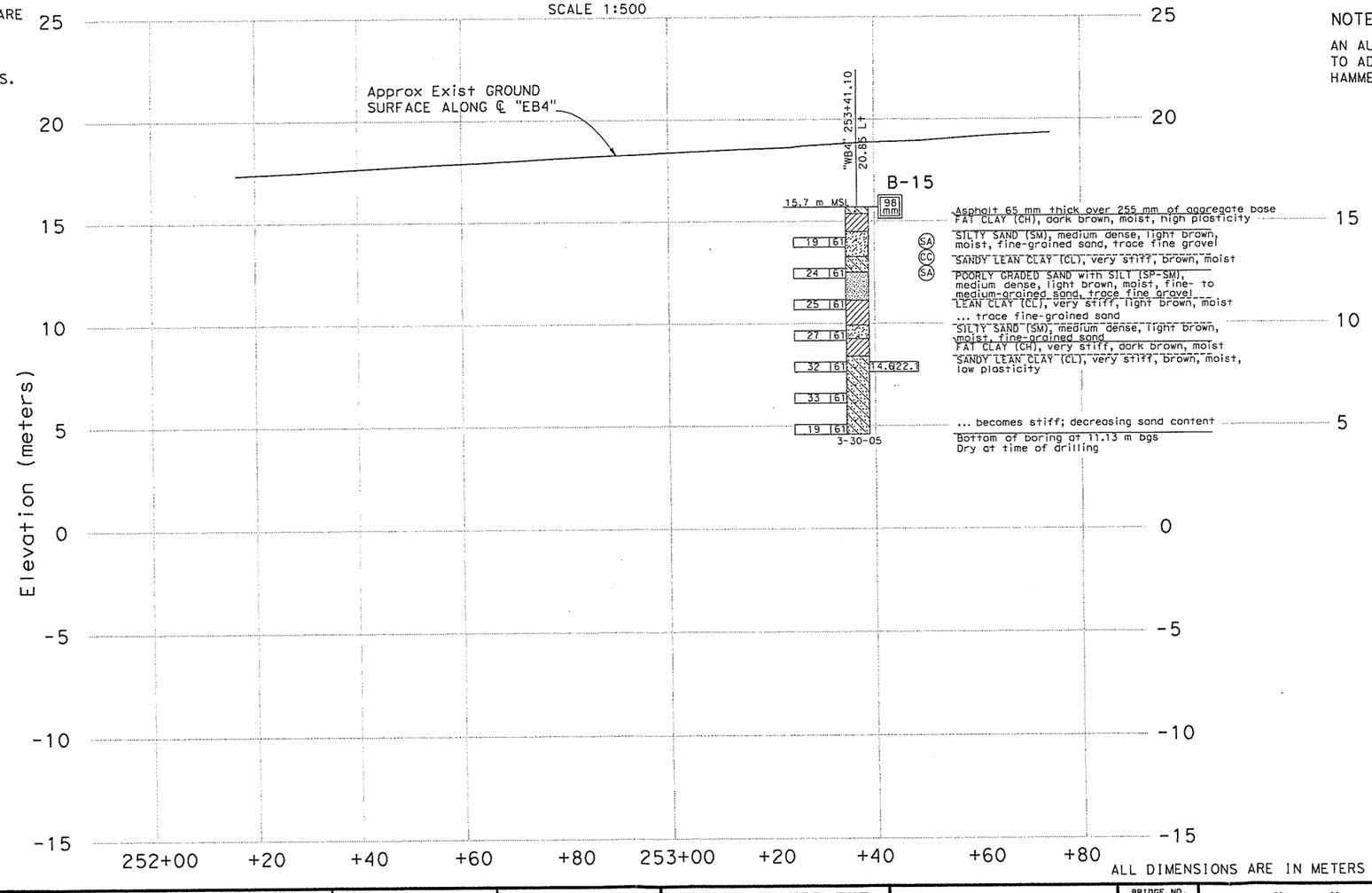
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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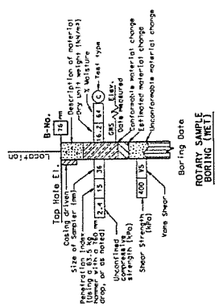
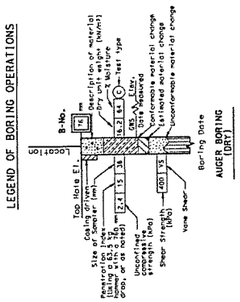
LEGEND OF BORING OPERATIONS

TEST TYPE: Atterberg Limits; Corrosivity Test; Consolidation; Direct Shear; Hydrometer; Wet Density (Log Composition Test); Resistance R-Value; Sieve Analysis; Split Barrel Impact Test; Unconsolidated Undrained Triaxial Compression Test; Wash Sieve





SLOPE INDICATOR | SAMPLE BORING (DRY) | ROTARY SAMPLE BORING (MET) | AUGER BORING (DRY) | TEST PIT | DIAMOND CORE BORING | JET BORING | ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS

GRAVEL | SAND | SILT | CLAY | SANDY CLAY or CLAYEY SAND | SANDY SILT or SILTY SAND | SILTY CLAY | CLAYEY SILT | PEAT and/or ORGANIC MATTER | TILL MATERIAL | COBBLE | IGNEOUS ROCK | SEDIMENTARY ROCK | METAMORPHIC

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>50	Very Dense	16-30	Very stiff
		>31	Hard

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DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 03/30/05		PROJECT ENGINEER

BRIDGE NO.
KILOMETER POST 37.9/41.3

SR4 "EB4" LINE STA 252+00 TO 253+80

LOG OF TEST BORINGS

CU 04275
EA 228501

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/17/05 | 7/28/06 | 8/01/06 | 2/28/01 | 10/25/01

SHEET 15 OF 30

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS: 0 10 20 30 40 50 60 70 80 90 100

FILE => ...\b-15.dgn

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

USERNAME => Christina\Desktop\Profile PLOTTED => 11/7/2007 TIME PLOTTED => 3:56:34 PM

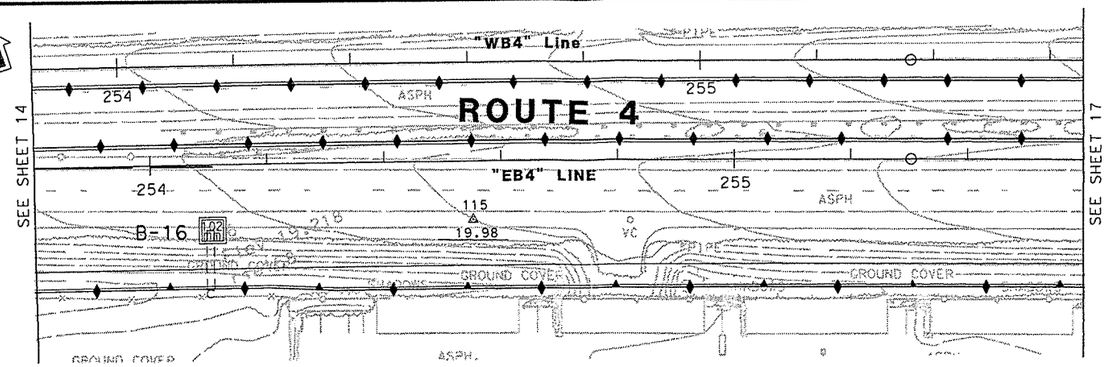
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

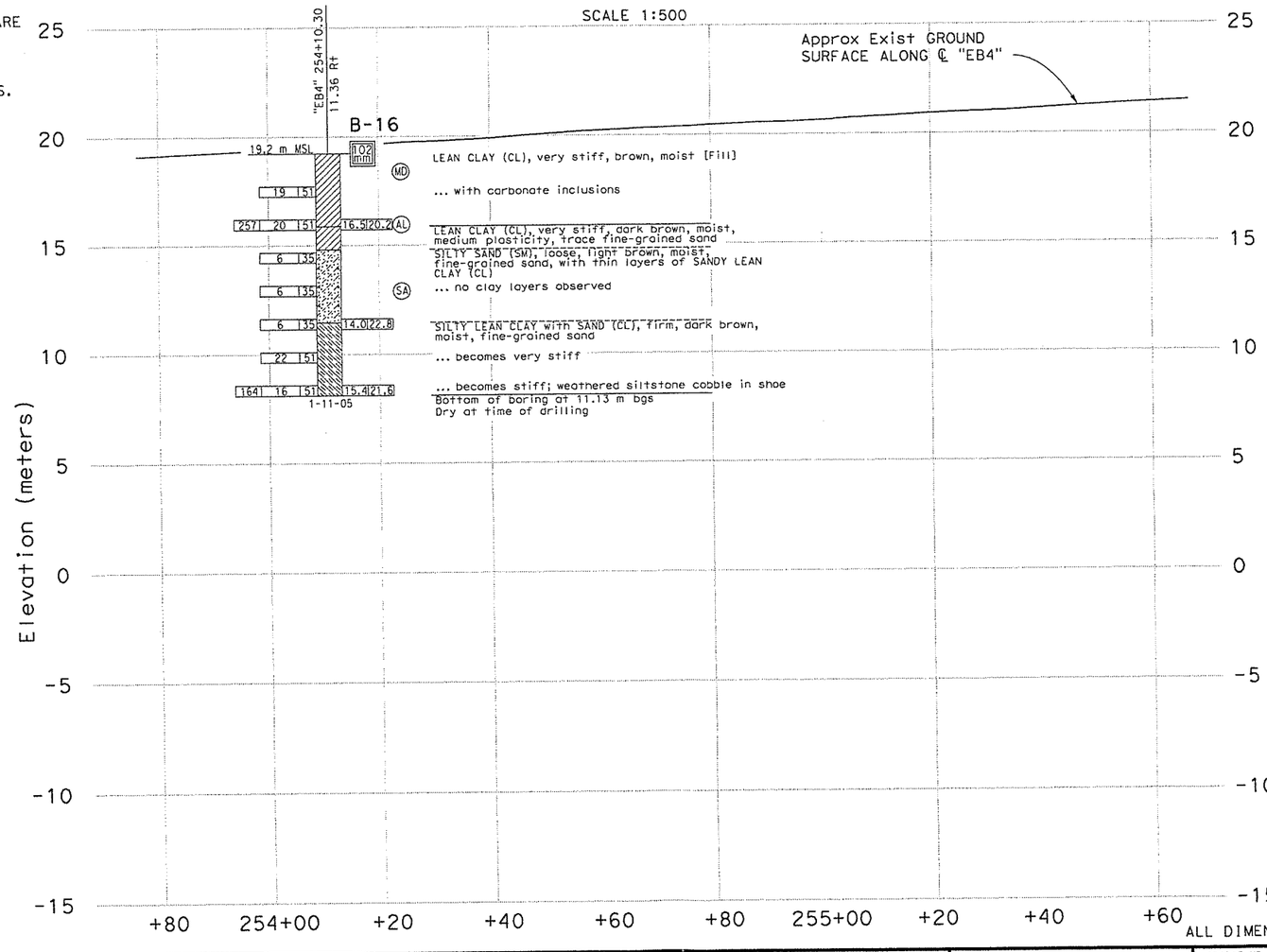
BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN

SCALE 1:500



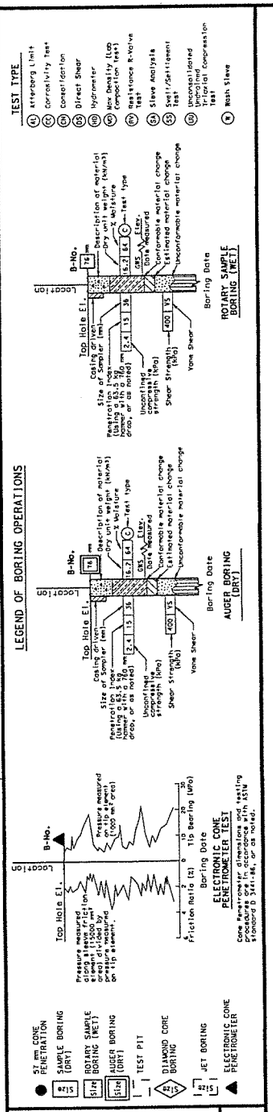
PROFILE VIEW

Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.



Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

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URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO.	SR4 "EB4" LINE STA 253+80 TO 255+60
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/11/05		PROJECT ENGINEER	KILOMETER POST 37.9/41.3	LOG OF TEST BORINGS

CU 04275
EA 228501

FILE => ...\b-16.dgn

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

DISREGARD PRINTS BEARING EARLIER REVISION DATES → REVISION DATES (PRELIMINARY STAGE ONLY) 10/17/05 | 7/28/06 | 8/31/06 | 2/28/07 | 10/25/07

SHEET 16 OF 30

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

USERNAME => Christina.Padilla PLOTTED => 11/7/2007 TIME PLOTTED => 3:56:39 PM

BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

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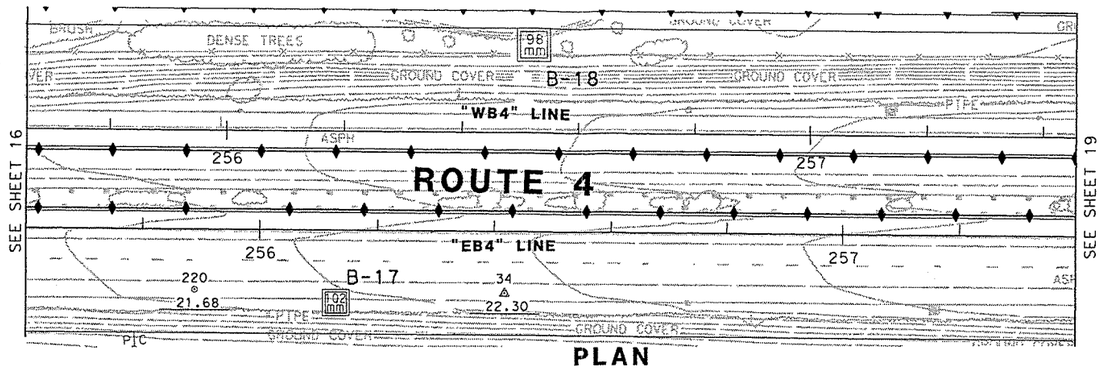
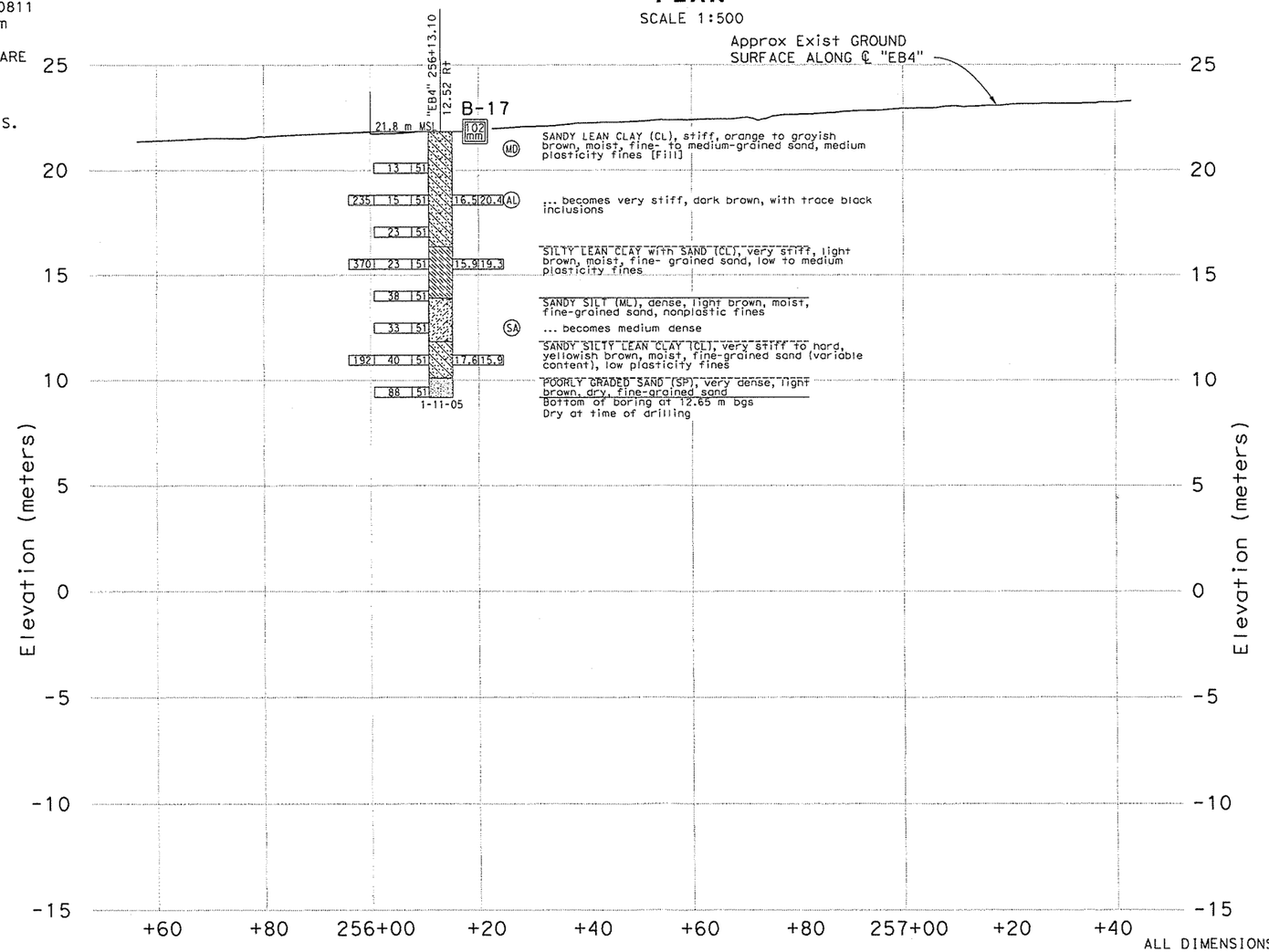


PLAN
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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LEGEND OF BORING OPERATIONS

TEST TYPE
A Atterberg Limits
C Corrosivity Test
CN Consolidation
D Direct Shear
H Hydrometer
M Mv Density (Lab Compaction Test)
R Resistance R-Value Test
SA Sieve Analysis
T Shear (Torvane or Pocket Penetrometer)
U Unconsolidated Undrained Triaxial Compression Test
W Wash Sieve

ROTARY SAMPLE BORING (WET)
AUGER BORING (DRY)
ELECTRONIC CONE PENETROMETER TEST

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/ 0.3m)	Granular	SPT N-Value (Blows/ 0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
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11-30	Medium Dense	5-8	Firm
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>50	Very Dense	16-30	Very stiff
		>31	Hard

LEGEND OF EARTH MATERIALS
GRAVEL, SAND, SILT, CLAY, CLAYEY SILT, PEAT and/or ORGANIC MATTER, FILL MATERIAL, COBBLE, SANDY CLAY or CLAYEY SAND, IGNEOUS ROCK, SEDIMENTARY ROCK, SANDY SILT or SILTY SAND, METAMORPHIC, SILTY CLAY

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO.	SR4 "EB4" LINE STA 255+60 TO 257+40
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 03/30/05		PROJECT ENGINEER	KILOMETER POST 37.9/41.3	LOG OF TEST BORINGS

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228501

FILE => ...\b-17.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/17/05 | 7/28/06 | 8/03/06 | 2/28/07 | 10/25/07

SHEET 17 OF 30

USERNAME => Christine.Dodge PLOTTED => 11/7/2007 TIME PLOTTED => 3:56:43 PM

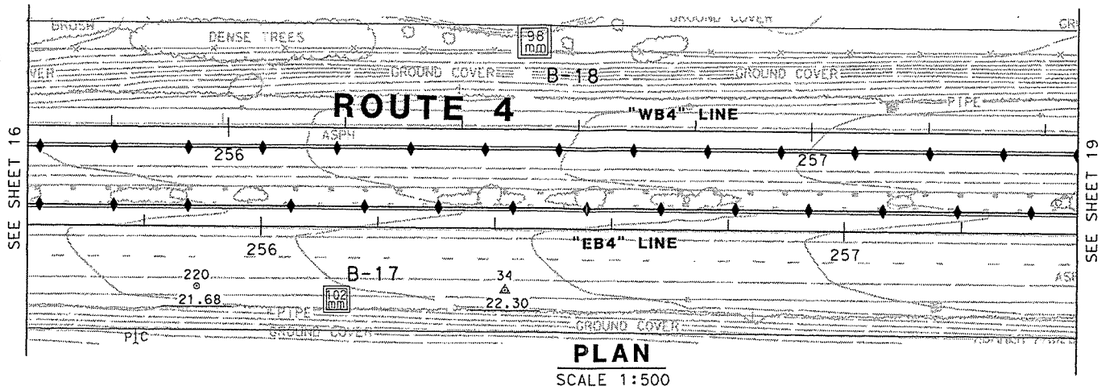
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

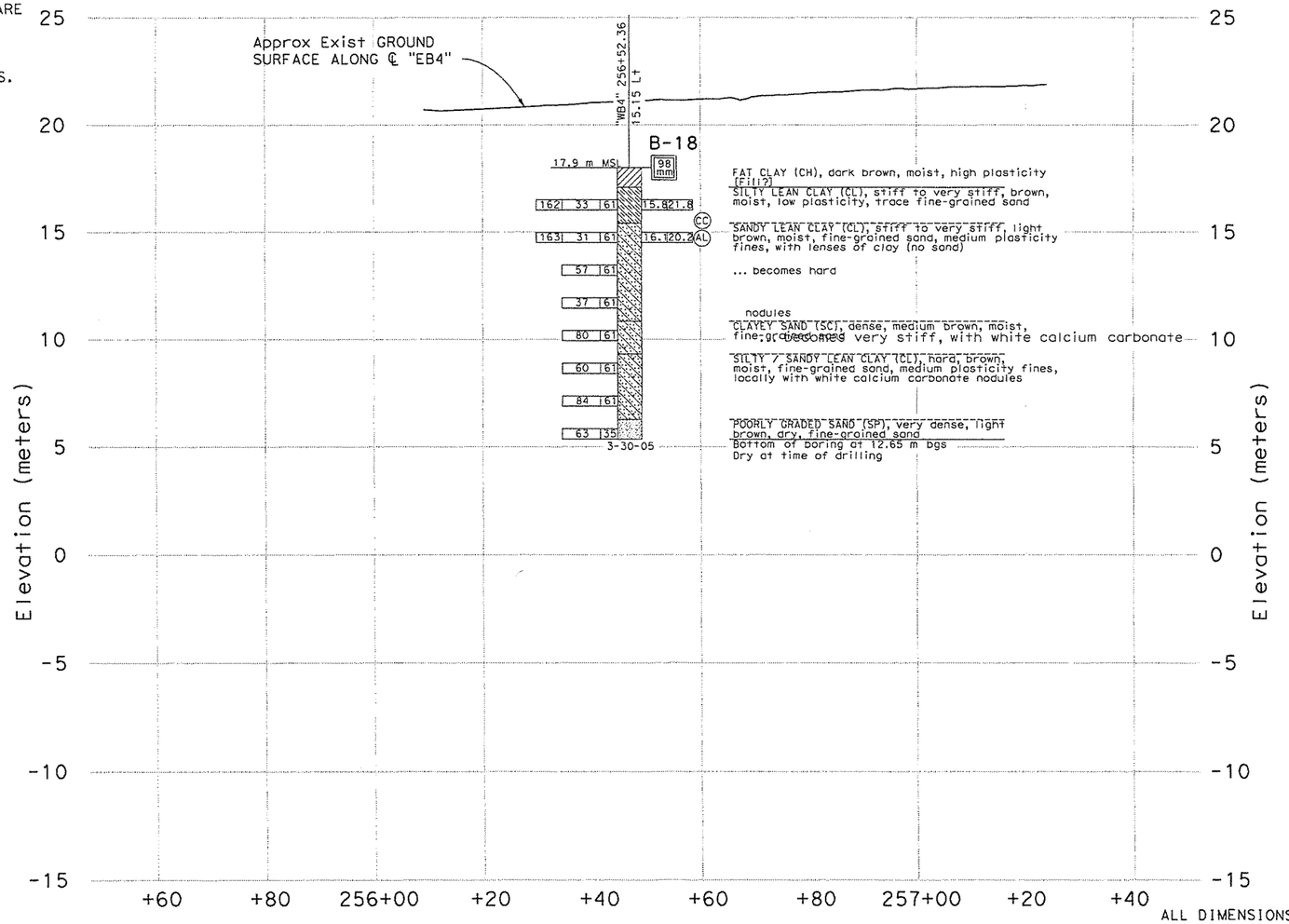
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymond — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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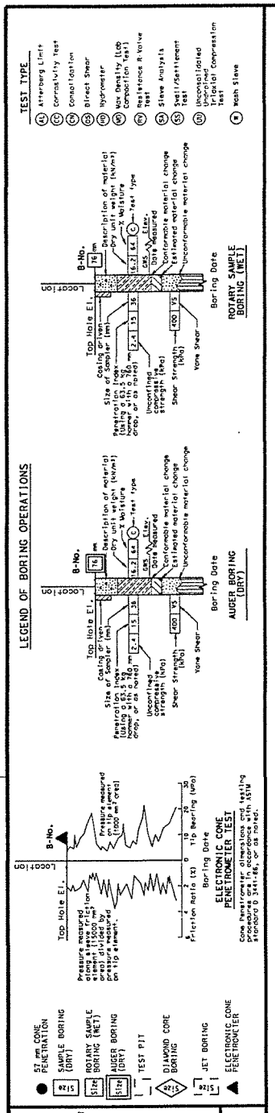
LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

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

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

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DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO.	SR4 "EB4" LINE STA 255+60 TO 257+40
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 03/30/05		PROJECT ENGINEER	KILOMETER POST 37.9/41.3	LOG OF TEST BORINGS

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228501

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 10/17/05 | 7/28/06 | 8/03/06 | 2/28/07 | 10/25/07

SHEET 18 OF 30

FILE => ...\b-18.dgn

USERNAME => Christina_Dafler@DOTTED => 11/7/2007 TIME PLOTTED => 3:56:48 PM

BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

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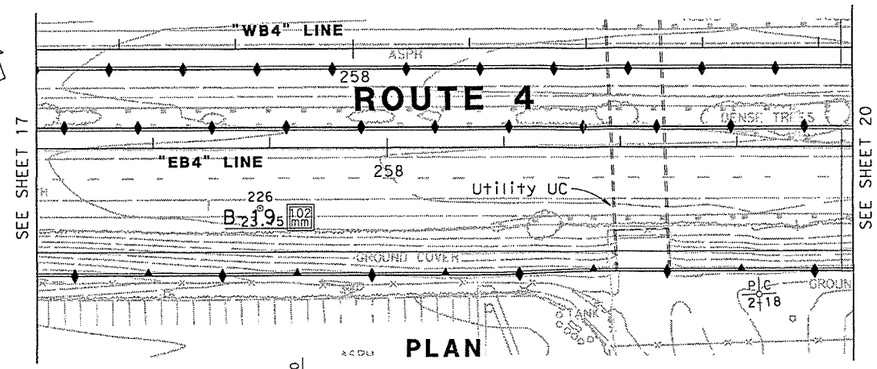
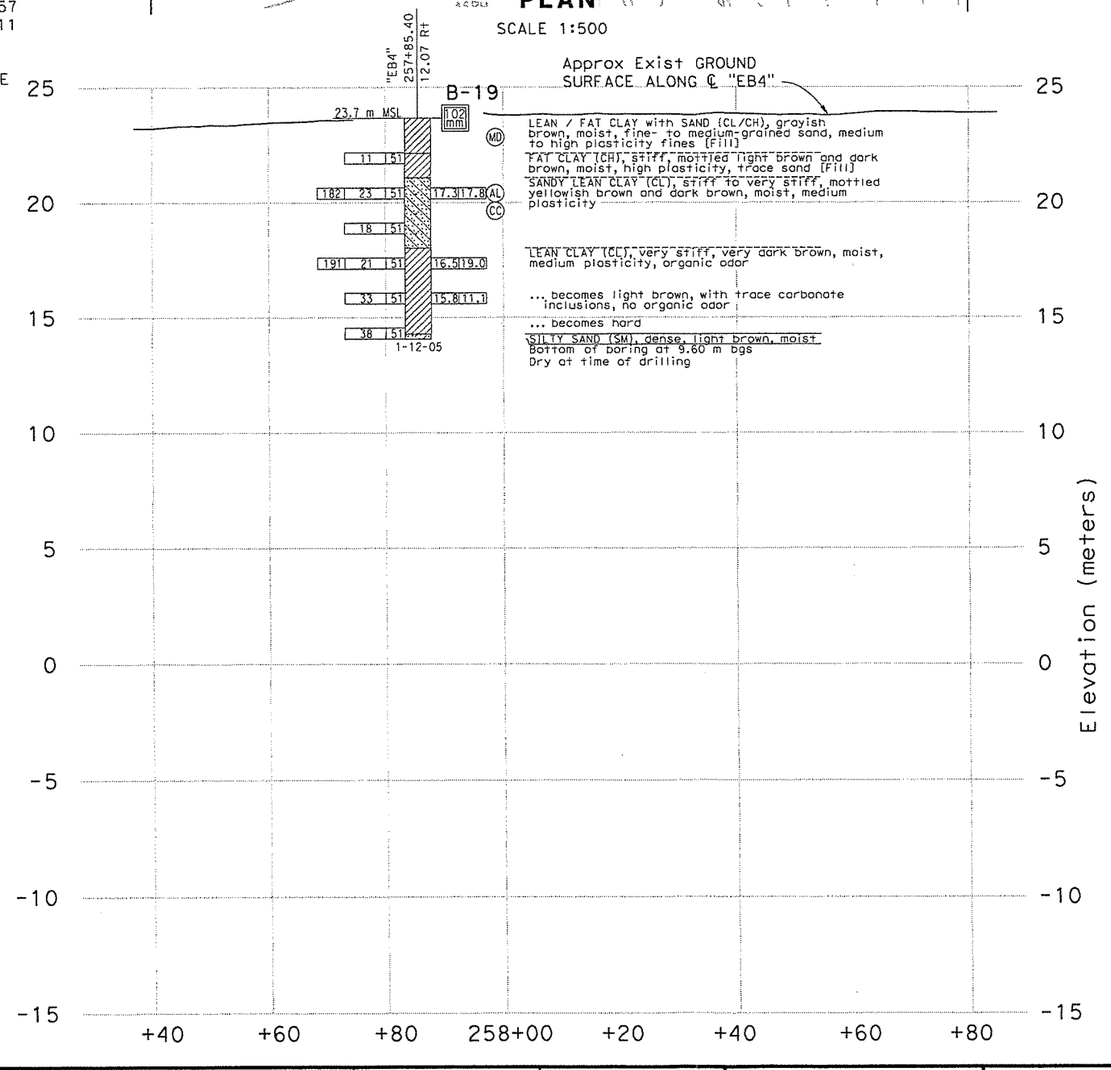
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.





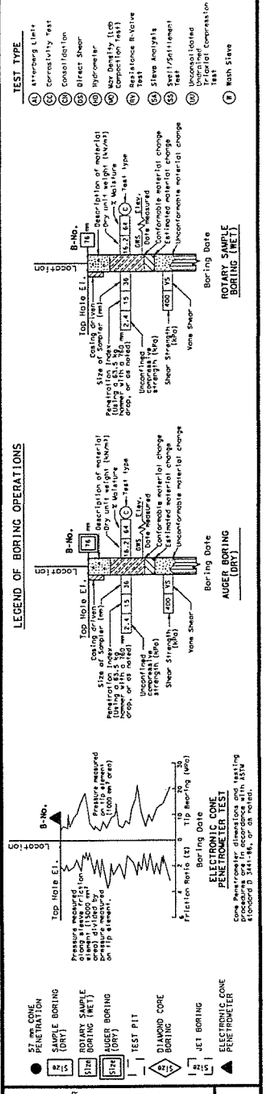
PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

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

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/12/05		PROJECT ENGINEER

BRIDGE NO.
KILOMETER POST 37.9/41.3

SR4 "EB4" LINE STA 257+40 TO 258+80
LOG OF TEST BORINGS

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228501

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/31/05 | 7/28/06 | 8/31/06 | 2/28/07 | 10/25/07

SHEET 19 OF 30

FILE => ...\b-19.dgn

USERNAME => Christina.Dacera@pb.com PLOTTED => 11/1/2007 TIME PLOTTED => 3:56:53 PM

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymond — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

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CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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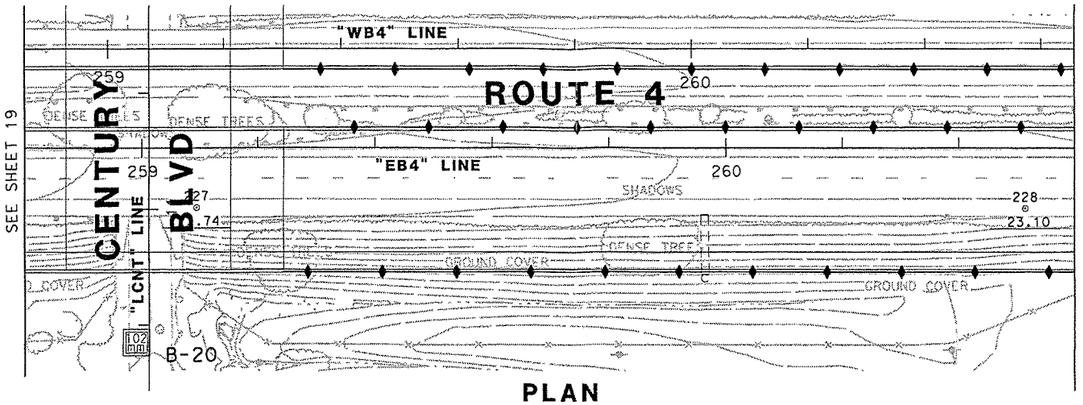
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

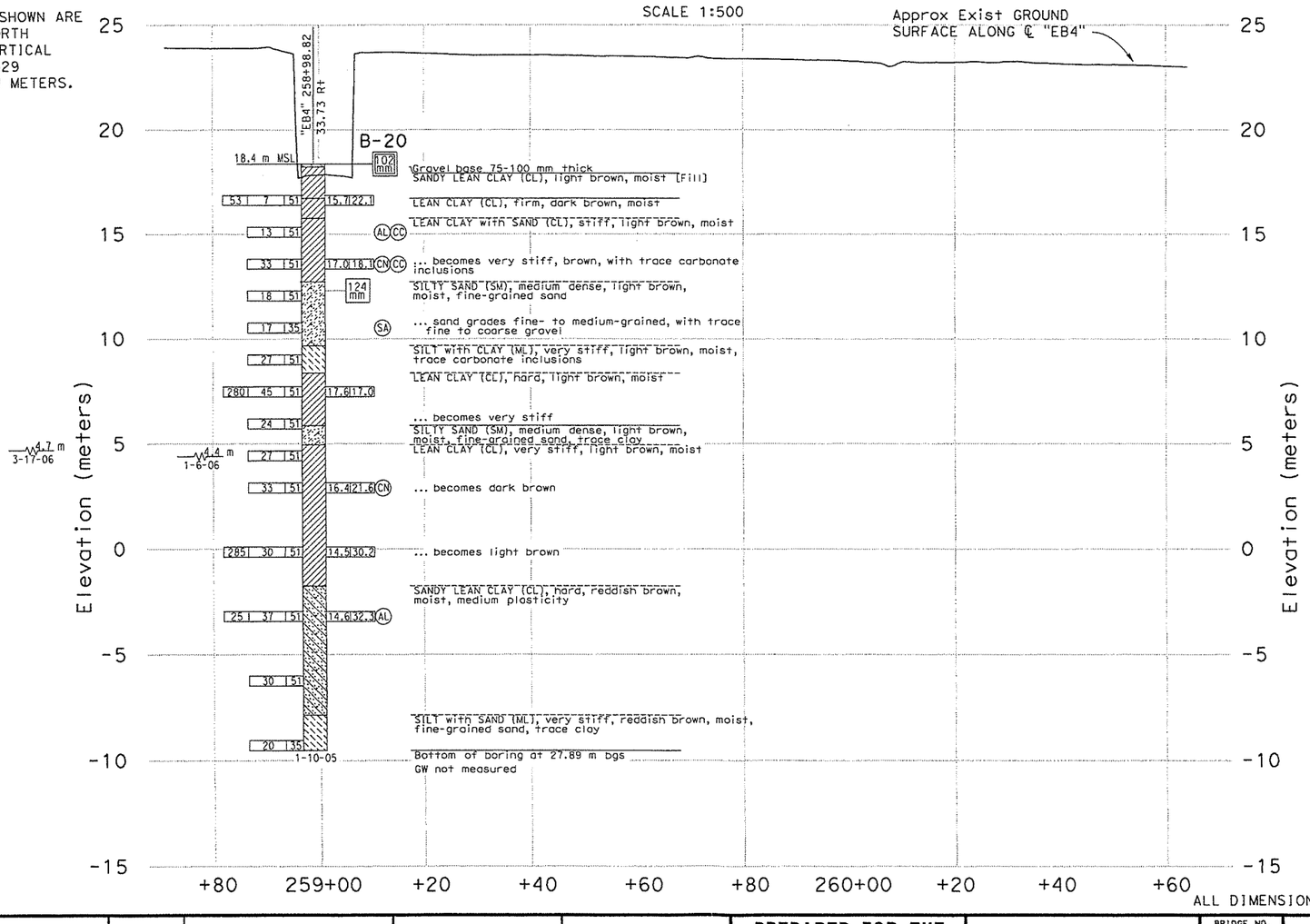
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500

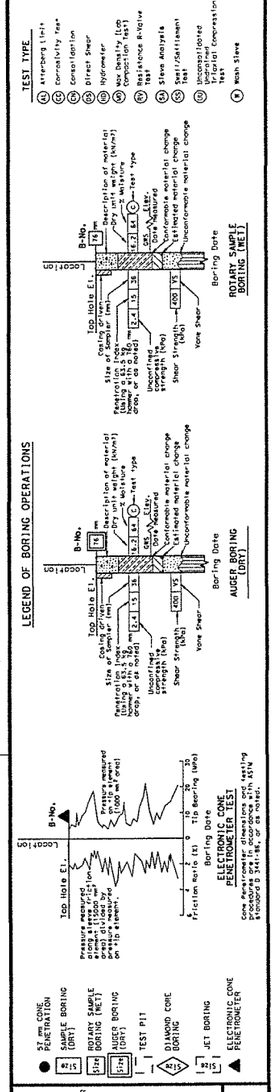


PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.



LEGEND OF EARTH MATERIALS
GRAVEL · SAND · SILT · CLAY · SANDY CLAY or CLAYEY SAND · SANDY SILT or SILTY SAND · SILTY CLAY · CLAYEY SILT · PEAT and/or ORGANIC MATTER · FILL MATERIAL · COBBLE · IGNEOUS ROCK · SEDIMENTARY ROCK · METAMORPHIC

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

Philip Meymond No. 2596 Exp. 6/30/09 GEOTECHNICAL REGISTERED PROFESSIONAL ENGINEER STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
SIGN OFF DATE	CHECKED BY	N. MEYER	H. BERGER, PROJECT ENGINEER
	S. MURUGAIAH, FIELD INVESTIGATION BY: DATE: 01/10/05		CU 04275 EA 228501

BRIDGE NO. — KILOMETER POST 37.9/41.3

SR4 "EB4" LINE STA 258+80 TO 260+60
LOG OF TEST BORINGS

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 10/31/05 · 2/28/06 · 8/30/06 · 2/28/07 · 10/25/07

SHEET 20 OF 30

FILE => ...\b-20.dgn

USERNAME => christina.gomez

TIME PLOTTED => 3:56:57 PM

DATE PLOTTED => 11/7/2007

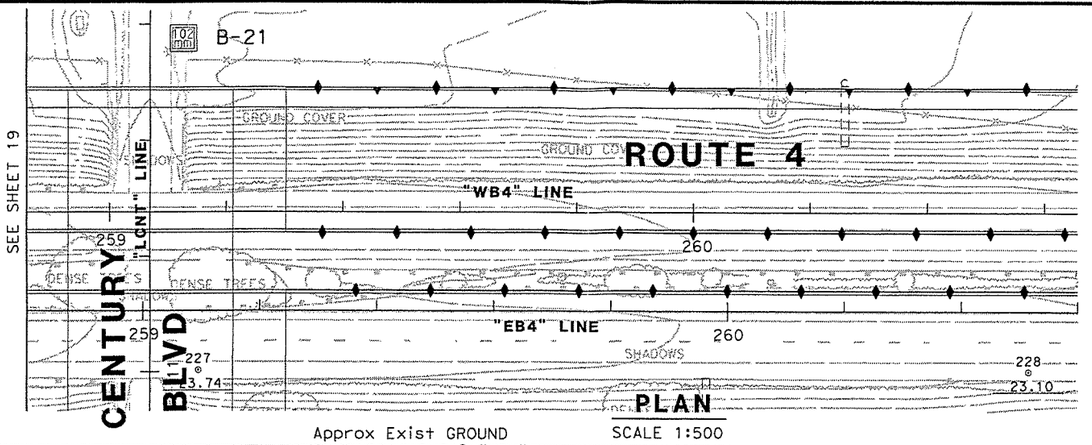
BENCH MARKS

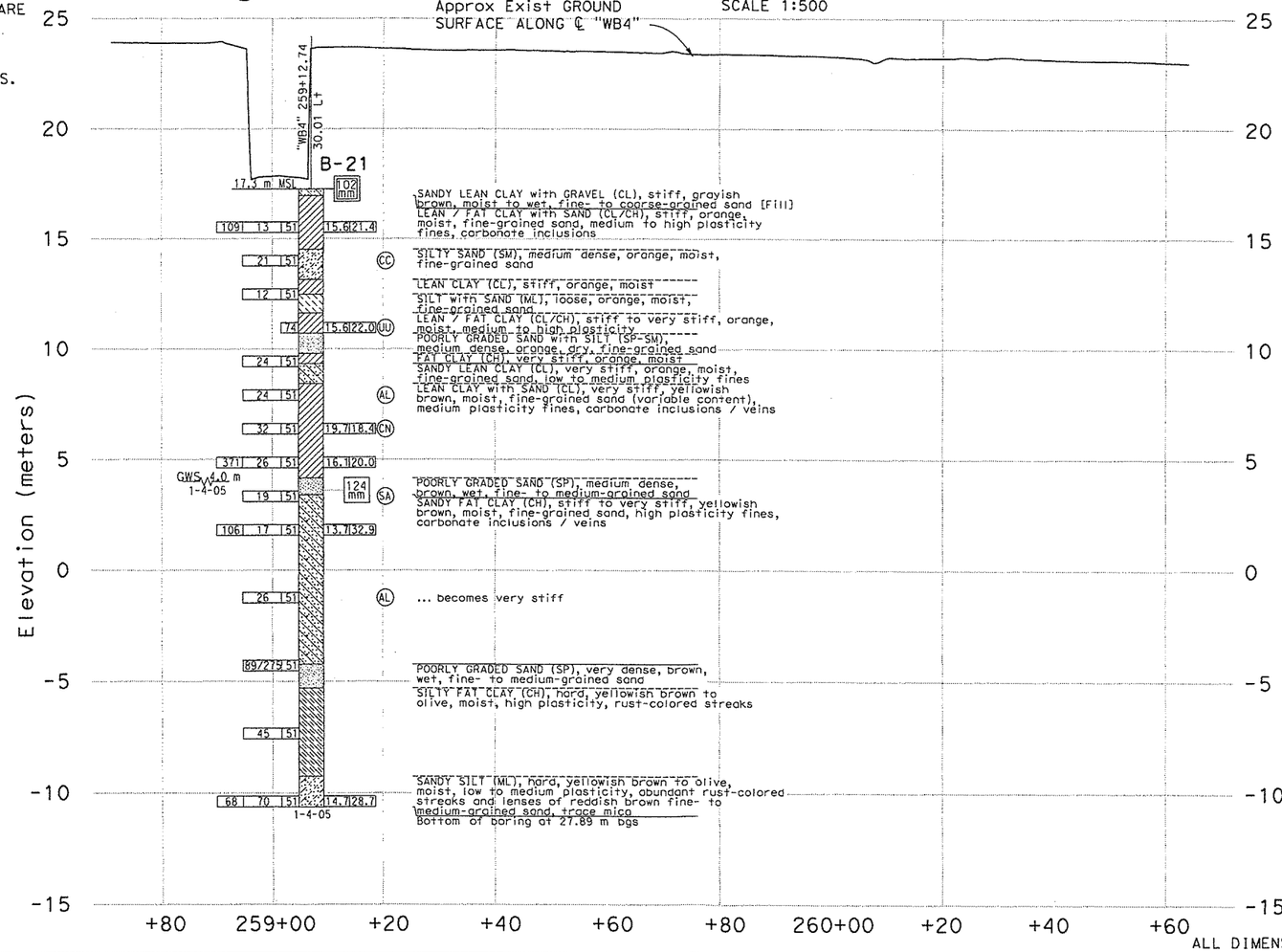
BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.





PROFILE VIEW

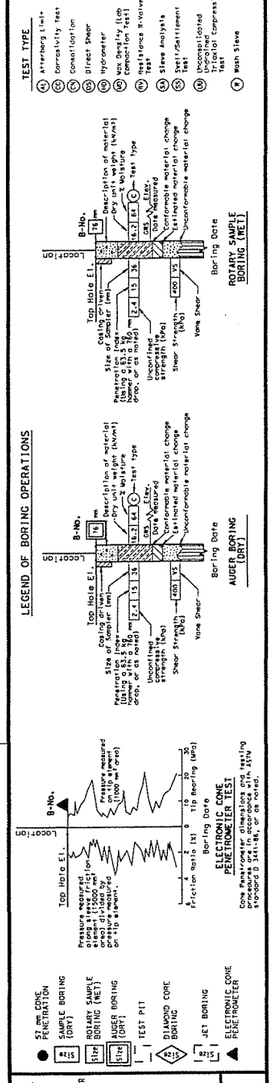
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

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

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/ 0.3m)	Granular	SPT N-Value (Blows/ 0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	P. RESPESS	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO.	SR4 "EB4" LINE STA 258+80 TO 260+60
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/04/05		PROJECT ENGINEER	KILOMETER POST 37.9/41.3	LOG OF TEST BORINGS

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228501

FILE => ...\b-21.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 10/17/05 | 7/28/06 | 8/28/06 | 2/28/07 | 10/25/07

SHEET 21 OF 30

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Weymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

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URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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USERNAME => C:\Christine\DGN\Sr4eb4PLOTTED => 11/7/2007 TIME PLOTTED => 4:12:14 PM

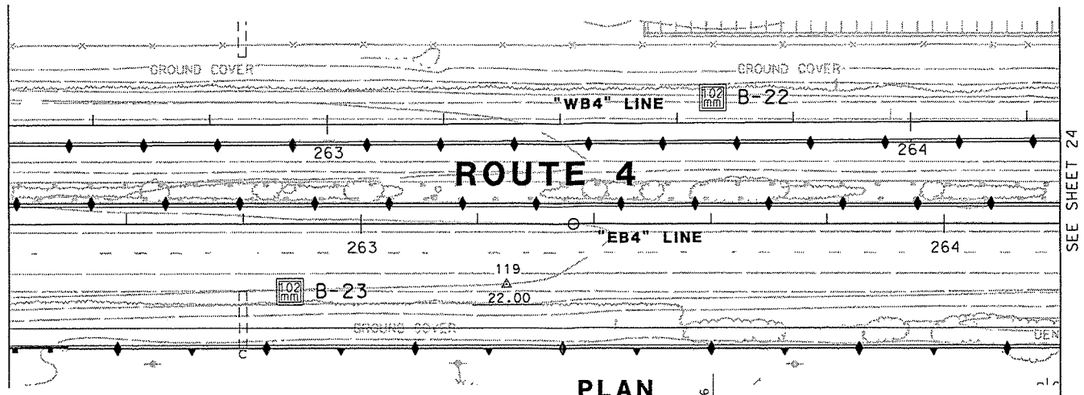
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

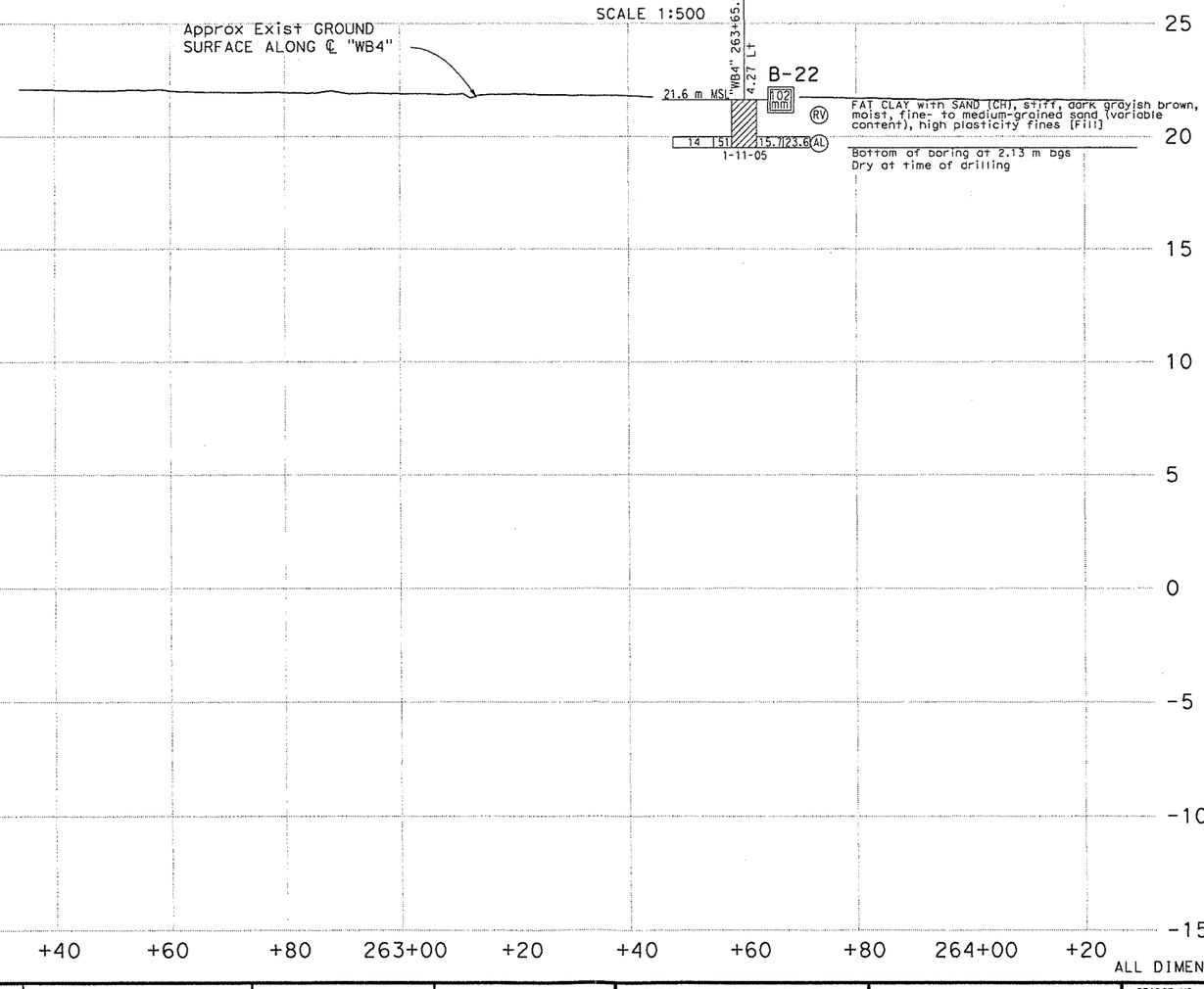
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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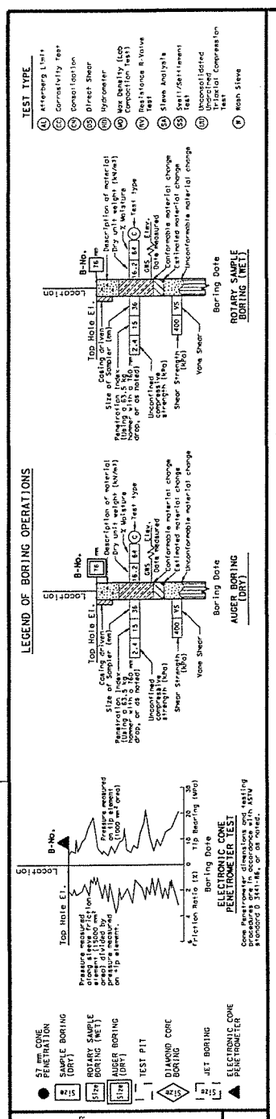
LEGEND OF BORING OPERATIONS



● 57 mm CONE PENETRATION
SAMPLE BORING (DRY)
ROTARY SAMPLE BORING (WET)
AUGER BORING (DRY)
TEST PIT
DIAMOND CORE BORING
JET BORING
ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS

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

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/ft) (0.3m)	Granular	SPT N-Value (Blows/ft) (0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	H. BERGER, PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	N. MEYER	S. MURUGAIAH, FIELD INVESTIGATION BY: DATE: 01/11/05

BRIDGE NO.
KILOMETER POST 37.9/41.3

SR4 "EB4" LINE STA 262+40 TO 264+20
LOG OF TEST BORINGS

CU 04275
EA 228501

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/31/05 · 12/28/06 · 8/31/07 · 2/28/07 · 10/25/07

SHEET 22 OF 30

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

FILE => ...\b-22.dgn

USERNAME => ChristinaDAbe#PLOTTED => 11/7/2007 TIME PLOTTED => 4:12:18 PM

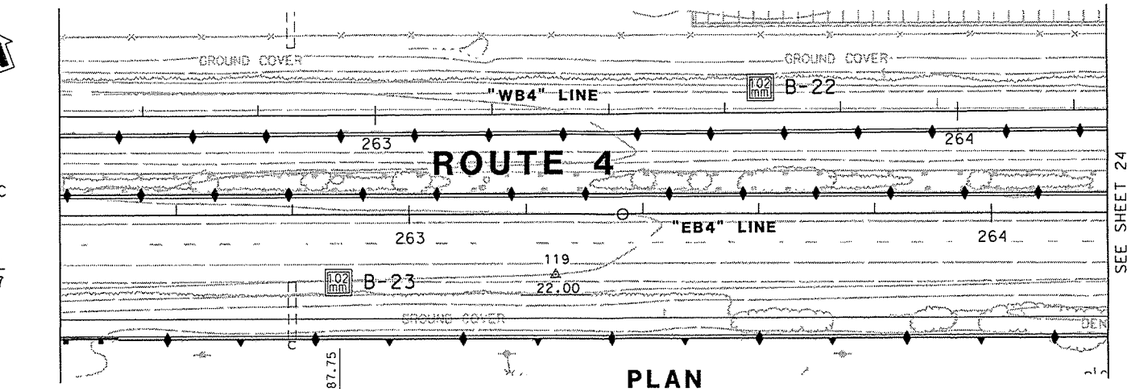
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

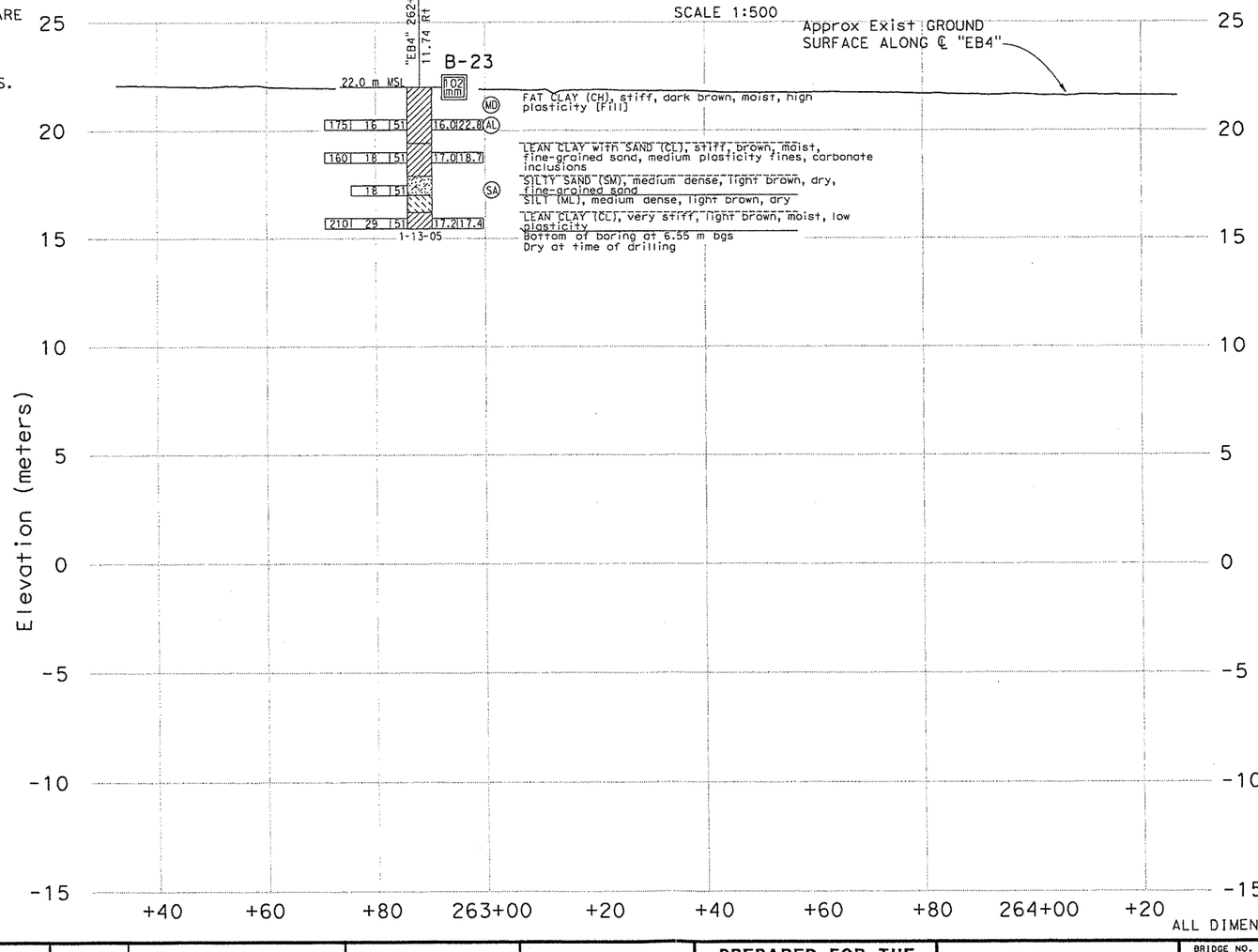
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CONTRA COSTA TRANSPORTATION AUTHORITY
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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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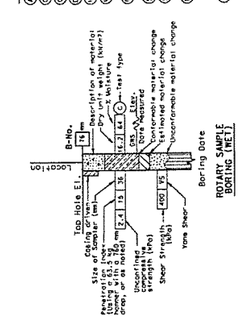
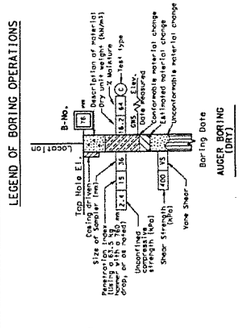
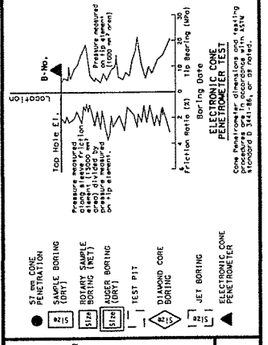
LEGEND OF BORING OPERATIONS

TEST TYPE
(A) Atterberg Limit (C) Corrosivity Test (CN) Consolidation (DS) Direct Shear (HY) Hydrometer (MD) Max Density (Lab Compaction Test) (P) Pressure Meter Test (R) R-Value Test (SA) Sieve Analysis (SE) Sand Equivalent Test (UC) Unconsolidated Undrained Triaxial Compression Test (V) Vane Shear







● 51 mm CONE PENETRATION
SAMPLE BORING (DRY)
ROTARY SAMPLE BORING (MET)
AUGER BORING (DRY)
TEST PIT
DIAMOND CORE BORING
JET BORING
ELECTRONIC CONE PENETROMETER

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
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5-10	Loose	2-4	Soft
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31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

LEGEND OF EARTH MATERIALS
GRAVEL; SAND; SILT; CLAY; SANDY CLAY or CLAYEY SAND; SANDY SILT or SILTY SAND; SILTY CLAY; CLAYEY SILT; PEAT and/or ORGANIC MATTER; FILL MATERIAL; COBBLE; IGNEOUS ROCK; SEDIMENTARY ROCK; METAMORPHIC

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/13/05		PROJECT ENGINEER

BRIDGE NO. | KILOMETER POST 37.9/41.3

SR4 "EB4" LINE STA 262+40 TO 264+20

LOG OF TEST BORINGS

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228501

FILE => ...\b-23.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/11/05; 7/28/06; 8/30/06; 2/28/07; 10/25/07

SHEET 23 OF 30

USERNAME => Chris1ino[36]6ePLOTTED => 11/7/2007 TIME PLOTTED => 4:12:23 PM

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

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CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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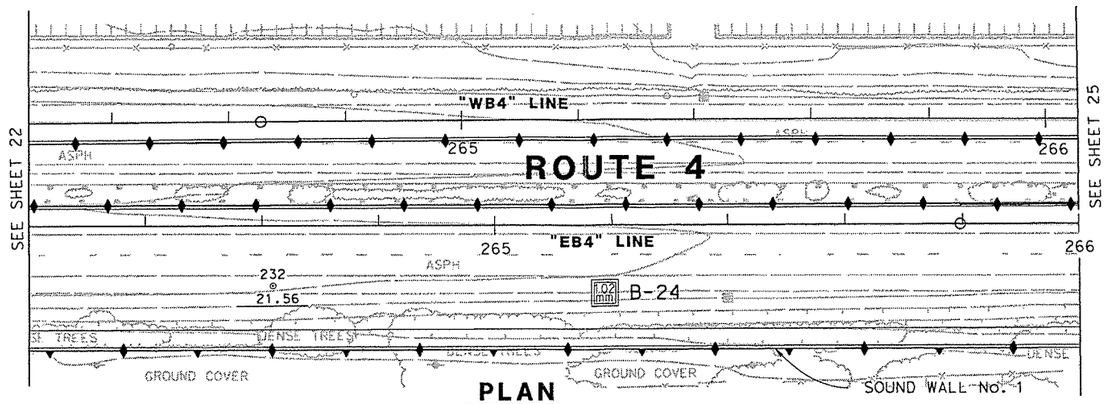
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

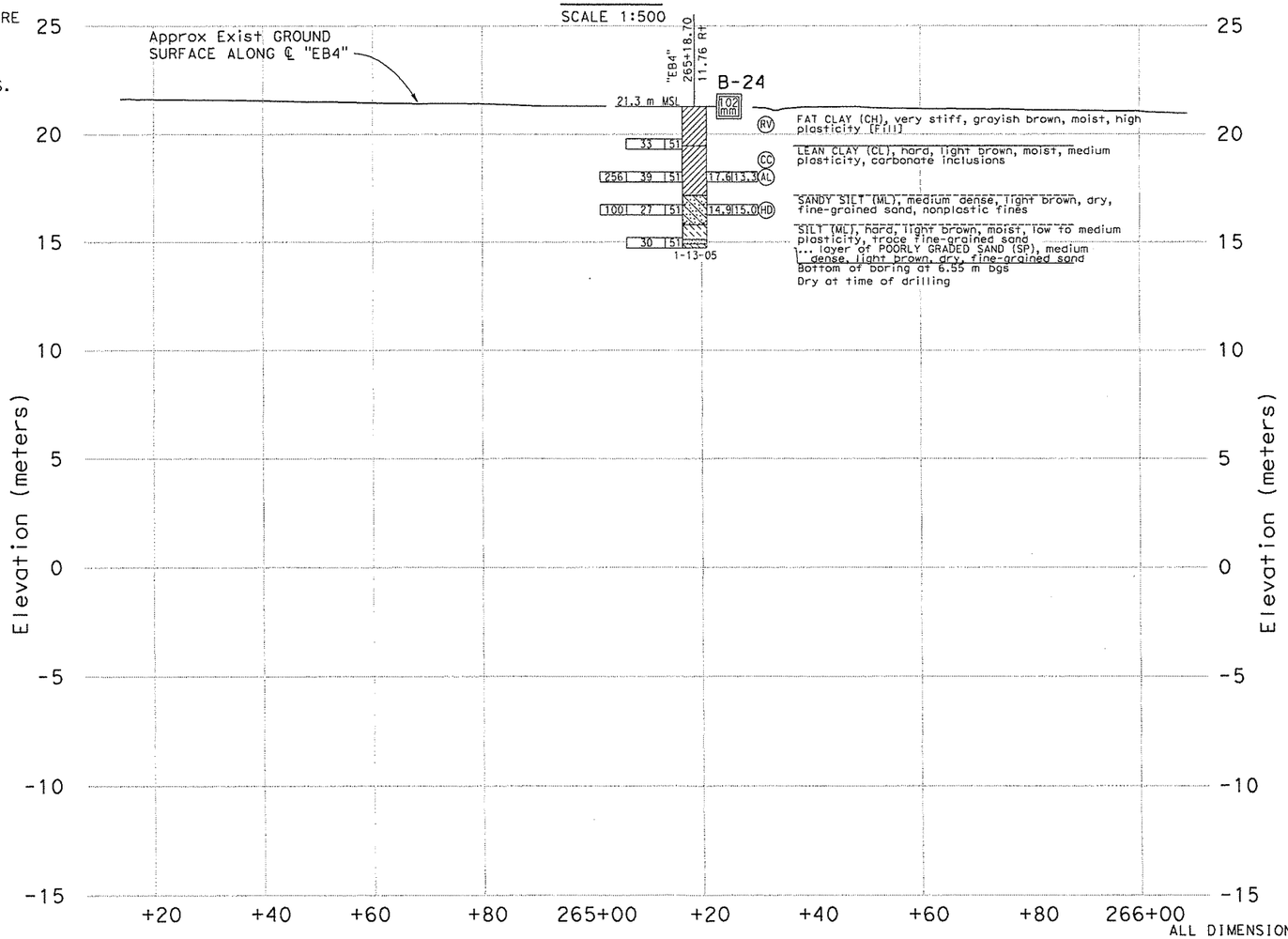
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



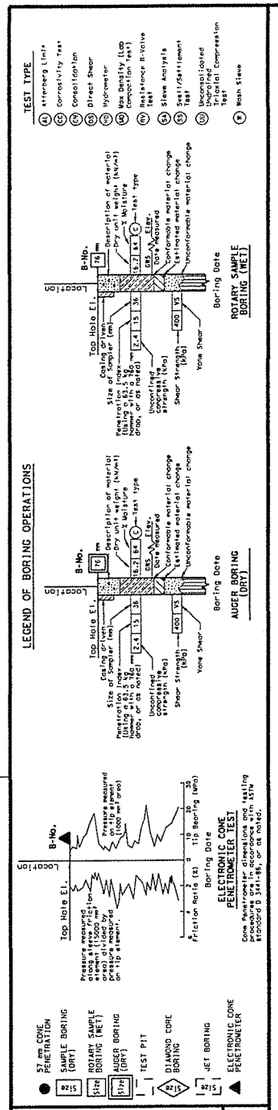
PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

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

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY	N. MEYER	DATE: 01/13/05		

BRIDGE NO.
KILOMETER POST 37.9/41.3

SR4 "EB4" LINE STA 264+20 TO 266+00
LOG OF TEST BORINGS

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228501

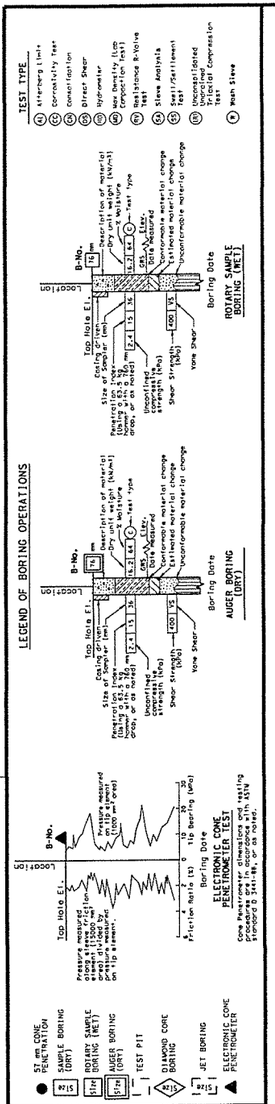
FILE => ...\b-24.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 10/17/05 | 7/28/06 | 8/01/06 | 2/28/07 | 10/25/07

SHEET 24 OF 30

USERNAME => c:\christina\Desktop\b-24.dgn PLOTTED => 11/7/2007 TIME PLOTTED => 4:12:27 PM



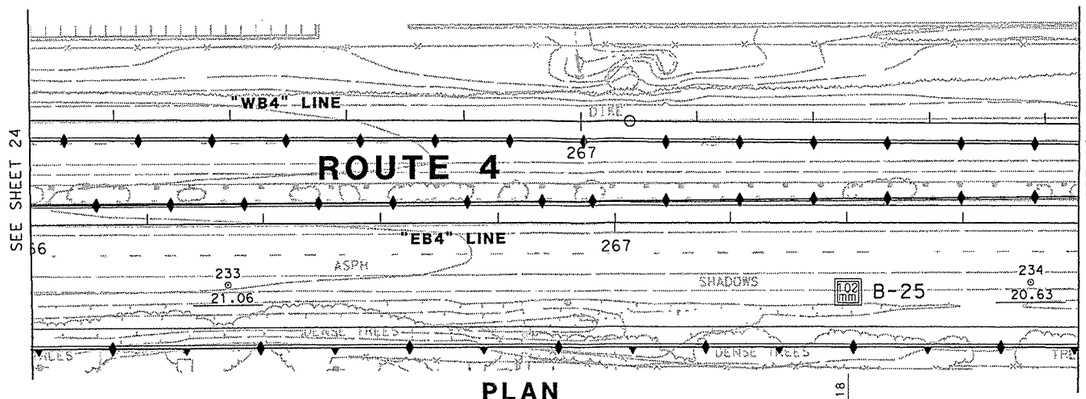
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

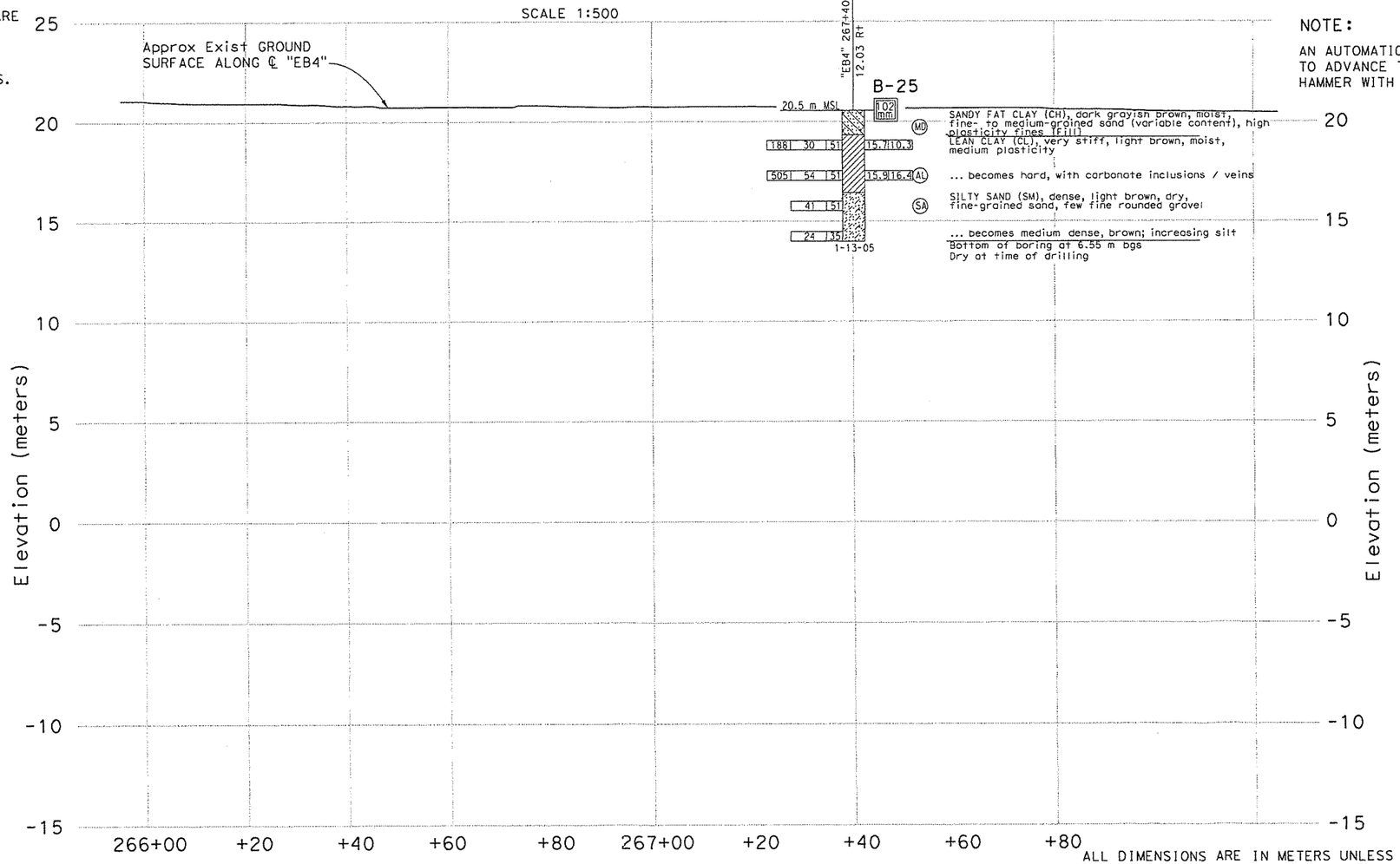
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

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CONTRA COSTA TRANSPORTATION AUTHORITY
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PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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DESIGN OVERSIGHT / SIGN OFF DATE	DRAWN BY	C. SOMERA	S. MURUGAIAH FIELD INVESTIGATION BY: DATE: 01/13/05	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER PROJECT ENGINEER	BRIDGE NO.
	CHECKED BY	N. MEYER				KILOMETER POST 37.9/41.3

SR4 "EB4" LINE STA 266+00 TO 267+80

LOG OF TEST BORINGS

CU 04275
EA 228501

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 10/31/05 | 7/28/06 | 8/28/06 | 2/28/07 | 10/25/07

SHEET 25 OF 30

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

FILE => ...\b-25.dgn

USERNAME => Christina.Bautista PLOTTED => 11/7/2007 TIME PLOTTED => 4:12:31 PM

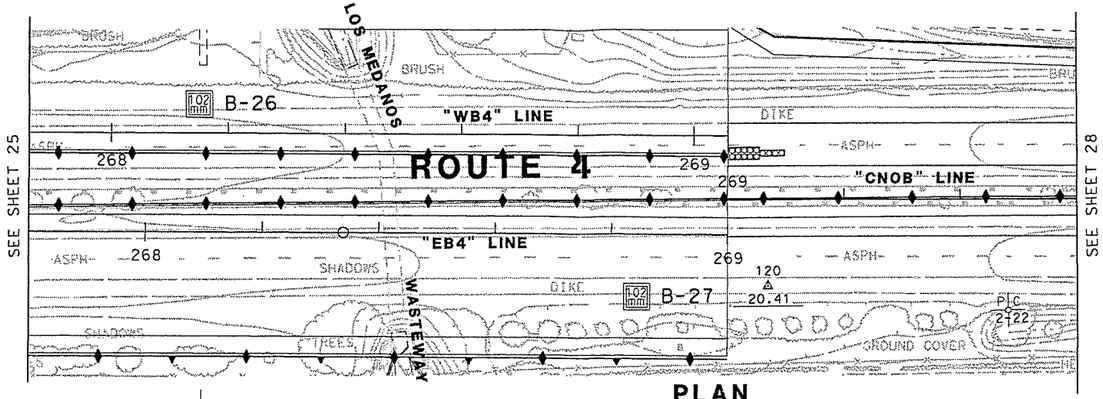
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

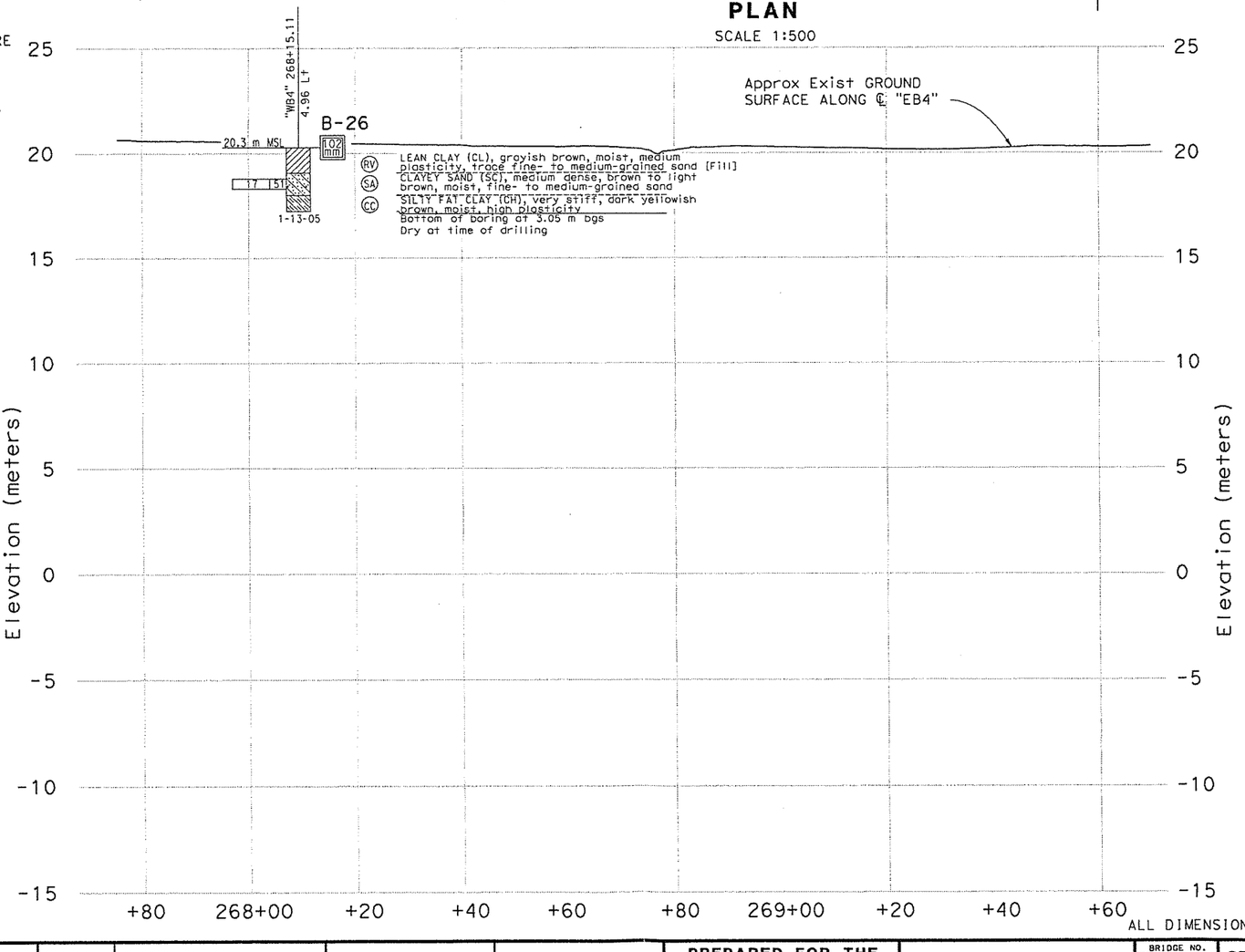
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500

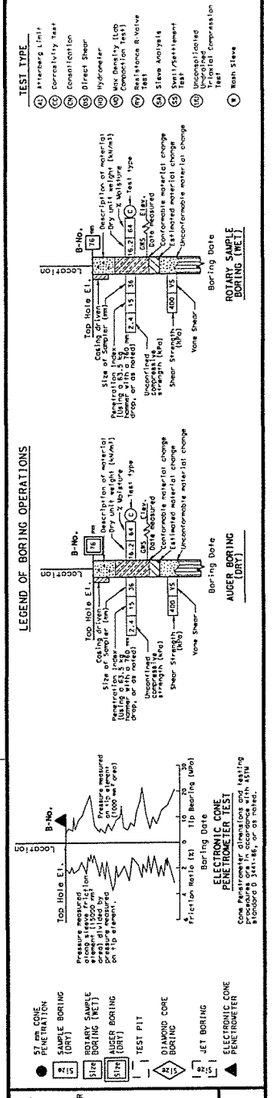


PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.



LEGEND OF EARTH MATERIALS
GRAVEL · SAND · SILT · CLAY · SANDY CLAY or CLAYEY SAND · SANDY SILT or SILTY SAND · SILTY CLAY · CLAYEY SILT · PEAT and/or ORGANIC MATTER · FILL MATERIAL · COBBLE · IGNEOUS ROCK · SEDIMENTARY ROCK · METAMORPHIC

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/ 0.3m)	Granular	SPT N-Value (Blows/ 0.3m)	Cohesive
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>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Weymond — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

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PLEASANT HILL, CA 94523

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DESIGN OVERSIGHT / SIGN OFF DATE	DRAWN BY	C. SOMERA	S. MURUGAIAH FIELD INVESTIGATION BY: DATE: 01/13/05	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER PROJECT ENGINEER
	CHECKED BY	N. MEYER			

BRIDGE NO.
KILOMETER POST 37.9/41.3

SR4 "EB4" LINE STA 267+80 TO "CNOB" 269+60

LOG OF TEST BORINGS

CU 04275
EA 228501

DISREGARD PRINTS BEARING EARLIER REVISION DATES →
REVISION DATES (PRELIMINARY STAGE ONLY): 10/17/05 · 1/26/06 · 8/03/06 · 2/28/07 · 10/25/07

SHEET 26 OF 30

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

FILE => ...\b-26.dgn

USERNAME => Christina[3966e4] PLOTTED => 11/7/2007 TIME PLOTTED => 4:12:36 PM

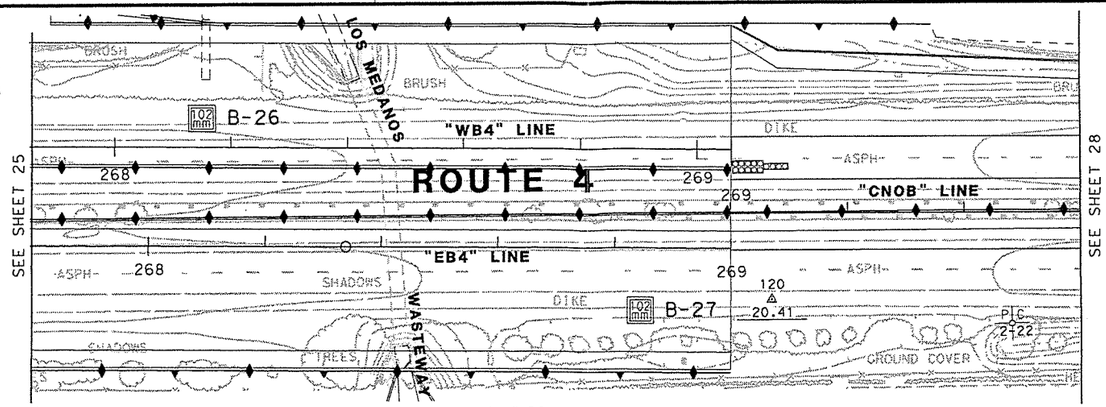
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

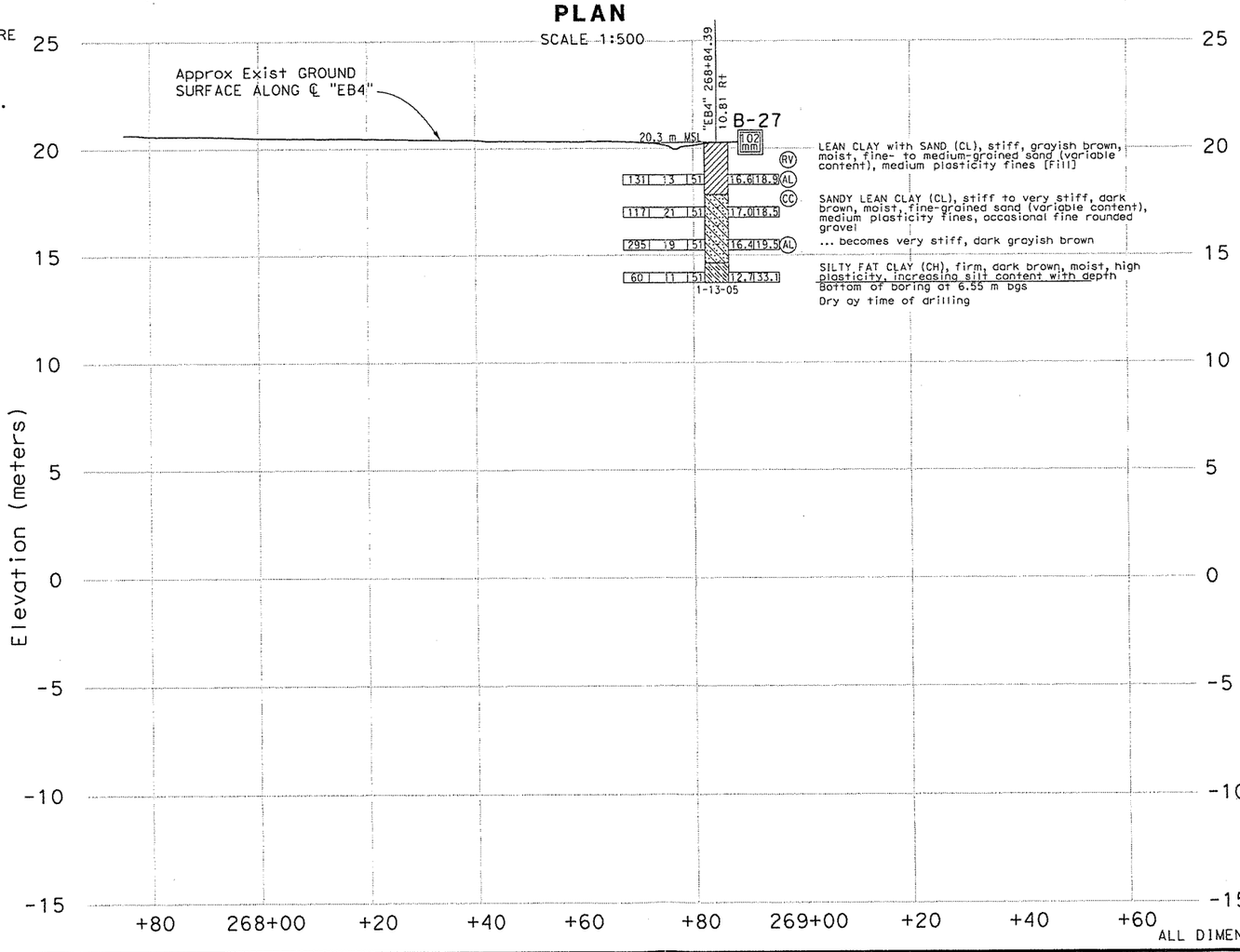
BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE. NORTHING=668761.20457 EASTING=1879751.30811 ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN

SCALE 1:500



ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

PROFILE VIEW
Horiz 1:500
Vert 1:125

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

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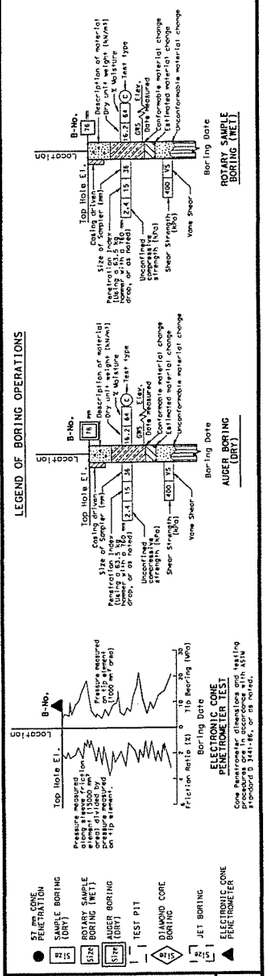
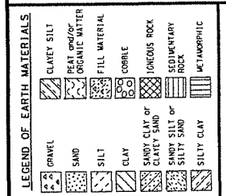
LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS



CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
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>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO.
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/13/05			PROJECT ENGINEER	KILOMETER POST 37.9/41.3

SR4 "EB4" LINE STA 267+80 TO "CNOB" 269+60

LOG OF TEST BORINGS

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228501

FILE => ...\b-27.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 10/1/05 | 7/28/06 | 8/31/06 | 2/28/07 | 10/25/07

SHEET 27 OF 30

USERNAME => Christina.DGN PLOTTED => 11/7/2007 TIME PLOTTED => 4:12:40 PM

BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

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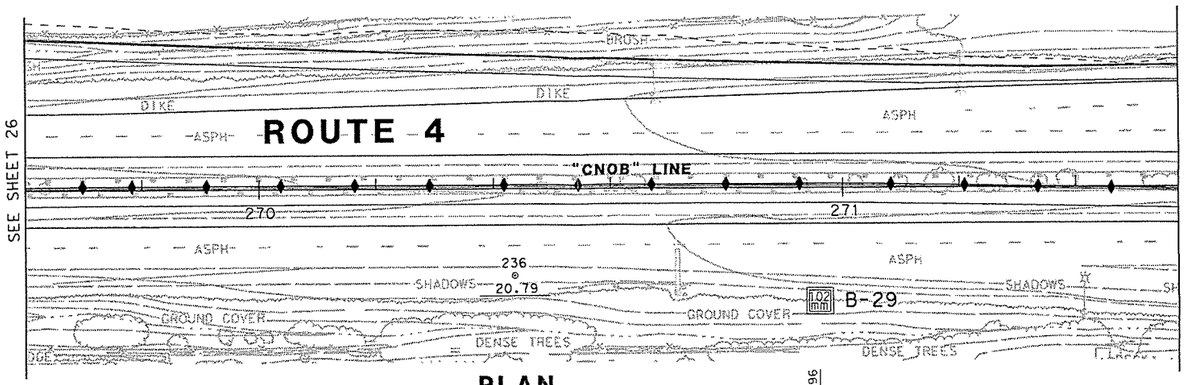
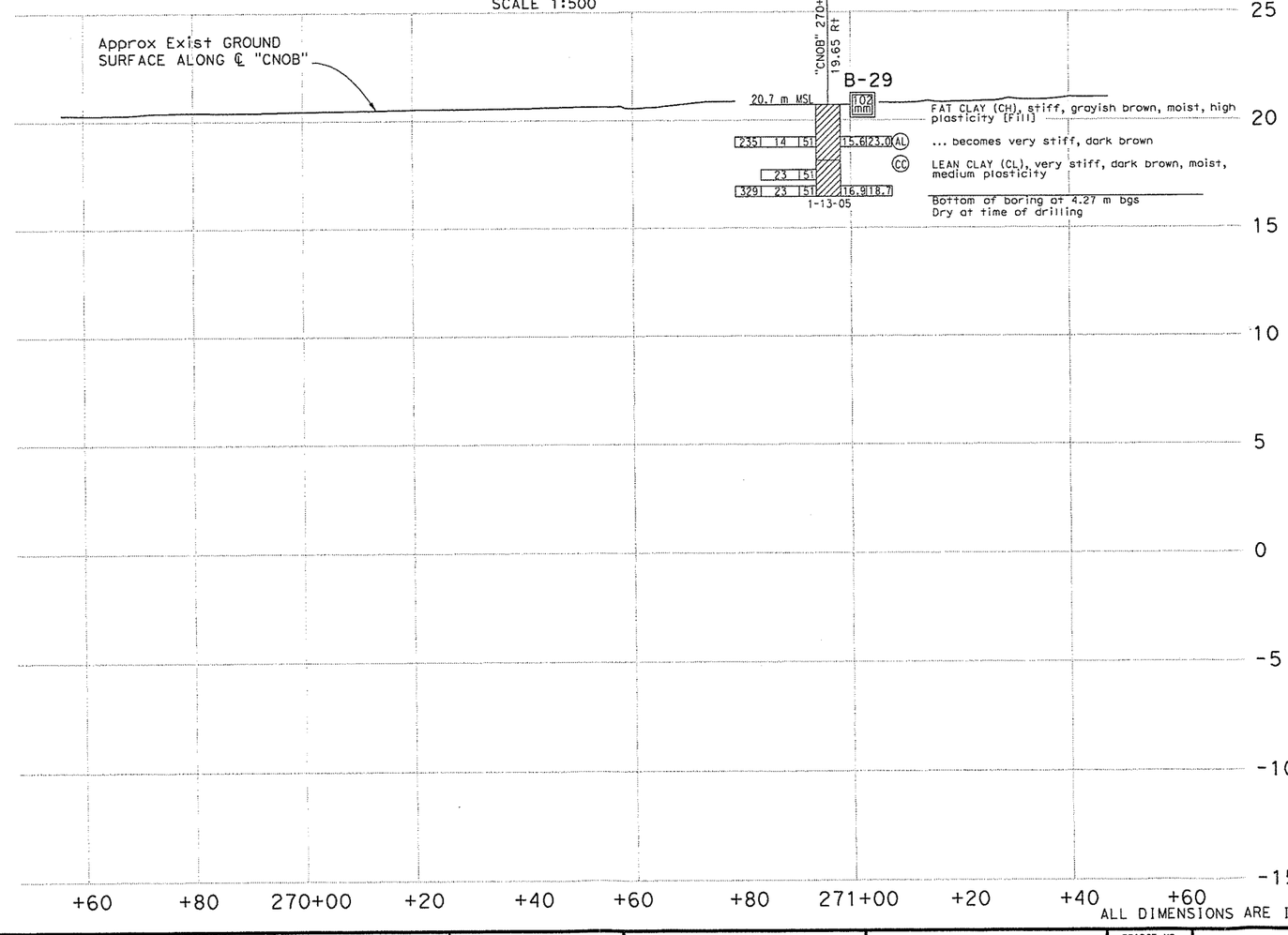


PLAN

SCALE 1:500



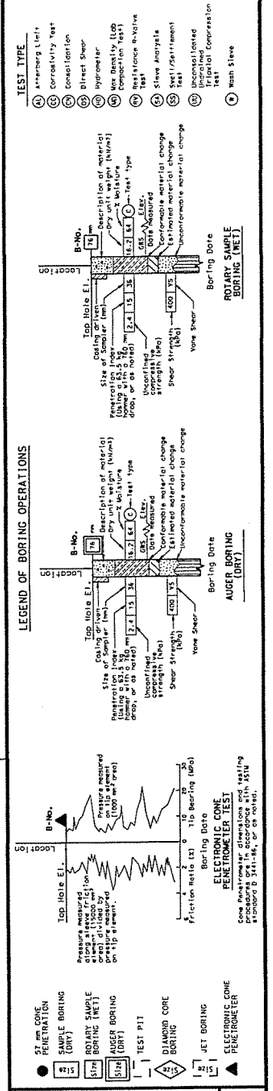
PROFILE VIEW

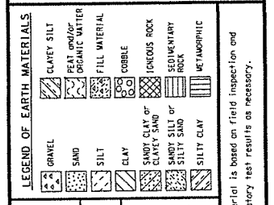
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.





CONSISTENCY CLASSIFICATION FOR SOILS

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DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

PLANS APPROVAL DATE

Philip Meymand No. 2596 Exp. 6/30/09 REGISTERED PROFESSIONAL ENGINEER GEOTECHNICAL STATE OF CALIFORNIA

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DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO.
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/13/05		PROJECT ENGINEER	KILOMETER POST 37.9/41.3

SR4 "CNOB" LINE STA 269+60 TO 271+60

LOG OF TEST BORINGS

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228501

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 10/31/05 7/28/06 8/28/06 2/28/07 10/25/07

SHEET 28 OF 30

FILE => ...\b-28.dgn

USERNAME => Christina,Pacheco PLOTTED => 11/7/2007 TIME PLOTTED => 4:12:46 PM

BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

CONTROL & BENCHMARK
No. BART-185

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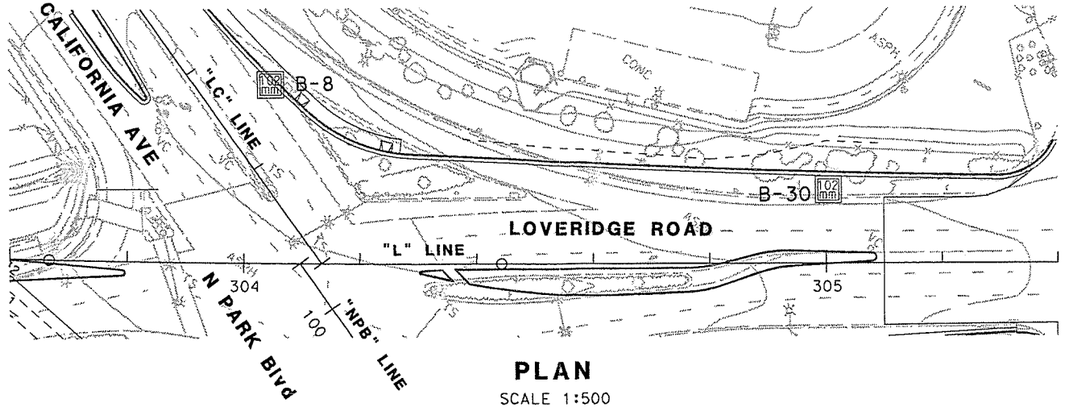
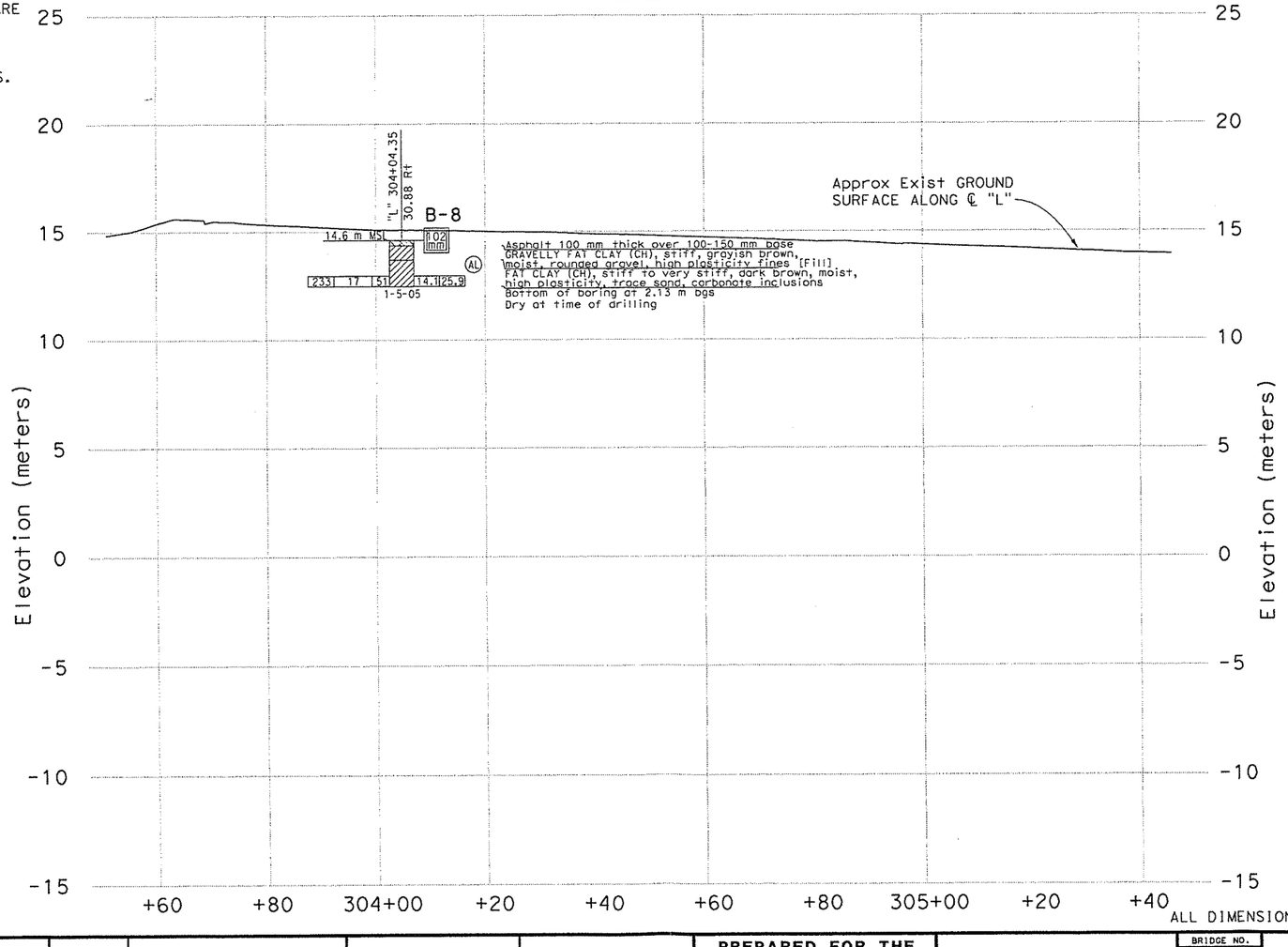


PLAN
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

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Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
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REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymond — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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LEGEND OF BORING OPERATIONS

TEST TYPE
(A) Atterberg Limit (C) Consolidation (DS) Direct Shear (H) Hydrometer (M) Max. Density (Mod. Compaction Test) (R) Resistance R-Value (SA) Sieve Analysis (SE) Sand Equivalent Test (UC) Unconsolidated Undrained Compression Test (W) Wash Sieve

ROTARY SAMPLE BORING (MET)
AUGER BORING (DRY)

LEGEND OF EARTH MATERIALS
GRAVEL, SAND, SILT, CLAY, CLAYEY SILT, PEAT and/or ORGANIC MATTER, FILL MATERIAL, COBBLE, SANDY CLAY or CLAYEY SAND, CLAYEY SILT or SILTY SAND, IGNEOUS ROCK, SEDIMENTARY ROCK, METAMORPHIC, SILTY CLAY

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

SPT N-Value (Blows/0.3m)	Granular	SPT N-Value (Blows/0.3m)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO.	SR4 "L" LINE STA 303+60 TO 305+40
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/05/05		PROJECT ENGINEER	KILOMETER POST 37.9/41.3	LOG OF TEST BORINGS

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228501

FILE => ...\b-29.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY)										SHEET	OF
10/17/05	7/28/06	8/03/06	7/28/07	10/25/07						29	30

USERNAME => Christina.Padelford PLOTTED => 11/7/2007 TIME PLOTTED => 4:12:50 PM

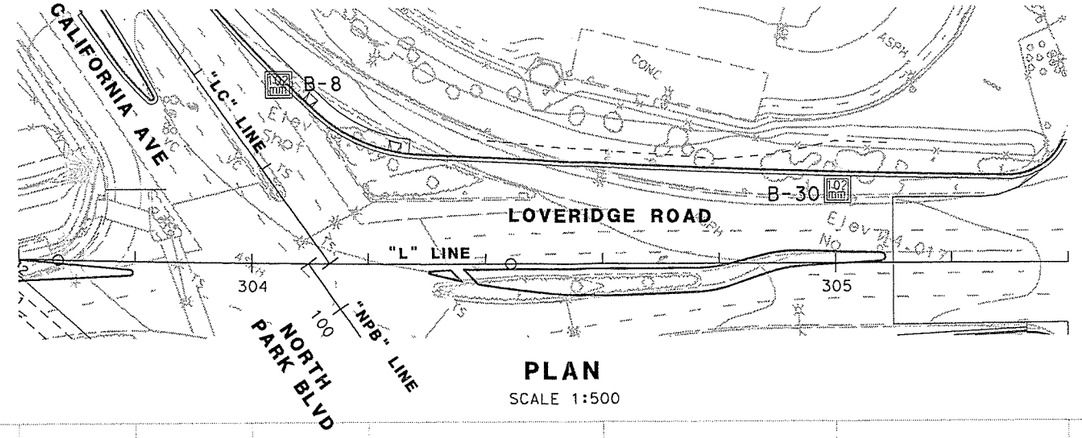
BENCH MARKS

BENCH MARK DATA
NORTHING=669454.97892
EASTING=1878040.53361
ELEVATION=17.943 m

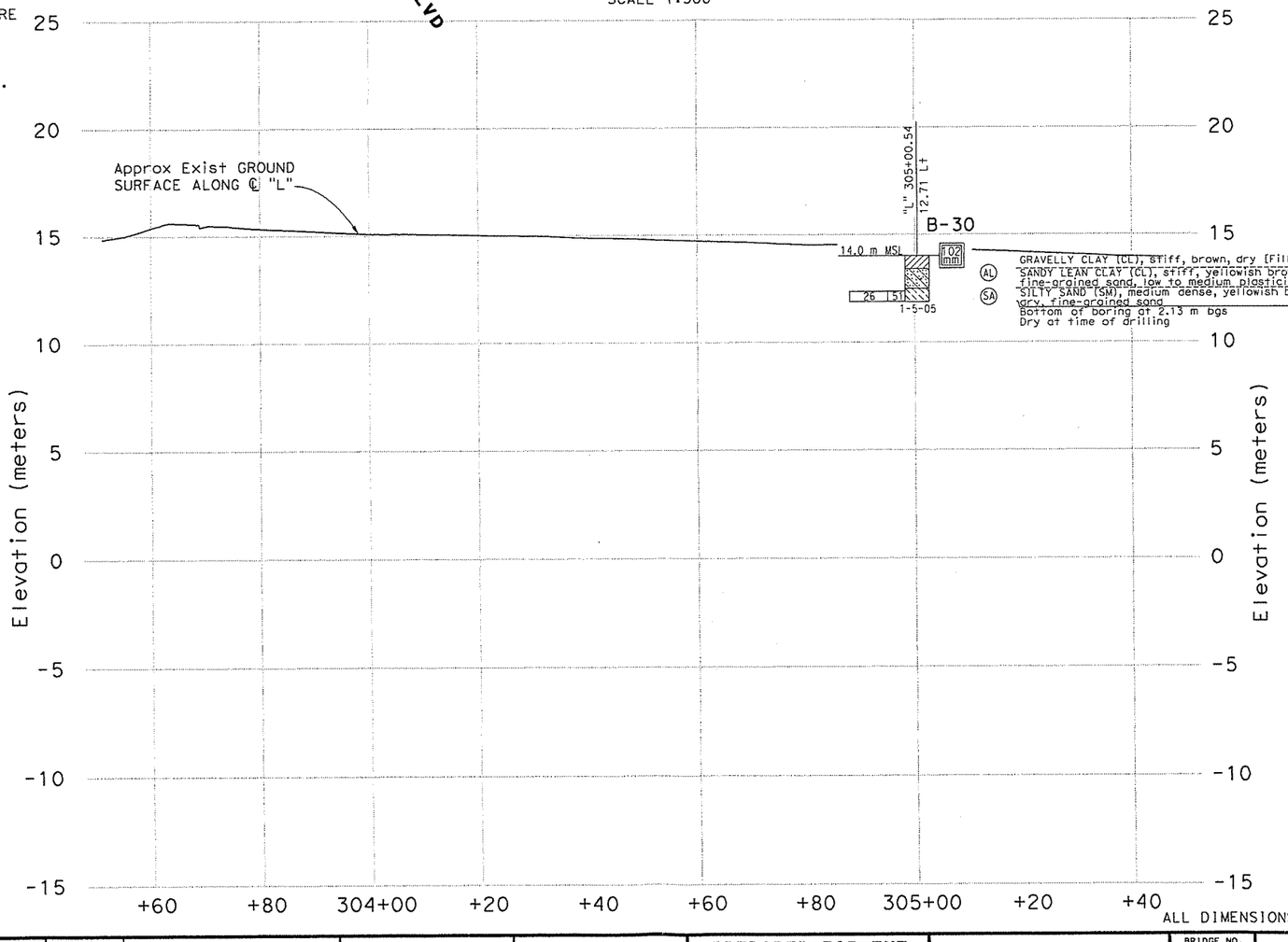
CONTROL & BENCHMARK
No. BART-185

BEING A 3-1/2 INCH BRASS DISC FOUND AT THE NORTHWEST QUADRANT OF THE LOVERIDGE/ ROUTE 4 INTERCHANGE. THE DISC IS STAMPED "BART CONTROL No. 185". THE DISC LIES 26.737 METERS LEFT OF STATION 245+68.164 "WB4" LINE.
NORTHING=668761.20457
EASTING=1879751.30811
ELEVATION=16.434 m

ELEVATIONS SHOWN ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1929 (NGVD 29) IN METERS.



PLAN
SCALE 1:500



PROFILE VIEW
Horiz 1:500
Vert 1:125

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

NOTE:

AN AUTOMATIC TRIP HAMMER WAS USED TO ADVANCE THE SAMPLER USING A 63.5 kg HAMMER WITH A 762 mm DROP.

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3	XX	XX

REGISTERED GEOTECHNICAL ENGINEER — DATE

REGISTERED PROFESSIONAL ENGINEER — Philip Meymand — No. 2596 — Exp. 6/30/09 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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LEGEND OF BORING OPERATIONS

TEST TYPE
(A) Atterberg Limit (CR) Corrosivity Test (CN) Consolidation (DS) Direct Shear (HY) Hydrometer (MD) Max. Density (Lab Compaction Test) (R) Resistance R-value Test (SA) Sieve Analysis (SE) Sand Equivalent Test (UC) (Unconsolidated Undrained) Compression Test (M) Wash Sieve

AUGER BORING (DRY)
B-No.
Location
Top Hole El.
Description of material: Dry unit weight (kN/m³), % Moisture, Test type
Penetration resistance (blows per 0.3 m drop, or as noted)
Date Measured
Unconfined compressive strength (kPa)
Coring Drilling
Site of Sampler (m)
Unconfined compressive strength (kPa)
Boring Date
Vane Shear
Shear Strength (kPa)

ROTARY SAMPLE BORING (WET)
Conformate material change
Interpolated material change
Unconformate material change

AUGER BORING (WET)

ELECTRONIC CONE PENETROMETER TEST
Pressure measured on tip element (1000 kPa max.)
Pressure measured on tip element.
Friction reads (kPa)
Tip Bearing (MPa)
Cone Penetrometer conducted using procedure ASTM D 3441, as revised.

57 mm CONE PENETRATION
CORE BARREL BORING (CBR)
ROTARY SAMPLE BORING (WET)
AUGER BORING (DRY)
TEST PIT
DIAMOND CORE BORING
JET BORING
ELECTRONIC CONE PENETROMETER

LEGEND OF EARTH MATERIALS
GRAVEL; SAND; SILT; CLAY; CLAYEY SILT; PEAT and/or ORGANIC MATTER; FILL MATERIAL; COBBLE; SANDY CLAY or CLAYEY SAND; SANDY SILT or SILTY SAND; SILTY CLAY; IGNEOUS ROCK; SEDIMENTARY ROCK; METAMORPHIC

CONSISTENCY CLASSIFICATION FOR SOILS
According to the Standard Penetration Test

Soil N-Value (Blows/0.3m)	Granular	Soil N-Value (Blows/0.3m)	Cohesive
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31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very stiff
		>31	Hard

NOTE: Visual classification of earth material is based on field inspection and is confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT	DRAWN BY	C. SOMERA	S. MURUGAIAH	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. BERGER	BRIDGE NO.	SR4 "L" LINE STA 303+60 TO 305+40
SIGN OFF DATE	CHECKED BY	N. MEYER	FIELD INVESTIGATION BY: DATE: 01/05/05		PROJECT ENGINEER	KILOMETER POST 37.9/41.3	LOG OF TEST BORINGS

CIVIL LOG OF TEST BORINGS SHEET (METRIC) (REV. 2/1/00)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228501

FILE => ...\b-30.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY)										SHEET	OF
10/17/05	1/23/06	8/28/06	2/28/07	10/25/07						30	30

USERNAME => Christina.Padilla PLOTTED => 11/7/2007 TIME PLOTTED => 4:12:54 PM

Appendix B
Laboratory Test Results

TABLE B-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information			USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, kN/m³	Sieve / Hydrometer				Atterberg Limits			UC Strength, kPa	UU Triaxial		Other Tests
Boring Number	Sample Number	Depth, meters				Gravel, %	Sand, %	<#200, %	<5μ, %	LL	PL	PI		Peak Deviator Stress, kPa	Confining Pressure, kPa	
B-2	2-2-4	1.98	CL	15.7	16.7					39	17	22	258			
B-4	4-1	0.6-1.2	CL							41	16	25				
B-4	4-2-3	1.83	CL	19.9	16.4								335			
B-4	4-3-3	3.35	SM			1	53	47								
B-4	4-5	6.25	SM			9	74	18								
B-6	6-1	0.6-1.7	CL							43	16	27				
B-6	6-2-3	1.98	CL	12.4	13.5								108			
B-7	7-1	0.6-1.5	CH													CORR
B-7	7-2-3	1.83	CL	10.8	15.1					39	18	21				
B-7	7-3A	2.4-3.0	CL													CORR
B-7	7-4-3	4.88	CL	19.8	16.4								578			
B-7	7-6-2	7.77	CL	17.6	15.8					42	18	24				SWELL
B-7	7-7-2	9.30	ML	22.3	15.0	0	43	57								
B-7	7-9-3	12.50	CL	24.5	15.4											SWELL
B-7	7-11-2	15.39	CH	33.4	13.8					87	27	60	175			
B-8	8-1	0.9-1.2	CH							52	18	34				
B-8	8-2-3	1.98	CH	25.9	14.1								233			
B-9	9-2-3	1.83	CH	23.8	14.8								137			
B-9	9-3	3.35	SM	20.3	14.2									45	62	
B-9	9-4-3	4.88	CL	17.5	17.1								129			
B-9	9-5-3	6.40	CL	24.1	14.4					31	17	14	16			
B-9	9-7-2	9.30	CH	34.3	13.4					52	21	31	34			
B-9	9-9-2	12.34	CH	35.4	13.2											SWELL
B-9	9-10-2	13.87	CH	36.3	13.2					87	27	60	82			
B-9	9-12-3	18.59	CL	20.6	16.8								152			
B-9	9-13-3	21.64	CH	23.0	16.2					51	24	27	508			
B-10	10-6-3	7.92	SM	8.6	14.3	0	72	28								
B-10	10-9-3	12.50	CL	26.3	15.2					40	18	22	99			

TABLE B-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information			USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, kN/m³	Sieve / Hydrometer				Atterberg Limits			UC Strength, kPa	UU Triaxial		Other Tests
Boring Number	Sample Number	Depth, meters				Gravel, %	Sand, %	<#200, %	<5μ, %	LL	PL	PI		Peak Deviator Stress, kPa	Confining Pressure, kPa	
B-10	10-12-2	18.44	CH	34.9	13.6					98	28	70	173			
B-10	10-13-3	21.64	SM	20.4	16.9											
B-12	12-1	0.6-1.5	CH													COMP
B-12	12-3-3	3.35	CH	28.2	13.9					88	27	61	268			
B-12	12-5-3	6.40	CH	30.6	13.5								195			
B-12	12-6-3	7.92	CH							84	26	58				
B-12	12-8-3	10.97	CH	31.4	13.3								158			
B-13	13-2-3	1.83	ML	21.7	15.6			64	29				53			
B-13	13-3B	3.35	SM			0	59	41								
B-13	13-5	6.25	ML					56	21							
B-14	14-3A	2.7-3.0	CL													CORR
B-14	14-3-3	3.20	CL	21.1	15.4			65	22	32	22	10	140			
B-14	14-5-4	6.40	ML	13.1	15.4											
B-16	16-1	0.6-1.5	CL													COMP
B-16	16-3-4	3.35	CL	20.2	16.5					48	18	30	257			
B-16	16-5	6.25	SM			1	72	28								
B-16	16-6B	7.92	CL	22.8	14.0											
B-16	16-8-4	10.97	CL	21.6	15.4								164			
B-17	17-1	0.6-1.5	CL													COMP
B-17	17-3-4	3.35	CL	20.4	16.5					44	17	27	235			
B-17	17-5-4	6.40	CL	19.3	15.9								370			
B-17	17-7-4	9.45	ML			0	43	57								
B-17	17-8-4	10.97	CL	15.9	17.6								192			
B-19	19-1	0.6-1.5	CL/CH													COMP
B-19	19-3A	3.0-3.7	CL													CORR
B-19	19-3-4	3.35	CL	17.8	17.3					34	16	18	182			
B-19	19-5-4	6.40	CL	19.0	16.5								191			
B-19	19-6-4	7.92	CL	11.1	15.8											

TABLE B-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information			USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, kN/m³	Sieve / Hydrometer				Atterberg Limits			UC Strength, kPa	UU Triaxial		Other Tests
Boring Number	Sample Number	Depth, meters				Gravel, %	Sand, %	<#200, %	<5μ, %	LL	PL	PI		Peak Deviator Stress, kPa	Confining Pressure, kPa	
B-20	20-1-4	1.83	CL	22.1	15.7								53			
B-20	20-2-3	3.20	CL							31	16	15				CORR
B-20	20-3-3	4.72	CL	18.1	17.0											CONS
B-20	20-3-4	4.88	CL													CORR
B-20	20-5	7.77	SM			3	72	25								
B-20	20-7-4	10.97	CL	17.0	17.6								280			
B-20	20-10-4	15.54	CL	21.6	16.4											CONS
B-20	20-11-4	18.59	CL	30.2	14.5								285			
B-20	20-12-4	21.64	CL	32.3	14.6					42	19	23	25			
B-21	21-1-3	1.83	CL/CH	21.4	15.6								109			
B-21	21-2-2	3.20	SM													CORR
B-21	21-4	6.10	CL/CH	22.0	15.6									135	86	
B-21	21-6-3	9.45	CL							48	21	27				
B-21	21-7-3	10.97	CL	18.4	16.6											CONS
B-21	21-8-3	12.50	CL	20.0	16.1								371			
B-21	21-9-2	13.87	CH			1	30	70								
B-21	21-10-2	15.39	CH	32.9	13.7								106			
B-21	21-11-2	18.44	CH							82	26	56				
B-21	21-14-2	27.58	ML	28.7	14.7								68			
B-22	22-2-4	1.98	CH	23.6	15.7					51	16	35				
B-23	23-1	0.6-1.5	CH													COMP
B-23	23-2-4	1.83	CH	22.8	16.0					51	17	34	175			
B-23	23-3-4	3.35	CL	18.7	17.0								160			
B-23	23-4-4	4.88	SM			2	71	27								
B-23	23-5-4	6.40	CL	17.4	17.2								210			
B-24	24-3A	2.7-3.0	CL													CORR
B-24	24-3-4	3.35	CL	13.3	17.6					33	15	18	256			
B-24	24-4-4	4.88	ML	15.0	14.9			67	27				100			

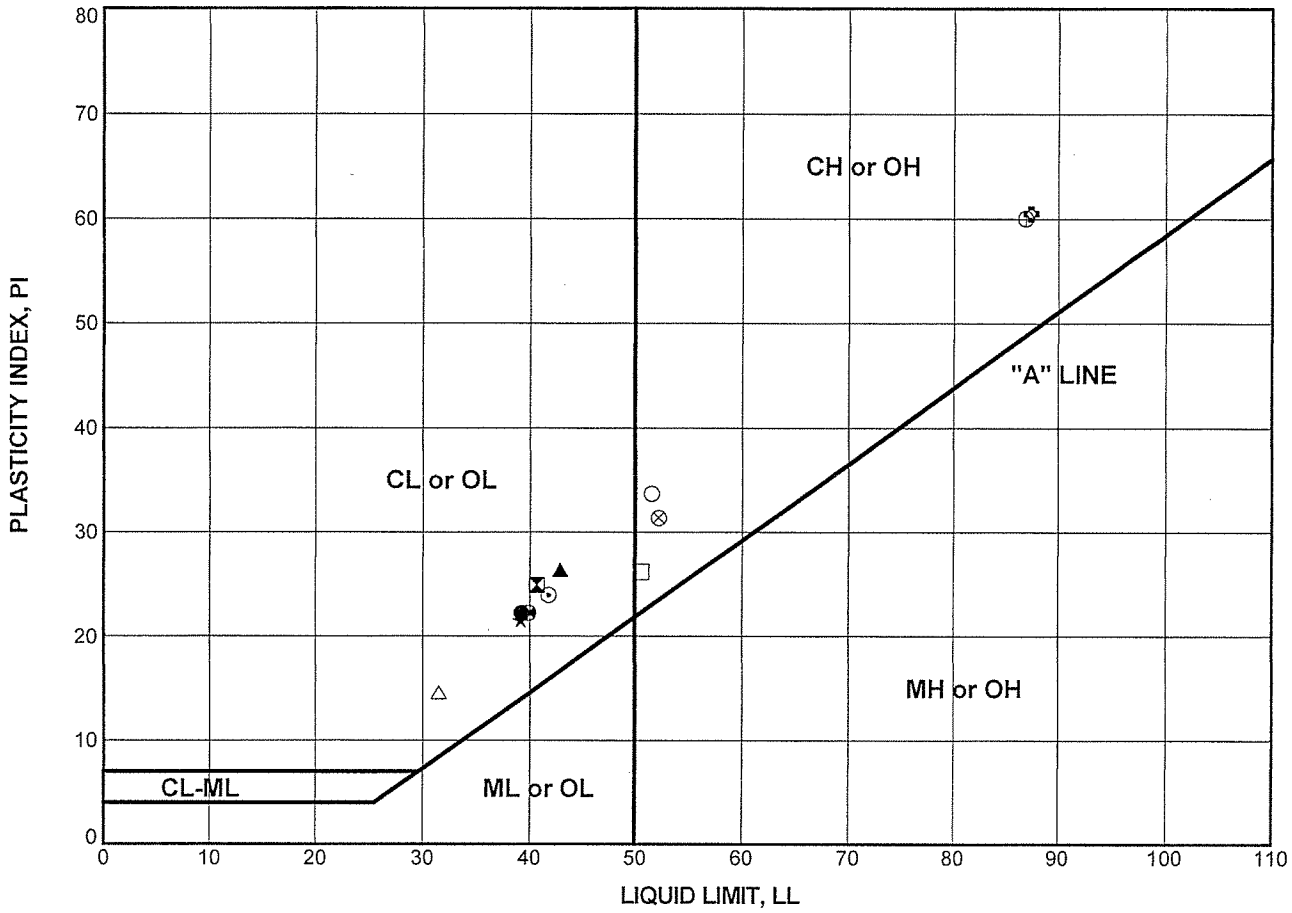
Report SOIL_1_PORTRAIT_SA_AL_UCUU_5M_MET; OAK_SR4PITTS.GPJ; 2/23/2005

TABLE B-1
SUMMARY OF SOIL LABORATORY DATA

Sample Information			USCS Group Symbol	In Situ Water Content, %	In Situ Dry Unit Weight, kN/m³	Sieve / Hydrometer				Atterberg Limits			UC Strength, kPa	UU Triaxial		Other Tests
Boring Number	Sample Number	Depth, meters				Gravel, %	Sand, %	<#200, %	<5μ, %	LL	PL	PI		Peak Deviator Stress, kPa	Confining Pressure, kPa	
B-25	25-1	0.6-1.5	CH													COMP
B-25	25-2-4	1.83	CL	10.3	15.7								188			
B-25	25-3-4	3.35	CL	16.4	15.9					46	19	27	505			
B-25	25-4-4	4.88	SM			2	82	16								
B-26	26-2-4	1.83	SC			1	58	41								
B-26	26-3	2.7-3.0	CH													CORR
B-27	27-2-4	1.83	CL	18.9	16.6					41	15	26	131			
B-27	27-3A	2.7-3.0	CL													CORR
B-27	27-3-4	3.35	CL	18.5	17.0								117			
B-27	27-4-4	4.88	CL	19.5	16.4					45	17	28	295			
B-27	27-5-4	6.40	CH	33.1	12.7								60			
B-29	29-2-4	1.83	CH	23.0	15.6					55	17	38	235			
B-29	29-3A	2.7-3.0	CL													CORR
B-29	29-4-4	4.11	CL	18.7	16.9								329			
B-30	30-1	0.6-1.2	CL							37	17	20				
B-30	30-2-3	1.98	SM			0	81	19								

The laboratory tests were performed in general accordance with the following ASTM standards:

Water Content - ASTM Test Method D2216
Dry Unit Weight - ASTM Test Method D2937
Particle Size Distribution Analysis by Mechanical Sieving and Hydrometer - ASTM Test Method D422
Atterberg Limits - ASTM Test Method D4318
Unconfined Compressive Strength Test (UC, q_u in kPa) - ASTM Test Method D2166
Unconsolidated Undrained Triaxial Compression Test (UU Triaxial) - ASTM Test Method D2850
One-dimensional Consolidation Test (CONS) - ASTM Test Method D2435
One-dimensional Swell/Settlement Potential Test (SWELL) - ASTM Test Method D4546
Laboratory Compaction Test (COMP) - ASTM Test Method D1557-B
Corrosivity Suite of Chemical Tests (CORR) - Redox by ASTM Test Method D1498; pH by ASTM Test Method D4972; Resistivity by ASTM Test Method G57; Sulfate Content and Chloride Content by ASTM Test Method D4327



Boring Number	Sample Number	Depth (meters)	Test Symbol	Moisture Content (%)	LL	PL	PI	Classification
B-2	2-2-4	1.98	●	16	39	17	22	Silty Lean Clay (CL)
B-4	4-1	0.23	⊠		41	16	25	Lean Clay (CL)
B-6	6-1	0.08	▲		43	16	27	Lean Clay (CL)
B-7	7-2-3	1.83	★	11	39	18	21	Silty Lean Clay (CL)
B-7	7-6-2	7.77	⊙	18	42	18	24	Silty Lean Clay (CL)
B-7	7-11-2	15.39	✪	33	87	27	60	Fat Clay (CH)
B-8	8-1	0.53	○		52	18	34	Fat Clay (CH)
B-9	9-5-3	6.40	△	24	31	17	14	Sandy Lean Clay (CL)
B-9	9-7-2	9.30	⊗	34	52	21	31	Fat Clay (CH)
B-9	9-10-2	13.87	⊕	36	87	27	60	Fat Clay (CH)
B-9	9-13-3	21.64	□	23	51	24	27	Fat Clay (CH)
B-10	10-9-3	12.50	⊠	26	40	18	22	Silty Lean Clay (CL)

Report: ATTERBERG_PLOT_12.PTS; File: OAK_SR4PITTS.GPJ; 2/23/2005

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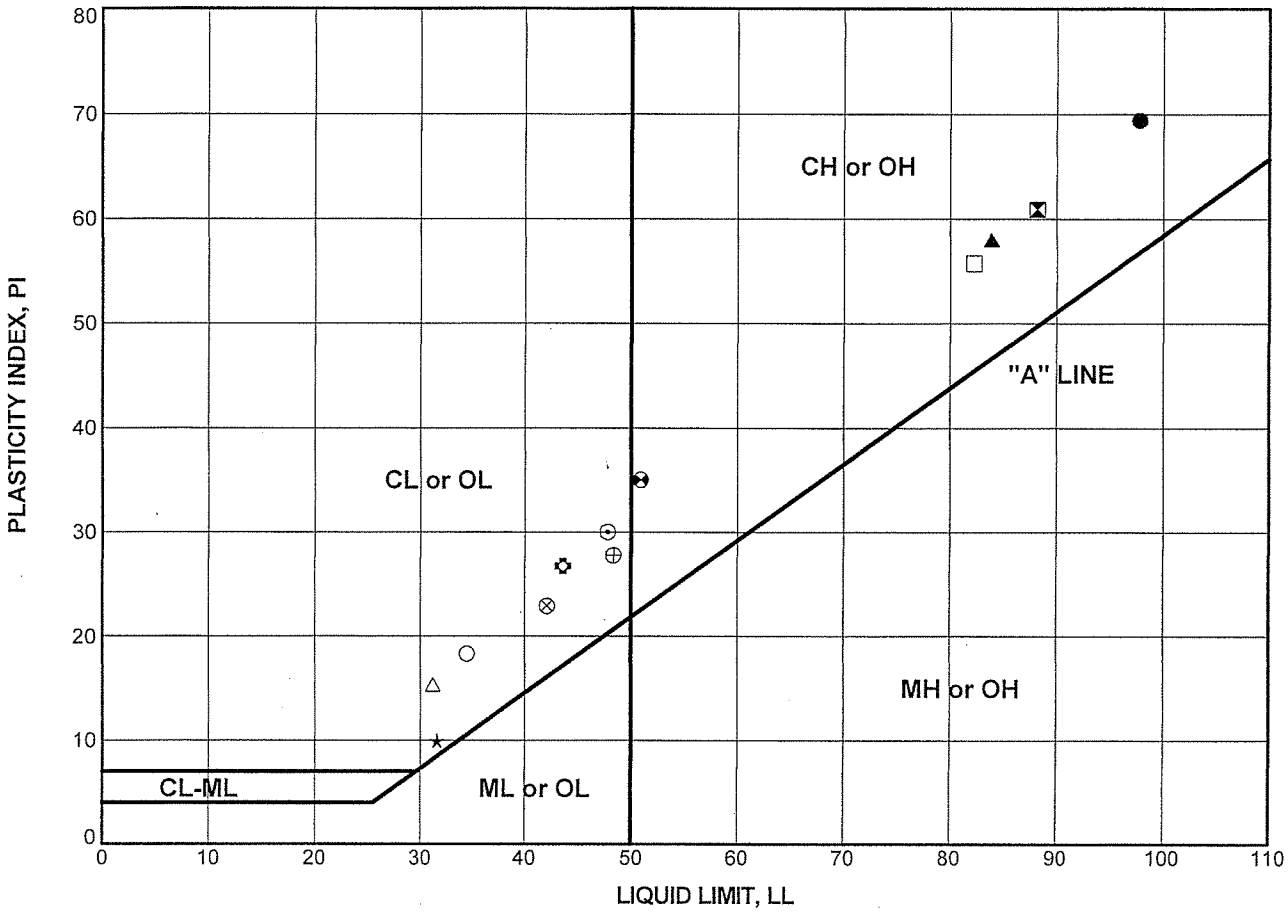
26814910.24000

PLASTICITY CHART

URS

Figure B-1



Boring Number	Sample Number	Depth (meters)	Test Symbol	Moisture Content (%)	LL	PL	PI	Classification
B-10	10-12-2	18.44	●	35	98	28	70	Silty Fat Clay (CH)
B-12	12-3-3	3.35	⊠	28	88	27	61	Fat Clay (CH)
B-12	12-6-3	7.92	▲		84	26	58	Fat Clay (CH)
B-14	14-3-3	3.20	★	21	32	22	10	Sandy Silty Lean Clay (CL)
B-16	16-3-4	3.35	⊙	20	48	18	30	Lean Clay (CL)
B-17	17-3-4	3.35	✿	20	44	17	27	Sandy Lean Clay (CL)
B-19	19-3-4	3.35	○	18	34	16	18	Sandy Lean Clay (CL)
B-20	20-2-3	3.20	△		31	16	15	Lean Clay with Sand (CL)
B-20	20-12-4	21.64	⊗	32	42	19	23	Sandy Lean Clay (CL)
B-21	21-6-3	9.45	⊕		48	21	27	Lean Clay with Sand (CL)
B-21	21-11-2	18.44	□		82	26	56	Sandy Fat Clay (CH)
B-22	22-2-4	1.98	⊖	24	51	16	35	Fat Clay with Sand (CH)

Report: ATTERBERG_PLOT_12 PTS; File: OAK_SR4PITTS.GPJ; 2/23/2005

State Route 4 Loveridge to Somersville Road
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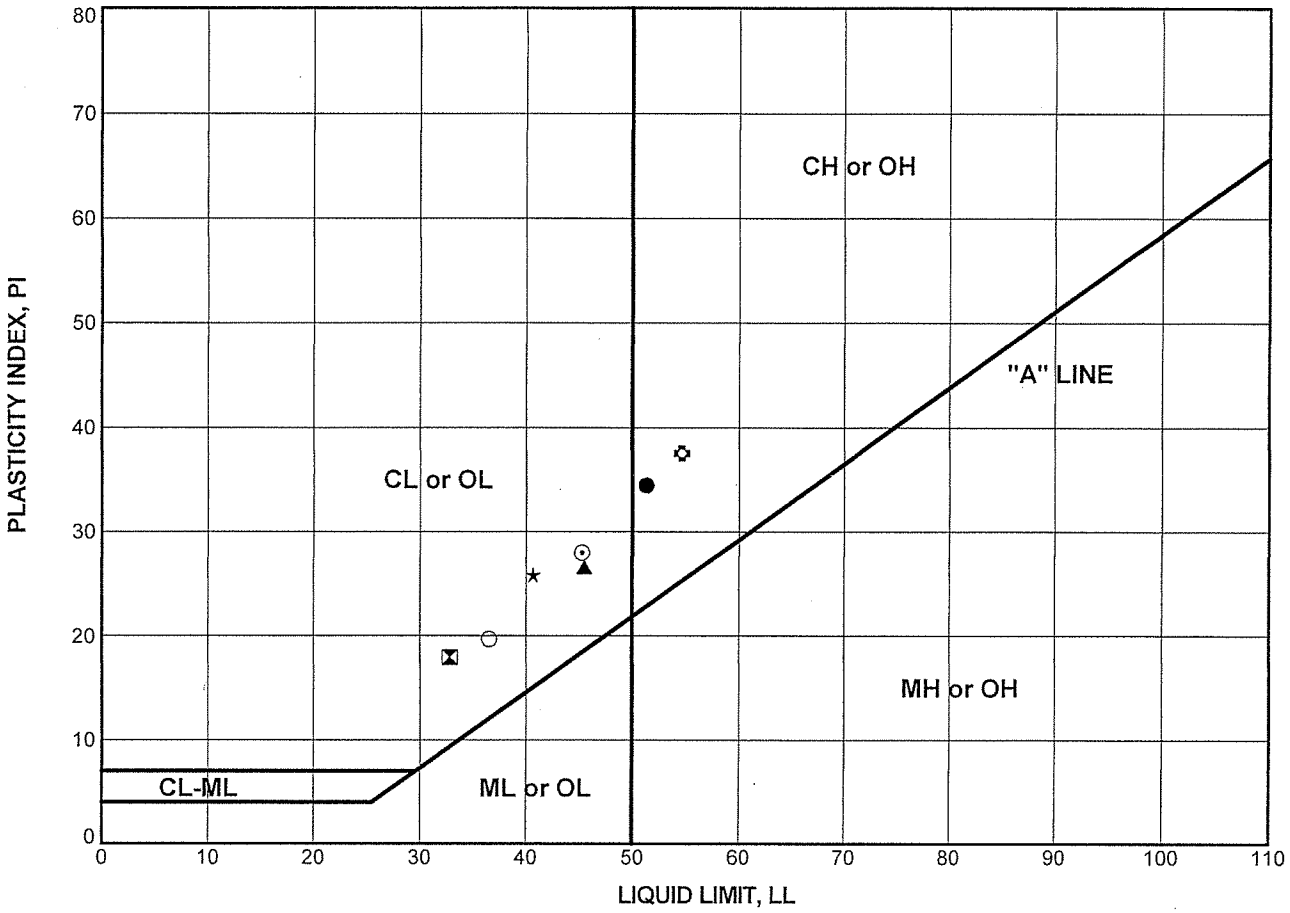
PLASTICITY CHART

URS

Figure B-2



Boring Number	Sample Number	Depth (meters)	Test Symbol	Moisture Content (%)	LL	PL	PI	Classification
B-23	23-2-4	1.83	●	23	51	17	34	Fat Clay (CH)
B-24	24-3-4	3.35	⊠	13	33	15	18	Lean Clay (CL)
B-25	25-3-4	3.35	▲	16	46	19	27	Lean Clay (CL)
B-27	27-2-4	1.83	★	19	41	15	26	Lean Clay with Sand (CL)
B-27	27-4-4	4.88	⊙	19	45	17	28	Sandy Lean Clay (CL)
B-29	29-2-4	1.83	✿	23	55	17	38	Fat Clay (CH)
B-30	30-1	0.23	○		37	17	20	Sandy Lean Clay (CL)

Report: ATTERBERG_PLOT_12 PTS; File: OAK_SR4PITTS.GPJ; 2/23/2005

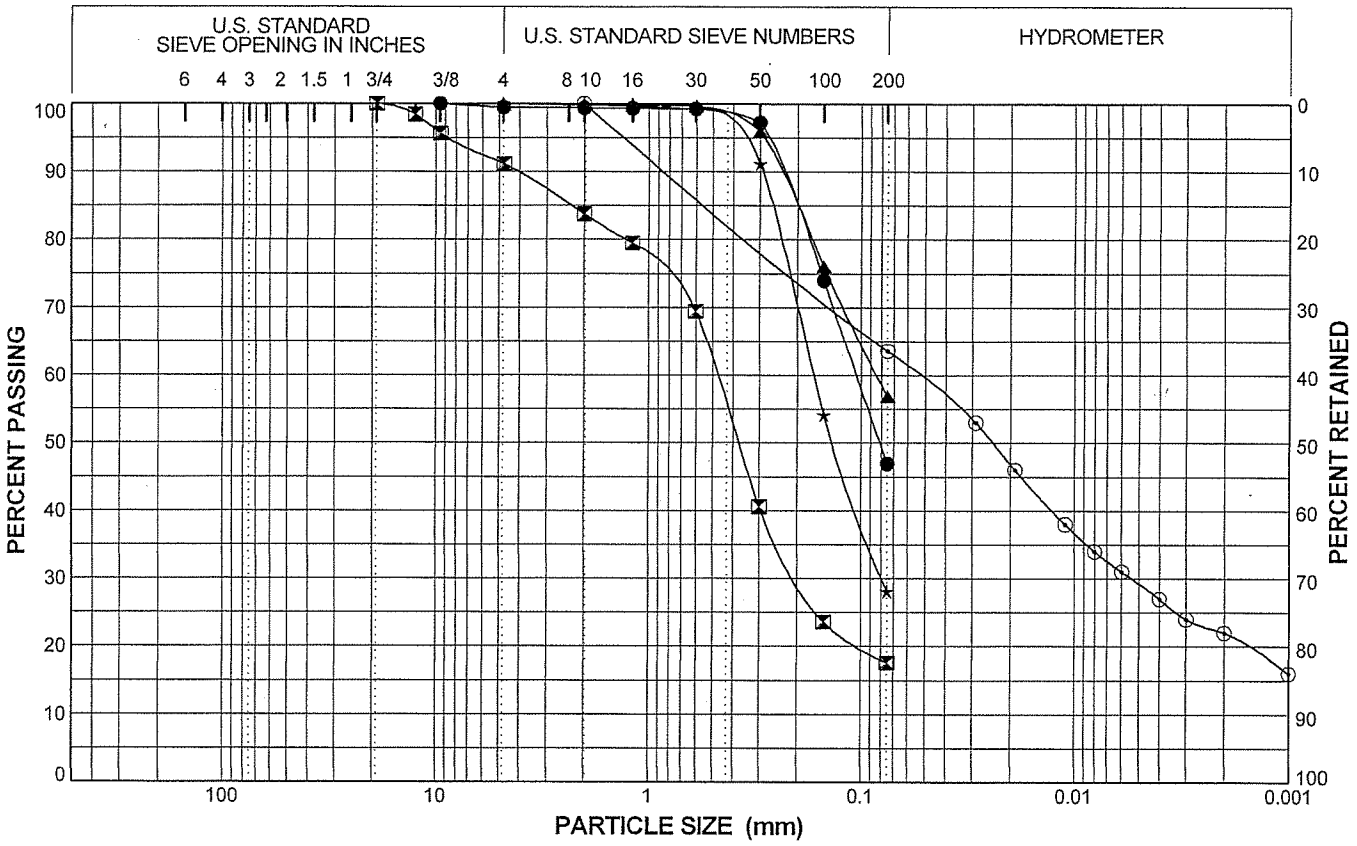
State Route 4 Loveridge to Somersville Road
Pittsburg, California
26814910.24000

PLASTICITY CHART

URS

Figure B-3

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (meters)	Symbol	LL	PI	Classification
B-4	4-3-3	3.35	●			Silty Sand (SM)
B-4	4-5	6.25	⊠			Silty Sand (SM)
B-7	7-7-2	9.30	▲			Sandy Silt (ML)
B-10	10-6-3	7.92	★			Silty Sand (SM)
B-13	13-2-3	1.83	⊙			Sandy Silt (ML)

State Route 4 Loveridge to Somersville Road
Pittsburg, California
26814910.24000

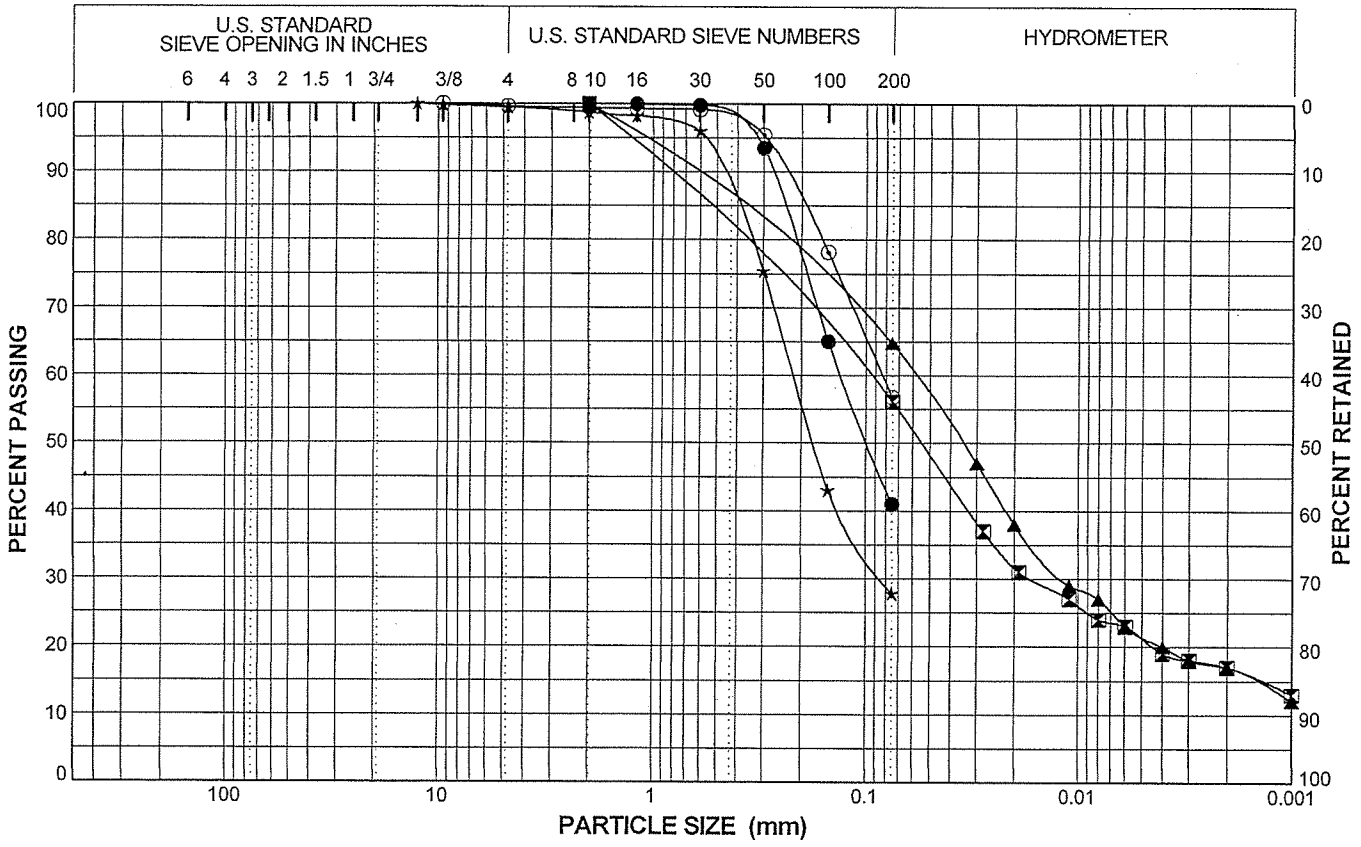
PARTICLE SIZE DISTRIBUTION CURVES

Figure B-4

URS

Report: SIEVE_5_CURVES_OAK; File: OAK_SR4PITTS.GPJ; 2/23/2005

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (meters)	Symbol	LL	PI	Classification
B-13	13-3B	3.35	●			Silty Sand (SM)
B-13	13-5	6.25	⊠			Sandy Silt (ML)
B-14	14-3-3	3.20	▲	32	10	Sandy Silty Lean Clay (CL)
B-16	16-5	6.25	★			Silty Sand (SM)
B-17	17-7-4	9.45	⊙			Sandy Silt (ML)

State Route 4 Loveridge to Somersville Road
Pittsburg, California
26814910.24000

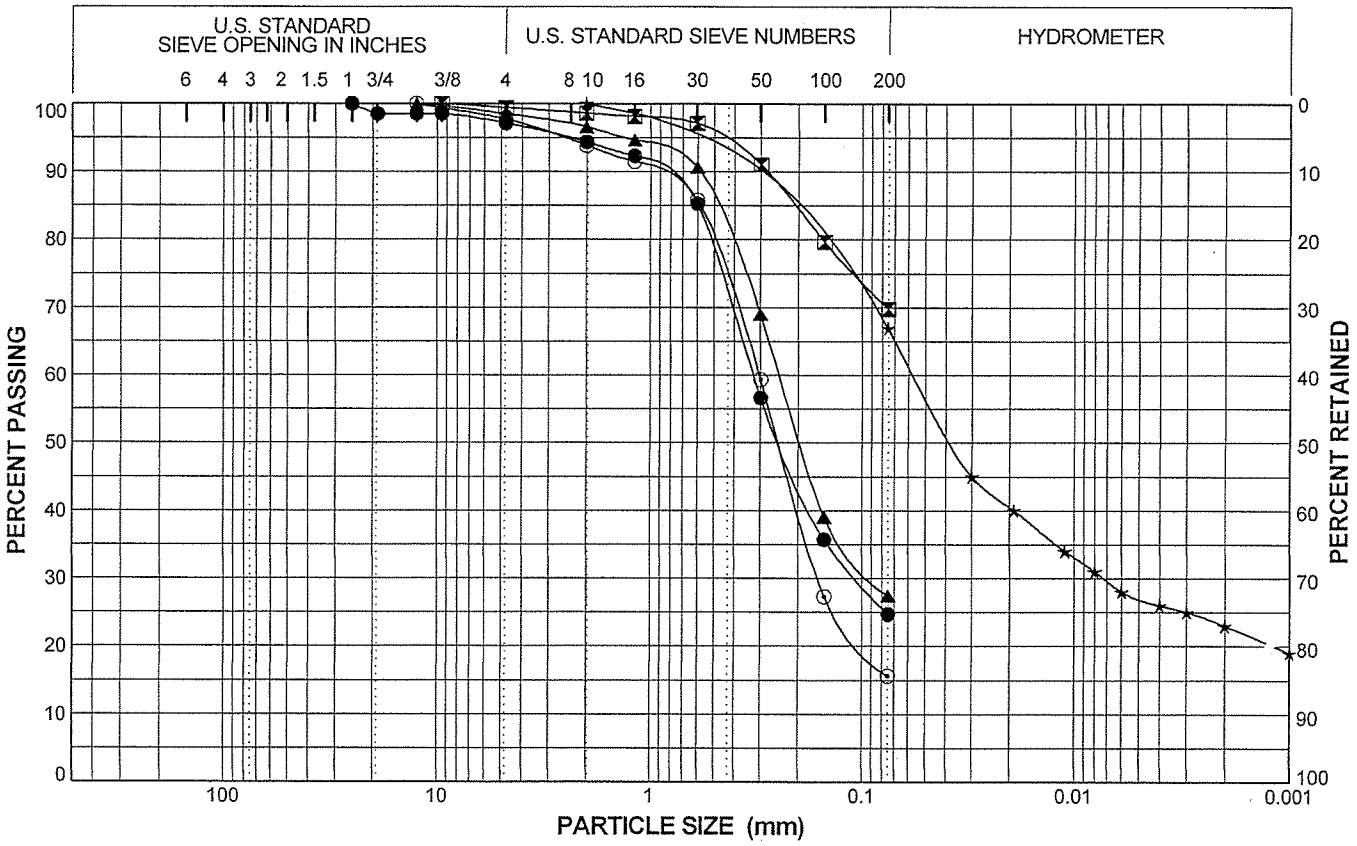
PARTICLE SIZE DISTRIBUTION CURVES

URS

Figure B-5

Report: SIEVE_5_CURVES_OAK; File: OAK_SR4PITTS.GPJ; 2/23/2005

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (meters)	Symbol	LL	PI	Classification
B-20	20-5	7.77	●			Silty Sand (SM)
B-21	21-9-2	13.87	⊠			Sandy Fat Clay (CH)
B-23	23-4-4	4.88	▲			Silty Sand (SM)
B-24	24-4-4	4.88	★			Sandy Silt (ML)
B-25	25-4-4	4.88	⊙			Silty Sand (SM)

State Route 4 Loveridge to Somersville Road
Pittsburg, California
26814910.24000

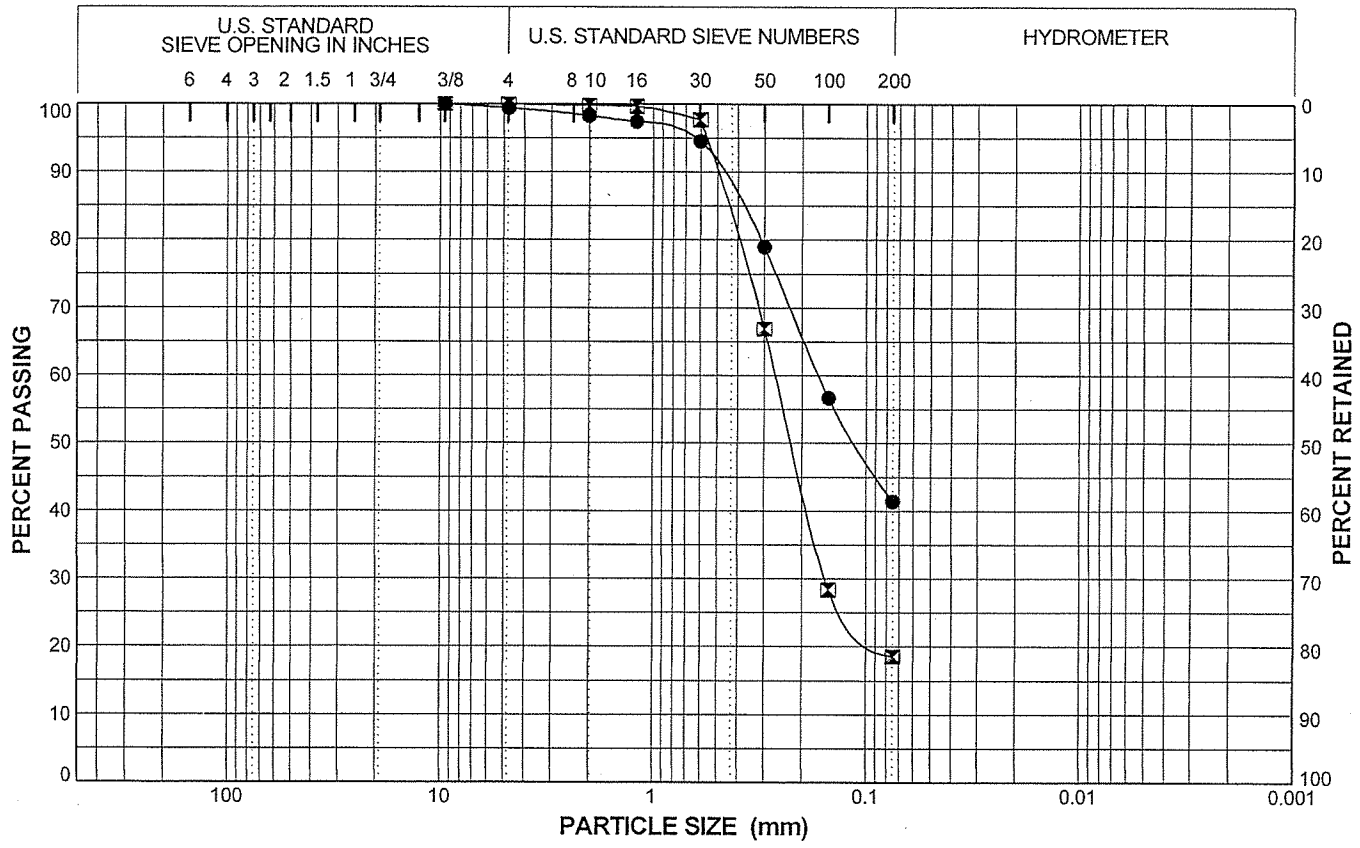
PARTICLE SIZE DISTRIBUTION CURVES

Figure B-6

URS

Report: SIEVE_5_CURVES_OAK; File: OAK_SR4PITTS.GPJ; 2/23/2005

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



Boring Number	Sample Number	Depth (meters)	Symbol	LL	PI	Classification
B-26	26-2-4	1.83	●			Clayey Sand (SC)
B-30	30-2-3	1.98	⊠			Silty Sand (SM)

Report: SIEVE_5_CURVES_OAK; File: OAK_SR4PITTS.GPJ; 2/23/2005

State Route 4 Loveridge to Somersville Road
Pittsburg, California
26814910.24000

PARTICLE SIZE DISTRIBUTION CURVES

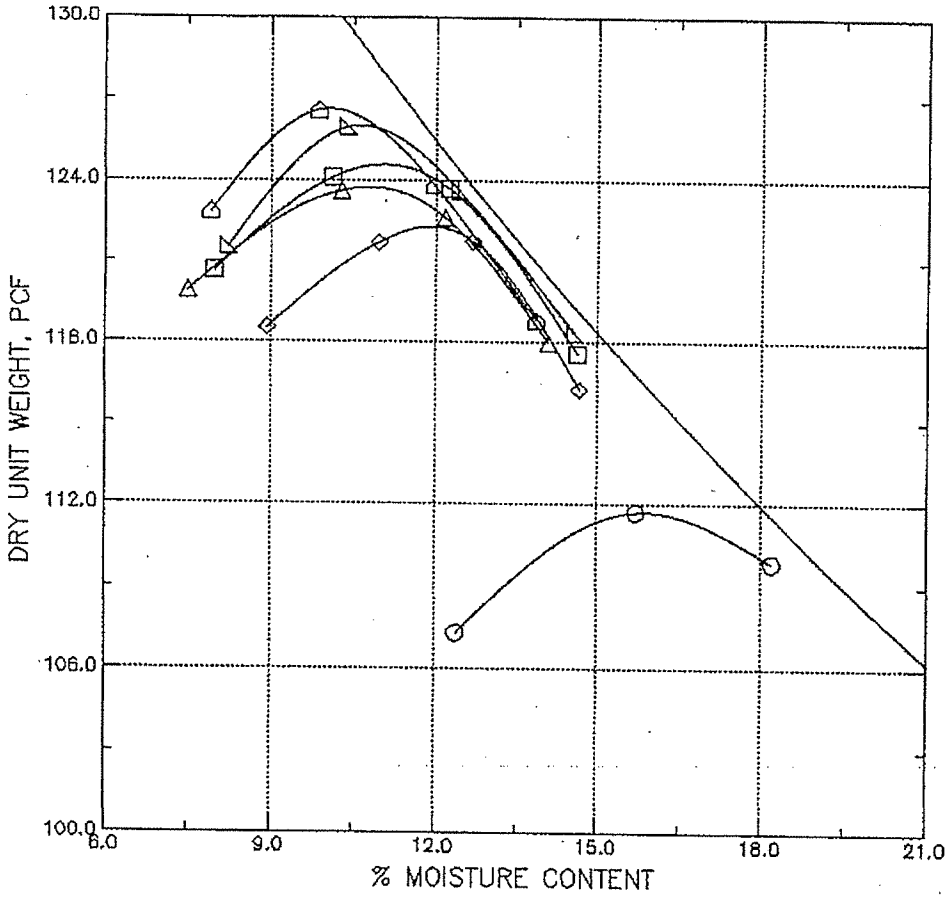
Figure B-7

URS

URS

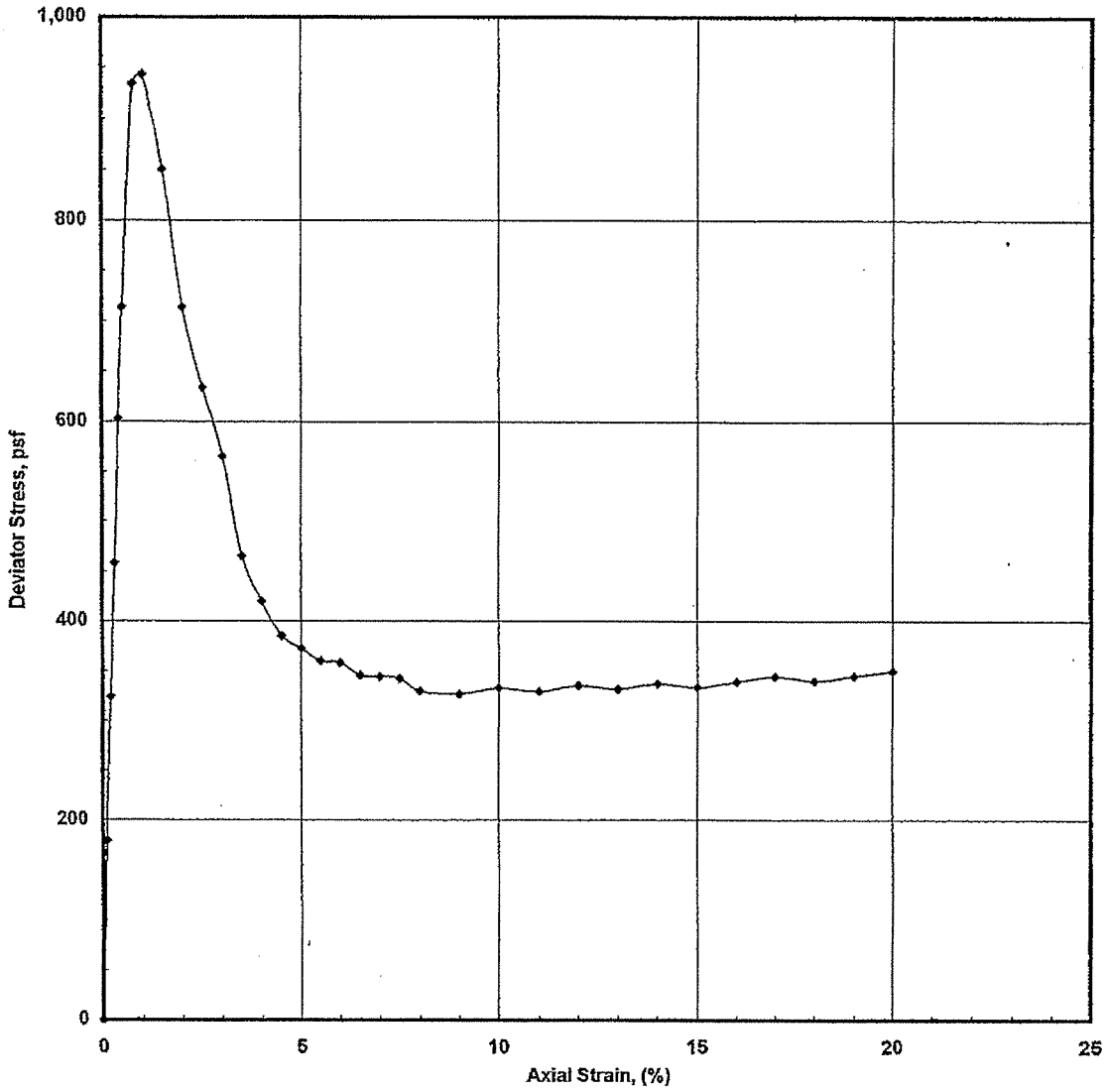
Project : SR 4 Loveridge to Somersville Rd.
Project No.: 26814910.24000
Location : Pittsburg, CA
Date: Fri Feb 11 2005

COMPACTION



Symbol	Boring No.	Sample No.	Depth	Filename	Maximum Dry Density, PCF	Optimum Moisture Content, %
◇	B-12	1	2.0-5.0 feet	B12-01	111.7	15.9
△	B-16	1	2.0-5.0 feet	B16-01	123.7	10.8
□	B-19	1	2.0-5.0 feet	B19-01	124.6	11.1
◇	B-23	1	2.0-5.0 feet	B23-01	122.3	11.9
△	B-17	1	2.0-5.0 feet	B17-01	126.6	10.1
△	B-25	1	2.0-5.0 feet	B25-01	126.0	10.6

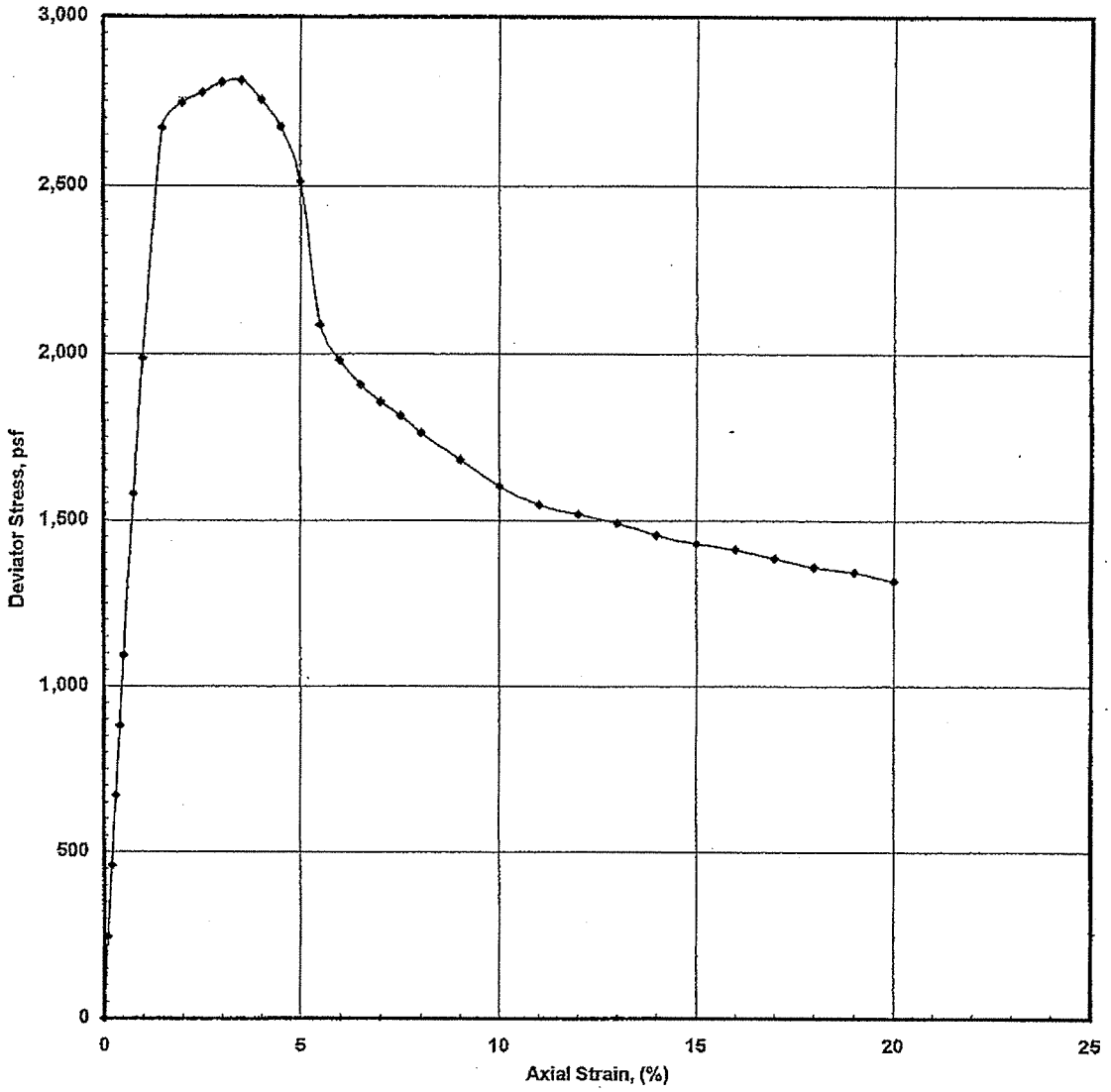
Figure B-8



Description: Brown clayey silty sand

Boring Number	Sample Number	Sample Depth (feet)	Dry Unit Weight (pcf)	Initial Moisture Content (%)	Specific Gravity (assumed)	Void Ratio	Initial Saturation (%)	Height/ Diameter Ratio	Rate of Shearing (%/min)	Confining Pressure (psf)	Peak Deviator Stress (psf)	Peak Shear Stress (psf)
B-9	3	11.0	90.6	20.3	2.65	0.825	65.1	2.08	0.75	1,300	943	472

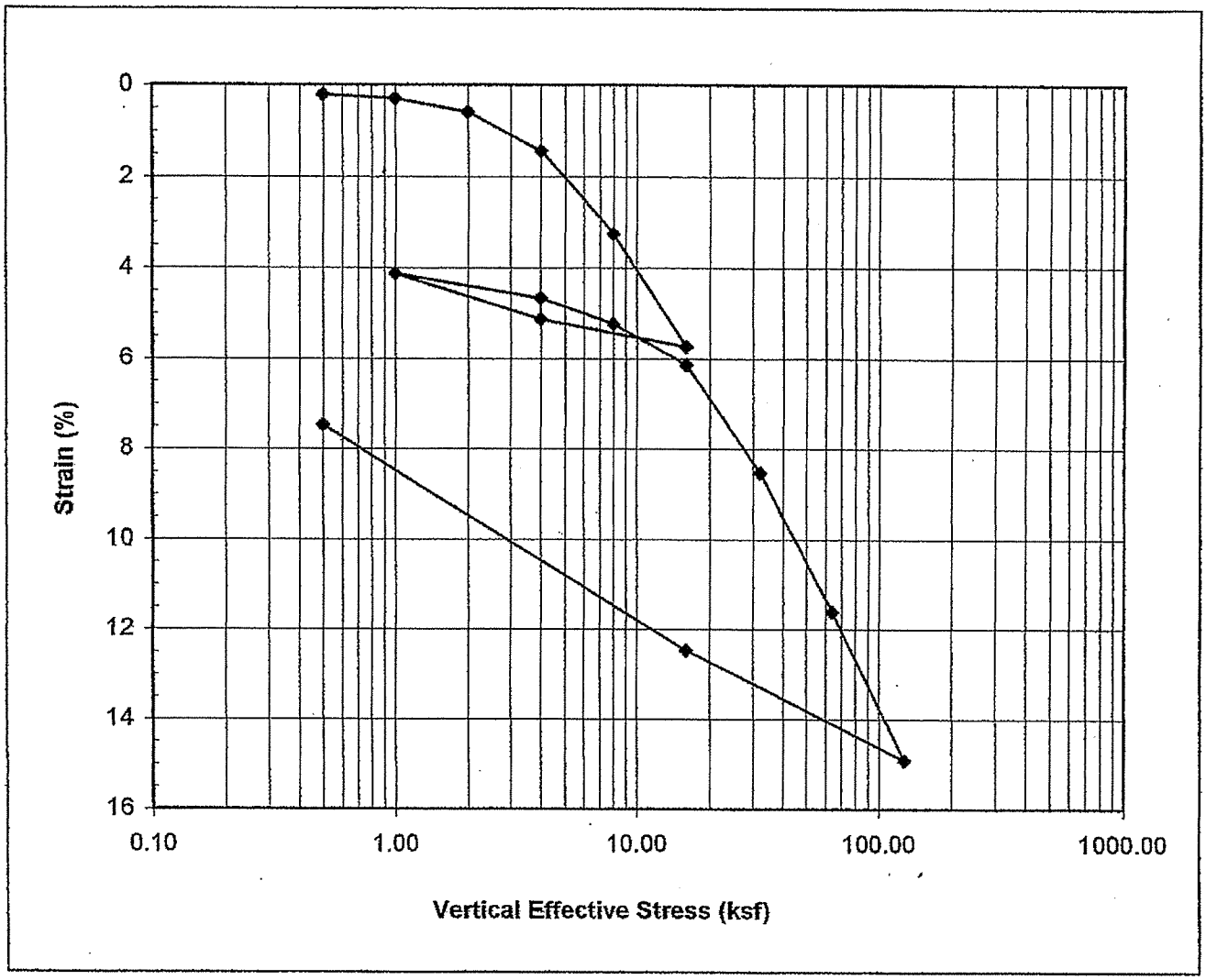
Project Name: SR 4	**UNCONSOLIDATED UNDRAINED TRIAXIAL TEST STRESS VS. STRAIN ASTM D2850**	URS
Project Number: 26814910.24000		Figure No. B-9
Location: Pittsburg, , CA		



Description: Brown sandy clay

Boring Number	Sample Number	Sample Depth (feet)	Dry Unit Weight (pcf)	Initial Moisture Content (%)	Specific Gravity (assumed)	Void Ratio	Initial Saturation (%)	Height/ Diameter Ratio	Rate of Shearing (%/min)	Confining Pressure (psf)	Peak Deviator Stress (psf)	Peak Shear Stress (psf)
CB-21	4	20-22	99.3	22.0	2.65	0.666	87.7	2.08	0.75	1,800	2,812	1,406

Project Name: SR 4	**UNCONSOLIDATED UNDRAINED TRIAXIAL TEST STRESS VS. STRAIN ASTM D2850**	URS
Project Number: 26814910.24000		Figure No. B-10
Location: Pittsburg, , CA		



Boring: CB-21 Sample: 7-3 Depth, ft: 36.0

Description: Brown sandy clay

	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est	Liquid Limit	Plasticity Index
Initial	18.41	125.4	105.9	0.585	84.7	0.8960	1.938	2.690	NA	NA
Final	17.33	134.3	114.5	0.466	100.0	0.8291				

Project: **SR 4**

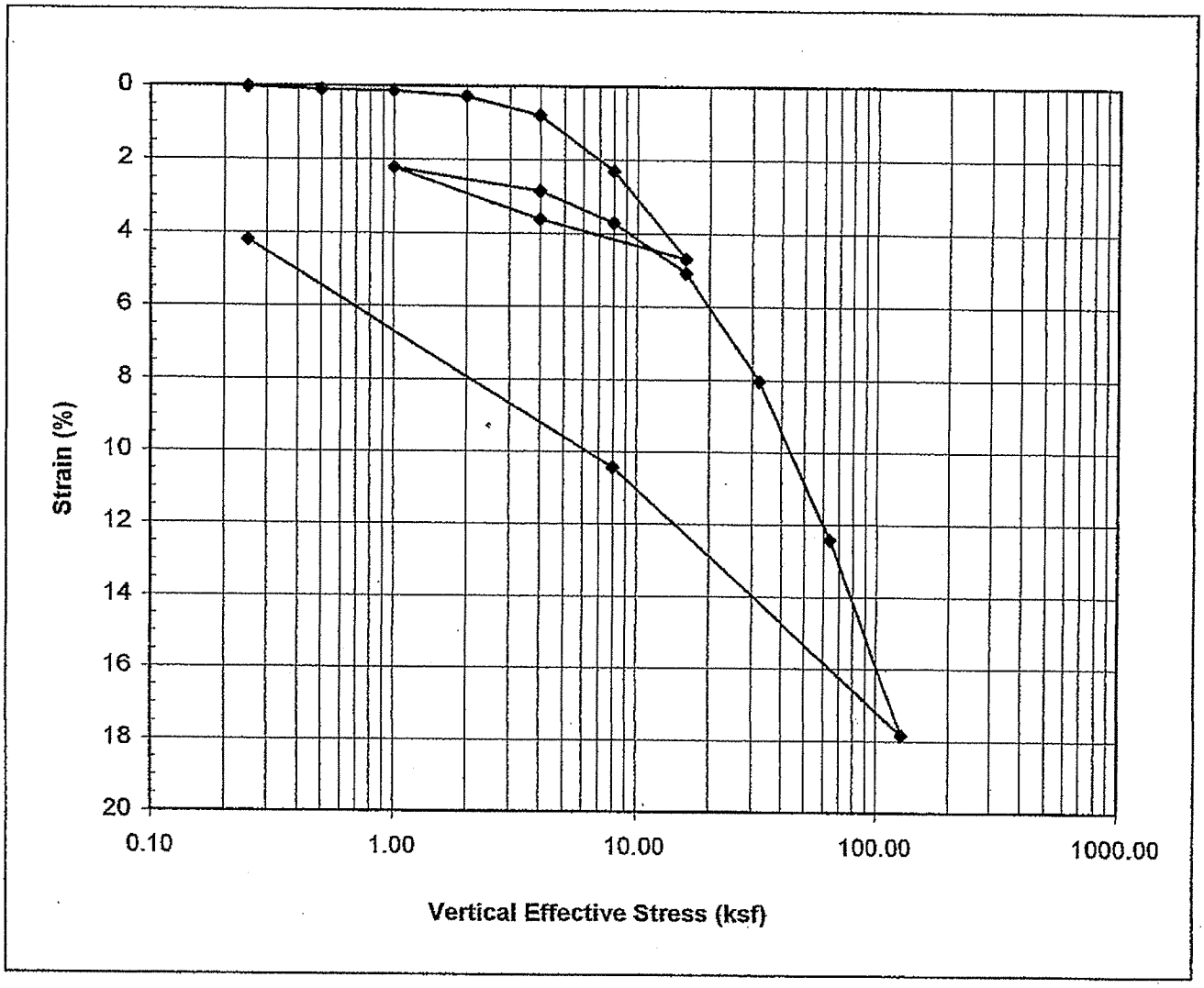
Project #: **26814910**

Date: **01/20/05**

URS

Consolidation Test

Figure: B-11



Boring: CB-20 Sample: 10-4 Depth, ft: 51.0

Description: Brown sandy clay

	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est.	Liquid Limit	Plasticity Index
Initial	21.60	126.8	104.2	0.610	95.2	0.8940	1.939	2.690	NA	NA
Final	20.17	130.8	108.8	0.543	100.0	0.8565				

Project: **SR 4**

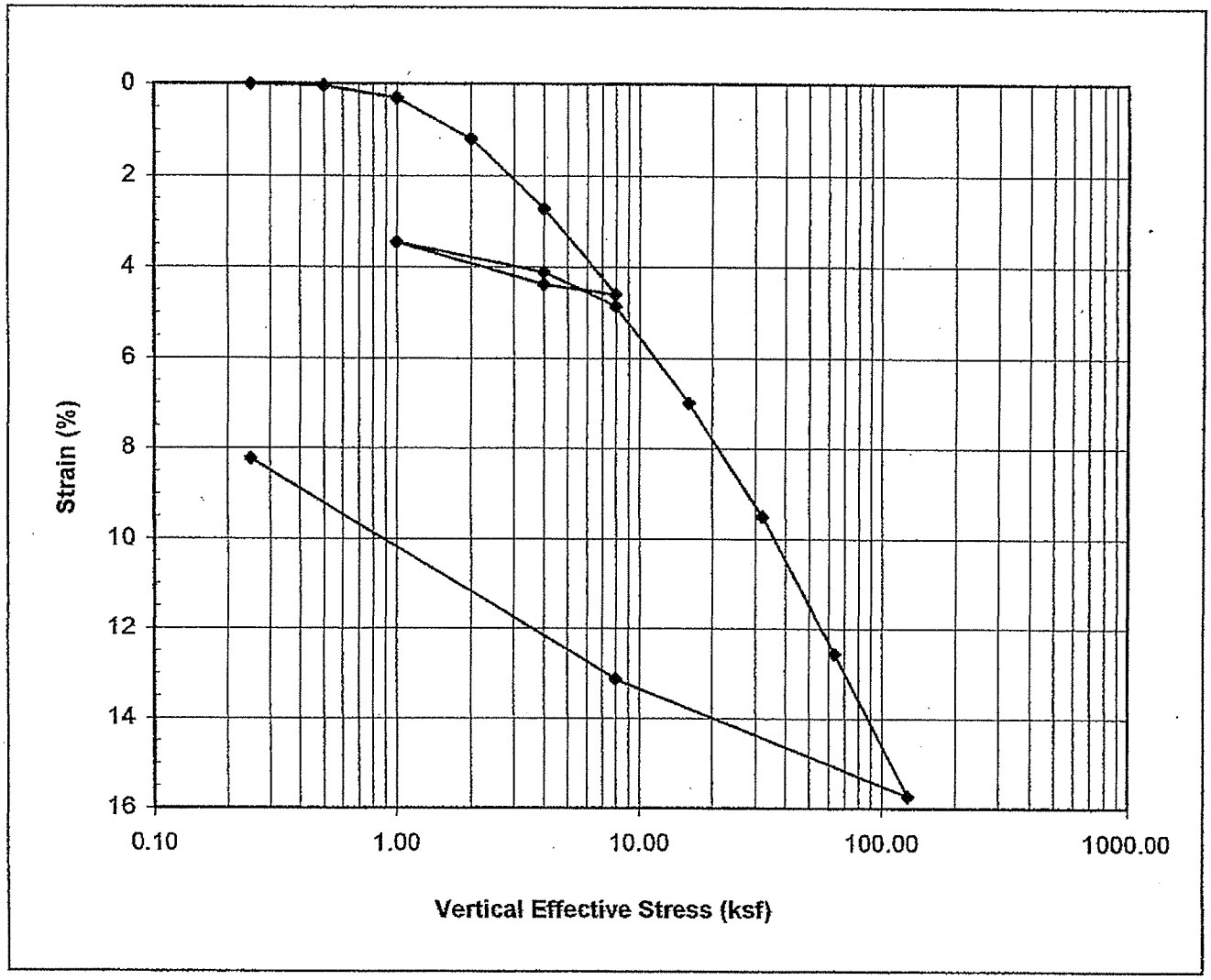
Project #: **26814910**

Date: **01/20/05**

URS

Consolidation Test

Figure: B-12



Boring: CB-20 Sample: 3-3 Depth, ft: 15.5

Description: Brown sandy clay

	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est.	Liquid Limit	Plasticity Index
Initial	18.05	128.0	108.5	0.611	82.7	0.9000	1.926	2.800	NA	NA
Final	17.07	138.4	118.2	0.478	99.9	0.8259				

Project: **SR 4**

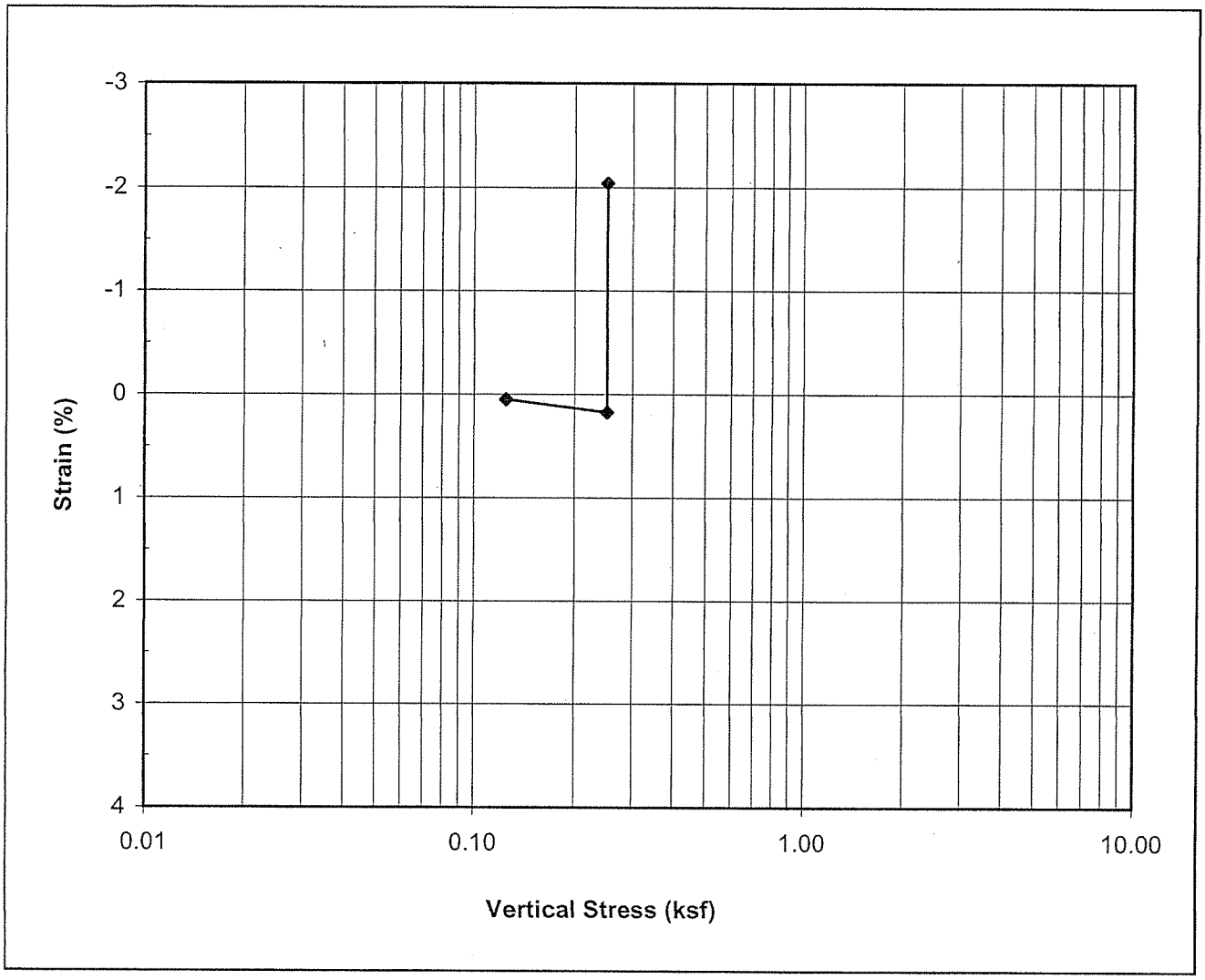
Project #: **26814910**

Date: **01/20/05**

URS

Consolidation Test

Figure: B-13



Boring: B-7 Sample: 6-2 Depth, ft: 25.5

Description: Brown fine sandy clay

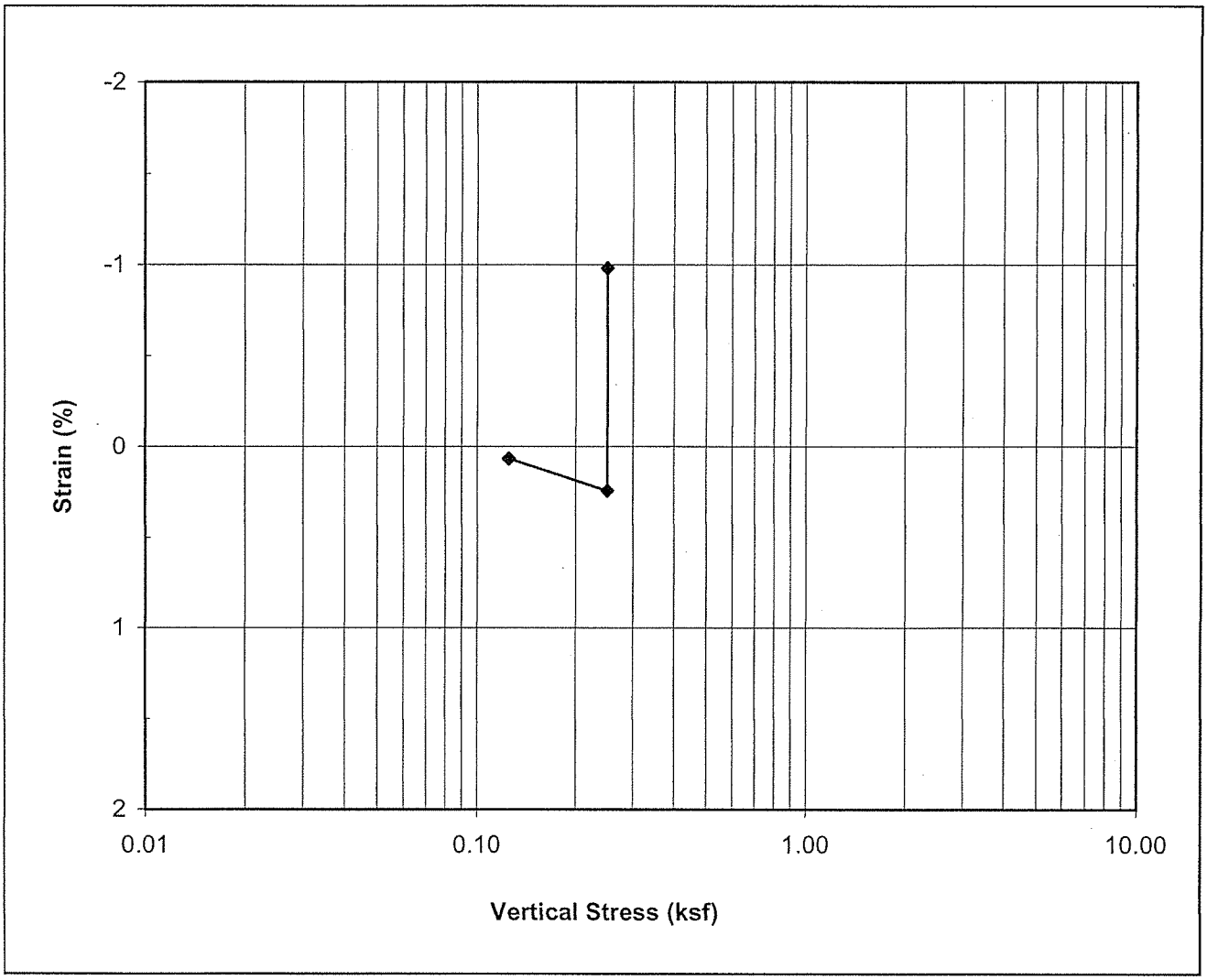
	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est.	Liquid Limit	Plasticity Index
Initial	17.57	118.2	100.5	0.645	72.2	0.4025	1.937	2.650	NA	NA
Final	25.61	123.7	98.5	0.679	100.0	0.4107				

Project: **SR 4**
Project #: **26814910**
Date: **02/10/05**

URS

Swell/Settlement Test

Figure: B-14



Boring: B-7 Sample: 9-3 Depth, ft: 41.0

Description: Brown fine sandy clay

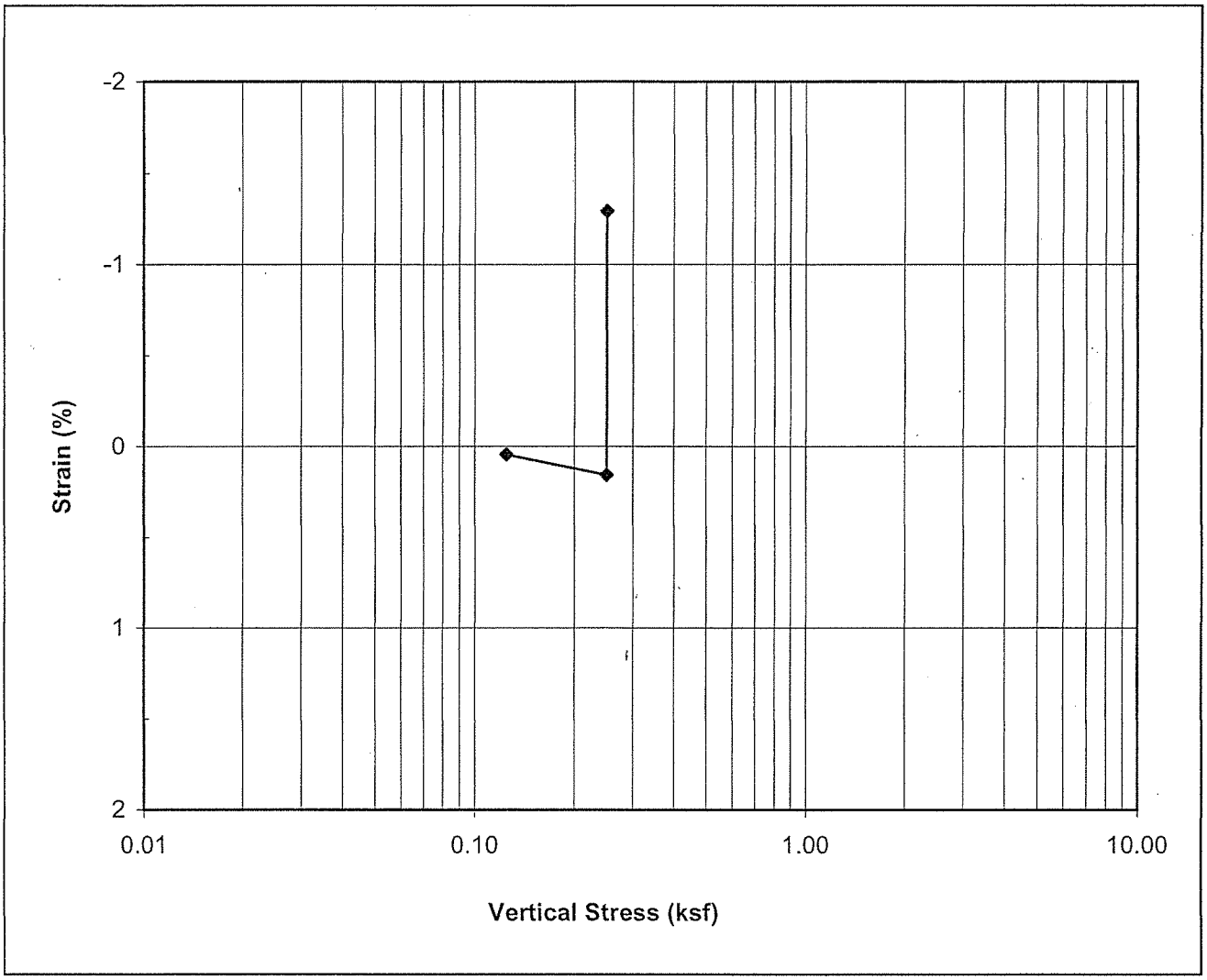
	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est.	Liquid Limit	Plasticity Index
Initial	24.54	122.4	98.3	0.714	92.8	0.4490	1.939	2.700	NA	NA
Final	27.05	123.7	97.4	0.731	100.0	0.4534				

Project: **SR 4**
Project #: **26814910**
Date: **02/10/05**

URS

Swell/Settlement Test

Figure: B-15



Boring: B-9 Sample: 9-2 Depth, ft: 40.5

Description: Brown fine sandy clay

	Water Content, %	Total Unit Weight, pcf	Dry Unit Weight, pcf	Void Ratio	Saturation, %	Height, inches	Diameter, inches	Specific Gravity, est.	Liquid Limit	Plasticity Index
Initial	35.42	113.7	83.9	1.007	95.0	0.4415	1.938	2.700	NA	NA
Final	38.24	114.6	82.9	1.033	100.0	0.4472				

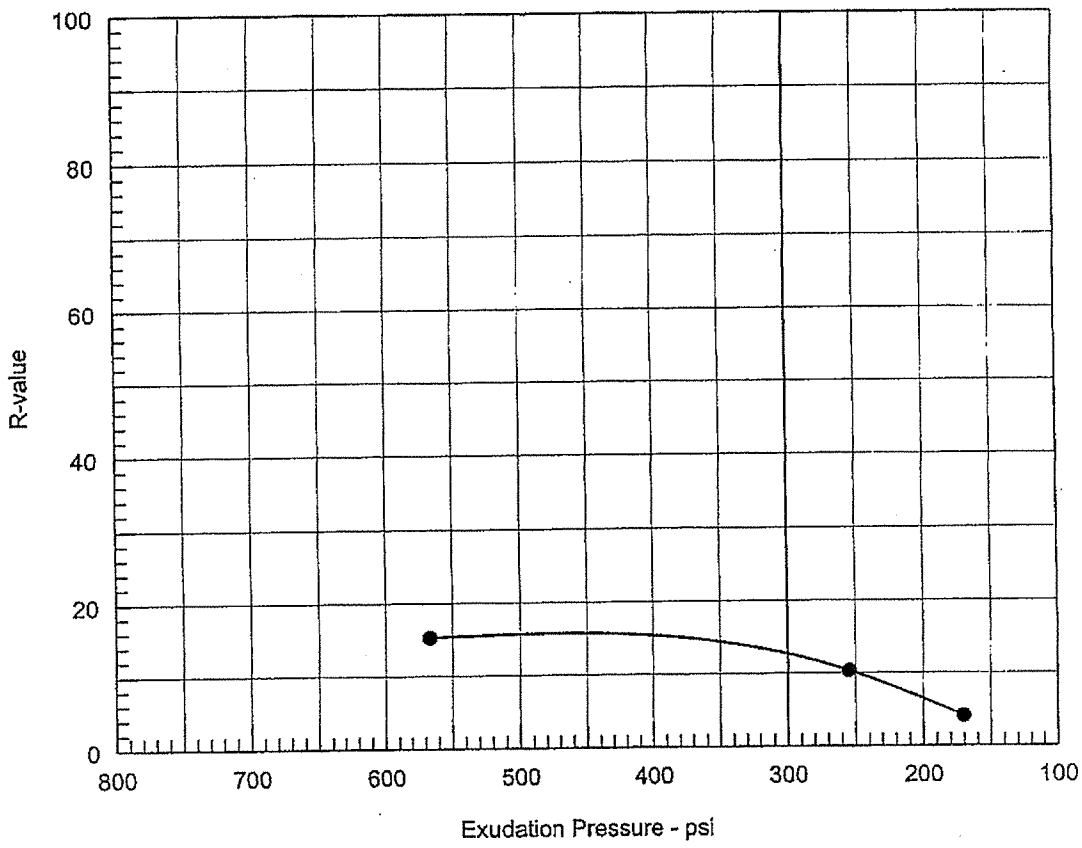
Project: **SR 4**
Project #: **26814910**
Date: **02/10/05**

URS

Swell/Settlement Test

Figure: B-16

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	50	109.0	18.1	0.24	128	2.65	567	14	15
2	40	112.7	19.8	0.00	138	2.65	255	9	10
3	30	110.3	20.7	0.00	150	2.60	170	4	4

Test Results	Material Description
R-value at 300 psi exudation pressure = 13	Brown silty clay, B-2-1, Type B, sampled received 1/31/2005

Project No.:
Project: SR 4 Loveridge to Somersville Rd
Location: B-2-1
Sample Number: S17378-1 **Depth:** 2-5ft
Date: 2/22/2005

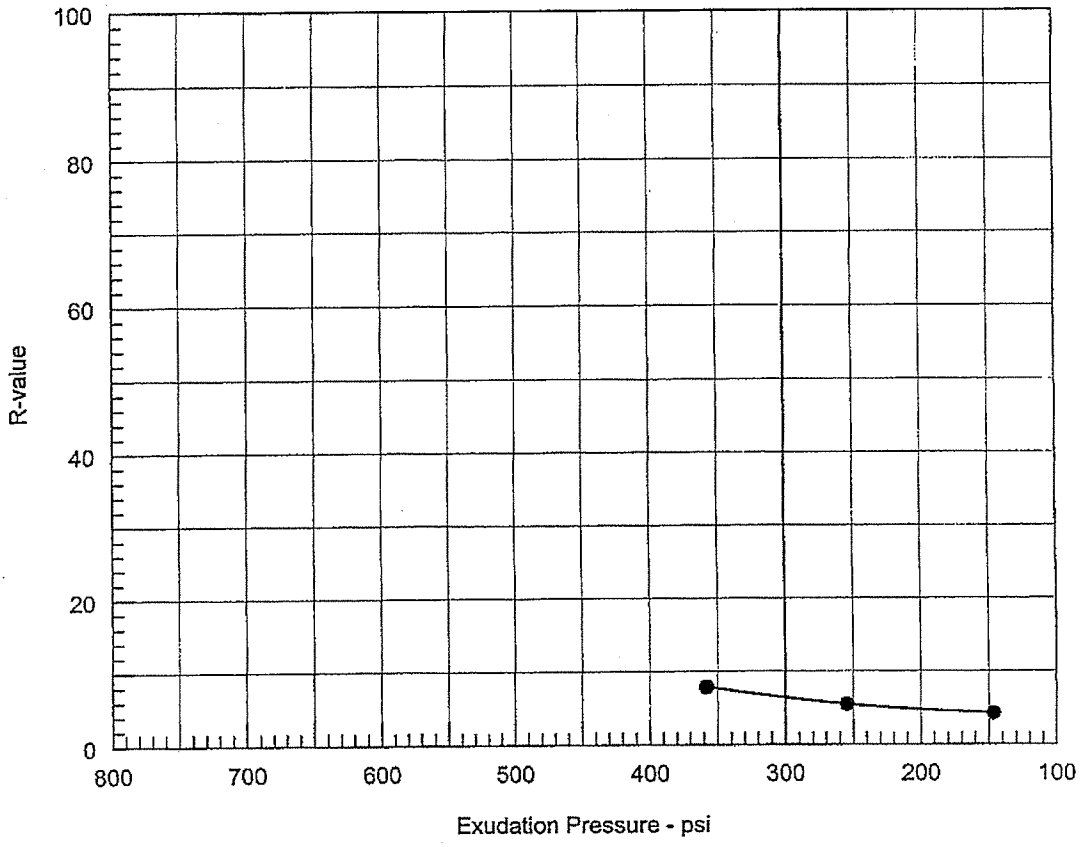
Tested by: DN
Checked by: LKL
Remarks:

R-VALUE TEST REPORT

SIGNET TESTING LABS, INC.

Figure B-17

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	20	98.5	23.6	0.00	149	2.70	146	4	4
2	35	103.4	21.8	0.00	143	2.70	358	7	8
3	25	100.3	22.7	0.00	144	2.53	255	6	6

Test Results	Material Description
R-value at 300 psi exudation pressure = 6	Brown silty clay, B-13-1, Type B, sampled received 1/31/2005

Project No.:
Project: SR 4 Loveridge to Somersville Rd
Location: B-13-1
Sample Number: S17378-2 **Depth:** 2-5ft
Date: 2/22/2005

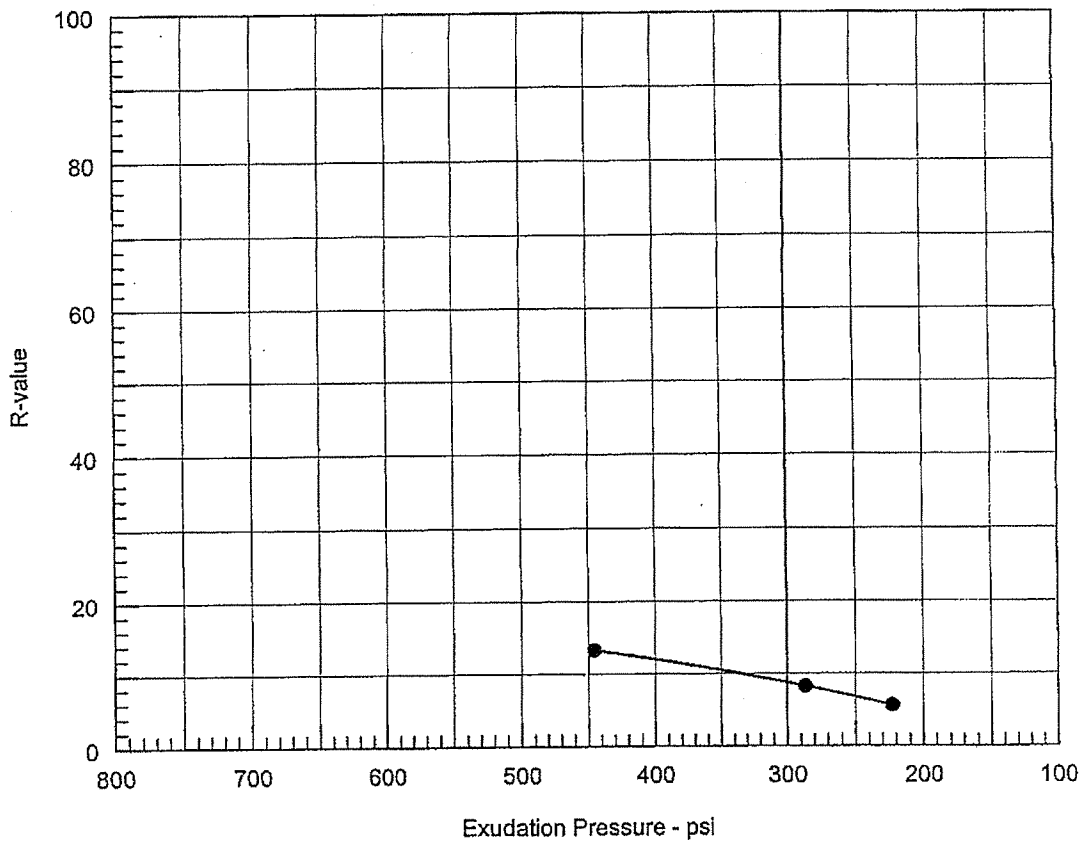
Tested by: DN
Checked by: LKL
Remarks:

R-VALUE TEST REPORT

SIGNET TESTING LABS, INC.

Figure B-18

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	25	105.4	19.5	0.00	140	2.49	286	8	8
2	20	103.4	20.4	0.00	146	2.58	223	5	6
3	30	100.7	18.6	0.00	133	2.58	446	13	13

Test Results	Material Description
R-value at 300 psi exudation pressure = 9	Brown silty clay, B-14-1, Type B, sampled received 1/31/2005

Project No.:
Project: SR 4 Loveridge to Somersville Rd
Location: B-14-1
Sample Number: S17378-3 **Depth:** 2-5ft
Date: 2/22/2005

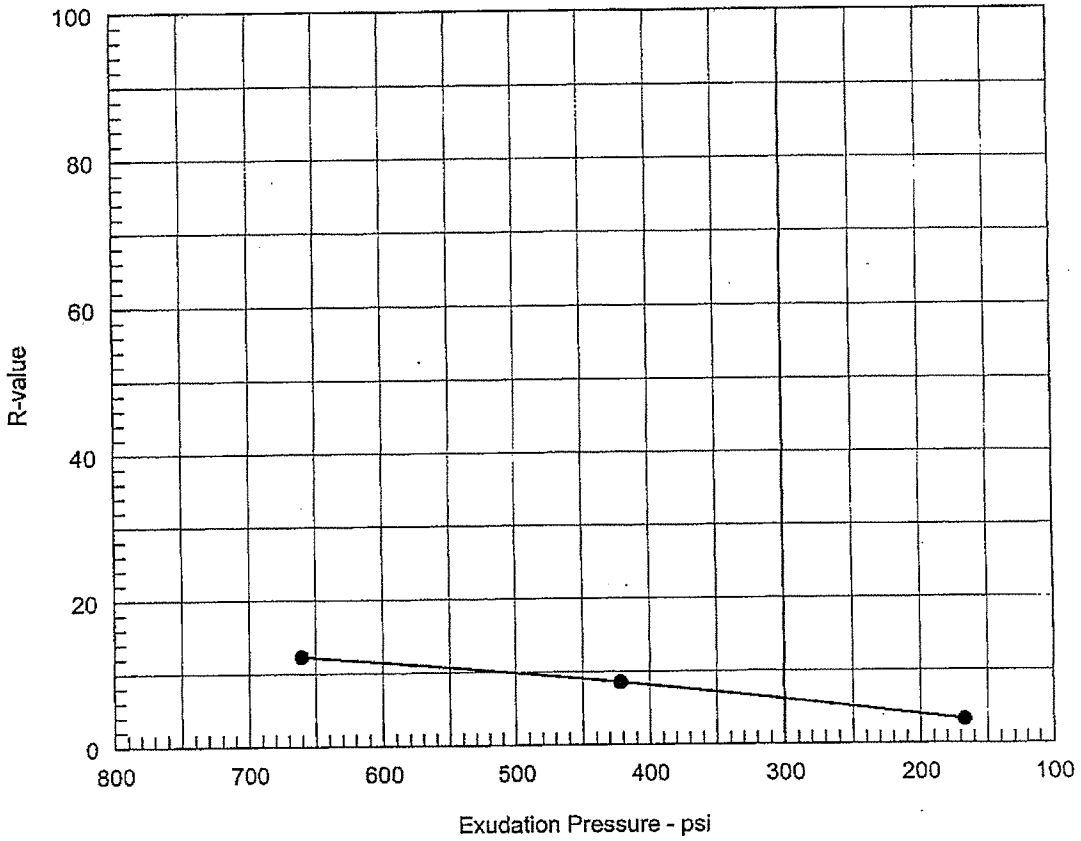
Tested by: DN
Checked by: LKL
Remarks:

R-VALUE TEST REPORT

SIGNET TESTING LABS, INC.

Figure B-19

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	75	109.7	17.7	0.45	127	2.31	660	14	12
2	25	108.6	22.1	0.00	140	2.70	422	8	9
3	20	107.7	24.7	0.00	152	2.68	167	3	3

Test Results	Material Description
R-value at 300 psi exudation pressure = 6	Dark brown silty clay, B-22-1, Type B, sampled received 1/31/2005

Project No.:
Project: SR 4 Loveridge to Somersville Rd
Location: B-22-1
Sample Number: S17378-4 **Depth:** 2-5ft
Date: 2/22/2005

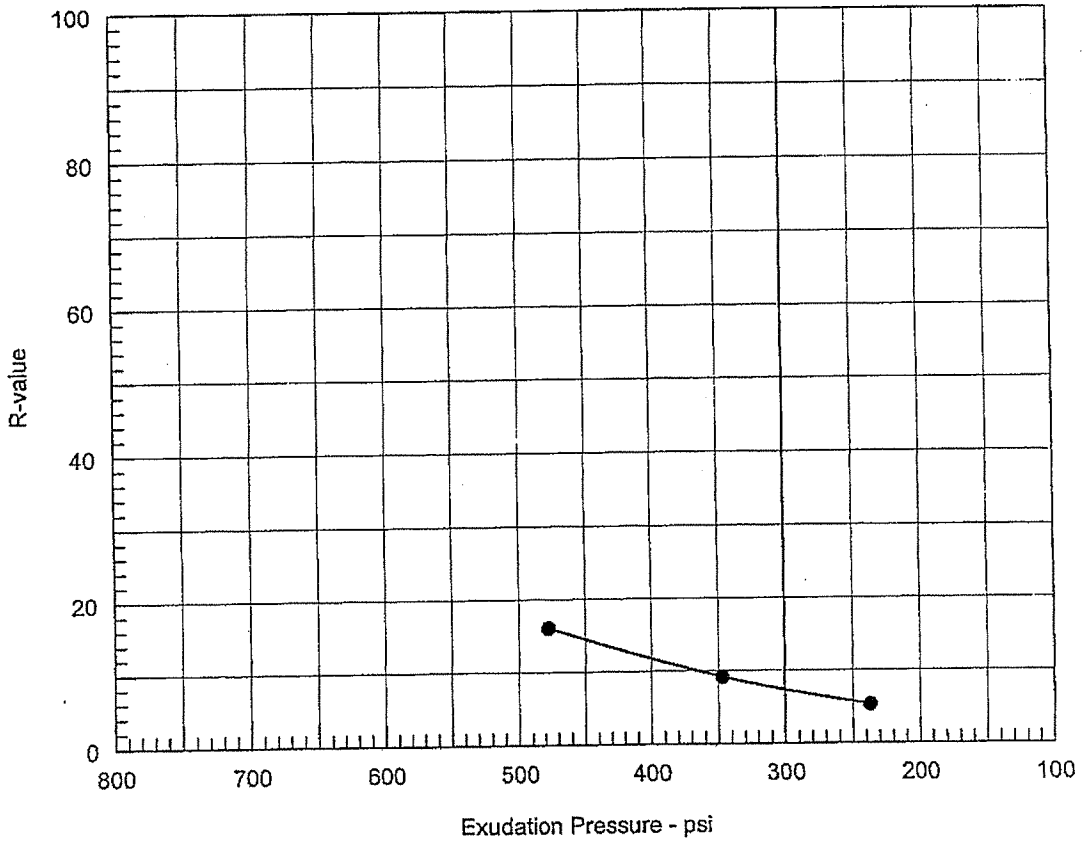
Tested by: LKL
Checked by: LKL
Remarks:

R-VALUE TEST REPORT

SIGNET TESTING LABS, INC.

Figure B-20

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	75	116.0	16.3	0.30	129	2.50	477	16	16
2	50	103.3	17.6	0.00	141	2.56	347	9	9
3	30	100.1	18.4	0.00	147	2.55	237	5	5

Test Results	Material Description
R-value at 300 psi exudation pressure = 7	Dark brown silty clay with gravel, B-24-1, Type B, sampled recevied 1/31/2005

Project No.:
Project: SR 4 Loveridge to Somersville Rd
Location: B-24-1
Sample Number: S17378-5 **Depth:** 2-5ft
Date: 2/22/2005

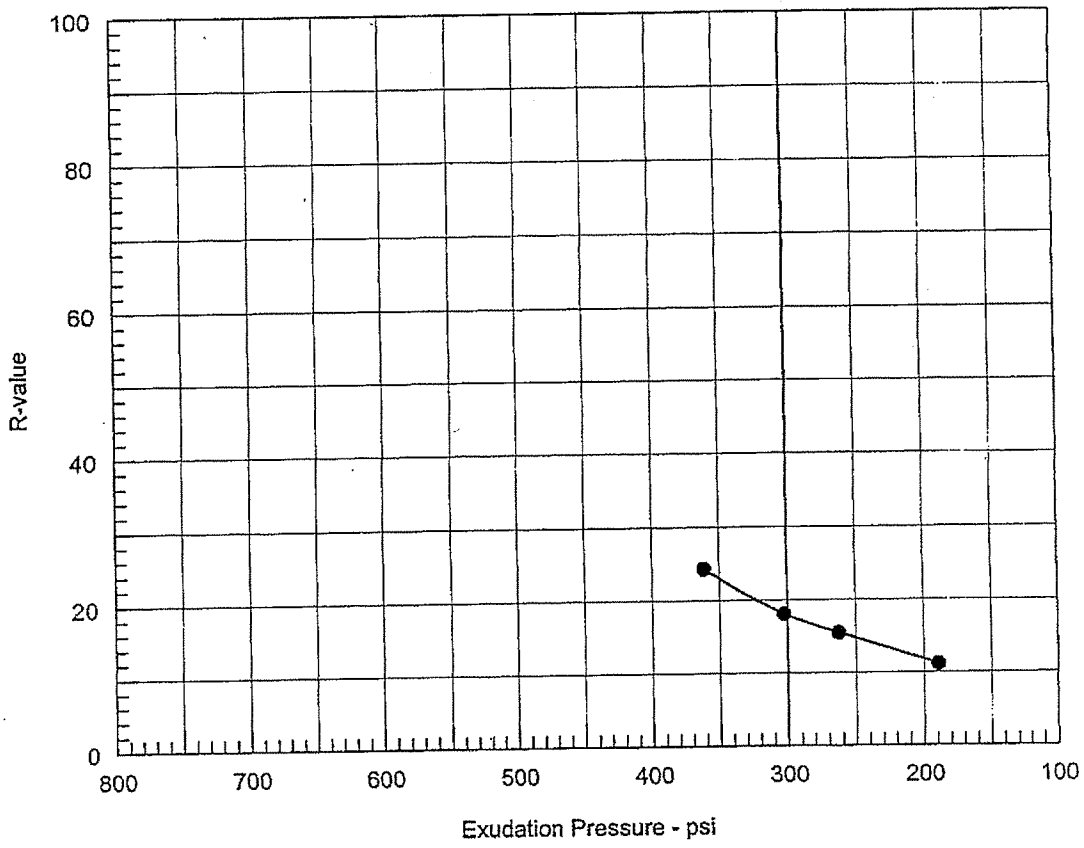
Tested by: LKL
Checked by: LKL
Remarks:

R-VALUE TEST REPORT

SIGNET TESTING LABS, INC.

Figure B-21

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	60	123.1	10.1	0.00	126	2.52	263	15	15
2	50	123.3	10.5	0.00	136	2.50	189	11	11
3	70	125.5	9.6	0.00	122	2.53	302	18	18
4	85	126.7	9.2	0.00	110	2.52	361	24	24

Test Results	Material Description
R-value at 300 psi exudation pressure = 18	Dark brown silty sandy clay with gravel, B-26-1, Type B, sampled received 1/31/2005

Project No.:

Project: SR 4 Loveridge to Somersville Rd

Location: B-26-1

Sample Number: S17378-6 **Depth:** 2-5ft

Date: 2/22/2005

Tested by: LKL

Checked by: LKL

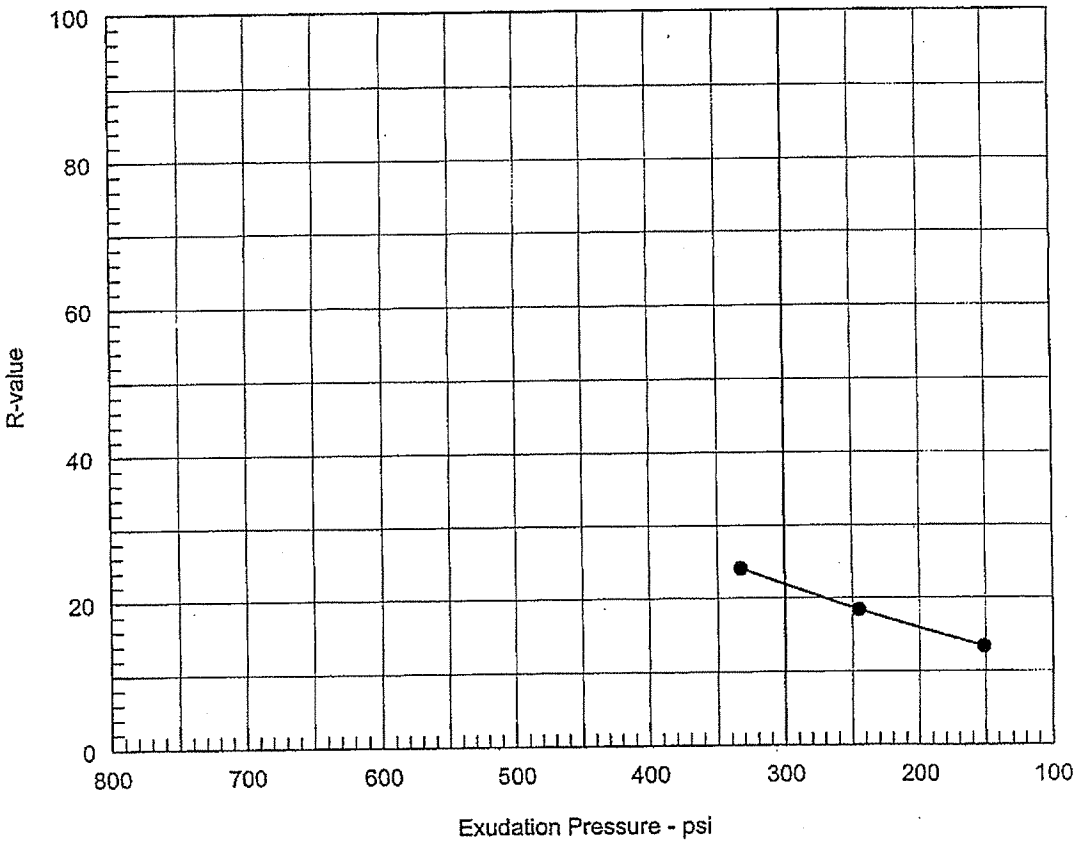
Remarks:

R-VALUE TEST REPORT

SIGNET TESTING LABS, INC.

Figure B-22

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	75	121.5	13.9	0.00	130	2.56	151	13	13
2	120	123.6	13.0	0.00	110	2.52	333	24	24
3	100	122.8	13.4	0.00	120	2.55	245	18	18

Test Results	Material Description
R-value at 300 psi exudation pressure = 22	Dark brown silty sandy clay with gravel, B-27-1, Type B, sampled received 1/31/2005

Project No.:
Project: SR 4 Loveridge to Somersville Rd
Location: B-27-1
Sample Number: S17378-7
Date: 2/22/2005

Tested by: LKL
Checked by: LKL
Remarks:

R-VALUE TEST REPORT

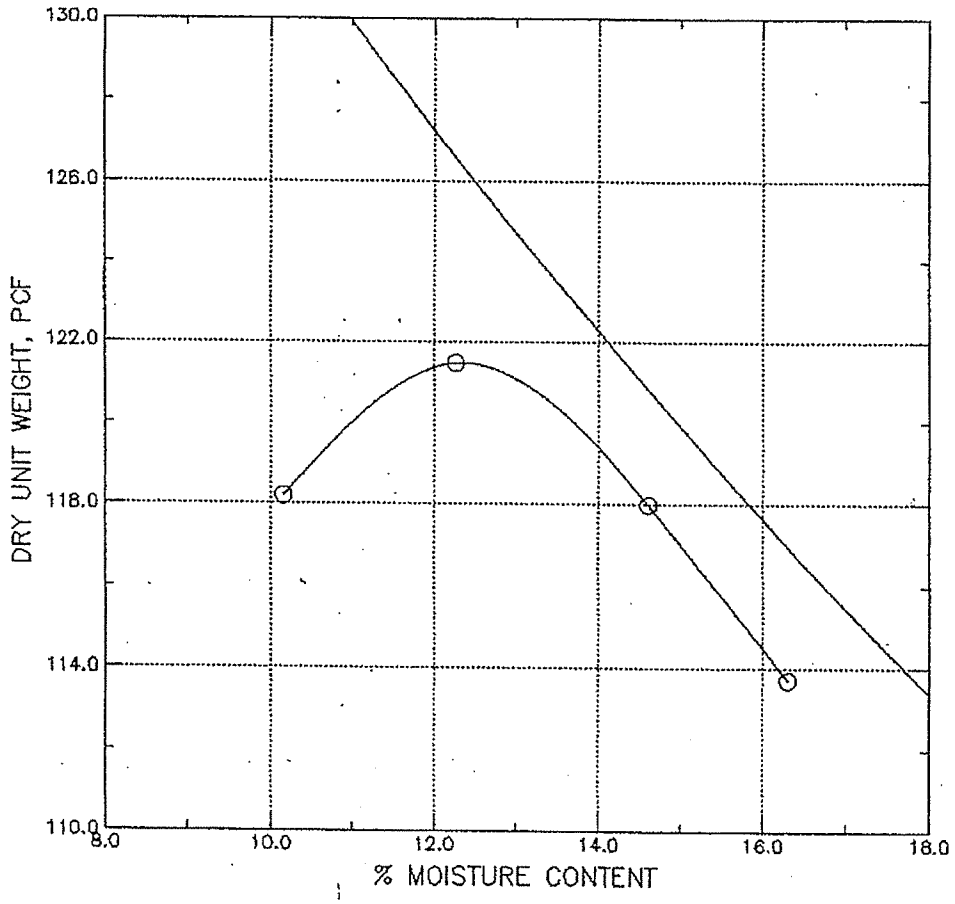
SIGNET TESTING LABS, INC.

Figure B-23

URS

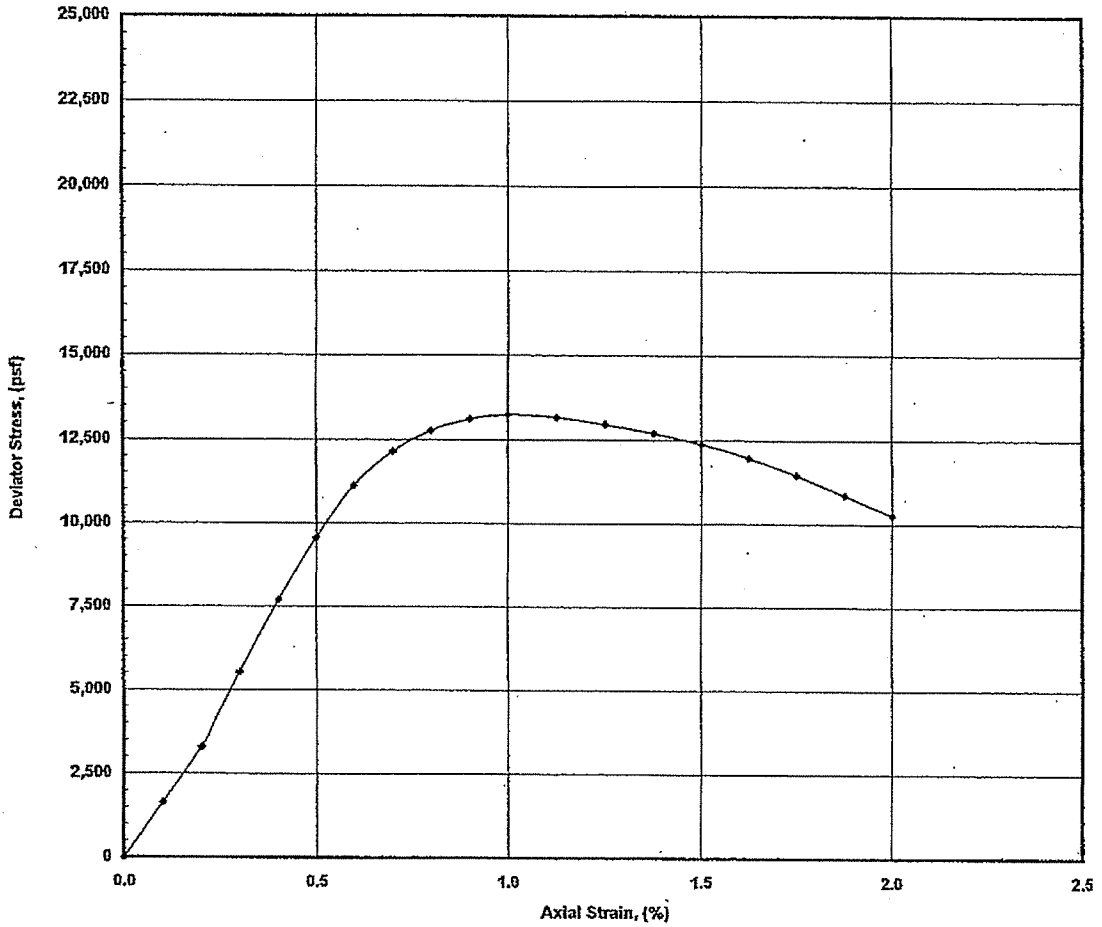
	Boring No. : Composite Sample No. : 9-10-11 Tested by : S. Capps Filename : COMP-1	Project : SR 4 Loveridge to Somersville Rd. Project No.: 26814911.35006 Location : Pittsburg, CA Date: Thu Sep 22 2005

COMPACTION



Sample Description	: Brown fine sandy clay
Compaction Test Designation	: ASTM D1557-B
Maximum Dry Density	: 121.5 pcf
Optimum Moisture Content	: 12.3 %

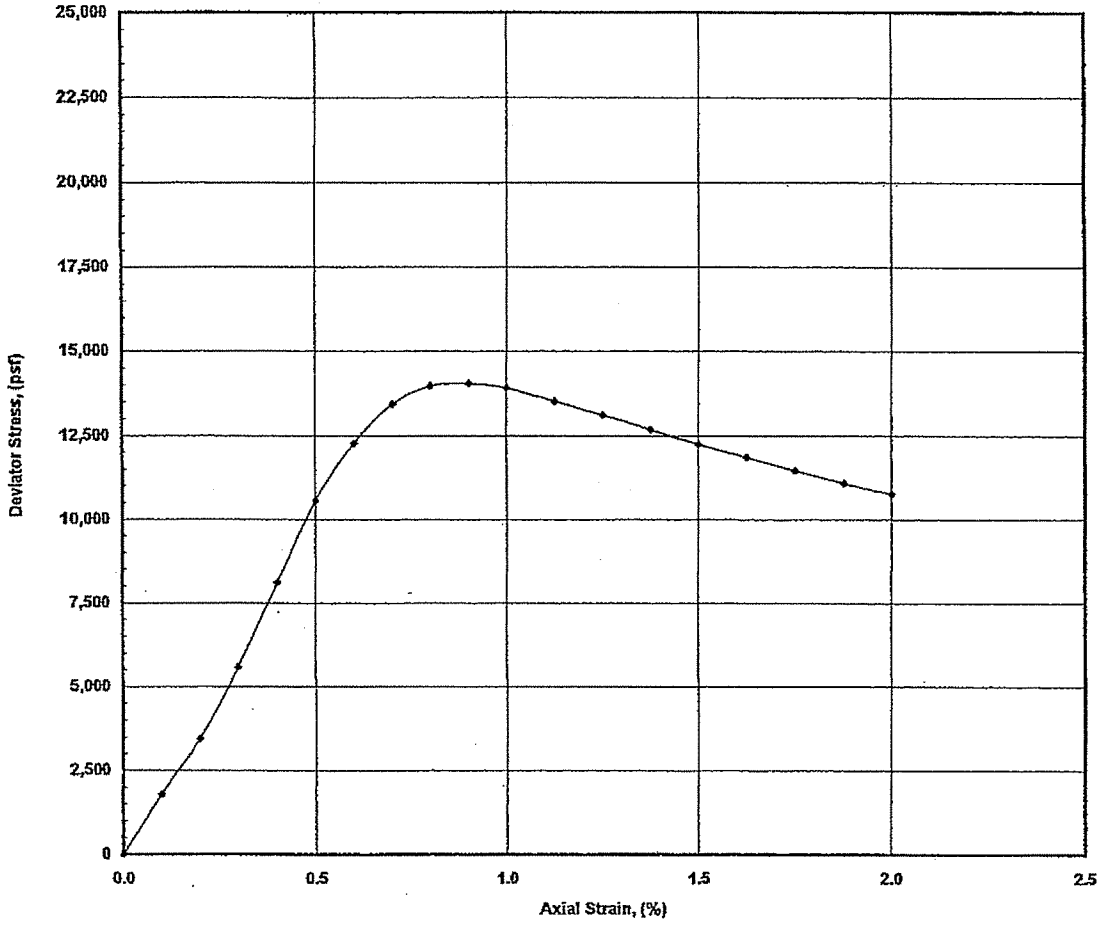
B-24



Soil Description: Brown sandy clay with 2% lime - cured 96 hours

Boring Number	Sample Number	% of MDD	Moist Unit Weight (pcf)	Dry Unit Weight (pcf)	Initial Moisture Content (%)	Specific Gravity (assumed)	Void Ratio	Initial Saturation (%)	Height/ Diameter Ratio	Rate of Shearing (%/min)	Peak Unconfined Strength (psf)	Peak Shear Stress (psf)
Composite 9-10-11	2% Lime	95	131.9	115.4	14.3	2.70	0.460	83.9	2.07	0.25	13,235	6,618

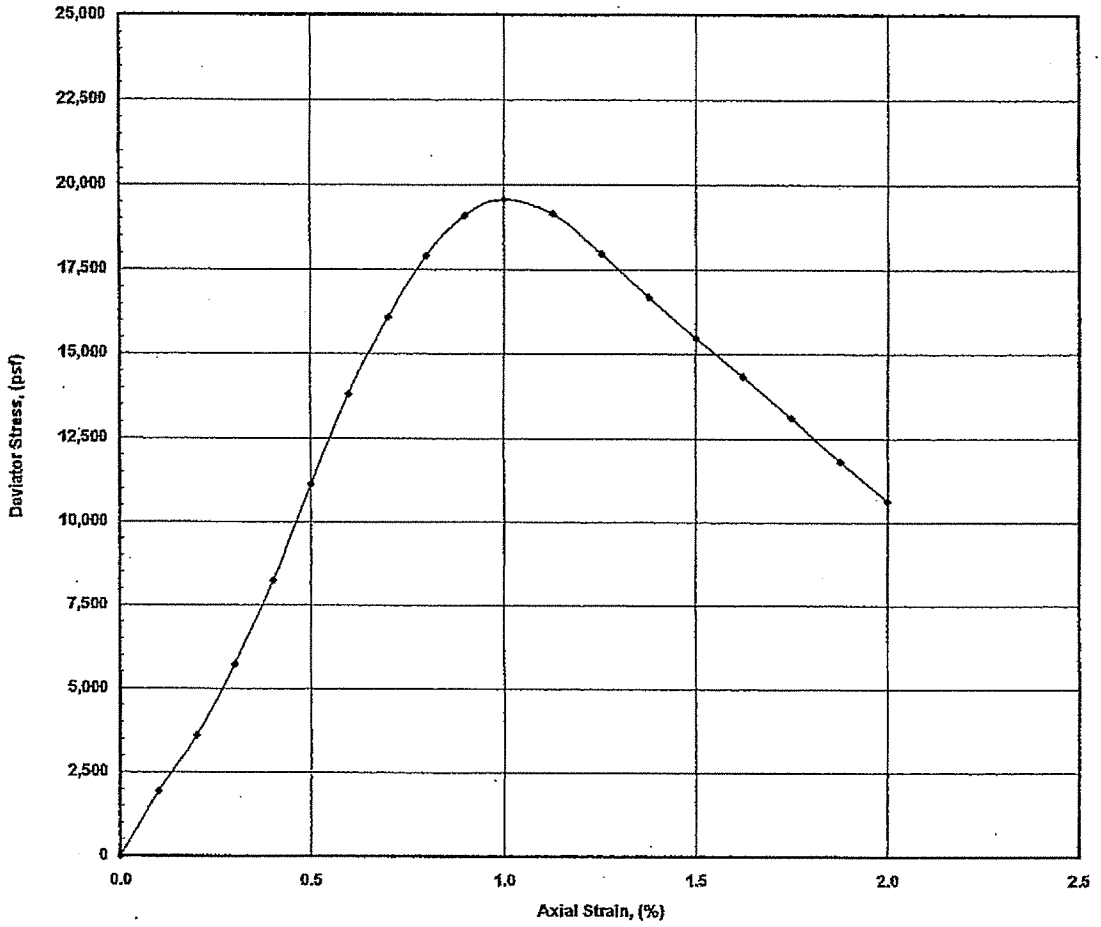
Project Name: SR-4 Loveridge to Somersville Road Project Number: 26814911.35006 Location: Pittsburg, CA	UNCONFINED COMPRESSIVE STRENGTH STRESS VS. STRAIN ASTM D5102 SOIL - LIME MIXTURES	URS B-25



Soil Description: Brown sandy clay with 3% lime - cured 96 hours

Boring Number	Sample Number	% of MDD	Moist Unit Weight (pcf)	Dry Unit Weight (pcf)	Initial Moisture Content (%)	Specific Gravity (assumed)	Void Ratio	Initial Saturation (%)	Height/ Diameter Ratio	Rate of Shearing (%/min)	Peak Unconfined Strength (psf)	Peak Shear Stress (psf)
Composite 9-10-11	3% Lime	95	131.9	115.4	14.3	2.70	0.460	83.9	2.07	0.25	14,048	7,024

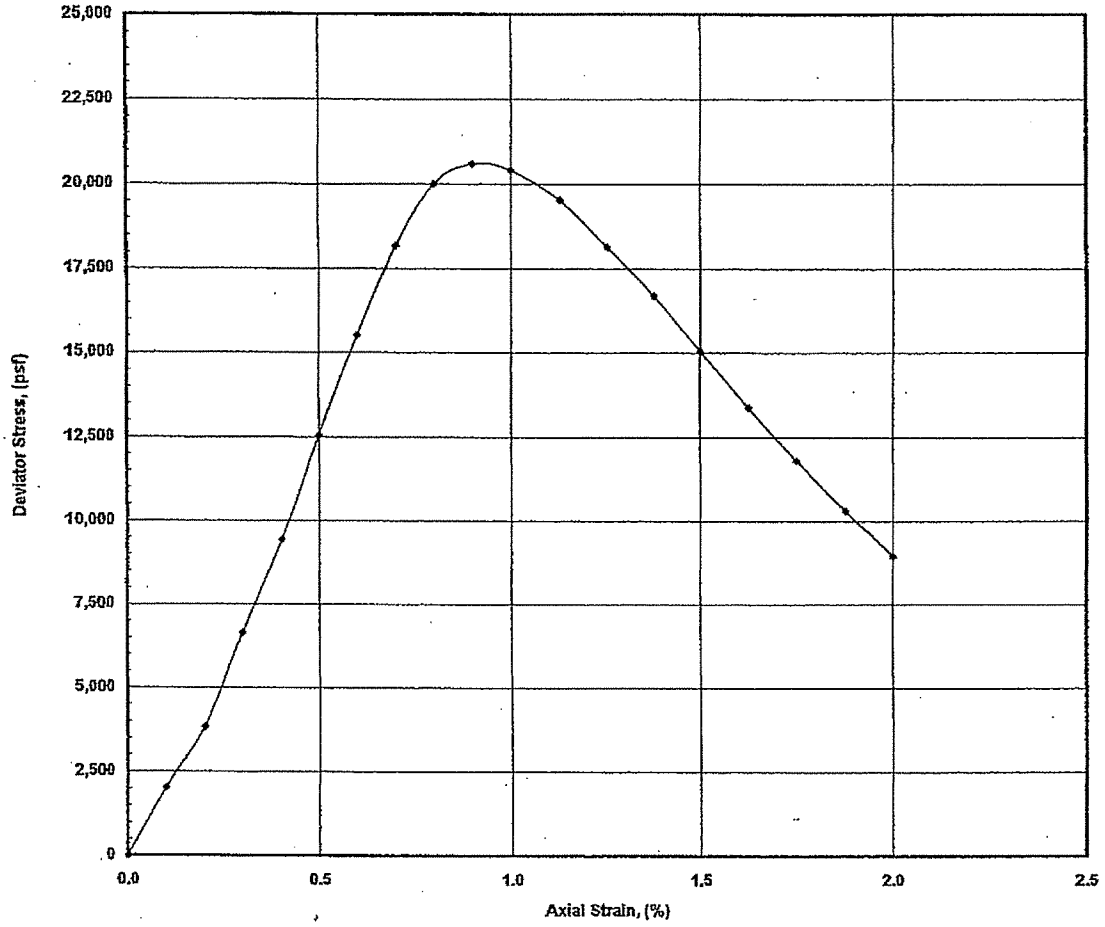
Project Name: SR-4 Loveridge to Somersville Road	**UNCONFINED COMPRESSIVE STRENGTH STRESS VS. STRAIN ASTM D5102 SOIL - LIME MIXTURES**	URS
Project Number: 26814911.35006		B-26
Location: Pittsburg, CA		



Soil Description: Brown sandy clay with 4% lime - cured 96 hours

Boring Number	Sample Number	% of MDD	Moist Unit Weight (pcf)	Dry Unit Weight (pcf)	Initial Moisture Content (%)	Specific Gravity (assumed)	Void Ratio	Initial Saturation (%)	Height/ Diameter Ratio	Rate of Shearing (%/min)	Peak Unconfined Strength (psf)	Peak Shear Stress (psf)
Composite 9-10-11	4% Lime	95	131.9	115.4	14.3	2.70	0.460	83.9	2.07	0.25	19,575	9,787

Project Name: SR-4 Loveridge to Somersville Road Project Number: 26814911.35006 Location: Pittsburg, CA	**UNCONFINED COMPRESSIVE STRENGTH STRESS VS. STRAIN ASTM D5102 SOIL - LIME MIXTURES**	URS B-27

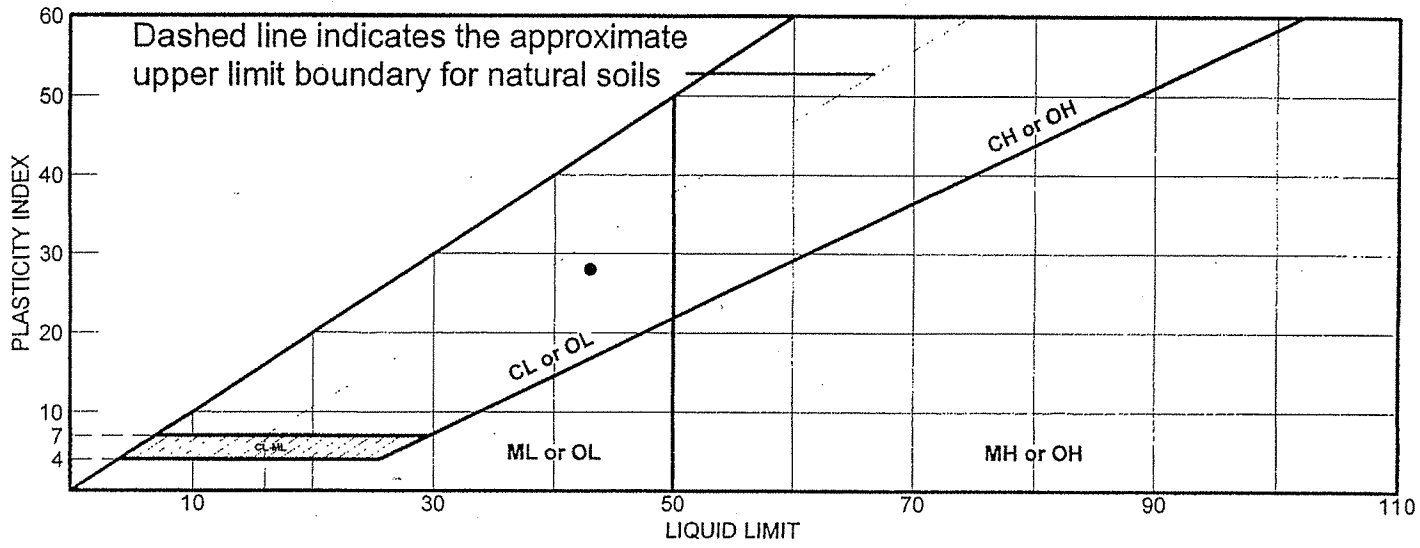


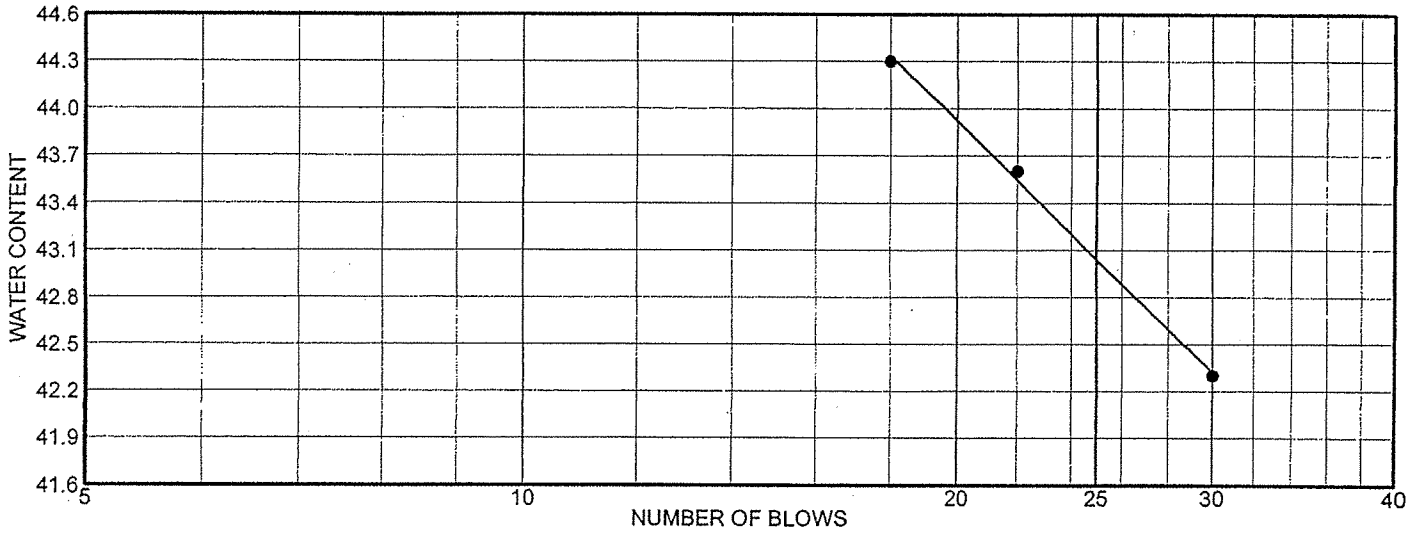
Soil Description: Brown sandy clay with 5% lime - cured 96 hours

Boring Number	Sample Number	% of MDD	Moist Unit Weight (pcf)	Dry Unit Weight (pcf)	Initial Moisture Content (%)	Specific Gravity (assumed)	Void Ratio	Initial Saturation (%)	Height/ Diameter Ratio	Rate of Shearing (%/min)	Peak Unconfined Strength (psf)	Peak Shear Stress (psf)
Composite 9-10-11	5% Lime	95	131.9	115.4	14.3	2.70	0.460	83.9	2.07	0.25	20,612	10,306

Project Name: SR-4 Loveridge to Somersville Road	UNCONFINED COMPRESSIVE STRENGTH STRESS VS. STRAIN ASTM D5102 SOIL - LIME MIXTURES	URS
Project Number: 26814911.35006		B-28
Location: Pittsburg, CA		

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark brown silty clay, Location 1 & 6	43	15	28		65.4	

Project No. **Client:** URS-Oakland

Project: Hwy 4

● **Location:** 1 & 6

Remarks:

● Location 1 & 6

LIQUID AND PLASTIC LIMITS TEST REPORT

SIGNET TESTING LABS, INC.

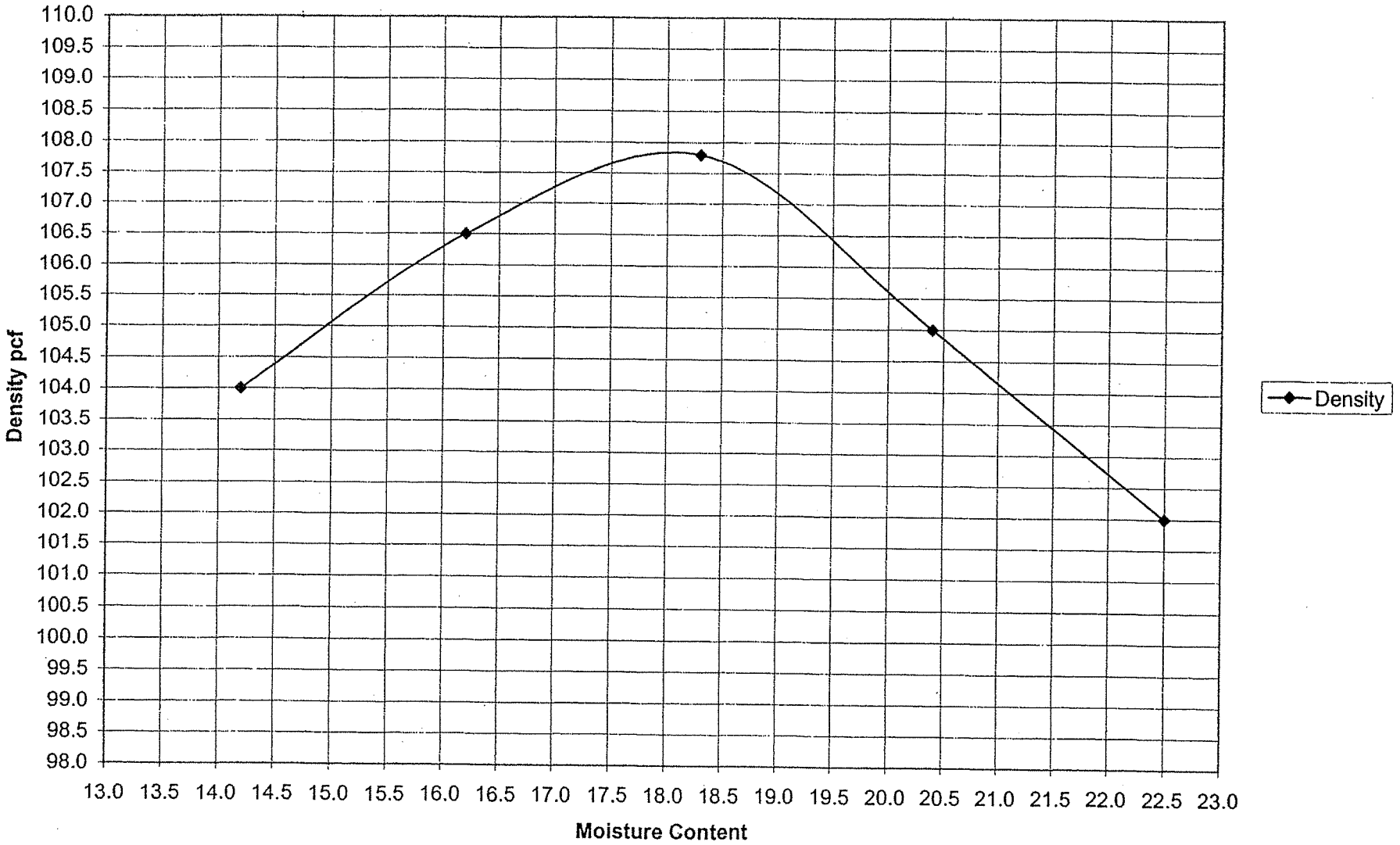
Project	Hwy 4	Lab #	S20163-1
Sample of	Loaction 1 and 6, Quicklime	STL #	

Unconfined Compressive Strength(psi) CTM 373

Percent Lime	Age (Days)	Specimen #1	Specimen #2	Average
3	7	446	414	430
5	7	470	510	490
7	7	525	478	502

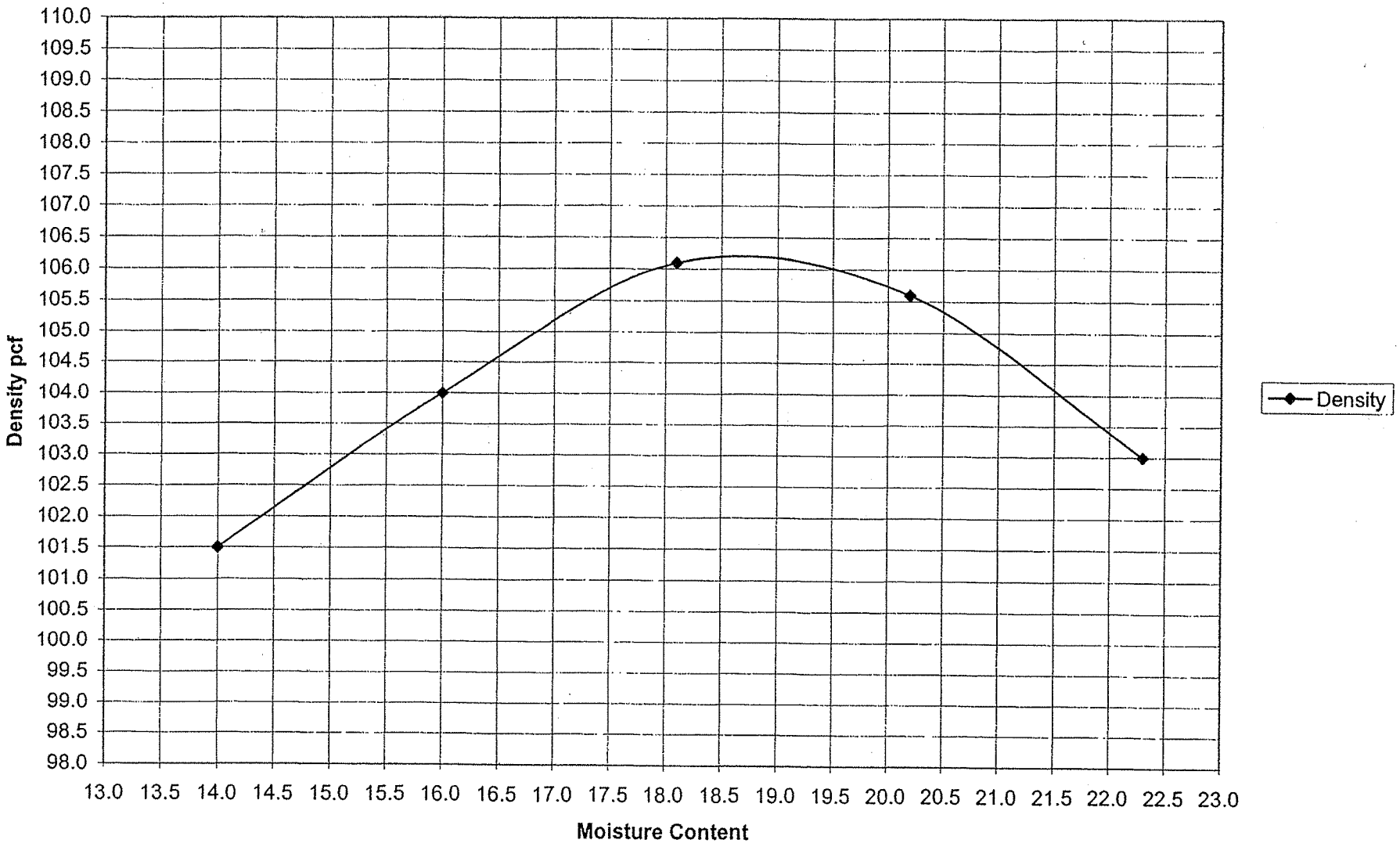
Quicklime 3% Maximum Density 107.9pcf / Opt. Moisture 18.1% Lab # S20163-1

Moisture Vs. Density



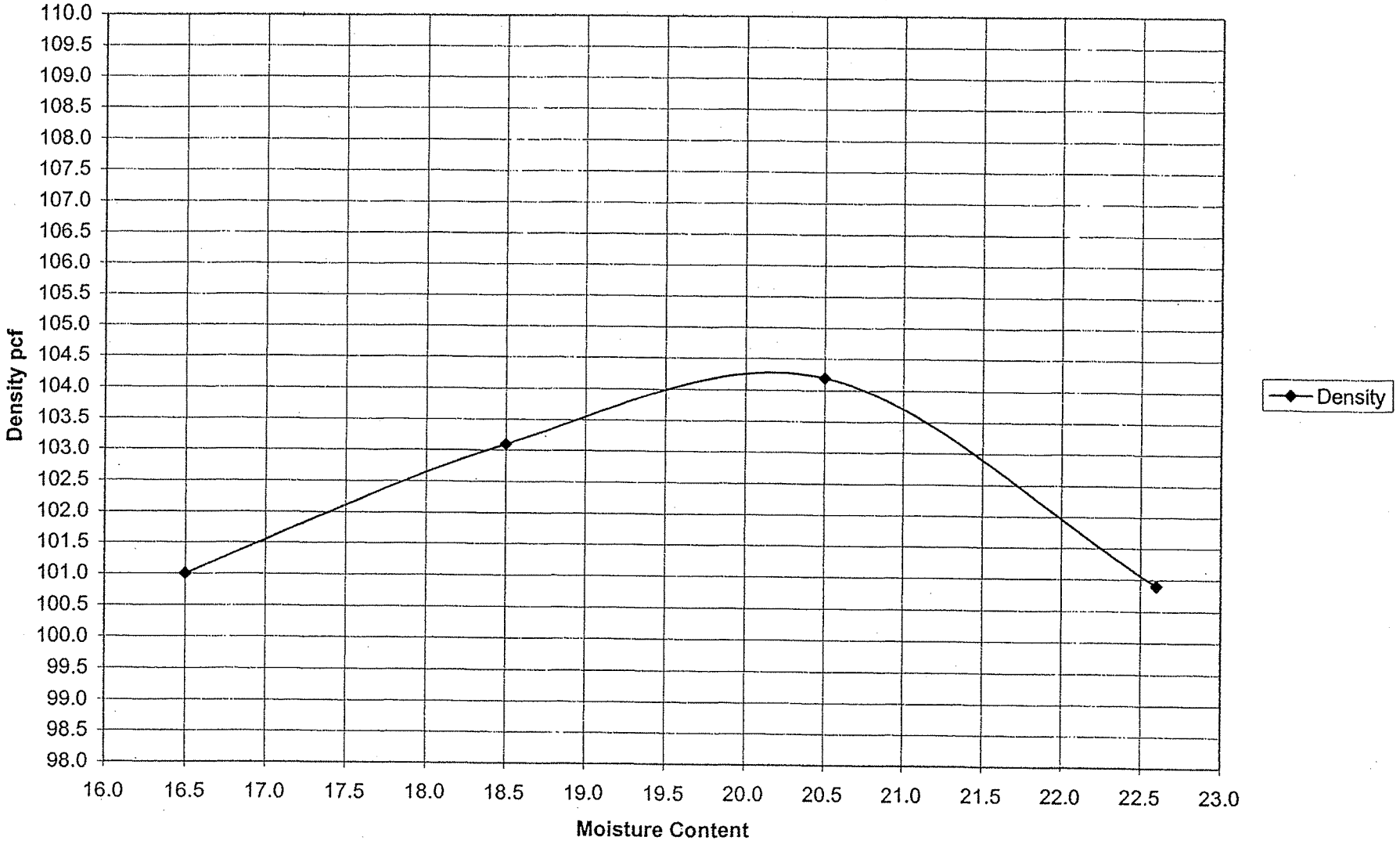
Quicklime 5% Maximum Density 106.2pcf / Opt. Moisture 18.7% Lab # S20163-1

Moisture Vs. Density



Quicklime 7% Maximum Density 104.3pcf / Opt. Moisture 20.2% Lab # S20163-1

Moisture Vs. Density



Project	Hwy 4	Lab #	S20163-1
Sample of	Loaction 1 and 6, Quicklime Plus	STL #	

Unconfined Compressive Strength(psi) CTM 373

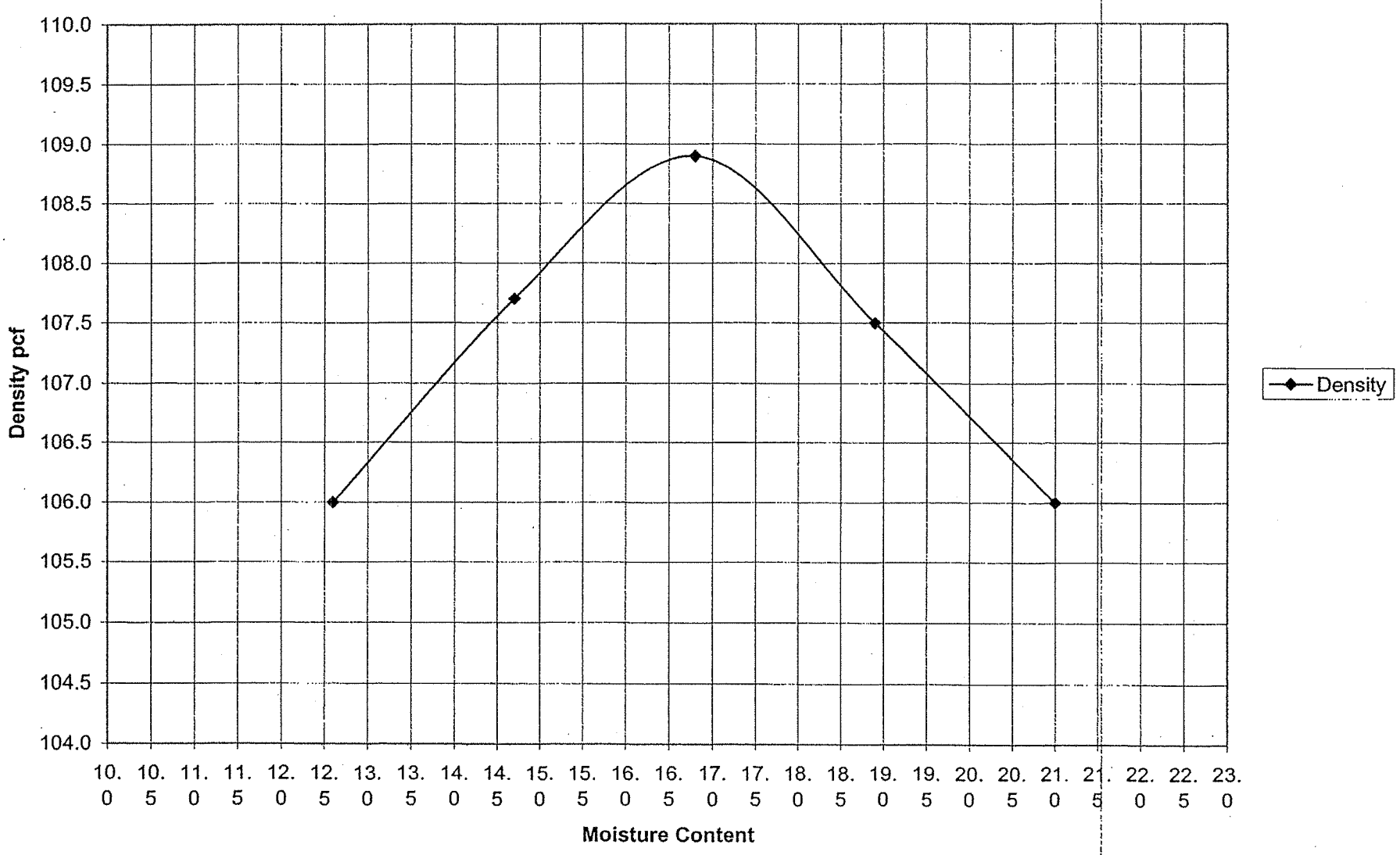
Percent Lime	Age (Days)	Specimen #1	Specimen #2	Average
3	7	255	263	259
5	7	311	326	319
7	7	382	382	382

Quicklime Plus 3%

Maximum Density 108.9pcf / Opt. Moisture 16.8%

Lab # S20163-1

Moisture Vs. Density

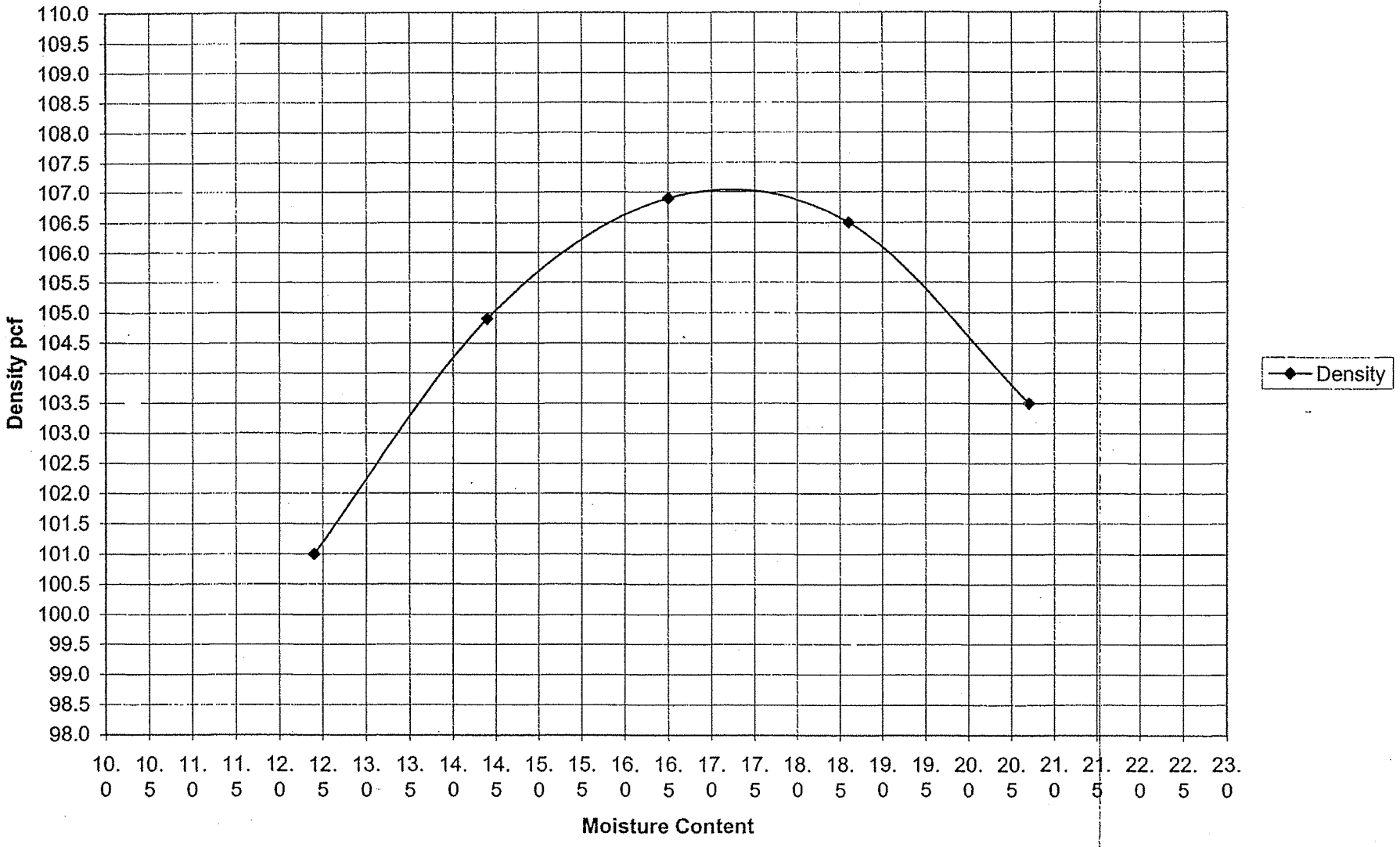


Quicklime Plus 5%

Maximum Density 107.0pcf / Opt. Moisture 17.3%

Lab # S20163-1

Moisture Vs. Density

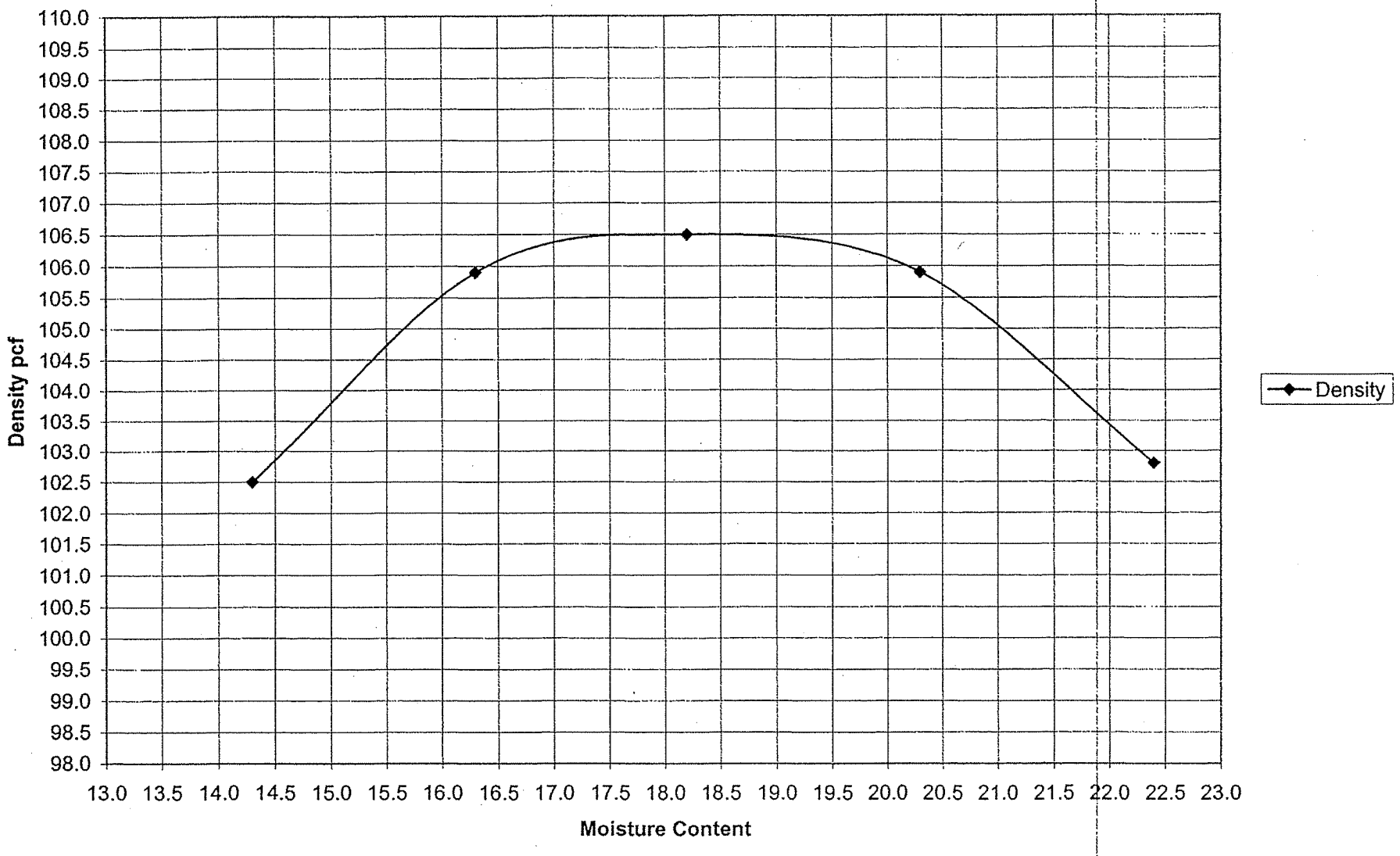


Quicklime Plus 7%

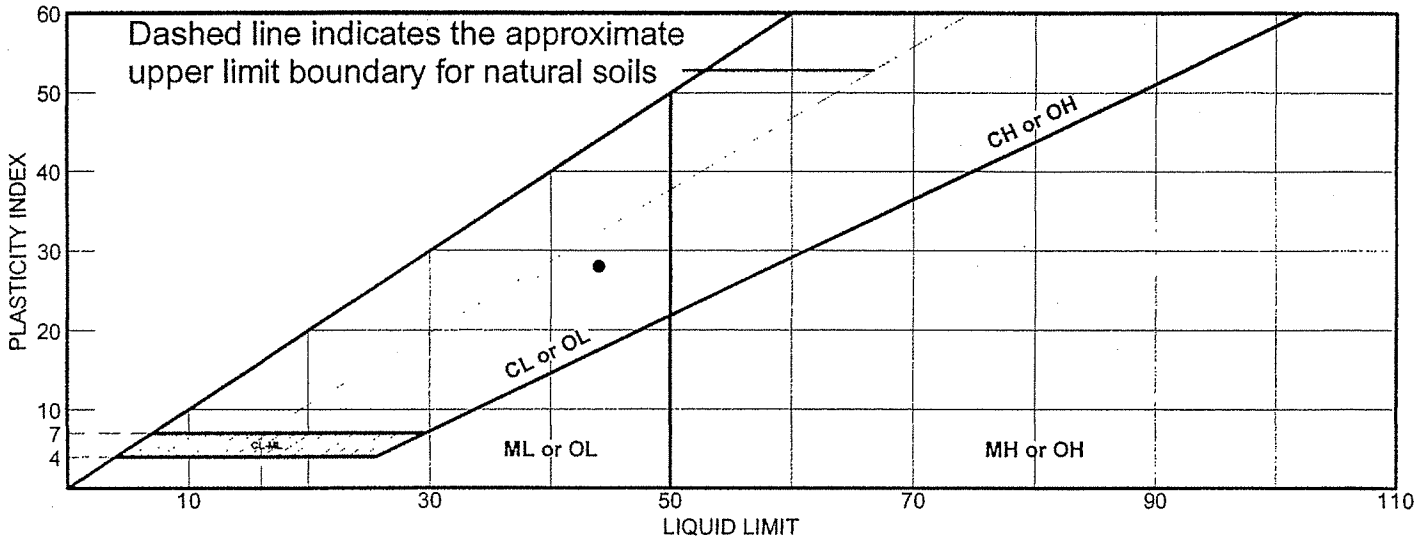
Maximum Density 106.5pcf / Opt. Moisture 18.4%

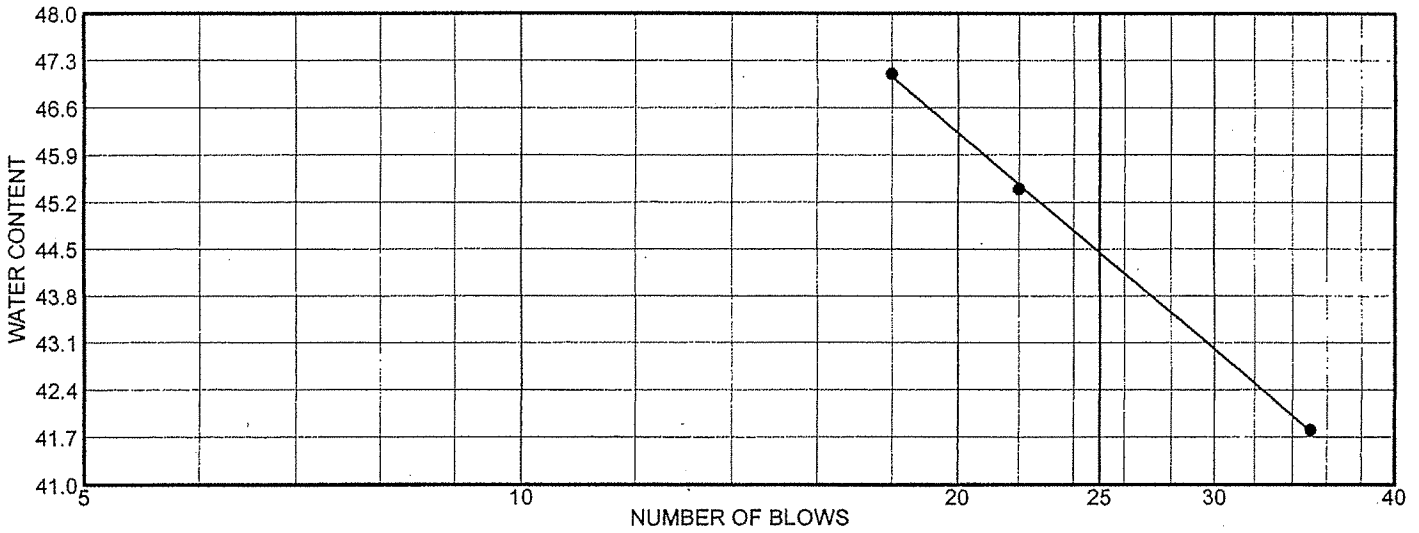
Lab # S20163-1

Moisture Vs. Density



LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark brown silty clay, Location 2 & 3	44	16	28		54.3	

Project No. **Client:** URS-Oakland

Project: Hwy 4

● **Location:** 2 & 3

Remarks:

● Location 2 & 3

LIQUID AND PLASTIC LIMITS TEST REPORT

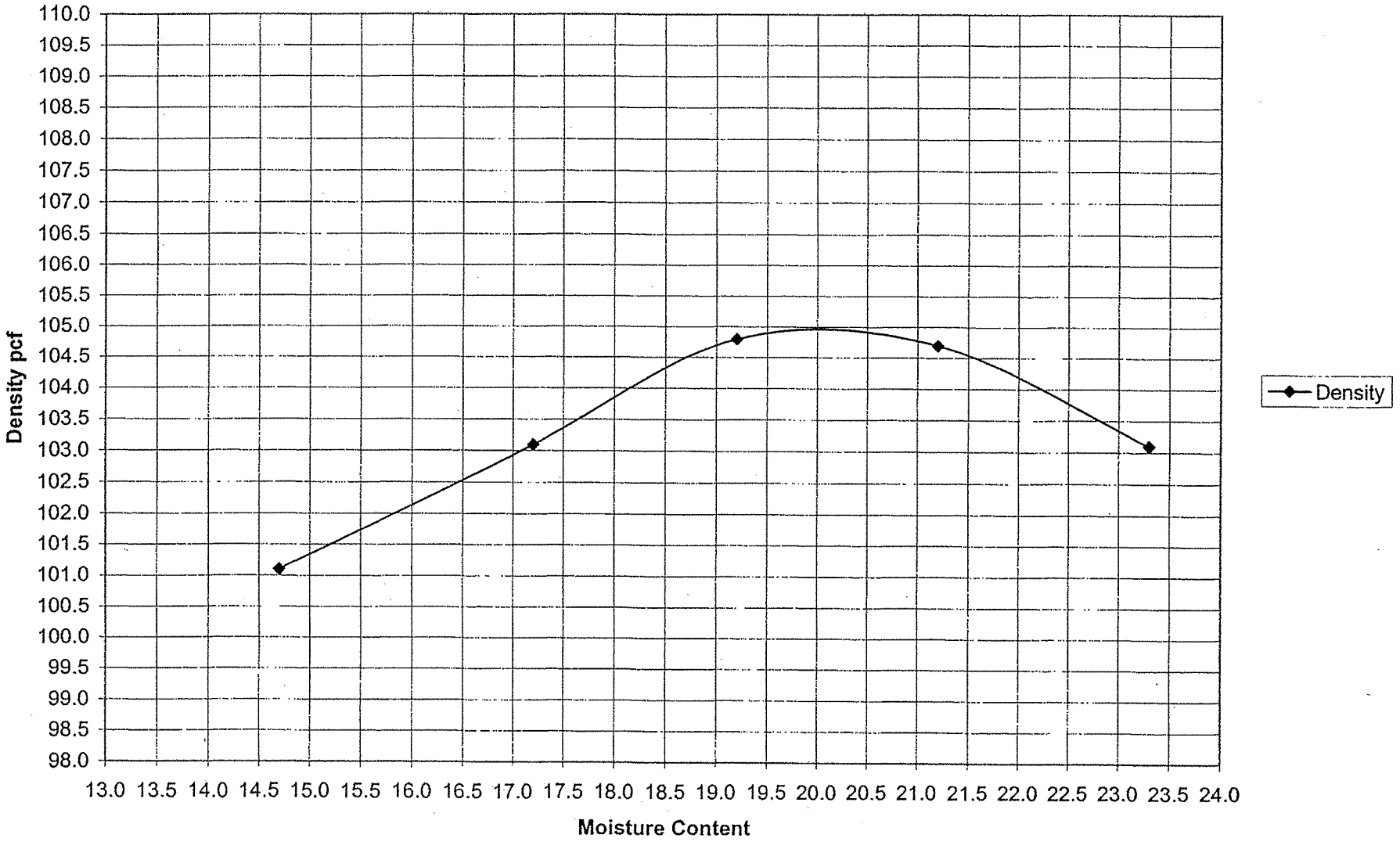
SIGNET TESTING LABS, INC.

Project	Hwy 4	Lab #	S20163-2/3
Sample of	Loaction 2 and 3, Quicklime	STL #	

Percent Lime	Age (Days)	Unconfined Compressive Strength(psi) CTM 373 Specimen #1	Specimen #2	Average
3	7	337	345	341
5	7	469	485	477
7	7	509	509	509

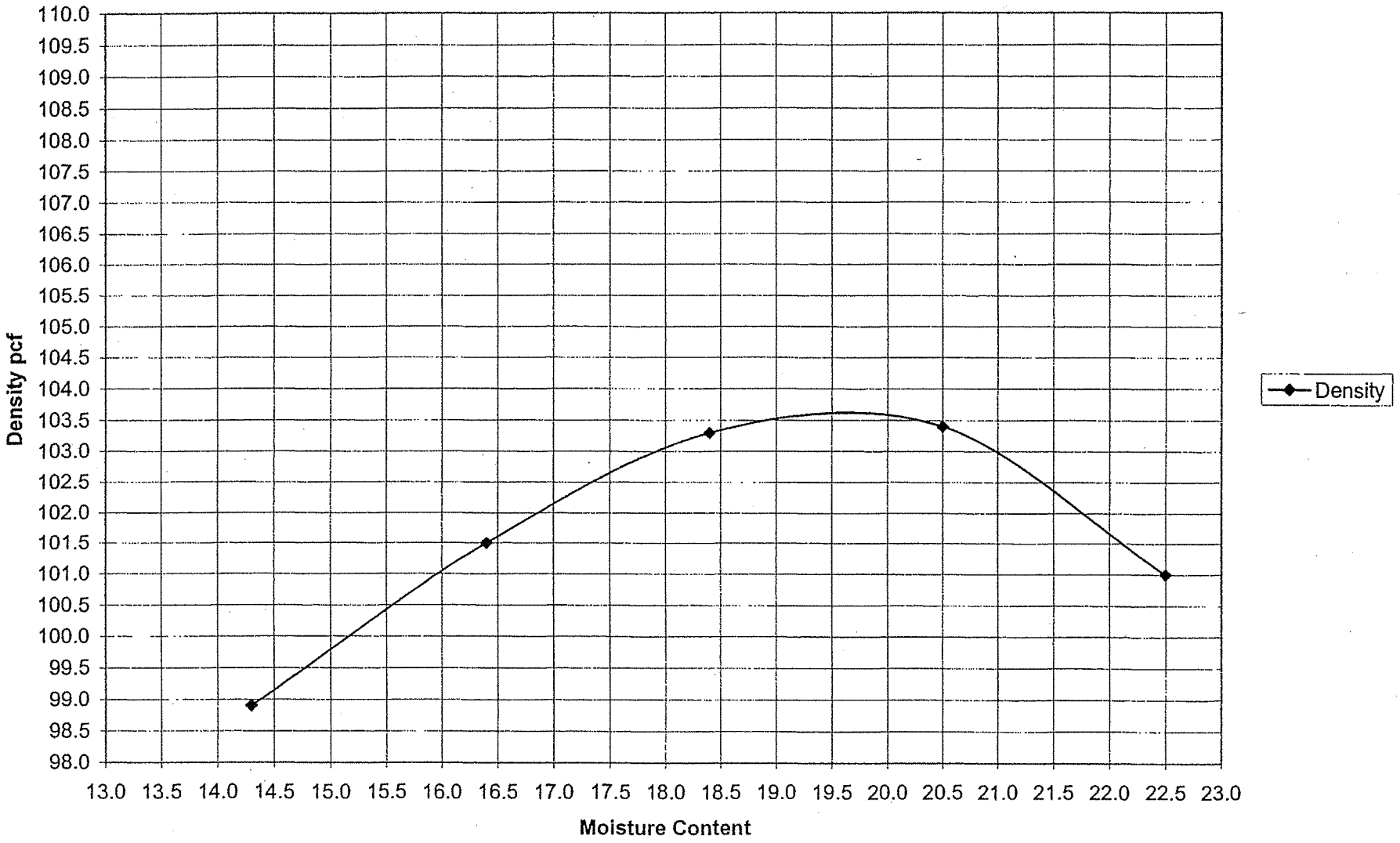
Quicklime Plus 7% Maximum Density 105.0pcf / Opt. Moisture 20.0% Lab # S20163-2/3

Moisture Vs. Density



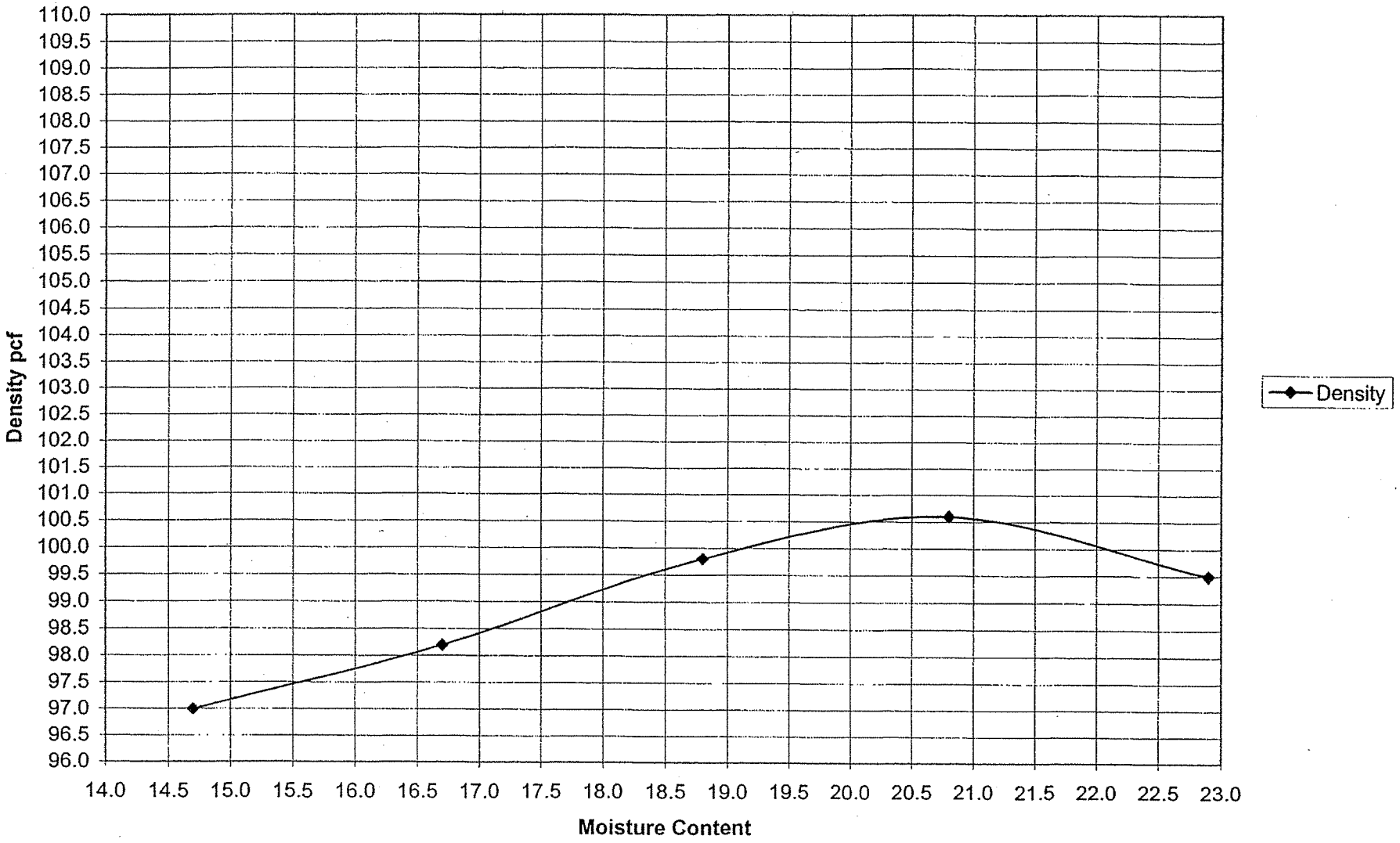
Quicklime 5% Maximum Density 103.6pcf / Opt. Moisture 19.5% Lab # S20163-2/3

Moisture Vs. Density



Quicklime 7% Maximum Density 100.6pcf / Opt. Moisture 20.7% Lab # S20163-2/3

Moisture Vs. Density



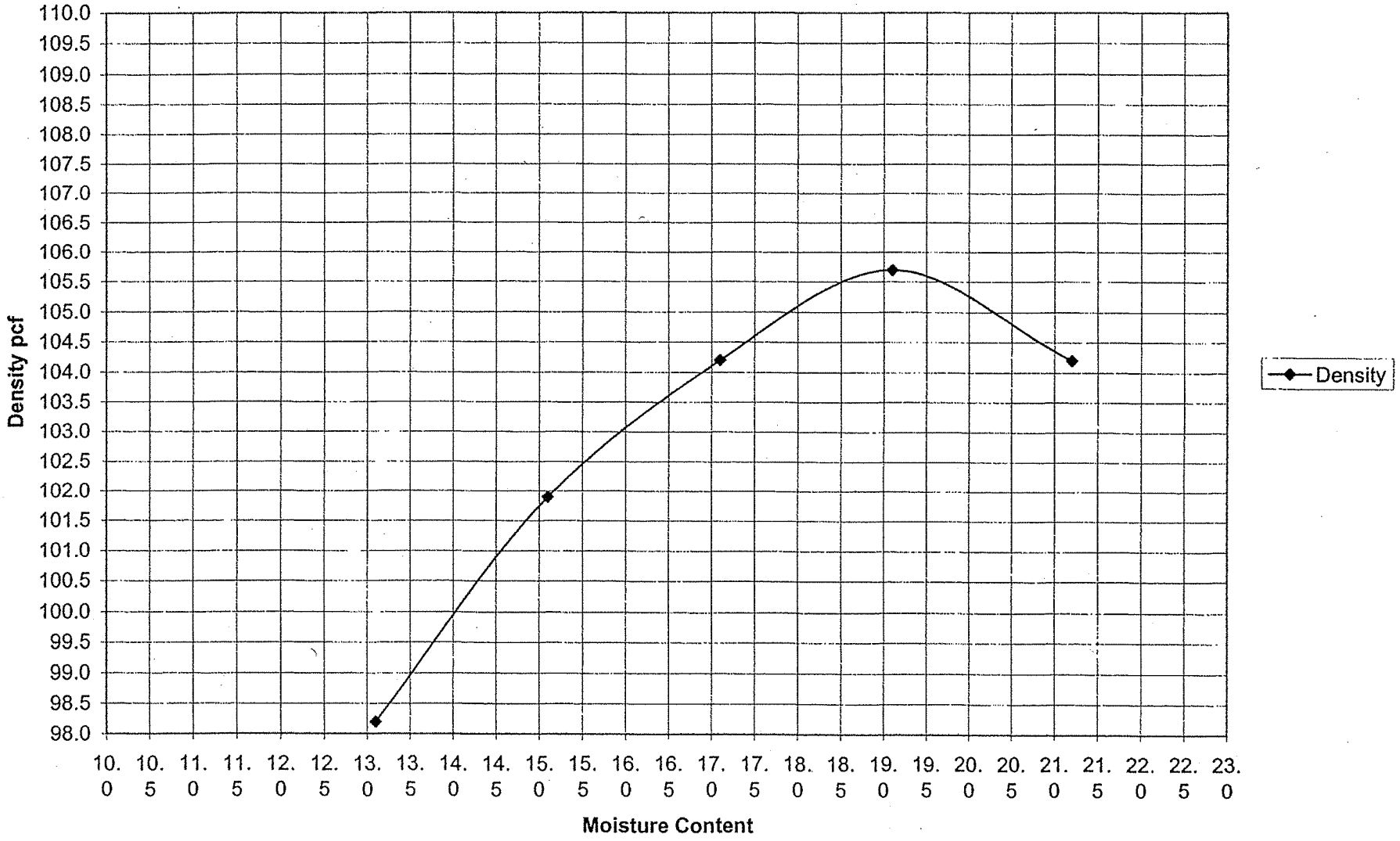
Project	Hwy 4	Lab #	S20163-2/3
Sample of	Loaction 2 and 3, Quicklime Plus	STL #	

Unconfined Compressive Strength(psi) CTM 373

Percent Lime	Age (Days)	Specimen #1	Specimen #2	Average
3	7	362	350	356
5	7	366	370	368
7	7	378	386	382

Quicklime Plus 5% Maximum Density 105.7pcf / Opt. Moisture 19.1% Lab # S20163-2/3

Moisture Vs. Density

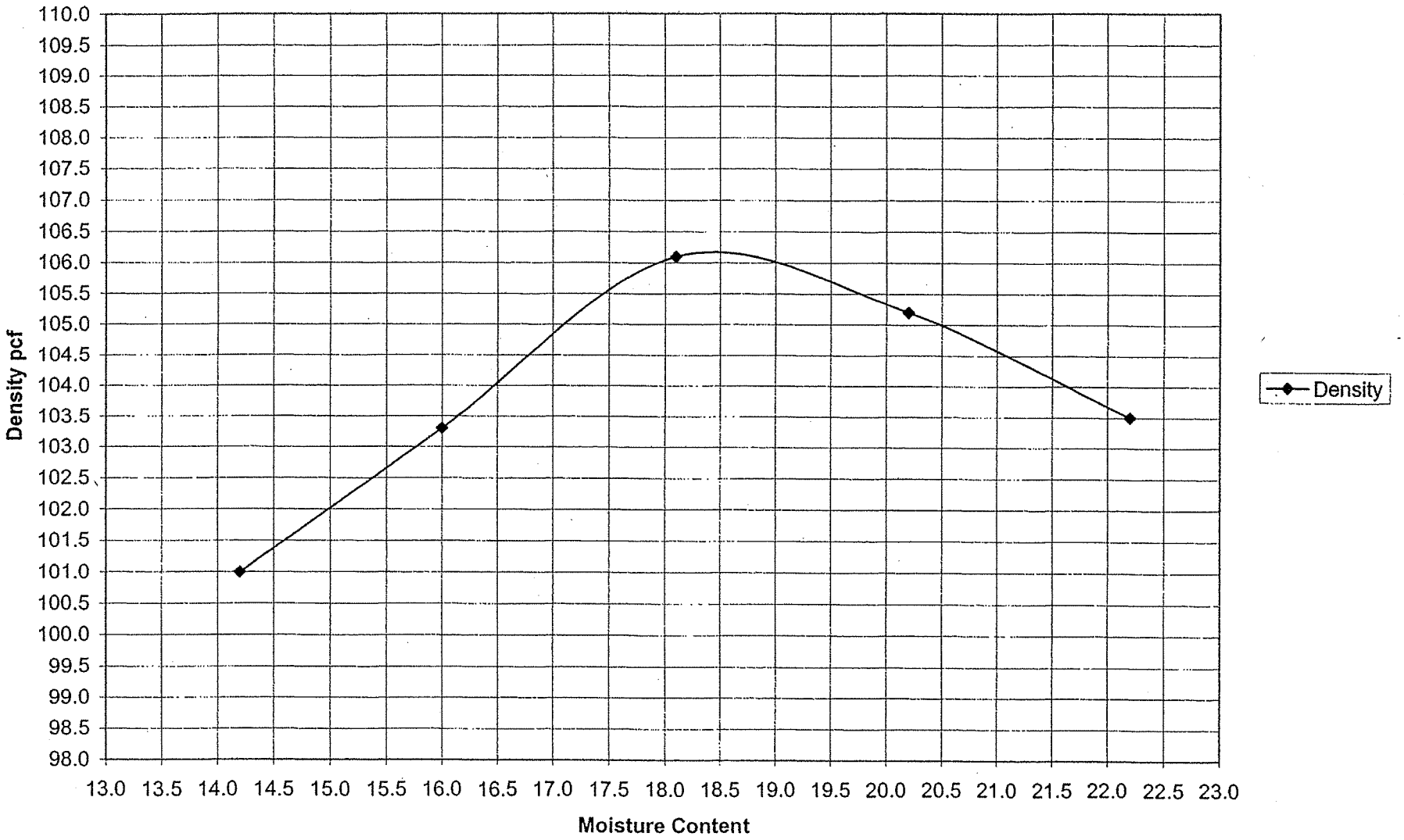


Quicklime Plus 3% Maximum Density 107.0pcf / Opt. Moisture 17.8% Lab # S20163-2/3

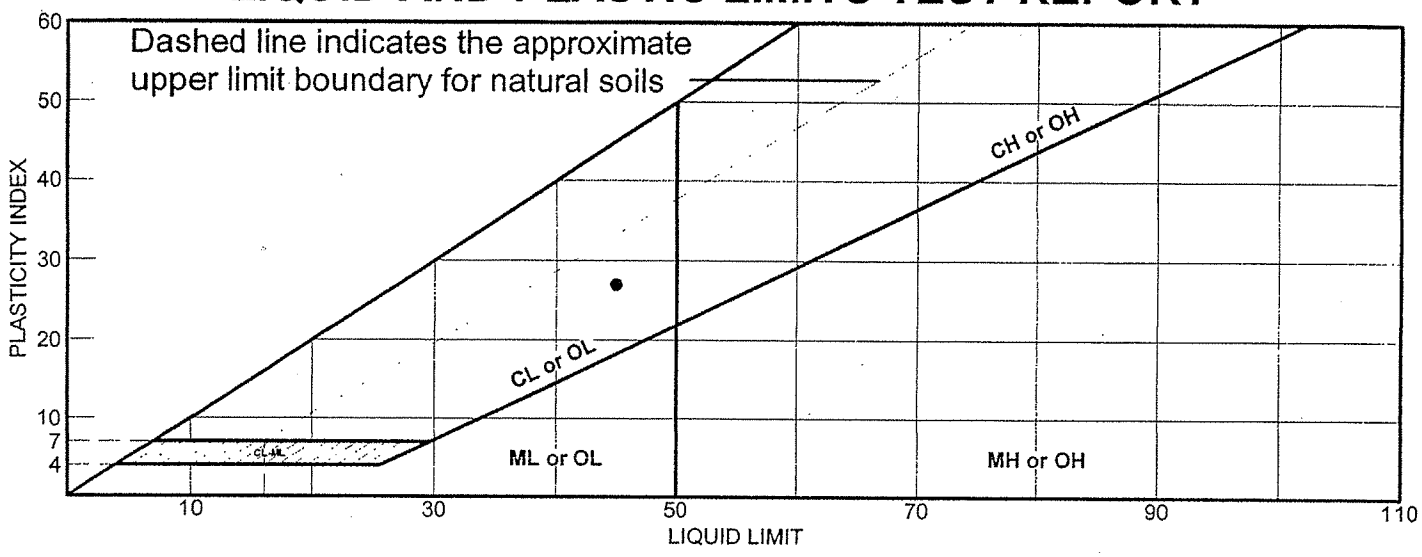
Moisture Vs. Density

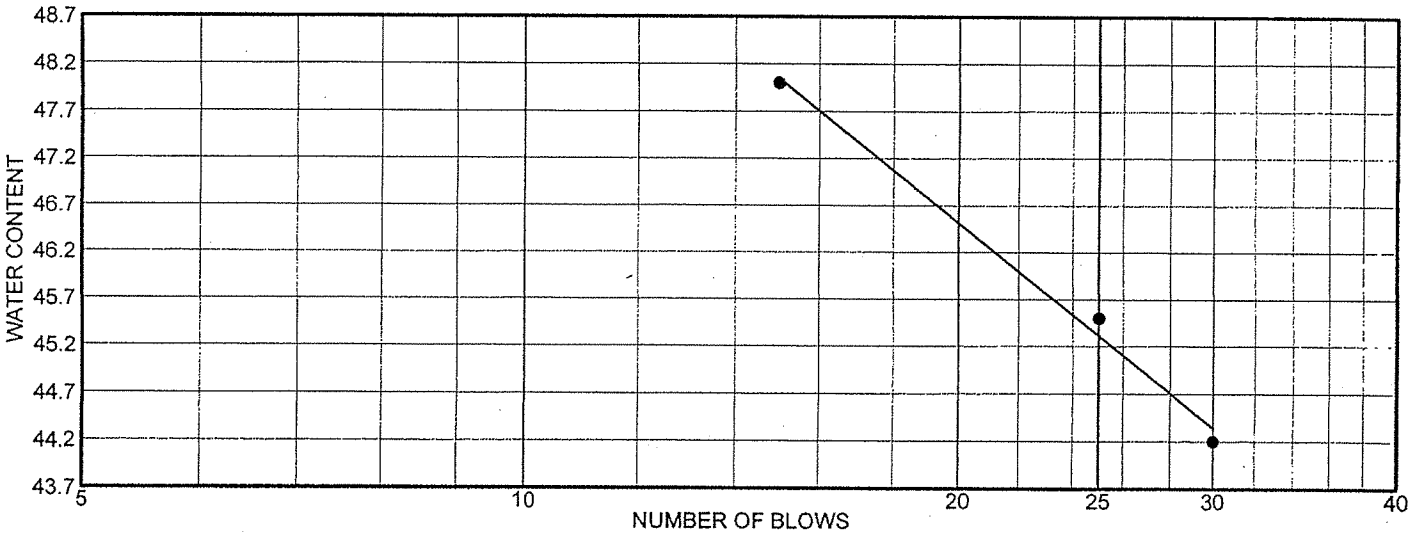
Quicklime 3% Maximum Density 106.2pcf / Opt. Moisture 18.4% Lab # S20163-2/3

Moisture Vs. Density



LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray brown silty clay, Location 4 & 5	45	18	27		54.0	

Project No. **Client:** URS-Oakland

Project: Hwy 4

● **Location:** 4 & 5

Remarks:

● Location 4 & 5

LIQUID AND PLASTIC LIMITS TEST REPORT

SIGNET TESTING LABS, INC.

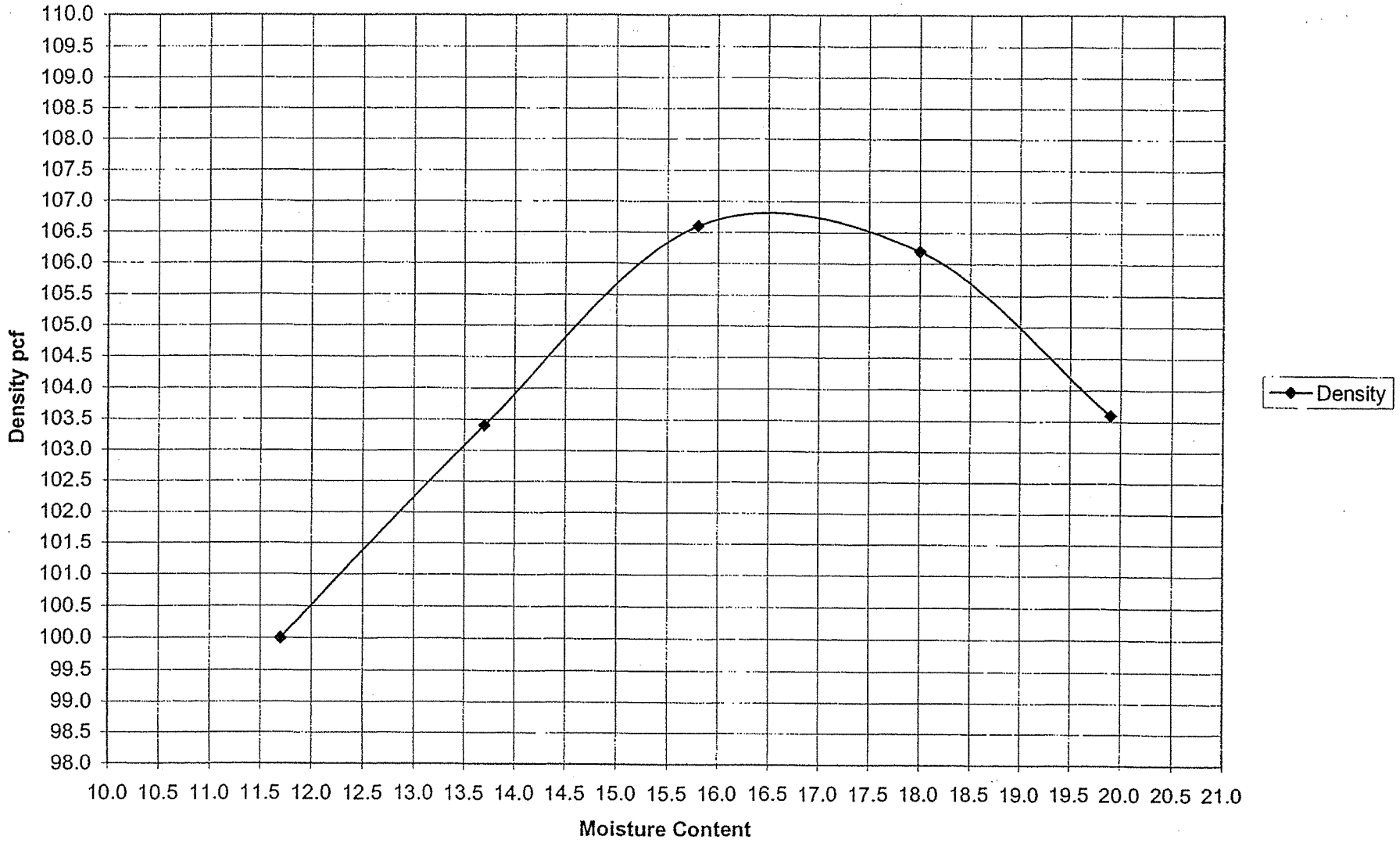
Project	Hwy 4	Lab #	S20163-4
Sample of	Loaction 4 and 5, Quicklime	STL #	

Unconfined Compressive Strength(psi) CTM 373

Percent Lime	Age (Days)	Specimen #1	Specimen #2	Average
3	7	319	342	331
5	7	422	406	414
7	7	454	438	446

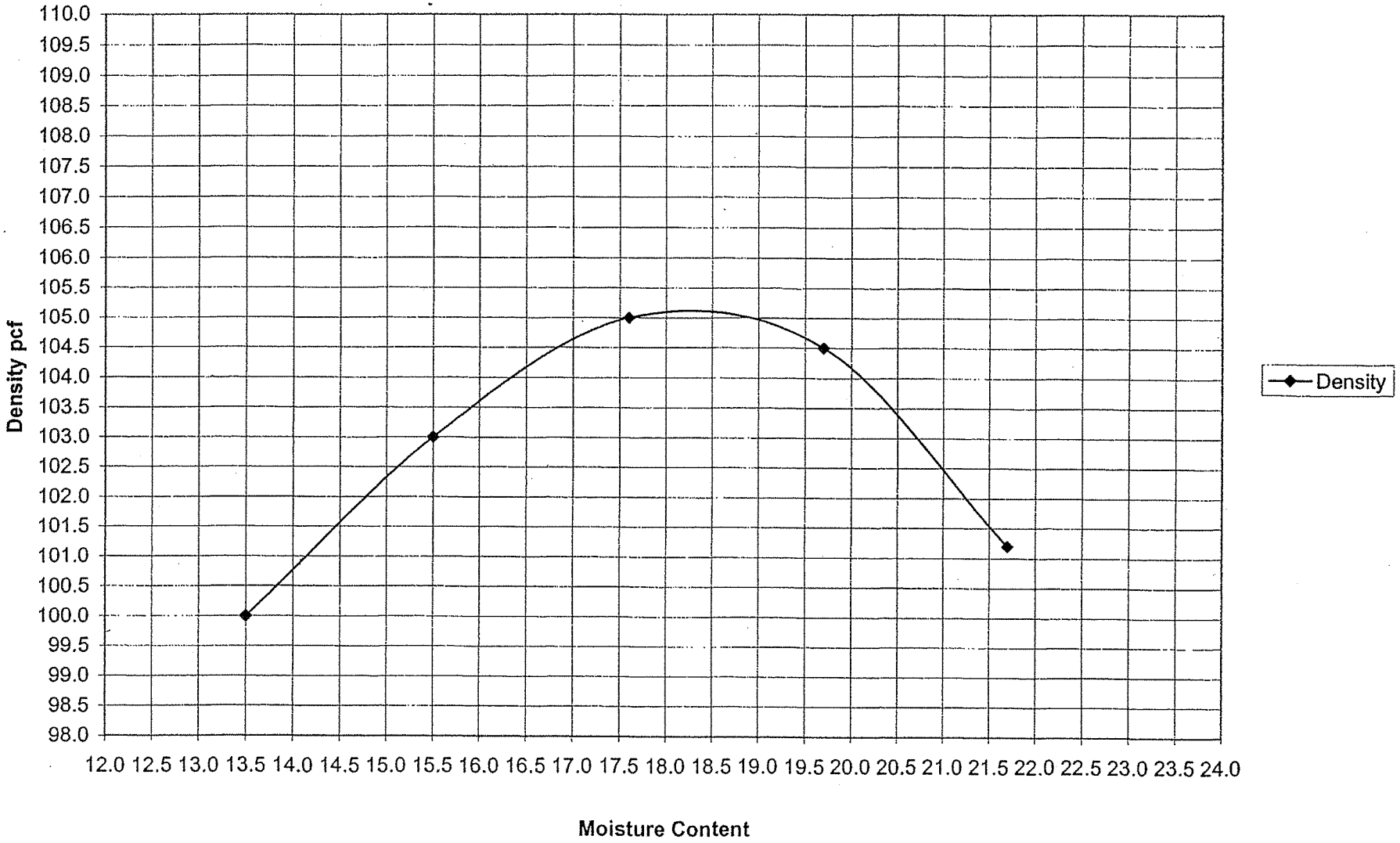
Quicklime 3% Maximum Density 106.8pcf / Opt. Moisture 16.5% Lab # S20163-4

Moisture Vs. Density



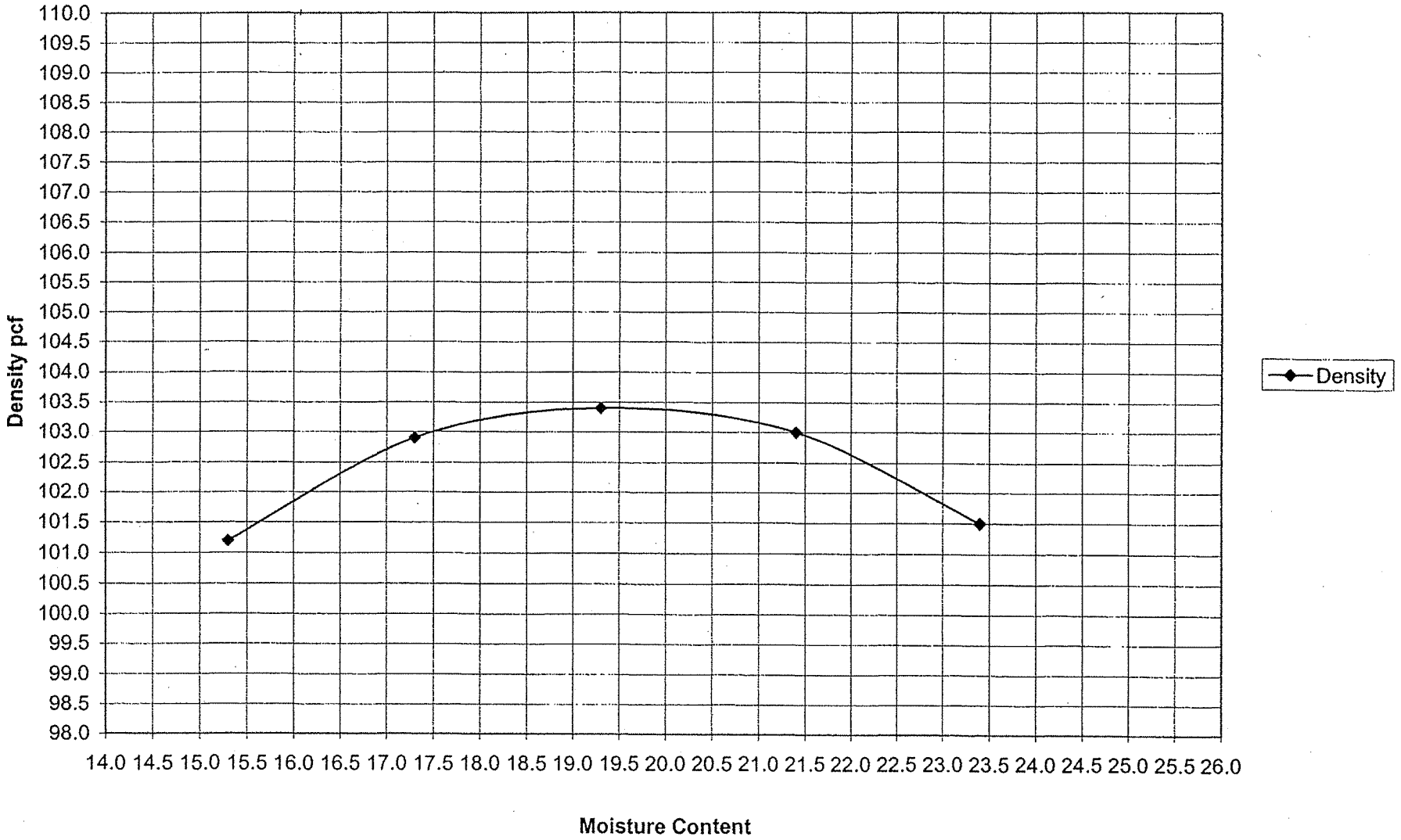
Quicklime 5% Maximum Density 105.1pcf / Opt. Moisture 18.3% Lab # S20163-4

Moisture Vs. Density



Quicklime 7% Maximum Density 103.4pcf / Opt. Moisture 19.5% Lab # S20163-4

Moisture Vs. Density



Project	Hwy 4	Lab #	S20163-4
Sample of	Loaction 4 and 5, Quicklime Plus	STL #	

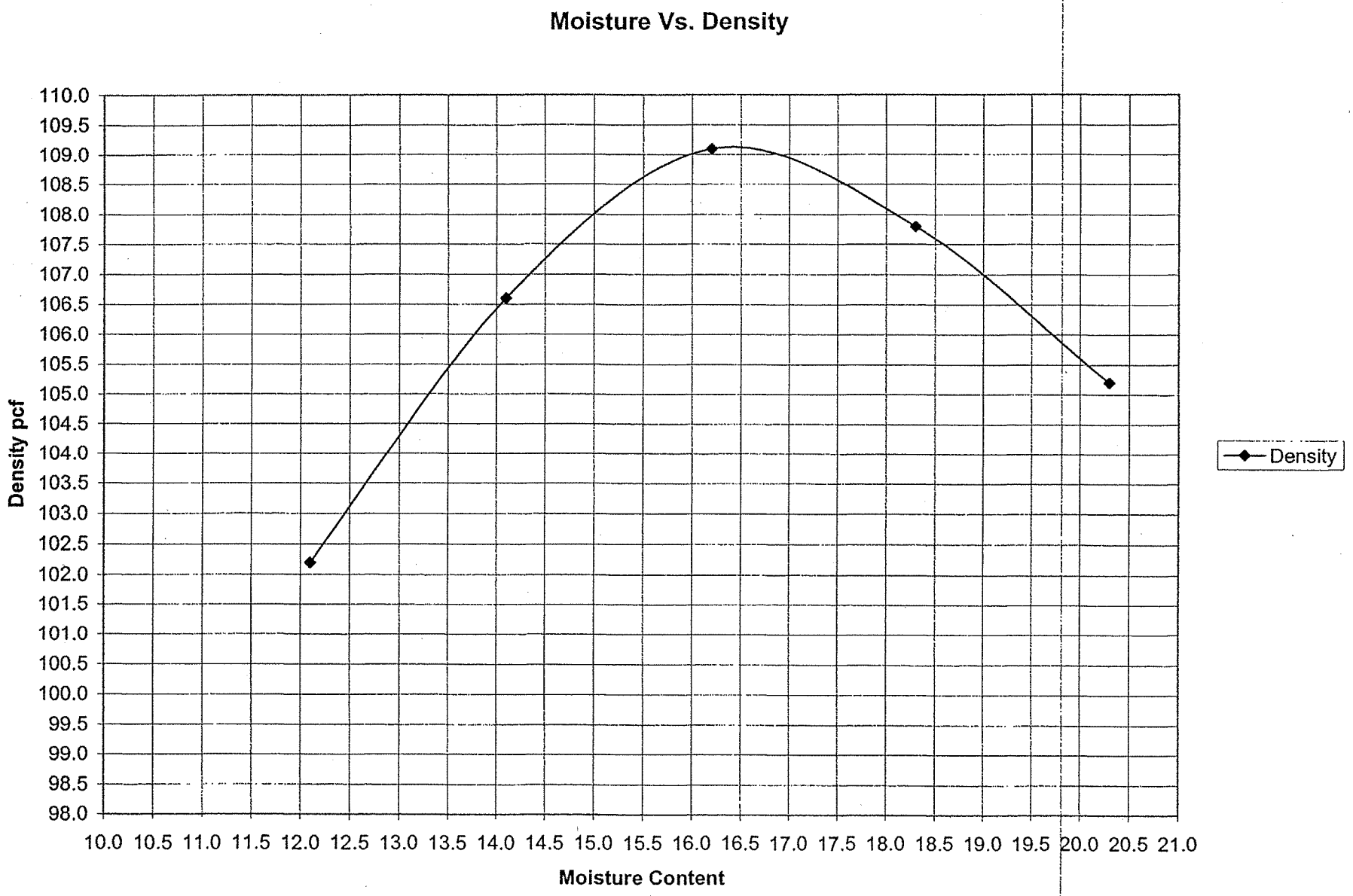
Unconfined Compressive Strength(psi) CTM 373

Percent Lime	Age (Days)	Specimen #1	Specimen #2	Average
3	7	223	247	235
5	7	286	294	290
7	7	374	342	358

Quicklime Plus 3%

Maximum Density 109.2pcf / Opt. Moisture 16.4%

Lab # S20163-4

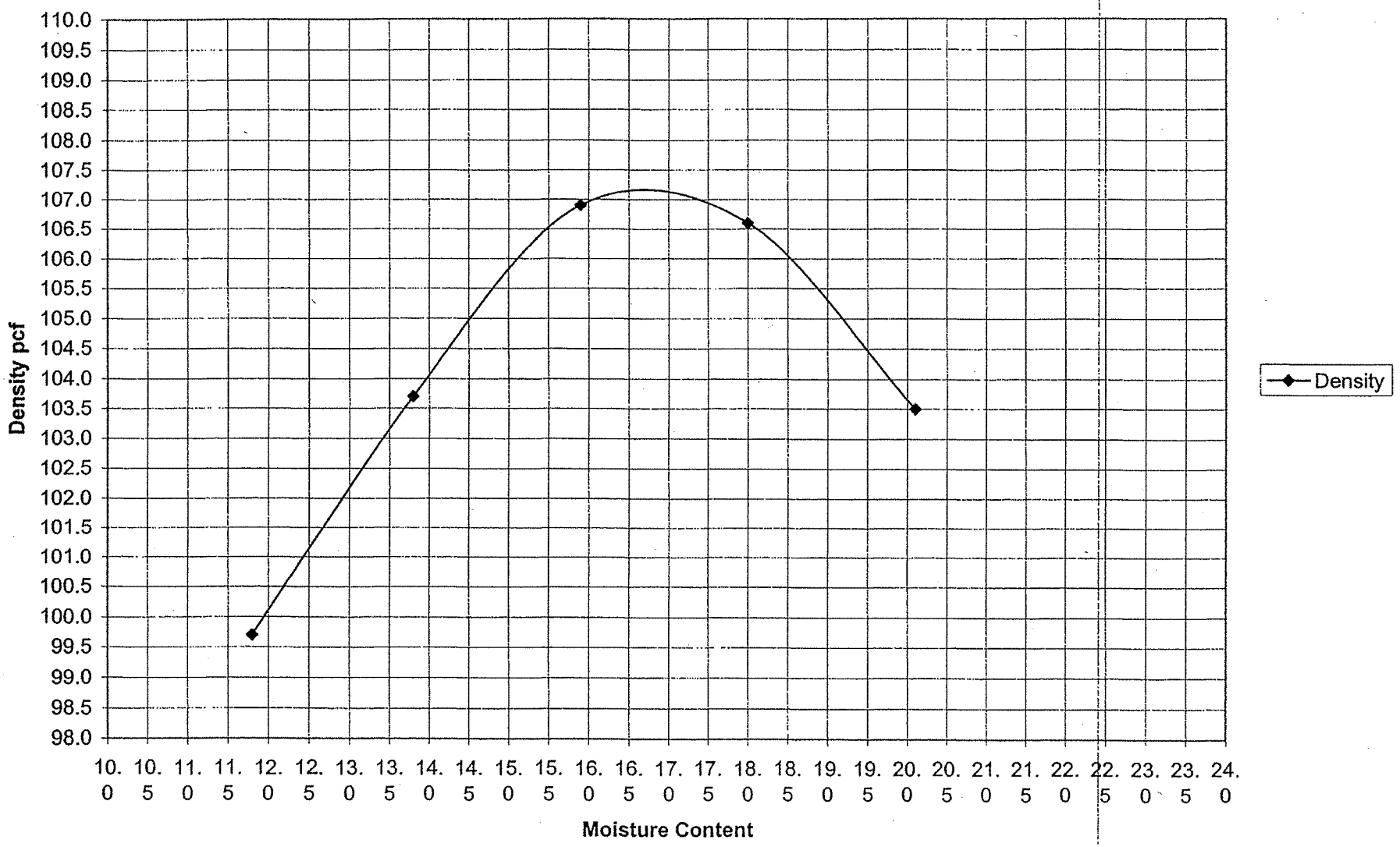


Quicklime Plus 5%

Maximum Density 107.2pcf / Opt. Moisture 16.7%

Lab # S20163-4

Moisture Vs. Density

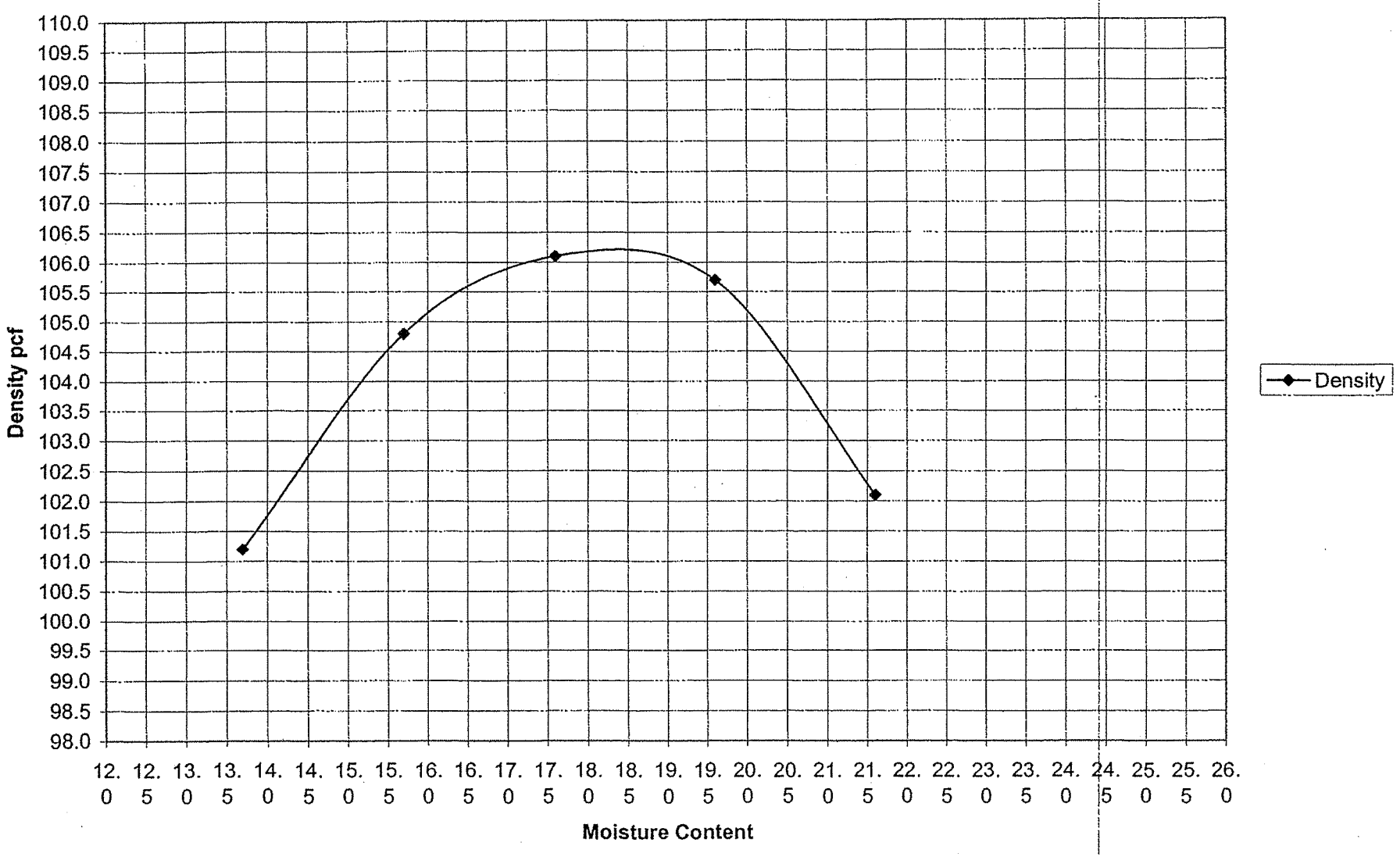


Quicklime Plus 7%

Maximum Density 106.3pcf / Opt. Moisture 18.4%

Lab # S20163-4

Moisture Vs. Density



Appendix C

Corrosion Report By V&A Consulting Engineers, Inc.

STATE ROUTE 4 WIDENING PROJECT
WEST OF LOVERIDGE ROAD, PITTSBURG, CA
TO SOMERSVILLE ROAD, ANTIOCH, CA

MATERIALS REPORT

Prepared for:

URS CORPORATION
1333 Broadway, Suite 800
Oakland, CA 94612

Prepared By:

V&A CONSULTING ENGINEERS INC.
Lake Merritt Plaza
1999 Harrison Street, Suite 975
Oakland, CA 94612

May 2006

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TEST METHODS....3
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TEST RESULTS AND DISCUSSION....8
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EXECUTIVE SUMMARY

V&A Consulting Engineers (V&A) was retained by URS Corporation to perform a Soil Corrosivity Investigation for the proposed State Route 4 Highway Widening Project between Loveridge Road in Pittsburg, CA and Somersville Road in Antioch, CA. The objective of this investigation is to measure various soil parameters and evaluate the results to determine the corrosivity of the soil to the proposed alignment associated with the highway widening project. Corrosivity was determined for the project alignment to depths ranging from 0 to 6 meters below grade.

This report provides recommendations for corrosion control for the Kirker Creek culvert and the Los Medanos Wasteway extension reinforced box culvert, and utility undercrossing.

The California Department of Transportation, Division of Engineering Services, Materials Engineering and Testing Services, Corrosion Technology Branch has published "Corrosion Guidelines" (Guidelines) to define corrosive soil. The Guidelines consider soil to be corrosive to structural elements (steel reinforced concrete) if one or more of the following conditions exist for water or soil samples:

> ***"Chloride concentration is 500 ppm (mg/kg) or greater, sulfate concentration is 2,000 mg/kg or greater, or the pH is 5.5 or less."***

Evaluation of the soil environment was made in terms of potential damage due to corrosion. Soil resistivity measurements were conducted in the field during the initial stages of the project. In addition, soil samples collected by URS during the geotechnical investigation were forwarded to Sequoia Analytical Laboratory in Sacramento, CA, for chemical analysis. The soil samples were analyzed for 'as-received' resistivity, minimum resistivity, and pH. The soil samples with a minimum resistivity of less than 1,000 ohm-cm were analyzed for water soluble chloride ion concentration and water soluble sulfate ion concentration, in accordance with the Guidelines. Table 2 lists the Minimum Soil Resistivity and Chemical Data, and the test methods for the chemical analysis of the soil samples.

The pH of the soil samples analyzed ranges from 7.1 to 9.1.

The water soluble chloride ion concentration of the soil borings analyzed ranges from the detection level of less than 20 milligrams per kilogram (mg/kg) to 210 mg/kg. The water soluble sulfate ion concentration of the soil borings analyzed ranges from the detection level of less than 20 mg/kg to 210 mg/kg. The soil is determined to be *non-corrosive* in accordance with the Guidelines.

CONCLUSIONS

- The chloride ion concentration of the soil borings analyzed is less than 500 mg/kg.
- The sulfate ion concentration of the soil borings is less than 2,000 mg/kg.
- The soil pH of the soil borings analyzed is greater than 5.5.
- The soil is considered to be *non-corrosive* to steel reinforcement in buried reinforced concrete, in accordance with the "Corrosion Guidelines."
- The water sample from Kirker Creek is considered to be *non-corrosive* in accordance with the Guidelines. The corrosivity of Old Kirker Creek is expected to be similar to the corrosivity of Kirker Creek.
- Water in the Los Medanos Wasteway is considered to be non-corrosive in accordance with the Guidelines.
- The project site is not located within 300 meters of a salt water or brackish water source.

RECOMMENDATIONS

Based on the test data and review of the project requirements, specific recommendations for each material alternative are listed below:

Buried Concrete Structures

Buried concrete structures including retaining walls, sounds walls, reinforced concrete box structures, drainage culverts overpasses, and underpasses should be constructed of durable concrete as described in ACI Standards 201.2R and 222R. These recommendations include, but are not limited to, the following minimum requirements for reinforced concrete structures installed in *non-corrosive* soil:

- The water/cement ratio should not exceed 0.50.
- A concrete cover of a minimum of 5 centimeters (2 inches) should be applied over all steel reinforcement.
- Salt-free sand and potable water free of organic matter, oil and salts should be used. Chloride ion concentration shall not exceed 300 ppm and sulfate ion concentration shall not exceed 150 ppm.

Culvert Backfill and Mechanically Stabilized Embankment Backfill

Fast setting concrete backfill may need to be used when placing culverts in existing roadways. When using an admixture to decrease concrete curing times, only non-chloride admixtures should be considered.

Non-corrosive backfill for metallic soil reinforcement, such as tie-back anchors or soil nails, and reinforced concrete structures shall meet the following requirements, in accordance with the Guidelines:

- Minimum resistivity greater than 1,500 ohm-cm.
- Water soluble chloride ion concentration less than 500 mg/kg.
- Water soluble sulfate ion concentration less than 2,000 mg/kg.
- A pH between 5.5 and 10.0.

Drainage Culvert Materials

- Galvanized steel pipe culverts used for water drainage shall have a minimum thickness of 2.0 millimeters and a soil side bitumastic coating for a minimum 50 year design life of the culverts. The parameters used for analysis are a pH of 7.09 and a minimum resistivity of 460 ohm-cm. Figure 854.3B of Topic 850 of the Highway Design Manual is used as a design reference for metallic piping.
- Galvanized steel pipe culverts used for water drainage shall have a minimum thickness of 1.3 millimeters and a soil side bitumastic coating for a minimum 25 year design life of the culverts. The parameters used for analysis are a pH of 7.09 and a minimum resistivity of 460 ohm-cm. Figure 854.3B of Topic 850 of the Highway Design Manual is used as a design reference for metallic piping.

Metallic Pipelines and Steel Pipe Casings

- The 1350 mm steel pipe casing for the sanitary sewer pipeline at approximate station 252 should have a corrosion allowance of 0.025 mm per year added to the thickness of the casing. A casing with a 50 year design life should have a minimum corrosion allowance of 1.25 mm.

TEST METHODS

In attempting to predict corrosion problems associated with a particular type of structure prior to installation, it is necessary to investigate the soil conditions the structure will encounter. Since corrosion is an electrochemical process accompanied by current flow, the electrochemical characteristics of a soil are of primary importance when evaluating corrosivity. Test methods utilized during this investigation reflect the most practical methods of evaluating corrosivity.

In-Situ Soil Resistivity

Resistivity of the soil was measured at 16 locations on the project alignment. Figure 1 shows the overall project vicinity map and Figure 2 shows the field soil resistivity testing locations and soil boring locations.

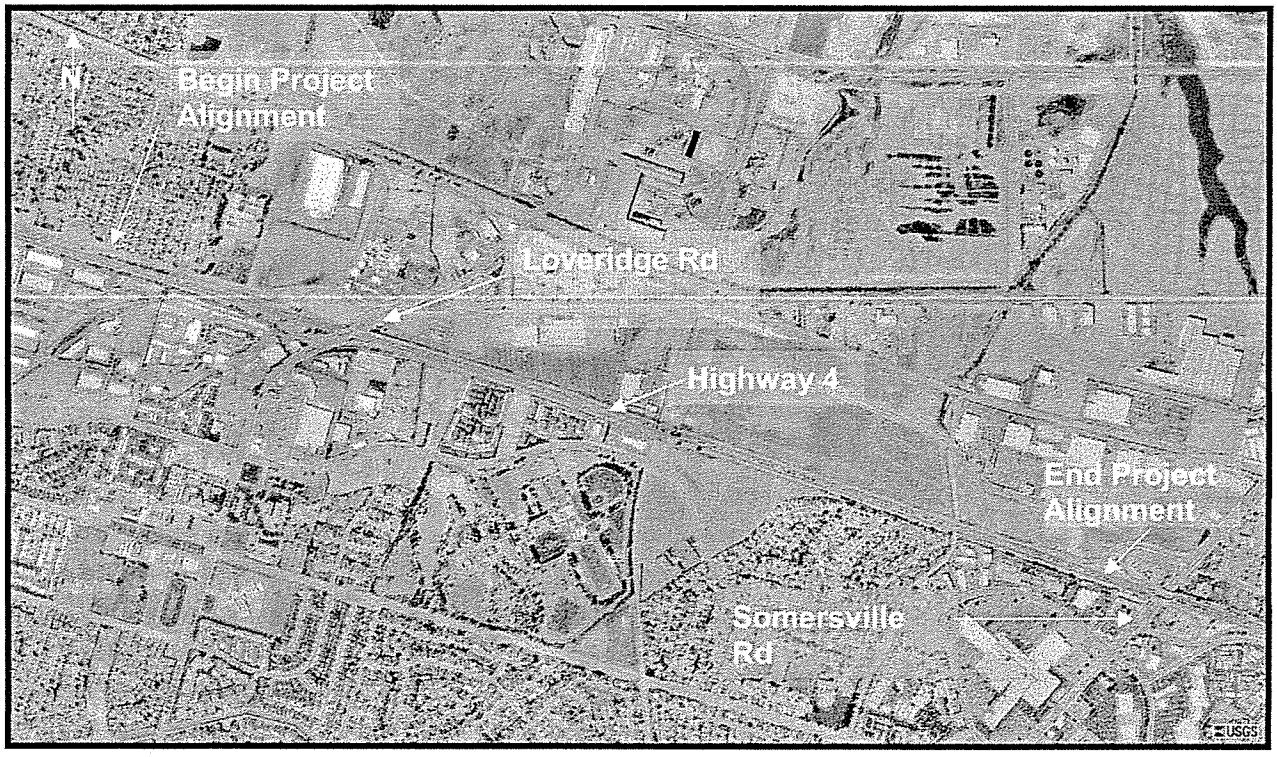


Figure 1 – Project Vicinity and Project Site Map

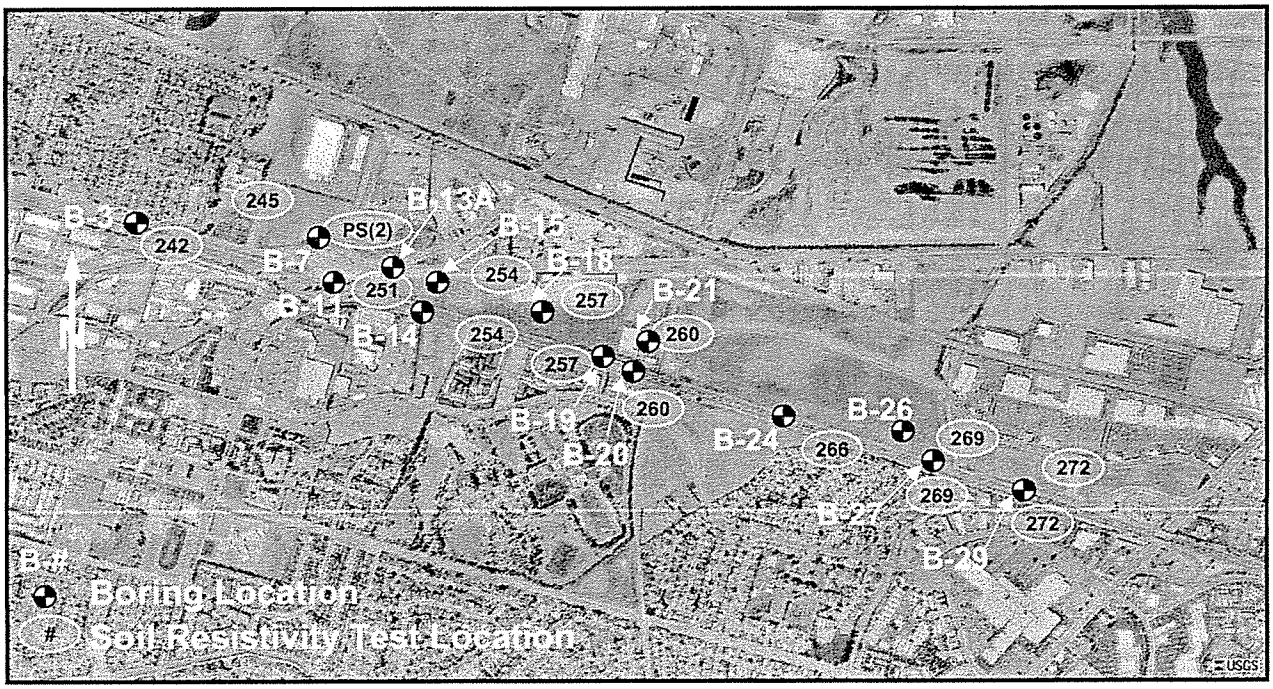


Figure 2 – In-Situ Resistivity Testing and Boring Locations

In-situ soil resistivity was measured using the Wenner 4-Electrode (Wenner) Method, with a Soil Resistance Meter, Model 400, manufactured by Nilsson Electrical Laboratory, Inc. The Wenner Method involves the use of four metal probes or electrodes, driven into the ground along a straight line, equidistant from each other, as shown in Figure 3.

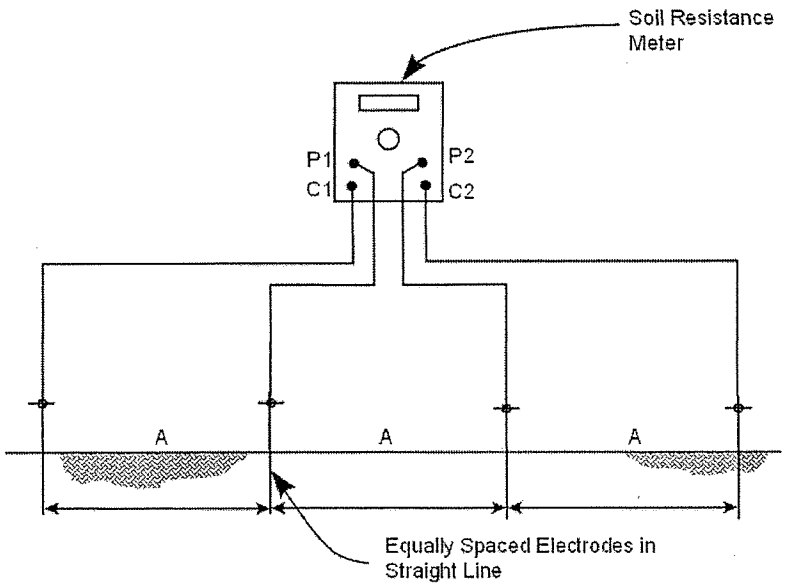


Figure 3 – In-Situ Soil Resistivity Measurement

An alternating current from the Soil Resistance Meter causes a current to flow through the soil between the outside electrodes, C1 and C2. Due to the resistance of the soil, the current creates a voltage gradient, which is proportional to the average resistance of the soil mass to a depth equal to the distance between probes. The voltage drop is then measured across electrodes P1 and P2. Resistivity of the soil is then computed from the instrument reading according to the following formula:

$$\rho = 2 \cdot \pi \cdot A \cdot R$$

Where:

ρ	=	soil resistivity (ohm-cm)
A	=	distance between electrodes (cm)
R	=	soil resistance, instrument reading (ohms)
π	=	3.14 (approx.)

Soil resistance is measured with electrodes spaced 1.5, 3, 4.5, and 6 meters apart (5, 10, 15 and 20 feet) apart. The resistivity values obtained represent the average resistivity of the soil to a depth equal to the pin spacing. An additional method of calculating the soil resistivity using the data from the Wenner Method is the Barnes-Layer resistivity calculation. The Barnes Layer calculation is used to determine the resistivity of the soil for each soil layer. While the Wenner Method at 3 meters will consider all 3 meters of soil below the surface, the Barnes-Layer method will consider the resistivity of only the layer of soil between 1.5m and 3m below the surface. This method assumes the soil layers are a uniform thickness and parallel to the surface, which may not always be true.

$\rho_{b-a} = KR_{b-a}$ and $\frac{1}{R_{b-a}} = \frac{1}{R_a} - \frac{1}{R_b}$

Where:

ρ_{b-a}	=	Soil resistivity of layer depth b-a (ohm-cm)
a	=	Soil depth to top of layer (cm)
b	=	Soil depth to bottom of layer (cm)
R_a	=	Soil resistance read at depth a (ohms)
R_b	=	Soil resistance read at depth b (ohms)
R_{b-a}	=	Resistance of soil layer from a to b (cm)
K	=	2 π (b-a)

Barnes Layer resistivity is calculated for layers 0 to 1.5, 1.5 to 3, 3 to 4.5, and 4.5 to 6 meters (0 - 5, 5 - 10, 10 - 15, and 15 – 20 feet) below grade.

Laboratory Analysis of Soil

To supplement the in-situ resistivity data, soil samples were obtained from the geotechnical investigation. Minimum soil resistivity of the selected soil borings was measured using a soil box, as shown in Figure 4.

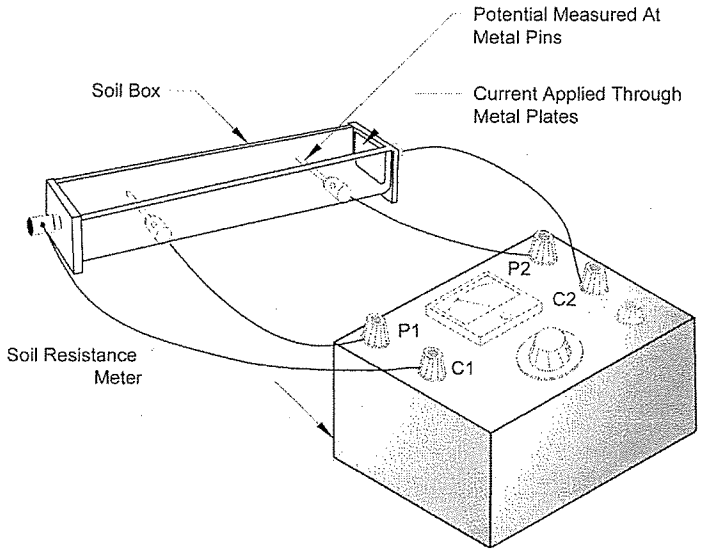


Figure 4 – Minimum Soil Resistivity Measurement

This apparatus consists of a small plastic box with metal end plates for passing current through the soil sample packed tightly into the box. Current is passed through the sample, causing a voltage drop across the soil sample. The soil resistivity was determined from this known voltage drop utilizing a Soil Resistance Meter, as described earlier.

The soil sample was placed in the soil box and the soil resistivity measured in the "as-found" state. Distilled water was added to the soil sample in 10-milliliter increments and the resistivity measured after each watering. As the soil sample became more saturated, the soil resistivity decreased until the minimum soil resistivity was reached.

The soil borings listed in Table 2 were analyzed for minimum resistivity and the samples with a minimum resistivity less than 1,000 ohm-cm were forwarded to Sequoia Analytical Laboratory in Sacramento for water soluble chloride and sulfate ion concentration. In addition to chemical analysis, all of the soil samples and the water sample from Kirker Creek were analyzed for pH.

TEST RESULTS AND DISCUSSION

Data obtained during this investigation has been summarized in tabular form for analysis and presentation. Table 1 lists the results of the field soil resistivity measurements conducted at the site. Table 2 lists the "as-received" and minimum soil resistivity for each sample collected as well as the chemical analysis of the samples.

In-Situ Soil Resistivity

Table 1 – In-Situ Soil Resistivity Data

Station	Site	Depth (m)	Resistivity (ohm-cm)		Layer (m)	Station	Site	Depth (m)	Resistivity (ohm-cm)		Layer (m)
			At Depth	Layer					At Depth	Layer	
242 EB	1	1.5	1,819	1,819	0 – 1.5	257 WB	9	1.5	1,149	1,149	0 – 1.5
		3	1,685	1,570	1.5 – 3			3	785	596	1.5 – 3
		4.5	1,264	843	3 – 4.5			4.5	1,034	2,827	3 – 4.5
		6	728	320	4.5 – 6			6	1,187	2,137	4.5 – 6
245 WB	2	1.5	2,585	2,585	0 – 1.5	260 EB	10	1.5	1,436	1,436	0 – 1.5
		3	2,107	1,777	1.5 – 3			3	1,111	906	1.5 – 3
		4.5	1,465	910	3 – 4.5			4.5	948	733	3 – 4.5
		6	919	434	4.5 – 6			6	651	336	4.5 – 6
PS NS	3	1.5	967	967	0 – 1.5	260 WB	11	1.5	1,053	1,053	0 – 1.5
		3	1,111	1,305	1.5 – 3			3	938	846	1.5 – 3
		4.5	1,005	845	3 – 4.5			4.5	891	808	3 – 4.5
		6	996	968	4.5 – 6			6	728	470	4.5 – 6
PS EW	4	1.5	910	910	0 – 1.5	266 EB	12	1.5	1,628	1,628	0 – 1.5
		3	919	929	1.5 – 3			3	1,130	865	1.5 – 3
		4.5	948	1,011	3 – 4.5			4.5	1,092	1,022	3 – 4.5
		6	919	843	4.5 – 6			6	1,187	1,611	4.5 – 6
251 EB	5	1.5	1,341	1,341	0 – 1.5	269 EB	13	1.5	1,149	1,149	0 – 1.5
		3	1,130	976	1.5 – 3			3	1,092	1,040	1.5 – 3
		4.5	1,120	1,102	3 – 4.5			4.5	1,207	1,528	3 – 4.5
		6	1,111	1,083	4.5 – 6			6	1,379	2,413	4.5 – 6
254 EB	6	1.5	1,053	1,053	0 – 1.5	269 WB	14	1.5	1,532	1,532	0 – 1.5
		3	785	626	1.5 – 3			3	1,092	848	1.5 – 3
		4.5	661	502	3 – 4.5			4.5	1,005	868	3 – 4.5
		6	613	503	4.5 – 6			6	766	447	4.5 – 6
254 WB	7	1.5	670	670	0 – 1.5	272 EB	15	1.5	1,724	1,724	0 – 1.5
		3	670	670	1.5 – 3			3	900	609	1.5 – 3
		4.5	776	1,131	3 – 4.5			4.5	776	608	3 – 4.5
		6	881	1,487	4.5 – 6			6	689	517	4.5 – 6
257 EB	8	1.5	1,053	1,053	0 – 1.5	272 WB	16	1.5	1,053	1,053	0 – 1.5
		3	823	676	1.5 – 3			3	823	676	1.5 – 3
		4.5	747	630	3 – 4.5			4.5	776	695	3 – 4.5
		6	728	676	4.5 – 6			6	651	440	4.5 – 6

EB – East Bound Lane WB – West Bound Lane

Corrosion of a metal is an electro-chemical process and is accompanied by the flow of electric current. Resistivity is a measure of the ability of a soil to conduct an electric current and is an important parameter in consideration of corrosion data. Soil resistivity is primarily dependent upon the chemical content and moisture content of the soil mass. The greater the amount of chemical constituents present in the soil, the lower the resistivity will be. As moisture content increases, resistivity decreases until maximum solubility of dissolved chemicals is attained. Beyond this point, an increase in moisture content results in dilution of the chemical concentration and resistivity increases. The corrosion rate of steel in soil normally increases as resistivity decreases. Therefore, in any particular group of soils, maximum corrosion will generally occur in the lowest resistivity areas.

Laboratory Analysis of Soil Samples

Table 2 – Minimum Soil Resistivity and Chemical Data

Sample	Approx. Station	Depth (m)	Minimum Resistivity (ohm-cm)	pH	Chloride (mg/kg)	Sulfate (mg/kg)
B-3, 2-A	242	1	460	8.5	ND	130
B-6, 1-A	247	1.5	630	8.0	ND	54
B-7, 1-A	248	1	630	8.0	ND	54
B-7, 3-A	248	3	740	8.5	48	210
B-11, 2-A	248	1.5	700	8.5	ND	ND
B-13, 3-A	251	3	540	9.0	210	130
B-14, 3-A	252	3	2,800	8.8	--	--
B-15, 3-A	253	3	670	8.5	ND	100
B-18, 3-A	256	3	760	9.1	ND	ND
B-19, 3-A	258	3	1,200	8.7	--	--
B-20, 2 - 4	259	1	1,000	8.2	ND	ND
B-21, 2 - 2	259	1	2,300	7.6	-	-
B-24, 3-A	265	3	870	8.8	ND	91
B-26, 3-A	268	3	2,400	8.1	--	--
B-27, 3-A	269	3	1,200	8.6	--	--
B-29, 3-A	271	3	860	8.0	ND	110
Kirker Creek Water Sample	242	0	2,500	7.1	13	69
Test Methods			CTM 643	EPA 9045C	EPA 300	EPA 300

mg/kg – milligrams per kilogram ND – Not Detected, below the detection limit of 20 mg/kg.

A wide variety of soluble salts is typically found in soils. Two soils having the same resistivity may have significantly different corrosion characteristics, depending on the specific ions available. The

major constituents that accelerate corrosion are chlorides, sulfates and the acidity (pH) of the soil. Chloride ions tend to break down otherwise protective surface deposits, and can result in corrosion of reinforcing steel in concrete structures. Sulfates in soil can be highly aggressive to Portland cement concrete by combining chemically with certain constituents of the concrete, principally tricalcium aluminate. This reaction is accompanied by expansion and eventual disruption of the concrete matrix. High concentrations of bicarbonates tend to decrease soil resistivities. Although bicarbonates are not aggressive to concrete, lower resistivity environments can promote corrosion activity.

Acidity, as indicated by the pH value, is another important factor of soil. The lower the pH (the more acidic the environment), the higher will be the corrosivity with respect to buried metallic and concrete structures. As pH increases above 7 (the neutral value), conditions become increasingly more alkaline and passive to buried structures.

- The water soluble chloride levels of the soil borings analyzed ranged from below the detection level of 20 mg/kg to 210 mg/kg.

- The water soluble sulfate levels of the soil borings analyzed ranged from below the detection level of 20 mg/kg to 210 mg/kg.

- The pH ranged from 7.1 to 9.1.

- Based on the corrosion analyses, the soil is classified as *non-corrosive* in accordance with the Corrosion Guidelines.

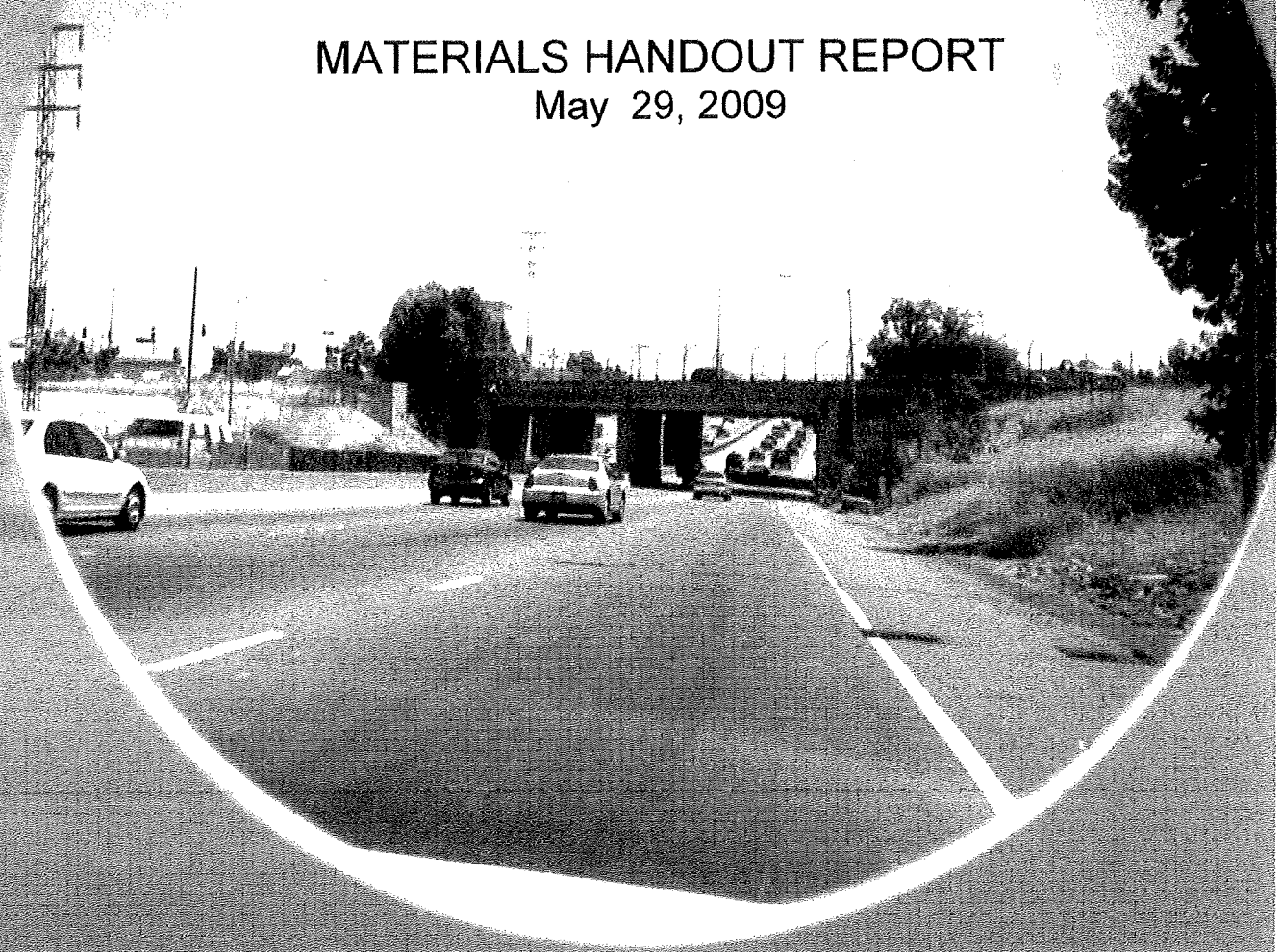
CONTRA COSTA TRANSPORTATION AUTHORITY

California Department of Transportation

SR4 (East) Widening Project
Loveridge Road to Somersville Road

04-CC-04, KP 37.9/41.3 (PM 23.71/26.8)
04275-228501

MATERIALS HANDOUT REPORT
May 29, 2009



URS

MATERIALS HANDOUT REPORT

SR4 (EAST) WIDENING PROJECT

LOVERIDGE ROAD TO SOMERSVILLE ROAD

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FIGURES

Figure 1 – Site Location Map Plan (available in November 9, 2007 Materials Report)

Figure 2 – Site Plan (available in November 9, 2007 Materials Report)

MATERIALS HANDOUT REPORT

SR4 (EAST) WIDENING PROJECT

LOVERIDGE ROAD TO SOMERSVILLE ROAD

INTRODUCTION

This Materials Handout Report presents the results of a geotechnical investigation for the proposed SR4 (East) Widening Project Loveridge Road to Somersville Road (KP 37.8 to KP 42.0).

The results of our materials available studies are presented in this report, and are consistent with the format presented in "Topic 111 – Materials Sites and Disposal Sites" of the Caltrans Highway Design Manual (2008). Background information of the project, previous investigations near the project site and the scope of work are included in the introduction.

Purpose and Scope of Geotechnical Services

The purpose of the Geotechnical Design and Materials Report was to document existing subsurface and groundwater conditions, make preliminary recommendations for structural pavement design, corrosion protection of subsurface structures and utilities, earthwork construction and grading factors, foundation support for existing drainage culverts to be modified, foundation support for new overhead sign structures, and specifications (standard and special provisions).

Available Reports

The following reports by URS are pertinent to this study:

- URS 11/09/2007, Final Materials Report, Loveridge Road to Somersville Road.
- URS 2/28/07, Final Foundation Report, Loveridge Road Overcrossing (Widen), Bridge No. 28 – 96 R/L.
- URS 2/28/07, Final Foundation Report, Century Boulevard Undercrossing (Widen), B ridge No. 28-99 R/L.
- URS 2/27/07, Final Foundation Report, Utilities Undercrossing (Widen) Bridge No. 28-105.
- URS 2/27/07, Final Foundation Report, Retaining Wall Nos. 1, 2A, 2B, 3A, 3B, 4, 5, 6 and Sound Wall No.1.

URS also reviewed as-built drawings for two existing culverts, the Kirker Creek and the Los Medanos Waste Way.

GENERAL INFORMATION

Description of Project

General

The proposed State Route (SR) 4 (East) Widening Project - Loveridge Road to Somersville Road (the Project) will widen SR4 from its current four lanes to an eight-lane facility from west of Loveridge Road (KP 37.9) to the Somersville Road Interchange (KP 41.3). The project location is shown on the attached vicinity map, Figure 1. The general project plan layout is presented on Figure 2.

This Project is part of the Contra Costa Transportation Authority's (CCTA's) overall plan to continue the widening of SR4 further into East County and is consistent with the Phase 1 Implementation Plan recommendation made in the SR4 (east) Railroad Ave. to SR 160 Major Investment Study (MIS). Funding for the project will be from Measure C, Measure J, STIP, TCRP, and ITIP funds.

Existing Facilities and Proposed Improvements

The existing freeway is a four-lane divided highway with two mixed-flow lanes in each direction. The freeway is at grade west of Loveridge Road and descends beneath the Loveridge Overcrossing structures and returns to grade to the east where the freeway spans a utility corridor and the Century Boulevard Undercrossing Structure. The Loveridge Overcrossing structures consist of two two-span steel girder bridges: an easterly Camp Stoneman Road Underpass and a westerly Loveridge Road Overcrossing Structure. The existing Century Boulevard Undercrossing is a single span structure.

The proposed project will widen the freeway from two to four lanes providing three mixed-flow and one High Occupancy Vehicle (HOV) lane in each direction. From SR 242 to west of Loveridge Road, the above improvements have either been completed, or are under construction. The improvements will conform to the existing four lane facility just before the Somersville Road Overcrossing. Some of the significant features of this project include:

- The Loveridge Road interchange will be widened and reconstructed to accommodate two left turn lanes, two through traveled lanes, shoulders sufficient for bicycles, and a sidewalk in each direction of travel. The existing Loveridge Road Overcrossing and Camp Stoneman Road Underpass will be removed.
- At the Loveridge Interchange, the eastbound diagonal on-and off-ramps will be reconstructed but the eastbound loop on-ramp eliminated. The westbound on- and off-ramps will be reconstructed at their current location maintaining the existing buttonhook configuration.
- California Avenue and North Park Boulevard will be shifted north to accommodate the freeway widening and new ramp configurations, and the intersection of Loveridge Road with California Ave/North Park Boulevard will be improved to accommodate the projected traffic volumes and increase public safety.

- The Century Boulevard Undercrossing structure will be reconstructed with two-span structures and lowering of the profile of Century Boulevard to meet vertical clearance requirements. The replaced structure will accommodate planned widening of Century Boulevard to provide two through lanes in each direction.
- The utilities undercrossing structure west of Century Boulevard will be lengthened to accommodate the widened freeway.
- Provisions in the freeway median and at the Loveridge Interchange will be made to accommodate a future mass transit extension.
- The storm water pump station located in the northwest corner of the Loveridge Interchange will be relocated further west to accommodate new construction features.
- Two existing drainage culverts (Kirker Creek and Los Medanos Waste Way) will be modified to accommodate the freeway widening. A previously existing culvert for Old Kirker Creek was abandoned and sealed during construction of the new Kirker Creek culvert.

The project will also include provisions for ramp metering with HOV preferential lanes and California Highway Patrol (CHP) enforcement areas. A number of retaining and sound walls will be constructed to minimize the impact of right of way and to reduce noise impact to the neighborhood. This freeway widening is anticipated to accommodate forecasted traffic through year 2030.

The materials report addresses the following: Design of structural pavement sections, earthwork construction (cuts, fills and material sources), earthwork grading factors, construction considerations, recommended material specifications (standard and special provisions), modifications to two drainage culverts (Kirker Creek and Los Medanos Waste Way) to accommodate the freeway widening, corrosion investigation, and overhead sign structures.

Pavements

R-Value Tests

Soils to be used for fill and the soils present at proposed subgrade locations are primarily silty clays with moderate to high plasticity. The pavement designs for the project are based on an R-Value equal to 6.

Lime Treatment

Lime treatment of the subgrade is recommended. All soils underlying new pavements, shoulders, and medians will be lime treated to a depth of 450 mm.

We recommend that the site subgrade soils be treated with 5 % Quicklime. Furthermore, we recommend that the Contractor retain a testing laboratory to verify the recommended percentage of Quicklime Plus during construction.

RECOMMENDED MATERIALS SPECIFICATIONS

Specifications

Earthwork

All earthwork shall be performed according to the current Caltrans Standard Specifications. Section 16, Clearing and Grubbing, and Section 19, Earthwork, of the Standard Specifications should be followed. Specific additions and modifications to those specification requirements are discussed below.

Earth Retaining Structures

2/15/07 DWH##

Earth retaining structures, consisting of Retaining Wall Number 3B, Retaining Wall Number 4 and Retaining Wall Number 5, shall conform to the details shown on the plans and the special provisions.

2. Add SSP S8-C15.

Attention is directed to "Precast Concrete Quality Control" of the special provisions.

Excavation and backfill shall conform to the details shown on the plans, the provisions in Section 19, "Earthwork," of the Standard Specifications, the provisions in "Earthwork" elsewhere in the special provisions, and the special provisions.

12. Paras 12 thru 18 pertain to mechanically stabilized embankment (MSE) and similar proprietary systems, otherwise delete Paras 12 thru 18 and insert earthwork requirements where applicable. Plans must show limits of earthwork for all alternatives allowed.

13. Delete if metallic soil reinforcement systems are not an option; requirements given are for Ø angle of 34 degrees.

15

Permeable material shall be used for the portion of the structure backfill for earth retaining structures with soil reinforcement within the limits shown on the plans. Permeable material shall be Class 1, Type B, conforming to the provisions in Section 68-1.025, "Permeable Material," of the Standard Specifications.

16. Delete if metallic soil reinforcement systems are not an option.

18

Water used for earthwork or dust control within 150 meters of earth retaining structures with metallic soil reinforcement shall conform to the provisions for water in Section 90-2.03, "Water," of the Standard Specifications.

Concrete

Concrete used in precast and cast-in-place reinforced concrete members of earth retaining structures shall conform to the details shown on the plans, the provisions in Section 51, "Concrete Structures," of the Standard Specifications, and the special provisions.

20*. Use only when there is the possibility in the contract of an MSE or similar proprietary system. Edit if not MSE.

The concrete leveling pads for the Mechanically Stabilized Embankment (MSE) system shall conform to the provisions in Section 90-10, "Minor Concrete," of the Standard Specifications.

21. Use for Climate Area III. Delete for Climate Areas I and II. See Appendix 4C of the PS&E Guide for Climate Areas.

2/15/07 DWH##

~~Concrete shall conform to the provisions in "Freezing Condition Requirements" of these special provisions and shall contain not less than 400 kg of cementitious material per cubic meter.~~

Reinforcement

Reinforcement shall conform to the provisions in Section 52, "Reinforcement," of the Standard Specifications and the special provisions.

Galvanizing

Soil reinforcement, connecting elements, and other steel components that are in contact with the earth shall be galvanized in conformance with the provisions in Section 75-1.05, "Galvanizing," of the Standard Specifications.

Drainage System

The drainage system shall conform to the details shown on the plans and the special provisions.

27

Corrugated steel pipe shall conform to the provisions in Section 66, "Corrugated Metal Pipe," of the Standard Specifications.

28

Perforated steel pipe underdrains and underdrain outlets and risers shall conform to the provisions in Section 68-1, "Underdrains," of the Standard Specifications.

29

The class of rock used for rock slope protection at drain pipe outlets shall be No. 3 Backing and shall conform to the provisions in Section 72-2, "Rock Slope Protection," of the Standard Specifications.

30

Filter fabric shall be ultraviolet (UV) ray protected, and shall conform to the provisions for fabric for underdrains in Section 88-1.03, "Filter Fabric," of the Standard Specifications and the special provisions.

31

Adhesive for bonding filter fabric to concrete panels shall be commercial grade.

Soil Reinforcement

Soil reinforcement shall conform to the details shown on the contract plans, the approved working drawings, the preapproved proprietary system details, and the special provisions.

33

MW70 and MW130 steel wire shall conform to the requirements in ASTM Designation A 82/A 82M. The welded wire mat shall conform to the requirements in ASTM Designation A 185/A 185M. MD70 and MD130 deformed steel wire may be substituted for MW70 and MW130 steel wire, respectively. The welded wire mat utilizing deformed steel wire shall conform to the requirements in ASTM Designation A 496/A 496M and ASTM Designation A 497/A 497M.

34

The button on button-head wires shall conform to the provisions in Section 50-1.05, "Prestressing Steel," of the Standard Specifications.

35

36

Sample button-head wire and coupler connectors shall develop the minimum tensile requirements for MW70 and MW130 steel wire in ASTM Designation A 82/A 82M without exceeding a total slip of the wires of 5.0 mm when tested in conformance with the provisions for tension testing of round wire samples in ASTM Designation A 370. When MD70 and MD130 deformed steel wire are substituted, samples shall develop the minimum tensile requirements contained in ASTM Designation A 496/A 496M. An independent testing laboratory shall perform button-head wire and coupler connection testing. Samples shall consist of 2 button-head wires each 600 mm long connected by a swaged coupler.

37

41

Geogrid soil reinforcement roll identification, storage, and handling shall be in accordance with ASTM Designation D 4873, and as specified in the preapproved proprietary details.

Construction

Earth retaining structures shall be constructed to the lines, grades, and details shown on the plans, and shall conform to the special provisions.

Earthwork

The foundation for the structure shall be graded level for a width equal to the length of soil reinforcement elements plus 300 mm or as shown on the contract plans. The foundation material shall be compacted to a relative compaction of not less than 95 percent per CTM 216. The Engineer shall approve the compacted foundation area prior to commencement of wall construction.

46

49

Structure backfill for earth retaining structures with soil reinforcement shall be compacted to a relative compaction of not less than 95 percent per CTM 216.

50. Use only when there is the possibility in the contract of an MSE or similar proprietary system to be constructed on embankment.

2/15/07 DWH##

~~A relative compaction of not less than 95 percent shall be obtained for embankment under earth retaining structures with soil reinforcement within the limits established by inclined planes sloping 1:1.5 (vertical:horizontal) out and down from lines 0.3 m outside the bottom limits of the structure, including permeable material when required.~~

51

55

Erosion Control (Netting)

Materials

Materials for the erosion control (netting) shall conform to the provisions in Section 20-2, "Materials," of the Standard Specifications and the special provisions.

5

Erosion Control Netting

Erosion control netting shall consist of 100 percent spun coir fiber and shall conform to the following:

Specification	Requirement
Weight, grams per square meter ASTM Designation: D 3776	400
Minimum Tensile Strength, kilonewtons, ASTM Designation: D 4595	9.0 to 11.3 kN/m in longitudinal direction (dry) 5.0 to 10.7 kN/m in cross-direction (dry) 6.0 to 9.8 kN/m in longitudinal direction (wet) 4.0 to 9.4 kN/m in cross- direction (wet)
Roll Width, meters, min.	4
Area/Roll, square meters, min.	200
Open Area, percent	63-70

Erosion Control (Type D)

Materials

Materials must comply with Section 20-2, "Materials," of the Standard Specifications and the special provisions.

7*. Use when another erosion control SSP specifies the same seed specifications; otherwise delete. Delete Paras 8 thru 13 when this Para is used. Edit blank space for the type of erosion control.

~~Seed~~

BR**

~~Seed for erosion control (Type D) must comply with "Erosion Control (_____)" of these special provisions.~~

8. Use Paras 8 thru 13 when seed is NOT specified elsewhere in the special provisions. Delete Para 7.

Imported Top Soil

CS**

Imported topsoil shall conform to the provisions in Section 20-2, "Materials," and Section 20-3, "Erosion Control," of the Standard Specifications and the special provisions.

CS**

The following Paras added to clarify the work requirements specific to this project.

Attention is directed to "Highway Planting and Irrigation Systems" elsewhere in the special provisions.

Lime Stabilization

Lime stabilization shall conform to the provisions in Section 24, "Lime Stabilization," of the Standard Specifications and the special provisions.

2*. Edit to include the amount of lime to be added, based on the Soils Report, and the compressive strength used in the design of the structural section, but not less than 2750 kPa.

BR**

Lime shall be added to the material to be stabilized at the rate of 5 percent by mass of the dry material. The exact rate will be determined by the Engineer based on an unconfined compressive strength of the lime stabilized material of 2750 kPa, as determined by California Test 373.

Aggregate Subbase

Aggregate subbase must comply with Section 25, "Aggregate Subbases," of the Standard Specifications and the special provisions.

2

Aggregate subbase must be Class 4.

3. A Construction Engineering Work Plan (CEWP) with FHWA is required to use this paragraph.

6

9. Use if aggregate subbase is specified to be measured by the tonne.

BR**

~~The Engineer converts tonnes to cubic meters for the purpose of reducing payment for noncompliant aggregate subbase left in place.~~

10*. Enter Class 1, Class 2 or Class 3.

BR**

Instead of Class 4 aggregate subbase, Class 1 aggregate subbase – complying with the aggregate grading and quality requirements in Section 25-1.02A, "Class 1, Class 2, and Class 3 Aggregate Subbases," of the Standard Specifications – may be used. If Class 1 aggregate subbase is used, do not change back to Class 4 subbase without written approval from the Engineer.

11

Aggregate Base

Aggregate base must comply with Section 26, "Aggregate Bases," of the Standard Specifications and the special provisions.

2

Aggregate base must be Class 3.

3. A Construction Engineering Work Plan (CEWP) with FHWA is required to use this paragraph.

Pavement Concrete Mix Proportions

49

The minimum cementitious materials content or the maximum water to cementitious materials ratio shall be determined in conformance with the requirements in California Test 559. Trial mixtures shall be made no more than 24 months before field qualification. The minimum cementitious materials content or the maximum water to cementitious materials ratio shall be that determined from the trial mixtures curve to produce a minimum modulus of rupture of 3.9 MPa at 28 days age and 4.5 MPa at 42 days age. To account for variances in materials, production of concrete, and modulus of rupture testing, the Contractor shall include as part of the proposed mix proportions an increase to the cementitious material content or a decrease to the water to cementitious materials ratio, determined from trial mixtures, to ensure that portland cement concrete produced during paving operations conforms to the requirements in "Modulus of Rupture," in this section.

50

At least 15 days prior to field qualification, the Contractor shall submit the proposed pavement concrete mix proportions with laboratory test reports. Laboratory test reports shall include modulus of rupture determined for each trial mixture at ages of 10, 21, 28 and 42 days in conformance with the applicable portions of California Test 559.

51

Modulus of Rupture

The Engineer will test portland cement concrete pavement for modulus of rupture in conformance with the requirements in California Test 523.

The Contractor shall perform sampling and testing of beam specimens to determine if concrete pavement has achieved a modulus of rupture of 2.4 MPa when requesting early use of concrete pavement in conformance with the provisions in Section 90-8.03, "Protecting Concrete Pavement," of the Standard Specifications. Beam specimens shall be made and tested in conformance with the requirements in California Test 523.

15

Slope Protection

BR**

Slope protection and rock slope protection shall be placed or constructed in conformance with the provisions in Section 72, "Slope Protection," of the Standard Specifications and the special provisions.

Use when rock slope protection fabric is specified. Do NOT use the nomenclature or contract item Filter Fabric (Rock Slope Protection).

Include a contract item for backing in the project when 1/4 T class or larger rock slope protection is specified.

Add to SSP 72-010. Include SSP S8-M81.

Para 1 thru 4: Use ONLY one paragraph.

1

BR**

Rock slope protection fabric shall be woven or nonwoven type fabric, Type A. ~~or Type B, at the option of the Contractor.~~

2. Use when any of the rock slope protection on the project to be placed directly over the fabric is larger than 1/4 T class.

BR**

~~Rock slope protection fabric shall be woven or nonwoven type fabric, Type B.~~

3*. Use when the type of rock slope protection fabric, woven or nonwoven, is specified and insert type.

BR**

~~Rock slope protection fabric shall be _____ type fabric, Type A or Type B, at the option of the Contractor.~~

4*. Use when the type of rock slope protection fabric, woven or nonwoven, is specified and when the rock slope protection on the project to be placed directly over the fabric is larger than 1/4 T class. Insert type.

BR**

~~Rock slope protection fabric shall be _____ type fabric, Type B.~~

Geosynthetic Clay Liner

Geosynthetic Clay Liner (GCL) shall be furnished and placed as shown on the plans and in conformance with the provisions of the special provisions.

GCL shall be Bentomat CL manufactured by Cetco Lining Technologies, or equivalent

Bentomat CL is a reinforced GCL consisting of a layer of sodium bentonite between two geotextiles, which are needle punched together and laminated to a thin flexible membrane liner. GCL shall conform to the following requirements:

Specification	Test Frequency	Requirement
Bentonite Swell Index ASTM Designation: D 5890	1 per 50 tonnes	24 mL/2g min.
Bentonite Fluid Loss ASTM Designation: D 5891	1 per 50 tonnes	18 mL max.
Bentonite Mass Area. ASTM Designation: D 5993	4,000 m2	3.6 kg/m2 min.
GCL Grab Strength ASTM Designation: D 6768	20,000 m2	78 N/cm
GCL Peel Strength ASTM Designation: D 6496	4,000 m2	4.4 N/cm min.
GCL Index Flux ASTM Designation: D 5887	Periodic	1x10-9 m3/m2/sec max.
GCL Hydraulic Conductivity ASTM Designation: D 5887	Periodic	5x10-10 cm/sec max.
GCL Hydrated Internal Shear Strength ASTM Designation: D 5321 and D6243	Periodic	24 kpa

Soil Amendments

Soil amendment shall be nitrogen and iron stabilized sawdust with an average weight of 160 kg/m3. Source of amendment material shall be listed in the submittal documents, for example, wood shavings from untreated lumber. Amendment shall be derived from a combination of untreated fir and pine or cedar wood, free from weed seed, dust, objectionable material and chemicals. Organic amendment shall contain the following physical properties:

Sieve Size	Percent Passing
9.5 mm	95-100
6.4 mm	90-95
2.4 mm	85-90
500 Micron	15-20

Chemistry shall be:

Nitrogen Content (dry weight):	0.56% - 0.84%
Iron Content:	Minimum 0.08% diluted acid soluble Fe on dry weight basis.
Soluble Salts:	Maximum 4.0 millimohos centimeter @ 25° C. as determined by saturation extract method.
Ash (dry weight):	0 - 8.0%

Imported Top Soil

Attention is directed to "Imported Topsoil" elsewhere in the special provisions for imported topsoil specifications and requirements.

Placement and Compaction of Fills

Subgrade preparation shall consist of moisture conditioning the exposed subgrade and compacting to a minimum relative compaction of 95 percent in accordance with the provisions of Section 19-5 of the Standard Specifications.

All embankment fill shall be placed in thin lifts and compacted to a minimum of 95 percent relative compaction (ASTM D1557 or Caltrans 216, using the dry weight basis) in accordance with Sections 19-3, 19-5 and 19-6 of the Standard Specifications. It is recommended that the relative compaction be measured on the basis of dry density.

Detention Basin

The bottom of the excavation, excavation slopes and foundations for embankments shall be scarified and compacted to at least 95% relative compaction (CTM 216) per Caltrans specifications.

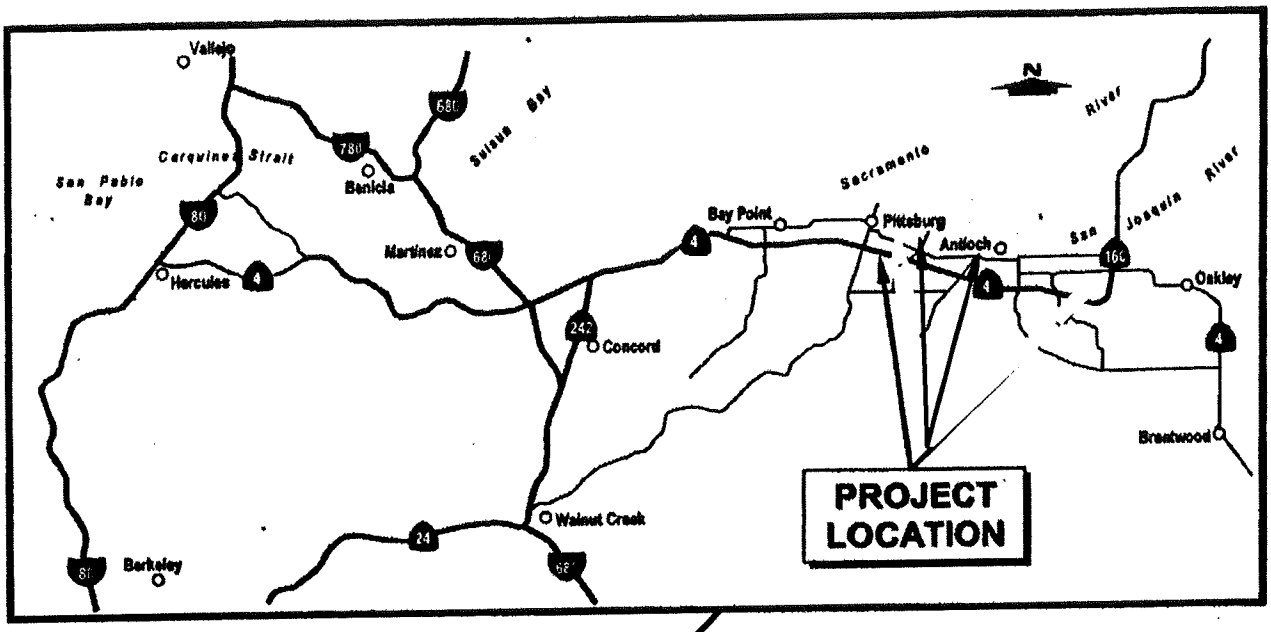
Embankment Construction

Native soil is expected to be suitable for the embankment fill. Fill shall be placed to at least 95% relative compaction (CTM 216) per Caltrans specifications, placed in uniform lifts not exceeding 200 mm in uncompacted thickness, and brought to uniform moisture content prior to compacting.

Liners

We recommend using a Bentomat CL GeoSynthetic Clay Liner (GCL) manufactured by Cetco Lining Technologies, or equivalent. 300 mm thick native soil cover shall be placed over the GCL and compacted to at least 95% relative compaction (CTM 216) per Caltrans specifications. Anchor trenches shall be used to hold the GCL in place. The GCL shall be installed in accordance with the recommendations provided by the manufacturer.

Figures



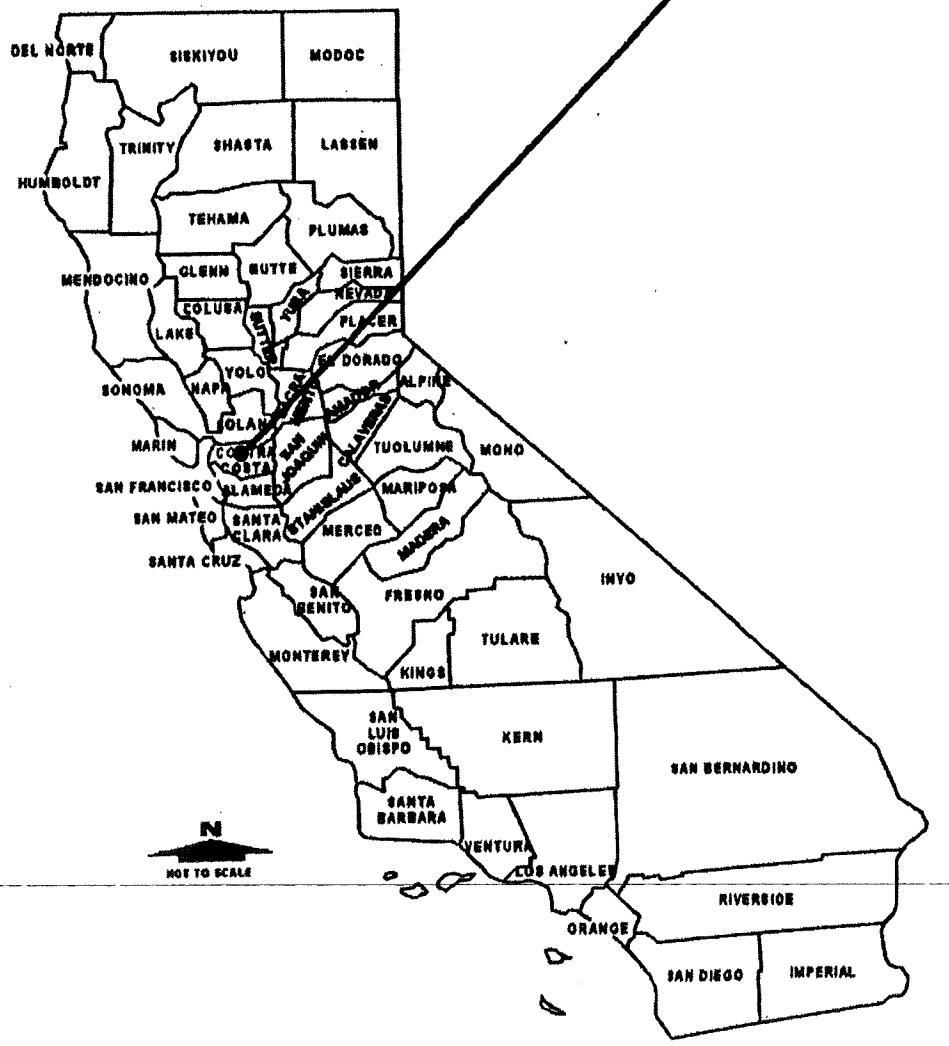


FIGURE 1

STATE ROUTE 4 (EAST) WIDENING PROJECT: LOVERIDGE TO SOMERSVILLE ROAD
04-CC-4, KP 37.9 - KP 41.3

PROJECT VICINITY MAP

CONTRA COSTA TRANSPORTATION AUTHORITY

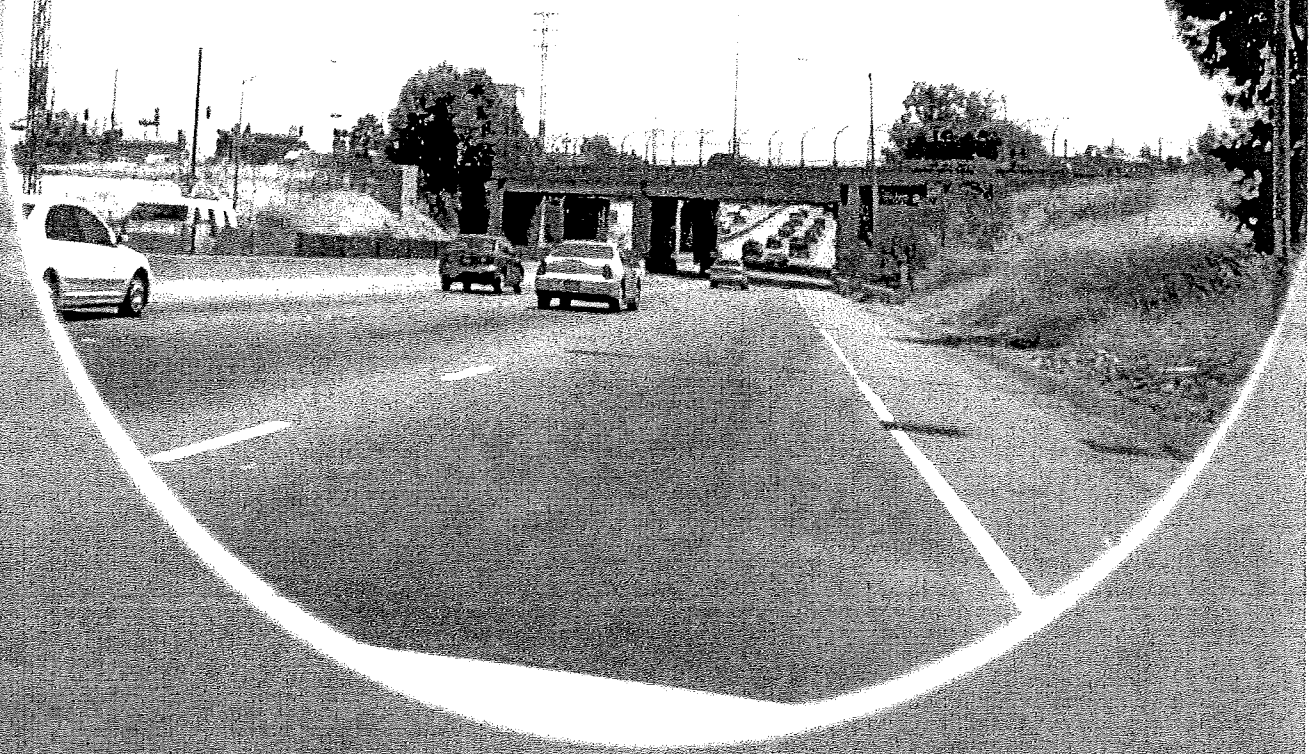
California Department of Transportation

SR4 (East) Widening Project
Loveridge Road to Somersville Road

04-CC-04, KP 37.9/41.3 (PM 23.71/26.8)
04275-228501

NON-STORMWATER INFORMATION HANDOUT

May 29, 2009



URS

SR4 (EAST) WIDENING PROJECT
LOVERIDGE ROAD TO SOMERSVILLE ROAD
NON-STORM WATER INFORMATION PACKAGE
SEEPAGE ESTIMATE FOR FOUNDATION EXCAVATIONS

This memorandum summarizes the estimates of ground water flow rate and permeability at the foundation excavations in the above referenced project area. It is our understanding that this information will be used in estimating dewatering quantities for water pollution control. Please note that the quantity of non-construction caused water, such as storm/run-off water or flow from adjacent drainage lines, is not included in this estimation.

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California Department of Transportation
District 4
Water Quality Program
111 Grand Avenue
Oakland, California 94612

ESTIMATED RATE OF SEEPAGE

Typical cross-sections were developed for the geotechnical analyses. Those cross-sections were used for estimating seepage flows in those locations where drilled piers or excavation below the expected water table are expected. Please note that the groundwater level may fluctuate with season and rainfall near the project locations. The approximate coefficient of permeability for different type of soils (Unified Soil Classification) is shown in Attachment 1 based on the FHWA "Highway Drainage Design" manual (Report No. FHWA-TS-80-224).

Retaining Walls

Retaining walls, 1 though 6 will be constructed. The foundations for the retaining walls are mostly spread footings. Portions of the following retaining walls will be constructed on piles:
Retaining Wall No. 3A – Driven piles
Retaining Wall No. 4 – CISS piles: L = 8m, Diam. = 360mm
Sign Posts adjacent to Retaining Walls – CIDH piles: L = 8m; Diam. = 1600mm

Within the area of Retaining Wall No. 4, the deepest boring B-20 reached a depth ~28m below ground surface. In the area of Retaining Wall No. 4, groundwater level was not measured. However, within the project area, the ground water surface was generally encountered at an elevation of +5m. Please note that the groundwater level may fluctuate with season and rainfall near the project locations.

Since the bottom of the leveling pad ranges from the Elevation 14.85m to 19.73m, pile lengths of 8.00m are above the expected water table. Furthermore, below elevation +5m (expected water table elevation), Boring 20 identified materials of low permeability (clays and silts). Flow to the drilled holes is expected to be low.

CIDH Piles for Overhead Sign Structures

This project contains eight regular overhead signs (OHS) and two message signs (CMS). CIDH pile foundations are designed to support all OHS. Both OHS and CMS are to be founded on CIDH pile with a diameter of 1524mm and lengths ranging from 7.0m to 7.6m. Within the project area, the ground water surface was generally encountered at an elevation of +5m. Therefore excavations for the CIDH piles are expected to encounter the water surface only in locations where the base of the foundation is below elevation +12.6m. The foundations for all the OHS and CMS are expected to be above this elevation. Therefore, excavations for the CIDH pile foundations for the OHS are not expected to encounter the water surface. Please note that the groundwater level may fluctuate with season and rainfall near the project locations.

CIDH Piles for Loveridge Road Overcrossing

While the abutments of this bridge are supported by precast/prestressed reinforced concrete piles, the bents of the bridge are supported by CIDH piles.

The seepage flows are calculated for the CIDH piles:
Loveridge Road OC (Replace) – Bent No. 2 – CIDH piles:
L = 22.55m (Pile Tip El=-15.1m); Diam. = 750mm – 24 piles
L = 22.50m (Pile Tip El=-15.4m); Diam. = 750mm – 32 piles

Loveridge Road OC (Replace) – Bent No. 3 – CIDH piles:
L = 22.55m (Pile Tip El=-15.4m); Diam. = 750mm – 26 piles
L = 22.55m (Pile Tip El=-15.4m); Diam. = 750mm – 32 piles

The expected subsurface profile for these locations was evaluated during the foundation design, and is presented in the Loveridge Road Overcrossing Foundation Report. The foundation report shows that clay material is encountered up to elevation -11m. Below this elevation a poorly graded sand (SP) layer is expected.

The seepage rate for each CIDH pile excavation is determined from the total volume of water filling the excavation up to the presumed groundwater level in one day. The volume of water filling the hole up to the estimated water table is 2,050 gall/day per CIDH pile. Please note that the groundwater level may fluctuate with season and rainfall near the project locations. Attachment 2 shows the location, dimensions, groundwater information and calculated seepage rate for each pile excavation.

CIDH Piles for Sound Walls

This project contains a sound wall. CIDH pile foundations are designed to support portions of the sound wall

Two different diameter CIDH piles will be used:
Sound Wall No. 1-CIDH piles: L = 9m; Diam. = 760mm – Sta. 15+82 to 15+92; 15+95 to 16+04 (top of pile elevation ~ 18m)
Sound Wall No. 1-CIDH piles: L = 4.9m; Diam. = 400mm-Sta. 10+00 to 15+82; 16+04 to 16+50 (top of pile elevation >18m)

Within the project area, the ground water surface was generally encountered at an elevation of +5m. Therefore, foundations for the CIDH piles for Sound Walls are expected to be above the water surface elevation. Excavations for the CIDH pile foundations for the CIDH piles for Sound Walls are not expected to encounter the water surface, and no dewatering from ground water conditions is expected. Please note that the groundwater level may fluctuate with season and rainfall near the project locations.

Pile Century Boulevard Undercrossing

All piles for the undercrossing structure foundations are made of precast/prestressed reinforced concrete. Therefore, no excavations will be performed for the installation of these piles. Thus, no significant foundation seepage is expected at this location.

CIDH Piles for Utilities Undercrossing

The foundations for the Utilities undercrossing are CIDH piles:
Utilities Undercrossing – CIDH piles: L = 8.8m; Diam. = 460mm – pile tip elevation = +8.8m

Within the project area, the ground water surface was generally encountered at an elevation of +5m. Therefore, foundations for the CIDH piles for the Utilities Undercrossing are expected to be above the water surface elevation (pile tip elevation +8.8m). Excavations for the CIDH pile foundations for the Utilities Undercrossing are not expected to encounter the water surface, and no dewatering from ground water conditions is expected. Please note that the groundwater level may fluctuate with season and rainfall near the project locations.

CIDH Piles for eBART Utility Corridor

The foundations for the eBART Utility Corridor are based on CIDH piles:
eBART Utility Corridor – CIDH piles: Pile Tip El=-4.7m; Diam. = 914mm

Subsurface profile developed for the Century undercrossing was used in this location. In addition, boring log 21, drilled in the vicinity of this area, was used. The expected subsurface profile for these locations was evaluated during the foundation design, and is presented in the Century Boulevard Undercrossing Foundation Report. The profile indicates low permeability clayey materials, with small sandy layers (as observed in boring 21).

The seepage rate for each excavation of CIDH pile is determined from the total volume of water filling the excavation up to the presumed groundwater level in one day.

For the piles in the eBART corridor, the total volume of water filling the excavation up to the presumed groundwater level in one day is 1,560 gall/day per CIDH pile. Please note that the groundwater level may fluctuate with season and rainfall near the project locations. Attachment 3 shows the location, dimensions, groundwater information and calculated seepage rate for each pile excavation.

Other Considerations

The contractor can use the coefficients of permeability provided by the aforementioned FHWA manual to compute his own flow rate. It is up to the contractor to determine the method of dewatering. Also, the contractor will be responsible for the design of the shoring and dewatering of the site.

References

FHWA, "Highway Subsurface Drainage," FHWA Report No. FHWA-TS-80-224, 1980.

Attachment 1

Coefficients of Permeability for Soils*

Unified Soil Classification	Relative Permeability	Coefficient of Permeability k (ft/day)
GW	Pervious	2.7 to 274
GP	Pervious to Very Pervious	13.7 to 27,400
GM	Semipervious	$2.7x10^{-4}$ to 27
GC	Impervious	$2.7x10^{-5}$ to $2.7x10^{-2}$
SW	Pervious	1.4 to 137
SP	Semipervious to Pervious	0.14 to 1.4
SM	Impervious to Semipervious	$2.7x10^{-4}$ to 1.4
SC	Impervious	$2.7x10^{-5}$ to 0.14
ML	Impervious	$2.7x10^{-5}$ to 0.14
CL	Impervious	$2.7x10^{-5}$ to $2.7x10^{-3}$
OL	Impervious	$2.7x10^{-5}$ to $2.7x10^{-2}$
MH	Very Impervious	$2.7x10^{-6}$ to $2.7x10^{-4}$
CH	Very Impervious	$2.7x10^{-7}$ to $2.7x10^{-5}$

* From FHWA-TS-80-224, Table 2, page 48.

Attachment 2

Location: Loveridge Road OC (Replace)	Number of Piles	CIDH Pile Diam. (mm)	CIDH Pile Length (m)	Approx. GWT Bgs[1] (m)	Seepage Rate – Volume (gall/day)
Bent 2	24	750	22.55	5	2,050
Bent 2	32	750	22.50	5	2,050
Bent 3	26	750	22.55	5	2,050
Bent 3	32	750	22.55	5	2,050

Attachment 3

Location: eBART Utility Corridor	Number of Piles	CIDH Pile Diam. (mm)	CIDH Pile Length (m)	Approx. GWT Bgs[1] (m)	Seepage Rate – Volume (gall/day)
Abut. 1	4	914	26.4	17	1,560
Abut. 2	4	914	26.5	17	1,560

SITE PLAN

Dist	COUNTY	ROUTE	TOTAL PROJECT	No.	SHEETS
04	CC	4	37.9/41.3		

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON

STATE HIGHWAY
IN CONTRA COSTA COUNTY
IN PITTSBURG AND ANTIOCH
FROM 0.9 KM WEST OF LOVERIDGE ROAD OVERCROSSING
TO 0.3 KM WEST OF SOMERSVILLE ROAD UNDERCROSSING

To be supplemented by Standard Plans dated July, 2004

INDEX OF SHEETS

SHEET No.

TITLE
TYPICAL CROSS SECTIONS
KEY MAP AND LINE INDEX
LAYOUT
PROFILE
CONSTRUCTION DETAILS
TEMPORARY WATER POLLUTION CONTROL DETAILS
EROSION CONTROL PLAN
CONTOUR GRADING AND PAVMENT ELEVATION
DRAINAGE PLAN, PROFILES, DETAILS, AND QUANTITIES
SANITARY SEWER PLAN
UTILITY PLAN AND DETAILS
WATER LINE PLANS
CORROSION PROTECTION DETAILS
STAGE CONSTRUCTION
TRAFFIC HANDLING PLAN
DETOUR
CONSTRUCTION AREA SIGNS
PAVEMEN[illegible]ELINEATION PLAN
SUMMARY OF [illegible]TIES
SIGN PLAN
RETAINING WA[illegible]
SOUND WALL
PL[illegible]
IRI[illegible]EMOVAL PLAN
PLAN[illegible] AND IRRIGATION PLAN
ELECTRICAL PLAN

LOCATION MAP

Caltrans

Caltrans Metric

BEGIN CONSTRUCTION
STA "[illegible]" KP 37.9
PM 23.7

Begin Work
Sta "EB4" 226+00

Limit of Work
(Loveridge Rd)
Sta "L" 307+14

Limit of Work
(Century Blvd)
Sta "LCNT" 11+82

END CONSTRUCTION
STA "CNOB" 271+80 KP 41.3
PM 25.8

End Work
Sta "CNOB" 276+60

Limit of Work
(Century Blvd)
Sta "LCNT" 10+00

Limit of Work (Loveridge Rd)
Sta "L" 300+00

Sta "CNOB" 269+00 AHD=
6.1 Lt Sta "EB4" 269+00 BK

14th St
PITTSBURG
ANTIOCH HWY
Kirker Creek
CITY LIMITS
SOMERSVILLE Rd
Canal
SPT CO RR
LOVERIDGE Rd OC
(REPLACE)
Br No. 28-0394
LOVERIDGE Rd OC
PUMPING PLANT
CALIFORNIA Ave
N PARK Blvd
PACE Blvd
CENTURY Blvd UC
Br No. 28-0395 R/L
CENTURY Blvd
CENTURY Ct
ROUTE 4
TO OAKLEY
KAISER
HOSPITAL
SOMERSVILLE Rd UC
RAILROAD Ave OC
HARBOR St OC
RAILROAD Ave
AVON St
MACARTHUR Ave
HARBOR St
NAVY St
CALIFORNIA Ave
NEWPORT Dr
EDWARD Ave
BENJAMIN Ave
PATRICIA Ave
DIANE Ave
CARION Ct
BLISS Ave
GARCIA Ave
MARTIN Wy
KELLY Ct
PIEDMONT Wy
BOBO Ct
COMMERCE PL
LELAND Dr
LOVERIDGE Rd
GLADSTONE Dr
Old Kirker Creek
UTILITIES UC
Br No. 28-0105
LIMITS
CITY
BELLE Dr
BELLE Ct
ARATA Wy
FIELD St
CHICKIE St
KENDREE St
Costa
Contra
DELTA FAIR Blvd
TO CONCORD
PITTSBURG
ANTIOCH
230
235
240
245
250
255
260
265
270
275
301

NO SCALE

THE CONTRACTOR SHALL POSSESS THE CLASS (OR CLASSES) OF LICENSE AS SPECIFIED IN THE "NOTICE TO CONTRACTORS."

APPROVED AS TO IMPACT ON STATE FACILITIES AND CONFORMANCE WITH APPLICABLE STATE STANDARDS AND PRACTICES AND THAT TECHNICAL OVERSIGHT WAS PERFORMED.

CONSULTANT DESIGN ENGINEER	CALTRANS DESIGN OVERSIGHT APPROVAL	REGISTRATION No.	LICENSE Exp DATE	DATE SIGNED
BEN RAZEGHI	SOTERO ANGELES	C-53896	12-31-09	9-17-08

Approved as to impact on State facilities and conformance with applicable State standards and practices and that technical oversight was performed as described in the California Department of Transportation A & E Consultant Service Manual.

B. Razeghi 9/17/08
PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

B. RAZEGHI
No. C-52725
Exp. 12-31-10
CIVIL
STATE OF CALIFORNIA
REGISTERED PROFESSIONAL ENGINEER

PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF ELECTRONIC COPIES OF THIS PLAN SHEET.

Approve as to features affecting City of Antioch

Approve as to features affecting City of Pittsburg

Contra Costa Transportation Authority
3478 Buskirk Avenue, Suite 100
Pleasant Hill, CA 94523

URS
3440 Vincent Road
Pleasant Hill, CA 94523

CONTRACT No. 04-228594

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2 - 4	RETAINING WALL No. 3A	- STRUCTURE PLAN No. 1 to 3
5	RETAINING WALL No. 3A	- PILE LAYOUT
6	RETAINING WALL No. 3A	- MISCELLANEOUS DETAILS
7 - 14	RETAINING WALL No. 3B	- STRUCTURE PLAN No. 1 to 8
15	RETAINING WALL No. 3A AND 3B	- BARRIER TRANSITION
16 - 23	RETAINING WALL No. 4	- STRUCTURE PLAN No. 1 to 8
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47	RETAINING WALL No. 3B AND 5	- TYPE G1 DRAIN DETAILS
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50	RETAINING WALL No. eBART 2A AND 2B	- STRUCTURE PLAN
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STANDARD PLANS DATED JULY 2004

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A10B	ACRONYMS AND ABBREVIATIONS (M-Z)
A10C	SYMBOLS (SHEET 1 OF 2)
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A85	CHAIN LINK FENCE
B0-3	BRIDGE DETAILS
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B3-1	RETAINING WALL TYPE 1 - H=1200 THROUGH 9100 MM
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B11-52	CHAIN LINK RAILING TYPE 7
B11-55	CONCRETE BARRIER TYPE 732
D73	DRAINAGE INLETS
D74A	DRAINAGE INLETS
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S-3	OVERHEAD SIGNS - TRUSS, SINGLE POST TYPE - BASE PLATE AND ANCHORAGE DETAILS
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Standard Plan Sheet No.
Detail No.

A - Section Identification

Caltrans Metric

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER — 02/08/08 DATE

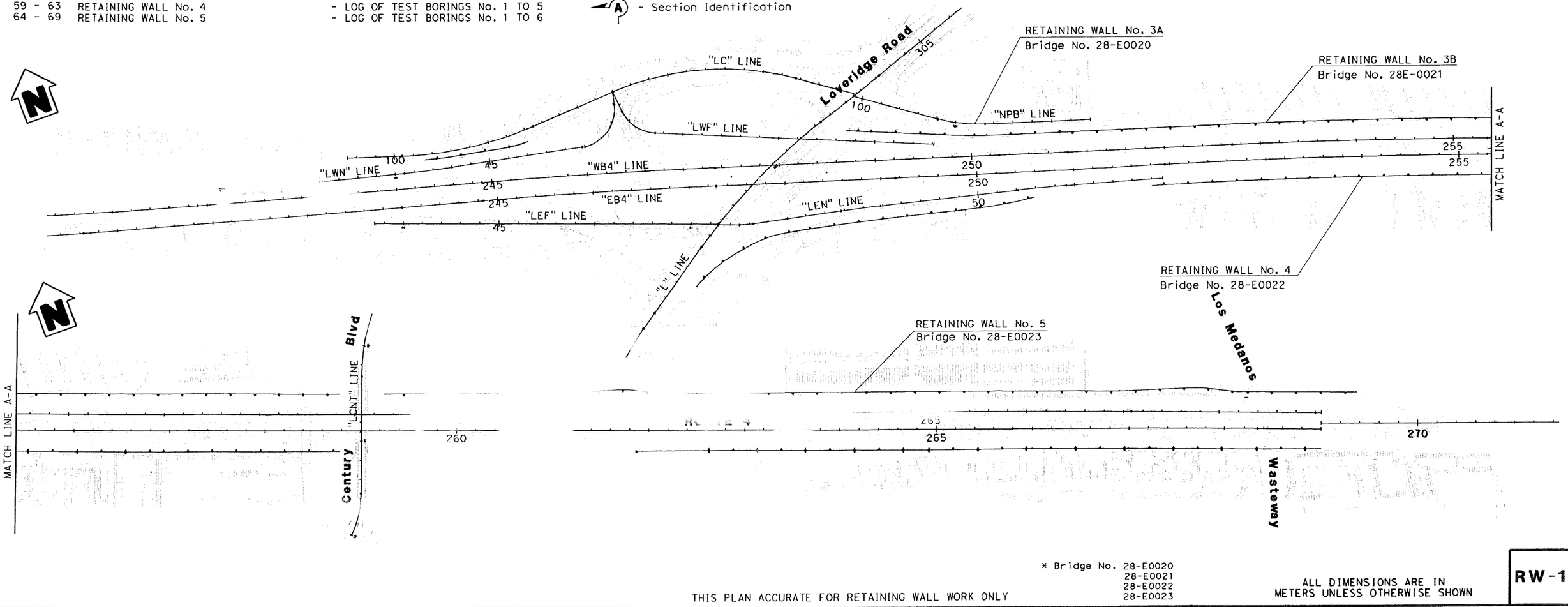
REGISTERED PROFESSIONAL ENGINEER — CHAO GONG No. C53837 Exp. 09/30/09 CIVIL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523



* Bridge No. 28-E0020
28-E0021
28-E0022
28-E0023

THIS PLAN ACCURATE FOR RETAINING WALL WORK ONLY

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

RW-1

DESIGN OVERSIGHT	DESIGN	BY C. Gong	CHECKED	LOAD FACTOR DESIGN	LIVE LOADING: HS20-44 AND ALTERNATIVE AND PERMIT DESIGN LOAD		PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	T. Johnson PROJECT ENGINEER	BRIDGE NO. *
	DETAILS	BY C. Somera	CHECKED	LAYOUT	BY E. Abi-Jaoude	CHECKED C. Gong			KP (PM) 37.9/41.3
SIGN OFF DATE	QUANTITIES	BY	CHECKED	SPECIFICATIONS	BY D. Harnagel	PLANS AND SPECS COUPARED W. LaFranchi			

RETAINING WALL No. 3A, 3B, 4 AND 5
KEY MAP

DESIGN GENERAL PLAN SHEET (METRIC) (REV. 10/27/05)

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100

CU 04275
EA 228591

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY): 10/27/05 | 01/26/06 | 08/08/06 | 02/16/07 | 05/30/07 | 11/27/07 | 02/08/08 | 05/09/08

SHEET 1 OF 69

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USER NAME = chris.sias DESIGNED = 6/22/2006 PLOTTED = 5/15/2008 2:15:52 PM

GENERAL WASTE DISCHARGE REQUIREMENTS

Handout

Construction Dewatering

California Regional Water Quality Control Board
North Coast Region

ORDER NO. 93-61
NPDES PERMIT NO. CA0024902

GENERAL NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMIT
WASTE DISCHARGE REQUIREMENTS

FOR

DISCHARGES OF GROUNDWATER TO SURFACE WATER
RELATED TO
CONSTRUCTION AND SUBSURFACE SEEPAGE DEWATERING ACTIVITIES
IN THE NORTH COAST REGION

The California Regional Water Quality Control Board, North Coast Region (hereinafter the Board), finds that:

1. The September 22, 1989, Memorandum of Agreement between the U.S. Environmental Protection Agency (hereinafter EPA) and the State Water Resources Control Board (hereinafter State Board) authorized and established procedures for the State to issue general National Pollutant Discharge Elimination System (NPDES) permits pursuant to 40 CFR 122.28 and 122.44.

2. 40 CFR 122.28 provides for the issuance of general permits to regulate a category of point sources if the sources: a) involve the same or substantially similar types of operations; b) discharge the same type of wastes; c) require the same type of effluent limitations or operating conditions; d) require similar monitoring; and, e) are more appropriately regulated under a general permit rather than individual permits.

3. Existing and future discharges of groundwater to surface waters from construction dewatering and subsurface seepage dewatering: a) result from similar operations - all involve extraction and discharge of groundwater; b) are the same type of waste - all are groundwater which may or may not contain pollutants; c) require similar effluent limitations for discharges to the same receiving waters; d) require similar minimum frequency of monitoring - annually; and , e) are determined to be more effectively regulated with general permits rather than individual permits. This Order therefore establishes requirements to regulate discharges of groundwater containing pollutants to surface waters under the jurisdiction of this Regional Board.

4. General waste discharge Requirements and NPDES permits will enable the Regional Board to expedite processing of requirements, simplify the application process for dischargers, better utilize limited staff resources, and avoid the expense and time involved in repetitive public noticing, hearings, and permit adoptions.

5. The Board adopted Water Quality Control Plans for the Klamath River Basin (1A) and the North Coastal Basin (1B) on March 20, 1975. The Klamath River Basin Plan (1A) was combined with the North Coastal Basin Plan (1B) to form the Water Quality Control Plan for the North Coast Region. The Plan for the North Coast Region was adopted by the Board on April 28, 1988 and approved by the State Water Resources Control Board on November 15, 1988. The Plan includes water quality objectives, implementation plans for point source and nonpoint source discharges and statewide plans and policies. The State Water Resources Control Board adopted the Inland Surface Waters Plan and the Enclosed Bays and Esturaries Plan on April 11, 1991.

6. This permit establishes effluent limitations for toxic substances as specified in Tables 1 and 2 of the Inland Surface Waters Plan.

The permittee is required to monitor the discharge for those substances likely to be in the permittee's waste stream as specified in the attached Monitoring and Reporting Program. This determination is based on a careful review of laboratory analyses of the discharge and descriptions of the dewatered area.

The permittee has certified that certain Table 1 and 2 substances are not in the waste stream, that no source has been identified which would likely result in the presence of such substances in the waste stream, and that no change has occurred that could cause such substance(s) to be present in the waste stream.

7. The permittee has submitted a report of waste discharge, an appropriate fee, and given notice of the intent to comply with the terms and conditions of this permit.

1000.00

8. The beneficial uses of waters of the region include:

a. municipal and domestic supply
b. agricultural supply
c. industrial supply
d. groundwater recharge
e. freshwater replenishment
f. navigation
g. hydropower generation
h. water contact recreation
i. non-contact water recreation
j. ocean commercial and sport fishing
k. warm freshwater habitat
l. cold freshwater habitat

m. preservation of areas of special biological significance
n. saline water habitat
o. wildlife habitat
p. preservation of rare and endangered species
q. marine habitat
r. fish migration
s. fish spawning
t. shellfish harvesting

9. Beneficial uses of areal groundwaters include:

a. domestic water supply
b. agricultural water supply
c. industrial supply

10. Effluent limitations, and toxic and pretreatment effluent standards established pursuant to Sections 208(b), 301, 302, 303(d), 304, 306, 307, and 403 of the Clean Water Act and amendments thereto are applicable to the permittee.

11. On October 28, 1968, the State Water Resources Control Board adopted Resolution 68-16 "Statement of Policy with Respect to Monitoring High Quality of Waters in California", Which requires the application of best practicable treatment or control discharge to maintain high quality of receiving waters.

12. Section 301(b)(2) of the Clean Water Act requires that all NPDES permits prescribe the application of best available technology economically achievable in the determination of technology-based effluent limitations.

13. The requirements contained in this Order were established by considering all the water quality control policies, plans, and regulations mentioned above and will protect and maintain the beneficial uses of the receiving waters.

14. The issuance of general waste discharge requirements for the above described discharges is exempt from the provisions of Chapter 3 (commencing with Section 21100) of Division 13 of the Public Resources Code in accordance with Water Code Section 13389. The discharges that will be authorized under these general waste discharge requirements are not "new sources" as defined in 33. U.S.C., Section 306 and 40 CFR, Part 122.2.

Moreover, as an activity for protection of the environment, in accordance with Title 14, California Code of Regulation, Section 14308, the issuance of general waste discharge requirements is exempt from the provisions of Chapter 3, Division 13, Section 21100, et seq.

15. The Board, in a public meeting, heard and considered all comments pertaining to the discharge.

16. This Order will serve as a National Pollutant Discharge Elimination System Permit pursuant to Section 402 of the Clean Water Act, or amendments thereto, and will take effect at the end of ten days from the date of adoption by the Board.

THEREFORE, IT IS HEREBY ORDERED that the permittee, in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder, and the provisions of the Clean Water Act and regulations and guidelines adopted thereunder, shall comply with the following:

A. ELIGIBILITY

1. Existing and future discharges of groundwater to surface waters resulting from construction dewatering and for subsurface seepage dewatering and similar operations may be eligible for this permit.

2. When an individual NPDES permit with more specific requirements is issued to a discharger, the applicability of this general permit to the individual NPDES permittee is automatically terminated on the effective date of the individual permit.

B. AUTHORIZATION

To be authorized to discharge under this Order, the discharger must submit a Report of Waste Discharge and an application for a NPDES permit (hereinafter Report of Waste Discharge) in accordance with the requirements of Part C of this Order. Upon receipt of the Report of Waste Discharge, the Executive Officer shall determine the applicability of this Order to such a discharge (including an evaluation that the discharge will result in attainment of the objectives set forth in the water quality control plans discussed in Finding Nos. 5 and 6). If the Executive Officer so finds, he shall notify the discharger that its discharge is authorized under the terms and conditions of this Order and prescribe the appropriate monitoring and reporting program.

For new discharges, the discharge shall not commence until receipt of the Executive Officer's written determination.

C. REPORT OF WASTE DISCHARGE

1. Deadline for Submission

a. Existing dischargers who intend to obtain coverage under this Order shall file a Report of Waste Discharge within 90 days of the effective date of this Order.

b. New discharges shall file a Report of Waste Discharge at least 60 days before start of discharge.

2. Failure to Submit a Report of Waste Discharge

Dischargers who fail to file a report of waste discharge and discharge pollutants to the waters of the State are in violation of the California Water Code and the Federal Clean Water Act.

3. Alternative Method of Disposal

The Report of Waste Discharge shall be accompanied by a feasibility study of reuse of the groundwater. If reuse is not feasible, the Report of Waste Discharge hasll be accompanied by a description of alternatives for disposal other than to surface waters.

D. DISCHARGE LIMITATIONS

Discharges authorized under this Order shall comply with the following discharge limitations, and additional limitations set forth in Attachment A. In the letter of determination, the Executive Officer shall indicate the discharge limitations in Attachment A applicable to the particular waste discharge.

1. The discharge of groundwater containing constituents in excess of the background level in the receiving water is prohibited.

2. The discharge of any waste not specifically regulated by this Permit is prohibited.

3. Creation of a pollution, contamination, or nuisance, as defined by Section 13050 of the California Water Code (CWC) is prohibited.

4. The discharge from the treatment facility of detectable levels of petroleum, petroleum constituents or volatile halogenated compounds is prohibited.[1]

E. RECEIVING WATER LIMITATIONS

1. The waste discharge must not cause the dissolved oxygen concentration of the receiving water to be depressed below 7.0

[1] For the purpose of this Permit, levels of detection are as follows:

CONSTITUENT	UNITS	DETECTION LIMIT
Petroleum Hydrocarbons	ug/l	50
Benzene	ug/l	0.5
Toluene	ug/l	0.5
Xylene	ug/l	0.5
Ethylbenzene	ug/l	0.5
Volatile Halogenated Compounds	ug/l	0.5

mg/l. In the event that the receiving waters are determined to have dissolved oxygen concentration of less than 7.0 mg/l, the discharge shall not depress the dissolved oxygen concentration below the existing level.

2. The discharge must not cause the pH of the receiving waters to be depressed below 6.5 nor raised above 8.5. Within this range, the discharge shall not cause the pH of the receiving waters to be changed at any time more than 0.5 units from that which occurs naturally.

3. The discharge must not cause the turbidity of the receiving waters to be increased more than 20 percent above naturally occurring background levels.

4. The discharge must not cause the receiving waters to contain floating materials, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.

5. The discharge must not cause the receiving waters to contain taste or odor-producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible products of aquatic origin, that cause nuisance, or that adversely affect beneficial uses.

6. The discharge of waste must not cause esthetically undesirable discoloration of the receiving waters.

7. The discharge must not cause bottom deposits in the receiving waters to the extent that such deposits cause nuisance or adversely affect beneficial uses.

8. The discharge must not contain concentrations of biostimulants which promote objectional aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses of the receiving waters.

Fertilizers Nutrients

9. The discharge must not cause the receiving waters to contain toxic substances in concentrations that are toxic to, degrade, or that produce detrimental physiological responses in human, plant, animal, or aquatic life.

10. The discharge must not cause a measurable temperature change in the receiving waters.

11. The discharge must not cause bioaccumulation of pesticide, fungicide, wood treatment chemical, or other toxic pollutant concentrations in bottom sediments or aquatic life to levels which are harmful to human health.

12. The discharge must not cause the receiving waters to contain oils, greases, waxes, or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water that cause nuisance or that otherwise adversely affect beneficial uses.

13. This discharge must not cause a violation of any applicable water quality standard for receiving waters adopted by the Board or the State Water Resources Control Board as required by the Federal Water Pollution Control Act, and regulations adopted thereunder. If more stringent applicable water quality standards are promulgated or approved pursuant to Section 303 of the Federal Water Pollution Control Act, or amendments thereto, the Board will revise and modify this Permit in accordance with such more stringent standards.

14. The discharge must not cause concentrations of contaminants to occur at levels which are harmful to human health in waters which are existing or potential sources of drinking water.

15. The discharge must not cause concentrations of toxic pollutants in the water column, sediments, or biota that adversely affect beneficial uses.

16. The discharge must not cause acute nor chronic toxicity in the receiving waters.

F. SOLIDS DISPOSAL

1. This Permit does not authorize waste discharge to land. Collected screenings, sludges, and other solids removed from liquid wastes shall be disposed of at a solid waste facility for which waste discharge requirements have been prescribed by a Regional Water Quality Control Board.

G. PROVISIONS

1. Duty to Comply

The permittee must comply with all of the conditions of this Permit. Any permit noncompliance constitutes a violation of the Clean Water Act and the Porter-Cologne Water Quality Control Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application. [40CFR122.41(a)]

The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if this Permit has not yet been modified to incorporate the requirement. [40CFR122.41(a)(1)]

2. Duty to Reapply

This permit expires on five years from the date of issuance. If the permittee wishes to continue an activity regulated by this Permit after the expiration date of this Permit, the permittee must apply for and obtain a new permit. The application, including a report of waste discharge in accordance with Title 23, California Code of Regulations must be received by the Board no later than 60 days prior to the expiration of this permit. [40CFR122.41(b)]

The Regional Administrator of the Environmental Protection Agency may grant permission to submit an application at a later date prior to the permit expiration date; and the Regional Administrator of the Environmental Protection Agency may grant permission to submit the information required by paragraphs(g)(7), (9), and (10) of 40CFR122.21 after the permit expiration date. [40CFR122.21(d)(2)]

3. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Permit. [40CFR122.41(c)]

4. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this Permit which has a reasonable likelihood of adversely affecting human health or the environment. [40CFR122.41(d)]

5. Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) that are installed or used by the permittee to achieve compliance with this Permit. Proper operation and maintenance includes adequate laboratory control and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems that are installed by a permittee only when necessary to achieve compliance with the conditions of this Permit. [40CFR122.41(e)]

6. Permit Actions

This Permit may be modified, revoked and reissued, or terminated for cause including, but not limited to, the following:

a. Violation of any terms or conditions of this Permit; or
b. Obtaining this Permit by misrepresentation or failure to

disclose fully all relevant facts; or

c. A change in any condition that requires either a temporary or a permanent reduction or elimination of the authorized discharge; or

d. A determination that the permitted activity endangers human health or the environment and can only be regulated to acceptable levels by permit modification or termination.

e. A determination that a certification that substances identified in Tables 1 and 2 of the Inland Surface Waters Plan do not occur in the discharge is no longer valid.

The Board may also review and revise this Permit at any time upon application of any person, or on the Board's own motion. [CWC 13263(e)]

If any toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is promulgated under Section 307(a) of the Clean Water Act for a toxic pollutant which is present in the discharge and that standard or prohibition is more stringent than any limitation on the pollutant to this Permit, this Permit shall be modified or revoked and reissued to conform to the toxic effluent standard or prohibition and the permittee so notified. [40CFR122.41(f)]

The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition. [40CFR122.41(f)]

7. Property Rights

This Permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations. [40CFR122.41(g)]

8. Duty to Provide Information

The permittee shall furnish the Board, State Water Resources Control Board (SWRCB), or Environmental Protection Agency (EPA), within a reasonable time, any information which the Board, SWRCB, or EPA may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Permit or to determine compliance with this Permit. The permittee shall also furnish to the Board, upon request, copies of records required to be kept by this Permit. [40CFR122.41(h)]

The permittee shall conduct analysis on any sample provided by EPA as part of the Discharge Monitoring Quality Assurance (DMQA) program. The results of any such analysis shall be submitted to EPA's DMQA manager.

9. Inspection and Entry

The permittee shall allow the Board, SWRCB, EPA, and/or other authorized representatives upon the presentation of credentials and other documents as may be required by law, to:

a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records are kept under the conditions of this permit;
b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this Permit;
c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Permit; and
d. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any locations. [40CFR122.41(i)]

10. Monitoring and Records

a. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

b. The permittee shall calibrate and perform maintenance procedures in accordance with manufacturer's specifications on all monitoring instruments and equipment to ensure accurate measurements. The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this Permit, and records of all data used to complete the application for this Permit, for a period of at least three years from the date of the sample, measurement, report, or application. This period may be extended by request of the Board, SWRCB, or EPA at any time. All monitoring instruments and devices used by the permittee to fulfill the prescribed monitoring program shall be properly maintained and calibrated as necessary, at least annually to ensure their continued accuracy.

c. Records of monitoring information shall include:

i. The date, exact place, and time of sampling or measurements;
ii. The individual(s) who performed the sampling or measurements;

iii. The date(s) analyses were performed;
iv. The individual(s) who performed the analyses;
v. The analytical techniques or methods used; and
vi. The results of such analyses.

d. Unless otherwise noted, all sampling and sample preservation shall be in accordance with the current edition of "Standard Methods for the Examination of Water and Wastewater" (American Public Health Association). All analyses must be conducted according to test procedures under 40 CFR Part 136, unless other test procedures have been specified in this Permit. Unless otherwise specified, all metals shall be reported as total metals. Test fish for bioassays and test temperatures shall be specified by the Board. Bioassays shall be performed in accordance with guidelines approved by the Board and the Department of Fish and Game.

11. Signatory Requirements

a. All permit applications, reports, or information submitted to the Regional Board, State Board, and/or EPA shall be signed by a responsible corporate officer. For purposes of this provision, a responsible corporate officer means:

i. a president, secretary, treasurer, or vice president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions for the corporation; or

ii. the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million (in second quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

OR

For a Partnership or Sole Proprietorship, all permit applications, reports, or information submitted to the Regional Board, State Board, and/or EPA shall be signed by a general partner or the proprietor, respectively.

OR

For a Municipality, State, or Other Non-Federal Public Agency, all permit applications, reports, or information submitted to the Regional Board, State Board, and/or EPA shall be signed by either a principal executive officer or ranking elected official. [40CFR122.22(a)]

b. Reports required by this Permit, other information requested by the Board, SWRCB, or EPA, and permit applications submitted for Group II stormwater discharges under 40CFR122.26(b)(3) may be signed by a duly authorized representative provided:

i. the authorization is made in writing by a person described in paragraph (a) of this provision;

ii. the authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company; and

iii. the written authorization is submitted to the Board prior to or together with any reports, information, or applications signed by the authorized representative. [40CFR122.22(b)(c)]

c. Any person signing a document under paragraph (a) or (b) of this provision shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted, is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations." [40CFR122.22(d)]

12. Reporting Requirements

a. Planned changes: The permittee shall give notice to the Regional Board as soon as possible of any planned physical alteration or additions to the permitted facility. Notice is required under this provision only when:

i. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in 40CFR122.29(b); or

ii. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants

which are subject neither to effluent limitations in the permit, nor the notification requirements under Provision 12 (g).

b. Anticipated noncompliance: The permittee will give advance notice to the Board of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

c. Transfers: This Permit is not transferable.

d. Definitions: The following definitions shall apply unless specified in this permit;

i. "Daily discharge" means the discharge of a pollutant measured during a calendar day of any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in terms of mass, the "daily discharge" is calculated as the total mass of the pollutant discharged over the sampling day. For pollutants with limitations expressed in other units of measurement, the "daily discharge" shall be the concentrations of the composite sample. When grab samples are used, the "daily discharge" determination of concentration shall be the arithmetic average (weighted by flow value) of all samples collected during the sampling day.

ii. "Daily average" discharge limitation means the highest allowable average of "daily discharges" over a calendar month, calculated as the sum of all "daily discharges" measured during a calendar month divided by the number of "daily discharges" measured during that month.

iii. "Daily Maximum" discharge limitations means that highest allowable "daily discharge" during the calendar month.

e. Monitoring reports: Monitoring results shall be reported at the intervals specified in the self monitoring program. By January 30 of each year, the permittee shall submit an annual report to the Regional Board. The report shall contain both tabular and graphical summaries of the monitoring data obtained during the previous year. In addition, the permittee shall discuss the compliance record and the corrective actions taken or planned which may be needed to bring the discharge into full compliance with the permit. If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR Part 136 or as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR.

f. Compliance schedules: Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

g. Noncompliance reporting: The permittee shall report any noncompliance at the time monitoring reports are submitted. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times and, if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate and prevent recurrence of the noncompliance.

The following events shall be reported orally as soon as the permittee becomes aware of the circumstances, and the written report shall be provided within five days of that time.

i. Any unanticipated bypass that violates any prohibition or exceeds any effluent limitation in the permit.

ii. Any upset that exceeds any effluent limitation in the permit.

iii. Violation of a maximum daily discharge limitation for any of the pollutants listed by the Board in this Permit.

iv. Any noncompliance that may endanger health or the environment.

The Executive Officer may waive the above-required written report.

h. Other information: Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Board, the permittee shall promptly submit such facts or information. [40CFR122.41(1)]

13. Bypass

The intentional diversion of waste streams from any portion of a treatment facility is prohibited.

14. Upset

In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof. [40 CFR 122.41(n)]

15. Enforcement

The Clean Water Act provides that any person who violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Clean Water Act is subject to a civil penalty not to exceed $25,000 per day of violation. Any person who negligently violates permit conditions implementing Sections 301, 302, 306, 307, or 308 of the Act is subject to a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment of not more than one year, or both. Higher penalties may be imposed for knowing violations and for repeat offenders. The Porter-Cologne Water Quality Control Act provides for civil and criminal penalties comparable to, and in some cases greater than, those provided under the Clean Water Act.

16. Existing Manufacturing, Commercial, Mining, and Silvicultural permittees

All existing manufacturing, commercial, mining, and silvicultural permittees must notify the Board as soon as they know or have reason to believe that any activity has occurred or will occur that would result in the discharge, on a routine or frequent basis, of any toxic pollutant that is not limited in this Permit, if that discharge will exceed one hundred micrograms per liter (100 ug/l). [40CFR122.42(a)(2)]

17. Availability

A copy of this Permit shall be maintained at the discharge facility and be available at all times to operating personnel.

18. Change in Discharge

In the event of a material change in the character, location, or volume of a discharge, (including any point or nonpoint discharge to land or groundwater) the permittee shall file with this Board a new report of waste discharge at least 180 days before making any such change. [CWC Section 13376]. A material change includes, but is not limited to, the following:

a. Significant change in disposal method, e.g., change from a land disposal to a direct discharge to water, or change in the method of treatment which would significantly alter the characteristics of the waste.

b. Significant change in the disposal area, e.g., moving the discharge to another drainage area, to a different water body, or to a disposal area, significantly removed from the original area, potentially causing different water quality or nuisance problems.

19. Severability

Provisions of these waste discharge requirements are severable. If any provision of these requirements is found invalid, the remainder of these requirements shall not be affected.

20. Monitoring

The Board or SWRCB may require the permittee to establish and maintain records, make reports, install, use, and maintain monitoring equipment or methods (including where appropriate biological monitoring methods), sample effluent as prescribed, and provide other information as may be reasonably required. [CWC Section 13267 and 133834].

The permittee must comply with the Contingency Planning and Notification Requirements Order No. 74-151 and the attached Monitoring and Reporting Program and any modifications to these documents as specified by the Executive Officer. Such documents are attached to this Permit and incorporated herein. The permittee shall file with the Board technical reports on self monitoring work performed according to the detailed specifications contained in any monitoring and reporting program as directed by the Board.

Chemical, bacteriological, and bioassay analyses shall be conducted at a laboratory certified for such analyses by the State Department of Health Services. In the event a certified laboratory is not available to the permittee, analyses performed by a noncertified laboratory will be accepted provided:

a. A quality assurance/quality control program is instituted by the laboratory. A manual containing the steps followed in this program must be kept in the laboratory and shall be available for inspection by staff of the Board. The quality assurance/quality control program must conform to EPA or State Department of Health Services guidelines.

b. The laboratory will become certified within the shortest practicable time if the State certification program is resumed.

Certification

I, Benjamin D. Kor, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, North Coast Region, on May 27, 1993

Benjamin D. Kor
Executive Officer

(NPDES.GEN)

Attachment A

GUIDANCE FOR INLAND SURFACE WATERS PLAN
PROVISIONS TO BE INCLUDED IN
MONITORING AND REPORTING PROGRAMS
ASSOCIATED WITH NPDES PERMITS

Monitoring and Reporting Programs should include the following:

1. Table 1 and 2 substances which need to be monitored in the effluent. Monitoring may also be required to assess compliance with water quality objectives in the receiving water. At a minimum this list should include the substances which are or are likely to be in the permittee's waste stream per finding No. 6 of the permit.

2. Short-term (acute) toxicity test and/or three species critical life stage (CLS) toxicity test for applicable permittees. Table 4 of the Inland Surface Waters Plan and the Enclosed Bays and Estuaries Plan specify the species and test requirements for CLS toxicity tests.

(The following footnotes should also be specified in regards to the critical life stage tests:)

* The sensitivity of the test organisms to a referenced toxicant shall be determined concurrently with each CLS bioassay and reported with the test results.

* Dilution and control waters should be obtained from an unaffected area of the receiving waters upstream of the wastewater outfall. Standard dilution water can be used if the stream segment upstream of the outfall exhibits toxicity greater than 1.0 TUc.

* Monitoring can be reduced to the most sensitive specifies after (*date or condition*)

3. Type of sample (grab, composite)

4. Monitoring location

5. Appropriate monitoring frequency

6. Analytical methods to be used. Monitoring data to be reported uncensored with Method Detection Limit (MDL) and Practical Quantitation Limit (PQL) or Limit of Quantitation (LOQ).

- Aquatic life water quality objectives for cadmium, chromium, copper, lead, nickel, silver, and zinc are based on the acid-soluble fraction. Compliance with these objectives shall be determined using the total recoverable method (or a method approved by the State Board's Executive Director or EPA)

- For objectives which are hardness- or pH-dependent, specify how to determine ambient water hardness or pH and that those measurements must be included with the results.

(For Bays and Estuaries dischargers delete need for hardness/pH testing to determine compliance with Effluent Limitations because these limitations are not hardness/pH dependent)

CONTRA COSTA TRANSPORTATION AUTHORITY

California Department of Transportation

SR4 (East) Widening Project
Loveridge Road to Somersville Road

04-CC-04, KP 37.9/41.3 (PM 23.71/26.8)
04275-228500

HAZARDOUS MATERIALS INVESTIGATION
(Draft Report)

May 12, 2005

URS

DRAFT REPORT

HAZARDOUS MATERIALS INVESTIGATION

STATE ROUTE 4 (EAST) WIDENING PROJECT LOVERIDGE ROAD TO SOMERSVILLE TOAD, PITTSBURG, CALIFORNIA

Prepared for
Contra Costa Transportation Authority
and Caltrans

May 12, 2005

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Appendices

Appendix A DTSC Caltrans Variance No. 00-H-VAR-01

Appendix B Encroachment and Boring Permits

Appendix C Analytical Laboratory Reports

ADL	aerially deposited lead
BS	blank spike
BSD	blank spike duplicate
BTEX	benzene, toluene, ethylbenzene, and total xylenes
CCR	California Code of Regulations
CCTA	Contra Costa Transportation Agency
COC	chain-of-custody
DI-WET	Deionized Waste Extraction Test
DPT	direct-push technology
DTSC	California Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ESL	Environmental Screening Level
HSC	Health and Safety Code
IDW	investigation-derived waste
LCS	laboratory control spike
MDL	method detection limit
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MS	matrix control spike
MSD	matrix control spike duplicate
PCB	polychlorinated biphenyl
PRG	Preliminary Remediation Goal
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
ROW	right-of-way
RPD	relative percent difference
RWQCB	Regional Water Quality Control Board
SR-4	State Route 4 (East)
STLC	California Soluble Threshold Leaching Characteristic
TCE	Trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TCMX	tetrachloro-m-xylene

TPH-d	Total petroleum hydrocarbons as diesel
TPH-g	Total petroleum hydrocarbons as gasoline
UCL	upper confidence limit
URS	URS Corporation
VOC	Volatile organic compound
WET	Standard Waste Extraction Test

URS Corporation (URS) prepared and implemented a work plan for a hazardous materials investigation to support the Contra Costa Transportation Agency (CCTA) and Caltrans with the State Route 4 (East) (SR-4) Widening Project from Loveridge Road to Somersville Road in Pittsburg, California. The project will involve excavation and movement of more than 200,000 cubic meters of soil along the right-of-way (ROW). It is anticipated that the project will import approximately 40,000 cubic meters of soil overall, assuming that the existing soils to be excavated can be used on the project. If some existing soils cannot be used due to contamination or soil compaction characteristics, corresponding amounts of additional imported soils will be needed.

The purpose of the investigation reported herein was to conduct a hazardous materials investigation to evaluate the soil and groundwater developed during dewatering, if any, and evaluate the potential for on-site reuse and off-site disposal options for soils excavated during the construction activities along the project ROW. The data were evaluated to satisfy state and federal agencies and/or disposal facility requirements.

1.1 REGULATORY ISSUES

The following paragraphs outline the soil-handling requirements in the most recently issued Caltrans lead-impacted soil handling variance by the California Department of Toxic Substances Control (DTSC) (Caltrans Variance No. 00-H-VAR-01). The current variance expires on September 22, 2005, and a new variance is currently being negotiated. A copy of the current variance is attached in Appendix A. If the soil contaminants exceed the prescribed criteria and are removed from the ROW, the soil must be handled as a hazardous waste.

The following bullet points describe potential lead-in-soil concentrations and the corresponding regulatory restrictions that apply.

- Soil with total lead <1,496 milligrams per kilogram (mg/kg) (the DTSC risk-based limit), with <0.5 milligrams per liter (mg/L) extractable lead with the Deionized Waste Extraction Test (DI-WET), can be used for fill on-site as long as it is more than 5 feet above the water table and is covered with 1 foot of non-hazardous cover.
- Soil with >0.5 mg/L and <50 mg/L extractable lead with the DI-WET and <1,496 mg/kg total lead can be used on the ROW fill on-site as long as it is more than 5 feet above the water table and is covered with a pavement structure.
- Soil with total lead >1,000 mg/kg and/or >5.0 mg/L extractable lead with the Standard Waste Extraction Test (WET) is a California hazardous waste and must be disposed of off-site in a hazardous waste landfill, if removed from the ROW.
- Soil with >5.0 mg/L extractable lead with the Toxicity Characteristic Leaching Procedure (TCLP) test is a federal Resource Conservation and Recovery Act (RCRA) waste and must be disposed of off-site in a hazardous waste landfill, if removed from the ROW.
- Per the Health and Safety Code (HSC), if soils containing total lead >350 mg/kg are disposed of off-site, such soils must be disposed of in a Class I hazardous waste landfill as a nonhazardous waste.

2.1 SITE DESCRIPTION

URS conducted the hazardous materials investigation on the upcoming 1.8-mile portion of the SR-4 widening project from Loveridge Road to Somersville Road in Pittsburg, California. Sampling was conducted from the edge of the roadway to the width of the planned excavation on either side of the existing freeway at a total of 18 selected zones (Figures SIS-1 through SIS-15).

Before any fieldwork was conducted, an encroachment permit was obtained from Caltrans. A boring permit was also obtained from the Contra Costa County Department of Environmental Health for work along the Caltrans ROW. These permits are included in Appendix B.

Underground utilities were located before the commencement of the field program using Underground Service Alert and a third-party underground utility location subcontractor.

2.2 SCOPE OF WORK

The scope of work for the soil and groundwater investigation is described in the *State Route 4 (East) Widening Project – Loveridge to Somersville Road Hazardous Materials Investigation Work Plan* (URS 2005).

3.1 SAMPLING ACTIVITIES

Soil and groundwater sampling activities along the SR-4 project area were undertaken from March 1 through 9, 2005. Gregg Drilling and Testing of Martinez, California, was retained as the drilling subcontractor. Sample collection was performed by URS personnel, including Mr. Jeff Paik (Environmental Engineer), Ms. Stacy Ball (Geologist), and Mr. Patrick Walz (Environmental Engineer).

Sampling was conducted at three locations perpendicularly from the edge of the roadway to the width of the planned excavation at a total of 18 selected zones. Typically, these were located at the pavement edge, approximately 1 meter from the pavement edge, and at the far edge of the proposed excavation. A total of 53 boreholes were advanced using a direct-push technology (DPT) rig or a stainless-steel hand auger. The portion of the SR-4 between Loveridge Road and Somersville Road has steep vegetated side slopes at many of the sample locations and limited the access of the DPT rig. For this reason, many of the borings were advanced using a hand auger.

The sampling depth at each location varied according to the total depth of the proposed excavation. Many were advanced to a total depth of 1 meter, but some were advanced to a depth of up to 2.5 meters. In addition, at 14 of the 53 locations, where the sample location could be accessed with the DPT rig, the boring location was Hydropunched™ to depths of up to approximately 15 meters in an effort to collect groundwater. At boring locations where groundwater was not immediately encountered, a temporary well was left open overnight. Even with a temporary well installed, groundwater was encountered and collected at only three of the 14 sample locations: HM-7-B, HM-8-B, and HM-16-A.

Following the completion of sampling at each location, the borehole was backfilled with a cement and bentonite grout mixture. The sample locations will be surveyed by URS with GPS equipment for the final report. All of the investigation-derived waste (IDW) was temporarily stored at a site selected by CCTA and Caltrans and was sampled, analyzed, and characterized for disposal.

3.2 SAMPLE COLLECTION AND HANDLING

Soil samples were collected in situ and placed into clean laboratory-provided glass jars using a stainless-steel hand auger at locations that were inaccessible to the DPT rig. At locations that were accessible with the DPT rig, the deeper soil samples were collected in situ using clear polycarbonate tubes, which were hydraulically driven into the ground prior to being retrieved, cut to size, and sealed with Teflon ™ tape and plastic end caps.

Groundwater samples were collected in clean bottles provided by the laboratory for the appropriate analyses. The bottles contained preservatives, as needed. All soil and groundwater samples were uniquely labeled and immediately stored on ice in a laboratory-provided ice chest. A trip blank was included in each ice chest containing groundwater samples.

Samples were transported under standard URS chain-of-custody (COC) procedures to Curtis and Tompkins Ltd. Analytical Laboratories of Berkeley, California, a State of California certified laboratory.

3.3 ANALYTICAL PROCEDURES

As described in the work plan, the first two 15-cm intervals of the soil column were collected and analyzed by the laboratory, and the next two 15-cm intervals were collected and held by the laboratory. A sample was also collected and analyzed at the 1-m interval, the 2-m interval, and the 2.5-m interval, depending on the final depth of the borehole. The soil samples were submitted for the following analyses:

- Total lead (U.S. Environmental Protection Agency [EPA] Method 6010B)
- Soil pH (EPA Method 9040)

Some randomly chosen soil samples were submitted for the following analyses in addition to the analyses above:

- Total petroleum hydrocarbons as gasoline (TPH-g) (EPA Method 8015M)
- Total petroleum hydrocarbons as diesel (TPH-d) (EPA Method 8015M)
- Benzene, toluene, ethylbenzene, and total xylenes (BTEX) (EPA Method 8020)
- Polychlorinated biphenyls (PCBs) (EPA Method 8082)
- Chlorinated herbicides (EPA Method 8151)
- Title 26 metals (EPA Method 6010B/7000)

Some soil samples were also submitted for follow-up analysis, including total lead and leachability testing with the California WET, the DI-WET, and/or the TCLP, based on preliminary analytical data. The WET is used to evaluate contaminant leachability from soils and other potential wastes for disposal in landfills. The standard WET uses an aggressive citric acid solution as the extracting medium. The DI-WET uses deionized water as the extraction medium to simulate rainfall and was used to evaluate soils intended for use on-site. Extracts from both versions were analyzed and compared to the California Soluble Threshold Leaching Characteristic (STLC) criterion for hazardous waste characterization for potential on-site use. The TCLP is the federal RCRA leaching procedure and is also used to evaluate contaminant leachability for hazardous waste characterization. The TCLP is not as stringent as the California WET.

Because the WET test has a ten-fold dilution, it is normal procedure to test the leachability of contaminants in soils that exceed the STLC criterion by 10 times or more. For example, in the case of total lead, the STLC criterion is 5 mg/L; therefore, soil sample results with concentrations equal to or greater than 50 mg/kg for total lead were submitted for WET leachability testing. Therefore, if the total concentration for a metal in a sample exceeded the STLC criterion by 10 times, the sample was then subjected to the WET for leaching and then analyzed to evaluate the leachability of the target metal. Soil samples with a metal concentration greater than 10 times the STLC criterion were also submitted for DI-WET leaching and analysis of the target metal.

The TCLP test has a twenty-fold dilution, and it is normal procedure to test the leachability of contaminants in soils that exceed the TCLP criterion by 20 times or more. Soil samples with a total metals concentration greater than 20 times the TCLP criterion were submitted for TCLP leaching and analysis for the target metal.

Groundwater samples were submitted for the following analyses:

- TPH-d (EPA Method 8015M)
- Volatile organic compounds (VOCs) (EPA Method 8260)
- Title 26 metals (EPA Method 6010B/7000)

Originally, 192 soil samples (including duplicate and IDW samples) were collected and submitted to the analytical laboratory for analysis. Of these, 16 samples were submitted for the more comprehensive list of analyses. In addition to the 192 soil samples submitted for analysis, 99 soil samples were also collected and submitted to the analytical laboratory to be held for additional analyses, if required. Nineteen of the samples held for additional analysis were subsequently analyzed by the laboratory at URS' request based on the analytical results from the first round of analysis. Tables 1 through 7 show the soil analytical results that were above the laboratory reporting limits. The complete analytical laboratory reports are provided in electronic format in the compact disk attached as Appendix C.

4.1 TOTAL PETROLEUM HYDROCARBONS – GASOLINE

A total of 16 soil samples (including one IDW sample) were analyzed for TPH-g. TPH-g was not detected above the laboratory reporting limit in any of the soil samples submitted for analysis for TPH-g.

4.2 TOTAL PETROLEUM HYDROCARBONS – DIESEL

A total of 16 soil samples (including one IDW sample) were analyzed for TPH-d. TPH-d was detected in nine of the samples analyzed, at concentrations ranging from 1.5 mg/kg (HM-4-B-1.0-1.15) to 61 mg/kg (HM-3-A-0-0.15). The analytical results for detected concentrations of TPH-d are presented in Table 1.

The San Francisco Bay Regional Water Quality Control Board (RWQCB) has published Environmental Screening Levels (ESLs) for various compounds, including the following for TPH-d: 100 mg/kg for soils less than 3 meters in depth in areas with groundwater that could be potentially used as drinking water. None of the reported results exceeded the 100 mg/kg ESL threshold value for TPH-d.

4.3 BTEX

A total of 16 soil samples (including one IDW sample) were analyzed for BTEX. No benzene, toluene, ethylbenzene, or total xylenes were detected above the laboratory reporting limits in any of the soil samples submitted for analysis.

4.4 PCBs

A total of 16 soil samples (including one IDW sample) were analyzed for PCBs. Aroclor-1254 was detected in sample HM-3-A-0-0.15 at a concentration of 19 µg/kg. Aroclor-1260 was detected in five of the samples analyzed, at concentrations ranging from 13 µg/kg (HM-17-A-0-0.15) to 28 µg/kg (HM-13-B-0.15-0.30). The analytical results for detected concentrations of PCBs are presented in Table 2.

EPA Region IX has published Preliminary Remediation Goals (PRGs) for various compounds for residential soils. None of the reported results exceeded the PRG criteria for PCBs for residential soils.

4.5 CHLORINATED HERBICIDES

A total of 16 soil samples (including one IDW sample) were analyzed for chlorinated herbicides. Chlorinated herbicides were not detected above the laboratory reporting limits in any of the soil samples submitted for analysis. However, results for analytes that were detected below the reporting limit but above the practical quantitation limit were reported and are presented in Table 3. None of the reported results exceeded the PRGs for chlorinated herbicides for residential soils.

4.6 METALS

A total of 16 soil samples (including one IDW sample) were analyzed for Title 26 metals, including antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc. In addition, a total of 211 soil samples were analyzed for total lead. The analytical results for the Title 26 metals (excluding lead) detected above the laboratory reporting limits are presented in Table 4. The analytical results for total lead detected above the laboratory reporting limits are presented in Table 5.

Of the 17 metals analyzed, concentrations in excess of the PRGs for metals in residential soils were only reported for arsenic and lead. These results are discussed in the following sections. The results for all other metals were below their respective PRGs for residential soils and below the Title 22 TTLC criteria for hazardous waste and are considered to be within background concentrations for soils in Northern California. Furthermore, all concentrations of metals except lead are below their respective "10 times the STLC" and "20 times the TCLP" criteria and were therefore not submitted for WET, DI-WET, or TCLP leachability testing and analysis.

4.6.1 Arsenic

Arsenic results ranged from 2.1 mg/kg (HM-13-B-0.15-0.30) to 8.7 mg/kg (HM-8-B-0.15-0.30). All of the 16 samples analyzed for arsenic exceeded the PRG for residential soils of 0.062 mg/kg.

The concentration of arsenic in naturally occurring soils in Northern California ranges from 5 mg/kg to 20 mg/kg (RWQCB 2005). Based on this reported range, the soil results for arsenic collected from boreholes across the proposed construction area are within the expected natural background concentrations found in soils in Northern California.

4.6.2 Lead

Results for total lead ranged from 0.76 mg/kg at sample location HM-6-A-0.15-0.30 to 2,300 mg/kg at sample location HM-3-A-0.15-0.30. The results from nineteen soil samples exceeded the EPA Region IX PRG of 150 mg/kg for lead in residential soil. However, the California TTLC lead limit of 1,000 mg/kg for soil to be disposed of off-site as hazardous waste and the Caltrans/DTSC lead-in-soil health-based criterion (from the Variance) of 1,496 mg/kg for soil to be reused on-site were exceeded at only two sample locations: HM-3-A-0.15-0.30 and HM-17-B-0.15-0.30.

4.6.3 Lead WET, DI-WET, and TCLP

A total of 40 soil samples were submitted for WET and DI-WET leachability testing and analysis for lead. In addition, TCLP extraction for leachability and analysis for lead was also requested for 24 of the samples.

The lead STLC criterion of 5 mg/L was exceeded in 19 of the samples submitted for WET leaching and analysis. The lead TCLP criterion of 5 mg/L was not exceeded in any of the samples submitted for leaching and analysis. The DI-WET leaching and analytical test results did not exceed the DTSC Variance guideline concentration of 0.5 mg/L for soil to be left on-site. The WET, DI-WET, and TCLP leaching and analytical results are presented on Table 6.

4.7 SOIL pH

A total of 192 samples from 53 sampling locations were submitted for soil pH analysis. The results for pH ranged from 6.4 to 8.7 standard pH units as shown on Table 7. No soil samples had a pH result less than 5.0 standard pH units. Therefore, the soils do not require special handling (i.e., do not require any restrictions for use as fill material within the ROW), as defined in the Caltrans Variance No. 00-H-VAR-01, Section 9 (a) 3.

Only detectable concentrations of analytical parameters found in the groundwater samples are presented in Tables 8 through 10. Copies of the complete analytical laboratory reports are provided on the compact disc attached as Appendix C.

An effort was made to collect groundwater samples at 14 locations. The boreholes were Hydropunched™ to depths of up to approximately 15 meters. However, groundwater was encountered at only three of the 14 sample locations: HM-7-B, HM-8-B, and HM-16-A.

5.1 TOTAL PETROLEUM HYDROCARBONS – DIESEL

A total of three water samples were submitted for TPH-d analysis; however, one of the three samples, HM-16-A-W, could not be extracted due to the viscous nature of the sample. TPH-d was detected in both of the samples analyzed at concentrations of 67 µg/L and 94 µg/L at locations HM-7-B-W and HM-8-C-W, respectively (see Table 8).

The RWQCB ESL for freshwater is 100 µg/L for TPH-d. Neither of the reported results exceeded the 100 mg/kg ESL threshold value.

5.2 VOLATILE ORGANIC COMPOUNDS

A total of three water samples were submitted for VOC analysis. Trichloroethene (TCE) was the only analyte detected above the laboratory reporting limit. TCE was detected in sample HM-16-A-W at a concentration of 320 µg/L, which exceeds the PRG criterion for tap water of 0.028 µg/L (see Table 9). This result also exceeds the National Pollutant Discharge Elimination System (NPDES) General Permit maximum daily discharge limit of 5 µg/L. However, this result does not exceed the hazardous waste criterion of 500 µg/L.

5.3 METALS

A total of two water samples were submitted for Title 26 metals analysis, which includes antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc.

Of the 17 metals analyzed, only barium, molybdenum, and selenium were detected above their respective laboratory reporting limits. Analytical results for the metals detected above the laboratory reporting limits are presented on Table 10. No concentrations in excess of their respective PRGs for tap water were reported for the metals analyzed.

URS reviewed the analytical data for compliance with quality assurance and quality control parameters.

The quality assurance/quality control (QA/QC) program includes standard sample collection procedures in the field and established analytical methodologies in the laboratory. Laboratory and field QC sample results were evaluated to assess the quality of the individual sample results and overall method performance. Analytical performance was evaluated on a "batch QC" basis by evaluating the QC sample results for groups of samples that were prepared and analyzed together. The data evaluation performed included review of:

- Blanks (laboratory method blanks and trip blanks),
- Spikes (laboratory control spikes [LCS], blank spikes [BS], matrix control spikes [MS], and surrogate spikes),
- Duplicates (blank spike duplicates [BSD] and matrix control spike duplicates [MSD]); and,
- Sample integrity (COC documentation, sample preservation, and holding time compliance).

The results of the data evaluation are summarized in the following paragraphs.

Laboratory method blanks are developed to evaluate evidence of contamination from laboratory instrumentation. When analytes are detected in the method blank, a "U" qualifier is given to positive results in the field sample that are less than five times the method blank detection, indicating that the result is an estimate of the true value. No qualification of data was necessary based on method blank results.

All LCS recoveries, MS/MSD recoveries, BS/BSD recoveries, and surrogate spike recoveries were within laboratory QC limits, with the exception of the following samples that required qualification:

- The relative percent difference (RPD) for lead was high between samples HM-2-B-0.15-0.30 and HM-2-B-0.15-0.30DUP. As a result, the lead detections in those two samples were qualified as estimated and flagged with a "J."
- Low tetrachloro-m-xylene (TCMX) surrogate recoveries were observed in samples HM-13-A-1.0-1.15 and HM-1-B-1.0-1.15. As a result, all PCB non-detections in these samples were qualified as estimated and flagged with a "UJ."
- The pentachlorophenol result in sample HM-15-A-0-0.15 was between the method detection limit (MDL) and the practical quantitation limit (PQL). As a result, the pentachlorophenol detection in this sample was qualified as estimated and flagged with a "J."
- The RPD for lead was high between samples HM-9-A-0.15-0.30 and HM-9-A-0.15-0.30DUP. As a result, the lead detections in those two samples were qualified as estimated and flagged with a "J."
- The lead MS recovery was low for samples HM-15-A-0-0.15 and HM-3-C-0-0.15. As a result, the lead detections in samples HM-15-A-0.15-0.30, HM-15-A-1.0-1.15, HM-9-A-0-0.15, HM-9-A-0.15-0.30, HM-9-A-0.15-0.30DUP, HM-9-A-1.0-1.15, HM-13-A-0-0.15, HM-13-A-0.15-0.30, HM-6-B-0-0.15, HM-6-B-0.15-0.30, HM-6-B-1.0-1.15, HM-6-B-2.0-2.15, HM-3-A-0.15-0.30, HM-3-A-1.0-1.15, HM-3-A-1.0-1.15DUP, HM-3-B-0-0.15, HM-3-B-0.15-0.30, HM-3-B-1.0-1.15, HM-3-C-0-0.15, HM-3-C-0.15-0.30, HM-3-C-1.0-1.15, HM-

1-A-0-0.15, HM-1-A-0.15-0.30, HM-1-A-0.30-0.45, HM-1-A-1.0-1.15, HM-1-B-0-0.15, HM-1-B-0.15-0.30, HM-1-C-0-0.15, HM-1-C-0.15-0.30, and HM-1-C-1.0-1.15 were qualified as estimated and flagged with a "J."

- The RPD for lead was high between samples HM-17-A-0.15-0.30 and HM-17-A-0.15-0.30DUP. As a result, the lead detections in those two samples were qualified as estimated and flagged with a "J."
- The barium MS recovery was high for sample HM-18-A-2.5-2.65. As a result, the barium detection in that sample was qualified as estimated and flagged with a "J."
- The barium MS recovery was high for sample HM-6-A-2.0-2.15. As a result, the barium detections in samples HM-17-A-0-0.15 and HM-5-A-0-0.15 were qualified as estimated and flagged with a "J."
- The RPD for lead was high between samples HM-15-B-0.15-0.30 and HM-15-B-0.15-0.30DUP. As a result, the lead detections in those two samples were qualified as estimated and flagged with a "J."
- The RPD for lead was high between samples HM-13-C-0.15-0.30 and HM-13-C-0.15-0.30DUP. As a result, the lead detections in those two samples were qualified as estimated and flagged with a "J."
- The RPD for lead was high between samples HM-11-A-0.15-0.30 and HM-11-A-0.15-0.30DUP. As a result, the lead detections in those two samples were qualified as estimated and flagged with a "J."
- Low TCMX surrogate recoveries were observed in samples HM-11-A-1.0-1.15 and HM-8-B-0.15-0.30. As a result, all PCB non-detections in these samples were qualified as estimated and flagged with a "UJ."
- The lead MS recovery was low for sample HM-15-B-0-0.15. As a result, the lead detections in samples HM-15-B-0-0.15, HM-15-B-0.15-0.30, HM-15-B-0.15-0.30DUP, HM-15-B-1.0-1.15, HM-15-C-0-0.15, HM-15-C-0.15-0.30, HM-9-B-0-0.15, HM-9-B-0.15-0.30, HM-9-B-1.0-1.15, HM-9-C-0-0.15, HM-9-C-0.15-0.30, HM-9-C-1.0-1.15, HM-13-B-0-0.15, HM-13-B-1.0-1.15, HM-13-C-0-0.15, HM-13-C-0.15-0.30, HM-13-C-0.15-0.30DUP, HM-13-C-1.0-1.15, and HM-11-A-0-0.15 were qualified as estimated and flagged with a "J."

Many of the TPH-d results were qualified by the laboratory with "H" and "Y" qualifiers. An "H" qualifier indicates that heavier hydrocarbons contributed to the quantitation. A "Y" qualifier indicates that the sample exhibits a chromatographic pattern that does not resemble the laboratory standard. TPH-d results for samples HM-4-B-1.0-1.15, HM-10-B-0-0.15, HM-15-A-0-0.15, HM-3-A-0-0.15, HM-17-0-0.15, HM-5-A-0-0.15, HM-13-B-0.15-0.30, HM-11-A-1.0-1.15, and HM-8-B-0.15-0.30 were qualified as estimated and flagged with "H" and "Y" qualifiers. TPH-d results for samples HM-8-C-W and HM-7-B-W were qualified as estimated and flagged with a "Y". These qualifiers are common for TPH analyses of environmental samples due to evaporation and degradation of the TPH in the environment.

COC documentation was complete and consistent. Samples were preserved as required per method specifications. All samples were analyzed within the method-specified holding times.

Except where noted above, the data quality evaluation indicated that no systematic problems were detected, and the overall data objectives for sample contamination, precision, accuracy, and sample integrity were met. These analytical data are of acceptable quality and may be used for their intended purposes.

This section details the statistical evaluation of the soil analytical data based on the following EPA guidance documents: *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites* (EPA 2002) and *ProUCL Version 3.0 User Guide* (Singh, Singh, and Maichle 2004). The 95 percent upper confidence limit (UCL) of the sample mean concentration was selected as the exposure point concentration (EPC) for soils to be left on-site, and the 90 percent UCL was selected as the EPC for soils to be taken off-site. Based on the statistical results, conclusions and recommendations are presented regarding the usage, handling, and/or disposal of excavated soil.

7.1 SOIL RESULTS

The analytical results for TPH-g, TPH-d, BTEX, PCBs, and chlorinated herbicides were below the applicable regulatory criteria and are therefore not evaluated further. The analytical results for heavy metals, other than lead and arsenic, were also below their regulatory criteria and also do not require further evaluation. Although the observed arsenic concentrations are higher than the PRG residential standard, these concentrations are considered to be at background levels for Northern California and are therefore do not require additional evaluation.

Lead concentrations were found to be elevated in some areas. Usually, aerially deposited lead (ADL) was found at the highest concentrations in the 0–0.15 meter and 0.15–0.30 meter depth intervals. A statistical evaluation and UCL calculation were performed for lead concentrations in soil and are presented in the following subsections.

7.1.1 Statistical Data Evaluation of Lead in Soil

The UCL is an EPA-approved statistical method for developing a conservative estimator of the mean concentration of soil constituents or contaminants. The UCL was used to evaluate whether the concentrations of lead in soil exceed the Caltrans Variance criteria for reuse on-site and for off-site disposal, if necessary.

Because multiple samples were collected at different depths at each sampling location, the total lead results from all depth intervals at each sample location were averaged to ensure that the data were relatively independent (a statistical assumption required for the calculation of UCL). This new data set, which consisted of one representative value at each boring location, was then used for the UCL calculations. This approach is conservative, considering that ADL is usually found in the upper 1 foot of soil, and had the entire soil column been analyzed, lower detections of lead would have been found in the deeper samples, and this would have reduced the overall averaged value for each boring location.

The data were also analyzed by depth to evaluate depth dependence. The UCL calculation was performed separately for sample results at soil depths between 0 and 0.15 meters, 0.15 and 0.30 meters, and greater than 0.30 meters.

To evaluate the potential special-handling requirements of the soil impacted with lead, representative concentrations were compared to relevant and applicable threshold concentrations. The representative concentration is derived according to EPA guidance documents (EPA 2002; Singh, Singh, and Maichle 2004). This concentration is represented by the 90 percent UCL for materials to be sent off-site for disposal and 95 percent UCL for soils to be reused on-site.

7.1.4 Special Note for Handling Soils

If soils with an unusual color or odor are discovered during excavation, URS recommends that these soils be stockpiled and additional sampling, analysis, and evaluation be conducted. This recommendation would apply whether the soils are managed according to the statistical approach or by individual soil areas. The evaluation results should be used to characterize the soil for reuse or disposal options.

7.2 GROUNDWATER RESULTS

Groundwater samples were collected at three sampling locations from the existing Caltrans ROW. URS personnel attempted to collect groundwater samples from the 11 other sampling locations by Hydropunching™ to depths of up to approximately 15 meters. However, groundwater was not encountered in these boreholes and therefore groundwater samples could not be collected from these areas.

Low levels of TPH-d, TCE, barium, molybdenum, and selenium were detected in the groundwater samples. Only TCE was detected above the EPA Region IX PRGs for tap water, at location HM-16-A at a concentration of 320 µg/L. It also exceeds the NPDES General Permit maximum daily discharge limit of 5 µg/L. However, the TCE concentration at this location was still below the hazardous waste criterion of 500 µg/L; therefore, groundwater that is pumped from this location can be used for dust control on the ROW as long as no surface water runoff is generated. However, this location's groundwater cannot be discharged under the General National NPDES permit without treatment to reduce TCE concentrations to below the NPDES permit criterion of 5 µg/L for TCE.

It would be extremely expensive, and perhaps impossible, to conduct a site reconnaissance or investigation that would ensure detection of all materials at the subject property that are now or might in the future be considered hazardous. Although URS did not discover hazardous materials through a reasonable and mutually agreed-upon limited scope of work at the subject property, URS cannot guarantee that no hazardous materials exist at the site. Also, even if the site is unaffected by hazardous materials at the time of our assessment, the site may later, due to natural phenomena or human intervention, become contaminated.

Our report was conducted under a contract with CCTA. Any reliance on our report by third parties shall be at that party's sole risk.

RWQCB. 2005. Screening For Environmental Concerns At Sites With Contaminated Soil and Groundwater. California Regional Water Quality Control Board, San Francisco Region.

Singh, A., A.K.Singh, and R. Maichle. 2004. *ProUCL Version 3.0 User Guide.* Office of Research and Development, U.S. Environmental Protection Agency. Report No. EPA/600/R04/079.

URS. 2005. *State Route 4 (East) Widening Project – Loveridge to Somersville Road Hazardous Materials Investigation Work Plan.* URS Corporation.

EPA. 2002. *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites.* U.S. Environmental Protection Agency. Office of Emergency and Remedial Response. Report No. OSWER 9285.6-10.

Tables

Table 1
Total Petroleum Hydrocarbon Results in Soil
SR-4 Widening Project - Loveridge to Somersville Road
Hazardous Materials Investigation Report

Sample ID	Date	Diesel C10-C24 Results (mg/kg)
ESL Residential (mg/kg)		100
HM-3-A-0-0.15	3/7/2005	61 HY
HM-4-B-1.0-1.15	3/1/2005	1.5 HY
HM-5-A-0-0.15	3/4/2005	12 HY
HM-8-B-0.15-0.30	3/8/2005	1.6 HY
HM-10-B-0-0.15	3/2/2005	15 HY
HM-11-A-1.0-1.15	3/8/2005	5.3 HY
HM-13-B-0.15-0.30	3/8/2005	26 HY
HM-15-A-0-0.15	3/7/2005	28 HY
HM-17-A-0-0.15	3/4/2005	15 HY

Notes:

ESL: Environmental screening level for shallow soil (<3 meters) where the groundwater is a potential source of drinking water (RWQCB 2005).

H: Heavier hydrocarbons contributed to the quantitation.

Y: Sample exhibits chromatographic pattern which does not resemble standard.

Table 2
Polychlorinated Biphenyl Results in Soil
SR-4 Widening Project - Loveridge to Somersville Road
Hazardous Materials Investigation Report

Sample ID	Date	Results (ug/kg)	
		Aroclor-1254	Aroclor-1260
PRG Residential (mg/kg)		220	220
HM-3-A-0-0.15	3/7/2005	**19**	**24**
HM-5-A-0-0.15	3/4/2005	<12	**14**
HM-13-B-0.15-0.30	3/8/2005	<11	**28**
HM-15-A-0-0.15	3/7/2005	<12	**17**
HM-17-A-0-0.15	3/4/2005	<12	**13**

Notes:

Detected analytes are shown in bold font.

PRG: Preliminary remediation goals for residential soil (EPA 2004).

Table 3
Chlorinated Herbicide Results in Soil
SR-4 Widening Project - Loveridge to Somersville Road
Hazardous Materials Investigation Report

Sample ID	Date	Pentachlorophenol Results (mg/kg)
PRG Residential (mg/kg)		3
HM-5-A-0-0.15	3/4/2005	0.005 J
HM-15-A-0-0.15	3/7/2005	0.005 J

Notes:

PRG: Preliminary remediation goals for residential soil (EPA 2004).

J: Estimated value.

Table 4
Metals (Excluding Lead) Results in Soil
SR-4 Widening Project - Loveridge to Somersville Road
Hazardous Materials Investigation Report

Sample ID	Date	Results (mg/kg)												
		Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Mercury	Molybdenum	Nickel	Selenium	Vanadium	Zinc
PRG Residential (mg/kg)		0.062	5,375	154	37	211	903	3,129	23	391	1,564	391	547	23,463
HM-1-B-1.0-1.15	3/7/2005	4.9	160	0.37	<0.18	16	7	16	<0.02	<0.7	19	<0.18	34	40
HM-3-A-0-0.15	3/7/2005	4.1	120	0.34	<0.26	22	9.2	24	0.12	<1.1	26	<0.26	43	52
HM-4-B-1.0-1.15	3/1/2005	8	230	0.67	0.31	25	9.1	26	0.29	<1.2	26	<0.31	52	64
HM-5-A-0-0.15	3/4/2005	7.5	180 J	0.69	0.62	27	8.9	32	0.046	1	27	<0.24	53	93
HM-5-C-1.0-1.15	3/1/2005	5.2	130	0.65	<0.22	30	12	20	0.045	<0.87	25	<0.22	55	38
HM-7-A-2.0-2.15	3/1/2005	8.5	260	0.7	0.48	24	10	28	0.027	<1.1	26	<0.27	54	64
HM-8-B-0.15-0.30	3/8/2005	8.7	210	0.77	1.3	25	10	31	<0.022	<1.2	25	1	58	66
HM-10-B-0-0.15	3/2/2005	6.3	160	0.57	0.36	21	12	23	0.12	<1.2	22	<0.3	60	53
HM-11-A-1.0-1.15	3/8/2005	6.1	150	0.45	0.94	18	8.3	19	0.036	<1.1	20	0.36	38	47
HM-13-A-1.0-1.15	3/7/2005	5.8	150	0.47	<0.22	19	7.5	19	<0.022	<0.89	20	<0.22	45	41
HM-13-B-0.15-0.30	3/8/2005	2.1	98	0.23	0.5	19	8.5	27	0.074	<0.76	19	0.76	76	120
HM-15-A-0-0.15	3/7/2005	2.8	82	0.24	0.41	25	11	57	0.089	<1	22	<0.25	53	79
HM-15-C-1.0-1.15	3/8/2005	6.6	140	0.58	0.92	20	8.6	22	<0.021	<1.2	20	0.44	46	45
HM-17-A-0-0.15	3/4/2005	3.4	27 J	0.54	2.3	39	31	160	3.7	1.8	30	<0.28	140	210
HM-18-A-2.5-2.65	3/3/2005	6.3	100 J	0.52	0.25	17	7.3	17	<0.022	<0.93	23	0.48	36	38
HM-DRUM	3/8/2005	6.2	180	0.53	0.95	20	9.7	21	0.032	<0.79	22	0.58	41	43

Notes:
J: Estimated value.

Table 5
Lead Results in Soil
SR-4 Widening Project - Loveridge to Somersville Road
Hazardous Materials Investigation Report

Sample ID	Date	Lead Results (mg/kg)	Result Exceeding 10xSTLC	Result Exceeding 20xTCLP	Result Exceeding TTLC	Result Exceeding 1496 mg/kg
PRG Residential (mg/kg)		150				
HM-1-A-0-0.15	3/7/2005	8 J	NO	NO	NO	NO
HM-1-A-0.15-0.30	3/7/2005	220 J	YES	YES	NO	NO
HM-1-A-0.30-0.45	3/7/2005	8.3 J	NO	NO	NO	NO
HM-1-A-1.0-1.15	3/7/2005	5.5 J	NO	NO	NO	NO
HM-1-B-0-0.15	3/7/2005	19 J	NO	NO	NO	NO
HM-1-B-0.15-0.30	3/7/2005	180 J	YES	YES	NO	NO
HM-1-B-0.30-0.45	3/7/2005	8.6	NO	NO	NO	NO
HM-1-B-1.0-1.15	3/7/2005	4.7	NO	NO	NO	NO
HM-1-C-0-0.15	3/7/2005	120 J	YES	YES	NO	NO
HM-1-C-0.15-0.30	3/7/2005	16 J	NO	NO	NO	NO
HM-1-C-1.0-1.15	3/7/2005	9.6 J	NO	NO	NO	NO
HM-2-A-0-0.15	3/2/2005	5.7	NO	NO	NO	NO
HM-2-A-0.15-0.30	3/2/2005	63	YES	NO	NO	NO
HM-2-A-0.30-0.45	3/2/2005	3.8	NO	NO	NO	NO
HM-2-A-1.0-1.15	3/2/2005	7.7	NO	NO	NO	NO
HM-2-B-0-0.15	3/2/2005	5.3	NO	NO	NO	NO
HM-2-B-0.15-0.30	3/2/2005	100 J	YES	YES	NO	NO
HM-2-B-0.15-0.30-DUP	3/2/2005	33 J	NO	NO	NO	NO
HM-2-B-0.30-0.45	3/2/2005	25	NO	NO	NO	NO
HM-2-B-1.0-1.15	3/2/2005	6	NO	NO	NO	NO
HM-2-C-0-0.15	3/2/2005	56	YES	NO	NO	NO
HM-2-C-0.15-0.30	3/2/2005	11	NO	NO	NO	NO
HM-2-C-1.0-1.15	3/2/2005	6.9	NO	NO	NO	NO
HM-3-A-0-0.15	3/7/2005	81	YES	NO	NO	NO
HM-3-A-0.15-0.30	3/7/2005	2300 J	YES	YES	YES	YES
HM-3-A-0.30-0.45	3/7/2005	40	NO	NO	NO	NO
HM-3-A-1.0-1.15	3/7/2005	8.2 J	NO	NO	NO	NO
HM-3-A-1.0-1.15-DUP	3/7/2005	8.1 J	NO	NO	NO	NO
HM-3-B-0-0.15	3/7/2005	87 J	YES	NO	NO	NO
HM-3-B-0.15-0.30	3/7/2005	170 J	YES	YES	NO	NO
HM-3-B-0.30-0.45	3/7/2005	7.6	NO	NO	NO	NO
HM-3-B-1.0-1.15	3/7/2005	6.9 J	NO	NO	NO	NO
HM-3-C-0-0.15	3/7/2005	200 J	YES	YES	NO	NO
HM-3-C-0.15-0.30	3/7/2005	22 J	NO	NO	NO	NO
HM-3-C-1.0-1.15	3/7/2005	8.9 J	NO	NO	NO	NO
HM-4-A-0-0.15	3/1/2005	15	NO	NO	NO	NO
HM-4-A-0.15-0.30	3/1/2005	11	NO	NO	NO	NO
HM-4-A-1.0-1.15	3/1/2005	7.1	NO	NO	NO	NO
HM-4-B-0-0.15	3/1/2005	75	YES	NO	NO	NO
HM-4-B-0.15-0.30	3/1/2005	10	NO	NO	NO	NO
HM-4-B-1.0-1.15	3/1/2005	11	NO	NO	NO	NO
HM-4-C-0-0.15	3/1/2005	24	NO	NO	NO	NO
HM-4-C-0.15-0.30	3/1/2005	22	NO	NO	NO	NO
HM-4-C-1.0-1.15	3/1/2005	8.6	NO	NO	NO	NO
HM-5-A-0-0.15	3/4/2005	82	YES	NO	NO	NO
HM-5-A-0.15-0.30	3/4/2005	41	NO	NO	NO	NO
HM-5-A-1.0-1.15	3/4/2005	9.5	NO	NO	NO	NO
HM-5-A-2.0-2.15	3/4/2005	8.9	NO	NO	NO	NO
HM-5-A-2.5-2.65	3/4/2005	5.7	NO	NO	NO	NO
HM-5-B-0-0.15	3/1/2005	93	YES	NO	NO	NO
HM-5-B-0.15-0.30	3/1/2005	310	YES	YES	NO	NO
HM-5-B-0.30-0.45	3/1/2005	71	YES	NO	NO	NO
HM-5-B-0.45-0.60	3/1/2005	18	NO	NO	NO	NO
HM-5-B-1.0-1.15	3/1/2005	8.3	NO	NO	NO	NO
HM-5-B-2.0-2.15	3/1/2005	18	NO	NO	NO	NO
HM-5-B-2.5-2.65	3/1/2005	7.6	NO	NO	NO	NO
HM-5-C-0-0.15	3/1/2005	40	NO	NO	NO	NO
HM-5-C-0.15-0.30	3/1/2005	39	NO	NO	NO	NO
HM-5-C-1.0-1.15	3/1/2005	6	NO	NO	NO	NO
HM-5-C-2.0-2.15	3/1/2005	7.5	NO	NO	NO	NO
HM-5-C-2.5-2.65	3/1/2005	7	NO	NO	NO	NO
HM-6-A-0-0.15	3/3/2005	30	NO	NO	NO	NO

Table 5
Lead Results in Soil
SR-4 Widening Project - Loveridge to Somersville Road
Hazardous Materials Investigation Report

Sample ID	Date	Lead Results (mg/kg)	Result Exceeding 10xSTLC	Result Exceeding 20xTCLP	Result Exceeding TTLC	Result Exceeding 1496 mg/kg
HM-6-A-0.15-0.30	3/3/2005	0.76	NO	NO	NO	NO
HM-6-A-1.0-1.15	3/3/2005	5.4	NO	NO	NO	NO
HM-6-A-2.0-2.15	3/3/2005	7.8	NO	NO	NO	NO
HM-6-B-0-0.15	3/7/2005	210 J	YES	YES	NO	NO
HM-6-B-0.15-0.30	3/7/2005	32 J	NO	NO	NO	NO
HM-6-B-1.0-1.15	3/7/2005	6.8 J	NO	NO	NO	NO
HM-6-B-2.0-2.15	3/7/2005	6.2 J	NO	NO	NO	NO
HM-6-C-0-0.15	3/1/2005	39	NO	NO	NO	NO
HM-6-C-0.15-0.30	3/1/2005	16	NO	NO	NO	NO
HM-6-C-1.0-1.15	3/1/2005	11	NO	NO	NO	NO
HM-6-C-2.0-2.15	3/1/2005	8.3	NO	NO	NO	NO
HM-7-A-0-0.15	3/1/2005	17	NO	NO	NO	NO
HM-7-A-0.15-0.30	3/1/2005	7.8	NO	NO	NO	NO
HM-7-A-1.0-1.15	3/1/2005	7.7	NO	NO	NO	NO
HM-7-A-2.0-2.15	3/1/2005	7.9	NO	NO	NO	NO
HM-7-B-0-0.15	3/1/2005	23	NO	NO	NO	NO
HM-7-B-0.15-0.30	3/1/2005	8.8	NO	NO	NO	NO
HM-7-B-1.0-1.15	3/1/2005	8.2	NO	NO	NO	NO
HM-7-B-2.0-2.15	3/1/2005	8.2	NO	NO	NO	NO
HM-8-A-0-0.15	3/1/2005	21	NO	NO	NO	NO
HM-8-A-0.15-0.30	3/1/2005	14	NO	NO	NO	NO
HM-8-A-1.0-1.15	3/1/2005	7.8	NO	NO	NO	NO
HM-8-A-2.0-2.15	3/1/2005	6.5	NO	NO	NO	NO
HM-8-B-0-0.15	3/8/2005	19	NO	NO	NO	NO
HM-8-B-0.15-0.30	3/8/2005	14	NO	NO	NO	NO
HM-8-B-1.0-1.15	3/8/2005	7.9	NO	NO	NO	NO
HM-8-B-2.0-2.15	3/8/2005	7.5	NO	NO	NO	NO
HM-8-B-2.0-2.15DUP	3/8/2005	7.8	NO	NO	NO	NO
HM-8-C-0-0.15	3/1/2005	57	YES	NO	NO	NO
HM-8-C-0.15-0.30	3/1/2005	30	NO	NO	NO	NO
HM-8-C-1.0-1.15	3/1/2005	7.7	NO	NO	NO	NO
HM-8-C-2.0-2.15	3/1/2005	6.3	NO	NO	NO	NO
HM-9-A-0-0.15	3/7/2005	10 J	NO	NO	NO	NO
HM-9-A-0.15-0.30	3/7/2005	7 J	NO	NO	NO	NO
HM-9-A-0.15-0.30-DUP	3/7/2005	12 J	NO	NO	NO	NO
HM-9-A-1.0-1.15	3/7/2005	20 J	NO	NO	NO	NO
HM-9-B-0-0.15	3/8/2005	160 J	YES	YES	NO	NO
HM-9-B-0.15-0.30	3/8/2005	100 J	YES	YES	NO	NO
HM-9-B-0.30-0.45	3/8/2005	21	NO	NO	NO	NO
HM-9-B-1.0-1.15	3/8/2005	12 J	NO	NO	NO	NO
HM-9-C-0-0.15	3/8/2005	19 J	NO	NO	NO	NO
HM-9-C-0.15-0.30	3/8/2005	15 J	NO	NO	NO	NO
HM-9-C-1.0-1.15	3/8/2005	9.3 J	NO	NO	NO	NO
HM-10-B-0-0.15	3/2/2005	11	NO	NO	NO	NO
HM-10-B-0.15-0.30	3/2/2005	10	NO	NO	NO	NO
HM-10-B-1.0-1.15	3/2/2005	7.2	NO	NO	NO	NO
HM-10-C-0-0.15	3/2/2005	22	NO	NO	NO	NO
HM-10-C-0.15-0.30	3/2/2005	43	NO	NO	NO	NO
HM-10-C-1.0-1.15	3/2/2005	6.9	NO	NO	NO	NO
HM-10-C-1.0-1.15-DUP	3/2/2005	7	NO	NO	NO	NO
HM-11-A-0-0.15	3/8/2005	14 J	NO	NO	NO	NO
HM-11-A-0.15-0.30	3/8/2005	8.3 J	NO	NO	NO	NO
HM-11-A-0.15-0.30DUP	3/8/2005	4.6 J	NO	NO	NO	NO
HM-11-A-1.0-1.15	3/8/2005	5.3	NO	NO	NO	NO
HM-11-B-0-0.15	3/8/2005	35	NO	NO	NO	NO
HM-11-B-0.15-0.30	3/8/2005	110	YES	YES	NO	NO
HM-11-B-0.30-0.45	3/8/2005	6.3	NO	NO	NO	NO
HM-11-B-1.0-1.15	3/8/2005	7.1	NO	NO	NO	NO
HM-11-C-0-0.15	3/8/2005	67	YES	NO	NO	NO
HM-11-C-0.15-0.30	3/8/2005	24	NO	NO	NO	NO
HM-11-C-1.0-1.15	3/8/2005	8	NO	NO	NO	NO
HM-12-A-0-0.15	3/2/2005	3.4	NO	NO	NO	NO
HM-12-A-0.15-0.30	3/2/2005	56	YES	NO	NO	NO

Table 5
Lead Results in Soil
SR-4 Widening Project - Loveridge to Somersville Road
Hazardous Materials Investigation Report

Sample ID	Date	Lead Results (mg/kg)	Result Exceeding 10xSTLC	Result Exceeding 20xTCLP	Result Exceeding TTLC	Result Exceeding 1496 mg/kg
HM-12-A-0.30-0.45	3/2/2005	16	NO	NO	NO	NO
HM-12-A-1.0-1.15	3/2/2005	6.2	NO	NO	NO	NO
HM-12-B-0-0.15	3/2/2005	35	NO	NO	NO	NO
HM-12-B-0.15-0.30	3/2/2005	42	NO	NO	NO	NO
HM-12-B-1.0-1.15	3/2/2005	7.7	NO	NO	NO	NO
HM-12-C-0-0.15	3/2/2005	26	NO	NO	NO	NO
HM-12-C-0.15-0.30	3/2/2005	13	NO	NO	NO	NO
HM-12-C-1.0-1.15	3/2/2005	6.5	NO	NO	NO	NO
HM-13-A-0-0.15	3/7/2005	7.4 J	NO	NO	NO	NO
HM-13-A-0.15-0.30	3/7/2005	16 J	NO	NO	NO	NO
HM-13-A-1.0-1.15	3/7/2005	6.5	NO	NO	NO	NO
HM-13-B-0-0.15	3/8/2005	120 J	YES	YES	NO	NO
HM-13-B-0.15-0.30	3/8/2005	340	YES	YES	NO	NO
HM-13-B-0.30-0.45	3/8/2005	11	NO	NO	NO	NO
HM-13-B-1.0-1.15	3/8/2005	8.6 J	NO	NO	NO	NO
HM-13-C-0-0.15	3/8/2005	50 J	YES	NO	NO	NO
HM-13-C-0.15-0.30	3/8/2005	6.9 J	NO	NO	NO	NO
HM-13-C-0.15-0.30DUP	3/8/2005	9.6 J	NO	NO	NO	NO
HM-13-C-1.0-1.15	3/8/2005	8.3 J	NO	NO	NO	NO
HM-14-A-0-0.15	3/2/2005	10	NO	NO	NO	NO
HM-14-A-0.15-0.30	3/2/2005	320	YES	YES	NO	NO
HM-14-A-0.30-0.45	3/2/2005	15	NO	NO	NO	NO
HM-14-A-1.0-1.15	3/2/2005	5.8	NO	NO	NO	NO
HM-14-B-0-0.15	3/2/2005	240	YES	YES	NO	NO
HM-14-B-0.15-0.30	3/2/2005	17	NO	NO	NO	NO
HM-14-B-1.0-1.15	3/2/2005	6.7	NO	NO	NO	NO
HM-14-C-0-0.15	3/2/2005	20	NO	NO	NO	NO
HM-14-C-0.15-0.30	3/2/2005	21	NO	NO	NO	NO
HM-14-C-1.0-1.15	3/2/2005	6.5	NO	NO	NO	NO
HM-15-A-0-0.15	3/7/2005	300	YES	YES	NO	NO
HM-15-A-0.15-0.30	3/7/2005	310 J	YES	YES	NO	NO
HM-15-A-0.30-0.45	3/7/2005	9	NO	NO	NO	NO
HM-15-A-1.0-1.15	3/7/2005	7.3 J	NO	NO	NO	NO
HM-15-B-0-0.15	3/8/2005	220 J	YES	YES	NO	NO
HM-15-B-0.15-0.30	3/8/2005	91 J	YES	NO	NO	NO
HM-15-B-0.15-0.30DUP	3/8/2005	59 J	YES	NO	NO	NO
HM-15-B-0.30-0.45	3/8/2005	22	NO	NO	NO	NO
HM-15-B-1.0-1.15	3/8/2005	6.4 J	NO	NO	NO	NO
HM-15-C-0-0.15	3/8/2005	12 J	NO	NO	NO	NO
HM-15-C-0.15-0.30	3/8/2005	19 J	NO	NO	NO	NO
HM-15-C-1.0-1.15	3/8/2005	10	NO	NO	NO	NO
HM-16-A-0-0.15	3/3/2005	19	NO	NO	NO	NO
HM-16-A-0.15-0.30	3/3/2005	600	YES	YES	NO	NO
HM-16-A-0.30-0.45	3/3/2005	45	NO	NO	NO	NO
HM-16-A-1.0-1.15	3/3/2005	6.3	NO	NO	NO	NO
HM-16-B-0-0.15	3/3/2005	24	NO	NO	NO	NO
HM-16-B-0.15-0.30	3/3/2005	40	NO	NO	NO	NO
HM-16-C-0-0.15	3/3/2005	8.4	NO	NO	NO	NO
HM-16-C-0.15-0.30	3/3/2005	16	NO	NO	NO	NO
HM-16-C-1.0-1.15	3/3/2005	10	NO	NO	NO	NO
HM-17-A-0-0.15	3/4/2005	140	YES	YES	NO	NO
HM-17-A-0.15-0.30	3/4/2005	110 J	YES	YES	NO	NO
HM-17-A-0.15-0.30-DU	3/4/2005	150 J	YES	YES	NO	NO
HM-17-A-0.30-0.45	3/4/2005	22	NO	NO	NO	NO
HM-17-A-1.0-1.15	3/4/2005	7.8	NO	NO	NO	NO
HM-17-A-2.0-2.15	3/4/2005	60	YES	NO	NO	NO
HM-17-A-2.5-2.65	3/4/2005	6.6	NO	NO	NO	NO
HM-17-B-0-0.15	3/4/2005	1800	YES	YES	YES	YES
HM-17-B-0.15-0.30	3/4/2005	160	YES	YES	NO	NO
HM-17-B-0.30-0.45	3/4/2005	60	YES	NO	NO	NO
HM-17-B-0.45-0.60	3/4/2005	80	YES	NO	NO	NO
HM-17-B-1.0-1.15	3/4/2005	46	NO	NO	NO	NO
HM-17-B-2.0-2.15	3/4/2005	16	NO	NO	NO	NO

Table 5
Lead Results in Soil
SR-4 Widening Project - Loveridge to Somersville Road
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Sample ID	Date	Lead Results (mg/kg)	Result Exceeding 10xSTLC	Result Exceeding 20xTCLP	Result Exceeding TTLC	Result Exceeding 1496 mg/kg
HM-17-B-2.5-2.65	3/4/2005	8.4	NO	NO	NO	NO
HM-17-C-0-0.15	3/4/2005	41	NO	NO	NO	NO
HM-17-C-0.15-0.30	3/4/2005	11	NO	NO	NO	NO
HM-17-C-1.0-1.15	3/4/2005	7.3	NO	NO	NO	NO
HM-17-C-2.0-2.15	3/4/2005	7.6	NO	NO	NO	NO
HM-17-C-2.0-2.15-DUP	3/4/2005	8.1	NO	NO	NO	NO
HM-17-C-2.5-2.65	3/4/2005	190	YES	YES	NO	NO
HM-18-A-1.0-1.15	3/3/2005	46	NO	NO	NO	NO
HM-18-A-2.0-2.15	3/3/2005	7.4	NO	NO	NO	NO
HM-18-A-2.5-2.65	3/3/2005	4.7	NO	NO	NO	NO
HM-18-B-0-0.15	3/3/2005	33	NO	NO	NO	NO
HM-18-B-1.0-1.15	3/3/2005	18	NO	NO	NO	NO
HM-18-B-2.0-2.15	3/3/2005	6.1	NO	NO	NO	NO
HM-18-B-2.5-2.65	3/3/2005	4.5	NO	NO	NO	NO
HM-18-C-0-0.15	3/3/2005	11	NO	NO	NO	NO
HM-18-C-0.15-0.30	3/3/2005	12	NO	NO	NO	NO
HM-18-C-1.0-1.15	3/3/2005	5.9	NO	NO	NO	NO
HM-18-C-2.0-2.15	3/3/2005	5.2	NO	NO	NO	NO
HM-18-C-2.5-2.65	3/3/2005	4.5	NO	NO	NO	NO
HM-DRUM	3/8/2005	8.1	NO	NO	NO	NO

Notes:
J: Estimated value.

Table 6
WET, DI-WET, and TCLP Lead Results for Soil
SR-4 Widening Project - Loveridge to Somersville Road
Hazardous Materials Investigation Report

Sample ID	Date	Results (mg/L)			WET Result Exceeding STLC	DI-WET Result Exceeding 0.5 mg/L	TCLP Result Exceeding TCLP
		WET Leachate	DI-WET Leachate	TCLP Leachate			
HM-1-A-0.15-0.30	3/7/2005	**13**	0.023	0.38	YES	NO	NO
HM-1-B-0.15-0.30	3/7/2005	2.1	0.006	0.095	NO	NO	NO
HM-1-C-0-0.15	3/7/2005	3.9	0.033	0.048	NO	NO	NO
HM-2-A-0.15-0.30	3/2/2005	**12**	0.021	NA	YES	NO	NO
HM-2-B-0.15-0.30	3/2/2005	**5.1**	0.032	0.23	YES	NO	NO
HM-2-C-0-0.15	3/2/2005	1.4	0.0068	NA	NO	NO	NO
HM-3-A-0-0.15	3/7/2005	1.2	0.0095	NA	NO	NO	NO
HM-3-A-0.15-0.30	3/7/2005	**49**	0.15	0.22	YES	NO	NO
HM-3-B-0-0.15	3/7/2005	3.2	0.0083	NA	NO	NO	NO
HM-3-B-0.15-0.30	3/7/2005	**27**	0.12	0.68	YES	NO	NO
HM-3-C-0-0.15	3/7/2005	**9.6**	0.029	0.046	YES	NO	NO
HM-4-B-0-0.15	3/1/2005	2.7	0.006	NA	NO	NO	NO
HM-5-A-0-0.15	3/4/2005	0.87	<0.003	NA	NO	NO	NO
HM-5-B-0-0.15	3/1/2005	2.2	0.0055	NA	NO	NO	NO
HM-5-B-0.15-0.30	3/1/2005	**8**	0.021	0.058	YES	NO	NO
HM-5-B-0.30-0.45	3/1/2005	0.14	0.0051	NA	NO	NO	NO
HM-6-B-0-0.15	3/7/2005	**8.4**	0.013	0.044	YES	NO	NO
HM-8-C-0-0.15	3/1/2005	0.5	0.0058	NA	NO	NO	NO
HM-9-B-0-0.15	3/8/2005	**11**	0.078	0.11	YES	NO	NO
HM-9-B-0.15-0.30	3/8/2005	**5.9**	0.056	0.14	YES	NO	NO
HM-11-B-0.15-0.30	3/8/2005	**11**	0.028	0.081	YES	NO	NO
HM-11-C-0-0.15	3/8/2005	1.2	0.0032	NA	NO	NO	NO
HM-12-A-0.15-0.30	3/2/2005	1.1	<0.003	NA	NO	NO	NO
HM-13-B-0-0.15	3/8/2005	**5.2**	0.029	0.095	YES	NO	NO
HM-13-B-0.15-0.30	3/8/2005	**31**	0.13	2	YES	NO	NO
HM-13-C-0-0.15	3/8/2005	1.6	0.024	NA	NO	NO	NO
HM-14-A-0.15-0.30	3/2/2005	**7.8**	0.0034	<0.03	YES	NO	NO
HM-14-B-0-0.15	3/2/2005	**15**	0.011	0.18	YES	NO	NO
HM-15-A-0-0.15	3/7/2005	2.2	0.0047	0.27	NO	NO	NO
HM-15-A-0.15-0.30	3/7/2005	3.8	0.0068	0.039	NO	NO	NO
HM-15-B-0-0.15	3/8/2005	**13**	0.018	0.1	YES	NO	NO
HM-15-B-0.15-0.30	3/8/2005	1.4	0.041	NA	NO	NO	NO
HM-16-A-0.15-0.30	3/3/2005	**23**	0.047	0.53	YES	NO	NO
HM-17-A-0.15-0.30	3/4/2005	3.7	0.0088	0.074	NO	NO	NO
HM-17-A-2.0-2.15	3/4/2005	1.1	0.016	NA	NO	NO	NO
HM-17-B-0-0.15	3/4/2005	**53**	0.059	2.8	YES	NO	NO
HM-17-B-0.15-0.30	3/4/2005	**6.4**	0.0034	<0.03	YES	NO	NO
HM-17-B-0.30-0.45	3/4/2005	**5.2**	<0.008	NA	YES	NO	NO
HM-17-B-0.45-0.60	3/4/2005	1.5	0.0093	NA	NO	NO	NO
HM-17-C-2.5-2.65	3/4/2005	<0.15	0.025	<0.03	NO	NO	NO

Notes:
WET results detected above the STLC are shown in bold font.

Table 7
pH Results in Soil
SR-4 Widening Project - Loveridge to Somersville Road
Hazardous Materials Investigation Report

Sample ID	Date	pH Results
HM-1-A-0-0.15	3/7/2005	8.1
HM-1-A-0.15-0.30	3/7/2005	8.2
HM-1-A-1.0-1.15	3/7/2005	8
HM-1-B-0-0.15	3/7/2005	7.3
HM-1-B-0.15-0.30	3/7/2005	8
HM-1-B-1.0-1.15	3/7/2005	8.2
HM-1-C-0-0.15	3/7/2005	7.2
HM-1-C-0.15-0.30	3/7/2005	7.2
HM-1-C-1.0-1.15	3/7/2005	7
HM-2-A-0-0.15	3/2/2005	7.6
HM-2-A-0.15-0.30	3/2/2005	7.5
HM-2-A-1.0-1.15	3/2/2005	7.9
HM-2-B-0-0.15	3/2/2005	7.6
HM-2-B-0.15-0.30	3/2/2005	8
HM-2-B-0.15-0.30-DUP	3/2/2005	7.7
HM-2-B-1.0-1.15	3/2/2005	8.2
HM-2-C-0-0.15	3/2/2005	7.6
HM-2-C-0.15-0.30	3/2/2005	7.9
HM-2-C-1.0-1.15	3/2/2005	8.6
HM-3-A-0-0.15	3/7/2005	8.1
HM-3-A-0.15-0.30	3/7/2005	7.9
HM-3-A-1.0-1.15	3/7/2005	7.8
HM-3-A-1.0-1.15-DUP	3/7/2005	7.6
HM-3-B-0-0.15	3/7/2005	7.4
HM-3-B-0.15-0.30	3/7/2005	7.1
HM-3-B-1.0-1.15	3/7/2005	6.7
HM-3-C-0-0.15	3/7/2005	6.8
HM-3-C-0.15-0.30	3/7/2005	7
HM-3-C-1.0-1.15	3/7/2005	6.9
HM-4-A-0-0.15	3/1/2005	7.6
HM-4-A-0.15-0.30	3/1/2005	6.9
HM-4-A-1.0-1.15	3/1/2005	7.6
HM-4-B-0-0.15	3/1/2005	7.7
HM-4-B-0.15-0.30	3/1/2005	7.8
HM-4-B-1.0-1.15	3/1/2005	7.3
HM-4-C-0-0.15	3/1/2005	7.7
HM-4-C-0.15-0.30	3/1/2005	7.9
HM-4-C-1.0-1.15	3/1/2005	7.6
HM-5-A-0-0.15	3/4/2005	7.4
HM-5-A-0.15-0.30	3/4/2005	7.4
HM-5-A-1.0-1.15	3/4/2005	7.4
HM-5-A-2.0-2.15	3/4/2005	7.2
HM-5-A-2.5-2.65	3/4/2005	8.1
HM-5-B-0-0.15	3/1/2005	6.9
HM-5-B-0.15-0.30	3/1/2005	6.9
HM-5-B-1.0-1.15	3/1/2005	7
HM-5-B-2.0-2.15	3/1/2005	7.1
HM-5-B-2.5-2.65	3/1/2005	7.7
HM-5-C-0-0.15	3/1/2005	7.4
HM-5-C-0.15-0.30	3/1/2005	7.6
HM-5-C-1.0-1.15	3/1/2005	6.8
HM-5-C-2.0-2.15	3/1/2005	6.4
HM-5-C-2.5-2.65	3/1/2005	6.7
HM-6-A-0-0.15	3/3/2005	8.2
HM-6-A-0.15-0.30	3/3/2005	8.1
HM-6-A-1.0-1.15	3/3/2005	7.8
HM-6-A-2.0-2.15	3/3/2005	7.9
HM-6-B-0-0.15	3/7/2005	6.9
HM-6-B-0.15-0.30	3/7/2005	7.2
HM-6-B-1.0-1.15	3/7/2005	8
HM-6-B-2.0-2.15	3/7/2005	7.9
HM-6-C-0-0.15	3/1/2005	7.3
HM-6-C-0.15-0.30	3/1/2005	7.7
HM-6-C-1.0-1.15	3/1/2005	7.3
HM-6-C-2.0-2.15	3/1/2005	7.4

Table 7
pH Results in Soil
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Sample ID	Date	pH Results
HM-7-A-0-0.15	3/1/2005	7.1
HM-7-A-0.15-0.30	3/1/2005	7.3
HM-7-A-1.0-1.15	3/1/2005	7.6
HM-7-A-2.0-2.15	3/1/2005	7.8
HM-7-B-0-0.15	3/1/2005	6.9
HM-7-B-0.15-0.30	3/1/2005	6.9
HM-7-B-1.0-1.15	3/1/2005	7.7
HM-7-B-2.0-2.15	3/1/2005	7.5
HM-8-A-0-0.15	3/1/2005	7.2
HM-8-A-0.15-0.30	3/1/2005	7.1
HM-8-A-1.0-1.15	3/1/2005	7.6
HM-8-A-2.0-2.15	3/1/2005	7.7
HM-8-B-0-0.15	3/8/2005	7.5
HM-8-B-0.15-0.30	3/8/2005	7.4
HM-8-B-1.0-1.15	3/8/2005	8.5
HM-8-B-2.0-2.15	3/8/2005	8.6
HM-8-B-2.0-2.15DUP	3/8/2005	8.6
HM-8-C-0-0.15	3/1/2005	6.8
HM-8-C-0.15-0.30	3/1/2005	6.8
HM-8-C-1.0-1.15	3/1/2005	7.7
HM-8-C-2.0-2.15	3/1/2005	8
HM-9-A-0-0.15	3/7/2005	8.3
HM-9-A-0.15-0.30	3/7/2005	7.3
HM-9-A-0.15-0.30-DUP	3/7/2005	8.2
HM-9-A-1.0-1.15	3/7/2005	7.8
HM-9-B-0-0.15	3/8/2005	7.7
HM-9-B-0.15-0.30	3/8/2005	7.9
HM-9-B-1.0-1.15	3/8/2005	8
HM-9-C-0-0.15	3/8/2005	7.3
HM-9-C-0.15-0.30	3/8/2005	7.3
HM-9-C-1.0-1.15	3/8/2005	8.7
HM-10-B-0.15-0.30	3/2/2005	7.7
HM-10-B-0-0.15	3/2/2005	7.7
HM-10-B-1.0-1.15	3/2/2005	7.8
HM-10-C-0.-0.15	3/2/2005	6.7
HM-10-C-0.15-0.30	3/2/2005	6.8
HM-10-C-1.0-1.15	3/2/2005	7.5
HM-10-C-1.0-1.15-DUP	3/2/2005	7.2
HM-11-A-0-0.15	3/8/2005	8.5
HM-11-A-0.15-0.30	3/8/2005	8.7
HM-11-A-0.15-0.30DUP	3/8/2005	8.6
HM-11-A-1.0-1.15	3/8/2005	8.5
HM-11-B-0-0.15	3/8/2005	7.8
HM-11-B-0.15-0.30	3/8/2005	8.2
HM-11-B-1.0-1.15	3/8/2005	8.4
HM-11-C-0-0.15	3/8/2005	7.4
HM-11-C-0.15-0.30	3/8/2005	7.5
HM-11-C-1.0-1.15	3/8/2005	7.4
HM-12-A-0-0.15	3/2/2005	7.5
HM-12-A-0.15-0.30	3/2/2005	7.9
HM-12-A-1.0-1.15	3/2/2005	8
HM-12-B-0-0.15	3/2/2005	7.5
HM-12-B-0.15-0.30	3/2/2005	7.9
HM-12-B-1.0-1.15	3/2/2005	8.1
HM-12-C-0-0.15	3/2/2005	7.7
HM-12-C-0.15-0.30	3/2/2005	7.3
HM-12-C-1.0-1.15	3/2/2005	7.5
HM-13-A-0-0.15	3/7/2005	8.1
HM-13-A-0.15-0.30	3/7/2005	8.2
HM-13-A-1.0-1.15	3/7/2005	8
HM-13-B-0-0.15	3/8/2005	7.9
HM-13-B-0.15-0.30	3/8/2005	7.9
HM-13-B-1.0-1.15	3/8/2005	8.2
HM-13-C-0-0.15	3/8/2005	7.7

Table 7
pH Results in Soil
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Sample ID	Date	pH Results
HM-13-C-0.15-0.30	3/8/2005	8.2
HM-13-C-0.15-0.30DUP	3/8/2005	8.1
HM-13-C-1.0-1.15	3/8/2005	8.1
HM-14-A-0-0.15	3/2/2005	8
HM-14-A-0.15-0.30	3/2/2005	7.9
HM-14-A-1.0-1.15	3/2/2005	8.4
HM-14-B-0-0.15	3/2/2005	7.8
HM-14-B-0.15-0.30	3/2/2005	8.2
HM-14-B-1.0-1.15	3/2/2005	7.6
HM-14-C-0-0.15	3/2/2005	7.2
HM-14-C-0.15-0.30	3/2/2005	7.5
HM-14-C-1.0-1.15	3/2/2005	7.8
HM-15-A-0-0.15	3/7/2005	8.7
HM-15-A-0.15-0.30	3/7/2005	8.2
HM-15-A-1.0-1.15	3/7/2005	7.8
HM-15-B-0-0.15	3/8/2005	7.2
HM-15-B-0.15-0.30	3/8/2005	8
HM-15-B-0.15-0.30DUP	3/8/2005	7.6
HM-15-B-1.0-1.15	3/8/2005	7.6
HM-15-C-0-0.15	3/8/2005	6.8
HM-15-C-0.15-0.30	3/8/2005	7
HM-15-C-1.0-1.15	3/8/2005	8.4
HM-16-A-0-0.15	3/3/2005	8.1
HM-16-A-0.15-0.30	3/3/2005	7.5
HM-16-A-1.0-1.15	3/3/2005	7.6
HM-16-B-0-0.15	3/3/2005	7.4
HM-16-B-0.15-0.30	3/3/2005	7.3
HM-16-C-0-0.15	3/3/2005	7.1
HM-16-C-0.15-0.30	3/3/2005	6.9
HM-16-C-1.0-1.15	3/3/2005	7.6
HM-17-A-0-0.15	3/4/2005	7.4
HM-17-A-0.15-0.30	3/4/2005	7.5
HM-17-A-0.15-0.30-DU	3/4/2005	7.4
HM-17-A-1.0-1.15	3/4/2005	7.7
HM-17-A-2.0-2.15	3/4/2005	7.1
HM-17-A-2.5-2.65	3/4/2005	6.7
HM-17-B-0-0.15	3/4/2005	6.8
HM-17-B-0.15-0.30	3/4/2005	7.2
HM-17-B-1.0-1.15	3/4/2005	7.3
HM-17-B-2.0-2.15	3/4/2005	7.1
HM-17-B-2.5-2.65	3/4/2005	7.3
HM-17-C-0-0.15	3/4/2005	6.9
HM-17-C-0.15-0.30	3/4/2005	6.8
HM-17-C-1.0-1.15	3/4/2005	7.6
HM-17-C-2.0-2.15	3/4/2005	7.6
HM-17-C-2.0-2.15-DUP	3/4/2005	7.5
HM-17-C-2.5-2.65	3/4/2005	7.4
HM-18-A-0-0.15	3/3/2005	7
HM-18-A-0.15-0.30	3/3/2005	7
HM-18-A-1.0-1.15	3/3/2005	7.2
HM-18-A-2.0-2.15	3/3/2005	7.9
HM-18-A-2.5-2.65	3/3/2005	7.7
HM-18-B-0-0.15	3/3/2005	7.2
HM-18-B-0.15-0.30	3/3/2005	7.2
HM-18-B-1.0-1.15	3/3/2005	6.8
HM-18-B-2.0-2.15	3/3/2005	7.7
HM-18-B-2.5-2.65	3/3/2005	7.7
HM-18-C-0-0.15	3/3/2005	7.3
HM-18-C-0.15-0.30	3/3/2005	7.4
HM-18-C-1.0-1.15	3/3/2005	7.4
HM-18-C-2.0-2.15	3/3/2005	8
HM-18-C-2.5-2.65	3/3/2005	8.7
HM-DRUM	3/8/2005	8.1

Table 9
Volatile Organic Compound Results in Groundwater
SR-4 Widening Project - Loveridge to Somersville Road
Hazardous Materials Investigation Report

Sample ID	Date	Trichloroethene Results (ug/L)
PRG Tap Water (ug/L)		0.028
HM-16-A-W	3/4/2005	320

Notes:

PRG: Preliminary remediation goals for tap water (EPA 2004).

Table 10
Metals Results in Groundwater
SR-4 Widening Project - Loveridge to Somersville Road
Hazardous Materials Investigation Report

Sample ID	Date	Results (ug/L)		
		Barium	Molybdenum	Selenium
PRG Tap Water (ug/L)		**260**	**180**	**180**
HM-7-B-W	3/2/2005	44	<20	<5
HM-8-C-W	3/9/2005	41	31	10

Notes:

Detected analytes are shown in bold font.

PRG: Preliminary remediation goals for tap water (EPA 2004).

Table 11
Upper Confidence Limit Concentrations for Total Lead and WET Lead in Soil
SR-4 Widening Project - Loveridge to Somersville Road
Hazardous Materials Investigation Report

Group	Analyte	Unit	No. of Samples	Detection Rate	Raw Data Summary Statistics				Shapiro-Wilk W Test			Upper Confidence Limit (UCL)			
					Mean	Std Dev	Min	Max	Normality Test p-value	Log-normality Test p-value	Distribution	Method of 90% UCL Calculation	Assessed 90% UCL	Method of 95% UCL Calculation	Assessed 95% UCL
(1) 0m - 0.15m	Total Lead	mg/kg	52	98%	92.02	251.20	0.06	1800	0.0000	0.0078	Non-parametric	92.5% Chebychev (Mean, Sd)	214.36	97.5% Chebychev (Mean, Sd)	309.57
(1) 0m - 0.15m	WET Leachate	mg/L	52	35%	3.10	7.80	0.0018	53	0.0000	0.0024	Non-parametric	92.5% Chebychev (Mean, Sd)	6.90	97.5% Chebychev (Mean, Sd)	9.85
(2) 0.15m - 0.3m	Total Lead	mg/kg	52	96%	117.87	329.74	0.07	2300	0.0000	0.0007	Non-parametric	92.5% Chebychev (Mean, Sd)	278.45	97.5% Chebychev (Mean, Sd)	403.43
(2) 0.15m - 0.3m	WET Leachate	mg/L	52	33%	4.45	9.19	0.0022	49	0.0000	0.0005	Non-parametric	92.5% Chebychev (Mean, Sd)	8.92	97.5% Chebychev (Mean, Sd)	12.40
(3) 0m - 0.3m (Avg by Location)	Total Lead	mg/kg	52	97%	104.95	211.89	0.0725	1190.5	0.0000	0.0001	Non-parametric	92.5% Chebychev (Mean, Sd)	208.14	97.5% Chebychev (Mean, Sd)	288.45
(3) 0m - 0.3m (Avg by Location)	WET Leachate	mg/L	52	34%	3.77	6.13	0.0022	29.7	0.0001	0.0001	Non-parametric	92.5% Chebychev (Mean, Sd)	6.76	97.5% Chebychev (Mean, Sd)	9.08
(4) >0.3m (Avg by Location)	Total Lead	mg/kg	51	100%	11.93	10.64	5.2	68.4	0.0000	0.0001	Non-parametric	90% Chebychev (Mean, Sd)	16.40	95% Chebychev (Mean, Sd)	18.42
(4) >0.3m (Avg by Location)	WET Leachate	mg/L	51	2%	0.34	0.26	0.1661	1.8	0.0000	0.0001	Non-parametric	Student's - t	0.39	Student's - t	0.40
(5) All Depth (Avg by Location)	Total Lead	mg/kg	52	99%	55.28	93.89	7.72	607.3	0.0000	0.0037	Non-parametric	90% Chebychev (Mean, Sd)	94.34	95% Chebychev (Mean, Sd)	112.03
(5) All Depth (Avg by Location)	WET Leachate	mg/L	52	18%	1.98	2.74	0.2475	12.9	0.0001	0.0001	Non-parametric	92.5% Chebychev (Mean, Sd)	3.32	97.5% Chebychev (Mean, Sd)	4.36

Notes:

Non-detected data are replaced with half of the detection limit to calculate summary statistics.

If duplicates exist, the average of primary and duplicate sample results is used.

Since multiple samples were collected in the same location (at different depths), for Groups (3), (4), and (5), the average of sample results from different depths is used to derive a single data point for each location for the purpose of statistical evaluation. Group (6) is for reference only and is not recommended for use to evaluate site-wide average concentrations.

Shapiro-Wilk W Test at 5% significance level.

The distributional assumption from (4) is used to select the appropriate UCL calculation method. For normal distribution, the UCL is based on the t-statistics. For lognormal distribution and non-parametric assumption, the UCL is based on the recommendations from Singh (2004), which takes into account of sample size and sample skewness.

References:

USEPA (2002). *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites.* Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Report No. OSWER 9285.6-10.
Singh, A., Singh, A. K., and Maichle, R. (2004). *ProUCL Version 3.0 User Guide.* Office of Research and Development, U.S. Environmental Protection Agency, Report No. EPA/600/R04/079.

Figures

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
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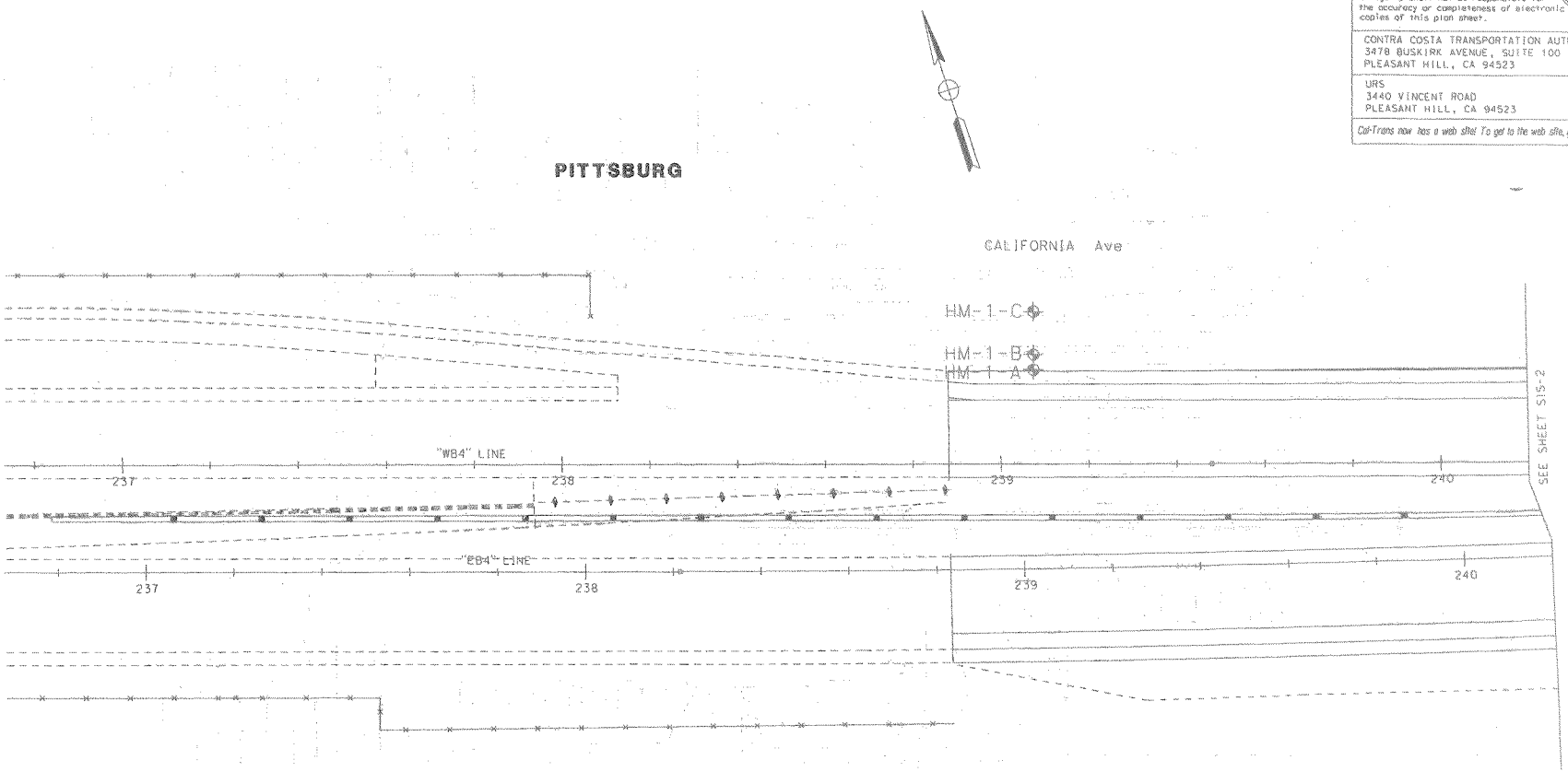

LEGEND:

- BORING LOCATION (APPROXIMATE)
- RETAINING WALL
- SOUND WALL
- COMBINED SOUND WALL/RETAINING WALL
- CONCRETE MEDIAN BARRIER
- DOUBLE THRIE BEAM BARRIER

SR-4 SOIL INVESTIGATION SAMPLING LOCATIONS

SCALE: 1:500

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

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DIANE Ave

Kirker Creek

CALIFORNIA Ave

HM-3-C
HM-3-B
HM-3-A

SEE SHEET SIS-1

"WB4" LINE

"EB4" LINE

241 242 243

HM-4-A
HM-4-B
HM-4-C

SEE SHEET SIS-3

20 21

Kirker Creek

SR-4 SOIL INVESTIGATION SAMPLING LOCATIONS

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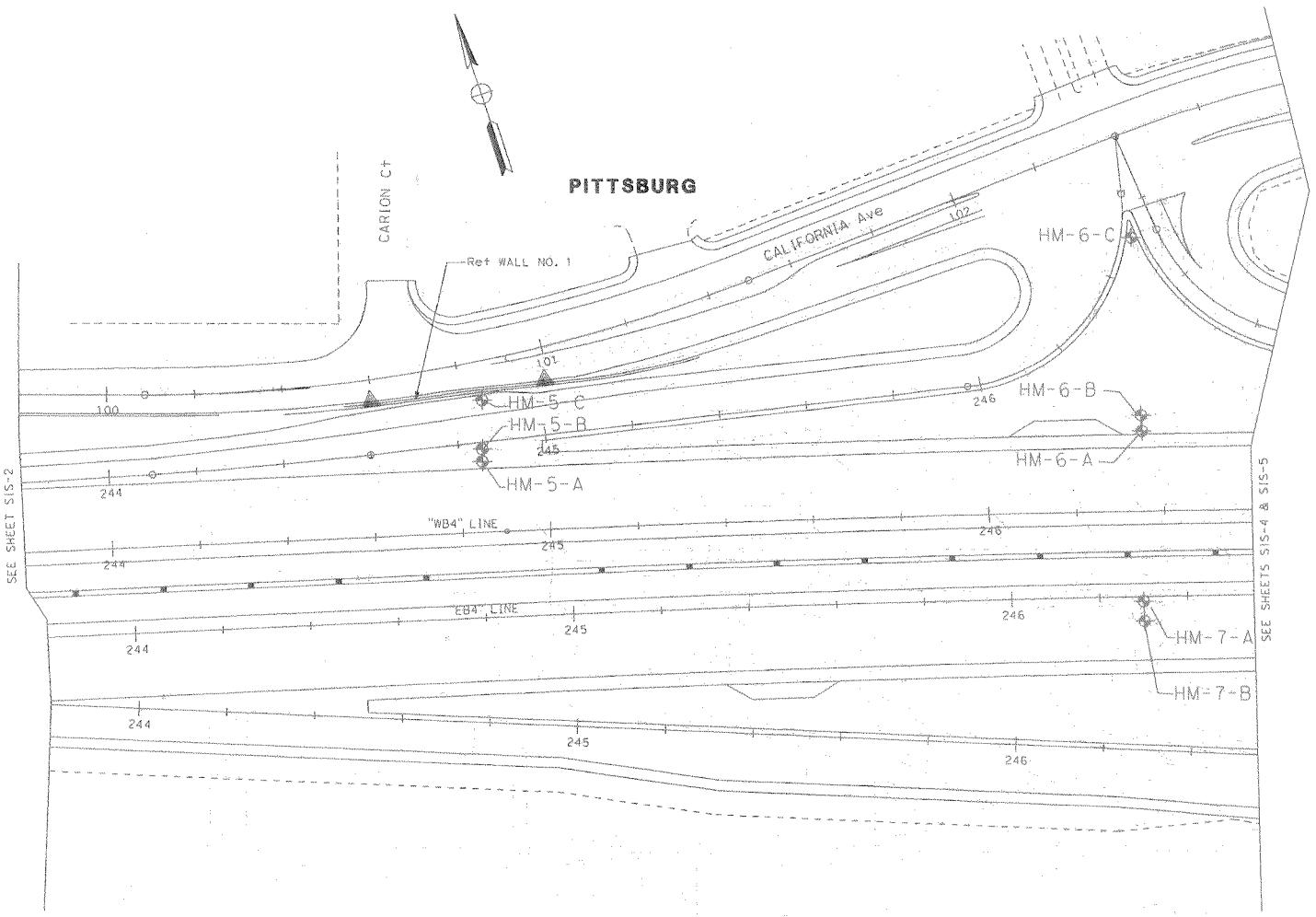

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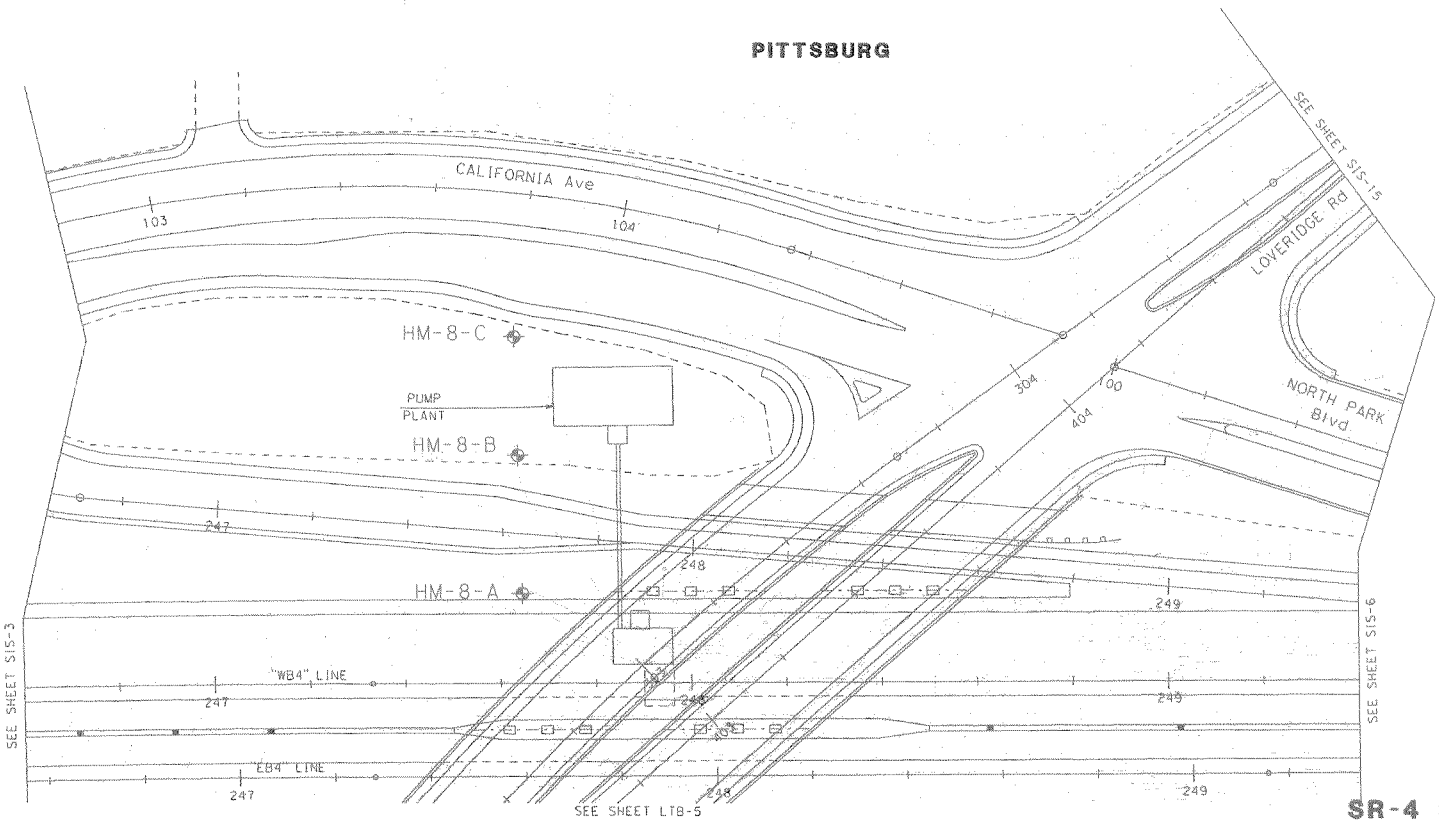

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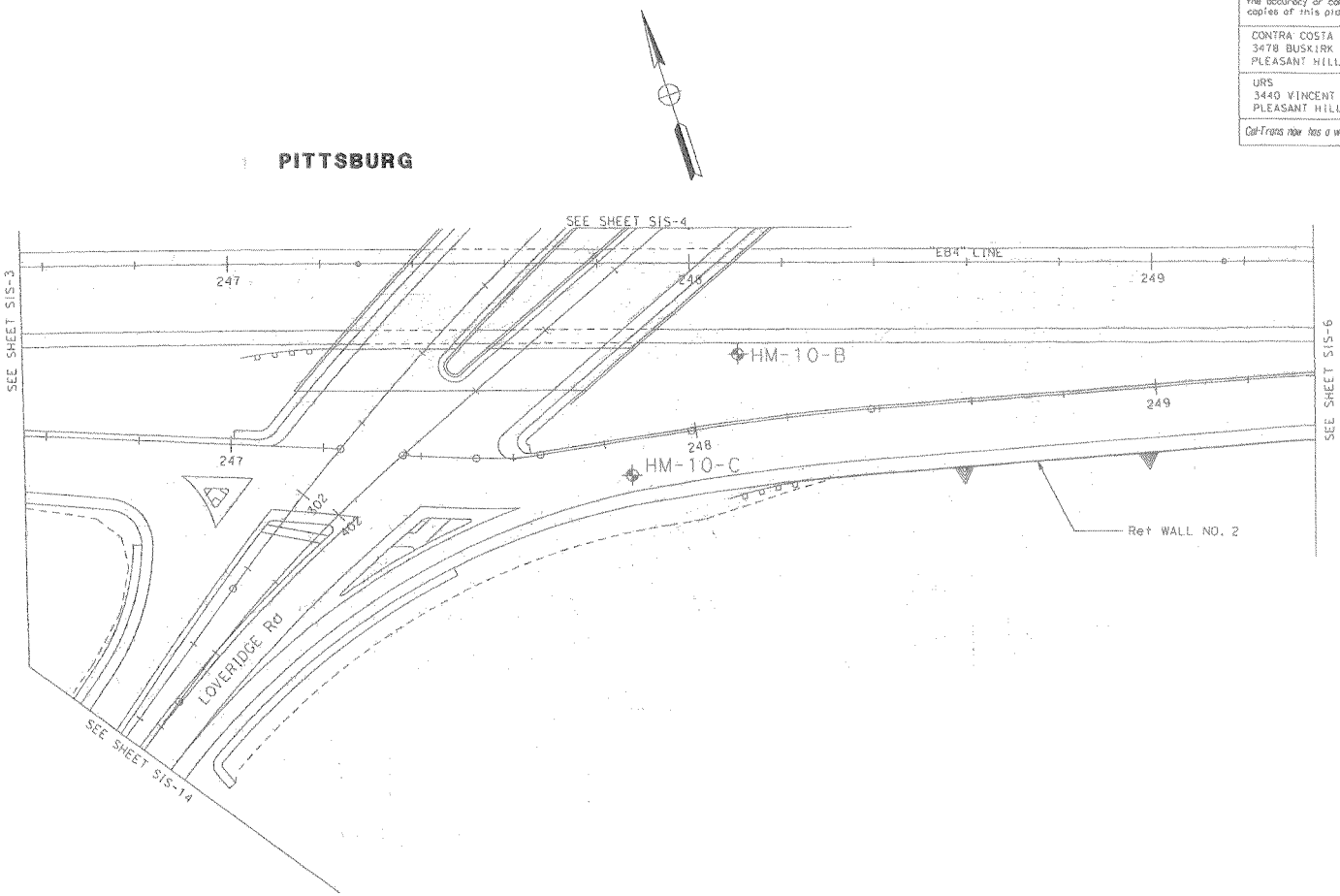

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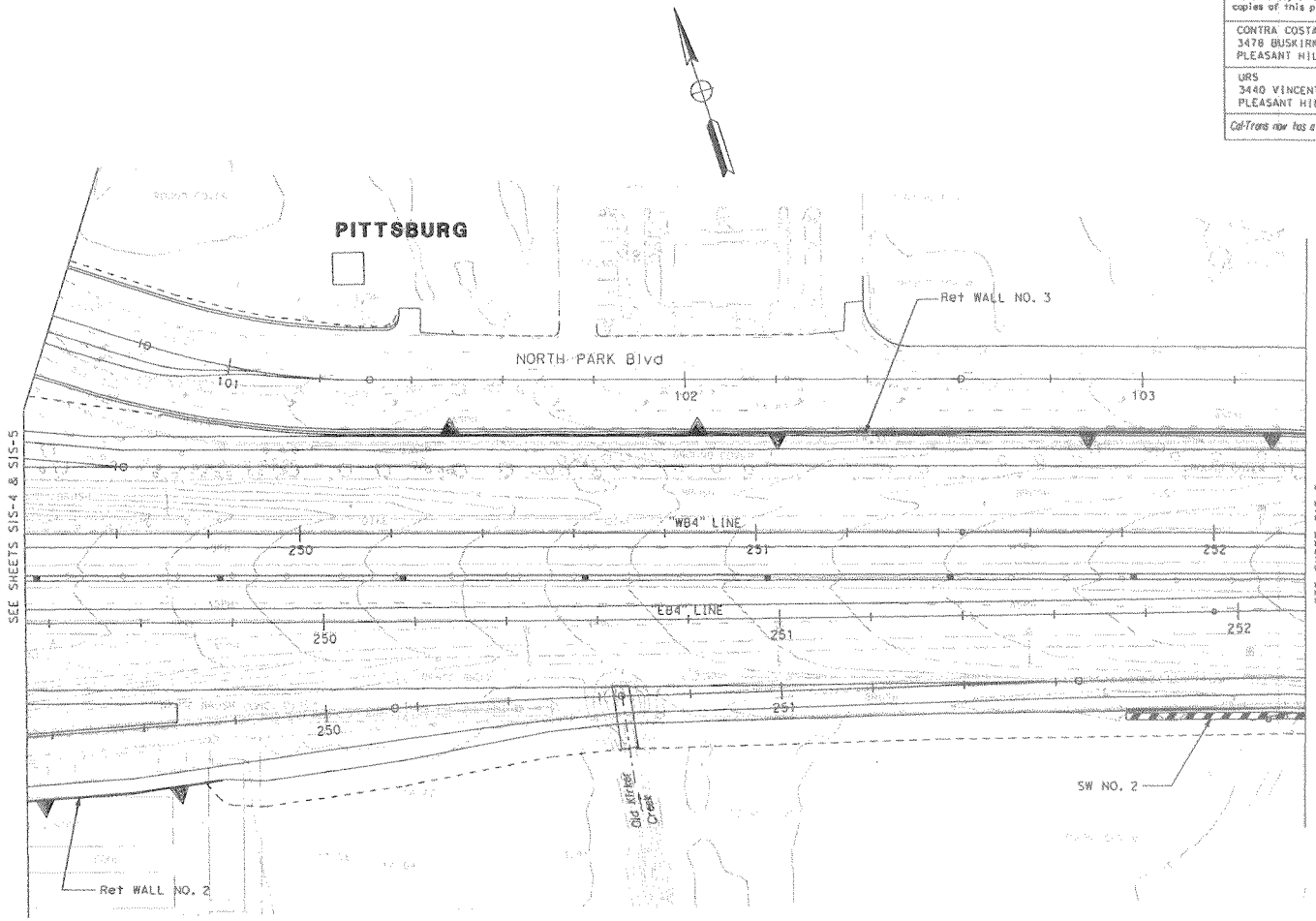

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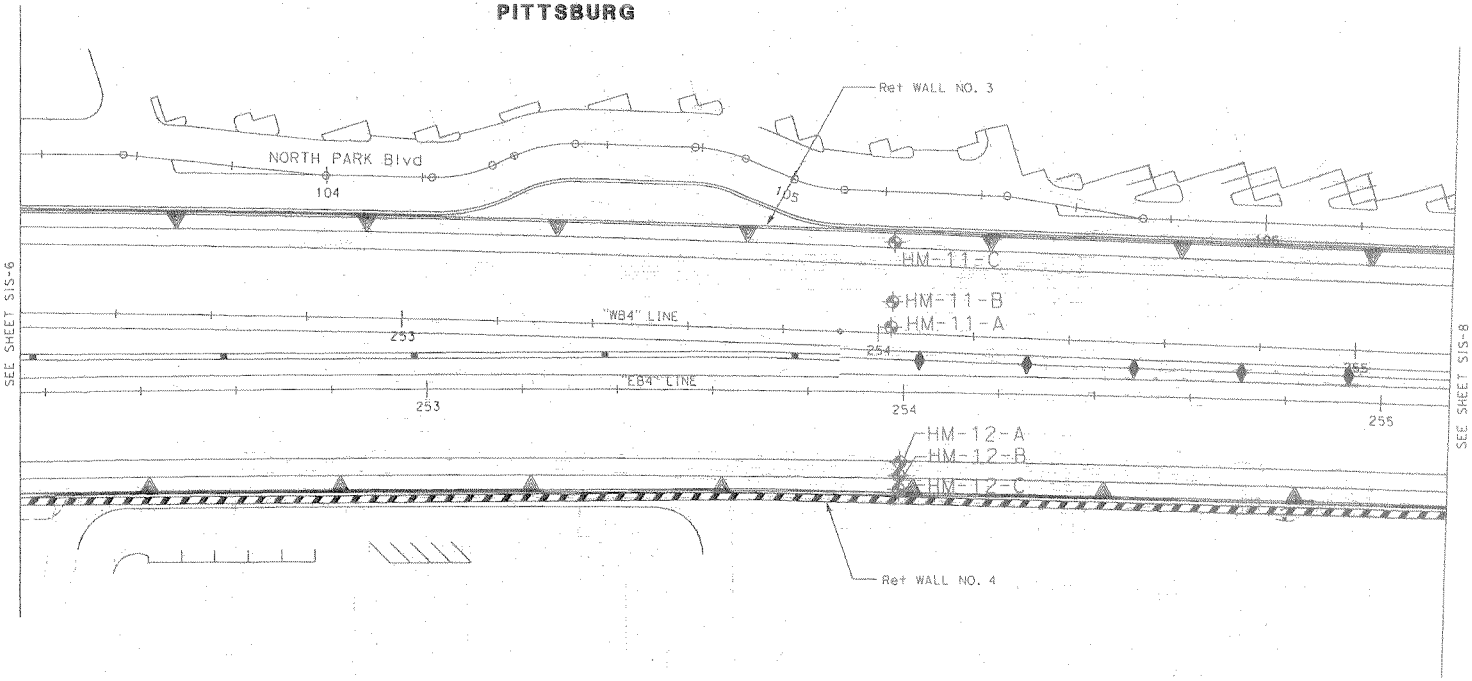

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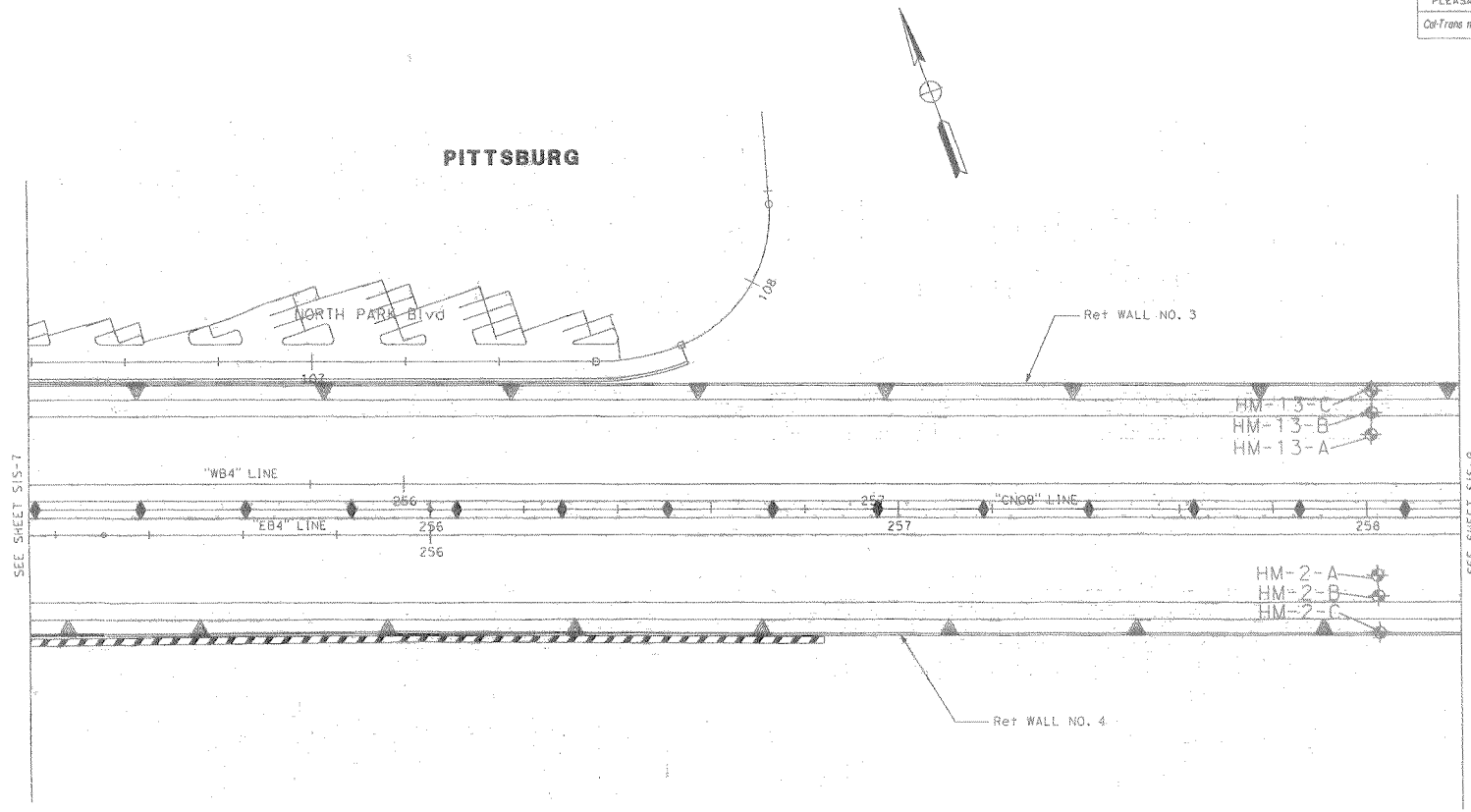

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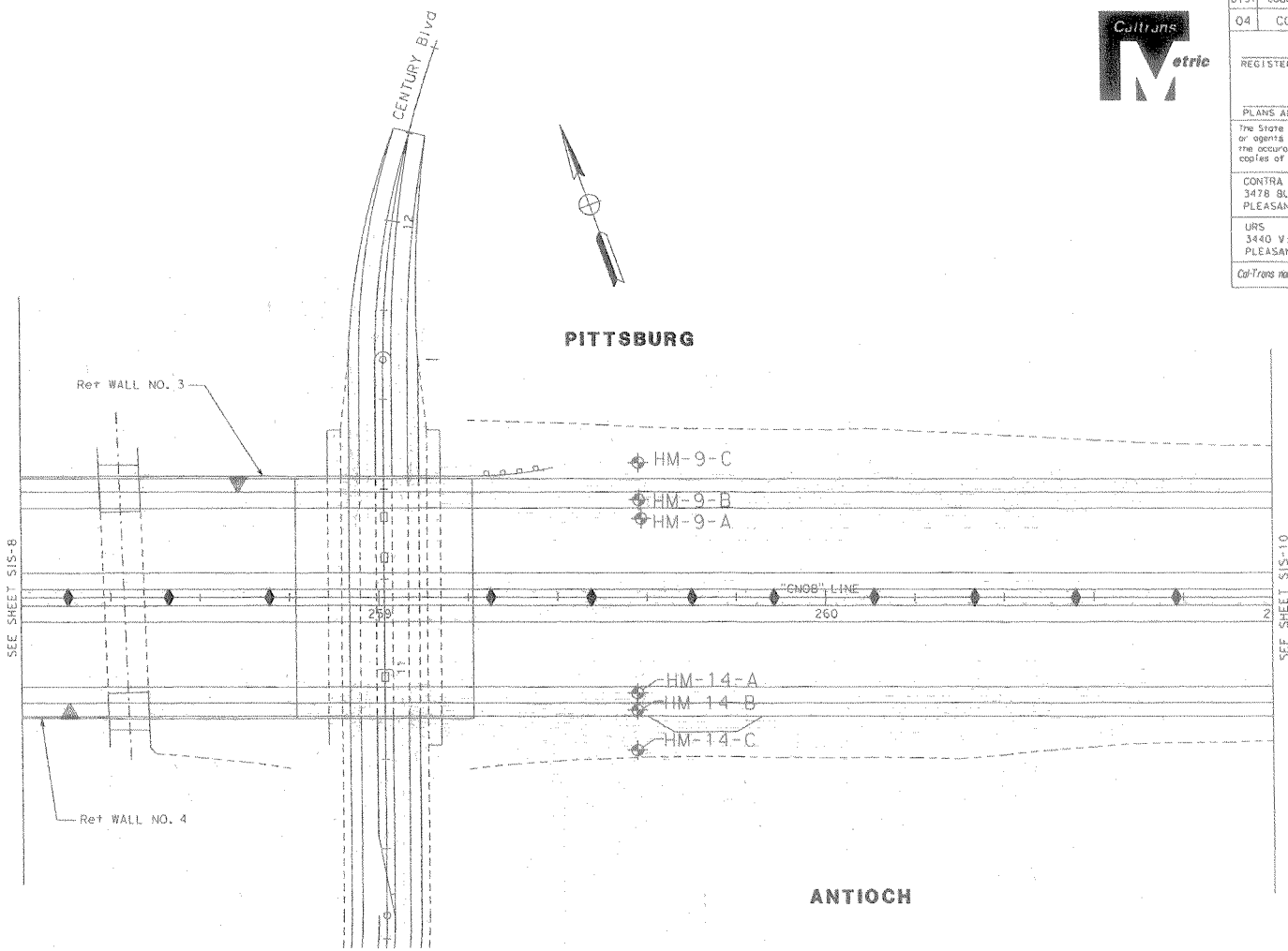

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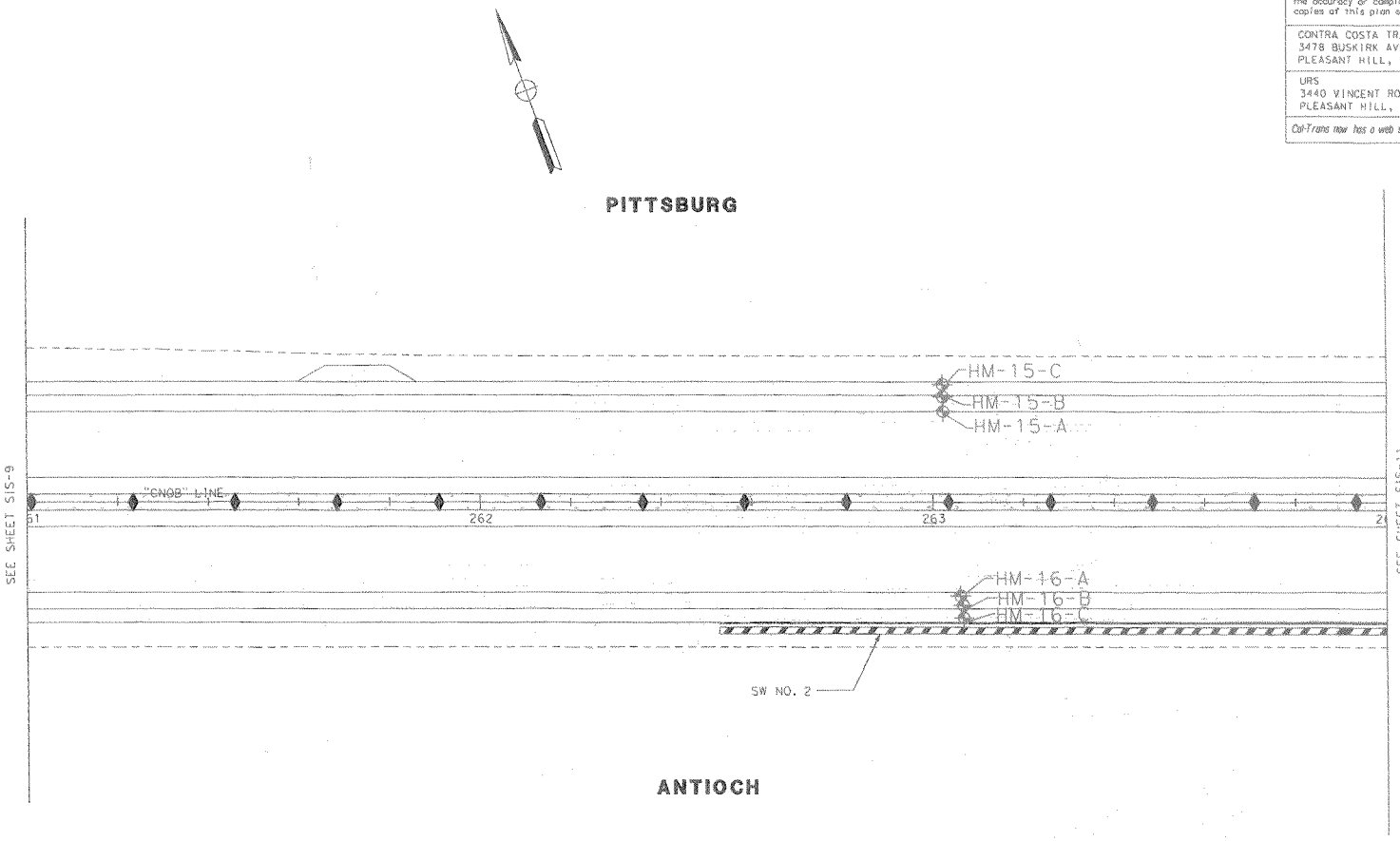


SR-4 SOIL INVESTIGATION SAMPLING LOCATIONS

SCALE: 1:500

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

SIS-10

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => VCJ
DGN FILE => $FILE$

CU 04275

EA 228500

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

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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

REGISTERED PROFESSIONAL ENGINEER — CIVIL — STATE OF CALIFORNIA

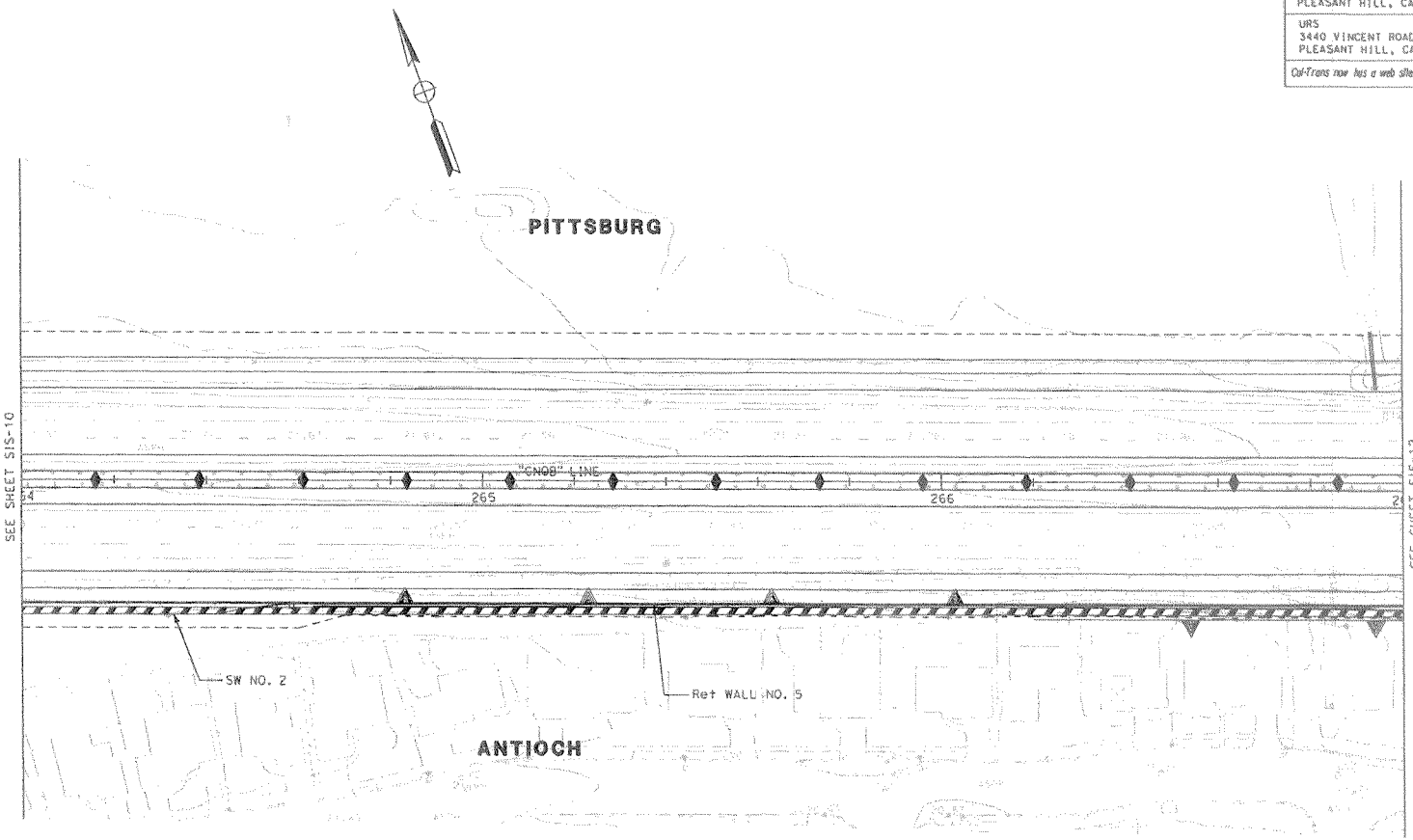
CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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

DESIGN OVERSIGHT	CALCULATED/ DESIGNED BY	DATE	REVISED BY
-	EAJ	03/05	
	CHECKED BY	DATE REVISED	
	BR	03/05	

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION



SR-4 SOIL INVESTIGATION SAMPLING LOCATIONS

SCALE: 1:500

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

SIS-11

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => VCJ
DGN FILE => $FILE$

CU 04275

EA 228500

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

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER — CIVIL — STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
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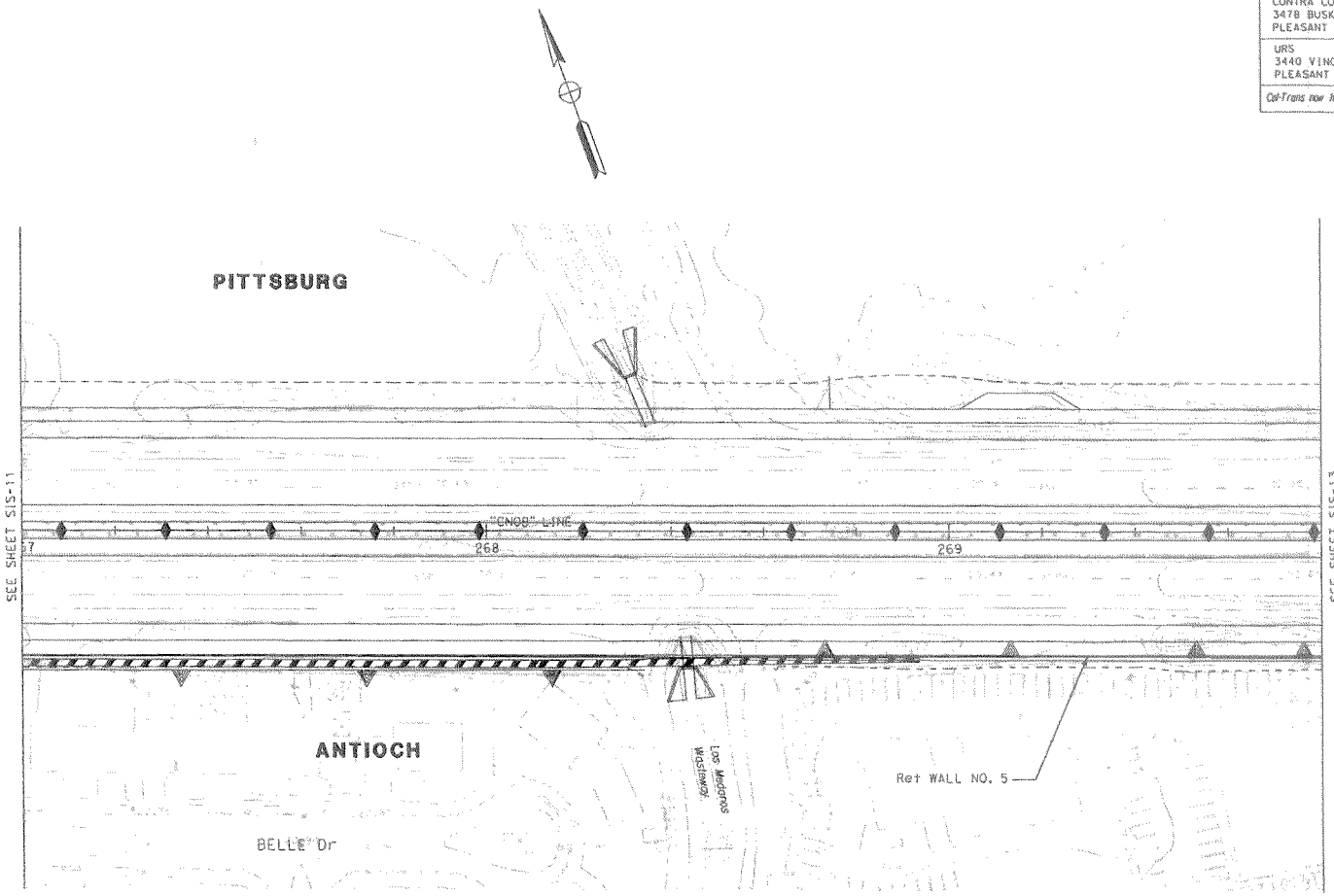
-	EAJ	03/05	BR	03/05
	CHECKED BY			

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans



SR-4 SOIL INVESTIGATION SAMPLING LOCATIONS

SCALE: 1:500

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

SIS-12

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => VCJ
DGN FILE => $FILE$

CU 04275

EA 228500

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

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER — No. — EXP. — CIVIL — STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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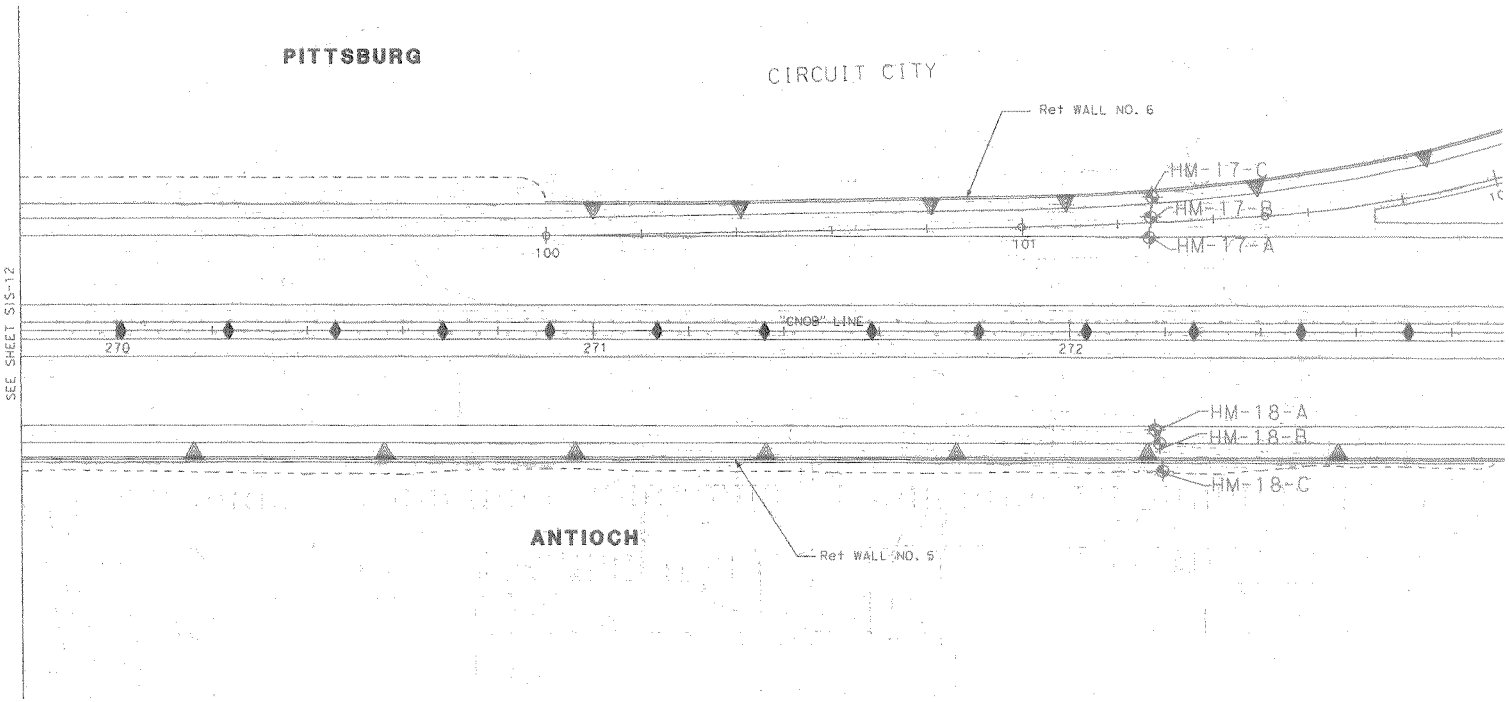
DATE	REVISED BY	DATE REVISED
EAJ	03/05	
BR	03/05	

CALCULATED/ DESIGNED BY
CHECKED BY

DESIGN OVERSIGHT
-

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans



SR-4 SOIL INVESTIGATION SAMPLING LOCATIONS

SCALE: 1:500

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

SIS-13

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => VCJ
DGN FILE => $FILE$

CU 04275

EA 228500

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

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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REGISTERED PROFESSIONAL ENGINEER — CIVIL — STATE OF CALIFORNIA

CONTRA COSTA TRANSPORTATION AUTHORITY
3478 BUSKIRK AVENUE, SUITE 100
PLEASANT HILL, CA 94523

URS
3440 VINCENT ROAD
PLEASANT HILL, CA 94523

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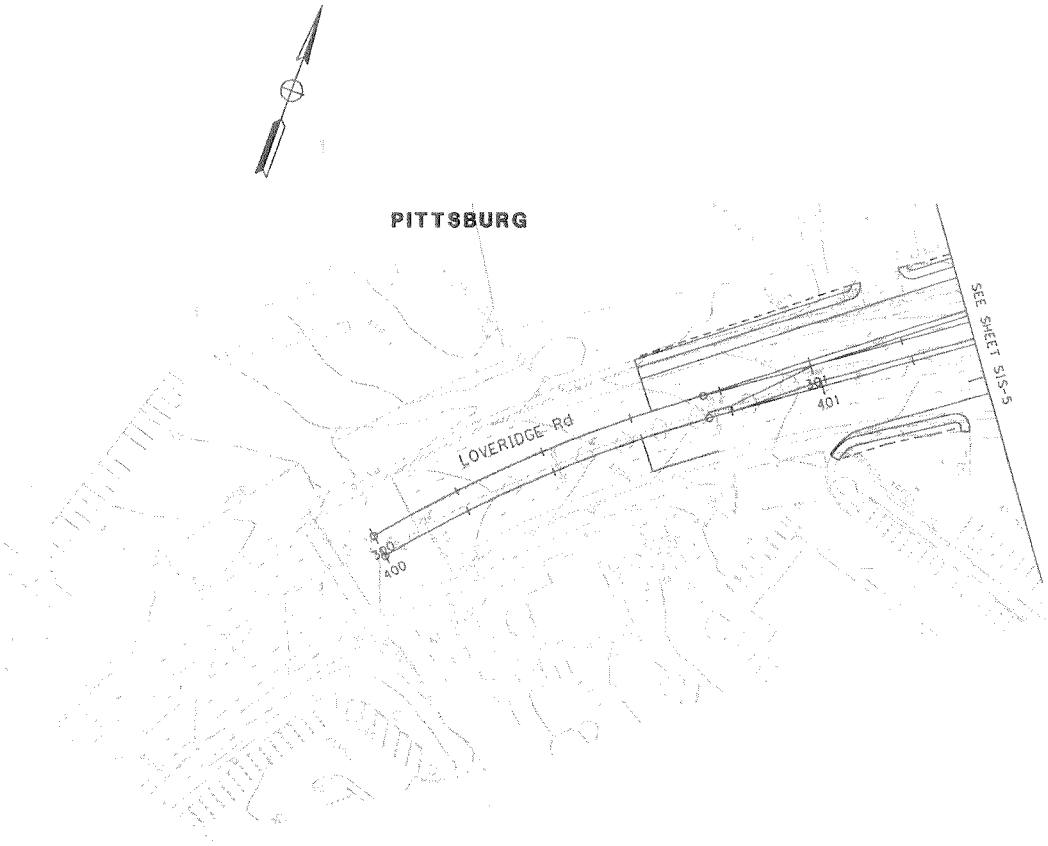
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

DESIGN OVERSIGHT	CALCULATED/ DESIGNED BY	DATE	REVISED BY
-	E.A.J	03/05	
CHECKED BY	BR	03/05	DATE REVISED



SR-4 SOIL INVESTIGATION SAMPLING LOCATIONS

SCALE: 1:500

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

SIS-14

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

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => VCJ
DGN FILE => $FILE$

CU 04275

EA 228500

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	CC	4	37.9/41.3		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — CIVIL — STATE OF CALIFORNIA

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STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

DESIGN OVERSIGHT -

	CALCULATED/ DESIGNED BY	DATE	REVISED BY
	EAJ	03/05	
	BR	03/05	DATE REVISED
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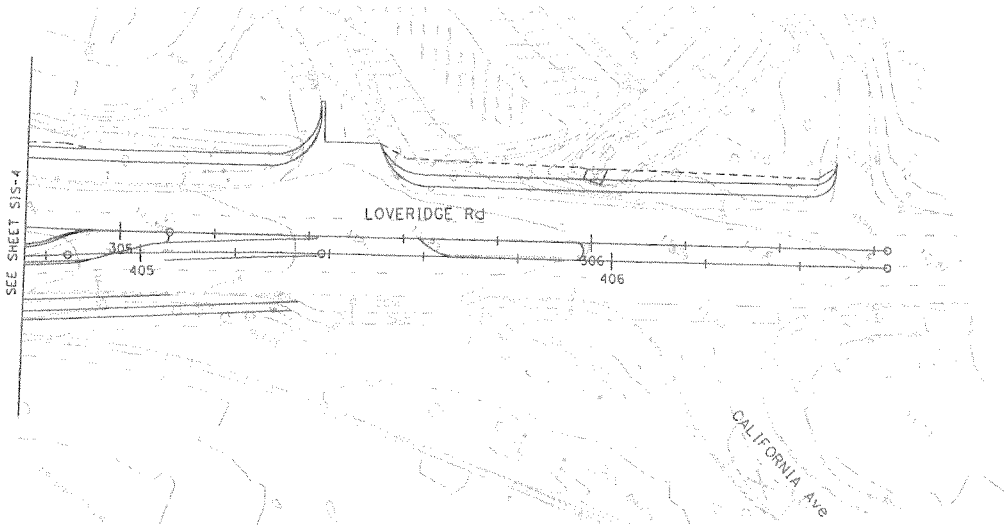
PITTSBURG



SR-4 SOIL INVESTIGATION SAMPLING LOCATIONS

SCALE: 1:500

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

SIS-15

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS 0 10 20 30 40

USERNAME => VCJ
DGN FILE => $FILE$

CU 04275

EA 228500

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

Appendix A

DTSC Caltrans Variance No. 00-H-VAR-01

California Environmental Protection Agency
Department of Toxic Substances Control

VARIANCE

Applicant Names:

Mr. Harry Yahata, District Director
State of California
Department of Transportation, District 4
(Caltrans)
111 West Grand Avenue
P.O. Box 23660
Oakland, California 94623-0660

Variance No. 00-H-VAR-01

Effective Date: September 22, 2000

Expiration Date: September 22, 2005

Modification History:

Pursuant to Section 25143 of the California Health and Safety Code, the Department of Toxic Substances Control hereby issues the attached Variance consisting of 8 pages to Department of Transportation District 04.

Frederick S. Moss
Chief, Permitting Division
Department of Toxic Substances Control

Date: 9/22/00

VARIANCE

1. INTRODUCTION.

1.1 Pursuant to Section 25143, Chapter 6.5, Division 20 of the Health and Safety Code (HSC), the California Department of Toxic Substances Control (DTSC) grants a variance to the applicant below for waste considered hazardous solely because of its contaminant concentrations and as further specified herein.

1.2 DTSC hereby grants a variance only from the requirements specified herein and only in accordance with all terms and conditions specified herein.

2. IDENTIFYING INFORMATION.

APPLICANT/OWNER/OPERATOR

Mr. Harry Yahata, District Director
State of California
Department of Transportation, District 4 (Caltrans)
111 West Grand Avenue
P.O. Box 23660
Oakland, California 94623-0660

3. TYPE OF VARIANCE.

Generation, Manifest, Transportation, Storage and Disposal

4. ISSUANCE AND EXPIRATION DATES.

DATE ISSUED: September 22, 2000 EXPIRATION DATE: September 22, 2005.

5. APPLICABLE STATUTES AND REGULATIONS. The hazardous waste that is the subject of this variance is fully regulated under HSC, Section 25100, et seq. and Title 22 of the California Code of Regulations (CCR) Division 4.5 except as specifically identified in Section 8 of this variance.

6. DEFINITION. For the purposes of this variance, waste that meets the criteria in paragraphs a) and b) of section 9 below, shall be referred to as "lead-contaminated soil(s)".

7. FINDINGS/DETERMINATIONS. DTSC has determined that the variance applicant meets the requirements set forth in HSC Section 25143 for a variance from specific regulatory requirements as outlined in Section 8 of this variance. The specific determinations and findings made by DTSC are as follows:

a) Caltrans intends to excavate, stockpile, transport, bury and cover large volumes of soil associated with highway construction projects throughout the State. In the

more urbanized highway corridors this soil is contaminated with lead, primarily due to historic emissions from automobile exhausts. In situ testing has shown the uppermost two feet of soil have been found to contain concentrations of lead in excess of regulatory thresholds. However, DTSC has prepared a risk assessment that shows that soil contaminated with low concentrations of lead can be managed in a way that presents no significant risk to human health and the environment.

b) The lead-contaminated soil will be placed only in Caltrans rights of way. Based on concentration levels, the wastes will be covered with a minimum thickness of one (1) foot of non-hazardous soil or asphalt cover and will always be five (5) feet above the highest groundwater elevation. Caltrans will assure that proper health and safety procedures will be followed for workers. This includes any persons engaged in maintenance work in areas where the waste has been buried and covered.

c) DTSC finds and requires that the lead contaminated soil excavated, stockpiled, transported, buried and covered is a non-RCRA hazardous waste, and that the hazardous waste management activity is insignificant as a potential hazard to human health and safety and the environment, when managed in accordance with the conditions, limitations and other requirements specified in this variance.

8. PROVISIONS SUBJECT TO VARIANCE.

DTSC, subject to all terms and conditions herein, waives the hazardous waste management requirements of Title 22,CCR, sections 66264.250 through 66264.259, 22 CCR 66268.1 through 66268.9, 22 CCR 66262.10, 22 CCR 66262.12, 22 CCR 66262.20, 22 CCR 66262.30 through 66262.34, 22 CCR 66262.40 through 66262.42, 22 CCR 66263.10 through 66263.18 and 22 CCR 66263.20 through 66263.23 for the generation, transportation, manifesting, storage and land disposal of hazardous waste. These management requirements are only waived provided all other requirements of this variance are complied with at Caltrans construction projects in the Caltrans District specified in section 2 above.

9. SPECIFICATIONS OF THE CONDITIONS, LIMITATIONS, OR OTHER REQUIREMENTS. The owner/operator shall be subject to the following conditions:

a) Caltrans shall manage all soil contaminated with lead at concentrations such that it is considered a hazardous waste pursuant to HSC 25117 and 22 CCR, Div 4.5, Chapter 11, unless the contaminant concentrations and management practices meet the following conditions:

1. Soil containing 500 ug/l extractible lead or less (based on a modified waste extraction test using deionized water as the extractant) and 350 ppm or less total lead may be used as fill provided that the lead-contaminated soil is placed a minimum of five (5) feet above the maximum water table elevation and covered with at least one (1) foot of nonhazardous soil. The limit on total lead within shall be the following: Total parts per million (ppm) lead shall be at or below the statutory limits in effect when the soil is used as fill or the risk based limit of 1496mg/kg, whichever is less. On the effective date of this variance, HSC section 25157.8 limits total lead

concentrations to 350 ppm. That section may be amended and/or expire in the future. Additionally, other parts of relevant statutes may be added or amended in the future to include lead limits applicable to this variance.

2. Soil containing more than 500 ug/l and less than 50 mg/l extractible lead (based on a modified waste extraction test using deionized water as the extractant) and 350 or less ppm total lead may be used as fill provided that the lead-contaminated soils are placed a minimum of five (5) feet above the maximum water table elevation and protected from infiltration by a pavement structure which will be maintained by Caltrans. Caltrans shall comply with the lead limits discussed in paragraph a) 1 above.

3. Contaminated soil with a pH < 5.0 shall be used as fill material only under the paved portion of the roadway.

b) Caltrans will implement appropriate health and safety procedures to protect its employees and the public, and to prevent or minimize exposure to potentially hazardous substances. A project-specific health and safety plan must be prepared and implemented. The monitoring and exposure standards shall be based on Construction Standards in Title 22, CCR section 1532.1.

c) All lead-contaminated soil that cannot be buried and covered within the same Caltrans corridor from where it originated shall be managed as a hazardous waste.

d) Lead-contaminated soil will not be moved outside the designated corridor boundaries (see paragraph q) below).

e) Lead-contaminated soil shall not be buried in areas where it will be in contact with groundwater or surface water.

f) Lead-contaminated soil shall be buried and covered only in locations that are protected from erosion resulting from storm water run-on and run-off.

g) The lead-contaminated soil shall be buried and covered in a manner that will prevent accidental or deliberate breach of the asphalt, concrete, and/or cover soil.

h) The presence of lead-contaminated soil will be incorporated into the projects' as-built drawings. The as-built drawings shall be annotated with the location, representative analytical data, and volume of lead-contaminated soil. The as-built drawings shall also state the depth of the cover. These as-built drawings shall be retained by Caltrans until its rights-of-way or property ownership are relinquished.

I) Caltrans shall ensure that no other hazardous wastes, other than the lead-contaminated soil, are placed in the burial areas.

j) Lead-contaminated soil shall not be buried within ten (10) feet of culverts or locations subject to frequent worker exposure.

k) Excavated lead-contaminated soil not placed into the designated area (fill area, roadbed area) by the end of the working day shall be stockpiled and covered with sheets of polyethylene or at least one foot of non-hazardous soil. The lead contaminated soil, while stockpiled or under transport, shall be protected from contacting surface water and being dislodged or transported by wind or storm water. The stockpile covers shall be inspected at least once a week and within 24 hours after rainstorms.

l) Caltrans shall ensure that all stockpiling of lead contaminated soil remains within the specified corridor. Stockpiling of lead-contaminated soil outside the area of contamination is in direct violation of land disposal restrictions and is prohibited.

m) Caltrans shall conduct confirmatory sampling, if appropriate, of any stockpile area after removal of the lead- contaminated soil to ensure that contamination has not been left behind or has not migrated from the stockpiled material to the surrounding soils. Caltrans shall ensure that test results are kept with Caltrans project records located at the District office or a subsequent permanent location and are available to DTSC upon request.

n) Caltrans shall stockpile lead-contaminated soil only on high ground (i.e. no sump areas or low points) which will not be affected by surface water run-on or run-off.

o) Caltrans shall not stockpile soil in an environmentally sensitive area.

p) Caltrans shall ensure that run-off which has come into contact with stockpiled lead-contaminated soil will not flow to storm drains, inlets, or waters of the state.

q) Caltrans may move lead-contaminated soil from one Caltrans project to another Caltrans project so long as the lead-contaminated soil remains within the same designated Caltrans corridor. Caltrans shall record this movement of lead- contaminated soil by using a bill of lading. The bill of lading must contain: 1) US DOT description including shipping name, hazard class and ID number; 2) handling codes; 3) quantity of material; 4) volume of material; and 5) any specific handling instructions. The bill of lading shall be referenced in and kept on file with the project's as-built drawings. Lead-contaminated soil must be kept covered during transportation.

r) For each specific corridor where this variance is to be implemented, all of the following information will be submitted in writing to DTSC at least five (5) days before construction of any project begins:

1. a plan drawing designating the boundaries of the corridor where lead-contaminated soils will be excavated, stockpiled, buried and covered;

2. a list of the Caltrans projects that the corridor encompasses;

3. a list of Caltrans contractors that will be conducting any phase of work on any project affected by this variance;

4. duration of corridor construction;

5. location where sampling and analytical data used to make lead concentration level determinations are kept (e.g. a particular Caltrans project file);

6. name and phone number (please include area code) of project resident engineer and project manager;

7. location where Caltrans and contractor health and safety records are kept;

8. location of project special provisions (including page or section number) for soil excavation, transportation, stockpile, burial and placement of cover material;

9. location of project drawings (including drawing page number) for soil excavation, burial and placement of cover in plan and cross section (For example, "The project plans are located at the resident engineer's office located at 5th and Main Streets, City of Fresno,. See pages xxxxx of contract xxxx");

10. If a Caltrans project within the corridor is added, changed or deleted, Caltrans must update the information provided to DTSC five (5) days before construction begins; and

11. The type of environmental document for each project, date of adoption, document title, Clearing House number and where the document is available for review. A copy of the Notice of Exemption for any project shall be submitted to the DTSC Headquarters Project Manager within five (5) days of signing.

s) Changes in location of lead-contaminated soil placement, quantities or protection measures (field changes) will be noted in the resident engineer's project log within five (5) days of the field change.

t) Caltrans shall ensure that field changes are in compliance with the requirements of this variance.

u) If areas subject to the terms of this variance are sold, relinquished or abandoned (including roadways), all future property owners shall be notified in writing in advance by Caltrans of the requirements of this variance, and Caltrans shall provide the owner with a copy of the variance. A copy of such a notice shall be sent to and contain the corridor location and project. Caltrans shall also disclose to the new owner the location of areas where lead contaminated soil has been buried. Future property owners will be subject to the same requirements as Caltrans retains the right to modify or revoke this variance pursuant to HSC 25143 upon a change of ownership or at any other time.

v) For the purposes of informing the public about instances where the variance is implemented, Caltrans shall:

1. Maintain current fact sheets at all Caltrans resident engineer offices and the Caltrans District office. Caltrans shall make the fact sheets available to anyone expressing an interest in variance-related work.

2. Maintain a binder(s) containing copies of all reports submitted to DTSC at the District office. Caltrans shall ensure that the binders are readily accessible to the public.

3. Carry out the following actions when it identifies additional projects:

(A) Notify the public via a display advertisement in a newspaper of general circulation in that area.

(B) Update and distribute the fact sheet to the mailing list and repository locations.

w) Caltrans implementation of this variance shall comply with all applicable state policies for water quality control, water quality control plans, waste discharge requirements (including storm water permits), and others issued by the State Water Resources Control Board or a California Regional Water Quality Control Board.

x) This variance is applicable only to soil considered hazardous because of aerially-deposited lead contamination. The variance is not applicable to any other hazardous waste.

y) Lead-contaminated soil may be buried only in areas where access is limited or where lead-contaminated soil is covered and contained by a pavement structure.

1) Dust containing lead-contaminated soil must be controlled. Water or dust palliative may be applied to control dust. If visible dust migration occurs, all excavation, stockpiling and truck loading and burying must be stopped. The granting of this variance confers no relief on Caltrans from compliance with the laws, regulations and requirements enforced by any local air district or the California Air Resources Board.

2) Sampling and analysis is required to show the lead contaminated soil meets the variance criteria specified in a). All sampling and analysis must be done according to U.S. EPA subsection SW-846.

z) All correspondence shall be directed to the following office:

Frederick S. Moss, Chief
Permitting Division
Department of Toxic Substances Control
400 P Street, 4th Floor
P.O. Box 806
Sacramento, CA 95812-0806

Attn: Caltrans Lead Variance Notification Unit

10. DISCLAIMER.

10.1 The issuance of this variance does not relieve Caltrans of the responsibility for compliance with Division 20, Chapter 6.5, HSC, or the regulations adopted thereunder, and any other laws and regulations other than those specifically identified in Section 8 of this variance. Caltrans is subject to all terms and conditions herein. The granting of this variance confers no relief from compliance with any federal, state or local requirements other than those specifically provided herein.

10.2 The issuance of this variance does not release Caltrans from any liability associated with the handling of hazardous waste, except as specifically provided herein and subject to all terms and conditions of this variance.

11. VARIANCE MODIFICATION OR REVOCATION. This variance is subject to review at the discretion of DTSC and may be modified or revoked at any time pursuant to Health and Safety Code section 25143.

12. CEQA DETERMINATION. DTSC adopted a Negative Declaration on September 22, 2000.

Approved:

9/22/00
Date

Frederick S. Moss, Chief
Permitting Division
Hazardous Waste Management Program
Department of Toxic Substances Control

Appendix B

Encroachment and Boring Permits

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

ENCROACHMENT PERMIT

TR-0120

Permit No.	
0404-NSV 2302	
Dist/Co/Rte/PM	
04-CC-4, 24.2/26.8	
Date	
December 21, 2004	
Fee Paid	Deposit
$	$
Performance Bond Amount (1)	Payment Bond Amount (2)
Bond Company	
Bond Number (1)	Bond Number (2)

In compliance with (*Check one*):

☒ Your application of December 14, 2004

☐ Utility Notice No. _____ of _____

☐ Agreement No. _____ of _____

☐ R/W Contract No. _____ of _____

TO: Contra Costa Transportation Authority
3478 Buskirk Avenue, Suite 100
Pleasant Hill, CA. 94523

Attn: Mr. Paul F. Maxwell
Phone: (925) 407-0121

, PERMITTEE

And subject to the following, **PERMISSION IS HEREBY GRANTED** to:

Conduct environmental and traffic studies; perform field survey and soil investigation for Project No. EA. 04-228510, Cooperative Agreement No.4-1376-C and EA. 04-228500, C.A. No. 4-2004, on State Highways 04-CC-4, Post Miles 24.2/26.8, in the County of Contra Costa.

A minimum of one week prior to start work under this work, notice shall be given to, and approval of construction details, operations, public safety, and traffic control shall be obtained from State Representative Hamid Karami, 1910 Olympic Boulevard, Walnut Creek, CA 94596, 925-926-6120, weekdays, between 7:30 AM and 4:00 PM.

All permitted work requires the permittee to apply for and obtain a work authorization number prior to start of work. See the attached " Encroachment Permit Project Work Scheduling Procedures" and the attached "Permit Project Work Scheduling Request Form". Additional time beyond the minimum seven days advanced notice required in the above paragraph may be required for obtaining the traffic control approval.

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

☒ Yes	☐ No	General Provisions
☐ Yes	☒ No	Utility Maintenance Provisions
☒ Yes	☐ No	Storm Water Special Provisions
☐ Yes	☒ No	A Cal-OSHA permit required prior to beginning work: #

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

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

(If any Caltrans effort expended)

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

This permit is void unless the work is completed before December 31, 2006.

This permit is to be strictly construed and no other work other than specifically mentioned is hereby authorized.
No project work shall be commenced until all other necessary permits and environmental clearances have been obtained.

PD
CC: R. Songey(2), H. Karami,
District Traffic Manager- B. Loo
Traffic Management Center-J. Richardson
Design- R. Pang
Program Management- M. Zebani

APPROVED:

BIJAN SARTIPI, District Director

BY:

S. S. NOZZARI, District Permit Engineer

NAME: Contra Costa Transportation Authority
PERMIT NO. 0404-NSV 2302
DATE: December 21, 2004

Suitable barricades, signs and lights, as approved by State's representative, to warn and protect traffic effectively shall enclose the site of the work.

Traffic control is restricted to closure of shoulder, authorized only between 9:00 AM and 3:00 PM, Monday through Friday holidays excluded.

When approved, traffic control performed under this permit shall be in accordance with the appropriate State Standard Plans T-10 through T-14. Where required by the plan, the use of a flashing arrow-board is MANDATORY.(See standard plan T-10)

Standard Plan Sheet T-10 is for shoulder closure only.

Unless specifically authorized by this permit, survey markings within the right of way shall be made with water-soluble paint or equivalent and removed upon completion of survey.

All survey operations shall be conducted off the traveled way except where necessary to cross-pavements and medians.

When survey operations are being conducted, the permittee shall furnish, place and maintain signs and safety equipment in accordance with the latest edition of the "Manual of Traffic Controls for Construction and Maintenance Work Zones".

All boring operations shall be conducted off the traveled way.

When operations are being conducted, the permittee shall furnish, place and maintain signs and safety equipment in accordance with the latest edition of the "Manual of Traffic Controls for Construction and Maintenance Work Zones".

Boring holes shall be backfilled as directed by the State Representative.

The permittee shall be responsible for any contaminated material and/ or groundwater, which is excavated. The permittee shall also comply with the rules and regulations, which may apply for the containment, disposal and/ or clean up of any contaminated material and/ or groundwater, which is excavated

All survey vehicles shall be parked outside the shoulder while work is in progress.

Notwithstanding General Provision No. 4, your contractor is required to apply for and obtain an None encroachment permit prior to starting work. .

Any collected data requested by Caltrans shall be furnished without any charge.

Changes to Permit Provisions are not allowed without prior approval from the State Representative.

Any damage to existing State facilities shall be repaired or replaced in kind by the permittee at permittee's expense.

NAME: Contra Costa Transportation Authority
PERMIT NO. 0404-NSV 2302
DATE: December 21, 2004

All Permittee's personnel shall wear appropriate personal protective equipment, including hard hats and bright-colored vests, shirts or jackets with retro-reflective material while on State highway right of way.

If an accident or other incident (related to or not related to the permitted activity) occurs within, or close to the permitted activity, the permittee shall immediately stop work and remove traffic controls from the highway unless public health, welfare and safety is endangered by unfinished work. Only traffic control to protect open excavations may remain in place. After free traffic flow is restored, work in accordance with the conditions of the permit may be returned.

Immediately following completion of the work permitted herein, the permittee shall fill out and mails the Notice of completion attached to this permit.

STATE OF CALIFORNIA, DEPARTMENT OF TRANSPORTATION
ENCROACHMENT PERMIT GENERAL PROVISIONS
TR-0045 (REV. 8/98)

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

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

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

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

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

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

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

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

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

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

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

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

13. **PEDESTRIAN AND BICYCLIST SAFETY:** A safe minimum passageway of 1.21 meter (4') shall be maintained through the work area at existing pedestrian or bicycle facilities. At no time shall pedestrians be diverted onto a portion of the street used for vehicular traffic. At locations where safe alternate passageways cannot be provided, appropriate signs and barricades shall be installed at the limits of construction and in advance of the limits of construction at the nearest crosswalk or intersection to detour pedestrians to facilities across the street.

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

15. **MINIMUM INTERFERENCE WITH TRAFFIC:** Permittee shall plan and conduct work so as to create the least possible inconvenience to the traveling public; traffic shall not be unreasonably delayed. On conventional highways, permittee shall place properly attired flagger(s) to stop or warn the traveling public in compliance with the Manual of Traffic Controls and Instructions to Flaggers Pamphlet.

16. **STORAGE OF EQUIPMENT AND MATERIALS:** Equipment and material storage in State right of way shall comply with Standard Specifications, Standard Plans, and Special Provisions. Whenever the permittee places an obstacle within 3.63 m (12') feet of the traveled way, the permittee shall place temporary railing (Type K).

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

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

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

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

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

22 **AS-BUILT PLANS:** When required, permittee shall submit one (1) set of as-built plans in compliance with Department's requirements. Plans shall be submitted within thirty (30) days after completion and approval of work.

As-Built plans or accompanying correspondence shall not include disclaimer statements of any kind. Such statements shall constitute non-compliance with these provisions. Failure to provide complete and signed As-Built plans shall be cause for bond or deposit retention by the Department.

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

24. **BONDING:** The permittee shall file bond(s), in advance, in the amount set by the Department. Failure to maintain bond(s) in full force and effect will result in the Department stopping of all work and revoking permit(s). Bonds are not required of public corporations or privately owned utilities, unless permittee failed to comply with the provision and conditions under a prior permit. The surety company is responsible for any latent defects as provided in California Code of Civil Procedures, Section 337.15. Local agency permittee shall comply with requirements established as follows: In recognition that project construction work done on State property will not be directly funded and paid by State, for the purpose of protecting stop notice claimants and the interests of State relative to successful project completion, the local agency permittee agrees to require the construction contractor furnish both a payment and performance bond in the local agency's name with both bonds complying with the requirements set forth in Section 3-1.02 of State's current Standard Specifications before performing any project construction work. The local agency permittee shall defend, indemnify, and hold harmless the State, its officers and employees from all project construction related claims by contractors and all stop notice or mechanic's lien claimants. The local agency also agrees to remedy, in a timely manner and to State's satisfaction, any latent defects occurring as a result of the project construction work.

25. **FUTURE MOVING OF INSTALLATIONS:** Permittee understands and agrees to rearrange a permitted installation upon request by the Department, for State construction, reconstruction, or maintenance

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

STORM WATER SPECIAL PROVISIONS for PROJECTS HAVING MINIMAL or NO IMPACT ON STORM WATER QUALITY

TR-XXXX (Rev. 11/12/2003)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ENCROACHMENT PERMIT PROJECTS WORK SCHEDULING PROCEDURES

1. The intent of these procedures is to help ensure public convenience by identifying planned closures on the State highway system, resolving potential conflicts, and disseminating all available real-time information to the California motorists via the internet, media, etc.
2. All permitted work (with or without traffic control) is subject to advance scheduling and approvals on a weekly basis.
3. Requests shall be submitted one week in advance for the weekly cycle. The one week in advance period is defined as the upcoming week that starts on Monday at Noon and ends Sunday at Midnight. Any closure that begins on upcoming Sunday and ends on the same day or on Monday must be requested on the prior week's submittal cycle.
4. Any requested traffic control shall be in conformance to that specified in the permit provisions or otherwise coordinated with the designated State representative in advance.
5. Requests for scheduling and approval of field work shall be submitted on attached form via facsimile at 510-286-3960, via E-mail to: Permit_Duty_Engineer@DOT.CA.GOV, or through the designated State representative.
6. Requests submitted with incomplete, illegible, orinaccurate information will be returned for correction. Assistance for completing the request form may be obtained from the designated State representative or via telephone at 510-286-4406.
7. All requests must include a contingency plan for restoring public traffic (i.e., reopening of a closed lane, ramp and/or shoulder) in the event of an equipment breakdown, shortage of or lack of production materials or any other failure which would otherwise delay restoring public convenience within the time limits specified in the permit. The contingency plan shall include availability of any proposed standby equipment and stockpiled materials that can be utilized for the immediate opening of closures, when ordered by the State representative. Acceptance of the contingency plan by the Engineer shall not relieve theContractor from the requirement ofopening thelane, ramp and shoulder closure to public traffic as specified in thelane closure hours section of the permit provisions.
8. Completed request forms shall be submitted on or before 12:00 Noon on Monday preceding the week during which work is to be scheduled.
9. The Permittee will be notified of approval or denial of the submitted request no later than 1:00 p.m. on Thursday of the week preceding the requested work schedule. When deemed necessary to ensure public convenience, Caltrans may deny or re-schedule the request.
10. Notification of approval shall be accompanied by a work authorization number, which must be provided to Caltrans at the time the scheduled work is performed.
11. Before, during, and after undertaking the approved traffic control, Permittee shall communicate with Caltrans/District Communication Center via telephone at 510-286-6359 as follows:
    a. If for any reason the scheduled work is cancelled or delayed, Permittee shall contact Caltrans and relay: "Work number _____ is 10-22" and shall provide any requested information regarding the cancellation (e.g. inclement weather, breakdown of equipment, lack of personnel, rescheduling, unforeseen problems, etc.).
    b. Prior to start of the approved work, Permittee shall contact Caltrans and relay: "Work number _____ is 10-97."
    c. During the work, any unexpected occurrences including delayed openings, accidents, etc. shall be communicated to Caltrans.
    d. Upon completion of the approved work, Permittee shall contact Caltrans and relay: "Work number _____ is 10-98."

Encroachment Permit Project Work Scheduling Request Form

Requests for scheduling & approval of traffic control shall be submitted weekly, on this form, through the designated State Representative by FAX to 510-286-3960 or E-mail: Permit_Duty_Engineer@DOT.CA.GOV, a minimum of 7 days in advance of proposed work

1. Permit No.: _____ Expiration Date: _____ 2. Request date: _____
3. State Representative: _____
4. Route _____ 5. County _____ 6. City or township _____
7. Permit Work Hours *Use 24 hour clock format:* ____:____ to ____:____ 8. *Requested Work Week: _____ to _____
9. ☐PostMiles or ☐Kilopost: From: ___.___ To: ___.___ 10. Existing Lanes (each dir) Dir___ Lns___ / Dir___ Lns___
11. Describe Location (use landmark if necessary): From: _____ To: _____
12. Name of Conventional Highway or Surface St _____
13. Check any of the following that apply: ☐Connector ramp *(Connects 2 State Rtes)* From SR #_____ To SR #_____
☐Off/ramp *(Freeway to City St)* Ramp Name _____ ☐ Ramp or Connector Completely Closed
☐On/ramp *(City St to Freeway)* Ramp Name; _____ ☐Full Closure (All lns,1 dir)
☐One-way Traffic Control w/flaggers or pilot car *(Alternate use of the same lane for both dir)*
☐Traffic Diversion *(Reconfigure lane use & divert traffic to allow at least 1 ln open in each dir, describe in comments below)*
☐Intermittent Traffic Control ☐Long-Term (24+ hour continuous) Long-Term Date/Time Open _____

IMPORTANT: Resubmit request weekly, a minimum of 7 days in advance. Work Hours and Days must comply with Permit Requirements. Deviation from permit provisions must be requested in writing to Caltrans. Once approved, a rider will be issued.

YEAR:			TIME		DIR	RESTRICTED LANES														BREAKS		#
Month	Day	Day of Week	Start (10-97)	Finish (10-98)	NB - SB EB - WB	ALL Lanes	SHLDR Left	SHLDR Right	1	2	3	4	5	6	V L	Aux Coll	CD Med	LT Pckt	RT Pckt	10-15 Min	Roll	Caltrans will complete and return

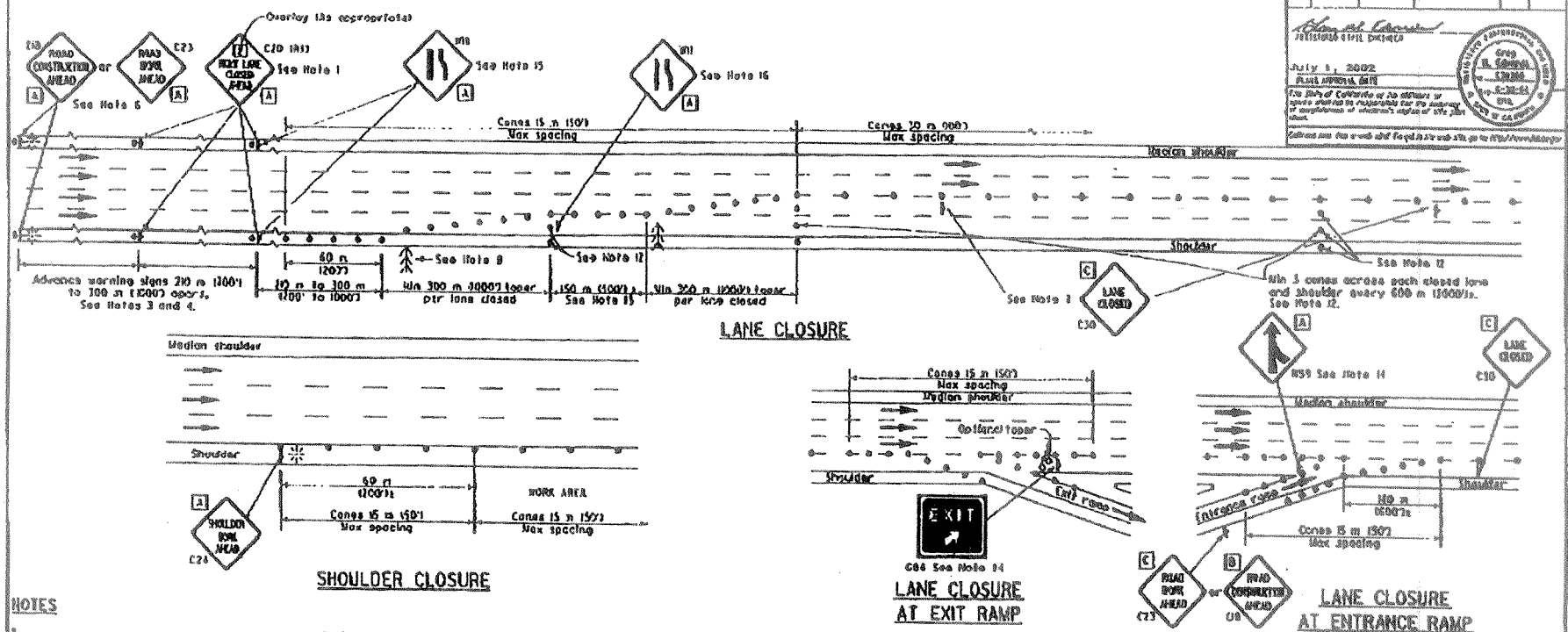
NOTES:
Month: Enter month (1 thru 12) for which traffic control is requested. **DAY:** Enter day of closure (1 thru 31) **Day of Week:** Enter (M-T-W-TH-F-SA-SU.)
DIRECTION (N – S – W – E) Enter North, South, East, West. Separate lane closure #'s are required for each direction unless work is on an undivided hwy.
LANES: Lanes are numbered in direction of travel from left to right, excluding turnpockets (left is always #1 or "fast lane") Check lanes or portions of highway to be closed, including Shoulders, Auxiliary Lane, Center Divide. "V/L" (Various Lanes) may be used, but comments must indicate the # of lanes to remain open at all times. "# " Work Scheduling Number - assigned by Caltrans and faxed back to reqestor.

13. Description of work _____
14. Detour *(Required for full closure)* _____
15. On-site during work (*circle if applicable*) CHP / PD / Other _____
16. Comments: _____
17. Contingency Plan:

Permittee:		Contractor:	
Address:			
Contact: (On-Site personnel)	Name(s)		
	Telephone-Office:	FAX:	
	Cellular:	Pager:	Other:

While performing the approved traffic control, Permittee shall notify Caltrans Communications Center via telephone at 510-286-6359 daily. Notifications shall be completed at start time (10-97) AND completion time (10-98), OR cancellation (10-22).

Received: 12/21/04 15:44;
12/21/2004 15:33 5102864712
5102864712 -> C.C. Transportation Auth.; Page 9
PAGE 09/09



NOTES

1. Median lane closures shall conform to the details for outside lane closures except that C20 (R3) signs shall be used.
2. Not less than one person shall be assigned to full time maintenance of traffic control devices on all night lane closures or day-time closures exceeding 8.6 km (5 mile) in length, including taper.
3. Duplicate sign installations are not required on opposite shoulder if at least one-half of the available lanes remain open to traffic.
   When the width of the median shoulder is less than 2.4 m (8') and the outside lanes are to be closed.
4. All advance warning sign installations shall be equipped with flags for daytime closures. Flashing beacons shall be placed at the locations indicated during night lane closure.
5. A C13 "END CONSTRUCTION" or C14 "END ROAD WORK" sign, as appropriate, shall be placed at the end of the lane closure unless the end of work area is obvious or ends within a larger project's limits.
6. If the G8 for C23 sign would follow within 600 m (2000') of a stationary C13, C23 or C18 "STATE HIGHWAY CONSTRUCTION AHEAD ____ MILES", use a C20 sign for the first advance warning sign.
7. Place a C30 sign every 600 m (2000') throughout length of lane closure.
8. One flashing arrow sign for each lane closed, the first flashing arrow sign shall be type I. All others may be either type I or type II.
9. A minimum 450 m (1500') of sight distance shall be provided where possible for vehicles approaching the first flashing arrow sign. Lane closures shall not begin at top of crest vertical curve or on a horizontal curve.
10. All cones used for night lane closures shall be fitted with reflective sleeves as specified in the specifications.
11. Portable delineators, placed at one-half the spacing indicated for traffic cones may be used in lieu of cones for daytime closures only.
12. Unless otherwise specified in the Special Provisions, a minimum of 3 cones shall be placed transversely across each closed lane and shoulder at each location where a taper across a traffic lane ends and every 600 m (2000') as shown on the "LANE CLOSURE" detail. Two Type II barricades may be used instead of the 3 cones. The transverse alignment of the cones or barricades on the closed shoulder may be shifted from the transverse alignment to provide access to the work.
13. Unless otherwise specified in the Special Provisions, the 150 m (500') section of the lane closure shown along lanelines shall be used between the 300 m (1000') lane closure tapers when two or more adjacent traffic lanes are to be closed.
14. Unless otherwise specified in the Special Provisions, the G84 and W59 signs shall be used as shown.
15. Where specified in the Special Provisions, a W11 "LANE REDUCTION SYMBOL" sign is to be used in place of the C20 "RIGHT LANE CLOSED AHEAD" sign.
16. The W11 "LANE REDUCTION SYMBOL" sign shown at this location is to be used where the W11 sign is used as advance warning as described in Note 15.

SIGN PANEL SIZE (Min)

A	210 mm x 1215 mm	(48" x 48")
B	900 mm x 900 mm	(36" x 36")
C	762 mm x 762 mm	(30" x 30")

LEGEND

- Traffic Cone
- Traffic Cone (optional taper)
- Portable Sign
- Flashing Arrow Sign
- Direction of Travel
- Portable Flashing Beacon

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

TRAFFIC CONTROL SYSTEM FOR LANE CLOSURE ON FREEWAYS AND EXPRESSWAYS

These "Standard Plans for Construction of Local Streets and Roads" contain units in two systems of measurement: International System of Units (SI or "metric") and United States Standard Measures shown in the parentheses (). The measurements expressed in the two systems are not necessarily equal or interchangeable. See the "Foreword" at the beginning of this publication.

NO SCALE

T10

July 1, 2002
PLANS APPROVAL DATE
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of these plans.

INITIAL APPROVED _____
☐ CONDITIONS

Well System

CONTRA COSTA HEALTH SERVICES

CONTRA COSTA
ENVIRONMENTAL HEALTH DIVISION
2120 DIAMOND BOULEVARD, SUITE 200
CONCORD, CA 94520
(925) 646-5225
www.cocoeh.org

WELL PERMIT APPLICATION

Type of Work:
- ☐ New Well (69) _____
- ☐ Repair (69)
- ☐ Abandonment (68)
- ☐ CPT / Inclinometer (01)
- ☒ Soil Boring (01)
- ☐ Piezometer w/ casing (67)
- ☐ Piezometer w/o casing (66)
- ☐ Flow Test (99)

Proposed Use:
- ☐ Domestic
- ☐ Public / Small Water System
- ☐ Agricultural
- ☐ Industrial
- ☐ Monitoring
- ☐ Other _____

Sewage Disposal (off-site):
- ☐ Septic System
- ☐ Sewer System _____

(ATTACH PLOT PLAN – For instructions see "The Well Permit Process" handout)

PLEASE PRINT CLEARLY. *REQUIRED FIELDS MUST BE COMPLETED.

*Legal Owner's Name: State of California Department of Transportation (CalTrans)			
*Owner Address: 111 Grand Ave., P.O.Box 23660			
*City/ State/ Zip: Oakland, CA 94623-0660		Country: USA	Owner Telephone: (510) 286-5568
*Owner Billing Address (if different from above)			
*Site Name (if different from owner address): State Route 4	*Assessor's Parcel #		Subdivision/Minor Subdivision #
*Site Address (if different from owner address): SR-4 between Harbor St. & Somersville Rd., Pittsburg, CA			Lot/Parcel #
*Contractor's Name: Gregg Drilling & Testing	*License # 657 485165		*Site Telephone: 925-313-5800
*Contractor's Mailing Address: 950 Howe Road Martinez, CA. 94553			*Contact Person's Telephone
*Consultant/Mailing Address: URS 1333 Broadway, Suite 800, Oakland CA. 94612			*Consultant's Telephone: 510.874-3201

*Construction/Destruction Specifications

Diameter of well casing N/A Casing Material N/A Gauge N/A Annular seal depth (50 feet minimum) _____

# of Soil Borings 54 Borehole Diameter 4" Boring Depth (b.g.s.*) 15'

Gravel/Sand packed ☐ Yes ☒ No Conductor casing ☐ Yes ☒ No Depth _____ Diameter _____

Type of material for annular seal/destruction (specify mix or product): ☒ Bentonite ☐ Concrete ☒ Cement

Method of drilling/destruction/Other: Direct Push / Hand auger

Variance ☐ Yes ☐ No (Required for water well seals less than 50 feet b.g.s./monitoring well seals less than 10 feet b.g.s.)
*b.g.s. = below ground surface

Performance Bond Requirement. (Contra Costa County Ordinance, Title 4 Health and Safety, Article 414-4.10; Section 414-4.1023 (a))
Prior to the issuance of a permit, the applicant shall post with the health officer a cash deposit or bond guaranteeing compliance with the terms of this chapter and the applicable permit, such bond to be in an amount deemed necessary by the health officer to remedy improper work but not in excess of five thousand dollars.

I hereby certify that the above information and submitted plans are true and correct and that the proposed work will comply with all permit conditions and applicable laws and regulations. I agree to obtain all required inspections, maintain a copy of the approved permit and plans at the job site until final approval, and obtain written authorization prior to deviating from the approved permit or plans, or placing the well in service. The issuance of this permit by Contra Costa Environmental Health Division does not guarantee a satisfactory and an indefinite operation of any well system.

Christine Turner
Signature of Contractor (C-57 Licensee)

2/1/05
Date

FOR OFFICE USE ONLY

Facility ID#:	PR#:	P/E#: 43	Census Tract:	REHS:
Amount Due: $ _____ Amount Paid: $ _____		Receipt #:	Received By:	
Check #: _____ / CASH / Credit Card: ☐ MC ☐ VISA		Date Received:	Supervisor:	

ALISTO ENGINEERING GROUP

July 19, 2005

Mr. Ben Razeghi, P.E.
URS Corporation
3440 Vincent Road, Suite C
Pleasant Hill, California 94523

10-05-048

Subject: Proposal for Asbestos and Lead-Based Paint Sampling
State Route 4 (East) Widening Project
Loveridge Road to Somersville Road, Pittsburg, California

Dear Mr. Razeghi:

In response to your request, Alisto Engineering Group is pleased to submit this proposal for asbestos and lead-based paint sampling of structures and concrete curbs along the proposed State Route (SR) 4 widening project between Loveridge Road and Somersville Road, Pittsburg, California.

SCOPE OF WORK

The proposed work will involve sampling of concrete structures along the project route that will be removed or repaired during the widening of SR4. The scope of work for the asbestos and lead-based paint surveying will include the following tasks:

Task 1: Preparation of Work Plan

A work plan describing the procedures and methodology to use for surveying and sampling of concrete materials for asbestos analysis and paint for lead analysis will be prepared for URS submittal to the Contra Costa County and California Department of Transportation (Caltrans) for review and approval. The work plan will include a site health and safety plan in accordance with the requirements of Federal and State Occupational Safety and Health Administration (OSHA)

Task 2: Asbestos and Lead-Based Paint Surveying

Representative samples of the concrete will be collected from the various structures that will be demolished in accordance with the guidelines and requirements of Contra Costa County, Caltrans and standard industry practice. All samples will be analyzed for asbestos by a laboratory accredited by the American Industrial Hygiene Association (AIHA) using polarized light microscopy (PLM). The quantification limit of PLM is approximately 1 percent asbestos.

Sample of paint chips or surface coatings from the various structures to be demolished will be collected for analysis of lead in accordance with the requirements of the County and Caltrans. The paint chip samples will be analyzed for lead by an AIHA

accredited and state-certified laboratory using EPA Method 7420. The work will be performed in accordance with applicable requirements of Federal and State OSHA, Environmental Protection Agency and State of California.

Based on information provided to Alisto, it is estimated that up to 15 samples of concrete and 10 paint chip samples will be collected from the various structures and locations. The bulk samples will be placed in sealed containers following recommended procedures for sample collection and preservation. Each sample will be numbered and logged, and accompanied with chain of custody forms during transport to an accredited laboratory. For cost estimating purposes, it is assumed that up to 35 sample layers will be analyzed for asbestos.

Task 3: Preparation of Letter Report

A letter report presenting the analytical results and location of samples collected will be prepared and submitted to URS Corporation within 20 days after completion of sample analysis. Depending on the results of the sampling and analysis, the report may also include recommendations for the handling and disposal of demolition debris and notification of appropriate regulatory agencies. The report will include all field notes, official laboratory reports and chain-of-custody documentations.

COST PROPOSAL

The lump sum cost for the proposed scope of work is $6,445, inclusive of labor, materials, supplies, travel, and laboratory analysis. Additional charges for sample analysis will be billed at $15.00 per sample for asbestos and $25.00 per sample for lead. Payment for our services is due within 30 days of submittal of invoice to URS otherwise a finance charge of 1.5 percent per month will be billed for unpaid balance beyond 30 days.

If you are in agreement with our proposal, please sign and return one copy as your acceptance. Please call if you have questions or need additional information.

Sincerely,

ALISTO ENGINEERING GROUP

Al Sevilla, P.E.
Principal

Accepted by:

URS CORPORATION

Authorized Signature

Scott C. Kelsey, Project Manager
Name and Title

8/2/05
Date

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

CENTRAL VALLEY REGION

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ORDER NO. R5-2008-0081
NPDES NO. CAG995001

WASTE DISCHARGE REQUIREMENTS FOR DEWATERING AND OTHER LOW THREAT DISCHARGES TO SURFACE WATERS

The following Dischargers are subject to waste discharge requirements as set forth in this Order (as authorized by the Notice of Applicability):

Table 1. Discharger Information

Dischargers	Individuals, public agencies, private businesses, and other legal entities (hereafter Dischargers) of clean or relatively pollutant-free wastewaters that pose little or no threat to the quality of waters of the United States. Discharges covered by this General Order are either 4 months or less in duration or have an average dry weather flow less than 0.25 million gallons per day (MGD).
The U.S. Environmental Protection Agency (USEPA) and the Regional Water Quality Control Board have classified these discharges as minor discharges.	

Table 2. Administrative Information

This Order was adopted by the Regional Water Quality Control Board on:	**12 June 2008**
This Order shall become effective on:	**12 June 2008**
This Order shall expire on:	**1 June 2013**
Those enrollees who are covered under this Order at the time of expiration will continue to be covered until coverage becomes effective under a reissued Order. Upon reissuance of this Order by the Regional Water Board, Dischargers seeking coverage under the reissued Order shall file a revised Notice of Intent.	

IT IS HEREBY ORDERED, that this Order supercedes Order No. 5-00-175 except for enforcement purposes; and in order to meet the provisions contained in division 7 of the Water Code (commencing with section 13000) and regulations adopted thereunder, and the provisions of the federal Clean Water Act (CWA), and regulations and guidelines adopted thereunder, applicable Dischargers shall comply with the requirements in this Order.

I, Pamela C. Creedon, Executive Officer, do hereby certify that this Order with all attachments is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Central Valley Region, on 12 June 2008.

PAMELA C. CREEDON, Executive Officer

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I. DISCHARGE INFORMATION

Individuals, public agencies, private businesses, and other legal entities often need to discharge clean or relatively pollutant-free wastewater that poses little or no threat to water quality. These discharges are often short-term and low volume in nature.

Water suppliers may have numerous intentional and unintentional releases of fresh water to surface waters and surface water drainage courses due to many factors, including system failures, pressure releases, and pipeline/tank flushing and dewatering. For the purpose of this Order, these multiple discharges from water suppliers shall be considered a project. Public and private water suppliers, such as irrigation districts, water districts, and water agencies, may apply for coverage under this General Order.

This General Order covers certain categories of dewatering and other low threat discharges to waters of the United States, which are either 4 months or less in duration or have an average dry weather flow that does not exceed 0.25 million gallons per day (MGD).

II. NOTIFICATION REQUIREMENTS

A. General Order Application

To obtain coverage under this General Order, which also serves as the National Pollutant Discharge Elimination System (NPDES) Permit, the Discharger must submit a complete Notice of Intent, as detailed in Attachment G. The Notice of Intent requires the Discharger to submit the following: (1) information concerning its discharge location; (2) a map showing the location of the site, treatment system (if applicable), discharge point(s), and receiving water; (3) an evaluation of reclamation options; (4) narrative and schematic descriptions of the existing or proposed treatment system, including blueprints signed by a Registered Engineer or Geologist (if applicable); (5) analysis of the proposed effluent for pollutants listed in Attachment B, Attachment C (if applicable), and any applicable 303(d) listed pollutants for the receiving water if discharging or proposing to discharge to an impaired waterbody; and (6) the appropriate fee. Dischargers applying for an exception to the analysis of the priority pollutants listed in Attachment B, as allowed by section 1.3, Step 8 and section 5.3 of the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (State Implementation Policy or SIP), shall submit the proper information with the Notice of Intent, as outlined in Attachment G. Water suppliers with a project that includes more than one existing or proposed discharge point must submit a Pollution Prevention and Monitoring and Reporting Plan with the Notice of Intent, as outlined in Attachment G.

B. General Order Coverage

Upon receipt of the Notice of Intent, the Executive Officer shall determine the applicability of this Order to the discharge. If the discharge is deemed eligible for coverage, the Executive Officer shall issue a Notice of Applicability to the Discharger, notifying the Discharger that the discharge is authorized under the terms and conditions

of this Order. New discharges for which coverage under this General Order is being sought shall not commence until after receiving the Executive Officer's written Notice of Applicability or until the California Regional Water Quality Control Board, Central Valley Region (hereinafter Regional Water Board) has issued an individual NPDES permit for the discharge.

This General Order shall apply to the individuals, public agencies, private businesses, and other legal entities who have submitted a complete Notice of Intent and have received a Notice of Applicability from the Executive Officer.

Dischargers currently covered by Order No. 5-00-175 are automatically granted coverage under this General Order for a period of 180 days following adoption of this General Order. Within 90 days, the Discharger shall file a new Notice of Intent for coverage under this General Order. Coverage under this General Order shall be terminated after the 180-day period unless the Executive Officer has issued the Discharger a written Notice of Applicability.

C. Eligibility Criteria

1. This General Order covers dewatering and other low threat discharges to surface waters.

2. To be authorized by this General Order, Dischargers must demonstrate that the discharge or proposed discharge meets the following criteria:

a. Pollutant concentrations in the discharge do not cause, have a reasonable potential to cause, or contribute to an excursion above any applicable federal water quality criterion established by USEPA pursuant to CWA section 303;

b. Pollutant concentrations in the discharge do not cause, have a reasonable potential to cause, or contribute to an excursion above any water quality objective adopted by the Regional Water Board or State Water Resources Control Board (State Water Board), including prohibitions of discharge for the receiving waters; and

c. The discharge does not cause acute or chronic toxicity in the receiving water.

3. The Discharger shall comply with all the terms and provisions of this General Order.

D. Termination of Coverage

1. Upon completion of treatment and cessation of the discharge, the Discharger shall request, in writing, official termination of coverage under this General Order from the Executive Officer. Upon submission of this request, the Discharger shall no longer be authorized to discharge wastewater covered by this General Order. The Discharger is subject to the terms and conditions of this General Order and is responsible for submitting the annual fee associated with this General Order until the Discharger submits a written request for official termination of coverage.

2. When the Regional Water Board issues an individual NPDES permit or Waste Discharge Requirements (WDRs) with more specific requirements to a Discharger, the applicability of this General Order to that Discharger is automatically terminated on the effective date of the individual permit or WDRs.

3. Dischargers authorized to discharge under this General Order who have been granted an exception to the priority pollutant criteria and objectives in the California Toxics Rule (CTR) and SIP, as allowed by section 5.3 of the SIP, must provide certification by a qualified biologist that the beneficial uses of the receiving water have been restored upon completion of the discharge.

4. Authorization to discharge shall be terminated 180 days after the effective date of this General Order for those Dischargers covered by Order No. 5-00-175, unless the Discharger receives a written Notice of Applicability for coverage under this General Order from the Executive Officer.

III. FINDINGS

The Regional Water Board finds:

A. Background. Dischargers of dewatering and other low threat discharges to surface waters are currently discharging pursuant to Order No. 5-00-175 and NPDES Permit No. CAG995001. Dischargers of dewatering and other low threat discharges to surface waters must obtain authorization under this General Order in order to continue their discharges to waters of the United States. To obtain authorization for continued and future discharges to waters of the United States, Dischargers must submit a complete Notice of Intent, as described in Section II, above.

B. Discharge Description.

1. The dewatering and other low threat discharges that may be authorized by this General Order are clean or relatively pollutant-free wastewaters that pose little or no threat to water quality. This General Order covers discharges which are either 4 months or less in duration or have an average dry weather flow of less than 0.25 MGD. Discharges that may be covered by this General Order include, but are not limited to the following:

   a. Well development water;

   b. Construction dewatering;

   c. Pump/well testing;

   d. Pipeline/tank pressure testing;

   e. Pipeline/tank flushing or dewatering;

   f. Condensate discharges;

g. Water supply system discharges; and

h. Miscellaneous dewatering/low threat discharges.

These wastewaters may be produced and treated on a continuous or batch basis.

2. Discharges that are not covered by this Order shall include the following:

a. Discharges to municipal wastewater collection systems;

b. Discharges to ponds, infiltration basins, spray disposal areas, subsurface infiltration; or other methods not involving discharge to surface waters and surface water drainage courses;

c. Discharges from groundwater cleanup projects, including sites polluted by industrial activity, underground leaking tanks, and farming practices;

d. Discharges of groundwater which has been polluted by industrial activity, underground leaking tanks, or farming practices, even if the project and/or proponent has no connection with the contamination; and

e. Discharges that cause acute or chronic toxicity and discharges that contain chemical or organic constituents, bacteria, herbicides, pesticides, oil and grease, radioactivity, salinity, or temperatures that may adversely impact beneficial uses or exceed any water quality objective or standard.

3. Dischargers already covered under the NPDES program, whether by general or individual permit other than Order No. 5-00-175, may elect to continue coverage under the existing permit or may submit a complete Notice of Intent for coverage under this General Order. Dischargers who submit a complete Notice of Intent for coverage under this General Order are not required to submit an individual permit application. The Regional Water Board may request additional information and determine that a Discharger is not eligible for coverage under this General Order and would be better regulated under an individual or other general NPDES permit or, for discharges to land, under WDRs. If the Regional Water Board issues an NPDES permit or WDRs, the applicability of this General Order to the specified discharge is immediately terminated on the effective date of the NPDES permit or WDRs.

C. Legal Authorities. This Order is issued pursuant to section 402 of the federal Clean Water Act (CWA) and implementing regulations adopted by the U.S. Environmental Protection Agency (USEPA) and chapter 5.5, division 7 of the California Water Code (commencing with section 13370). It shall serve as an NPDES permit for point source discharges to surface waters of dewatering and other low threat wastewaters. This Order also serves as WDRs pursuant to article 4, chapter 4, division 7 of the Water Code (commencing with section 13260).

Section 122.28 of Title 40 of the *Code of Federal Regulations* (40 CFR 122.28)

authorizes EPA and approved states to issue general permits to regulate a point source category, if the sources:

1. Involve the same or substantially similar types of operations;
2. Discharge the same type of waste;
3. Require the same type of effluent limitations or operating conditions;
4. Require similar monitoring; and
5. Are more appropriately regulated under a general permit rather than individual permits.

On 22 September 1989, USEPA granted the State of California, through the State Water Board and the Regional Water Boards, the authority to issue general NPDES permits pursuant to 40 CFR Parts 122 and 123.

D. Background and Rationale for Requirements. The Regional Water Board developed the requirements in this Order based on readily available information for several similar discharges and the requirements contained in Order No. 5-00-175. The Fact Sheet (Attachment F), which contains background information and rationale for Order requirements, is hereby incorporated into this Order and constitutes part of the Findings for this Order. Attachments A through E and G through H are also incorporated into this Order.

E. California Environmental Quality Act (CEQA). Under Water Code section 13389, this action to adopt an NPDES permit is exempt from the provisions of CEQA, Public Resources Code sections 21100-21177, except requirements for "new sources"[1] as defined in the Federal Water Pollution Control Act. For any "new source" compliance with CEQA must be achieved before a Notice of Applicability for coverage under this General Order can be issued for the project.

The SIP at section 5.3 authorizes the Regional Water Board to grant categorical exceptions from meeting the priority pollutant criteria/objectives, if determined to be necessary to implement control measures regarding drinking water conducted to fulfill statutory requirements under the Safe drinking water Act or California Health and Safety Code. Generally, discharges of potable water are done to fulfill California Department of Health and Safety statutory requirements, and to ensure steady and safe drinking water supply to end-users. The potable water discharges under this permit are mostly intermittent, short duration, high flow discharges that comply with California Department of Health and Safety Maximum Contaminant Levels, for protection of human health. Therefore, potable water discharges as qualified under this permit have been determined to pose no significant threat to water quality and meet the conditions for categorical exception under SIP. The Board's actions on issuing this permit for existing and new potable water discharges, and on the exceptions is exempt from CEQA in accordance with California Code of Regulations, Title 14, Section 15061 (b)(3) which states that CEQA only applies to projects which have the potential for causing adverse environmental effects.

[1] A "new source" is a discharge type for which USEPA has issued New Source Performance Standards. A "new source" does not mean a new discharge.

To satisfy the Categorical Exception requirements of Section 5.3 of the SIP, dischargers seeking enrollment under this General Order will be required to submit project-specific information to the Executive Officer on the discharge and its water quality effects. The information required by the SIP is included in the application requirements contained in section V of Attachment G.

F. Technology-based Effluent Limitations. Section 301(b) of the CWA and implementing USEPA permit regulations at 40 CFR 122.44 require that permits include conditions meeting applicable technology-based requirements at a minimum, and any more stringent effluent limitations necessary to meet applicable water quality standards. The discharges authorized by this Order must meet minimum federal technology-based requirements based on Best Professional Judgment (BPJ) in accordance with 40 CFR 125.3. A detailed discussion of the technology-based effluent limitations development is included in the Fact Sheet (Attachment F).

G. Water Quality-Based Effluent Limitations (WQBELs). Section 301(b) of the CWA and 40 CFR 122.44(d) require that permits include limitations more stringent than applicable federal technology-based requirements where necessary to achieve applicable water quality standards.

40 CFR 122.44(d)(1)(i) mandates that permits include effluent limitations for all pollutants that are or may be discharged at levels that have the reasonable potential to cause or contribute to an exceedance of a water quality standard, including numeric and narrative objectives within a standard. Where reasonable potential has been established for a pollutant, but there is no numeric criterion or objective for the pollutant, WQBELs must be established using: (1) USEPA criteria guidance under CWA section 304(a), supplemented where necessary by other relevant information; (2) an indicator parameter for the pollutant of concern; or (3) a calculated numeric water quality criterion, such as a proposed state criterion or policy interpreting the state's narrative criterion, supplemented with other relevant information, as provided in 40 CFR 122.44(d)(1)(vi).

H. Water Quality Control Plans. The Regional Water Board adopted a Water Quality Control Plan, Fourth Edition (Revised February 2007), for the Sacramento and San Joaquin River Basins and a Water Quality Control Plan, Second Edition (Revised January 2004), for the Tulare Lake Basin (hereinafter Basin Plans) that designate beneficial uses, establish water quality objectives, and contain implementation programs and policies to achieve those objectives for all waters addressed through the plans. In addition, the Basin Plans implement State Water Board Resolution No. 88-63, which established state policy that all waters, with certain exceptions, should be considered suitable or potentially suitable for municipal or domestic supply. The typical beneficial uses identified in the Basin Plans include the following: municipal and domestic supply; agricultural irrigation; stock watering; process supply; service supply; hydropower supply; water contact recreation; canoeing and rafting recreation; other non-contact water recreation; warm freshwater aquatic habitat; cold freshwater habitat;warm fish migration habitat; cold fish migration habitat; warm and cold spawning habitat; wildlife habitat; navigation; rare, threatened, or endangered species habitat;

groundwater recharge; and freshwater replenishment.

The Basin Plans include a list of Water Quality Limited Segments (WQLSs), which are defined as "…*those sections of lakes, streams, rivers or other fresh water bodies where water quality does not meet (or is not expected to meet) water quality standards even after the application of appropriate limitations for point sources (40 CFR 130, et seq.)*." The Basin Plans also state, "*Additional treatment beyond minimum federal standards will be imposed on dischargers to WQLSs. Dischargers will be assigned or allocated a maximum allowable load of critical pollutants so that water quality objectives can be met in the segment*." Dischargers seeking coverage under this General Permit whose discharge is to a receiving water that is listed as a WQLS shall analyze the discharge for the applicable listed constituents, the results of which shall be included in the Discharger's Notice of Intent. The Regional Water Board will not authorize discharges under this General Order that would contribute to the further impairment of the WQLS.

I. Bay-Delta Plan. The Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan) was adopted in May 1995 by the State Water Board, superseding the 1991 Bay-Delta Plan. The Bay-Delta Plan identifies the beneficial uses of the estuary and includes objectives for flow, salinity, and endangered species protection.

The Bay-Delta Plan attempts to create a management plan that is acceptable to the stakeholders while, at the same time, is protective of beneficial uses of the Sacramento – San Joaquin Delta. The State Water Board adopted Decision 1641 (D-1641) on 29 December 1999. D-1641 implements flow objectives for the Bay-Delta Estuary, approves a petition to change points of diversion of the Central Valley Project and the State Water Project in the Southern Delta, and approves a petition to change places of use and purposes of use of the Central Valley Project. The water quality objectives of the Bay-Delta Plan are implemented as part of this Order.

J. National Toxics Rule (NTR) and California Toxics Rule (CTR). USEPA adopted the NTR on 22 December 1992, and later amended it on 4 May 1995 and 9 November 1999. About 40 criteria in the NTR applied in California. On 18 May 2000, USEPA adopted the CTR. The CTR promulgated new toxics criteria for California and, in addition, incorporated the previously adopted NTR criteria that were applicable in the state. The CTR was amended on 13 February 2001. These rules contain water quality criteria for priority pollutants.

K. State Implementation Policy. On 2 March 2000, the State Water Board adopted the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (State Implementation Policy or SIP). The SIP became effective on 28 April 28 2000 with respect to the priority pollutant criteria promulgated for California by USEPA through the NTR and to the priority pollutant objectives established by the Regional Water Board in the Basin Plans. The SIP became effective on 18 May 2000 with respect to the priority pollutant criteria promulgated by USEPA through the CTR. The State Water Board adopted amendments to the SIP on 24 February 2005 that became effective on 13 July 2005. The SIP establishes implementation provisions for priority pollutant criteria and

objectives and provisions for chronic toxicity control.

Section 5.3 of the SIP authorizes the Regional Water Board, after compliance with the California Environmental Quality Act (CEQA), to allow certain dischargers short-term or seasonal exceptions from meeting the priority pollutant criteria and objectives if the Regional Water Board determines the discharge is necessary to implement control measures regarding drinking water conducted to fulfill statutory requirements under the federal Safe Drinking Water Act or the California Health and Safety Code.

This General Order authorizes a categorical exception to the criteria and objectives in the CTR and SIP for Dischargers who submit the information required by section 5.3 of the SIP as outlined in Attachment G and meet the exception criteria, as determined by the Regional Water Board. As required by the SIP, Dischargers authorized to discharge under this General Order with an exception to the priority pollutant criteria and objectives must provide certification by a qualified biologist that the receiving water beneficial uses have been restored upon completion of the project. This General Order requires full compliance with the requirements of the CTR and SIP for all other authorized discharges.

L. Alaska Rule. On 30 March 2000, USEPA revised its regulation that specifies when new and revised state and tribal water quality standards become effective for CWA purposes [40 CRR 131.21; 65 Fed. Reg. 24641 (27 April 2000)]. Under the revised regulation (also known as the Alaska rule), new and revised standards submitted to USEPA after 30 May 2000, must be approved by USEPA before being used for CWA purposes. The final rule also provides that standards already in effect and submitted to USEPA by 30 May 2000 may be used for CWA purposes, whether or not approved by USEPA.

M. Stringency of Requirements for Individual Pollutants. This Order contains both technology-based effluent limitations and WQBELs for individual pollutants. The technology-based effluent limitations consist of restrictions on 5-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS). This Order's technology-based pollutant restrictions implement the minimum, applicable federal technology-based requirements.

WQBELs have been scientifically derived to implement water quality objectives that protect beneficial uses. The WQBELs consist of restrictions on chlorine residual, pH, and settleable solids. Both the beneficial uses and the water quality objectives have been approved pursuant to federal law and are the applicable federal water quality standards. To the extent that toxic pollutant WQBELs were derived from the CTR, the CTR is the applicable standard pursuant to 40 CFR 131.38. The scientific procedures for calculating the individual WQBELs for priority pollutants are based on the CTR-SIP, which was approved by USEPA on 18 May 2000. All beneficial uses and water quality objectives contained in the Basin Plans were approved under state law and submitted to and approved by USEPA prior to 30 May 2000. Any water quality objectives and beneficial uses submitted to USEPA prior to 30 May 2000, but not approved by USEPA before that date, are nonetheless "*applicable water quality standards for purposes of the [Clean Water] Act*" pursuant to 40 CFR 131.21(c)(1). Collectively, this Order's

restrictions on individual pollutants are no more stringent than required to implement the technology-based requirements of the CWA and the applicable water quality standards for purposes of the CWA.

N. Antidegradation Policy. 40 CFR 131.12 requires that the state water quality standards include an antidegradation policy consistent with the federal policy. The State Water Board established California's antidegradation policy in State Water Board Resolution No. 68-16. Resolution No. 68-16 incorporates the federal antidegradation policy where the federal policy applies under federal law. Resolution No. 68-16 requires that existing quality of waters be maintained unless degradation is justified based on specific findings. The Regional Water Board's Basin Plans implement, and incorporate by reference, both the state and federal antidegradation policies. As described in the Fact Sheet (Attachment F), due to the short-term and low volume nature of discharge expected from discharges regulated under this General Order, the impact on existing water quality will be insignificant. If, however, the Regional Water Board, subsequent to review of any Notice of Intent, finds that the impact of a discharge will not be insignificant, then authorization for coverage under this General Order will be denied and coverage under an individual permit will be required (including preparation of an antidegradation analysis).

O. Anti-Backsliding Requirements. Sections 402(o)(2) and 303(d)(4) of the CWA and federal regulations at 40 CFR 122.44(l) prohibit backsliding in NPDES permits. These anti-backsliding provisions require effluent limitations in a reissued permit to be as stringent as those in the previous permit, with some exceptions where limitations may be relaxed. All effluent limitations in this Order are at least as stringent as the effluent limitations in Order No. 5-00-175.

P. Endangered Species Act. This Order does not authorize any act that results in the taking of a threatened or endangered species or any act that is now prohibited, or becomes prohibited in the future, under either the California Endangered Species Act (Fish and Game Code sections 2050 to 2097) or the Federal Endangered Species Act (16 U.S.C.A. sections 1531 to 1544). This Order requires compliance with effluent limitations, receiving water limitations, and other requirements to protect the beneficial uses of waters of the state. The discharger is responsible for meeting all requirements of the applicable Endangered Species Act.

Q. Monitoring and Reporting. 40 CFR 122.48 requires that all NPDES permits specify requirements for recording and reporting monitoring results. CWC sections 13267 and 13383 authorize the Regional Water Board to require technical and monitoring reports. The Monitoring and Reporting Program establishes monitoring and reporting requirements to implement federal and State requirements. The Monitoring and Reporting Program is provided in Attachment E.

R. Standard and Special Provisions. Standard Provisions, which apply to all NPDES permits in accordance with 40 CFR 122.41, and additional conditions applicable to specified categories of permits in accordance with 40 CFR 122.42, are provided in Attachment D. The discharger must comply with all standard provisions and with those additional conditions that are applicable under 40 CFR 122.42. The Regional Water

Board has also included in this Order special provisions applicable to the Discharger. A rationale for the special provisions contained in this Order is provided in the Fact Sheet.

S. Provisions and Requirements Implementing State Law. The provisions/requirements in section VII.A.2.r of this Order are included to implement state law only. These provisions/requirements are not required or authorized under the federal CWA; consequently, violations of these provisions/requirements are not subject to the enforcement remedies that are available for NPDES violations.

T. Notification of Interested Parties. The Regional Water Board has notified interested agencies and persons of its intent to prescribe WDRs for dewatering and other low threat discharges to surface waters. Details of notification are provided in the Fact Sheet of this Order.

U. Consideration of Public Comment. The Regional Water Board, in a public meeting, heard and considered all comments pertaining to dewatering and other low threat discharges to surface waters. Details of the Public Hearing are provided in the Fact Sheet.

IV. DISCHARGE PROHIBITIONS

A. The discharge of wastes other than those which meet eligibility criteria in Section II.C of this Order is prohibited unless the Discharger obtains coverage under another general or individual Order that regulates the discharge of such wastes.

B. The by-pass or overflow of wastes to surface waters is prohibited, except as allowed by Federal Standard Provisions I.G. and I.H. (Attachment D).

C. Neither the discharge nor its treatment shall create a nuisance as defined in section 13050 of the CWC.

D. A Discharger shall not allow pollutant-free wastewater to be discharged into the treatment and disposal system (if applicable) in amounts that significantly diminish the system's capability to comply with this Order. Pollutant-free wastewater means rainfall, groundwater, cooling waters, and condensates that are essentially free of pollutants.

E. Discharge of polluted groundwater is prohibited.

F. Discharges having an average dry weather discharge flow exceeding 0.25 MGD are prohibited unless the discharge is 4 months or less in duration.

V. EFFLUENT LIMITATIONS AND DISCHARGE SPECIFICATIONS

A. Effluent Limitations – Applicable to All Dewatering and Other Low Threat Discharges

1. Final Effluent Limitations

a. The discharge of pollutants from dewatering and other low threat discharges shall not exceed the following effluent limitations:

Table 3. Effluent Limitations

Parameter	Units	Effluent Limitations		
		Average Monthly	Weekly Average	Maximum Daily
Biochemical Oxygen Demand (5-day @ 20°C)	mg/L	10	15	30
Total Suspended Solids	mg/L	10	15	30
Settleable Solids	mL/L	--	--	0.1

b. Total Residual Chlorine. Effluent total residual chlorine shall not exceed:

i. 0.011 mg/L, as a 4-day average; and
ii. 0.019 mg/L, as a 1-hour average.

B. Effluent Limitations – Applicable to Dewatering and Other Low Threat Discharges to Specific Waterbodies

1. Final Effluent Limitations – Discharges within the Sacramento and San Joaquin River Basins (Except Goose Creek)

The pH of all dewatering and other low threat discharges within the Sacramento and San Joaquin River Basins (except Goose Creek) shall at all times be within the range of 6.5 and 8.5.

2. Final Effluent Limitations – Discharges to Goose Creek

The pH of all dewatering and other low threat discharges to Goose Creek shall at all times be within the range of 7.5 and 9.5.

3. Final Effluent Limitations – Discharges within the Tulare Lake Basin

The pH of all dewatering and other low threat discharges within the Tulare Lake Basin shall at all times be within the range of 6.5 and 8.3.

C. Land Discharge Specifications

[Not Applicable]

D. Reclamation Specifications

[Not Applicable]

VI. RECEIVING WATER LIMITATIONS

A. Surface Water Limitations

Receiving water limitations are based on water quality objectives contained in the Basin Plans for the Sacramento and San Joaquin River Basin and the Tulare Lake Basin and are a required part of this Order. Compliance with any amendment or revision to the water quality objectives contained in the Basin Plans adopted by the Regional Water Board subsequent to adoption of this Order is also required. Any discharge authorized for coverage under this General Order shall not cause the following in the receiving water:

1. **Un-ionized Ammonia.** Un-ionized ammonia to be present in amounts that adversely affect beneficial uses or in excess of 0.025 mg/L (as N) in waterbodies in the Tulare Lake Basin.

2. **Bacteria.** The fecal coliform concentration, based on a minimum of not less than five samples for any 30-day period, to exceed a geometric mean of 200 MPN/100 mL and no more than 10 percent of the total number of fecal coliform samples taken during any 30-day period to exceed 400 MPN/100 mL.

3. **Biostimulatory Substances.** Water to contain biostimulatory substances which promote aquatic growths in concentrations that cause nuisance or adversely affect beneficial uses.

4. **Chemical Constituents.** Chemical constituents to be present in concentrations that adversely affect beneficial uses.

5. **Color.** Discoloration that causes nuisance or adversely affects beneficial uses.

6. **Dissolved Oxygen.** For surface waters outside of the Delta for the Sacramento and San Joaquin River Basins and for the Tulare Lake Basin:

   a. The monthly median of the mean daily dissolved oxygen concentration to fall below 85 percent of saturation in the main water mass;
   b. The 95 percentile dissolved oxygen concentration to fall below 75 percent of saturation;
   c. The dissolved oxygen concentration to be reduced below 5.0 for water bodies designated WARM mg/L at any time; nor
   d. The dissolved oxygen concentration to be reduced below 5.0 for water bodies designated WARM mg/L at any time; nor

   Within the legal boundaries of the Delta, the dissolved oxygen concentrations shall not be reduced below: 7.0 mg/L in the Sacramento River (below the I Street Bridge) and in all Delta waters west of the Antioch Bridge; 6.0 mg/L in the San Joaquin River (between Turner Cut and Stockton, 1 September through 30 November); and 5.0 mg/L in all other Delta waters except those bodies of water which are constructed for

special purposes and from which fish have been excluded or where the fishery is not important as a beneficial use.

7. **Floating Material.** Floating material to be present in amounts that cause nuisance or adversely affect beneficial uses.

8. **Oil and Grease.** Oils, greases, waxes, or other materials to be present in concentrations that cause nuisance, result in a visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses.

9. **pH.** The pH to be depressed below 6.5, raised above 8.5, nor changed by more than 0.5 units for the Sacramento and San Joaquin River Basins (except Goose Creek). The pH to be depressed below 7.5, nor raised above 9.5 within Goose Creek. The pH to be depressed below 6.5, raised above 8.3, nor changed by more than 0.3 units for the Tulare Lake Basin.

10. **Pesticides:**

    a. Pesticides to be present, individually or in combination, in concentrations that adversely affect beneficial uses;
    b. Pesticides to be present in bottom sediments or aquatic life in concentrations that adversely affect beneficial uses;
    c. Total identifiable persistent chlorinated hydrocarbon pesticides to be present in the water column at concentrations detectable within the accuracy of analytical methods approved by USEPA or the Executive Officer for the Sacramento and San Joaquin River Basins or prescribed in Standard Methods for the Examination of Water and Wastewater, 18th Edition, or other equivalent methods approved by the Executive Officer for the Tulare Lake Basin;
    d. Pesticide concentrations to exceed those allowable by applicable antidegradation policies (see State Water Board Resolution No. 68-16 and 40 CFR 131.12.) for the Sacramento and San Joaquin River Basins;
    e. Pesticide concentrations to exceed the lowest levels technically and economically achievable for the Sacramento and San Joaquin River Basins;
    f. Pesticides to be present in concentrations in excess of the maximum contaminant levels (MCLs) set forth in CCR, Title 22, division 4, chapter 15 for the Sacramento and San Joaquin River Basins or as specified in Table 64444-A (Organic Chemicals) of section 64444 of Title 22 of the CCR for the Tulare Lake Basin; nor
    g. Thiobencarb to be present in excess of 1.0 µg/L for the Sacramento and San Joaquin River Basins.

11. **Radioactivity:**

    a. Radionuclides to be present in concentrations that are harmful or deleterious to human, plant, animal, or aquatic life nor that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal, or aquatic life.

b. Radionuclides to be present in excess of the MCLs specified in Table 4 (MCL Radioactivity) of Section 64443 of Title 22 of the California Code of Regulations.

12. **Suspended Sediments.** The suspended sediment load and suspended sediment discharge rate of surface waters to be altered in such a manner as to cause nuisance or adversely affect beneficial uses.

13. **Settleable Substances.** Substances to be present in concentrations that result in the deposition of material that causes nuisance or adversely affects beneficial uses.

14. **Suspended Material.** Suspended material to be present in concentrations that cause nuisance or adversely affect beneficial uses.

15. **Taste and Odors.** Taste- or odor-producing substances to be present in concentrations that impart undesirable tastes or odors to fish flesh or other edible products of aquatic origin, or that cause nuisance, or otherwise adversely affect beneficial uses or domestic or municipal water supplies.

16. **Temperature.** The natural temperature to be increased by more than 5°F.

17. **Total Dissolved Solids.** The total dissolved solids to exceed 1,000 mg/L.

18. **Toxicity.** Toxic substances to be present, individually or in combination, in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life.

19. **Turbidity.** The turbidity to increase as follows:

    a. More than 1 Nephelometric Turbidity Unit (NTU) where natural turbidity is between 0 and 5 NTUs.

    b. More than 20 percent where natural turbidity is between 5 and 50 NTUs.

    c. More than 10 NTU where natural turbidity is between 50 and 100 NTUs.

    d. More than 10 percent where natural turbidity is greater than 100 NTUs.

B. Groundwater Limitations

[Not Applicable]

VII. PROVISIONS

A. Standard Provisions

1. All Dischargers authorized to discharge under this General Order shall comply with all Standard Provisions included in Attachment D of this Order.

2. All Dischargers authorized to discharge under this General Order shall comply with the following provisions:

a. If a Discharger's wastewater treatment plant is publicly owned or subject to regulation by California Public Utilities Commission, it shall be supervised and operated by persons possessing certificates of appropriate grade according to Title 23, CCR, division 3, chapter 26.

b. After notice and opportunity for a hearing, this Order may be terminated or modified for cause, including, but not limited to:

i. violation of any term or condition contained in this Order;

ii. obtaining this Order by misrepresentation or by failing to disclose fully all relevant facts;

iii. a change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge; and

iv. a material change in the character, location, or volume of discharge.

The causes for modification include:

• *New regulations.* New regulations have been promulgated under section 405(d) of the CWA, or the standards or regulations on which the permit was based have been changed by promulgation of amended standards or regulations or by judicial decision after the permit was issued.

• *Land application plans.* When required by a permit condition to incorporate a land application plan for beneficial reuse of sewage sludge, to revise an existing land application plan, or to add a land application plan.

• *Change in sludge use or disposal practice.* Under 40 CFR 122.62(a)(1), a change in the Discharger's sludge use or disposal practice is a cause for modification of the permit. It is cause for revocation and reissuance if the Discharger requests or agrees.

The Regional Water Board may review and revise this Order at any time upon application of any affected person or the Regional Water Board's own motion.

c. If a toxic effluent standard or prohibition (including any scheduled compliance specified in such effluent standard or prohibition) is established under section

307(a) of the CWA, or amendments thereto, for a toxic pollutant that is present in the discharge authorized herein, and such standard or prohibition is more stringent than any limitation upon such pollutant in this Order, the Regional Water Board will revise or modify this Order in accordance with such toxic effluent standard or prohibition.

The Discharger shall comply with effluent standards and prohibitions within the time provided in the regulations that establish those standards or prohibitions, even if this Order has not yet been modified.

d. This Order shall be modified, or alternately revoked and reissued, to comply with any applicable effluent standard or limitation issued or approved under sections 301(b)(2)(C) and (D), 304(b)(2), and 307(a)(2) of the CWA, if the effluent standard or limitation so issued or approved:

i. contains different conditions or is otherwise more stringent than any effluent limitation in the Order; or

ii. controls any pollutant limited in the Order.

The Order, as modified or reissued under this paragraph, shall also contain any other requirements of the CWA then applicable.

e. The provisions of this Order are severable. If any provision of this Order is found invalid, the remainder of this Order shall not be affected.

f. The Discharger shall take all reasonable steps to minimize any adverse effects to waters of the State or users of those waters resulting from any discharge or sludge use or disposal in violation of this Order. Reasonable steps shall include such accelerated or additional monitoring as necessary to determine the nature and impact of the non-complying discharge or sludge use or disposal.

g. The discharge of any radiological, chemical or biological warfare agent or high-level, radiological waste is prohibited.

h. A copy of this Order and the Notice of Applicability shall be maintained at the discharge facility and be available at all times to operating personnel. Key operating personnel shall be familiar with its content.

i. Safeguard to electric power failure:

i. The Discharger shall provide safeguards to assure that, should there be reduction, loss, or failure of electric power, the discharge shall comply with the terms and conditions of this Order.

ii. Upon written request by the Regional Water Board a Discharger shall submit a written description of safeguards. Such safeguards may include alternate power sources, standby generators, retention capacity, operating procedures, or other means. A description of the safeguards provided shall include an

analysis of the frequency, duration, and impact of power failures experienced over the past 5 years on effluent quality and on the capability of the Discharger to comply with the terms and conditions of the Order. The adequacy of the safeguards is subject to the approval of the Regional Water Board.

iii. Should the treatment works not include safeguards against reduction, loss, or failure of electric power, or should the Regional Water Board not approve the existing safeguards, the Discharger shall, within 90 days of having been advised in writing by the Regional Water Board that the existing safeguards are inadequate, provide to the Regional Water Board and USEPA a schedule of compliance for providing safeguards such that in the event of reduction, loss, or failure of electric power, the Discharger shall comply with the terms and conditions of this Order. The schedule of compliance shall, upon approval of the Regional Water Board, become a condition of this Order.

j. A Discharger, upon written request of the Regional Water Board, shall file with the Board a technical report on its preventive (failsafe) and contingency (cleanup) plans for controlling accidental discharges, and for minimizing the effect of such events. This report may be combined with that required under Regional Water Board Standard Provision contained in section VII.A.2.k. of this Order.

The technical report shall:

i. Identify the possible sources of spills, leaks, untreated waste by-pass, and contaminated drainage. Loading and storage areas, power outage, waste treatment unit outage, and failure of process equipment, tanks and pipes should be considered.

ii. Evaluate the effectiveness of present facilities and procedures and state when they became operational.

iii. Predict the effectiveness of the proposed facilities and procedures and provide an implementation schedule containing interim and final dates when they will be constructed, implemented, or operational.

The Regional Water Board, after review of the technical report, may establish conditions which it deems necessary to control accidental discharges and to minimize the effects of such events. Such conditions shall be incorporated as part of the Notice of Applicability, upon notice to the Discharger.

k. The Discharger shall submit technical reports as directed by the Executive Officer. All technical reports required herein that involve planning, investigation, evaluation, or design, or other work requiring interpretation and proper application of engineering or geologic sciences, shall be prepared by or under the direction of persons registered to practice in California pursuant to California Business and Professions Code, sections 6735, 7835, and 7835.1. To demonstrate compliance with Title 16, CCR, sections 415 and 3065, all technical

reports must contain a statement of the qualifications of the responsible registered professional(s). As required by these laws, completed technical reports must bear the signature(s) and seal(s) of the registered professional(s) in a manner such that all work can be clearly attributed to the professional responsible for the work.

l. Laboratories that perform sample analyses must be identified in all monitoring reports submitted to the Regional Water Board and USEPA.

m. Effluent samples shall be taken downstream of the last addition of wastes to the treatment or discharge works where a representative sample may be obtained prior to mixing with the receiving waters. Samples shall be collected at such a point and in such a manner to ensure a representative sample of the discharge.

n. All monitoring and analysis instruments and devices used by a Discharger to fulfill the prescribed monitoring program shall be properly maintained and calibrated as necessary, at least yearly, to ensure their continued accuracy.

o. Each Discharger shall file with the Regional Water Board technical reports on self-monitoring performed according to the detailed specifications contained in the Monitoring and Reporting Program attached to this Order.

p. The results of all monitoring required by this Order shall be reported to the Regional Water Board, and shall be submitted in such a format as to allow direct comparison with the limitations and requirements contained in the Notice of Applicability. Unless otherwise specified, discharge flows shall be reported in terms of the monthly average and the daily maximum discharge flows.

q. The Regional Water Board is authorized to enforce the terms of this permit under several provisions of the CWC, including, but not limited to, sections 13385, 13386, and 13387.

r. In the event a Discharger does not comply or will be unable to comply for any reason, with any prohibition, maximum daily effluent limitation, 1-hour average effluent limitation, or receiving water limitation contained in this Order, the Discharger shall notify the Regional Water Board by telephone (916) 464-3291 within 24 hours of having knowledge of such noncompliance, and shall confirm this notification in writing within 5 days, unless the Regional Water Board waives confirmation. The written notification shall include the information required by the Standard Provision contained in Attachment D section V.E.1.
[40 CFR 122.41(l)(6)(i)].

B. Monitoring and Reporting Program Requirements

Each Discharger shall comply with the Monitoring and Reporting Program, and future revisions thereto, in Attachment E of this Order as specified in the Notice of Applicability from the Executive Officer.

C. Special Provisions

1. Reopener Provisions

a. This Order may be reopened for modification, or revocation and reissuance in accordance with the provisions contained in 40 CFR 122.62.

b. Conditions that necessitate a major modification of a permit are described in 40 CFR 122.62, including:

i. If new or amended applicable water quality standards are promulgated or approved pursuant to section 303 of the CWA, or amendments thereto, this permit may be reopened and modified in accordance with the new or amended standards.

ii. When new information, that was not available at the time of permit issuance, would have justified different permit conditions at the time of issuance.

c. Total Residual Chlorine. If a statewide policy for total residual chlorine is adopted during the term of this Order, this Order may be reopened and modified to maintain consistency with the statewide policy.

2. Special Studies, Technical Reports, and Additional Monitoring Requirements

a. Pollution Prevention and Monitoring and Reporting Plan (PPMRP). Water suppliers enrolling under this General Order that have or propose to have numerous discharge points shall prepare and implement a PPMRP in lieu of the specific Effluent Monitoring Requirements and Receiving Water Monitoring Requirements contained in sections IV and VIII of the Monitoring and Reporting Program (Attachment E). The PPMRP must be submitted with the Notice of Intent and is subject to approval by the Executive Officer. The PPMRP shall include, at a minimum, the elements identified in Attachment H and shall be prepared and implemented in accordance with the General Monitoring Provisions, Other Monitoring Requirements, and Reporting Requirements contained in sections I, IX, and X, respectively, of the Monitoring and Reporting Program (Attachment E).

3. Best Management Practices and Pollution Prevention

a. Salinity. Each Discharger authorized to discharge under this General Order shall utilize practices to minimize discharges of salinity.

4. Construction, Operation and Maintenance Specifications

[Not Applicable]

5. Special Provisions for Municipal Facilities (POTWs Only)

[Not Applicable]

6. Other Special Provisions

a. In the event of any change in control or ownership of land or waste discharge facilities presently owned or controlled by the Discharger, the Discharger shall notify the succeeding owner or operator of the existence of this Order by letter, a copy of which shall be immediately forwarded to the Regional Water Board.

To assume operation under this Order, the succeeding owner or operator must apply in writing to the Executive Officer requesting transfer of the Order. The request must contain the requesting entity's full legal name, the State of incorporation if a corporation, address and telephone number of the persons responsible for contact with the Regional Water Board and a statement. The statement shall comply with the signatory and certification requirements in the federal Standard Provisions (Attachment D, section V.B.) and state that the new owner or operator assumes full responsibility for compliance with this Order. Failure to submit the request shall be considered a discharge without requirements, a violation of the CWC. Transfer shall be approved or disapproved in writing by the Executive Officer.

b. Collected screenings and other solids removed from liquid wastes shall be disposed of in a manner that is consistent with Chapter 15, Division 3, Title 23 of the CCR and approved by the Executive Officer.

Any proposed change in solids use or disposal practice shall be reported to the Executive Officer and USEPA Regional Administrator at least 90 days in advance of the change.

7. Compliance Schedules

[Not Applicable]

VIII. COMPLIANCE DETERMINATION

Total Residual Chlorine Effluent Limitations. Monitoring for chlorine residual or for dechlorination agent residual in the effluent is an appropriate method for compliance determination. A positive residual dechlorination agent in the effluent indicates that chlorine is not present in the discharge, which demonstrates compliance with the effluent limitations. This type of monitoring can also be used to prove that some chlorine residual exceedances are false positives. For Dischargers that dechlorinate, field monitoring data showing either a positive dechlorination agent residual or a chlorine residual at or below the prescribed limit is sufficient to show compliance with the total residual chlorine effluent limitations, as long as the instruments are maintained and calibrated in accordance with the manufacturer's recommendations.

Any quantifiable excursion above the 1-hour average or 4-day average total residual chlorine effluent limitations is a violation. "Quantifiable" means any excursion greater than or equal to a reporting level of 0.08 mg/L, or any more stringent reporting level included in a final statewide policy or standard for total residual chlorine.

If the Discharger conducts continuous monitoring and the Discharger can demonstrate, through data collected from a back-up monitoring system and submitted in its monitoring reports, that a chlorine spike recorded by the continuous monitor was not actually due to chlorine, then any excursion resulting from the recorded spikes may not be considered an exceedance, but rather reported as a false positive.

ATTACHMENT A – DEFINITIONS

Arithmetic Mean (μ)
Also called the average, is the sum of measured values divided by the number of samples. For ambient water concentrations, the arithmetic mean is calculated as follows:

Arithmetic mean = $\mu = \Sigma x / n$ where: Σx is the sum of the measured ambient water concentrations, and n is the number of samples.

Average Monthly Effluent Limitation (AMEL)
The highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.

Average Weekly Effluent Limitation (AWEL)
The highest allowable average of daily discharges over a calendar week (Sunday through Saturday), calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week.

Bioaccumulative
Those substances taken up by an organism from its surrounding medium through gill membranes, epithelial tissue, or from food and subsequently concentrated and retained in the body of the organism.

Carcinogenic
Pollutants are substances that are known to cause cancer in living organisms.

Coefficient of Variation (CV)
CV is a measure of the data variability and is calculated as the estimated standard deviation divided by the arithmetic mean of the observed values.

Daily Discharge
Daily Discharge is defined as either: (1) the total mass of the constituent discharged over the calendar day (12:00 am through 11:59 pm) or any 24-hour period that reasonably represents a calendar day for purposes of sampling (as specified in the permit), for a constituent with limitations expressed in units of mass or; (2) the unweighted arithmetic mean measurement of the constituent over the day for a constituent with limitations expressed in other units of measurement (e.g., concentration).

The daily discharge may be determined by the analytical results of a composite sample taken over the course of 1 day (a calendar day or other 24-hour period defined as a day) or by the arithmetic mean of analytical results from one or more grab samples taken over the course of the day.

For composite sampling, if 1 day is defined as a 24-hour period other than a calendar day, the analytical result for the 24-hour period will be considered as the result for the calendar day in which the 24-hour period ends.

Detected, but Not Quantified (DNQ)
DNQ are those sample results less than the RL, but greater than or equal to the laboratory's MDL.

Dilution Credit
Dilution Credit is the amount of dilution granted to a discharge in the calculation of a water quality-based effluent limitation, based on the allowance of a specified mixing zone. It is calculated from the dilution ratio or determined through conducting a mixing zone study or modeling of the discharge and receiving water.

Effluent Concentration Allowance (ECA)
ECA is a value derived from the water quality criterion/objective, dilution credit, and ambient background concentration that is used, in conjunction with the coefficient of variation for the effluent monitoring data, to calculate a long-term average (LTA) discharge concentration. The ECA has the same meaning as waste load allocation (WLA) as used in USEPA guidance (Technical Support Document For Water Quality-based Toxics Control, March 1991, second printing, EPA/505/2-90-001).

Enclosed Bays
Enclosed Bays means indentations along the coast that enclose an area of oceanic water within distinct headlands or harbor works. Enclosed bays include all bays where the narrowest distance between the headlands or outermost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. Enclosed bays include, but are not limited to, Humboldt Bay, Bodega Harbor, Tomales Bay, Drake's Estero, San Francisco Bay, Morro Bay, Los Angeles-Long Beach Harbor, Upper and Lower Newport Bay, Mission Bay, and San Diego Bay. Enclosed bays do not include inland surface waters or ocean waters.

Estimated Chemical Concentration
The estimated chemical concentration that results from the confirmed detection of the substance by the analytical method below the ML value.

Estuaries
Estuaries means waters, including coastal lagoons, located at the mouths of streams that serve as areas of mixing for fresh and ocean waters. Coastal lagoons and mouths of streams that are temporarily separated from the ocean by sandbars shall be considered estuaries. Estuarine waters shall be considered to extend from a bay or the open ocean to a point upstream where there is no significant mixing of fresh water and seawater. Estuarine waters included, but are not limited to, the Sacramento-San Joaquin Delta, as defined in CWC section 12220, Suisun Bay, Carquinez Strait downstream to the Carquinez Bridge, and appropriate areas of the Smith, Mad, Eel, Noyo, Russian, Klamath, San Diego, and Otay rivers. Estuaries do not include inland surface waters or ocean waters.

Inland Surface Waters
All surface waters of the State that do not include the ocean, enclosed bays, or estuaries.

Instantaneous Maximum Effluent Limitation
The highest allowable value for any single grab sample or aliquot (i.e., each grab sample or aliquot is independently compared to the instantaneous maximum limitation).

Instantaneous Minimum Effluent Limitation
The lowest allowable value for any single grab sample or aliquot (i.e., each grab sample or aliquot is independently compared to the instantaneous minimum limitation).

Maximum Daily Effluent Limitation (MDEL)
The highest allowable daily discharge of a pollutant, over a calendar day (or 24-hour period). For pollutants with limitations expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement, the daily discharge is calculated as the arithmetic mean measurement of the pollutant over the day.

Median
The middle measurement in a set of data. The median of a set of data is found by first arranging the measurements in order of magnitude (either increasing or decreasing order). If the number of measurements (*n*) is odd, then the median = $X_{(n+1)/2}$. If *n* is even, then the median = $(X_{n/2} + X_{(n/2)+1})/2$ (i.e., the midpoint between the *n*/2 and *n*/2+1).

Method Detection Limit (MDL)
MDL is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero, as defined in 40 CFR Part 136, Attachment B, revised as of 3 July 1999.

Minimum Level (ML)
ML is the concentration at which the entire analytical system must give a recognizable signal and acceptable calibration point. The ML is the concentration in a sample that is equivalent to the concentration of the lowest calibration standard analyzed by a specific analytical procedure, assuming that all the method specified sample weights, volumes, and processing steps have been followed.

Mixing Zone
Mixing Zone is a limited volume of receiving water that is allocated for mixing with a wastewater discharge where water quality criteria can be exceeded without causing adverse effects to the overall water body.

Not Detected (ND)
Sample results which are less than the laboratory's MDL.

Ocean Waters
The territorial marine waters of the State as defined by California law to the extent these waters are outside of enclosed bays, estuaries, and coastal lagoons. Discharges to ocean waters are regulated in accordance with the State Water Board's California Ocean Plan.

Persistent Pollutants
Persistent pollutants are substances for which degradation or decomposition in the environment is nonexistent or very slow.

Pollutant Minimization Program (PMP)
PMP means waste minimization and pollution prevention actions that include, but are not limited to, product substitution, waste stream recycling, alternative waste management methods, and education of the public and businesses. The goal of the PMP shall be to reduce all potential sources of a priority pollutant(s) through pollutant minimization (control) strategies, including pollution prevention measures as appropriate, to maintain the effluent concentration at or below the water quality-based effluent limitation. Pollution prevention measures may be particularly appropriate for persistent bioaccumulative priority pollutants where there is evidence that beneficial uses are being impacted. The Regional Water Board may consider cost effectiveness when establishing the requirements of a PMP. The completion and implementation of a Pollution Prevention Plan, if required pursuant to CWC section 13263.3(d), shall be considered to fulfill the PMP requirements.

Pollution Prevention
Pollution Prevention means any action that causes a net reduction in the use or generation of a hazardous substance or other pollutant that is discharged into water and includes, but is not limited to, input change, operational improvement, production process change, and product reformulation (as defined in Water Code section 13263.3). Pollution prevention does not include actions that merely shift a pollutant in wastewater from one environmental medium to another environmental medium, unless clear environmental benefits of such an approach are identified to the satisfaction of the State or Regional Water Board.

Reporting Level (RL)
RL is the ML (and its associated analytical method) chosen by the Discharger for reporting and compliance determination from the MLs included in this Order. The MLs included in this Order correspond to approved analytical methods for reporting a sample result that are selected by the Regional Water Board either from Appendix 4 of the SIP in accordance with section 2.4.2 of the SIP or established in accordance with section 2.4.3 of the SIP. The ML is based on the proper application of method-based analytical procedures for sample preparation and the absence of any matrix interferences. Other factors may be applied to the ML depending on the specific sample preparation steps employed. For example, the treatment typically applied in cases where there are matrix-effects is to dilute the sample or sample aliquot by a factor of ten. In such cases, this additional factor must be applied to the ML in the computation of the RL.

Satellite Collection System
The portion, if any, of a sanitary sewer system owned or operated by a different public agency than the agency that owns and operates the wastewater treatment facility that a sanitary sewer system is tributary to.

Source of Drinking Water
Any water designated as municipal or domestic supply (MUN) in a Regional Water Board Basin Plan.

Standard Deviation (σ)
Standard Deviation is a measure of variability that is calculated as follows:

$$\sigma = (\sum[(x - \mu)^2]/(n - 1))^{0.5}$$

where:
x is the observed value;
μ is the arithmetic mean of the observed values; and
n is the number of samples.

Toxicity Reduction Evaluation (TRE)
TRE is a study conducted in a step-wise process designed to identify the causative agents of effluent or ambient toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in toxicity. The first steps of the TRE consist of the collection of data relevant to the toxicity, including additional toxicity testing, and an evaluation of facility operations and maintenance practices, and best management practices. A Toxicity Identification Evaluation (TIE) may be required as part of the TRE, if appropriate. (A TIE is a set of procedures to identify the specific chemical(s) responsible for toxicity. These procedures are performed in three phases (characterization, identification, and confirmation) using aquatic organism toxicity tests.)

ATTACHMENT B – SCREENING REQUIREMENTS FOR ALL DISCHARGES[a]

I. Dischargers seeking authorization to discharge under this General Order shall sample and analyze the effluent for the constituents contained in Table B-1. The results of the analyses shall be compared to the corresponding screening level and shall be submitted as part of the Notice of Intent.

Table B-1. Screening Levels for Priority Pollutants

Priority Pollutant[1]	Units	Screening Level (Most Stringent Objective/Criterion)	Most Stringent Objective/Criteria		
			Human Health	Chronic Aquatic Life	Acute Aquatic Life
Antimony, Total Recoverable	µg/L	6	6	--	--
Arsenic, Total Recoverable	µg/L	10	10	150	340
Beryllium, Total Recoverable	µg/L	4	4	--	--
Chromium (VI)	µg/L	11	100	11	16
Mercury, Total Recoverable	µg/L	0.05	0.05	0.77	1.4
Selenium, Total Recoverable	µg/L	5.0	20	5.0	20
Thallium, Total Recoverable	µg/L	1.7	1.7	40	1,400
Cyanide, Total (as CN)	µg/L	5.2	150	5.2	22
Asbestos	MFL	7	7	--	--
2,3,7,8-TCDD (Dioxin)	µg/L	1.3E-08	1.3E-08	0.00001	0.01
Acrolein	µg/L	320	320	--	--
Acrylonitrile	µg/L	0.059	0.059	--	7,550
Benzene	µg/L	1	1	--	--
Bromoform	µg/L	4.3	4.3	--	--
Carbon Tetrachloride	µg/L	0.25	0.25	--	--
Chlorobenzene	µg/L	70	70	--	--
Chlorodibromomethane	µg/L	0.401	0.401	--	--
Chloroethane	µg/L	--	--	--	--
2-Chloroethylvinyl Ether	µg/L	--	--	--	--
Chloroform	µg/L	80	80	1,240	--
Dichlorobromomethane	µg/L	0.56	0.56	--	--
1,1-Dichloroethane	µg/L	5	5	--	--
1,2-Dichloroethane	µg/L	0.38	0.38	20,000	--
1,1-Dichloroethylene	µg/L	0.057	0.057	--	--
1,2-Dichloropropane	µg/L	0.52	0.52	5,700	--
1,3-Dichloropropylene	µg/L	0.5	0.5	244	6,060
Ethylbenzene	µg/L	300	300	--	--
Methyl Bromide	µg/L	48	48	--	11,000
Methyl Chloride	µg/L	--	--	--	--
Methylene Chloride	µg/L	4.7	4.7	--	--
1,1,2,2-Tetrachloroethane	µg/L	0.17	0.17	2,400	--
Tetrachloroethylene	µg/L	0.8	0.8	840	--
Toluene	µg/L	150	150	--	--
1,2-Trans-Dichloroethylene	µg/L	10	10	--	--

[a] Dischargers applying for a categorical exception for meeting the priority pollutant criteria/objectives as authorized by section 5.3 of the SIP are not required to perform wastewater sampling for the priority pollutants contained in Tables B-1 or B-2. Dischargers of low volume discharges seeking an exception to the sampling requirements contained in Tables B-1 and B-2 must submit justification that the existing or proposed discharge will have no significant adverse impact on water quality.

Priority Pollutant[1]	Units	Screening Level (Most Stringent Objective/Criterion)	Most Stringent Objective/Criteria		
			Human Health	Chronic Aquatic Life	Acute Aquatic Life
1,1,1-Trichloroethane	µg/L	200	200	--	18,000
1,1,2-Trichloroethane	µg/L	0.60	0.60	9,400	--
Trichloroethylene	µg/L	2.7	2.7	--	45,000
Vinyl Chloride	µg/L	0.5	0.5	--	--
2-Chlorophenol	µg/L	120	120	--	--
2,4-Dichlorophenol	µg/L	93	93	--	--
2,4-Dimethylphenol	µg/L	540	540	--	--
2-Methyl-4,6-Dinitrophenol	µg/L	13.4	13.4	--	230
2,4-Dinitrophenol	µg/L	70	70	--	230
2-Nitrophenol	µg/L	--	--	--	--
4-Nitrophenol	µg/L	--	--	--	--
3-Methyl-4-Chlorophenol	µg/L	--	--	--	--
Pentachlorophenol	µg/L	0.28	0.28	23	30
Phenol	µg/L	21,000	21,000	--	--
2,4,6-Trichlorophenol	µg/L	2.1	2.1	--	--
Acenaphthene	µg/L	1,200	1,200	--	--
Acenaphthylene	µg/L	--	--	--	--
Anthracene	µg/L	9,600	9,600	--	--
Benzidine	µg/L	0.00012	0.00012	--	2,500
Benzo(a)Anthracene	µg/L	0.0044	0.0044	--	--
Benzo(a)Pyrene	µg/L	0.0044	0.0044	--	--
Benzo(b)Fluoranthene	µg/L	0.0044	0.0044	--	--
Benzo(ghi)Perylene	µg/L	--	--	--	--
Benzo(k)Fluoranthene	µg/L	0.0044	0.0044	--	--
Bis(2-Chloroethoxy)Methane	µg/L	--	--	--	--
Bis(2-Chloroethyl)Ether	µg/L	0.031	0.031	122	238,000
Bis(2-Chloroisopropyl)Ether	µg/L	1,400	1,400	--	--
Bis(2-Ethylhexyl)Phthalate	µg/L	1.8	1.8	--	--
4-Bromophenyl Phenyl Ether	µg/L	--	--	--	--
Butylbenzyl Phthalate	µg/L	3,000	3,000	--	--
2-Chloronaphthalene	µg/L	1,700	1,700	--	--
4-Chlorophenyl Phenyl Ether	µg/L	--	--	--	--
Chrysene	µg/L	0.0044	0.0044	--	--
Dibenzo(a,h)Anthracene	µg/L	0.0044	0.0044	--	--
1,2-Dichlorobenzene	µg/L	600	600	763	--
1,3-Dichlorobenzene	µg/L	400	400	763	--
1,4-Dichlorobenzene	µg/L	5	5	763	--
3,3-Dichlorobenzidine	µg/L	0.04	0.04	--	--
Diethyl Phthalate	µg/L	23,000	23,000	--	--
Dimethyl Phthalate	µg/L	313,000	313,000	--	--
Di-n-Butyl Phthalate	µg/L	2,700	2,700	--	--
2,4-Dinitrotoluene	µg/L	0.11	0.11	230	330
2,6-Dinitrotoluene	µg/L	--	--	--	--
Di-n-Octyl Phthalate	µg/L	--	--	--	--
1,2-Diphenylhydrazine	µg/L	0.040	0.040	--	270
Fluoranthene	µg/L	300	300	--	--
Fluorene	µg/L	1,300	1,300	--	--
Hexachlorobenzene	µg/L	0.00075	0.00075	--	250
Hexachlorobutadiene	µg/L	0.44	0.44	9.3	90
Hexachlorocyclopentadiene	µg/L	50	50	--	--

Priority Pollutant[1]	Units	Screening Level (Most Stringent Objective/Criterion)	Most Stringent Objective/Criteria		
			Human Health	Chronic Aquatic Life	Acute Aquatic Life
Hexachloroethane	µg/L	1.9	1.9	540	980
Indeno(1,2,3-cd) Pyrene	µg/L	0.0044	0.0044	--	--
Isophorone	µg/L	8.4	8.4	--	117,000
Naphthalene	µg/L	--	--	--	--
Nitrobenzene	µg/L	17	17	--	27,000
N-Nitrosodimethylamine	µg/L	0.00069	0.00069	--	
N-Nitrosodi-n-Propylamine	µg/L	0.005	0.005	--	5,850
N-Nitrosodiphenylamine	µg/L	5.0	5.0	--	5,850
Phenanthrene	µg/L	--	--	--	--
Pyrene	µg/L	960	960	--	--
1,2,4-Trichlorobenzene	µg/L	5	5	250	50
Aldrin	µg/L	0.00013	0.00013	--	3
alpha-BHC	µg/L	0.0039	0.0039	--	--
beta-BHC	µg/L	0.014	0.014	--	--
gamma-BHC	µg/L	0.019	0.019	0.08	0.95
delta-BHC	µg/L	--	--	--	--
Chlordane	µg/L	0.00057	0.00057	0.0043	2.4
4,4-DDT	µg/L	0.00059	0.00059	0.001	1.1
4,4-DDE	µg/L	0.00059	0.00059	--	--
4,4-DDD	µg/L	0.00083	0.00083	--	--
Dieldrin	µg/L	0.00014	0.00014	0.056	0.24
alpha-Endosulfan	µg/L	0.056	42	0.056	0.22
beta-Endosulfan	µg/L	0.056	110	0.056	0.22
Endosulfan Sulfate	µg/L	110	110	--	--
Endrin	µg/L	0.036	0.76	0.036	0.086
Endrin Aldehyde	µg/L	0.76	0.76	--	--
Heptachlor	µg/L	0.00021	0.00021	0.0038	0.52
Heptchlor Epoxide	µg/L	0.00010	0.00010	0.0038	0.52
PCBs sum[2]	µg/L	0.00017	0.00017	0.014	--
Toxaphene	µg/L	0.0002	0.00073	0.0002	0.73

[1] Pollutants shall be analyzed using the analytical methods described in 40 CFR Part 136 and in accordance with the General Monitoring Provisions contained in section I of the Monitoring and Reporting Program (Attachment E).

[2] This objective applies to the sum of PCB Aroclors 1242, 1254, 1221, 1232, 1248, 1280, and 1016.

II. Dischargers seeking authorization to discharge under this General Order shall sample and analyze the effluent for the constituents contained in Table B-2. The results of the analyses shall be compared to the corresponding screening level and shall be submitted as part of the Notice of Intent. The screening levels contained in Table B-2 are based on hardness. For waters with hardness concentrations less than 50 mg/L, screening levels shall be based on a hardness value of 25 mg/L. For waters with hardness concentrations greater than or equal to 50 mg/L but less than 100 mg/L, screening levels shall be based on a hardness value of 75 mg/L. For waters with hardness concentrations greater than or equal to 100 mg/L but less than 200 mg/L, screening levels shall be based on a hardness value of 150 mg/L. For waters with hardness concentrations greater than or equal to 200 mg/L, screening levels shall be based on a hardness value of 200 mg/L.

Table B-2. Screening Levels for Hardness-Dependent Metals

Parameter[1]	Units	Hardness in mg/L (H)			
		H <50	50≤ H <100	100≤ H <200	H ≥200
		Screening Level	Screening Level	Screening Level	Screening Level
Cadmium, Total Recoverable	µg/L	0.83	1.96	3.4	4.24
Chromium (III)	µg/L	67	164	288	365
Copper, Total Recoverable	µg/L	2.85	7.3	13.2	16.9
Lead, Total Recoverable	µg/L	0.54	2.2	5.3	7.7
Nickel, Total Recoverable	µg/L	16.1	40.9	73.5	93.8
Silver, Total Recoverable	µg/L	0.37	2.47	8.15	13.4
Zinc, Total Recoverable	µg/L	37	93.9	168.9	215.6

[1] Pollutants shall be analyzed using the analytical methods described in 40 CFR Part 136 and in accordance with the General Monitoring Provisions contained in section I of the Monitoring and Reporting Program (Attachment E).

ATTACHMENT C – SCREENING REQUIREMENTS FOR DISCHARGES TO SPECIFIC WATERBODIES

I. In addition to the analyses required in Attachment B, dischargers seeking authorization to discharge under this General Order to the Sacramento River from Keswick Dam to the I Street Bridge at City of Sacramento, American River from Folsom Dam to the Sacramento River, Folsom Lake, and the Sacramento-San Joaquin Delta shall sample and analyze the effluent for the constituents contained in Table C-1. The screening levels contained in Table C-1 for arsenic, copper, silver, and zinc supercede those contained in Attachment B for the same parameters. The results of the analyses shall be compared to the corresponding screening level and shall be submitted as part of the Notice of Intent.

Table C-1. Screening Levels for Discharges to the Sacramento River from Keswick Dam to the I Street Bridge at City of Sacramento, American River from Folsom Dam to the Sacramento River, Folsom Lake, and the Sacramento-San Joaquin Delta

Parameter[1]	Units	Screening Level
Arsenic, Total Recoverable	mg/L	0.01
Copper, Total Recoverable	mg/L	0.01[2]
Silver, Total Recoverable	mg/L	0.01
Zinc, Total Recoverable	mg/L	0.1[2]

[1] Pollutants shall be analyzed using the analytical methods described in 40 CFR Part 136 and in accordance with the General Monitoring Provisions contained in section I of the Monitoring and Reporting Program (Attachment E).

[2] Does not apply to Sacramento River above the State Highway 32 Bridge at Hamilton City.

II. In addition to the analyses required in Attachment B, dischargers seeking authorization to discharge under this General Order to the Sacramento River and its tributaries above the State Highway 32 Bridge at Hamilton City shall sample and analyze the effluent for the constituents contained in Table C-2. The screening levels contained in Table C-2 for copper, zinc, and cadmium supercede those contained in Attachment B for the same parameters. The results of the analyses shall be compared to the corresponding screening level and shall be submitted as part of the Notice of Intent. The screening levels contained in Table C-2 are based on hardness. For waters with hardness concentrations less than 50 mg/L, screening levels shall be based on a hardness value of 25 mg/L. For waters with hardness concentrations greater than or equal to 50 mg/L but less than 100 mg/L, screening levels shall be based on a hardness value of 75 mg/L. For waters with hardness concentrations greater than or equal to 100 mg/L but less than 200 mg/L, screening levels shall be based on a hardness value of 150 mg/L. For waters with hardness concentrations greater than or equal to 200 mg/L, screening levels shall be based on a hardness value of 200 mg/L.

Table C-2. Screening Levels for Discharges to the Sacramento River and Its Tributaries Above the State Highway 32 Bridge at Hamilton City

Parameter[1]	Units	Hardness in mg/L (H)			
		H <50	50≤ H <100	100≤ H <200	H ≥200
		Screening Level	Screening Level	Screening Level	Screening Level
Copper, Total Recoverable	µg/L	3.8	10.0	19.4	25.0
Zinc, Total Recoverable	µg/L	11.0	28.0	49.0	62.0
Cadmium, Total Recoverable	µg/L	0.13	0.49	1.0	1.6

[1] Pollutants shall be analyzed using the analytical methods described in 40 CFR Part 136 and in accordance with the General Monitoring Provisions contained in section I of the Monitoring and Reporting Program (Attachment E).

III. In addition to the analyses required in Attachment B, dischargers seeking authorization to discharge under this General Order within the Sacramento and San Joaquin River Basins and waters designated COLD in the Tulare Lake Basin shall sample and analyze the effluent for the constituents contained in Table C-3. The screening level contained in Table C-3 for persistent chlorinated hydrocarbon pesticides supercedes those contained in Attachment B for the same parameters. The results of the analyses shall be compared to the corresponding screening level and shall be submitted as part of the Notice of Intent.

Table C-3. Screening Levels for Discharges Within the Sacramento and San Joaquin River Basins and Waters Designated as COLD in the Tulare Lake Basin

Parameter[1]	Units	Screening Level
Persistent Chlorinated Hydrocarbon Pesticides	µg/L	ND[2]

[1] Pollutants shall be analyzed using the analytical methods described in 40 CFR Part 136 and in accordance with the General Monitoring Provisions contained in section I of the Monitoring and Reporting Program (Attachment E).

[2] The non-detectable (ND) screening level applies to each individual pesticide. No individual pesticide may be present in the discharge at detectable concentrations. The Discharger shall use USEPA standard analytical techniques with a maximum acceptable detection level of 0.05 µg/L. Persistent chlorinated hydrocarbon pesticides include aldrin, dieldrin, chlordane, endrin, endrin aldehyde, heptachlor, heptachlor epoxide, hexachlorocyclohexane (alpha-BHC, beta-BHC, delta-BHC, and gamma-BHC or lindane), endosulfan (alpha and beta), endosulfan sulfate, toxaphene, 4,4'DDD, 4,4'DDE, and 4,4'DDT.

ATTACHMENT D – STANDARD PROVISIONS

I. STANDARD PROVISIONS – PERMIT COMPLIANCE

A. Duty to Comply

1. The Discharger must comply with all of the conditions of this Order. Any noncompliance constitutes a violation of the Clean Water Act (CWA) and the California Water Code (CWC) and is grounds for enforcement action, for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application. (40 CFR 122.41(a).)

2. The Discharger shall comply with effluent standards or prohibitions established under section 307(a) of the CWA for toxic pollutants and with standards for sewage sludge use or disposal established under section 405(d) of the CWA within the time provided in the regulations that establish these standards or prohibitions, even if this Order has not yet been modified to incorporate the requirement. (40 CFR 122.41(a)(1).)

B. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense for a Discharger in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this Order. (40 CFR 122.41(c).)

C. Duty to Mitigate

The Discharger shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this Order that has a reasonable likelihood of adversely affecting human health or the environment. (40 CFR 122.41(d).)

D. Proper Operation and Maintenance

The Discharger shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the Discharger to achieve compliance with the conditions of this Order. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems that are installed by a Discharger only when necessary to achieve compliance with the conditions of this Order. (40 CFR 122.41(e).)

E. Property Rights

1. This Order does not convey any property rights of any sort or any exclusive privileges. (40 CFR 122.41(g).)

2. The issuance of this Order does not authorize any injury to persons or property or invasion of other private rights, or any infringement of state or local law or regulations. (40 CFR 122.5(c).)

F. Inspection and Entry

The Discharger shall allow the Regional Water Board, State Water Board, United States Environmental Protection Agency (USEPA), and/or their authorized representatives (including an authorized contractor acting as their representative), upon the presentation of credentials and other documents, as may be required by law, to (40 CFR 122.41(i); CWC section 13383):

1. Enter upon the Discharger's premises where a regulated facility or activity is located or conducted, or where records are kept under the conditions of this Order (40 CFR 122.41(i)(1));

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this Order (40 CFR 122.41(i)(2));

3. Inspect and photograph, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Order (40 CFR 122.41(i)(3)); and

4. Sample or monitor, at reasonable times, for the purposes of assuring Order compliance or as otherwise authorized by the CWA or the CWC, any substances or parameters at any location. (40 CFR 122.41(i)(4).)

G. Bypass

1. Definitions

a. "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility. (40 CFR 122.41(m)(1)(i).)

b. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities, which causes them to become inoperable, or substantial and permanent loss of natural resources that can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production. (40 CFR 122.41(m)(1)(ii).)

2. Bypass not exceeding limitations. The Discharger may allow any bypass to occur which does not cause exceedances of effluent limitations, but only if it is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions listed in Standard Provisions – Permit Compliance I.G.3, I.G.4, and I.G.5 below. (40 CFR 122.41(m)(2).)

3. Prohibition of bypass. Bypass is prohibited, and the Regional Water Board may take enforcement action against a Discharger for bypass, unless (40 CFR 122.41(m)(4)(i)):

a. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage (40 CFR 122.41(m)(4)(i)(A));

b. There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass that occurred during normal periods of equipment downtime or preventive maintenance (40 CFR 122.41(m)(4)(i)(B)); and

c. The Discharger submitted notice to the Regional Water Board as required under Standard Provisions – Permit Compliance I.G.5 below. (40 CFR 122.41(m)(4)(i)(C).)

4. The Regional Water Board may approve an anticipated bypass, after considering its adverse effects, if the Regional Water Board determines that it will meet the three conditions listed in Standard Provisions – Permit Compliance I.G.3 above. (40 CFR 122.41(m)(4)(ii).)

5. Notice

a. Anticipated bypass. If the Discharger knows in advance of the need for a bypass, it shall submit a notice, if possible at least 10 days before the date of the bypass. (40 CFR 122.41(m)(3)(i).)

b. Unanticipated bypass. The Discharger shall submit notice of an unanticipated bypass as required in Standard Provisions - Reporting V.E below (24-hour notice). (40 CFR 122.41(m)(3)(ii).)

H. Upset

Upset means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the Discharger. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation. (40 CFR 122.41(n)(1).)

1. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of Standard Provisions – Permit Compliance I.H.2 below are met. No determination made during administrative review of claims that noncompliance was

caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review. (40 CFR 122.41(n)(2).)

2. Conditions necessary for a demonstration of upset. A Discharger who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs or other relevant evidence that (40 CFR 122.41(n)(3)):

   a. An upset occurred and that the Discharger can identify the cause(s) of the upset (40 CFR 122.41(n)(3)(i));

   b. The permitted facility was, at the time, being properly operated (40 CFR 122.41(n)(3)(ii));

   c. The Discharger submitted notice of the upset as required in Standard Provisions – Reporting V.E.2.b below (24-hour notice) (40 CFR 122.41(n)(3)(iii)); and

   d. The Discharger complied with any remedial measures required under Standard Provisions – Permit Compliance I.C above. (40 CFR 122.41(n)(3)(iv).)

3. Burden of proof. In any enforcement proceeding, the Discharger seeking to establish the occurrence of an upset has the burden of proof. (40 CFR 122.41(n)(4).)

II. STANDARD PROVISIONS – PERMIT ACTION

A. General

This Order may be modified, revoked and reissued, or terminated for cause. The filing of a request by the Discharger for modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any Order condition. (40 CFR 122.41(f).)

B. Duty to Reapply

If the Discharger wishes to continue an activity regulated by this Order after the expiration date of this Order, the Discharger must apply for and obtain a new permit. (40 CFR 122.41(b).)

C. Transfers

This Order is not transferable to any person except after notice to the Regional Water Board. The Regional Water Board may require modification or revocation and reissuance of the Order to change the name of the Discharger and incorporate such other requirements as may be necessary under the CWA and the CWC. (40 CFR 122.41(l)(3) and 122.61.)

III. STANDARD PROVISIONS – MONITORING

A. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. (40 CFR 122.41(j)(1).)

B. Monitoring results must be conducted according to test procedures under 40 CFR Part 136 or, in the case of sludge use or disposal, approved under 40 CFR Part 136 unless otherwise specified in 40 CFR Part 503 unless other test procedures have been specified in this Order. (40 CFR 122.41(j)(4) and 122.44(i)(1)(iv).)

IV. STANDARD PROVISIONS – RECORDS

A. Except for records of monitoring information required by this Order related to the Discharger's sewage sludge use and disposal activities, which shall be retained for a period of at least 5 years (or longer as required by 40 CFR Part 503), the Discharger shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this Order, and records of all data used to complete the application for this Order, for a period of at least three (3) years from the date of the sample, measurement, report or application. This period may be extended by request of the Regional Water Board Executive Officer at any time. (40 CFR 122.41(j)(2).)

B. Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements (40 CFR 122.41(j)(3)(i));

2. The individual(s) who performed the sampling or measurements (40 CFR 122.41(j)(3)(ii));

3. The date(s) analyses were performed (40 CFR 122.41(j)(3)(iii));

4. The individual(s) who performed the analyses (40 CFR 122.41(j)(3)(iv));

5. The analytical techniques or methods used (40 CFR 122.41(j)(3)(v)); and

6. The results of such analyses. (40 CFR 122.41(j)(3)(vi).)

C. Claims of confidentiality for the following information will be denied (40 CFR 122.7(b)):

1. The name and address of any permit applicant or Discharger (40 CFR 122.7(b)(1)); and

2. Permit applications and attachments, permits and effluent data. (40 CFR 122.7(b)(2).)

V. STANDARD PROVISIONS – REPORTING

A. Duty to Provide Information

The Discharger shall furnish to the Regional Water Board, State Water Board, or USEPA within a reasonable time, any information which the Regional Water Board, State Water Board, or USEPA may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Order or to determine compliance with this Order. Upon request, the Discharger shall also furnish to the Regional Water Board, State Water Board, or USEPA copies of records required to be kept by this Order. (40 CFR 122.41(h); Wat. Code, § 13267.)

B. Signatory and Certification Requirements

1. All applications, reports, or information submitted to the Regional Water Board, State Water Board, and/or USEPA shall be signed and certified in accordance with Standard Provisions – Reporting V.B.2, V.B.3, V.B.4, V.B.5, V.B.6, and V.B.7 below. (40 CFR 122.41(k).)

2. For a corporation, all permit applications shall be signed by a responsible corporate officer. For the purpose of this section, a responsible corporate officer means: (i) A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures. (40 CFR 122.22(a)(1).)

3. For a partnership or sole proprietorship, all permit applications shall be signed by a general partner or the proprietor, respectively. (40 CFR 122.22(a)(2).)

4. For a municipality, State, federal, or other public agency, all permit applications shall be signed by either a principal executive officer or ranking elected official. For purposes of this provision, a principal executive officer of a federal agency includes: (i) the chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrators of USEPA). (40 CFR 122.22(a)(3).).

5. All reports required by this Order and other information requested by the Regional Water Board, State Water Board, or USEPA shall be signed by a person described

in Standard Provisions – Reporting V.B.2 above, or by a duly authorized representative of that person. A person is a duly authorized representative only if:

a. The authorization is made in writing by a person described in Standard Provisions – Reporting V.B.2 above (40 CFR 122.22(b)(1));

b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.) (40 CFR 122.22(b)(2)); and

c. The written authorization is submitted to the Regional Water Board and State Water Board. (40 CFR 122.22(b)(3).)

6. If an authorization under Standard Provisions – Reporting V.B.3 above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Standard Provisions – Reporting V.B.3 above must be submitted to the Regional Water Board and State Water Board prior to or together with any reports, information, or applications, to be signed by an authorized representative. (40 CFR 122.22(c).)

7. Any person signing a document under Standard Provisions – Reporting V.B.2 or V.B.3 above shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations." (40 CFR 122.22(d).)

C. Monitoring Reports

1. Monitoring results shall be reported at the intervals specified in the Monitoring and Reporting Program (Attachment E) in this Order. (40 CFR 122.22(l)(4).)

2. Monitoring results must be reported on a Discharge Monitoring Report (DMR) form or forms provided or specified by the Regional Water Board or State Water Board for reporting results of monitoring of sludge use or disposal practices. (40 CFR 122.41(l)(4)(i).)

3. If the Discharger monitors any pollutant more frequently than required by this Order using test procedures approved under 40 CFR Part 136 or, in the case of sludge use

or disposal, approved under 40 CFR Part 136 unless otherwise specified in 40 CFR Part 503, or as specified in this Order, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR or sludge reporting form specified by the Regional Water Board. (40 CFR 122.41(l)(4)(ii).)

4. Calculations for all limitations, which require averaging of measurements, shall utilize an arithmetic mean unless otherwise specified in this Order. (40 CFR 122.41(l)(4)(iii).)

D. Compliance Schedules

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this Order, shall be submitted no later than 14 days following each schedule date. (40 CFR 122.41(l)(5).)

E. Twenty-Four Hour Reporting

1. The Discharger shall report any noncompliance that may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the Discharger becomes aware of the circumstances. A written submission shall also be provided within five (5) days of the time the Discharger becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. (40 CFR 122.41(l)(6)(i).)

2. The following shall be included as information that must be reported within 24 hours under this paragraph (40 CFR 122.41(l)(6)(ii)):

   a. Any unanticipated bypass that exceeds any effluent limitation in this Order. (40 CFR 122.41(l)(6)(ii)(A).)

   b. Any upset that exceeds any effluent limitation in this Order. (40 CFR 122.41(l)(6)(ii)(B).)

3. The Regional Water Board may waive the above-required written report under this provision on a case-by-case basis if an oral report has been received within 24 hours. (40 CFR 122.41(l)(6)(iii).)

F. Planned Changes

The Discharger shall give notice to the Regional Water Board as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required under this provision only when (40 CFR 122.41(l)(1)):

1. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in 40 CFR 122.29(b) (40 CFR 122.41(l)(1)(i)); or

2. If the discharge is not an existing manufacturing, commercial, mining, or silvicultural discharge as referenced in 40 CFR 122.42(a), the alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants that are not subject to effluent limitations in this Order. (40 CFR 122.41(l)(1)(ii).)

The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants that are subject neither to effluent limitations in this Order nor to notification requirements under 40 CFR 122.42(a)(1) (see Additional Provisions—Notification Levels VII.A.1). (40 CFR 122.41(l)(1)(ii).)

3. If the discharge is an existing manufacturing, commercial, mining, or silvicultural discharge, the alteration or addition results in a significant change in the Discharger's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan. (40 CFR 122.41(l)(1)(iii).)

G. Anticipated Noncompliance

The Discharger shall give advance notice to the Regional Water Board or State Water Board of any planned changes in the permitted facility or activity that may result in noncompliance with General Order requirements. (40 CFR 122.41(l)(2).)

H. Other Noncompliance

The Discharger shall report all instances of noncompliance not reported under Standard Provisions – Reporting V.C, V.D, and V.E above at the time monitoring reports are submitted. The reports shall contain the information listed in Standard Provision – Reporting V.E above. (40 CFR 122.41(l)(7).)

I. Other Information

When the Discharger becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Regional Water Board, State Water Board, or USEPA, the Discharger shall promptly submit such facts or information. (40 CFR 122.41(l)(8).)

VI. STANDARD PROVISIONS – ENFORCEMENT

A. The Regional Water Board is authorized to enforce the terms of this permit under several provisions of the CWC, including, but not limited to, sections 13385, 13386, and 13387

VII. ADDITIONAL PROVISIONS – NOTIFICATION LEVELS

A. Non-Municipal Facilities

Existing manufacturing, commercial, mining, and silvicultural Dischargers shall notify the Regional Water Board as soon as they know or have reason to believe (40 CFR 122.42(a)):

1. That any activity has occurred or will occur that would result in the discharge, on a routine or frequent basis, of any toxic pollutant that is not limited in this Order, if that discharge will exceed the highest of the following "notification levels" (40 CFR 122.42(a)(1)):

a. 100 micrograms per liter (µg/L) (40 CFR 122.42(a)(1)(i));

b. 200 µg/L for acrolein and acrylonitrile; 500 µg/L for 2,4-dinitrophenol and 2-methyl-4,6-dinitrophenol; and 1 milligram per liter (mg/L) for antimony (40 CFR 122.42(a)(1)(ii));

c. Five (5) times the maximum concentration value reported for that pollutant in the Report of Waste Discharge (40 CFR 122.42(a)(1)(iii)); or

d. The level established by the Regional Water Board in accordance with 40 CFR 122.44(f). (40 CFR 122.42(a)(1)(iv).)

2. That any activity has occurred or will occur that would result in the discharge, on a non-routine or infrequent basis, of any toxic pollutant that is not limited in this Order, if that discharge will exceed the highest of the following “notification levels" (40 CFR 122.42(a)(2)):

a. 500 micrograms per liter (µg/L) (40 CFR 122.42(a)(2)(i));

b. 1 milligram per liter (mg/L) for antimony (40 CFR 122.42(a)(2)(ii));

c. Ten (10) times the maximum concentration value reported for that pollutant in the Report of Waste Discharge (40 CFR 122.42(a)(2)(iii)); or

d. The level established by the Regional Water Board in accordance with section 122.44(f). (40 CFR 122.42(a)(2)(iv).)

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ATTACHMENT E – MONITORING AND REPORTING PROGRAM

Title 40 of the Code of Federal Regulations (CFR), Part 122.48 (40 CFR 122.48) requires that all National Pollutant Discharge Elimination System (NPDES) permits specify monitoring and reporting requirements. California Water Code (CWC) sections 13267 and 13383 also authorize the Regional Water Quality Control Board (Regional Water Board) to require technical and monitoring reports. This Monitoring and Reporting Program establishes monitoring and reporting requirements, which implement the federal and California regulations.

I. GENERAL MONITORING PROVISIONS

A. Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. All samples shall be taken at the monitoring locations specified below and, unless otherwise specified, before the monitored flow joins or is diluted by any other waste stream, body of water, or substance. Monitoring locations shall not be changed without notification to and the approval of this Regional Water Board.

B. Chemical, bacteriological, and bioassay analyses shall be conducted at a laboratory certified for such analyses by the Department of Public Health (DPH; formerly the Department of Health Services). In the event a certified laboratory is not available to the Discharger, analyses performed by a non-certified laboratory will be accepted provided a Quality Assurance-Quality Control Program is instituted by the laboratory. A manual containing the steps followed in this program must be kept in the laboratory and shall be available for inspection by Regional Water Board staff. The Quality Assurance-Quality Control Program must conform to USEPA guidelines or to procedures approved by the Regional Water Board.

C. All analyses shall be performed in a laboratory certified to perform such analyses by DPH. Laboratories that perform sample analyses shall be identified in all monitoring reports.

D. Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. All monitoring instruments and devices used by the Discharger to fulfill the prescribed monitoring program shall be properly maintained and calibrated as necessary to ensure their continued accuracy. All flow measurement devices shall be calibrated at least once per year to ensure continued accuracy of the devices.

E. Monitoring results, including noncompliance, shall be reported at intervals and in a manner specified in this Monitoring and Reporting Program.

F. Laboratories analyzing monitoring samples shall be certified by DPH, in accordance with the provision of CWC section 13176, and must include quality assurance/quality control data with their reports.

II. MONITORING LOCATIONS

Each Discharger shall establish the following monitoring locations to demonstrate compliance with the effluent limitations, discharge specifications, and other requirements in this Order:

Table E-1. Monitoring Station Locations

Discharge Point Name	Monitoring Location Name	Monitoring Location Description
001[1]	EFF-001	A location where a representative sample of the effluent can be collected prior to discharging to surface water.
--	RSW-001	Shall be located 50 feet upstream from the point of discharge.
--	RSW-002	Shall be located 50 feet downstream from the point of discharge.

[1] Dischargers enrolled under this General Order for more than one discharge point must comply with effluent limitations and monitoring requirements at each discharge point.

III. INFLUENT MONITORING REQUIREMENTS

[Not Applicable]

IV. EFFLUENT MONITORING REQUIREMENTS

A. Monitoring Location EFF-001

1. For discharges having a duration greater than 4 months, the Discharger shall monitor the dewatering or low threat wastewater at EFF-001 as follows:

Table E-2. Effluent Monitoring – Discharges Greater than 4 Months in Duration

Parameter	Units	Sample Type	Minimum Sampling Frequency[1]	Required Analytical Test Method
Biochemical Oxygen Demand (5-day @ 20°C)	mg/L	Grab	1/Quarter	[2]
Chlorine, Total Residual	mg/L	Grab	1/Quarter	[2,3,4]
Electrical Conductivity @ 25°C	µmhos/cm	Grab	1/Quarter	[2]
Flow	MGD	Meter	Continuous	[2]
pH	standard units	Grab	1/Month	[2]
Settleable Solids	mL/L	Grab	1/Quarter	[2]
Total Suspended Solids	mg/L	Grab	1/Quarter	[2]
Temperature	°F	Grab	1/Month	[2]

[1] If the discharge is intermittent rather than continuous, then on the first day of each such intermittent discharge, the Discharger shall monitor and record data for all of the constituents listed above, after which the frequencies of analysis given in the schedule shall apply for the duration of each such intermittent discharge. In no event shall the Discharger be required to monitor and record data more often than twice the frequencies listed in the table.

[2] Pollutants shall be analyzed using the analytical methods described in 40 CFR Part 136.
[3] A handheld field meter may be used, provided the meter utilizes a USEPA-approved algorithm/method and is calibrated and maintained in accordance with the manufacturer's instructions. A calibration and maintenance log for each meter used for monitoring required by this Monitoring and Reporting Program shall be maintained at the Facility.
[4] Total chlorine residual must be monitored with a method sensitive to and accurate at a reporting level of 0.08 mg/L, or any more stringent reporting level included in a final statewide policy or standard for total residual chlorine.

2. For discharges having a duration less than 4 months, the Discharger shall monitor the dewatering or low threat wastewater at EFF-001 as follows:

Table E-3. Effluent Monitoring – Discharges Less than 4 Months in Duration

Parameter	Units	Sample Type	Minimum Sampling Frequency[1,2]	Required Analytical Test Method
Biochemical Oxygen Demand (5-day @ 20°C)	mg/L	Grab	2/Month	[3]
Chlorine, Total Residual	mg/L	Grab	1/Discharge Event	[3,4,5]
Electrical Conductivity @ 25°C	µmhos/cm	Grab	2/Month	[3]
pH	standard units	Grab	2/Month	[3]
Settleable Solids	mL/L	Grab	2/Month	[3]
Total Suspended Solids	mg/L	Grab	2/Month	[3]

[1] If the discharge is intermittent rather than continuous, then on the first day of each such intermittent discharge, the Discharger shall monitor and record data for all of the constituents listed above, after which the frequencies of analysis given in the schedule shall apply for the duration of each such intermittent discharge. In no event shall the Discharger be required to monitor and record data more often than twice the frequencies listed in the table.
[2] The first sample shall be collected at the start of discharge.
[3] Pollutants shall be analyzed using the analytical methods described in 40 CFR Part 136.
[4] A handheld field meter may be used, provided the meter utilizes a USEPA-approved algorithm/method and is calibrated and maintained in accordance with the manufacturer's instructions. A calibration and maintenance log for each meter used for monitoring required by this Monitoring and Reporting Program shall be maintained at the Facility.
[5] Total chlorine residual must be monitored with a method sensitive to and accurate at a reporting level of 0.08 mg/L, or any more stringent reporting level included in a final statewide policy or standard for total residual chlorine.

V. WHOLE EFFLUENT TOXICITY TESTING REQUIREMENTS

[Not Applicable]

VI. LAND DISCHARGE MONITORING REQUIREMENTS

[Not Applicable]

VII. RECLAMATION MONITORING REQUIREMENTS

[Not Applicable]

VIII. RECEIVING WATER MONITORING REQUIREMENTS – SURFACE WATER

A. Monitoring Locations RSW-001 and RSW-002

1. For discharges having a duration greater than 4 months, the Discharger shall monitor the receiving water at RSW-001 and RSW-002 as follows:

Table E-4. Receiving Water Monitoring Requirements – Discharges Greater than 4 Months in Duration

Parameter	Units	Sample Type	Minimum Sampling Frequency	Required Analytical Test Method
Dissolved Oxygen	mg/L	Grab	1/Month	[1]
Electrical Conductivity @ 25°C	µmhos/cm	Grab	1/Month	[1]
pH	standard units	Grab	1/Month	[1]
Temperature	°F	Grab	1/Month	[1]

[1] Pollutants shall be analyzed using the analytical methods described in 40 CFR Part 136.

2. For discharges having a duration less than 4 months, the Discharger shall monitor the receiving water at RSW-001 and RSW-002 as follows:

Table E-5. Receiving Water Monitoring Requirements – Discharges Less than 4 Months in Duration

Parameter	Units	Sample Type	Minimum Sampling Frequency	Required Analytical Test Method
Dissolved Oxygen	mg/L	Grab	2/Week	[1]
Electrical Conductivity @ 25°C	µmhos/cm	Grab	2/Week	[1]
pH	standard units	Grab	2/Week	[1]
Temperature	°F	Grab	2/Week	[1]

[1] Pollutants shall be analyzed using the analytical methods described in 40 CFR Part 136.

3. In conducting the receiving water sampling, a log shall be kept of the receiving water conditions throughout the reach bounded by RSW-001 and RSW-002. Attention shall be given to the presence or absence of:

a. Floating or suspended matter;
b. Discoloration;
c. Bottom deposits;
d. Aquatic life;
e. Visible films, sheens, or coatings;
f. Fungi, slimes, or objectionable growths; and
g. Potential nuisance conditions.

Notes on receiving water conditions shall be summarized in the monitoring report.

IX. OTHER MONITORING REQUIREMENTS

A. Post-Discharge Report

A post-discharge report shall be submitted after each discharge. The report shall include:

1. Any variations from the Notice of Intent;

2. If the discharge resulted in any discoloration or turbidity in the receiving water and an explanation of upstream and downstream conditions identified in the receiving water monitoring required by section VII.A.3 of this Monitoring and Reporting Program;

3. Identification and explanation of any violations of this General Order;

4. Explanation of corrective actions taken to comply with this General Order; and

5. Identification and explanation of any complaints caused by the discharge.

X. REPORTING REQUIREMENTS

A. General Monitoring and Reporting Requirements

1. New Dischargers who have received a Notice of Applicability for coverage under this General Order shall inform this Regional Water Board 24 hours before the start of the discharge.

2. Authorized Dischargers shall comply with all Standard Provisions (Attachment D) related to monitoring, reporting, and recordkeeping.

3. Upon written request of the Regional Water Board, a Discharger shall submit a summary monitoring report. The report shall contain both tabular and graphical summaries of the monitoring data obtained during the previous year(s).

4. A Discharger shall report to the Regional Water Board any toxic chemical release data it reports to the State Emergency Response Commission within 15 days of reporting the data to the Commission pursuant to section 313 of the "Emergency Planning and Community Right to Know Act" of 1986.

5. Monitoring frequencies may be adjusted by the Executive Officer to a less frequent basis if a Discharger makes a request and the request is backed by statistical trends of monitoring data submitted.

B. Self Monitoring Reports (SMRs)

1. At any time during the term of this permit, the State Water Board or the Regional Water Board may notify authorized Dischargers to electronically submit Self-Monitoring Reports (SMRs) using the State Water Board's California Integrated

Water Quality System (CIWQS) Program Web site (http://www.waterboards.ca.gov/ciwqs/index.html). Until such notification is given, each Discharger shall submit hard copy SMRs. The CIWQS Web site will provide additional directions for SMR submittal in the event there will be service interruption for electronic submittal.

2. Authorized Dischargers shall report in the SMR the results for all monitoring specified in this Monitoring and Reporting Program under sections III through IX. Dischargers shall submit quarterly SMRs including the results of all required monitoring using USEPA-approved test methods or other test methods specified in this Order. If a Discharger monitors any pollutant more frequently than required by this Order, the results of this monitoring shall be included in the calculations and reporting of the data submitted in the SMR.

3. Monitoring periods and reporting for all required monitoring shall be completed according to the following schedule:

Table E-6. Monitoring Periods and Reporting Schedule

Sampling Frequency	Monitoring Period Begins On…	Monitoring Period	SMR Due Date
1/Discharge Event	Notice of Applicability effective date	All	1 May 1 August 1 November 1 February
Continuous	Notice of Applicability effective date	All	1 May 1 August 1 November 1 February
2/Week	Sunday following Notice of Applicability effective date or on Notice of Applicability effective date if on a Sunday	Sunday through Saturday	1 May 1 August 1 November 1 February
1/Month	First day of calendar month following Notice of Applicability effective date or on Notice of Applicability effective date if that date is first day of the month	First day of calendar month through last day of calendar month	1 May 1 August 1 November 1 February
2/Month	First day of calendar month following Notice of Applicability effective date or on Notice of Applicability effective date if that date is first day of the month	First day of calendar month through last day of calendar month	1 May 1 August 1 November 1 February
1/Quarter	Closest of 1 January, 1 April, 1 July, or 1 October following (or on) Notice of Applicability effective date	1 January through 1 March 1 April through 30 June 1 July through 30 September 1 October through 31 December	1 May 1 August 1 November 1 February

4. **Reporting Protocols.** Authorized Dischargers shall report with each sample result the applicable reported Minimum Level (ML) and the current Method Detection Limit (MDL), as determined by the procedure in 40 CFR Part 136.

The Discharger shall report the results of analytical determinations for the presence of chemical constituents in a sample using the following reporting protocols:

a. Sample results greater than or equal to the reported ML shall be reported as measured by the laboratory (i.e., the measured chemical concentration in the sample).

b. Sample results less than the RL, but greater than or equal to the laboratory's MDL, shall be reported as "Detected, but Not Quantified," or DNQ. The estimated chemical concentration of the sample shall also be reported.

For the purposes of data collection, the laboratory shall write the estimated chemical concentration next to DNQ as well as the words "Estimated Concentration" (may be shortened to "Est. Conc."). The laboratory may, if such information is available, include numerical estimates of the data quality for the reported result. Numerical estimates of data quality may be percent accuracy (+ a percentage of the reported value), numerical ranges (low to high), or any other means considered appropriate by the laboratory.

c. Sample results less than the laboratory's MDL shall be reported as "Not Detected," or ND.

d. Dischargers are to instruct laboratories to establish calibration standards so that the ML value (or its equivalent if there is differential treatment of samples relative to calibration standards) is the lowest calibration standard. At no time is the Discharger to use analytical data derived from extrapolation beyond the lowest point of the calibration curve.

5. **Compliance Determination.** Compliance with effluent limitations for priority pollutants shall be determined using sample reporting protocols defined above and Attachment A of this Order. For purposes of reporting and administrative enforcement by the Regional Water Board and the State Water Board, the Discharger shall be deemed out of compliance with effluent limitations if the concentration of the priority pollutant in the monitoring sample is greater than the effluent limitation and greater than or equal to the reporting level (RL).

6. **Multiple Sample Data.** When determining compliance with an AMEL, AWEL, or MDEL for priority pollutants and more than one sample result is available, each Discharger shall compute the arithmetic mean unless the data set contains one or more reported determinations of "Detected, but Not Quantified" (DNQ) or "Not Detected" (ND). In those cases, the Discharger shall compute the median in place of the arithmetic mean in accordance with the following procedure:

a. The data set shall be ranked from low to high, ranking the reported ND determinations lowest, DNQ determinations next, followed by quantified values (if any). The order of the individual ND or DNQ determinations is unimportant.

b. The median value of the data set shall be determined. If the data set has an odd number of data points, then the median is the middle value. If the data set has an even number of data points, then the median is the average of the two values around the middle unless one or both of the points are ND or DNQ, in which case the median value shall be the lower of the two data points where DNQ is lower than a value and ND is lower than DNQ.

7. Authorized Dischargers shall submit SMRs in accordance with the following requirements:

a. The Discharger shall arrange all reported data in a tabular format. The data shall be summarized to clearly illustrate whether the facility is operating in compliance with interim and/or final effluent limitations. The Discharger is not required to duplicate the submittal of data that is entered in a tabular format within CIWQS. When electronic submittal of data is required and CIWQS does not provide for entry into a tabular format within the system, the Discharger shall electronically submit the data in a tabular format as an attachment.

b. Each Discharger shall attach a cover letter to the SMR. The information contained in the cover letter shall clearly identify violations of the WDRs; discuss corrective actions taken or planned; and the proposed time schedule for corrective actions. Identified violations must include a description of the requirement that was violated and a description of the violation.

c. SMRs must be submitted to the Regional Water Board, signed and certified as required by the Standard Provisions (Attachment D), to the address listed below:

Regional Water Quality Control Board
Central Valley Region
NPDES Compliance and Enforcement Unit
11020 Sun Center Dr., Suite #200
Rancho Cordova, CA 95670-6114

C. Discharge Monitoring Reports (DMRs)

[Not Applicable]

D. Other Reports

ATTACHMENT F – FACT SHEET

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ATTACHMENT F – FACT SHEET

As described in the Findings in section II of this Order, this Fact Sheet includes the legal requirements and technical rationale that serve as the basis for the requirements of this Order.

This Order has been prepared under a standardized format to accommodate a broad range of discharge requirements for Dischargers in California. Only those sections or subsections of this Order that are specifically identified as "not applicable" have been determined not to apply to this Discharger. Sections or subsections of this Order not specifically identified as "not applicable" are fully applicable to this Discharger.

I. PERMIT INFORMATION

A. Background

In 1972, the Federal Water Pollution Control Act (also referred to as the Clean Water Act) was amended to provide that the discharge of pollutants to waters of the United States from any point source is effectively prohibited unless the discharge is in compliance with an National Pollutant Discharge Elimination System (NPDES) Permit.

On 22 September 1989, the United States Environmental Protection Agency (USEPA) granted the State of California, through the State Water Resources Control Board (State Water Board) and the Regional Water Quality Control Boards (Regional Water Boards), the authority to issue general NPDES permits pursuant to 40 Code of Federal Regulations (CFR) Parts 122 and 123.

40 CFR 122.28 provides for issuance of general permits to regulate a category of point sources if the sources involve the same or substantially similar types of operations; discharge the same type of waste; require the same type of effluent limitations or operating conditions; require similar monitoring; and are more appropriately regulated under a general order rather than individual orders.

Dischargers of dewatering and other low threat wastewaters to surface waters of the United States are currently regulated by Order No. 5-00-175, which was adopted on 16 June 2000 and expired on 1 June 2005. The terms and conditions of the current Order have been automatically continued and remain in effect until new Waste Discharge Requirements (WDRs) and NPDES permit are adopted pursuant to this Order.

B. General Criteria

1. This Order serves as a general NPDES Permit for the discharge to surface waters of wastewater with a low threat to water quality. The following dewatering and other low threat discharges may be covered under this General Order:

   a. Well development water, which includes discharges associated with supply well installation, development, test pumping and purging;

b. Construction dewatering;

c. Pump/well testing, which includes discharges associated with the operation and maintenance activities of existing pumps and wells;

d. Pipeline/tank pressure testing, which includes discharges associated with hydrostatic testing;

e. Pipeline/tank flushing or dewatering, which includes discharges associated with flushing, cleaning, and disinfection;

f. Condensate, which includes discharges associated with atmospheric condensates such as refrigeration, air conditioners, and compressor condensates and cooling towers;

g. Water supply system, which includes discharges associated with fire hydrant flushes and system operation, maintenance, and testing activities of a water supply system; and

h. Miscellaneous dewatering and low threat discharges, which includes discharges from potable water sources, drinking fountain water, foundation or footage drainage, sea water infiltration and discharges from fire fighting activities, irrigation of vegetative erosion control measures, street wash water, diverted stream flows, water from crawl space pumps, lawn watering, individual residential car washing, rising groundwaters and natural springs, groundwater infiltration as defined in 40 CFR 35.2005(b)(20) and uncontaminated pumped groundwater, flows from riparian habitats and wetlands, waters not otherwise containing wastes as defined in California Water Code (CWC) section 13050(d), and other types of discharges identified and recommended by the permittees and approved by the Regional Water Board.

2. On 17 April 1997, the State Water Board adopted Order No. 97-03-DWQ, NPDES General Permit No. CAS000001 for the regulation of storm water discharges associated with industrial activities. Special Condition D.1 of Order No. 97-03-DWQ authorizes non-storm water discharges. Special Condition D.1.c of Order No. 97-03-DWQ allows the Regional Water Board to establish additional monitoring and reporting requirements for these discharges. The Regional Water Board finds that the additional monitoring and reporting requirements and discharge limitations contained in this Order are necessary to assure compliance with water quality objectives and standards and that coverage under this Order is therefore necessary for the following discharges listed in Special Condition D.1 of Order No. 97-03-DWQ: fire hydrant flushing; potable water sources, including potable water related to the operation, maintenance, or testing of potable water systems; atmospheric condensates including refrigeration, air conditioning and compressor condensate, and groundwater dewatering systems.

3. On 19 August 1999, the State Water Board adopted Order No. 99-08-DWQ, NPDES General Permit No. CAS000002 for the regulation of storm water discharges

associated with construction activities. Special Provision C.3 of Order No. 99-08-DWQ allows for the limited discharge of non-storm water discharges where they do not cause or contribute to a violation of any water quality standard. The Receiving Water Limitations of Order No. 99-08-DWQ requires compliance with all applicable water quality standards including those contained in the Basin Plans. The Regional Water Board finds that Order No. 99-08-DWQ provides adequate water quality protection and compliance monitoring. Non-storm water discharges related to construction activities may continue to be regulated under Order No. 99-08-DWQ while construction activities continue.

4. This Order does not cover the following:

a. The treatment and discharge of water causing acute or chronic toxicity in the receiving water or containing chemicals or organic constituents, bacteria, herbicides, pesticides, oil and grease, radioactivity, salinity, or temperatures that may adversely threaten beneficial uses;

b. Wastewaters discharged to municipal wastewater collection systems;

c. Discharges to ponds, infiltration basins, spray disposal areas, subsurface infiltration, or other methods not involving discharge to surface waters and surface water drainage courses; and

d. Discharges of polluted groundwater, treated or untreated. There are many sites of groundwater pollution in the Central Valley Region of California. The pollution may have been caused by many factors including industrial activity, underground leaking tanks, and farming practices. This General Order is not intended for discharges of groundwater where such pollution exists, even if the project and/or proponent has no connection with the pollution.

5. Dischargers of dewatering and other low threat discharges who are already covered under the NPDES program, whether by general or individual permit other than Order No. 5-00-175, may elect to continue coverage under the existing permit or may submit a complete Notice of Intent for coverage under this General Order. Dischargers who submit a complete Notice of Intent under this General Order are not required to submit an individual permit application. The Regional Water Board may request additional information and determine that a Discharger is not eligible for coverage under this General Order and would be better regulated under an individual or other general NPDES permit or, for discharges to land, under WDRs. If the Regional Water Board issues an NPDES permit or WDRs, the applicability of this General Order to the specified discharge is immediately terminated on the effective date of the NPDES permit or WDRs.

II. NOTIFICATION REQUIREMENTS

A. Dischargers enrolling for coverage under this General Order are required to submit a complete Notice of Intent, as detailed in Attachment G, which includes:

1. General information about the Discharger and the existing or proposed discharge.

2. A project map which includes the location of the project, discharge point(s), and receiving water. The map shall also identify wells and residences within 1,500 feet.

3. Evaluation of reclamation options.

Pursuant to section 2, Article X, California Constitution, and CWC section 275, on preventing waste and unreasonable use of waters of the state, the Regional Water Board encourages, wherever practicable, water conservation and/or re-use of wastewater. Therefore, to obtain coverage under this Order, Dischargers are required to evaluate their reclamation options. These options include:

a. Sanitary Sewage System

If all the discharge is accepted by the local municipal wastewater treatment plant (WWTP), then authorization to discharge under an NPDES permit is not needed for the proposed project. Dischargers may submit any denial or restrictive flow letter from the WWTP as proof that this option is not viable or explain why it is infeasible to connect to the WWTP.

b. Land Disposal

The land disposal option is usually restricted to the dry season (May through October) unless the Discharger can prove that the discharge can be retained on land during the wet season (November through April). All Dischargers must fully explain why land disposal is not a viable option.

c. Underground Injection

Additional information regarding the feasibility of underground injection as a disposal option can be obtained from the USEPA Region 9 Office, Underground Injection Control Unit.

4. Blueprints of the proposed treatment system.

Though treatment of the effluent is not required by this General Order, continuous compliance with the requirements of this General Order is required. If there is any doubt about the ability to continuously comply with the requirements of this General Order, the Discharger shall contact a professional engineer to assure the effluent is properly treated prior to discharge. Dischargers seeking authorization to discharge under this General Order must provide engineering blueprints of the existing or proposed treatment system to reduce any pollutants to levels that will meet the

effluent limitations prior to discharging into surface waters. Plans submitted must be signed by a Registered Engineer or Geologist.

5. Categorical exception for priority pollutant criteria and objectives.

As discussed in section III.K of this General Order, section 5.3 of the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (State Implementation Policy or SIP) allows the Regional Water Board to allow certain Dischargers short-term or seasonal exceptions from meeting priority pollutant criteria and objectives. These exceptions are for discharges that are necessary to implement control measures that fulfill statutory requirements regarding drinking water. Dischargers applying for a categorical exception to the priority pollutant criteria and objectives as authorized by section 5.3 of the SIP must submit the following information with the Notice of Intent:

a. A detailed description of the proposed action, including the proposed method of completing the action;

b. A time schedule;

c. A discharge and receiving water quality monitoring plan (before project initiation, during the project, and after project completion, with the appropriate quality assurance and quality control procedures);

d. CEQA documentation;

e. Contingency plans;

f. Identification of alternate water supply (if needed); and

g. Residual waste disposal plans.

6. Wastewater sampling.

Dischargers applying for coverage under this Order are required to analyze the existing or proposed discharge for constituents regulated under the California Toxics Rule (CTR) and applicable Basin Plans (listed in Attachments B and C), and submit the results with the Notice of Intent.

The screening levels for the constituents in Attachments B and C are based on the most restrictive water quality objectives/criteria. The most restrictive criteria are necessary because this Order is intended as a general order and covers dewatering and low threat discharges to all surface waters in the Central Valley Region of California. If the analytical test results of the discharge show that any constituent concentrations exceed the water quality screening levels listed in Attachment B and Attachment C (if applicable), then the discharge will not be allowed under this General Order. If the analytical test results of the discharge show that all constituent concentrations are below the screening levels in Attachments B and C (if applicable), then the Discharger will be enrolled under this General Order.

Dischargers applying for an exception to the priority pollutant criteria and objectives, as authorized by section 5.3 of the SIP, are not required to analyze the existing or proposed discharge for constituents regulated under the CTR as listed in Attachment B. However, if the Regional Water Board finds that the discharge does not meet the requirements for an exception to the priority pollutant criteria and objectives, the Discharger will be required to analyze the existing or proposed discharge for the constituents regulated under the CTR as listed in Attachment B and submit the analytical test results.

Section 1.3, Step 8 of the SIP reads, in part, *"The RWQCB shall require periodic monitoring (at least once prior to the issuance and reissuance of a permit) for pollutants for which criteria or objectives apply and for which no effluent limitations have been established; however, the RWQCB may choose to exempt low volume discharges, determined to have no significant adverse impact on water quality, from this monitoring requirement."* Certain types of low volume discharges (i.e., discharges having an average dry weather flow less than 0.25 MGD) may qualify for an exception to the sampling requirements contained in Attachment B, provided the Discharger can sufficiently justify that the discharge will have no significant adverse impact on water quality. For example, discharges of potable water from line flushing could be exempt from pesticide analysis since the presence of such pesticides would not be allowed in the potable water system. Dischargers seeking an exception to the sampling requirements contained in Attachment B must submit justification as part of the Notice of Intent. If the Regional Water Board finds that the justification is not sufficient to grant an exception to the sampling requirements, the Discharger will be required to analyze the existing or proposed discharge for all constituents regulated under the CTR, as listed in Attachment B, and submit the analytical test results.

If a Discharger discharges or proposes to discharge into a water quality limited segment (WQLS), the Discharger must sample the discharge for the constituents causing the impairment in the receiving water under the current 303(d) list and submit the result with the Notice of Intent. The list of WQLSs can be found under the Clean Water Act (CWA), Section 303(d) List at the web site: http://www.waterboards.ca.gov/tmdl/303d_lists2006approved.html. If the analytical data demonstrate that constituent concentrations in the discharge will contribute to the impairment of the receiving water, the discharge will not be authorized under this General Order.

7. Pollution Prevention and Monitoring and Reporting Program (PPMRP).

Special Provision VII.C.2.b requires water suppliers having more than one discharge point to prepare and implement a PPMRP rather than identify and monitor each discharge, as required in sections IV and VIII of the Monitoring and Reporting Program (Attachment E). The PPMRP must be submitted with the Notice of Intent and is subject to approval by the Executive Officer. The PPMRP must include, at a minimum, the elements identified in Attachment H.

8. Current State Water Board Adopted Permit Fees. Information concerning the applicable fees can be found at http://www.waterboards.ca.gov/fees/.

III. DISCHARGE DESCRIPTION

A. Discharge Description

Individuals and miscellaneous public and private businesses often need to discharge clean or relatively pollutant-free wastewater that poses little or no threat to water quality. These discharges are typically low volume discharges and/or short-term in nature. This General Order covers dewatering and low threat discharges to surface waters of the United States which are either 4 months or less in duration or have an average dry weather flow less than 0.25 MGD.

B. Summary of Existing Requirements

Effluent limitations contained in Order No. 5-00-175 for dewatering and other low threat discharges are as follows:

Table F-1. Historic Effluent Limitations

Parameter	Units	Effluent Limitations		
		Monthly Average	Weekly Average	Daily Maximum
Biochemical Oxygen Demand (5-day @ 20°C)	mg/L	10	15	30
Total Suspended Solids	mg/L	10	15	30
Settleable Solids	mL/L	--	--	0.1
Chlorine, Total Residual	mg/L	--	--	0.02[1]
pH	standard units	--	--	[2]
Average Dry Weather Flow	MGD	--	--	0.25[3]

[1] Effluent discharged into a surface water body shall not contain chlorine in excess of 0.02 mg/L (instantaneous maximum). If the wastewater contains chlorine in excess of 0.02 mg/L, the Discharger shall certify that chlorine will be reduced to a maximum of 0.02 mg/L before wastes enter surface water.

[2] Effluent discharged into a surface water body shall not have a pH less than 6.5 nor greater than 8.5.

[3] The average dry weather (May through October) discharge flow shall not exceed 0.25 MGD unless the discharge is 4 months or less in duration in which case there is no flow limit.

IV. APPLICABLE PLANS, POLICIES, AND REGULATIONS

The requirements contained in this Order are based on the applicable plans, policies, and regulations identified in the Findings in section II of this Order. This section provides supplemental information, where appropriate, for the plans, policies, and regulations relevant to the discharge.

A. Legal Authorities

This Order is issued pursuant to section 402 of the federal CWA and implementing regulations adopted by the USEPA and chapter 5.5, division 7 of the CWC (commencing with section 13370). It shall serve as a NPDES permit for point source discharges of dewatering and other low threat wastewaters to surface waters. This Order also serves as WDRs pursuant to article 4, chapter 4, division 7 of the CWC (commencing with section 13260).

B. California Environmental Quality Act (CEQA)

Under CWC section 13389, this action to adopt an NPDES permit is exempt from the provisions of CEQA, Public Resources Code sections 21100 through 21177. The Board's actions on issuing this permit for existing and new potable water discharges, and on the exceptions allowed by section 5.3 of the SIP is exempt from CEQA in accordance with California Code of Regulations, Title 14, Section 15061 (b)(3) which states that CEQA only applies to projects which have the potential for causing adverse environmental effects.

To satisfy the Categorical Exception requirements of Section 5.3 of the SIP, dischargers seeking enrollment under this General Order will be required to submit project-specific information to the Executive Officer on the discharge and its water quality effects. The information required by the SIP is presented in the application requirements contained in section V of Attachment G.

C. State and Federal Regulations, Policies, and Plans

1. **Water Quality Control Plans.** The Regional Water Board adopted a *Water Quality Control Plan, Fourth Edition (Revised February 2007),* for the Sacramento and San Joaquin River Basins and a *Water Quality Control Plan, Second Edition (Revised January 2004),* for the Tulare Lake Basin (hereinafter Basin Plans) that designate beneficial uses, establish water quality objectives, and contain implementation programs and policies to achieve those objectives for all waters addressed through the plans. In addition, the Basin Plans implement State Water Board Resolution No. 88-63, which established state policy that all waters, with certain exceptions, should be considered suitable or potentially suitable for municipal or domestic supply. The Basin Plans identify the typical beneficial uses as follows: municipal and domestic supply; agricultural irrigation; stock watering; process supply; service supply; hydropower supply; water contact recreation; canoeing and rafting recreation; other non-contact water recreation; warm freshwater aquatic habitat; cold freshwater habitat; warm fish migration habitat; cold fish migration habitat; warm and cold spawning habitat; wildlife habitat; navigation; rare, threatened, or endangered species habitat; groundwater recharge; and freshwater replenishment.

   Requirements of this Order implement the Basin Plans.

2. **National Toxics Rule (NTR) and California Toxics Rule (CTR).** USEPA adopted the NTR on 22 December 1992, and later amended it on 4 May 1995 and

9 November 1999. About 40 criteria in the NTR applied in California. On 18 May 2000, USEPA adopted the CTR. The CTR promulgated new toxics criteria for California and, in addition, incorporated the previously adopted NTR criteria that were applicable in the state. The CTR was amended on 13 February 2001. These rules contain water quality criteria for priority pollutants.

3. **State Implementation Policy.** On 2 March 2000, the State Water Board adopted the *Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California* (State Implementation Policy or SIP). The SIP became effective on 28 April 2000 with respect to the priority pollutant criteria promulgated for California by USEPA through the NTR and to the priority pollutant objectives established by the Regional Water Board in the Basin Plans. The SIP became effective on 18 May 2000 with respect to the priority pollutant criteria promulgated by USEPA through the CTR. The State Water Board adopted amendments to the SIP on 24 February 2005 that became effective on 13 July 2005. The SIP establishes implementation provisions for priority pollutant criteria and objectives and provisions for chronic toxicity control.

   Section 5.3 of the SIP authorizes the Regional Water Board, after compliance with CEQA, to allow certain Dischargers short-term or seasonal exceptions from meeting priority pollutant criteria and objectives. This General Order authorizes a categorical exception to priority pollutant criteria and objectives for Dischargers who submit the appropriate information required by the SIP as required in the Notice of Intent (see Attachment G).

   Requirements of this Order implement the SIP.

4. **Alaska Rule.** On 30 March 2000, USEPA revised its regulation that specifies when new and revised state and tribal water quality standards become effective for CWA purposes (40 CFR 131.21, 65 Fed. Reg. 24641 (27 April 2000)). Under the revised regulation (also known as the Alaska rule), new and revised standards submitted to USEPA after 30 May 2000, must be approved by USEPA before being used for CWA purposes. The final rule also provides that standards already in effect and submitted to USEPA by 30 May 2000, may be used for CWA purposes, whether or not approved by USEPA.

5. **Antidegradation Policy.** 40 CFR 131.12 requires that the state water quality standards include an antidegradation policy consistent with the federal policy. The State Water Board established California's antidegradation policy in State Water Board Resolution No. 68-16. Resolution No. 68-16 incorporates the federal antidegradation policy where the federal policy applies under federal law. Resolution No. 68-16 requires that existing water quality be maintained unless degradation is justified based on specific findings. The Basin Plans implement, and incorporate by reference, both the state and federal antidegradation policies. The permitted discharge must be consistent with the antidegradation provision of 40 CFR 131.12 and Resolution No. 68-16. As discussed in detail in the section V.D.4. of this Fact Sheet, the discharge is consistent with the antidegradation provisions of 40 CFR 131.12 and State Water Board Resolution 68-16.

6. **Anti-Backsliding Requirements.** Sections 402(o)(2) and 303(d)(4) of the CWA and federal regulations at 40 CFR 122.44(l) prohibit backsliding in NPDES permits. These anti-backsliding provisions require that effluent limitations in a reissued permit must be as stringent as those in the previous permit, with some exceptions in which limitations may be relaxed. Compliance with the anti-backsliding requirements is discussed in Section V.D.3.

7. **Endangered Species Act.** This Order does not authorize any act that results in the taking of a threatened or endangered species or any act that is now prohibited, or becomes prohibited in the future, under either the California Endangered Species Act (Fish and Game Code sections 2050 to 2097) or the Federal Endangered Species Act (16 U.S.C.A. sections 1531 to 1544). This Order requires compliance with effluent limitations, receiving water limitations, and other requirements to protect the beneficial uses of waters of the state. The Discharger is responsible for meeting all requirements of the applicable Endangered Species Act.

D. Impaired Water Bodies on CWA 303(d) List

1. Under section 303(d) of the 1972 CWA, states, territories and authorized tribes are required to develop lists of water quality limited segments. The waters on these lists do not meet water quality standards, even after point sources of pollution have installed the minimum required levels of pollution control technology. On 30 November 2006 USEPA gave final approval to California's 2006 section 303(d) list of WQLSs. The Basin Plans references this list of WQLSs, which are defined as "…*those sections of lakes, streams, rivers or other fresh water bodies where water quality does not meet (or is not expected to meet) water quality standards even after the application of appropriate limitations for point sources* (40 CFR Part 130, et seq.)." The Basin Plans also states, "*Additional treatment beyond minimum federal standards will be imposed on dischargers to [WQLSs]. Dischargers will be assigned or allocated a maximum allowable load of critical pollutants so that water quality objectives can be met in the segment*." Impaired waters do not support beneficial uses. If discharging or proposing to discharge into a WQLS , the Discharger must provide wastewater analysis of the 303(d) listed constituents of concern as part of the Notice of Intent.

E. Other Plans, Policies, and Regulations

1. The State Water Board adopted the *Water Quality Control Policy for the Enclosed Bays and Estuaries of California*. The requirements within this Order are consistent with the Policy.

V. RATIONALE FOR EFFLUENT LIMITATIONS AND DISCHARGE SPECIFICATIONS

Effluent limitations and toxic and pretreatment effluent standards established pursuant to sections 301 (Effluent Limitations), 302 (Water Quality Related Effluent Limitations), 304 (Information and Guidelines), and 307 (Toxic and Pretreatment Effluent Standards) of the CWA and amendments thereto are applicable to the discharge.

The CWA mandates the implementation of effluent limitations that are as stringent as necessary to meet water quality standards established pursuant to state or federal law [33 U.S.C., §1311(b)(1)(C); 40 CFR 122.44(d)(1)]. NPDES permits must incorporate discharge limits necessary to ensure that water quality standards are met. This requirement applies to narrative criteria as well as to criteria specifying maximum amounts of particular pollutants. Pursuant to federal regulations, 40 CFR 122.44(d)(1)(i), NPDES permits must contain limits that control all pollutants that "*are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard, including state narrative criteria for water quality*." Federal regulations, 40 CFR 122.44(d)(1)(vi), further provide that "[w]*here a state has not established a water quality criterion for a specific chemical pollutant that is present in an effluent at a concentration that causes, has the reasonable potential to cause, or contributes to an excursion above a narrative criterion within an applicable State water quality standard, the permitting authority must establish effluent limits*."

The CWA requires point source dischargers to control the amount of conventional, non-conventional, and toxic pollutants that are discharged into the waters of the United States. The control of pollutants discharged is established through effluent limitations and other requirements in NPDES permits. There are two principal bases for effluent limitations in the *Code of Federal Regulations*: 40 CFR 122.44(a) requires that permits include applicable technology-based limitations and standards; and 40 CFR 122.44(d) requires that permits include water quality-based effluent limitations (WQBELs) to attain and maintain applicable numeric and narrative water quality criteria to protect the beneficial uses of the receiving water where numeric water quality objectives have not been established. The Basin Plans at page IV-17.00 for the Sacramento and San Joaquin River Basins and at page IV-21 for the Tulare Lake Basin, contain an implementation policy, "*Policy for Application of Water Quality Objectives*" for the Sacramento and San Joaquin River Basins and "*Application of Water Quality Objectives*" for the Tulare Lake Basin, that specify that the Regional Water Board "*will, on a case-by-case basis, adopt numerical limitations in orders which will implement the narrative objectives*." This Policy complies with 40 CFR 122.44(d)(1). With respect to narrative objectives, the Regional Water Board must establish effluent limitations using one or more of three specified sources, including (1) USEPA's published water quality criteria, (2) a proposed state criterion (i.e., water quality objective) or an explicit state policy interpreting its narrative water quality criteria (i.e., the Regional Water Board's "*Policy for Application of Water Quality Objectives*")(40 CFR 122.44(d)(1)(vi)(A), (B) or (C)), or (3) an indicator parameter. The Basin Plans contain a narrative objective requiring that: "*All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life*" (narrative toxicity objective). The Basin Plans require the application of the most stringent objective necessary to ensure that surface water and groundwater do not contain chemical constituents, discoloration, toxic substances, radionuclides, or taste and odor producing substances that adversely affect beneficial uses. The Basin Plans state that material and relevant information, including numeric criteria, and recommendations from other agencies and scientific literature will be utilized in evaluating compliance with the narrative toxicity objective. The Basin Plans also limit chemical constituents in concentrations that adversely affect surface water beneficial uses. The

Basin Plans further state that, to protect all beneficial uses, the Regional Water Board may apply limits more stringent than maximum contaminant levels (MCLs).

A. Discharge Prohibitions

1. As stated in section I.G of Attachment D, Standard Provisions, this Order prohibits bypass from any portion of the treatment facility. Federal regulations, 40 CFR 122.41(m), define "bypass" as the intentional diversion of waste streams from any portion of a treatment facility. This section of the federal regulations, 40 CFR 122.41(m)(4), prohibits bypass unless it is unavoidable to prevent loss of life, personal injury, or severe property damage. In considering the Regional Water Board's prohibition of bypasses, the State Water Board adopted a precedential decision, Order No. WQO 2002-0015, which cites the federal regulations, 40 CFR 122.41(m), as allowing bypass only for essential maintenance to assure efficient operation.

2. The discharges authorized by this General Order are low-volume discharges and/or short-term in nature, and therefore have a low threat to water quality. For the purposes of this Order, discharges having an average dry weather discharge flow less than 0.25 MGD will be considered low volume discharges. Discharges less than 4 months in duration will be considered short-term discharges. Consistent with Order No. 5-00-175, this Order prohibits discharges that have an average dry weather discharge flow greater than 0.25 MGD unless the discharge is less than 4 months in duration. The Regional Water Board will regulate discharges that do not meet these criteria by individual orders.

B. Technology-Based Effluent Limitations

1. Scope and Authority

Section 301(b) of the CWA and implementing USEPA permit regulations at 40 CFR 122.44 require that permits include conditions meeting applicable technology-based requirements at a minimum, and any more stringent effluent limitations necessary to meet applicable water quality standards. The discharge authorized by this Order must meet minimum federal technology-based requirements based on Best Professional Judgment (BPJ) in accordance with 40 CFR 125.3.

The CWA requires that technology-based effluent limitations be established based on several levels of controls:

a. Best practicable treatment control technology (BPT) represents the average of the best performance by plants within an industrial category or subcategory. BPT standards apply to toxic, conventional, and non-conventional pollutants.

b. Best available technology economically achievable (BAT) represents the best existing performance of treatment technologies that are economically achievable

within an industrial point source category. BAT standards apply to toxic and non-conventional pollutants.

c. Best conventional pollutant control technology (BCT) represents the control from existing industrial point sources of conventional pollutants including 5-day biochemical oxygen demand (BOD_5), total suspended solids (TSS), fecal coliform, pH, and oil and grease. The BCT standard is established after considering the "cost reasonableness" of the relationship between the cost of attaining a reduction in effluent discharge and the benefits that would result, and also the cost effectiveness of additional industrial treatment beyond BPT.

d. New source performance standards (NSPS) represent the best available demonstrated control technology standards. The intent of NSPS guidelines is to set limitations that represent state-of-the-art treatment technology for new sources.

The CWA requires USEPA to develop effluent limitations, guidelines, and standards (ELGs) representing application of BPT, BAT, BCT, and NSPS. CWA section 402(a)(1) and 40 CFR 125.3 authorize the use of best professional judgment (BPJ) to derive technology-based effluent limitations on a case-by-case basis where ELGs are not available for certain industrial categories and/or pollutants of concern. Where BPJ is used, the permit writer must consider specific factors outlined in 40 CFR 125.3.

2. Applicable Technology-Based Effluent Limitations

a. The dewatering and other low threat discharges authorized by this General Order are considered high-quality wastewaters that are relatively pollutant-free and pose a low threat to water quality. Based on the expectation that the water quality of these discharges would be characteristic of wastewater that receives tertiary treatment, effluent limitations were established in Order No. 5-00-175 that reflect similar requirements established in permits for tertiary treatment plants by the Regional Water Board. These effluent limitations are retained in this General Order.

Summary of Technology-based Effluent Limitations
Discharge Point No. 001

Table F-2. Summary of Technology-based Effluent Limitations

Parameter	Units	Effluent Limitations		
		Average Monthly	Average Weekly	Maximum Daily
Biochemical Oxygen Demand (5-day @ 20°C)	mg/L	10	15	30
Total Suspended Solids	mg/L	10	15	30

C. Water Quality-Based Effluent Limitations (WQBELs)

1. Scope and Authority

Section 301(b) of the CWA and 40 CFR 122.44(d) require that permits include limitations more stringent than applicable federal technology-based requirements where necessary to achieve applicable water quality standards.

40 CFR 122.44(d)(1)(i) mandates that permits include effluent limitations for all pollutants that are or may be discharged at levels that have the reasonable potential to cause or contribute to an exceedance of a water quality standard, including numeric and narrative objectives within a standard. Where reasonable potential has been established for a pollutant, but there is no numeric criterion or objective for the pollutant, WQBELs must be established using: (1) USEPA criteria guidance under CWA section 304(a), supplemented where necessary by other relevant information; (2) an indicator parameter for the pollutant of concern; or (3) a calculated numeric water quality criterion, such as a proposed state criterion or policy interpreting the state's narrative criterion, supplemented with other relevant information, as provided in 40 CFR 122.44(d)(1)(vi).

The process for determining reasonable potential and calculating WQBELs when necessary is intended to protect the designated uses of the receiving water as specified in the Basin Plans, and achieve applicable water quality objectives and criteria that are contained in other state plans and policies, or any applicable water quality criteria contained in the CTR and NTR.

2. Applicable Beneficial Uses and Water Quality Criteria and Objectives

a. Receiving Water. Dewatering and other low threat discharges may potentially discharge to all surface waters in the Central Valley. Beneficial uses for the Sacramento and San Joaquin River Basins are as follows: municipal and domestic supply, agricultural irrigation, stock watering, process supply, service supply, and hydropower supply, water contact recreation, canoeing and rafting recreation, other non-contact water recreation, warm freshwater aquatic habitat, cold freshwater aquatic habitat, warm fish migration habitat, cold fish migration habitat, warm and cold spawning habitat, wildlife habitat, and navigation. Beneficial uses for the Tulare Lake Basin are: municipal and domestic supply; agricultural irrigation; agricultural stock watering; industrial process water supply; process water supply; hydropower supply; water contact recreation; other non-contact water recreation; warm freshwater aquatic habitat; cold freshwater aquatic habitat; wildlife habitat; rare, threatened, or endangered species habitat; cold spawning habitat; groundwater recharge; and freshwater replenishment.

b. Hardness. While no effluent limitation for hardness is necessary in this Order, hardness is critical to the assessment of reasonable potential for certain metals. The California Toxics Rule, at (c)(4), states the following:

"Application of metals criteria. (i) *For purposes of calculating freshwater aquatic life criteria for metals from the equations in paragraph (b)(2) of this section, for waters with a hardness of 400 mg/L or less as calcium carbonate, the actual ambient hardness of the surface water shall be used in those equations.*" [emphasis added]

The State Water Board, in footnote 19 to Water Quality Order No. 2004-0013, stated: "*We note that…the Regional Water Board…applied a variable hardness value whereby effluent limitations will vary depending on the actual, current hardness values in the receiving water. We recommend that the Regional Water Board establish either fixed or seasonal effluent limitations for metals, as provided in the SIP, rather than 'floating' effluent limitations*."

This General Order does not authorize discharges that have the reasonable potential to exceed water quality objectives. Therefore, screening levels must be set to protect the beneficial uses of the receiving water for all discharge conditions. In the absence of the option of including condition-dependent, "floating" screening levels that are reflective of actual conditions at the time of discharge, effluent limitations must be set using a reasonable worst-case condition in order to protect beneficial uses for all discharge conditions. Dependent on receiving water conditions, use of either the lowest observed effluent hardness or the lowest observed receiving water hardness may be more protective of aquatic life beneficial uses. For example, under effluent dominated discharge conditions, use of the lowest observed effluent hardness is the most protective.

This permit includes screening levels for cadmium, chromium (III), copper, lead, nickel, silver, and zinc which are dependent on water hardness. The CTR expresses the objectives for these metals through equations where the hardness of the receiving water is a variable. To simplify the permitting process, it was necessary that fixed hardness values be used in these equations. To calculate screening levels for waters with hardness concentrations less than 50 mg/L, a hardness value of 25 mg/L was used. To calculate screening levels for waters with hardness concentrations greater than or equal to 50 mg/L but less than 100 mg/L, a hardness value of 75 mg/L was used. To calculate screening levels for waters with hardness concentrations greater than or equal to 100 mg/L but less than 200 mg/L, a hardness value of 150 mg/L was used, and to calculate screening levels for waters with hardness concentrations greater than or equal to 200 mg/L, a hardness value of 200 mg/L was used.

The Order requires the Discharger to analyze the proposed effluent and the upstream receiving water for hardness and submit the analytical results with the Notice of Intent. Due to the uncertainty of the various types of discharge conditions that could be covered under this General Order, and in order to ensure the protection of water quality for all discharge conditions, the lowest hardness value of the proposed effluent and upstream receiving water will be used to determine the appropriate screening level (see Table B-2 of Attachment B and Table C-2 of Attachment C).

c. Assimilative Capacity/Mixing Zone. The effluent limitations for dewatering and other low threat discharges are calculated assuming no dilution. For most practical purposes, discharges from these operations do not flow directly into a receiving water with significant volume to consider dilution credit or to allocate a mixing zone. Many creeks and streams in the Central Valley are dry during the summer months. Therefore, for many months of the year, these discharges may represent all or nearly all of the flow in some portions of the receiving creeks or streams. Because this Order is intended to serve as a general order and covers discharges to all surface waters in the Central Valley, the effluent limitations established pursuant to this General Order are established to achieve the most protective water quality objective for the surface water beneficial uses in the Central Valley. Therefore, it is assumed there is no assimilative capacity and no dilution credits have been granted.

An exception to this assumption may be applied based on the demonstration of a mixing zone in accordance with section 1.4.2 of the SIP and an approved mixing zone study demonstrating compliance with water quality objectives in the receiving water as prescribed in the Basin Plans. This exception process is more appropriate for an individual order, and would not be appropriate for a general order, that should be protective of most stringent water quality objectives and beneficial uses. If a Discharger requests that a dilution credit be included in the computation of an effluent limitation or that a mixing zone be allowed, an individual order will be required. However, if no mixing zone is proposed, this General Order provides coverage for all discharges to receiving waters in the Central Valley Region.

3. Determining the Need for WQBELs

a. CWA section 301 (b)(1) requires NPDES permits to include effluent limitations that achieve technology-based standards and any more stringent limitations necessary to meet water quality standards. Water quality standards include Regional Water Board Basin Plan beneficial uses and narrative and numeric water quality objectives, State Water Board-adopted standards, and federal standards, including the CTR and NTR. The Basin Plans include numeric site-specific water quality objectives and narrative objectives for toxicity, chemical constituents, and tastes and odors. The narrative toxicity objective states: "*All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life*." With regards to the narrative chemical constituents objective, the Basin Plans state that waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses. At minimum, "…*water designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents in excess of the maximum contaminant levels (MCLs)" in Title 22 of CCR.* The narrative tastes and odors objective states: *"Water shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes or odors to domestic or municipal water supplies or to fish*

flesh or other edible products of aquatic origin, or that cause nuisance, or otherwise adversely affect beneficial uses."

b. Federal regulations require effluent limitations for all pollutants that are or may be discharged at a level that will cause or have the reasonable potential to cause, or contribute to an in-stream excursion above a narrative or numerical water quality standard.

c. This Order requires Dischargers seeking authorization to discharge under this General Order to provide analysis of the proposed effluent. As described below, based on these analyses, the Regional Water Board shall conduct an RPA in accordance with section 1.3, Step 7 of the SIP by comparing the results to the screening criteria contained in Attachment B and Attachment C (if applicable) to determine reasonable potential. Although the SIP applies directly to the control of CTR priority pollutants, the State Water Board has held that the Regional Water Board may use the SIP as guidance for water quality-based toxics control.[1] The SIP states in the introduction "*The goal of this Policy is to establish a standardized approach for permitting discharges of toxic pollutants to non-ocean surface waters in a manner that promotes statewide consistency*." Therefore, in this Order the RPA procedures from the SIP were used to evaluate reasonable potential for both CTR and non-CTR constituents.

d. All Dewatering and Other Low Threat Discharges

Chlorine Residual. Dewatering and other low threat discharges may contain chlorine, which is extremely toxic to aquatic organisms. Due to the potential for chlorine to be discharged, these discharges have a reasonable potential to cause or contribute to an in-stream excursion above the Basin Plans' narrative toxicity objective. In order to protect the beneficial uses of the receiving water, this Order includes effluent limitations for total residual chlorine.

The USEPA *Technical Support Document for Water Quality-based Toxics Control* (EPA/505/2-90-001) contains statistical methods for converting chronic (4-day) and acute (1-hour) aquatic life criteria to average monthly and maximum daily effluent limitations based on the variability of the existing data and the expected frequency of monitoring. Because projects that would be granted coverage under this General Order are typically short in duration, reasonable potential exists for acute toxicity over short periods of time and an average 1-hour limitation is considered more appropriate than an average daily limitation. Average 1-hour and 4-day effluent limitations for chlorine, based on USEPA Quality Criteria for Water, May 1986 [The Gold Book], are included in this Order.

The San Francisco Regional Water Board included a reporting level of 0.08 mg/L to determine compliance with the effluent limitations contained in the General Order for Discharges from Surface Water Treatment Facilities for Potable Supply (Order No. R2-2003-0062, NPDES No. CAG382001). The reporting level of 0.08

[1] See Order WQO 2001-16 (Napa) and Order WQO 2004-0013 (Yuba City).

mg/L represents a level that handheld field meters are capable of achieving. The Regional Water Board concurs with the approach used by the San Francisco Regional Water Board. Therefore, this Order requires dischargers to utilize a method capable of achieving a reporting level of 0.08 mg/L, consistent with the reporting level required by the San Francisco Regional Water Board, until the State Water Board adopts a statewide policy with a specified reporting level achievable in the field and laboratory. A reopener has been included that will allow the Regional Water Board to reopen the Order if a statewide policy for total residual chlorine takes effect during the term of the permit, to allow the Regional Water Board to make modifications consistent with the statewide policy. If the statewide policy includes a reporting level more stringent than 0.08 mg/L, the General Order will automatically incorporate the statewide reporting level.

Settleable Solids. For inland surface waters, the Basin Plans state that "[w]*ater shall not contain substances in concentrations that result in the deposition of material that causes nuisance or adversely affects beneficial uses.*" Settleable solids are a constituent of concern in dewatering and other low threat discharges. Order No. 5-00-175 established a maximum daily effluent limitation for settleable solids of 0.1 mL/L based on protection of the narrative settleable solids objective. This General Order retains the effluent limitation for settleable solids.

Priority Pollutants. This General Order is not intended to regulate discharges that have the reasonable potential to exceed water quality standards, which would be more appropriately regulated by an individual order. Since this is a general order for all dewatering and other low threat discharges to surface waters in the Central Valley of California, this General Order establishes screening levels in Attachment B that are protective of beneficial uses under all discharge conditions and are based on the most protective water quality criteria for priority pollutants. Dischargers enrolling under this Order are required to analyze the proposed discharge for constituents regulated under the CTR and submit the results as part of the Notice of Intent. If the analytical data demonstrate that any constituent concentrations in the discharge exceed the water quality screening levels listed in Attachment B, the discharge will not be allowed under this General Order. If all constituent concentrations are below the screening levels listed in Attachment B, the discharge will be authorized for coverage under this General Order.

Several priority pollutants do not have applicable CTR criteria or MCLs. However, water quality limits have been developed to interpret narrative Basin Plan objectives for several of these pollutants which include chloroethane, methyl chloride, 2-nitrophenol, 4-nitrophenol, 3-methyl-4-chlorophenol, 4-bromophenyl phenyl ether, 2,6-dinitrotoluene, naphthalene, and delta-BHC. Analysis of dilution, proximity of downstream diversions, and other factors is required in order to determine the applicability of interpreting the narrative objective for these pollutants based on water quality limits. This type of analysis is beyond the scope of this General Order. In addition to these pollutants, several priority

pollutants have no CTR criteria, MCLs, or alternative water quality limits to interpret narrative Basin Plan objectives. These pollutants include 2-chloroethylvinyl ether, acenaphthylene, benzo(ghi)perylene, bis(2-chloroethoxy)methane, 4-chlorophenyl phenyl ether, di-n-octyl phthalate, and pheneanthrene. A screening requirement for pollutants that do not have applicable criteria is included in Attachment B. Due to the short-term and low volume nature of the discharges covered by this General Order and the lack of applicable criteria, effluent limitations for these pollutants are not established in this General Order. However, if the analytical data demonstrate that constituent concentrations are present in the effluent at levels that affect the beneficial uses of the receiving water, then authorization for coverage under this Order will be denied and coverage under an individual permit will be required (including analysis of appropriate water quality criteria necessary to protect the beneficial uses of the receiving water).

Table F-3 summarizes the bases of screening levels contained in Attachment B.

Table F-3. Summary of Screening Level Bases for Priority Pollutants

Parameter	Basis[1]
Antimony, Total Recoverable	HH, MCL
Arsenic, Total Recoverable	HH, MCL
Beryllium, Total Recoverable	HH, MCL
Cadmium, Total Recoverable	AL, CTR
Chromium (III)	AL, CTR
Chromium (VI)	AL, CTR
Copper, Total Recoverable	AL, CTR
Lead, Total Recoverable	AL, CTR
Mercury, Total Recoverable	HH, CTR
Nickel, Total Recoverable	AL, CTR
Selenium, Total Recoverable	AL, CTR
Silver, Total Recoverable	AL, CTR
Thallium, Total Recoverable	HH, CTR
Zinc, Total Recoverable	AL, CTR
Cyanide, Total (as CN)	AL, CTR
Asbestos	HH, CTR
2,3,7,8-TCDD	HH, CTR
Acrolein	HH, CTR
Acrylonitrile	HH, CTR
Benzene	HH, MCL
Bromoform	HH, CTR
Carbon Tetrachloride	HH, CTR
Chlorobenzene	HH, MCL
Chlorodibromomethane	HH,CTR
Chloroform	HH, MCL
Dichlorobromomethane	HH, CTR
1,1-Dichloroethane	HH, MCL
1,2-Dichloroethane	HH, CTR
1,1-Dichloroethylene	HH, CTR
1,2-Dichloropropane	HH, CTR
1,3-Dichloropropylene	HH, MCL

Parameter	Basis[1]
Ethylbenzene	HH, MCL
Methyl Bromide	HH, CTR
Methylene Chloride	HH, CTR
1,1,2,2-Tetrachloroethane	HH, CTR
Tetrachloroethylene	HH, CTR
Toluene	HH, MCL
1,2-Trans-Dichloroethylene	HH, MCL
1,1,1-Trichloroethane	HH, MCL
1,1,2-Trichloroethane	HH, CTR
Trichloroethylene	HH, CTR
Vinyl Chloride	HH, MCL
2-Chlorophenol	HH, CTR
2,4-Dichlorophenol	HH, CTR
2,4-Dimethylphenol	HH, CTR
2-Methyl-4,6-Dinitrophenol	HH, CTR
2,4-Dinitrophenol	HH, CTR
Pentachlorophenol	HH, CTR
Phenol	HH, CTR
2,4,6-Trichlorophenol	HH, CTR
Acenaphthene	HH, CTR
Anthracene	HH, CTR
Benzidine	HH, CTR
Benzo(a)Anthracene	HH, CTR
Benzo(a)Pyrene	HH, CTR
Benzo(b)Fluoranthene	HH, CTR
Benzo(k)Fluoranthene	HH, CTR
Bis(2-Chloroethyl)Ether	HH, CTR
Bis(2-Chloroisopropyl)Ether	HH, CTR
Bis(2-Ethylhexyl)Phthalate	HH, CTR
Butylbenzyl Phthalate	HH, CTR
2-Chloronaphthalene	HH, CTR
Chrysene	HH, CTR
Dibenzo(a,h)Anthracene	HH, CTR
1,2-Dichlorobenzene	HH, MCL
1,3-Dichlorobenzene	HH, CTR
1,4-Dichlorobenzene	HH, MCL
3,3 Dichlorobenzidine	HH, CTR
Diethyl Phthalate	HH, CTR
Dimethyl Phthalate	HH, CTR
Di-n-Butyl Phthalate	HH, CTR
2,4-Dinitrotoluene	HH, CTR
1,2-Diphenylhydrazine	HH, CTR
Fluoranthene	HH, CTR
Fluorene	HH, CTR
Hexachlorobenzene	HH, CTR
Hexachlorobutadiene	HH, CTR
Hexachlorocyclopentadiene	HH, MCL
Hexachloroethane	HH, CTR
Indeno(1,2,3-cd)Pyrene	HH, CTR
Isophorone	HH, CTR
Nitrobenzene	HH, CTR

Parameter	Basis[1]
N-Nitrosodimethylamine	HH, CTR
N-Nitrosodi-n-Propylamine	HH, CTR
N-Nitrosodiphenylamine	HH, CTR
Pyrene	HH, CTR
1,2,4-Trichlorobenzene	HH, MCL
Aldrin	HH, CTR
alpha-BHC	HH, CTR
beta-BHC	HH, CTR
gamma-BHC	HH, CTR
Chlordane	HH, CTR
4,4'-DDT	HH, CTR
4,4'-DDE (linked to DDT)	HH, CTR
4,4'-DDD	HH, CTR
Dieldrin	HH, CTR
alpha-Endosulfan	AL, CTR
beta-Endolsulfan	AL, CTR
Endosulfan Sulfate	HH, CTR
Endrin	AL, CTR
Endrin Aldehyde	AL, CTR
Heptachlor	HH, CTR
Heptachlor Epoxide	HH, CTR
PCBs sum[3]	HH, CTR
Toxaphene	AL, CTR

[1] HH-Human health criteria.
MCL - Based on Primary Maximum Contaminant Level.
AL-Aquatic life criteria.
CTR - Based on water quality criteria contained in the California Toxics Rule, and applied as specified in the SIP.

e. Discharges to Specific Waterbodies

i. The Basin Plans establish specific water quality criteria for discharges to specific watersheds/reaches and are included as screening levels in Attachment C. If the discharge is within an applicable watershed/reach included in Attachment C, the Discharger is required to analyze a representative sample of the discharge for the applicable pollutants and submit the results as part of the Notice of Intent. The screening levels contained in Attachment C supercede those contained in Attachment B for respective parameters applicable to the discharge. If the analytical data demonstrate that constituent concentrations in the discharge exceed the water quality screening levels listed in Attachment C, the discharge will not be allowed under this General Order. If all constituent concentrations are below the screening levels listed in Attachment C, the discharge will be authorized for coverage under this General Order.

ii. The Basin Plan for the Sacramento and San Joaquin River Basins includes a water quality objective for surface waters (except for Goose Lake) that the "…pH shall not be depressed below 6.5 nor raised above 8.5. Changes in normal ambient pH levels shall not exceed 0.5 in fresh waters with designated

COLD or WARM beneficial uses." The Basin Plan for the Tulare Lake Basin includes a water quality objective for surface waters that the "…pH shall not be depressed below 6.5, raised above 8.3, or changed at any time more than 0.3 units from normal ambient pH." Effluent limitations for pH are included in this Order based on the Basin Plan objectives for pH.

4. WQBEL Calculations

The effluent limitations for chlorine residual were based on the Basin Plans' narrative toxicity objective and are applied directly as 4-day and 1-hour average effluent limitations. The effluent limitation for settleable solids was retained from Order No. 5-00-175 and was applied as a maximum daily effluent limitation. Basin Plan-specific objectives for pH were applied as instantaneous effluent limitations.

Summary of WQBELs
Discharge Point No. 001

Table F-4. Summary of WQBELs

Parameter	Units	Maximum Daily Effluent Limitation	4-Day Average	1-Hour Average
Chlorine, Total Residual	mg/L	--	0.011	0.019
pH	Standard units	[1]	--	--
Settleable Solids	mL/L	0.1		

[1] The pH of all dewatering and other low threat discharges within the Sacramento and San Joaquin River Basins (except Goose Creek) shall at all times be within the range of 6.5 and 8.5. The pH of all dewatering and other low threat discharges to Goose Creek shall at all times be within the range of 7.5 and 9.5. The pH of all dewatering and other low threat discharges within the Tulare Lake Basin shall at all times be within the range of 6.5 and 8.3.

5. Whole Effluent Toxicity (WET)

The Basin Plans contain a narrative toxicity objective that states, "All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life." (Basin Plan at page III-8.00 for the Sacramento and San Joaquin River Basins and III-6 for the Tulare Lake Basin.) The dewatering and other low threat discharges authorized by this General Order have a low threat to water quality. Because the discharges authorized by this General Order are low volume and/or short-term in nature and are not expected to contribute to acute or chronic toxicity, effluent limitations for acute toxicity and acute and chronic WET testing is not required by this General Order.

D. Final Effluent Limitations

1. Mass-based Effluent Limitations

[Not Applicable]

2. Averaging Periods for Effluent Limitations

40 CFR 122.45 (d) requires maximum daily and average monthly discharge limitations for all dischargers other than publicly owned treatment works unless impracticable. Effluent limitations for pH are based on numeric objectives contained in the Basin Plans and are established as instantaneous effluent limitations. The effluent limitations for BOD_5 and TSS are based on the expectation that the water quality of low threat discharges authorized by this General Order will be similar in characteristics of wastewater that receives tertiary treatment and reflects the effluent limitations required of a treatment plant that uses tertiary treatment (as reflected in maximum daily, average weekly, and average monthly effluent limitations). The effluent limitations for chlorine residual were based on the Basin Plans' narrative toxicity objectives and are applied directly as 4-day and 1-hour average effluent limitations.

3. Satisfaction of Anti-Backsliding Requirements

All effluent limitations in this Order are at least as stringent as the effluent limitations in the existing Order.

4. Satisfaction of Antidegradation Policy

The permitted discharge is consistent with the antidegradation provisions of 40 CFR 131.12 and State Water Board Resolution No. 68-16. Compliance with these requirements will result in the use of best practicable treatment or control of the discharge. Due to the expected short-term duration and the low volume of discharge expected from Dischargers regulated under this Order, the impact on existing water quality will be insignificant. This Order also requires all dischargers to implement practices to minimize the discharge of salinity to receiving waters. If, however, the Regional Water Board, subsequent to review of any Notice of Intent, finds that the impact of a discharge will not be insignificant, then authorization for coverage under this Order will be denied and coverage under an individual permit will be required (including preparation of an antidegradation analysis).

5. Summary of Final Effluent Limitations

a. All Dewatering and Other Low Threat Discharges

Table F-5. Summary of Final Effluent Limitations

Parameter	Units	Effluent Limitations			Basis[1]
		Average Monthly	Average Weekly	Maximum Daily	
Biochemical Oxygen Demand (5-day @ 20°C)	mg/L	10	15	30	TB, PO
Chlorine, Total Residual	mg/L	--	--	[2]	NAWQC
Settleable Solids	mL/L	--	--	0.1	BP, PO

Total Suspended Solids	mg/L	10	15	30	TB, PO

[1] TB – Technology-based effluent limitation based on the expectation that the water quality of low threat discharges authorized by this General Order will be characteristic of wastewater that receives tertiary treatment and reflects similar requirements established in permits for tertiary treatment plants by the Regional Water Board.
PO – Based on effluent limitations established in Order No. 5-00-175.
NAWQC – Based on USEPA's National Ambient Water Quality Criteria for the protection of freshwater aquatic life.
BP – Based on water quality objectives contained in the Basin Plans.

[2] The discharge shall not exceed the following effluent limitations for total residual chlorine:
a. 0.011 mg/L, as a 4-day average; and
b. 0.019 mg/L, as a 1-hour average.

b. Discharges to Specific Waterbodies

i. The pH of all dewatering and other low threat within the Sacramento and San Joaquin River Basins (except Goose Creek) shall at all times be within the range of 6.5 and 8.5.

ii. The pH of all dewatering and other low threat discharges to Goose Creek shall at all times be within the range of 7.5 and 9.5.

iii. The pH of all dewatering and other low threat discharges within the Tulare Lake Basin shall at all times be within the range of 6.5 and 8.3.

E. Interim Effluent Limitations

[Not Applicable]

F. Land Discharge Specifications

[Not Applicable]

G. Reclamation Specifications

[Not Applicable]

VI. RATIONALE FOR RECEIVING WATER LIMITATIONS

Basin Plan water quality objectives to protect the beneficial uses of surface water and groundwater include numeric objectives and narrative objectives, including objectives for chemical constituents, toxicity, and tastes and odors. The toxicity objective requires that surface water and groundwater be maintained free of toxic substances in concentrations that produce detrimental physiological responses in humans, plants, animals, or aquatic life. The chemical constituent objective requires that surface water and groundwater shall not contain chemical constituents in concentrations that adversely affect any beneficial use or that exceed the MCLs in Title 22, CCR. The tastes and odors objective states that surface water and groundwater shall not contain taste- or odor-producing substances in concentrations that cause nuisance or adversely affect beneficial uses. The Basin Plans require the application of the most stringent objective necessary to ensure that surface

water and groundwater do not contain chemical constituents, toxic substances, radionuclides, or taste and odor producing substances in concentrations that adversely affect domestic drinking water supply, agricultural supply, or any other beneficial use.

A. Surface Water

1. CWA section 303(a-c) requires states to adopt water quality standards, including criteria where they are necessary to protect beneficial uses. The Regional Water Board adopted water quality criteria as water quality objectives in the Basin Plans. The Basin Plans state that "*[t]he numerical and narrative water quality objectives define the least stringent standards that the Regional Water Board will apply to regional waters in order to protect the beneficial uses.*" The Basin Plans include numeric and narrative water quality objectives for various beneficial uses and water bodies. This Order contains receiving surface water limitations based on the Basin Plans' numerical and narrative water quality objectives for ammonia, bacteria, biostimulatory substances, chemical constituents, color, dissolved oxygen, floating material, oil and grease, pH, pesticides, radioactivity, suspended sediment, settleable substances, suspended material, tastes and odors, temperature, toxicity, and turbidity. This Order also requires compliance with any amendment or revision to the water quality objectives contained in the Basin Plans adopted by the Regional Water Board subsequent to adoption of this Order.

B. Groundwater

[Not Applicable]

VII. RATIONALE FOR MONITORING AND REPORTING REQUIREMENTS

40 CFR 122.48 requires that all NPDES permits specify requirements for recording and reporting monitoring results. CWC sections 13267 and 13383 authorizes the Regional Water Board to require technical and monitoring reports. The Monitoring and Reporting Program (Attachment E) of this Order, establishes monitoring and reporting requirements to implement federal and state requirements. The following provides the rationale for the monitoring and reporting requirements contained in the Monitoring and Reporting Program for dewatering and other low threat discharges.

A. Influent Monitoring

[Not Applicable]

B. Effluent Monitoring

1. Pursuant to the requirements of 40 CFR 122.44(i)(2) effluent monitoring is required for all constituents with effluent limitations. Effluent monitoring is necessary to assess compliance with effluent limitations, assess the effectiveness of the treatment process (where applicable), and to assess the impacts of the discharge on the receiving stream.

2. For discharges with a duration greater than 4 months, the effluent monitoring frequencies and sample types for BOD_5 (quarterly), TSS (quarterly), settleable solids (quarterly), flow (continuous), temperature (monthly), and pH (monthly) have been retained from Order No. 5-00-175.

3. For discharges with a duration less than 4 months, the effluent monitoring frequencies (twice monthly) and sample types for BOD_5, TSS, settleable solids, and pH have been retained from Order No. 5-00-175.

4. Effluent limitations have been established in this Order for chlorine residual. Therefore, monitoring has been established in this Order to determine compliance with the effluent limitations for chlorine residual (quarterly for discharges with a duration greater than 4 months and once per discharge event for discharges with a duration less than 4 months).

5. To address increasing salinity levels in receiving waters in the Central Valley Region of California, this General Order requires Dischargers to implement practices to minimize the discharge of salinity. Monitoring for electrical conductivity is established in this General Order to characterize salinity in dewatering and other low threat discharges and to ensure that the discharge of salinity to the receiving water is minimized (quarterly for discharges with a duration greater than 4 months and twice monthly for discharges with a duration less than 4 months).

C. Whole Effluent Toxicity Testing Requirements

The dewatering and other low threat discharges authorized by this General Order have a low threat to water quality. Because the discharges authorized by this General Order are low volume and/or short-term in nature and are not expected to contribute to acute or chronic toxicity, effluent limitations for acute toxicity and acute and chronic WET testing is not required by this General Order.

D. Receiving Water Monitoring

1. Surface Water

a. Receiving water monitoring is necessary to assess compliance with receiving water limitations and to assess the impacts of the discharge on the receiving stream.

b. Receiving water monitoring frequencies (monthly) and sample types (grab) for temperature, pH, electrical conductivity, and dissolved oxygen have been retained from Order No. 5-00-175 for discharges greater than 4 months in duration.

c. Receiving water monitoring frequencies (twice weekly) and sample types (grab) for temperature, pH, electrical conductivity, and dissolved oxygen have been retained from Order No. 5-00-175 for discharges less than 4 months in duration.

d. Consistent with Order No. 5-00-175, this General Order requires Dischargers to maintain a log of the receiving water conditions, giving attention to floating or suspended matter; discoloration; bottom deposits; aquatic life; visible films, sheens, or coatings; fungi, slimes, or objectionable growths; and potential nuisance conditions.

2. Groundwater

[Not Applicable]

E. Other Monitoring Requirements

1. Post-Discharge Report. Consistent with Order No. 5-00-175, this General Order requires Dischargers to submit a post-discharge report after each discharge.

VIII. RATIONALE FOR PROVISIONS

A. Standard Provisions

Standard Provisions, which apply to all NPDES permits in accordance with 40 CFR 122.41, and additional conditions applicable to specified categories of permits in accordance with 40 CFR 122.42, are provided in Attachment D. The discharger must comply with all standard provisions and with those additional conditions that are applicable under 40 CFR 122.42.

40 CFR 122.41(a)(1) and (b) through (n) establish conditions that apply to all State-issued NPDES permits. These conditions must be incorporated into the permits either expressly or by reference. If incorporated by reference, a specific citation to the regulations must be included in the Order. 40 CFR 123.25(a)(12) allows the state to omit or modify conditions to impose more stringent requirements. In accordance with 40 CFR 123.25, this Order omits federal conditions that address enforcement authority specified in 40 CFR 122.41(j)(5) and (k)(2) because the enforcement authority under the CWC is more stringent. In lieu of these conditions, this Order incorporates by reference CWC section 13387(e).

B. Special Provisions

1. Reopener Provisions

a. The reopener provisions allow the Regional Water Board to reopen the permit in accordance with 40 CFR 122.62.

b. Total Residual Chlorine. The State Water Board has developed the TRC/CPO draft policy, which, when adopted, is intended to establish consistent standards and implementation procedures for regulating chlorine statewide. This reopener allows the Regional Water Board to reopen the Order to include a revised reporting level to determine compliance with effluent limitations for total residual

chlorine if a statewide policy for total residual chlorine is adopted during the term of this Order.

2. Special Studies and Additional Monitoring Requirements

a. Pollution Prevention and Monitoring and Reporting Plan (PPMRP). Water suppliers may have numerous intentional and unintentional releases of fresh water to surface waters and surface water drainage courses due to many factors, including system failures, pressure releases, and pipeline/tank flushing and dewatering. For the purposes of this General Order, these multiple discharges shall be considered a project. Water suppliers covered by this General Order may include irrigation districts, water districts, and water agencies. In lieu of the specific effluent and receiving water monitoring requirements included in the Monitoring and Reporting Program (Attachment E), water suppliers with more than one discharge point must develop and implement a PPMRP in accordance with the requirements of Attachment H.

3. Best Management Practices and Pollution Prevention

a. Salinity. The Regional Water Board, with cooperation of the State Water Board, has begun the process to develop a new policy for the regulation of salinity in the Central Valley. In a statement issued at the 16 March 2006, Regional Water Board meeting, Board Member Dr. Karl Longley recommended that the Regional Water Board continue to exercise its authority to regulate discharges of salt to minimize salinity increases within the Central Valley. Dr. Longley stated, "*The process of developing new salinity control policies does not, therefore, mean that we should stop regulating salt discharges until a salinity Policy is developed. In the meantime, the Board should consider all possible interim approaches to continue controlling and regulating salts in a reasonable manner, and encourage all stakeholder groups that may be affected by the Regional Board's policy to actively participate in policy development*."

In order to address increasing salinity levels in receiving waters throughout the Central Valley Region of California, Dischargers enrolled under this General Order shall implement practices to minimize the discharge of salinity to the receiving water.

4. Construction, Operation, and Maintenance Specifications

[Not Applicable]

5. Special Provisions for Municipal Facilities (POTWs Only)

[Not Applicable]

6. Other Special Provisions

[Not Applicable]

7. Compliance Schedules

[Not Applicable]

IX. PUBLIC PARTICIPATION

The Regional Water Board is considering the issuance of WDRs that will serve as a general NPDES permit for dewatering and other low threat discharges. As a step in the WDR adoption process, the Regional Water Board staff has developed tentative WDRs. The Regional Water Board encourages public participation in the WDR adoption process.

A. Notification of Interested Parties

The Regional Water Board has notified interested agencies, parties, and persons of its intent to prescribe general WDRs for dewatering and other low threat discharges and has provided them with an opportunity to submit their written comments and recommendations. Notification was provided to interested parties through specific mailings, distribution through the Regional Water Board Lyris Email System and through publication in major newspapers for the following communities: Bakersfield, Contra Costa County, Fresno, Redding and Sacramento.

B. Written Comments

The staff determinations are tentative. Interested persons are invited to submit written comments concerning these tentative WDRs. Comments must be submitted either in person or by mail to the Executive Office at the Regional Water Board at the address above on the cover page of this Order.

To be fully responded to by staff and considered by the Regional Water Board, written comments must be received at the Regional Water Board offices by 5:00 p.m. on 1 May 2008.

C. Public Hearing

The Regional Water Board will hold a public hearing on the tentative WDRs during its regular Board meeting on the following date and time and at the following location:

Date: 12 June 2008
Time: 8:30 a.m.
Location: Regional Water Quality Control Board, Central Valley Region
11020 Sun Center Dr., Suite #200
Rancho Cordova, CA 95670

Interested persons are invited to attend. At the public hearing, the Regional Water Board will hear testimony, if any, pertinent to the discharge, WDRs, and permit. Oral testimony will be heard; however, for accuracy of the record, important testimony should be in writing.

Please be aware that dates and venues may change. Our web address is www.waterboards.ca.gov/centralvalley where you can access the current agenda for changes in dates and locations.

D. Waste Discharge Requirements Petitions

Any aggrieved person may petition the State Water Board to review the decision of the Regional Water Board regarding the final WDRs. The petition must be submitted within 30 days of the Regional Water Board's action to the following address:

State Water Resources Control Board
Office of Chief Counsel
P.O. Box 100, 1001 I Street
Sacramento, CA 95812-0100

E. Information and Copying

The tentative effluent limitations and special provisions, comments received, and other information are on file and may be inspected at the address above at any time between 8:30 a.m. and 4:45 p.m., Monday through Friday. Copying of documents may be arranged through the Regional Water Board by calling (916) 464-3291.

F. Register of Interested Persons

Any person interested in being placed on the mailing list for information regarding this general WDRs and NPDES permit should contact the Regional Water Board, reference the general WDRs and NPDES permit, and provide a name, address, and phone number.

G. Additional Information

Requests for additional information or questions regarding this Order should be directed to Mike Negrete at (916) 464-4662.

ATTACHMENT G –NOTICE OF INTENT
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

NOTICE OF INTENT

TO COMPLY WITH THE TERMS OF
GENERAL ORDER NO. R5-2008-0081
FOR
DEWATERING AND OTHER LOW
THREAT DISCHARGES TO SURFACE WATERS

A. CONTRACTOR/OPERATOR[1]

Name			
Mailing Address			
City	State	ZIP	Phone
Contact Person			
☐ Contractor	☐ Operator	☐ Contractor/Operator	
Signature:[3]		Date:	

B. PROPERTY OWNER[2]

Name			
Mailing Address			
City	State	ZIP	Phone
Contact Person			
Signature:[3]		Date:	

C. WATER SUPPLIERS (IF APPLICABLE)

Name			
Mailing Address			
City	State	ZIP	Phone
Contact Person			
Signature:[3]		Date:	

D. BILLING ADDRESS

Name			
Mailing Address			
City	State	ZIP	Phone
Contact Person			

[1] If additional owners/operators are involved, provide the information in a supplementary letter.
[2] If additional property owners are involved, provide the information in a supplementary letter.
[3] I hereby certify under penalty of perjury that the information provided in this application and in any attachments is true and accurate to the best of my knowledge. By signing this NOI, I agree to closely monitor and stop the discharge if there is any violation of the General Permit. The Regional Board will be immediately notified of any violation, of the General Permit

FORM AMENDED: 22 August 2008

E. PROFESSIONAL ENGINEER

If a professional engineer has evaluated the existing or proposed discharge for compliance with this General Order, identify.			
Name			
Mailing Address			
City	State	ZIP	Phone
Signature	Certificate No.	Date	

F. DISCHARGE LOCATION[1]

Street (including address, if any)
City/County
Nearest Cross Street(s)
Township/Range/Section T_____, R_____, Section_____, MDB&M
Attach a map of at least 1:24000 (1" = 2000') showing the discharge site (e.g., USGS 7.5' topographic map). The map should also show the treatment system, discharge point and surface waters. Wells and residences within 1,500 feet shall be identified.

G. DISCHARGE INFORMATION

Identify type of discharge	
☐ Well Development Water	☐ Pipeline/Tank Pressure Testing
☐ Construction Dewatering	☐ Pipeline/Tank Flushing or Dewatering
☐ Pump/Well Testing	☐ Condensate
☐ Water Supply System	☐ Other
If other, please describe	
If additives are in the discharge, describe and quantify	
Start Date	Stop Date (estimate)
Discharge Rate (MGD)	☐ Continuous ☐ Intermittent

H. EVALUATION OF RECLAMATION OPTIONS

Provide an evaluation of reclamation options and justification for selecting a surface water disposal alternative. If no alternative disposal options are viable, explain why (attach additional sheet as necessary). If alternative disposal options are feasible, contact the Regional Water Board. This Order does not apply if there is no discharge to surface waters.		
Is discharge to the local municipal wastewater treatment plant a viable option?	☐ Yes	☐ No
Is land disposal a viable option?	☐ Yes	☐ No
Is underground injection a viable option?	☐ Yes	☐ No

[1] Water suppliers that have more than one existing or proposed discharge point are not required to complete this section. Dischargers other than water suppliers with more than one existing or proposed discharge point should provide the information in a supplementary letter.

I. TREATMENT SYSTEM

Identify type of treatment system	☐ None	☐ Pond	☐ Other
☐ Provide narrative and schematic descriptions of the existing or proposed treatment system and engineering blueprints signed by a Registered Engineer or Geologist. If there is no treatment system, describe why treatment is not necessary.			

J. RECEIVING WATER INFORMATION

Name of receiving waterbody
Name of major downstream waterbody

K. CATEGORICAL EXCEPTION FOR PRIORITY POLLUTANT CRITERIA/OBJECTIVES

Is the discharge necessary to implement control measures regarding drinking water conducted to fulfill statutory requirements under the federal Safe Drinking Water Act or the California Health and Safety Code?	☐ YES	☐ NO
If yes, the Discharger shall submit the following for the approval of the Executive Officer:		
☐ A detailed description of the proposed action, including the proposed method of completing the action.		
☐ A time schedule.		
☐ A discharge and receiving water quality monitoring plan (before project initiation, during the project, and after project completion, with the appropriate quality and quality control procedures).		
☐ CEQA documentation.		
☐ Contingency plans.		
☐ Identification of alternate water supply (if needed).		
☐ Residual waste disposal plans.		

L. WASTEWATER SAMPLING

☐ Provide the results of analysis of the existing or proposed effluent for pollutants listed in Attachment B. Dischargers applying for a categorical exception for meeting the priority pollutant criteria/objectives as authorized by section 5.3 of the SIP are not required to perform wastewater sampling for the priority pollutants contained in Attachment B. Dischargers of low volume discharges seeking an exception to the sampling requirements contained in Attachment B must submit justification that the existing or proposed discharge will have no significant adverse impact on water quality.
☐ Provide the results of analysis of the existing or proposed effluent for pollutants listed in Attachment C (if applicable).
☐ Provide the results of analysis of the existing or proposed effluent and the upstream receiving water for hardness.
☐ Provide the results of analysis of the existing or proposed effluent for pollutants causing impairment under the current CWA 303(d) List if discharging or proposing to discharge to an impaired surface water. The list of impaired surface waters can be found under the CWA Section 303(d) list at the web site: http://www.waterboards.ca.gov/tmdl/303d_lists2006approved.html
☐ Provide the analytical data from the laboratory.

M. POLLUTION PREVENTION AND MONITORING AND REPORTING PLAN

☐ Water suppliers with more than one discharge point shall submit a Pollution Prevention and Monitoring and Reporting Plan which contains all of the elements identified in Attachment H.

N. FEE REQUIREMENTS

☐ Provide the applicable fees. Information concerning the applicable fees can be found at http://www.waterboardsb.ca.gov/fees/. Checks must be made payable to the State Water Resources Control Board.

ATTACHMENT H – POLLUTION PREVENTION AND MONITORING AND REPORTING PLAN

Water suppliers that have or propose to have numerous discharge points covered by this General Order are required to develop a Pollution Prevention and Monitoring and Reporting Plan (PPMRP) and submit with the Notice of Intent. The following requirements must be included in the PPMRP:

I. POLLUTION PREVENTION PLAN

A. Provide a general description of the distribution system and potential discharge locations. Identify pollutant types, flow rate ranges, and receiving waters.

B. Identify the treatment systems, spill contingency plans, operation and maintenance procedures, inspections, equipment, supplies, training, erosion control, etc.

II. MONITORING AND REPORTING PROGRAM

A. Develop a representative sampling and analysis program. Dischargers are not required to sample all discharges if reasonable assurance is provided that the discharges will comply with requirements. Provide rationale for selection of the effluent and receiving water monitoring plan. Describe sampling methods, locations, and frequency of monitoring. Inspection plans and visual observations for discoloration, stream bottom deposits, etc. must be included.

B. The sampling and analysis program must be developed and implemented in accordance with the General Monitoring Provisions, Other Monitoring Requirements, and Reporting Requirements contained in sections I, IX, and X, respectively, of the Monitoring and Reporting Program (Attachment E).

DEPARTMENT OF THE ARMY
SAN FRANCISCO DISTRICT, U.S. ARMY CORPS OF ENGINEERS
1455 MARKET STREET
SAN FRANCISCO, CALIFORNIA 94103-1398

Regulatory Division

SUBJECT: File Number 2002-26746S

JUL 24 2009

Ms. Susan Miller
Contra Costa Transportation Authority
3478 Buskirk Avenue, Suite 100
Pleasant Hill, California 94523

Dear Ms. Miller:

Enclosed is your signed copy of a Department of the Army permit (Enclosure 1) to widen and improve State Route 4 (SR-4) in the cities of Pittsburg and Antioch, Contra Costa County, California. The project would widen SR-4 from the existing four lanes to eight lanes with one High-Occupancy Vehicle lane (HOV) in each direction. The project also includes redesign and reconstruction of the interchanges within the project limits and the addition of auxiliary lanes between on-ramps and off-ramps.

Please complete the appropriate parts of "Project Status" form (Enclosure 2), and return it to this office as your work progresses. You are responsible for ensuring that the contractor or workers executing the activity authorized herein are knowledgeable of the terms and conditions of this authorization.

Should you have any questions regarding this matter, please call Hal Durio of our Regulatory Division at 415-503-6785. Please address all correspondence to the Regulatory Division and refer to the File Number at the head of this letter. If you would like to provide comments on our permit review process, please complete the Customer Survey Form available online at http://per2.nwp.usace.army.mil/survey.html.

Sincerely,

Jane M. Hicks

Laurence M. Farrell
Lieutenant Colonel, U.S. Army
Commanding

Enclosures

DEPARTMENT OF THE ARMY
SAN FRANCISCO DISTRICT, U.S. ARMY CORPS OF ENGINEERS
1455 MARKET STREET
SAN FRANCISCO, CALIFORNIA 94103-1398

DEPARTMENT OF THE ARMY PERMIT

PERMITTEE: Ms. Susan Miller, Contra Costa Transportation Authority

PERMIT NO.: 2002-26746S

ISSUING OFFICE: San Francisco District, U.S. Army Corps of Engineers

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate District or Division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below:

PROJECT DESCRIPTION: The Contra Costa Transit Authority (CCTA) is authorized through this Department of the Army permit to perform the following work:

A. Fill 0.048 acre (100 lineal feet) of wetland supported by sediment within a concrete lined Kirker Creek located between the existing highway and some unused railroad tracks on the south side of SR-4.

B. Fill 0.021 acre of wetland and 0.005 acre of waters of the U.S. by placing approximately 66 lineal feet of Old Kirker Creek on the south side of SR-4 into a culvert.

C. Fill 0.010 acre of wetland on the north side of SR-4 at the northwest edge of Loveridge Road at Old Kirker Creek.

D. Fill 0.022 acre (75 lineal feet) of waters of U.S. to extend culverts on both the north and south side of SR-4 at the Los Medanos Wasteway.

E. Fill 0.060 acre of wetlands and 0.066 acre of waters of the U.S. at the West Antioch Creek Complex, which will place approximately 1040 lineal feet of waters and combined wetland into new culverts.

The project is approximately 6.1 miles long. The work will widen the highway from two lanes in each direction to four lanes in each direction, one HOV lane and three mixed flow lanes. Auxiliary lanes, which span between on ramps to off ramps, have been designed into the project to allow for longer distance and safer merging of traffic. Five main intersections, Loveridge Road, Somersville, Contra Loma Boulevard-L Street, Lone Tree Way-A Street and Hillcrest Avenue, will be redesigned to accommodate the highway widening and to improve traffic flow. The G Street interchange, which currently has an eastbound exit ramp and westbound entrance ramp will be reconstructed to remove highway access and accommodate highway widening. The Cavallo Road Undercrossing and the Roosevelt Lane Pedestrian Undercrossing will be widened. (Refer to "State Route 4 (East) Widening Project: Loveridge Road To State Route 160", dated November 10, 2003.)

Because of funding and construction restrictions, the project will be built in four segments and some of the segments will be divided into phases. The work is planned to be completed over the next 10 years, as funding becomes available. Segment 1 is scheduled to be constructed first, beginning in 2009. The timing and order of Segment 2, Segment 3, and Segment 4 will be determined as funding becomes available. The segments and phases of construction are described below.

Segment 1: The Loveridge Road segment, between PM 23.7 and PM 25.8, is scheduled to be constructed first. It will tie into the previously completed SR-4 project, which ended in Pittsburg at approximately PM

24.2 (where Kirker Creek passes under SR-4). The Loveridge Road segment ends at PM 25.8, slightly east of the Los Medanos Wasteway. (For details of Segment 1, refer to "Project Plans for Construction on State Highway in Contra Costa County, in Pittsburg and Antioch from 0.9 KM West of Loveridge Road Overcrossing to 0.3 KM West of Somersville Road Undercrossing", and dated September 17, 2008).

Segment 2: The second segment, the Somersville Road Undercrossing segment, extends eastward from where the Loveridge Road segment ends and is between PM R25.61 and PM R26.62. (For details of the Somersville Road Undercrossing phase, refer to "Project Plans for Construction on State Highway in Contra Costa County, in Antioch and Pittsburg from 0.7 Mile West of Somersville Road Undercrossing to 0.5 Mile East of Somersville Road Undercrossing", dated July 15, 2008).

Segment 3: Segment 3 begins at PM 26.5 and ends at PM 27.5. The Contra Loma Boulevard-L Street Interchange will be rebuilt to accommodate widening of Contra Loma Boulevard and L Street to a four lane facility with room for left turn lanes. SR-4 will be widened and elevated 3 feet to allow more overhead over Contra Loma Boulevard-L Street, and the on and off ramps will be redesigned, adjacent to where West Antioch Creek crosses under SR-4.

The G Street Overcrossing will be reconstructed along with some of the local street intersections to accommodate SR-4 widening, improve local traffic flow and remove the on and off ramps so there will be no SR-4 access from G Street. (For details of Segment 3, refer to the project plans entitled "Project Plans for Construction of State Highway in Contra Costa County, in Antioch from 0.3 Mile West of Contra Loma Boulevard Undercrossing to 0.2 Mile East of G Street Overcrossing" and dated April 22, 2009.)

Segment 4: Segment 4 begins at the end of Segment 3 and extends to PM 29.7, near the SR4/Route 160 Interchange. Segment 4 is divided into 2 phases, which CCTA refers to as Phase 4a and Phase 4b. Phase 4a will rebuild the SR-4/Lone Tree Way-A Street Interchange and the Cavallo Road Undercrossing. Phase 4b will reconfigure the SR-4/Hillcrest Avenue Interchange and widen the highway to the end of the project limits. (For details of Segment 4A, see the project plans entitled "Project Plans for Construction on State Highway in Contra Costa County, in Antioch from 0.61 Miles West of "A" Street Undercrossing to 0.10 Miles East of Hillcrest Avenue Overcrossing" and dated January 16, 2009. For details of Segment 4B, see the project plans entitled "Project Plans for Construction on State Highway in Contra Costa County, in Antioch from 0.33 Miles West of Hillcrest Avenue Overcrossing to 0.98 Miles East of Hillcrest Avenue Overcrossing" and dated April 17, 2009.)

PROJECT LOCATION: This project is located in Pittsburg and Antioch in Contra Costa County, California. The project is on State Route 4 (SR-4) starting 0.84 mile west of Loveridge Road (Post Mile 23.7) and ending approximately 0.7 mile east of Hillcrest Avenue (Post Mile 29.7).

PERMIT CONDITIONS

GENERAL CONDITIONS:

1. The time limit for completing the work authorized ends on July 15, 2019. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity

authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and State coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions.

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

7. You understand and agree that, if future operations by the United States require the removal, relocation or other alteration of the structure or work authorized herein, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, you will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

SPECIAL CONDITIONS:

1. This Corps permit does not authorize you to take an endangered species. In order to legally take a listed species, you must have a separate authorization under the Endangered Species Act (ESA) (e.g., an ESA Section 10 permit or a Biological Opinion (BO) under ESA Section 7 with "incidental take" provisions with which you must comply). The enclosed U.S. Fish and Wildlife Service (FWS) BO dated June 13, 2005 (151422SWR04SR9275:ES) (as amended by Amendment to Biological Opinion for the State Route 4 Widening Project dated April 15, 2008 (Service File No. 1-1-05-F-0158)) contains mandatory terms and conditions to implement the reasonable and prudent measures that are associated with "incidental take" that is also specified in the BO. Your authorization under this Corps permit is conditional upon your compliance with all of the mandatory terms and conditions associated with incidental take authorized by the attached BO, whose terms and conditions are incorporated by reference in this permit. Failure to comply with the terms and conditions associated with incidental take of the BO, where a take of the listed species occurs, will constitute an unauthorized take and it will also constitute non-compliance with this Corps permit. The FWS is the appropriate authority to determine compliance with the terms and conditions of its BO and with the ESA.

2. CCTA will mitigate for the 0.139 acre of permanent wetland loss within the three segments of the project through the purchase of 0.14 acre of wetland credits from an approved wetland creation mitigation bank within the service area of the Contra Costa County SR-4 Widening Project.

3. CCTA may not begin construction on any part of the SR-4 project that will impact Corps jurisdiction until the Corps has received copies of receipts from the mitigation bank purchases (see Special Conditions 2 and above) and has approved these purchases in writing.

4. For permanent impact to 0.093 acre of other waters of the United States, CCTA shall use standard BMP (best management practices) erosion control standards on all disturbed ground associated with Corps jurisdiction, re-grade the soil surface to conform to existing grades, and plant the disturbed areas with an appropriate native species ground cover seed mix.

5. CCTA will provide the Corps with the final project plans for all project segments prior to start of work. CCTA will apply to the Corps for a permit modification before any work in waters of the U.S. if either of the following conditions arise: a) the final project plans for any segment are significantly different than the above permitted project description; or b) if impacts to waters of the U.S. are greater for any segment than described in the above permitted project description.

FURTHER INFORMATION:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

   ( ) Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. Section 403).
   (X) Section 404 of the Clean Water Act (33 U.S.C. Section 1344).
   ( ) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. Section 1413).

2. Limits of this authorization:

   a. This permit does not obviate the need to obtain other Federal, State, or local authorizations required by law.

   b. This permit does not grant any property rights or exclusive privileges.

   c. This permit does not authorize any injury to the property or rights of others.

   d. This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability: In issuing this permit, the Federal Government does not assume any liability for the following:

   a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

   b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

   c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

   d. Design or construction deficiencies associated with the permitted work.

   e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision: This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:

   a. You fail to comply with the terms and conditions of this permit.

   b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate. (See Item 4 above.)

   c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

   Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 C.F.R. Section 325.7 or enforcement procedures such as those contained in 33 C.F.R. Sections 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an

administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 C.F.R. Section 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions: General Condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

Adam J. Miller — 7/24/2009

(PERMITTEE) (DATE)

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

Jane M. Hicks — 7/24/09

Cr Laurence M. Farrell (DATE)
Lieutenant Colonel, U.S. Army
District Commander

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

(TRANSFEREE) (DATE)

Copies Furnished (w/encl 1 only):

US FWS, Sacramento, CA
CA DFG, Yountville, CA
CA RWQCB, Oakland, CA

PROJECT STATUS

Please use the forms below to report the dates when you start and finish the work authorized by the enclosed permit. Also if you suspend work for an extended period of time, use the forms below to report the dates you suspended and resumedwork. The second copy is provided for your records. If you find that you cannot complete the work within the time granted by the permit, please apply for a time extension at least one month before your permit expires. If you materially change the plan or scope of the work, it will be necessary for you to submit new drawings and a request for a modification of your permit.

(cut as needed) ----------

Date:_____

NOTICE OF COMPLETION OF WORK under Department of the Army Permit No. 26746S
TO: District Engineer, US Army Corps of Engineers, RegulatoryDivision, 1455 Market Street, 16th Floor, San Francisco, CA 94103-1398

In compliance with the conditions of Permit No.26746S, this is to notify you that work was completed on _____.

Permittee: Ms. Susan Miller, Contra Costa Transportation Authority
Address: 3478 Buskirk Avenue, Suite 100, Pleasant Hill, CA 94523

(cut as needed) ----------

Date:_____

NOTICE OF RESUMPTION OF WORK under Department of the Army Permit No.26746S
TO: District Engineer, US Army Corps of Engineers, RegulatoryDivision, 1455 Market Street, 16th Floor, San Francisco, CA 94103-1398

In compliance with the conditions of Permit No.26746S, this is to notify you that work was completed on _____.

Permittee: Ms. Susan Miller, Contra Costa Transportation Authority
Address: 3478 Buskirk Avenue, Suite 100, Pleasant Hill, CA 94523

(cut as needed) ----------

Date:_____

NOTICE OF SUSPENSION OF WORK under Department of the Army Permit No.26746S
TO: District Engineer, US Army Corps of Engineers, RegulatoryDivision, 1455 Market Street, 16th Floor, San Francisco, CA 94103-1398

In compliance with the conditions of Permit No.26746S, this is to notify you that work was completed on _____.

Permittee: Ms. Susan Miller, Contra Costa Transportation Authority
Address: 3478 Buskirk Avenue, Suite 100, Pleasant Hill, CA 94523

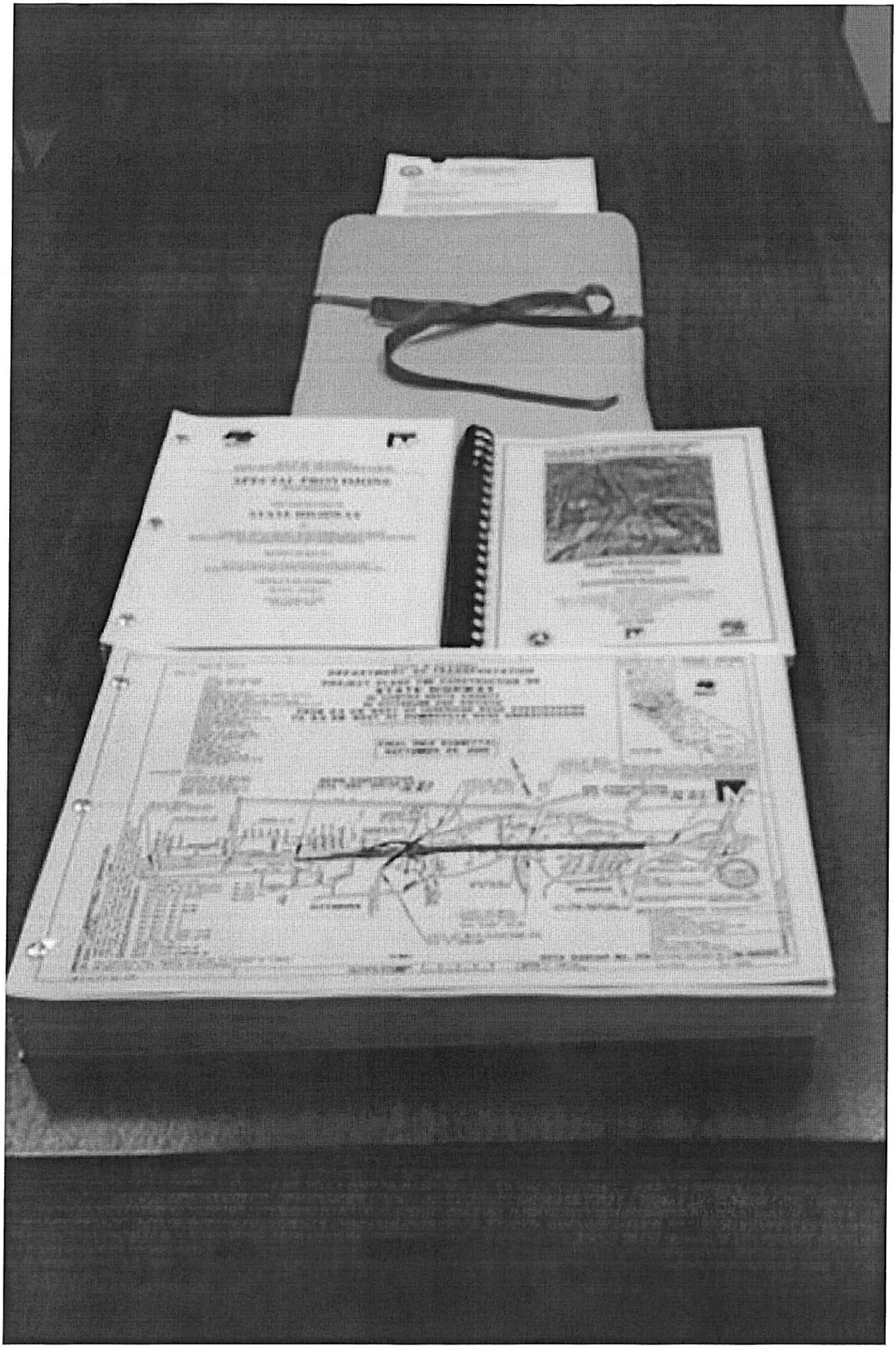
(cut as needed) ----------

Date:_____

NOTICE OF COMMENCEMENT OF WORK under Department of the Army Permit No.26746S
TO: District Engineer, US Army Corps of Engineers, RegulatoryDivision, 1455 Market Street, 16th Floor, San Francisco, CA 94103-1398

In compliance with the conditions of Permit No.26746S, this is to notify you that work was completed on _____.

Permittee: Ms. Susan Miller, Contra Costa Transportation Authority
Address: 3478 Buskirk Avenue, Suite 100, Pleasant Hill, CA 94523



STATE OF CALIFORNIA THE RESOURCES AGENCY
DEPARTMENT OF FISH AND GAME
BAY DELTA REGION
(707) 944-5520
Mailing address:
POST OFFICE BOX 47
YOUNTVILLE CALIFORNIA 94599
Street address:
7329 SILVERADO TRAIL
NAPA CALIFORNIA 94558

November 6, 2008

Notification Number: 1600-2008-0217-3

Susan Miller
Contra Costa County Transportation Authority
3478 Buskirk Avenue, Suite 100
Pleasant Hill, CA 94523

1602 LAKE AND STREAMBED ALTERATION AGREEMENT

This agreement is issued by the Department of Fish and Game pursuant to Division 2, Chapter 6 of the California Fish and Game Code:

WHEREAS, the Applicant, Susan Miller/Contra Costa County Transportation Authority, submitted a signed NOTIFICATION proposing to substantially divert or obstruct the natural flow of, or substantially change the bed, channel, or bank of, or use material from the streambed or lake of the following waters: Kirker Creek, Old Kirker Creek, Los Medanos Wasteway, in the Kirker Creek Watershed, County of Contra Costa, State of California; and

WHEREAS, the Department has determined that such operations may substantially adversely affect existing fish and wildlife resources including water quality, hydrology, aquatic or terrestrial plant or animal species; and

WHEREAS, the project has undergone the appropriate review under the California Environmental Quality Act; and

WHEREAS, the Applicant shall undertake the project as proposed in the signed PROJECT DESCRIPTION and PROJECT CONDITIONS (attached). If the Applicant changes the project from that described in the PROJECT DESCRIPTION and does not include the PROJECT CONDITIONS, this agreement is no longer valid; and

WHEREAS, the agreement shall expire on December 31, 2012; with the work to occur between April 15 and October 15; and

WHEREAS, nothing in this agreement authorizes the Applicant to trespass on any land or property, nor does it relieve the Applicant of the responsibility for compliance with applicable Federal, State, or local laws or ordinances. Placement, or removal, of any material below the level of ordinary high water may come under the jurisdiction of the U. S. Army Corps of Engineers pursuant to Section 404 of the Clean Water Act;

THEREFORE, the Applicant may proceed with the project as described in the PROJECT DESCRIPTION and PROJECT CONDITIONS. A copy of this agreement, with attached PROJECT DESCRIPTION and PROJECT CONDITIONS, shall be provided to contractors and subcontractors and shall be in their possession at the work site.

Failure to comply with all conditions of this agreement may result in legal action.

This agreement is approved by:

Charles Armor
Regional Manager
Bay Delta Region

cc: Melissa Escaron
Warden Garrett
Lieutenant Christensen

STATE OF CALIFORNIA THE RESOURCES AGENCY
DEPARTMENT OF FISH AND GAME
BAY DELTA REGION
(707) 944-5520
Mailing address:
POST OFFICE BOX 47
YOUNTVILLE, CALIFORNIA 94599
Street address:
7329 SILVERADO TRAIL
NAPA, CALIFORNIA 94558

Notification Number: 1600-2008-0217-3
Kirker Creek Watershed, Contra Costa County
Caltrans EA 04275-228591

Contra Costa Transportation Authority
Attn: Susan Miller
3478 Buskirk Ave, Suite 100
Pleasant Hill, 94523

PROJECT DESCRIPTION and PROJECT CONDITIONS

Description

The Contra Costa Transportation Authority (CCTA), in cooperation with the California Department of Transportation (Caltrans) proposes to widen State Route 4 (SR4), its interchanges, and local roadways from west of Loveridge Road (post mile (PM) 23.5) to the Somersville Road interchange (PM 25.6). The California Department of Fish and Game (the Department) is issuing this Streambed Alteration Agreement for the project described herein. The project would widen SR4 from four lanes to an eight-lane facility. The project will reduce existing traffic congestion, improve traffic operations, improve air quality and encourage high occupancy vehicle usage to accommodate travel demand to meet 20 year design criteria. This project is a component of the overall program to improve transportation through northern Contra Costa County.

The project is located within the Kirker Creek watershed which drains to the north from the Mt. Diablo foothills, crosses under SR 4, drains into New York Slough and finally into Suisun Bay. The road widening component of this project will require the extension of two culverts and the replacement of a third culvert. These culvert changes, as well as road widening activity, will result in permanent impacts to Kirker Creek , Old Kirker Creek, and the Los Medanos

Wasteway. Temporary stream diversions may be implemented at all three sites if water is present during
construction. Wetlands located within the Department's riparian jurisdiction will be impacted by the widening and will be mitigated for as described in the Mitigation and Monitoring plan for Jurisdictional Waters of the U.S.

A Biological Opinion (#1-1-05-F-0158) for the California red-legged frog (CRLF) was issued by the United States Fish and Wildlife Service on June 13, 2005 for this project (amendment issued on April 15, 2008).

Kirker Creek

Kirker Creek currently crosses under SR 4 in a 72-inch reinforced concrete pipe combined with a twin 10-foot by 8-foot reinforced concrete box. Approximately 99 linear feet and 2110 square feet of existing channel will be excavated to accommodate the pouring of the new longer culvert. Approximately 123 linear feet and 5813 square feet of Kirker Creek will be permanently impacted by the culvert extensions on the south side of SR 4.

One wingwall, 47.6 linear feet long, and one headwall, 86 linear feet long, will be constructed on the south side of SR 4.

Approximately 394 cubic yards (4058 square feet) of rock slope protection (RSP) will be placed on the south side of SR 4 to secure the sloped banks along the creek.

Old Kirker Creek

The existing box culvert at Old Kirker Creek (approximately 235 linear feet) will be replaced with a longer culvert to accommodate the freeway widening. Approximately 274 linear feet of the existing channel will be excavated to accommodate the placement of the new longer culvert. Approximately 65.5 linear feet and 2190 square feet of Old Kirker Creek will be permanently impacted by the culvert extension.

One headwall (52 linear feet long) will be constructed on the south side of SR 4.

Approximately 75 cubic yards (796 square feet) of RSP will be placed on the south side of SR 4 to secure the sloped banks along the creek.

Los Medanos Wasteway

The Los Medanos Wasteway crosses SR4 in a 8-foot by 7-foot reinforced concrete box culvert. Approximately 75 linear feet and 620 square feet of the existing channel will be excavated to accommodate the pouring of the new longer culverts. Approximately 128 linear feet and 7244 square feet of Los Medanos Wasteway will be permanently impacted by the culvert extensions on the north and south side of SR 4.

Four wingwalls and two headwalls (102 linear feet combined lengths) will be constructed on the north and south side of SR 4.

Conditions

1. To offset impacts to wetlands within the Department's riparian jurisdiction, CCTA shall implement the mitigation described in the Mitigation and Monitoring plan for Jurisdictional Waters of the U.S.

2. Work within the stream/riparian corridor shall be confined to the period of April 15 to October 15. Revegetation work is not confined to this time period but must be completed in the same calendar year.

3. Each riparian tree greater than 4 inches diameter at breast height (DBH) that is removed or damaged, shall be replaced with native trees in a riparian area at a minimum 3:1 ratio. Temporarily impacted riparian understory shall be replaced at a 1:1 ratio.

4. If mitigation plantings cannot be accommodated onsite, then CCTA shall mitigate offsite. The offsite mitigation location must be as close to the project site as possible and within the same watershed.

5. Pre-construction surveys for western pond turtles (WPT) shall be conducted by a qualified biologist within 48-hours prior to commencement of construction activities to determine if WPTs are in the project area. CCTA shall implement measures to avoid direct injury of WPTs, as well as measures to avoid areas where they are observed to occur. If a WPT is observed, it should be left alone to move out of the area on its own. If it does not move on its own, it can be relocated to a safe downstream location by a qualified biological monitor.

6. Between April 15 and September 30, any dewatered potential giant garter snake (GGS) or CRLF habitat as identified by a qualified biological monitor (as determined by a combination of academic training and professional experience) will remain dry with no puddle water for at least 15 consecutive days before workers excavate or fill dewatered habitat. Efforts will be made to ensure the dewatered potential habitat does not continue to support GGS or CRLF prey i.e. fish, tadpoles, and aquatic insects.

7. Construction personnel will participate in a worker environmental awareness program approved by the Department and USFWS. A qualified biologist will inform all construction personnel about the life history of the CRLF and GGS, how to identify them, their habitat, and what to do if a CRLF or GGS is discovered.

8. A qualified biologist will conduct a pre-construction survey for CRLF and GGS no more than 24 hours prior to the start of construction activities. If construction activities stop for a period of 2 or more weeks, a new CRLF and GGS survey will be completed no more than 24 hours prior to the re-initiation of construction.

9. If a live CRLF or GGS is discovered, CCTA will stop construction in the vicinity of the animal and notify the project biological monitor, the Department (Melissa Escaron, 707.339.0334) and the USFWS immediately. The biological monitor will remain in the area for the remainder of the workday to ensure the animal is not harmed or that it leaves the site and does not return. Escape routes for the animal will be determined in advance of construction.

10. If the CRLF or GGS does not leave the site on its own within 1 work day, further

consultation with the Department and USFWS will be conducted.

11. Upon locating dead or injured CRLF or GGS, CCTA will notify the Department and USFWS.

12. No plastic monofilament, jute, or similar erosion control matting that could entangle amphibians or reptiles will be used.

13. Prior to commencement of work within the stream zone, CCTA shall photograph the project site. Upon completion of work activities, CCTA shall photograph the project site at designated photo stations. Labeled copies of photographs shall be sent to the Department of Fish and Game within 5 days of completion of the project. Notification of work commencement shall be sent to the Department at P.O. Box 47, Yountville, CA 94599. Refer to Notification 1600-2008-0217-3 when notifying the Department.

14. Equipment shall not be operated in wetted areas (including but not limited to ponded, flowing, or wetland areas).

15. The work period for completing the work within the stream zone, shall be restricted to periods of low or no stream flow and dry weather. Excavation for and placement of the fill shall not begin unless a no precipitation forecast is obtained covering the entire construction phase (within the area covered in this Agreement) and the time necessary to implement erosion control measures. This forecast shall be documented upon request by the Department.

16. No phase of the project may be started if that phase and its associated erosion control measures cannot be completed prior to the onset of precipitation if that construction phase may cause the introduction of sediments into the stream. After any storm event, CCTA shall inspect all sites currently under construction and all sites scheduled to begin construction within the next 72 hours for erosion and sedimentation problems and take corrective action as needed. Seventy-two-hour weather forecasts from the National Weather Service shall be consulted prior to start up of any phase of the project that may result in sediment runoff to the stream, and construction plans made to meet this condition.

17. All construction activity shall terminate at any site that has surface runoff until runoff ceases and no further storms are forecast for the following 24-hour period.

18. Staging and storage areas for equipment, materials, fuels, lubricants and solvents, shall be located outside of the stream channel and banks, avoiding areas of concentrated ground squirrel burrows. Stationary equipment such as motors, pumps, generators, compressors and welders, located within or adjacent to the stream shall be positioned over drip-pans. Any equipment or vehicles driven and/or operated within or adjacent to the stream must be checked and maintained daily, to prevent leaks of materials that if introduced to water could be deleterious to aquatic life. No fueling, cleaning, or maintenance of vehicles or equipment shall take place within any areas where an accidental discharge to a watercourse may occur, vehicles must be moved away from the stream prior to refueling and lubrication.

19. Erosion control measures shall be utilized throughout all phases of operation where sediment runoff from exposed slopes threatens to enter waterways. At no time shall silt laden runoff be allowed to enter the stream or directed to where it may enter the stream. Only clean rocks and boulders shall be used for the project. Erosion control structures shall be monitored for effectiveness and shall be repaired or replaced as needed. Build up of soil behind the fence shall be removed promptly and any breaches or undermined areas repaired at once.

20. When work in a flowing stream is unavoidable, the entire stream flow shall be diverted around or through the work area during the excavation and/or construction operations. Stream flow shall be diverted using gravity flow through temporary culverts/pipes or pumped around the work site with the use of hoses. Any temporary dam or other artificial obstruction constructed shall only be built from materials such as sandbags or clean gravel which will cause little or no siltation. No other diversion method shall be use without authorization of the Department. If another diversion method is preferred, the operator must submit a plan detailing the desired diversion method. Authorization of any other diversion method shall be at the discretion of the Department. Normal flows will be restored to the affected stream immediately upon completion of work at that location.

21. All exposed/disturbed areas and access points within the stream zone left barren of

vegetation as a result of the construction activities shall be restored by seeding with a blend native and non-native erosion control grass seeds. Seeded areas shall be mulched. All other areas of disturbed soil which drain toward the stream channel shall be seeded with erosion control grass seeds. Revegetation shall be completed as soon as possible after construction activities in those areas cease. Seeding placed after October 15 must be covered with broadcast straw, jute netting, coconut fiber blanket or similar erosion control blanket. Erosion control with monofilament shall not be used.

22. Streambank areas receiving rock slope protection (rip rap) shall be back-filled with appropriate topsoil. The topsoil fill should be placed to fill the voids in the rock slope protection and provide a substrate for revegetation efforts. Only clean rocks and boulders shall be used.

23. Rip rap will be set below grade and keyed into the bank. Rip rap rock shall be of the proper size and weight to withstand high flows. When possible, rip rap shall be backfilled with soil and planted with riparian vegetation.

24. Building materials and/or construction equipment shall not be stockpiled or stored where they could be washed into the water or where they will cover aquatic or riparian vegetation.

25. Debris, soil, silt, bark, rubbish, creosote-treated wood, raw cement/concrete or washings thereof, asphalt, paint or other coating material, oil or other petroleum products, or any other substances which could be hazardous to aquatic life, resulting from project related activities, shall be prevented from contaminating the soil and/or entering the stream. Any of these materials, placed within or where they may enter a stream or lake, by CCTA or any party working under contract, or with the permission of CCTA, shall be removed immediately.

26. The contractor shall not dump any litter or construction debris within the riparian/stream zone. All such debris and waste shall be picked up daily and properly disposed of at an appropriate site.

27. This agreement does not authorize the take of any state or federally listed species. Liability for any take or incidental take of such listed species remains the responsibility of CCTA for the

duration of the project. Any unauthorized take of such listed species may result in prosecution and nullification of the agreement.

28. Prior to the beginning of any excavation, clearing or staging in or near the riparian area, a focused survey of all potentially suitable California red-legged frogs (CRLF) habitat shall be conducted 14 days prior to instream construction or disturbance of riparian areas. In the event that a CRLF is observed in the area, work in the riparian area shall be halted and the USFWS should be contacted to determine appropriate actions. Results of pre-construction surveys shall be reported to the Department.

29. If construction, grading, or other project-related activities are scheduled during the nesting season for protected raptors and migratory birds (February 15 to August 15), a focused survey for active nests of such birds shall be conducted within 500 feet of project activities by a qualified biologist (as determined by a combination of academic training and professional experience in biological sciences and related resource management activities) within 15 days prior to the beginning to project-related activities. A minimum of 3 separate survey days within the 15 days shall be conducted. The results of the survey shall be emailed to Melissa Escaron at mescaron@dfg.ca.gov, refer to Notification Number 1600-2008-0217-3. If active nests are found, CCTA shall consult with the Department and the United States Fish and Wildlife Service (USFWS) regarding appropriate action to comply with the Migratory Bird Treaty Act of 1918 and the Fish & Game Code of California. If a lapse in project-related work of 15 days or longer occurs, another focused survey and if required, consultation with the Department and USFWS, will be required before project work can be reinitiated.

30. No pile driving will occur within the riparian corridor.

31. Prior to construction near existing culverts they shall be inspected for wildlife. If any wildlife is encountered during the course of the inspection, said wildlife shall be allowed to leave the area unharmed, and shall be flushed, hazed, or herded in a safe direction away from the project site. This condition does not allow for the take or disturbance of any state or federally listed species, or state listed species of special concern.

32. If any sensitive species are observed in project surveys, CCTA shall submit California Natural Diversity Data Base (CNDDB) forms to the CNDDB for all preconstruction survey data within five working days of the sightings, and provide DFG Region 3 with copies of the CNDDB forms and survey maps.

33. Environmentally sensitive area (ESA) fencing will be used to delineate and protect the sensitive areas surrounding the construction site.

34. All protective measures included in the Biological Opinion (#1-1-05-F-0158 and amendment issued on April 15 2008) issued by the United States Fish and Wildlife Service on June 13, 2005 for this project will be implemented.

35. To the extent that any provisions of this Agreement provide for activities that require CCTA to traverse another owner's property, such provisions are agreed to with the understanding that CCTA possesses the legal right to so traverse. In the absence of such right, any such provision is void.

36. In the event that the project scope, nature, or environmental impact is altered by the imposition of subsequent permit conditions by any local, state or federal regulatory authority, CCTA shall notify the Department of any imposed project modifications that interfere with compliance to Department conditions.

If CCTA needs more time to complete the authorized activity, the work period may be extended on a day-to-day basis by contacting Melissa Escaron at (707) 339-0334 or the Yountville office at (707) 944-5520.

A copy of this Agreement must be provided to the contractor and all subcontractors who work within the stream zone and must be in their possession at the work site.

Department personnel or its agents may inspect the work site at any time.

CCTA is liable for compliance with the terms of this Agreement, including violations committed

by the contractors and/or subcontractors. The Department reserves the right to suspend construction activity described in this Agreement if the Department determines any of the following has occurred:

A). Failure to comply with any of the conditions of this Agreement

B). Information provided in support of the Agreement is determined by the Department to be inaccurate.

C). Information becomes available to the Department that was not known when preparing the original conditions of this Agreement (including, but not limited to, the occurrence of state or federally listed species in the area or risk to resources not previously observed)

D).The project as described in the Agreement has changed or conditions affecting fish and wildlife resources change.

Any violation of the terms of this Agreement may result in the project being stopped, a citation being issued, or charges being filed with the District Attorney. Contractors and subcontractors may also be liable for violating the conditions of this agreement.

Amendments and Extensions

CCTA shall notify the Department before any modifications are made in the project plans submitted to the Department. Project modifications may require an amendment or a new notification.

This Agreement is transferable to subsequent owners of the project property by requesting an amendment.

To extend the Agreement beyond the expiration date, a written request or completed "Request to Extend Lake or Streambed Alteration Agreement" form, with an appropriate fee, must be submitted to the Department (1600 Program, Post Office Box 47, Yountville, California 94599) for consideration at least 30 days before the Agreement expiration date. An extension requires a fee. The Fee Schedule and Extension form can be obtained at www.dfg.ca.gov/habcon/1600/Forms.html or by phone at (707) 944-5520. Extensions of the original Agreement are issued at the discretion of the Department.

To modify the project, a written request for an amendment or a completed "Request to Amend Lake or Streambed Alteration Agreement" form, with an appropriate fee, must be submitted to the Department (1600 Program, Post Office Box 47, Yountville, California 94599). An amendment requires a fee. The Fee Schedule and Amendment form can be obtained at www.dfg.ca.gov/1600 or by phone at (707) 944-5520. Amendments to the original Agreement are issued at the discretion of the Department.

Please note that you may not proceed with construction until your proposed project has undergone CEQA review and the Department signs the Agreement.

I, the undersigned, state that the above is the final description of the project I am submitting to the Department for CEQA review, leading to an Agreement, and agree to implement the conditions above required by the Department as part of that project. I will not proceed with this project until the Department signs the Agreement. I also understand that the CEQA review may result in the addition of measures to the project to avoid, minimize, or compensate for significant environmental impacts:

Applicant's name (print): SUSAN H. MILLER

Applicant's signature: Susan H. Miller

Signed the 16th **day of** OCTOBER, **2008**

FOR DEPARTMENT USE ONLY				
Date Received	Amount Received	Amount Due	Date Complete	Notification No
5/15/08	$ 4,000.00	$		1600-2008-0217-3

#036208
WOODWARD-CLYDE CONSTRUCTION

~~GILMORE~~
ESCHEON
LT. CHRISTEN

STATE OF CALIFORNIA
DEPARTMENT OF FISH AND GAME

NOTIFICATION OF LAKE OR STREAMBED ALTERATION

Complete EACH field, unless otherwise indicated, following the enclosed instructions and submit ALL required enclosures. Attach additional pages, if necessary.

Fish & Game
MAY 15 2008
Yountville

1. APPLICANT PROPOSING PROJECT

Name	Susan Miller		
Business/Agency	Contra Costa Transportation Authority		
Street Address	3478 Buskirk Avenue, Suite 100		
City, State, Zip	Pleasant Hill, CA 94523		
Telephone	(925) 256-4736	Fax	(925) 256-5580
Email	smiller@ccta.net		

2. CONTACT PERSON (*Complete only if different from applicant*)

Name	Jan Novak, U.R.S. Corporation		
Street Address	1333 Broadway, Suite 800		
City, State, Zip	Oakland, CA 94612		
Telephone	(510) 874-1733	Fax	(510) 874-3268
Email	jan_novak@urscorp.com		

3. PROPERTY OWNER (*Complete only if different from applicant*)

Name	Laurie Lau, Caltrans		
Street Address	111 Grand Avenue		
City, State, Zip	Oakland, CA 94612		
Telephone	(510) 286-5568	Fax	(510) 286-5580
Email	laurie_lau@dot.ca.gov		

4. PROJECT NAME AND AGREEMENT TERM

A. Project Name	State Route (SR) 4 (East) Widening Project - Loveridge Road to Somersville Road
B. Agreement Term Requested	☑ Regular (*5 years or less*) ☐ Long-term (*greater than 5 years*)

C. Project Term		D. Seasonal Work Period		E. Number of Work Days
Beginning (*year*)	Ending (*year*)	Start Date (*month/day*)	End Date (*month/day*)	
2009	2013	05/08	10/17	810.00

5. AGREEMENT TYPE

Check the applicable box. If box B, C, D, or E is checked, complete the specified attachment.		
A.	☑ Standard *(Most construction projects, excluding the categories listed below)*	
B.	☐ Gravel/Sand/Rock Extraction (*Attachment A*)	*Mine I.D. Number:* _____
C.	☐ Timber Harvesting (*Attachment B*)	THP *Number:* _____
D.	☐ Water Diversion/Extraction/Impoundment (*Attachment C*)	*SWRCB Number:* _____
E.	☐ Routine Maintenance (*Attachment D*)	
F.	☐ DFG Fisheries Restoration Grant Program (FRGP)	*FRGP Contract Number:* _____
G.	☐ Master	
H.	☐ Master Timber Harvesting	

6. FEES

Please see the current fee schedule to determine the appropriate notification fee. Itemize each project's estimated cost and corresponding fee. ***Note: The Department may not process this notification until the correct fee has been received.***

	A. Project	B. Project Cost	C. Project Fee
1	State Route 4 (East) Widening Project - Loveridge to Somersville Road Sgmnt.	$107,000,000.00	$4,000.00
2			
3			
4			
5			
		D. Base Fee *(if applicable)*	
		E. TOTAL FEE ENCLOSED	$4,000.00

7. PRIOR NOTIFICATION OR ORDER

A. Has a notification previously been submitted to, or a Lake or Streambed Alteration Agreement previously been issued by, the Department for the project described in this notification?

☑ Yes (*Provide the information below*) ☐ No

Applicant: CCTA Notification Number: 1600-2007-0033-3 Date: 01/24/07

B. Is this notification being submitted in response to an order, notice, or other directive ("order") by a court or administrative agency (including the Department)?

☑ No ☐ Yes (*Enclose a copy of the order, notice, or other directive. If the directive is not in writing, identify the person who directed the applicant to submit this notification and the agency he or she represents, and describe the circumstances relating to the order.*)

☐ *Continued on additional page(s)*

8. PROJECT LOCATION

A. Address or description of project location.

(Include a map that marks the location of the project with a reference to the nearest city or town, and provide driving directions from a major road or highway)

The project area consists of SR4 from just east of the Loveridge Road Interchange to the Somersville Road Interchange. The project is located in the Kirker Creek Watershed. See Attachment 1 - Project Location Map.

☐ *Continued on additional page(s)*

B. River, stream, or lake affected by the project.	Kirker Crk., Old Kirker Crk., West Antioch Crk., Los Medanos Wasteway
C. What water body is the river, stream, or lake tributary to?	San Joaquin River
D. Is the river or stream segment affected by the project listed in the state or federal Wild and Scenic Rivers Acts?	☐ Yes ☑ No ☐ Unknown
E. County	Contra Costa

F. USGS 7.5 Minute Quad Map Name	G. Township	H. Range	I. Section	J. ¼ Section
Los Medanos Land Grant (Honker Bay, Antioch North)	NA	NA	NA	NA

☐ *Continued on additional page(s)*

K. Meridian (*check one*) ☐ Humboldt ☑ Mt. Diablo ☐ San Bernardino

L. Assessor's Parcel Number(s)

Please see Attachment 2

☑ *Continued on additional page(s)*

M. Coordinates (*If available, provide at least latitude/longitude or UTM coordinates and check appropriate boxes)*

Latitude/Longitude	*Latitude:*	37.999001	*Longitude:*	-121.821281
	☐ Degrees/Minutes/Seconds		☑ Decimal Degrees	☐ Decimal Minutes
UTM	*Easting:*		*Northing:*	☐ Zone 10 ☐ Zone 11
Datum used for Latitude/Longitude or UTM	☐ NAD 27		☐ NAD 83 or WGS 84	

9. PROJECT CATEGORY AND WORK TYPE *(Check each box that applies)*

PROJECT CATEGORY	NEW CONSTRUCTION	REPLACE EXISTING STRUCTURE	REPAIR/MAINTAIN EXISTING STRUCTURE
Bank stabilization – bioengineering/recontouring	☑	☐	☐
Bank stabilization – rip-rap/retaining wall/gabion	☑	☐	☐
Boat dock/pier	☐	☐	☐
Boat ramp	☐	☐	☐
Bridge	☐	☐	☐
Channel clearing/vegetation management	☐	☐	☐
Culvert	☑	☐	☐
Debris basin	☐	☐	☐
Dam	☐	☐	☐
Diversion structure – weir or pump intake	☐	☐	☐
Filling of wetland, river, stream, or lake	☑	☐	☐
Geotechnical survey	☐	☐	☐
Habitat enhancement – revegetation/mitigation	☑	☐	☐
Levee	☐	☐	☐
Low water crossing	☐	☐	☐
Road/trail	☑	☐	☐
Sediment removal – pond, stream, or marina	☐	☐	☐
Storm drain outfall structure	☑	☐	☐
Temporary stream crossing	☐	☐	☐
Utility crossing : Horizontal Directional Drilling	☐	☐	☐
Jack/bore	☐	☐	☐
Open trench	☐	☐	☐
Other *(specify)*:	☐	☐	☐

10. PROJECT DESCRIPTION

A. Describe the project in detail. Photographs of the project location and immediate surrounding area should be included.

- Include any structures (e.g., rip-rap, culverts, or channel clearing) that will be placed, built, or completed in or near the stream, river, or lake.
- Specify the type and volume of materials that will be used.
- If water will be diverted or drafted, specify the purpose or use.

Enclose diagrams, drawings, plans, and/or maps that provide all of the following: site specific construction details; the dimensions of each structure and/or extent of each activity in the bed, channel, bank or floodplain; an overview of the entire project area (i.e., "bird's-eye view") showing the location of each structure and/or activity, significant area features, and where the equipment/machinery will enter and exit the project area.

The Contra Costa Transportation Authority (CCTA), in cooperation with the Federal Highway Administration (FHWA) and the California Department of Transportation (Caltrans) proposes to widen State Route 4 (SR 4), its interchanges, and affected local roadways from west of Loveridge Road (KP 37.9) to the Somersville Road interchange (KP 41.3). The project would widen SR 4 within the limits above from its current four lanes to an eight-lane facility. This will reduce existing traffic congestion, improve traffic operations,improve air quality, and encourage high occupancy vehicle use to accommodate travel demand to meet 20 year design criteria. This is a necessary component of the overall program to improve transportation through northern Contra Costa County.

(Continued) See Attachment 3

☑ *Continued on additional page(s)*

B. Specify the equipment and machinery that will be used to complete the project.

Equipment expected to be used include backhoes, crawler, shovels compaction equipment, and concrete equipment.

☐ *Continued on additional page(s)*

C. Will water be present during the proposed work period (specified in box 4.D) in the stream, river, or lake (specified in box 8.B).	☑ Yes ☐ No (*Skip to box 11*)
D. Will the proposed project require work in the wetted portion of the channel?	☑ Yes (*Enclose a plan to divert water around work site*) ☐ No

11. PROJECT IMPACTS

A. Describe impacts to the bed, channel, and bank of the river, stream, or lake, and the associated riparian habitat. Specify the dimensions of the modifications in length (linear feet) and area (square feet or acres) and the type and volume of material (cubic yards) that will be moved, displaced, or otherwise disturbed, if applicable.

The road widening component of this project will require the extension of two culverts and the replacement of a third culvert. These culvert changes, as well as road widening activity, will result in permanent impacts to the waters of Kirker Creek and the Los Medanos Wasteway, and impacts to wetlands of Kirker Creek, Old Kirker Creek, and the Los Medanos Wasteway.

Areas of impact and maps illustrating these impacts are provided in Attachment 5.

☑ *Continued on additional page(s)*

B. Will the project affect any vegetation? ☑ Yes (*Complete the tables below*) ☐ No

Vegetation Type	Temporary Impact	Permanent Impact
Freshwater Marsh (Ludwigia hexapetala, T. latifolia, Polygonum lapath)	Linear feet: _____ Total area: 0.013 acres	Linear feet: _____ Total area: 0.084 acres
	Linear feet: _____ Total area: _____	Linear feet: _____ Total area: _____

Tree Species	Number of Trees to be Removed	Trunk Diameter (range)
See Attachment 6		

☑ *Continued on additional page(s)*

C. Are any special status animal or plant species, or habitat that could support such species, known to be present on or near the project site?

☑ Yes (*List each species and/or describe the habitat below*) ☐ No ☐ Unknown

California Red-Legged Frog (Rana aurora draytonii)

CCTA assumes the presence of California red-legged frogs at West Antioch Creek. See Attachment 7 for details.

☑ *Continued on additional page(s)*

D. Identify the source(s) of information that supports a "yes" or "no" answer above in Box 11.C.

USFWS Biological Opinion (1-1-05-F-0158) June 14, 2005. California red-legged frog is assumed to occur further east in West Antioch Creek but NONE present within the project area.

☐ *Continued on additional page(s)*

E. Has a biological study been completed for the project site?

☑ Yes (*Enclose the biological study*) ☐ No

Note: A biological assessment or study may be required to evaluate potential project impacts on biological resources.

F. Has a hydrological study been completed for the project or project site?

☑ Yes (*Enclose the hydrological study*) ☐ No

Note: A hydrological study or other information on site hydraulics (e.g., flows, channel characteristics, and/or flood recurrence intervals) may be required to evaluate potential project impacts on hydrology.

12. MEASURES TO PROTECT FISH, WILDIFE, AND PLANT RESOURCES

A. Describe the techniques that will be used to prevent sediment from entering watercourses during and after construction.

Please see included Mitigation and Monitoring Plan for Jurisdictional Waters of the U.S.

☐ *Continued on additional page(s)*

B. Describe project avoidance and/or minimization measures to protect fish, wildlife, and plant resources.

Please see included Mitigation and Monitoring Plan for Jurisdictional Waters of the U.S.

☐ *Continued on additional page(s)*

C. Describe any project mitigation and/or compensation measures to protect fish, wildlife, and plant resources.

Please see included Mitigation and Monitoring Plan for Jurisdictional Waters of the U.S.

☐ *Continued on additional page(s)*

13. PERMITS

List any local, state, and federal permits required for the project and check the corresponding box(es). Enclose a copy of each permit that has been issued.

A.	USFWS Biological Opinion; NMFS Letter of Concurrence	☐ Applied	☑ Issued
B.	USACE Individual Permit	☑ Applied	☐ Issued
C.	SFRWQCB Clean Water Act 401 Water Quality Certification	☑ Applied	☐ Issued

D. Unknown whether ☐ local, ☐ state, or ☐ federal permit is needed for the project. (*Check each box that applies*)

☐ *Continued on additional page(s)*

14. ENVIRONMENTAL REVIEW

A. Has a draft or final document been prepared for the project pursuant to the California Environmental Quality Act (CEQA), National Environmental Protection Act (NEPA), California Endangered Species Act (CESA) and/or federal Endangered Species Act (ESA)?

☑ Yes (*Check the box for each CEQA, NEPA, CESA, and ESA document that has been prepared and enclose a copy of each*)

☐ No (*Check the box for each CEQA, NEPA, CESA, and ESA document listed below that will be or is being prepared*)

☐ Notice of Exemption	☐ Mitigated Negative Declaration	☑ NEPA document (*type*): Env. Analysis
☐ Initial Study	☐ Environmental Impact Report	☐ CESA document (*type*):
☑ Negative Declaration	☐ Notice of Determination *(Enclose)*	☑ ESA document (*type*): Biological Opinion
☐ THP/ NTMP	☐ Mitigation, Monitoring, Reporting Plan	

B. State Clearinghouse Number (*if applicable*)	**2004092135**		
C. Has a CEQA lead agency been determined?	☑ Yes (*Complete boxes D, E, and F*)	☐ No (*Skip to box 14.G*)	
D. CEQA Lead Agency	California Department of Transportation		
E. Contact Person	**Susan Miller (CCTA)**	**F. Telephone Number**	**(925) 256-4700**

G. If the project described in this notification is part of a larger project or plan, briefly describe that larger project or plan.

The Loveridge Segment of the SR 4 project is the first of four segments that will eventually widen SR 4 approximately 1.33 kilometers (0.8 mile) west of Loveridge Road to approximately 1.24 kilometers (0.7 mile) east of Hillcrest Avenue. The major improvements include widening SR4 from four to eight lanes, and widening its interchanges and all affected local roadways. The engineering of this project was also influenced by the eBART project, which is scheduled to begin construction in 2010. The eBART project plans to lay public transit railway tracks in the median between the east and west bound tracks of SR 4. This project has been engineered to allow room for the rail system.

☐ *Continued on additional page(s)*

H. Has an environmental filing fee (Fish and Game Code section 711.4) been paid?

☑ Yes (*Enclose proof of payment*) ☐ No (*Briefly explain below the reason a filing fee has not been paid)*

Note: If a filing fee is required, the Department may not finalize a Lake or Streambed Alteration Agreement until the filing fee is paid.

15. SITE INSPECTION

Check one box only.

☐ In the event the Department determines that a site inspection is necessary, I hereby authorize a Department representative to enter the property where the project described in this notification will take place at any reasonable time, and hereby certify that I am authorized to grant the Department such entry.

☑ I request the Department to first contact (*insert name*) Jan Novak at (*insert telephone number*) (510) 874-1733 to schedule a date and time to enter the property where the project described in this notification will take place. I understand that this may delay the Department's determination as to whether a Lake or Streambed Alteration Agreement is required and/or the Department's issuance of a draft agreement pursuant to this notification.

16. DIGITAL FORMAT

Is any of the information included as part of the notification available in digital format (i.e., CD, DVD, etc.)?

☑ Yes (Please enclose the information via digital media with the completed notification form)

☐ No

17. SIGNATURE

I hereby certify that to the best of my knowledge the information in this notification is true and correct and that I am authorized to sign this notification as, or on behalf of, the applicant. I understand that if any information in this notification is found to be untrue or incorrect, the Department may suspend processing this notification or suspend or revoke any draft or final Lake or Streambed Alteration Agreement issued pursuant to this notification. I understand also that if any information in this notification is found to be untrue or incorrect and the project described in this notification has already begun, I and/or the applicant may be subject to civil or criminal prosecution. I understand that this notification applies only to the project(s) described herein and that I and/or the applicant may be subject to civil or criminal prosecution for undertaking any project not described herein unless the Department has been separately notified of that project in accordance with Fish and Game Code section 1602 or 1611.

Jan Novak — Signature of Applicant or Applicant's Authorized Representative

5/12/08 — Date

Jan Novak — Print Name

United States Department of the Interior

BUREAU OF RECLAMATION
South-Central California Area Office
1243 N Street
Fresno, California 93721-1813

IN REPLY REFER TO:
SCC-454
LND-6.00
LND-07-26

MAR 03 2009

Mr. John O. Carlston
Senior Right of Way Agent
Local Public Agency/Utility Services
Department of Transportation
District 4
P.O. Box 23440
Oakland, CA 94623-0440

Subject: Executed Amendment to Existing Joint Use Agreement (Agreement) – State of California Department of Transportation (CalTrans) – Contract No. 14-06-200-6020 – Temporary Access to Los Medanos Wasteway including Lateral 14 – Contra Costa County – Central Valley Project

Dear Mr. Carlston:

Enclosed for your records is a copy of the subject executed duplicate original Agreement.

If you have any questions regarding this matter, please feel free to contact Sheryl Carter, Lead Realty Specialist, at 559-487-5299, at 559-487-5933 for the hearing impaired, or by e-mail at scarter@mp.usbr.gov.

Sincerely,

Laura M. Couron

Laura M. Couron
Realty Specialist

Enclosure

cc: Mr. Dino Angelosante
Real Property Specialist
Contra Costa Water District
1330 Concord Avenue
Concord, CA 94524 (w/enclosure)

CVP -1728
07-26

Contract No. 14-06-200-6020

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL VALLEY PROJECT

STATE OF CALIFORNIA
CALIFORNIA DEPARTMENT OF TRANSPORTATION (CALTRANS)

JOINT USE AGREEMENT

Subject to the provisions of the contract between the United States (United States) and the State of California (State), dated October 12, 1956, and entitled, "Contract for Grants of Easements Covering Crossing of State of California Highway Facilities and Features of the Central Valley Project, (Contract) and the conditions set forth below, the United States of America hereby grants, without warranty of title, or consents to a right of joint use to the State of California, as provided for under Article II, Section 2 of the subject Contract.

For transverse crossing for the rehabilitation of shoulder widening to existing State Highway 4 crossing of the subject Contract for the purpose Highway 4 Widening Project, and to extend the Los Medanos Wasteway beneath State Highway 4 of Grantee and Contra Costa Canal of Grantor located at USBR Unit Number 41, inclusive, Central Valley Project.

Said lands located in Section 22 of Township 2 North, Range 1 East, M.D.B.M., in Contra Costa County, California, being a portion of the Contra Costa Canal right-of-way Station 34+45, Milepost 13.85. The area is described in Right-of-Way Record Map referred to as Exhibit "A," and all made a part hereof.

Every instrument hereafter executed under the subject Contract, as to each crossing therein set forth under Section Article III, Section 3, of the subject Contract, shall specify a reference to the plans of such crossing where such plans show such common area, as shown on Exhibit "B" titled "Drainage Details Los Medanos Wasteway RCB Extension", dated March, 2005, and bearing the legend number U-12, DD-33, DD-34, and DD-35.

General Provisions

1. State shall assume the cost of accommodating United States' facilities existing or presently planned to be constructed within a five-year period from date of execution of this Joint Use Agreement, which accommodation is necessary by reason of the construction, operation or maintenance of State's highway facilities in the joint use area.

2. Should United States desire any betterment of its facilities, United States shall defray any additional cost of such betterment. For the purpose of this agreement, "betterment" is defined as an increase in capacity or utility of United States' facilities.

3. State shall submit to United States its plans for such crossings and the method of installation thereof and obtain United States' prior approval thereof, which approval shall not be

DUPLICATE ORIGINAL

unreasonably withheld.

4. State shall maintain, repair, and replace its facilities located in the area of joint use at its sole expense.

5. State in exercising any of its rights in the joint use area shall make adequate provisions for the protection of the traveling public and provide such barricades and safety devices as are required on State's highway construction projects.

6. All work by State shall be planned and carried out so that there will be no interference with the flow of water conveyed by irrigation facilities of United States.

7. All work by State shall conform to recognized standards of construction and shall be subject to inspection and approval by United States.

8. Except in emergencies, State shall give reasonable notice to United States before performing any work in the joint use area where such work will be performed in or on any facility of United States.

9. After State's compliance with paragraph 1 hereinabove, each party may thereafter alter or improve its facilities within the joint use area, provided, however, that the moving party shall first assume the cost of accommodating the other party's facilities in the joint use area affected by the proposed alteration or improvement of its facilities. Provided further, that neither party shall perform any alteration or improvement of its facilities within such joint use area until such party shall have submitted to the other party plans therefore and shall obtain the other party's approval thereof, which approval shall not be unreasonable withheld.

10. No facilities other than those of State shall be permitted in the area of joint use other than by permit issued by United States.

11. Should State desire to transfer control, operation, possession or maintenance of any of its facilities within the joint use area, such transfer shall be subject to the approval of United States, which approval will not be unreasonably withheld.

12. Each party shall at all times exercise its respective rights within the area of joint use so as not to unreasonably interfere with the rights of the other party.

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DISTRICT - 4

By: Macpherson 12/23/08
R.A. Macpherson Date
Deputy District Director, Right of Way

THE UNITED STATE OF AMERICA

By: 12/31/08
Michael P. Jackson Date
Area Manager
South-California Area Office

APPROVAL RECOMMENDED:

12-22-08

Mark L. Weaver — Date
District Office Chief

12/17/08

John O. Carlston — Date
District Branch Chief

Linda S. Adams
Secretary for
Environmental Protection

State Water Resources Control Board

Executive Office

Charles R. Hoppin, Chairman
1001 I Street • Sacramento, California 95814 • (916) 341-5615
Mailing Address: P.O. Box 100 • Sacramento, California • 95812-0100
Fax (916) 341-5621 • http://www.waterboards.ca.gov

Arnold Schwarzenegger
Governor

JUL 0 6 2009

Ms. Susan Miller
Contra Costa Transportation Authority
3478 Buskirk Ave., Suite 100
Pleasant Hill, CA 94523

Dear Ms. Miller:

CLEAN WATER ACT (CWA) SECTION 401 WATER QUALITY CERTIFICATION FOR THE STATE ROUTE 4 WIDENING PROJECT (PROJECT), CITIES OF PITTSBURG AND ANTIOCH, CONTRA COSTA COUNTY (CORPS FILE #2002-26746N)

On April 11, 2008, the San Francisco Bay Regional Water Quality Control Board (San Francisco Bay Water Board) received an application from the Contra Costa Transportation Authority (Authority) for CWA section 401 Water Quality Certification (Certification) for Phase 1 of the Project. San Francisco Bay Water Board staff reviewed the information submitted by the Authority describing the project activities and the proposed water quality protection measures.

On February 11, 2009, the project file was forwarded to the State Water Resources Control Board (State Water Board) because the project was expanded to include Phase 2, which extends into the jurisdiction of the Central Valley Regional Water Quality Control Board (Central Valley Water Board). The State Water Board issues or denies certifications that affect waters within multiple Regional Water Boards. State Water Board staff consulted with the San Francisco Bay Water Board and Central Valley Water Board, as well as the U.S. Army Corps of Engineers.

Pursuant to Title 23, section 3838 of the California Code of Regulations, I hereby make the Certification determination described in the Enclosure for these projects. Attachments A through D to the Enclosure are also a part of this Certification.

If you require further assistance, please contact Amna Hawatky, the staff person most knowledgeable on the subject, at (916) 341-5483 (ahawatky@waterboards.ca.gov). You may also contact Bill Orme, Chief of the 401 Certification and Wetlands Protection Unit, at (916) 341-5464 (borme@waterboards.ca.gov).

Sincerely,

Dorothy Rice
Executive Director

Enclosure

cc: (See next page)

cc: (all with Enclosure)

Mr. Jan Novak
U.R.S. Corporation
1333 Broadway, Suite 800
Oakland, CA 94612
Jan_Novak@URSCorp.com

Mr. David Smith
Wetlands Regulatory Office
U.S. Environmental Protection Agency, Region 9
75 Hawthorne St.
San Francisco, CA 94105
Smith.DavidW@epamail.epa.gov

Ms. Jane Hicks
Regulatory Branch
San Francisco District
U.S. Army Corps of Engineers
1455 Market Street
San Francisco, CA 94103-1398
jane.m.hicks@usace.army.mil

Mr. Bruce H. Wolfe
San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612
BWolfe@waterboards.ca.gov

Ms. Pamela Creedon
Central Valley Regional Water Quality Control Board
11020 Sun Center Drive, #200
Rancho Cordova, CA 95670-6114
PCreedon@waterboards.ca.gov

Ms. Melissa Escaron
California Department of Fish and Game
P.O. Box 47
Yountville, CA 94599
MESCARON@dfg.ca.gov

cc: (See continuation page)

SIGNATORY REQUIREMENTS

All Documents Submitted In Compliance With This Order Shall Meet The Following Signatory Requirements:

1. All applications, reports, or information submitted to the State Water Resources Control Board (State Water Board) must be signed and certified as follows

   (a) For a corporation, by a responsible corporate officer of at least the level of vice president.
   (b) For a partnership or sole proprietorship, by a general partner or proprietor, respectively.
   (c) For a municipality, or a state, federal, or other public agency, by either a principal executive officer or ranking elected official.

2. A duly authorized representative of a person designated in Items 1.a through 1.c above may sign documents if:

   (a) The authorization is made in writing by a person described in Items 1.a through 1.c above.
   (b) The authorization specifies either an individual or position having responsibility for the overall operation of the regulated activity.
   (c) The written authorization is submitted to the State Water Board Executive Director.

3. Any person signing a document under this section shall make the following certification:

   "I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

cc: (all with Enclosure)

Mr. Hardeep Takhar
California Department of Transportation
111 Grand Avenue
Oakland, CA 94612
Hardeep_S_Takhar@dot.ca.gov

Mr. Ryan Olah
U.S. Fish and Wildlife Service
2800 Cottage Way, Room W-2605
Sacramento, CA 95825
ryan_olah@fws.gov

State Water Resources Control Board

Executive Office

Linda S. Adams
Secretary for Environmental Protection

Charles R. Hoppin, Chairman
1001 I Street • Sacramento, California 95814 • (916) 341-5603
Mailing Address: P.O. Box 100 • Sacramento, California • 95812-0100
Fax (916) 341-5621 • http://www.waterboards.ca.gov

Arnold Schwarzenegger
Governor

ACTION ON REQUEST FOR CLEAN WATER ACT (CWA) SECTION 401 WATER QUALITY CERTIFICATION FOR THE STATE ROUTE 4 (SR4) WIDENING PROJECT, CONTRA COSTA COUNTY (Corps File No. 2002-26746N)

PROJECT: CWA Section 401 Certification SR4 Widening Project, Contra Costa County

APPLICANT: Ms. Susan Miller
Contra Costa Transportation Authority
3478 Buskirk Avenue, Suite 100
Pleasant Hill, CA 94523

This Order responds to your request for a 401 Water Quality Certification (Certification) for the Contra Costa County Transportation Authority's (Authority) SR4 Widening Project (Project). The Authority has applied for a U.S. Army Corps of Engineers (Corps) Individual Permit (Corps No. 2002-26746N) pursuant to section 404 of the CWA (33 U.S.C. 1344) for the proposed Project. The Authority has applied to the State Water Resources Control Board (State Water Board) for a Certification that the Project will not violate State water quality standards.

ACTION:

- ☒ Order for Standard Certification
- ☐ Order for Denial of Certification
- ☐ Order for an Amendment of a Technically Conditioned Certification
- ☐ Order for Waiver of Waste Discharge Requirements

PROJECT DESCRIPTION:

The Authority proposes to widen SR4 in the cities of Pittsburg and Antioch, through Contra Costa County. The Project is located 0.8 miles west of Loveridge Road, and approximately 0.7 miles east of Hillcrest Avenue. This Certification applies to the entirety of the Project from Loveridge Road to State Route 160.

The Project's purpose is to provide traffic congestion relief and meet future traffic demand through the year 2030. Widening activities consist of converting the existing four lane highway to an eight lane facility (three lanes plus a commuter lane). The Project has been designed with additional space within the SR4 median to accommodate the possibility of future public transit improvements.

The primary receiving waters in the Project area are Old Kirker Creek, Kirker Creek, the Los Medanos Wasteway, and West Antioch Creek. All drain to Suisun Bay, approximately four miles north of SR4. Work in jurisdictional waters includes:

- Replacement of a box culvert at Old Kirker Creek. The existing Old Kirker Creek concrete box culvert will be replaced with a higher capacity double box culvert and

extended approximately 38 feet upstream. Approximately 28 linear feet of riprap will be placed upstream of the new culvert;

- In-kind replacement and extension of box culverts at Kirker Creek and the Los Medanos Wasteway. Rock slope protection will be placed at the outlets and inlets of both culverts. Kirker Creek currently crosses beneath SR4 through a 72 inch concrete pipe and double box culvert, and daylights north of Loveridge Road; this system will be replaced in-kind and extended to the south by approximately 98 linear feet with an additional 82 linear feet of riprap; and
- Relocation of a 36 inch sanitary sewer line crossing Old Kirker Creek. The existing line crosses the creek south of the upstream end of the existing culvert and will be relocated south of the existing SR4 crossing.

Additional work includes:

- Widening of the Roosevelt Lane pedestrian undercrossing and the Cavallo Road undercrossings;
- Reconstruction of the Loveridge Road, Somersville Road, Contra Loma; Boulevard-L Street, Lone Tree Way- A Street, and Hillcrest Avenue interchanges. A sixth intersection at G street would be redesigned to accommodate a new SR4 overstructure;
- Replacement of the Century Boulevard undercrossing structure; and
- Shifting of SR4 frontage roads California Avenue and North Park Boulevard to the north to accommodate widening and interchange improvement activities.

STANDARD CONDITIONS:

1. This Certification action is subject to modification or revocation upon administrative or judicial review, including review and amendment pursuant to section 13330 of the California Water Code and Article 6 (commencing with section 3867) of Chapter 28, Title 23 of the California Code of Regulations.

2. This Certification action is not intended and shall not be construed to apply to any activity involving a hydroelectric facility requiring a Federal Energy Regulatory Commission (FERC) license or an amendment to a FERC license unless the pertinent certification application was filed pursuant to subsection 3855(b) of Chapter 28, Title 23 of the California Code of Regulations, and the application specifically identified that a FERC license or amendment to a FERC license for a hydroelectric facility was being sought.

3. This Certification is conditioned upon total payment of any fee required under Chapter 28, Title 23 of the California Code of Regulations and owed by the applicant.

ADDITIONAL CONDITIONS:

1. **Best Management Practices (BMPs)**

   a. Appropriate BMPs shall be implemented throughout the project activities to help minimize sediment disturbance and suspension within the water. All BMP materials shall be on site and ready for use prior to project implementation. BMPs shall be in full compliance with all specifications governing the proper design, installation, operation, and maintenance of such management practices.

   b. No equipment shall be operated in areas of flowing or standing water; no fueling, cleaning or maintenance of vehicles or equipment shall take place within jurisdictional waters or within any areas where an accidental discharge may occur.

   c. Activities shall not cause turbidity increases in surface water to exceed:

      (a) where natural turbidity is between 0 and 5 Nephelometric Turbidity Units (NTUs), increases shall not exceed 1 NTU;

      (b) where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent;

      (c) where natural turbidity is between 50 and 100 NTUs, increases shall not exceed 10 NTUs;

      (d) where natural turbidity is greater than 100 NTUs, increases shall not exceed 10 percent.

      Except that these limits will be eased during in-water working periods to allow a turbidity increase of 15 NTU over background turbidity as measured in surface waters 300 feet downstream from the working area. In determining compliance with the above limits, appropriate averaging periods may be applied provided that beneficial uses will be fully protected.

   d. Activities shall not cause settleable matter to exceed 0.1 ml/l in surface waters as measured in surface waters 300 feet downstream from the project.

   e. In the event that project activities occur in surface waters, result in the deposition of soil materials, or create a visible plume, the following monitoring shall be conducted immediately upstream and 300 feet downstream of the work site and the results reported to the State Water Board:

Parameter	Unit	Type of Sample	Frequency of Sample
Turbidity	NTU	Grab	Every 4 hours during work in water
Settleable Material	ml/l	Grab	Same as above.

f. The Authority shall notify the State Water Board immediately if the above criteria are exceeded.

g. Dewatering and diversion activities shall be executed as described in the "Dewatering and Non-Storm Water Discharge Control Plan" revised May 9, 2009. Any deviation from the Project plans shall require State Water Board approval.

h. Stream diversion activities shall occur only between April 1st and October 15th.

i. Prior to dewatering and diversion activities, the Authority shall ensure a biologist is on site to ensure no sensitive aquatic species are stranded in areas of dewatering and diversion.

j. The Authority shall immediately remove stream diversion structures when diversion is no longer necessary. All diverted streams shall be returned to their original condition.

k. All on- and off-site biofiltration swales shall incorporate a soil amendment to enhance their infiltrative capacity and be maintained on a regular basis to ensure optimal treatment functionality.

l. The off-site stormwater treatment project shall be completed at or before Project completion.

m. No debris, soil, silt, sand, cement, concrete, or washings thereof, other construction related materials or wastes, oil or petroleum products or other organic or earthen material shall be allowed to enter into or be placed where it may be washed by rainfall or runoff into jurisdictional wetlands or waters. Upon completion of construction, all construction-related materials shall be removed from the work area and any areas adjacent to the work area.

n. Disturbance or removal of vegetation shall be minimized. The site shall be stabilized utilizing BMPs, including the successful reestablishment of native vegetation, to enhance wildlife habitat values, and to prevent and control erosion and sedimentation. Revegetation work is not confined to the period of April 1st to October 15, but must be completed in the same calendar year.

2. Monitoring Reports

a. Monitoring reports will be submitted by November 1st of each monitoring year to the 401 Program Managers of the State Water Board and the appropriate Regional Water Board(s) documenting work undertaken the previous year(s). The reports, at a minimum, shall include:

i. Names, titles, and affiliations of all persons who prepared the report and conducted field work;
ii. Copies of Corps permits, any special Conditions, and subsequent Letters of Memorandum;
iii. Analysis of all quantitative monitoring data;
iv. Electronic or color copies of all photo-documentation;
v. Maps showing the monitoring area, vegetation survey sites, and photo-documentation points; and
vi. Remedial action recommendations, as needed.

b. Monitoring reports shall be submitted for five years. Reports shall be directed to: Program Manager, Certification and Wetlands Program at the following State and appropriate Regional Water Board office(s):

State Water Resources Control Board
Division of Water Quality
1001 "I" Street, 15th Floor
Sacramento, CA 95814

San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

Central Valley Regional Water Quality Control Board
Sacramento Office
11020 Sun Center Drive, Suite 200
Rancho Cordova, CA 95670-6114

c. The Authority shall notify the State Water Board within 24 hours of any noncompliance that may impact the beneficial uses of waters of the State. The notification shall include the volume and type of materials discharged and recovered, measures used to contain the discharge, and measures used to prevent future discharges.

ADMINISTRATIVE CONDITIONS:

1. The Authority shall submit to the State Water Board a Bill of Sale of 0.944 acres of seasonal freshwater wetland mitigation credits from Elsie Gridley Mitigation Bank.

2. The Authority shall adhere to the conditions imposed by the Project Individual Permit, issued to the Authority by the Corps.

3. A copy of the Storm Water Pollution Prevention Plan (SWPPP) shall be provided to the State Water Board at least 30 days prior to the start of construction. Except as expressly allowed in this Certification, the discharge, or creation of the potential for discharge, to waters of the State of any construction wastes and/or soil materials including cement, fresh concrete, or washings thereof, silts, clay, sand, oil or petroleum products and other organic materials to waters of the State is prohibited.

4. The Authority shall maintain a copy of this Certification and supporting documentation (Attachments) at the Project site during construction for review by site personnel and agencies. All personnel (employees, contractors, and subcontractors) performing work on the proposed project shall be adequately informed and trained regarding the conditions of this Certification.

5. The Authority shall grant State Water Board and Regional Water Board staff, or an authorized representative, upon presentation of credentials and other documents as may be required by law, permission to enter the project site at reasonable times, to ensure compliance with the terms and conditions of this Certification and/or to determine the impacts the project may have on the waters of the State.

6. In the event of any violation or threatened violation of the conditions of this Certification, the violation or threatened violation must be subject to any remedies, penalties, processes, or sanctions as provided for under State law.

7. The State Water Board reserves the right to suspend, cancel, or modify and reissue this Certification, after providing notice to the Authority and/or responsible Project Site Supervisor, if the State Water Board determines that the project fails to comply with any of the terms or conditions of the Certification.

8. Designs and details for all post construction BMPs shall be submitted to the State Water Board for review and approval. Post construction BMPs shall not be constructed until State Water Board staff has approved the designs for the BMPs.

9. The activity(ies) described in the 401 Certification application shall not result in the taking of any State endangered species, threatened species, or candidate species, or the habitat of such a species unless the activity is authorized by the California Department of Fish and Game pursuant to a permit, memorandum of understanding, or other document or program in accordance with Fish and Game Code sections 2081, 2081.1, or 2086.

10. All protective measures included in the Biological Opinion (#1-1-05-F-0158 and amendment issued on April 15, 2008) issued by the United States Fish and Wildlife Service on June 13, 2005 and the 1602 Lake and Streambed Alteration Agreement (#1600-2008-0217-3) issued by the California Department of Fish and Game on November 6, 2008 for this project will be implemented. All protective measures included in the 1602 Lake and Streambed Alteration Agreement for the Somersville to State Route 160 segment will be implemented. A copy of the 1602 Lake and Streambed Alteration Agreement for the Somersville to State Route 160 shall be provided to the State Water Board prior to any discharge to waters of the State.

11. Any significant modifications to the Mitigation and Monitoring Report, June 2009 (Attachment D) must be approved by the State Water Board before implementation.

12. This Certification does not obviate the need to obtain other permits that may be required by federal, state, or local authorities.

13. Failure to comply with any condition of this Certification shall constitute a violation of the CWA and the Porter-Cologne Water Quality Control Act. Any such certification previously granted shall immediately be revoked, and any or all discharges shall cease. The permittee may then be subject to administrative and/or civil liability pursuant to Water Code section 13385.

14. Certification is conditioned upon total payment of the full fee required in State regulations (23 CCR section 3833). State Water Board staff received two checks one on March 1, 2009 ($943.00) and another April 4, 2009 ($347.00) for fees associated with this Project.

STATE WATER BOARD CONTACT PERSON:

If you have any questions, please contact State Water Board Environmental Scientist Amna Hawatky at (916) 341-5483 (**ahawatky@waterboards.ca.gov**). You may also contact Bill Orme, Chief of the 401 Certification and Wetlands Protection Unit, at (916) 341-5464 (**borme@waterboards.ca.gov**).

WATER QUALITY CERTIFICATION:

I hereby issue an order certifying that any discharge from the referenced project will comply with the applicable provisions of Clean Water Act sections 301 (Effluent Limitations), 302 (Water Quality Related Effluent Limitations), 303 (Water Quality Standards and Implementation Plans), 306 (National Standards of Performance), and 307 (Toxic and Pretreatment Effluent Standards), if all of the conditions listed in the certification action are met. This discharge is also regulated pursuant to State Water Board Quality Order No. 2003-0017-DWQ, which authorizes this certification to serve as Waste Discharge Requirements pursuant to the Porter-Cologne Water Quality Control Act (Wat. Code, § 13000 et seq.).

Except insofar as may be modified by any preceding conditions, all certification actions are contingent on: (a) the discharge being limited and all proposed mitigation being completed in strict compliance with the Mitigation and Monitoring Report for Jurisdictional Waters of the U.S, Project Information Sheet (Attachment B), and (b) compliance with all applicable requirements of the Regional Water Board's Water Quality Control Plan.

Dorothy Rice, Executive Director
State Water Resources Control Board

7.06.09
Date

Attachments:
A. Signatory Requirements
B. Project Information Sheet
C. Project Impacts and Mitigation
D. Mitigation and Monitoring Report