FOR CONTRACT NO.: 06-0E5904

INFORMATION HANDOUT

1. GEOTECHNICAL DESIGN REPORT
(Pipe Jacking at David Road and Sandrini Road)

2. UNDERGROUND CLASSIFICATION

ROUTE: 06-Mad-99, 145-KP 16.4/16.8, 14.3/14.8

State of California
Department of Transportation

Memorandum

Business, Transportation and Housing Agency

Flex your power!
Be energy efficient!

To: **GURBHAY BRAR**
Design Senior, Design IV
Project Development

Attention: Gurdeep Brar

Date: February 11, 2011

File: 06-KER-99 PM 3.99/10.4
06-0E5901
0600000057
Pipe Jacking at David Road and Sandrini Road

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES – MS 5

Subject: Geotechnical Design Report (GDR)

1.0 Introduction

Per your request, the Office of Geotechnical Design North (OGDN) has prepared this Geotechnical Design Report for the proposed pipe jacking at two locations along State Route 99 at David Road and Sandrini Road in Kern County, as shown in Figure 1, Site Vicinity Map, in the Appendix.

The purpose of this report is to document and discuss site subsurface geotechnical conditions, and provide preliminary geotechnical design and construction recommendations. Cone Penetration Testing (CPT) was performed to study the subsurface conditions at the sites.

2.0 Existing Facilities and Proposed Improvements

Route 99 at the project locations is a six-lane freeway composed of three 12-foot lanes and 10-foot paved outside shoulders. The lands east of Route 99 at the project locations are primarily used as agriculture fields. The diversion of the storm water from these fields to David Road and Sandrini Road has produced severe flooding in the areas in the past. Currently, storm runoff flows along these roads westerly until reaching the northbound outside shoulder of Route 99 to be collected. The collected storm runoff then flows northerly along the shoulder and drains into a canal located west of Route 99 through a cross culvert.

Based on District 6 Traffic Investigation, the existing side ditch of Route 99 appears to have inadequate capacity to carry tributary runoff throughout its length during larger storm evens. At locations where storm runoff exceeded the capacity of the side ditch, runoff had encroached the northbound traveled lanes of Route 99.

The proposed project will re-grade the northbound outside slopes, construct a detention basin at David Road, and install cross culverts at David Road and Sandrini Road in accordance with Caltrans Standard Plans (Map 2006). The culverts will be circular reinforced concrete pipes with a diameter of 36 inches. The lengths of the culverts are to be 176 feet and 97 feet at David Road and Sandrini Road, respectively. Based on the Drainage Profiles provided to us, we understand that the cross culvert at David Road will be installed at about 12 feet below the existing roadway surface with a cross slope of 1.36%. The cross culvert at Sandrini Road will be installed at about 10 feet below the existing roadway surface with a cross slope of 0.70%. Pipe Jacking method has been considered for the installations of the cross culverts. The proposed drainage profiles are provided in the Appendix.

3.0 Pertinent Reports and Investigations

In preparation of this report, the following documents have been reviewed:

1. Project Report (PSR), 06-KER-99 PM 3.99/10.4, 06222-0E5900, HB-1 20.XX.201.015, NOV 2009, November 30, 2009
2. Project Plan For Construction On State Highway, In Kern County, In And Near Bakersfield From 0.7 Mile South of Panama Lane Overcrossing To 0.2 Mile North of Ming Avenue Overcrossing, June 29, 1987
3. Climatological Summary, Period of Record: Feb 1998 to Dec 2008, Station: Hanford Municipal Airport (KHJO), California, Western Regional Climate Center (WRCC)
4. Geologic Map of California, OLAF P. Jenkins Edition, Bakersfield Sheet, State of California, The Resources Agency, Department of Conservation, Division of Mines and Geology, 1967
5. Geotechnical Services Design Manual, Version 1.0, August 2009
6. 2007 Caltrans Deterministic PGA Map Fault Identifications (FID) Shown, September, 2007
7. Seismic Design Criteria, Version 1.5, Caltrans, August 2009

8. Groundwater Level Data, Wells 32S28E20Q001M, 32S28E20R061M, 32S28E20N001M, 32S28E33J001M, 32S28E32H002M, 32S28E32P001M, Department of Water Resources
9. A General Location Guide for Ultramafic Rocks in California – Areas More Likely to Contain Naturally Occurring Asbestos, Compiled by Ronald K. Churchill and Robert L. Hill, CDMG, 2000

4.0 Physical Setting

The physical setting of the project site and the surrounding area was reviewed to provide climate, topography and drainage, geology, and seismicity characteristics to aid in project design and construction planning. The following summarizes the results of this review.

4.1 Climate

Climate information of the proposed project area is obtained based on a Climatological Summary produced by the Western Regional Climate Center (WRCC) over a period between February 1998 and December 2008. The data were collected in Hanford Municipal Airport, California station.

According to Summary, the average annual precipitation is 7.67 inches, with a majority of the precipitation (over 80 percent) occurs between (include) November and April. The average daily minimum temperature ranges from 35.7° Fahrenheit (F) in December to 64.9° F in July. The average daily maximum temperature ranges from 54.3° F in January to 96.7° F in July.

4.2 Topography & Drainage

In the areas near the sites, the terrain is flat. Lands in the areas are primarily used as agriculture fields. At David Road site, the ground surface elevations range approximately from 421 to 425 feet above Mean Sea Level (MSL). At Sandrini Road site, the ground surface elevations range approximately from 346 to 350 feet about MSL. Surface drainage feature is limited to minor remnant of arbitrary stormwater runoffs in the areas.

4.3 Geology

The site is situated in the southern portion of the Great Valley geomorphic province of California, an elongated lowland between the Sierra Nevada Mountains and the Coast Ranges. Unconsolidated Recent and Pleistocene sediments eroded from the Sierra Nevada Mountains and the Coast Range form the surface of the Great Valley. Below the surface of the Great Valley, a sequence of sedimentary rock deposited from the Mesozoic (Jurassic and Cretaceous) to the Cenozoic extends to as deep as 15,000 feet.

Locally, based on the Geologic Map of California, Bakersfield Sheet, the David Road site is underlain by Great Valley Fan Deposit (Qf), and the Sandrini Road site is underlain by Dune Sand Deposit (Qs). Figure 2, Geology Map, is provided in the Appendix.

5.0 Exploration

To explore the subsurface condition, four Cone Penetration Testing (CPTs) were performed at the project sites on December 15, 2010. CPTs 15D01-01 and 15D02-02 were performed at David Road site and were extended to depths of about 50 feet below the existing ground surface. CPTs 15D03-03 and 15D04-04 were performed at the Sandrini Road site and were extended to depths of about 35 feet below the existing ground surface.

Logs of the CPTs and a CPT Soil Behavior Type Legend are provided in the Appendix.

6.0 Geotechnical Conditions

6.1 Subsurface Soil Conditions

6.1.1 David Road Site

Based on the result of CPTs, the subsurface materials at the David Road site consisted of predominantly sands with interbedded thin layers of silts and mixtures of silts and sands. The Cone (Tip) Resistances, q_c, recorded in the materials ranged between approximately from less than 20 to over 400 tons per square foot (tsf), with an average of approximately 60 tsf. The values of the recorded q_c indicate that the subsurface sandy materials exhibit

loose to very dense relative densities. The loose materials appeared to be localized within 5 feet from the existing ground surface.

6.1.2 Sandrini Road Site

Based on the result of CPTs, the subsurface materials at the Sandrini Road site consisted of predominantly sands with interbedded thin layers of silts and mixtures of silts and sands. The Cone (Tip) Resistances, q_c, recorded in the materials ranged between approximately from less than 50 to over 400 tons per square foot (tsf), with an average of approximately 100 tsf. The values of the recorded q_c indicate that the subsurface sandy materials exhibit medium dense to very dense relative densities.

6.2 Groundwater

Groundwater was not encountered in the CPTs performed at the sites. Groundwater levels recorded in the wells of Department of Water Resources (DWR) located near the project sites were used to estimate the groundwater conditions at the sites. Tables 2 and 3 below summarize the groundwater levels recorded in these wells.

Table 2 - Groundwater Levels for Sandrini Road Site

Location	Date	Groundwater Level, Below Ground Surface (ft)
State Well 32S28E20Q001M	1970 - 1977	146.9 – 168.0
State Well 32S28E20R061M	July 2007	20.0
State Well 32S28E20N001M	1981 - 2010	75.0 – 187.0

Table 3 - Groundwater Levels for David Road Site

Location	Date	Groundwater Level, Below Ground Surface (ft)
State Well 32S28E33J001M	1954 - 1957	201.5 – 238.6
State Well 32S28E32H002M	November 1981	318.0
State Well 32S28E32P001M	1954 - 1959	107.6 – 120.8

Groundwater condition may have changed significantly since the time of the above groundwater levels were recorded and will fluctuate according to the seasonal and other local conditions.

6.3 Corrosion

Based on the available geologic information and the results of previous projects, the subsurface soils at the sites are considered non-corrosive.

6.4 Asbestos

According to "A General Location Guide for Ultramafic Rocks in California – Areas More Likely to Contain Naturally Occurring Asbestos, Compiled by Ronald K. Churchill and Robert L. Hill, August 2000, CDMG", the sites are not in the area of naturally occurring asbestos.

7.0 Geotechnical Recommendations

7.1 Cross Culverts

We understand that the proposed 36-inch diameter reinforced concrete cross culverts will be designed and constructed in accordance with Caltrans Standard Plans (May 2006).

Based on the CPT data, the existing materials at the David Road and Sandrini Road sites are suitable for and should provide adequate supports to the proposed cross culverts.

In accordance with the requirement of California State Division of Occupational Safety and Health (Cal/OSHA), Mining and Tunneling Unit (refer to Cal/OSHA Regulations, Subchapter 20, Tunnel Safety Orders, Article Eight, Tunnel Classifications, Section 8842, Tunnel Classifications), and based on the geologic information as well as the CPT data, the sites are considered as Nongassy.

7.2 Pipe Jacking

7.2.1 General

We understand that pipe jacking method, as general, has been considered to install the cross culverts at the sites. Pipe jacking at the sites shall conform to the provisions in Section 65, Reinforced Concrete Pipe, especially the provisions in Section 65.1.05, Jacking Pipe, of Caltrans Standard Specification (May 2006).

7.2.2 Pipe Jacking Methods

Detail of pipe jacking method has not been made available at this time. Broadly, pipe jacking includes many trenchless construction methods. Based on the scope of the proposed construction and the site conditions, Microtunneling or Horizontal Auger Boring is considered favorable at the sites. Manned-Personnel Tunnel Boring Machine is not recommended. A general discussion for Microtunneling and Horizontal Auger Boring is provided below.

Microtunneling – Microtunneling is a laser guided process that uses a remotely controlled Microtunnel Boring Machine (MTBM) and the pipe jacking technique to install pipelines underground without opening trench. Pipelines of various diameters can be installed by Microtunneling. Since it is laser guided, microtunneling is considered the most accurate pipeline installation method. The standard line and grade tolerance for microtunneling is one inch.

Horizontal Auger Boring – Horizontal Auger Boring is commonly referred as "Jack and Bore" method. It involves the use of an auger to penetrate the ground and remove soil.

Surrounding the auger, a steel casing is jacked together with the auger tube. The casing may be the product pipe to be installed, or may be used as an exterior pipe when an interior product/carrier pipe is installed. Horizontal auger boring can be done either with or without laser guidance. Due to the augering process, the maximum diameter of the pipe is limited to 60 inches. The diameter of the cross culverts proposed at the sites is 36 inches, which is less than the maximum limit of the method.

7.2.3 Pipe Jacking Induced Settlement

Pipe jacking may result in settlement at ground surface. The cause of settlement is considered to be the formation of "subsidence trough" along the longitudinal axis of the tunnel. The trough is a cone shaped depression beginning somewhere above the tunnel and propagating upward to the ground surface. The formation of the trough is the results of overcutting and incremental collapse/caving of the tunnel crown as jacked pipe proceeds. A semi-empirical method, Volume Loss, is used to estimate the pipe jacking induced settlement at the sites. The method approximates the ground loss by estimating the volume of the subsidence trough. The estimated pipe jacking induced settlements at the ground surface of the sites are on the order of ¾ inch.

We recommend that settlement monitoring be included and implemented during pipe jacking. Recommendations for settlement monitoring are provided in 8.0 Construction Considerations.

7.2.4 Pipe Jacking Induced Heaving

Heaving may occur during pipe jacking when there is insufficient overburden pressure. Based on the drainage profiles provided, the pipes will be installed at about 12 and 10 feet below the roadway surface at David Road site and Sandrini Road site, respectively. As such, a minimum of 10 feet overburden is anticipated to be available during the pipe jacking. Therefore, heaving is not anticipated at the roadway surfaces at the sites.

7.3 Jacking & Receiving Pits

7.3.1 Excavation

Construction of jacking and receiving pits will require excavation. Excavation depth has not been made available at this time. Based on the drainage profile provided, we anticipate that the excavations will be no greater than 20 feet below the existing ground surface. Based on the results of the CPTs and the assumed maximum excavation depth of 20 feet, excavations should be able to achieve by using conventional earth moving equipments at the sites. Difficult excavation is not anticipated.

Excavation shall conform to the provisions in Section 19, Earthwork, especially the provisions in Section 19-3, Structure Excavation And Backfill, of Caltrans Standard Specification (May 2006).

7.3.2 Groundwater and Surface Water Control

Based on the CPT data and the groundwater level records of the state wells, groundwater is not anticipated to affect the proposed constructions. If the construction is in raining season, depending on the actual weather condition, localized purged groundwater may develop in the vicinities of the sites. Provided it occurs and affects the excavations, dewatering should be achieved by using temporary pump and sump. Permanent dewatering is not anticipated at the sites.

The ground surface around the perimeter of the excavation should be properly prepared, i.e. sloped, such that surface runoff is directed away from the excavation and flooding is prevented from being adjacent to the excavation.

Groundwater and surface water control shall conform to the provisions in Section 19, Earthwork, especially the provisions in Section 19-3.04, Water Control And Foundation Treatment, of Caltrans Standard Specification (May 2006).

7.3.3 Excavation Induced Settlement

Excavation may result in settlement at ground surface in the area surrounding the excavation. Based on the granular nature of the subsurface materials indicated by the

CPT data and a deep groundwater level anticipated based on the groundwater level records of the state wells, and based the anticipation of a relatively shallow excavation (less than 20 feet), the excavation induced settlement at the sites should be able to maintain at minimum provided the excavations are properly sloped or shored. We recommend that the ground surface in the vicinity of the excavation be monitored for settlement. Recommendations for settlement monitoring are provided in 8.0 Construction Considerations.

8.0 Construction Considerations

8.1 Settlement Monitoring

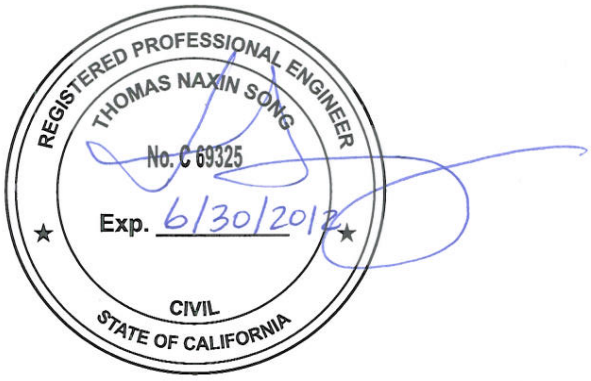
Settlement monitoring should be included in the project submittal for review. Monitoring program should be set up and carried out by the contractor to determine the effects of the construction on the adjacent roadways and structures. Survey monuments should be set and read prior to the start of construction activities to establish the pre-existing conditions. We recommend that the survey monuments be capable of being read to an accuracy of 0.01 foot.

For excavation induced settlement, the monument should be set in the adjacent ground and on the shoring if applicable. We recommend that, at minimum, eight monuments be set up in the area surrounding the excavation, with one monument at each of the four corners and one monument at each mid-point of four sides.

For pipe jacking induced settlement, the monuments should be set directly above and offset from the alignments of jacked pipes. We recommend that, at minimum, three rows of monuments be set up, with one row directly above the alignment, one row offset 10 feet to the right of the alignment, and one row offset 10 feet to the left of the alignment. Each row should have a minimum of three monuments, with one at each end and one at the midpoint.

Survey should be made periodically, more often and no less than once per week during construction, and extend at minimum one month after the completion of construction. We recommend that the settlement monitoring be performed by a licensed third party contractor.

If you have any questions or comments, please call Thomas Song at (916) 227-1057 or John Huang at (916) 227-1037.



Thomas Naxin Song, P.E.
Transportation Engineer, Civil
Geotechnical Design – North
Branch E

Attachments

c: District Project Manager, Steven Milton
Project Coordination Engineer, Peggy Lim
GS Corporate, Mark William
District Environmental Planning, Trais Norris
District Construction R.E. Pending File
District Materials Engineer, Doug Lambert

APPENDIX

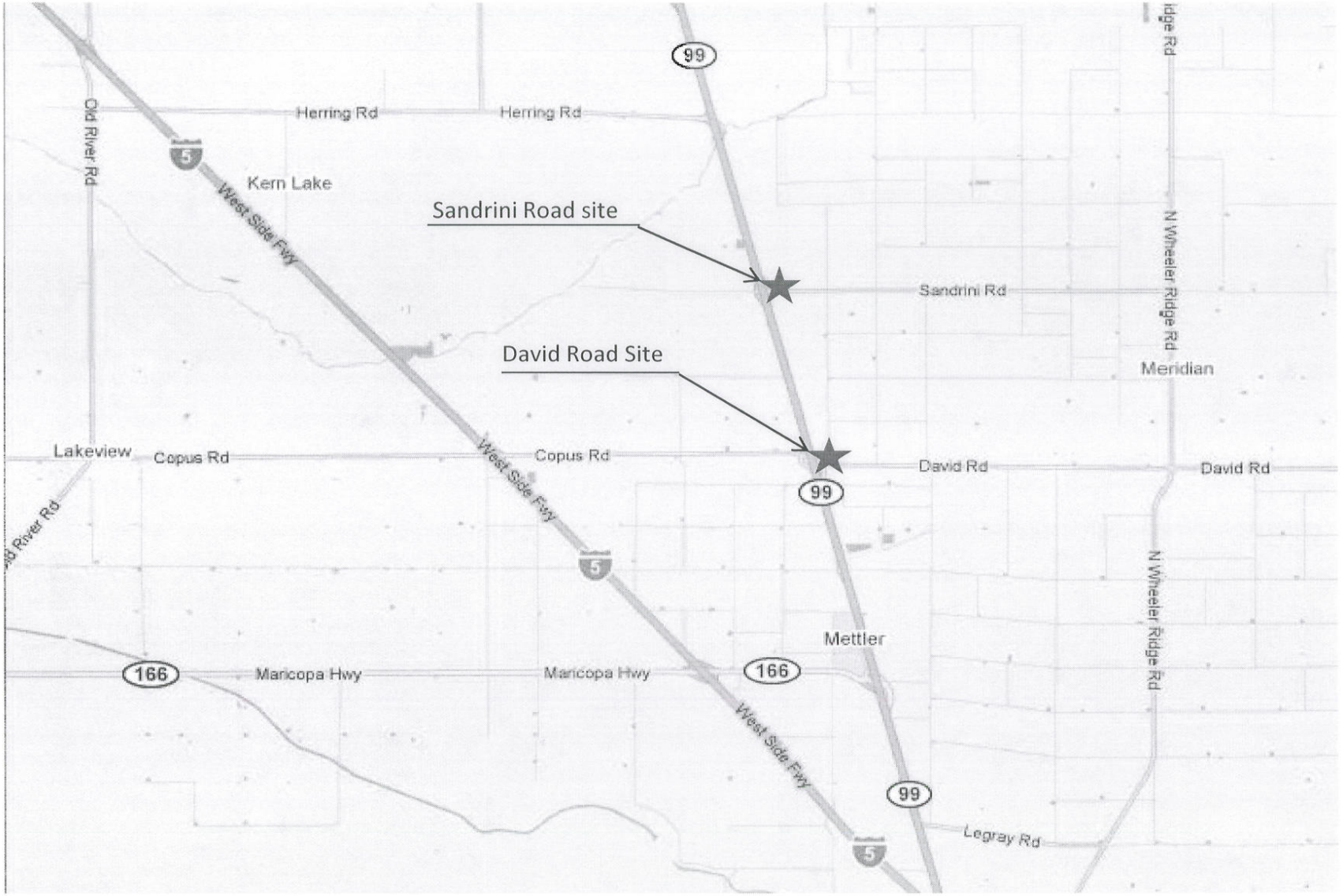
Figure 1 Vicinity Map

Figure 2 Geology Map

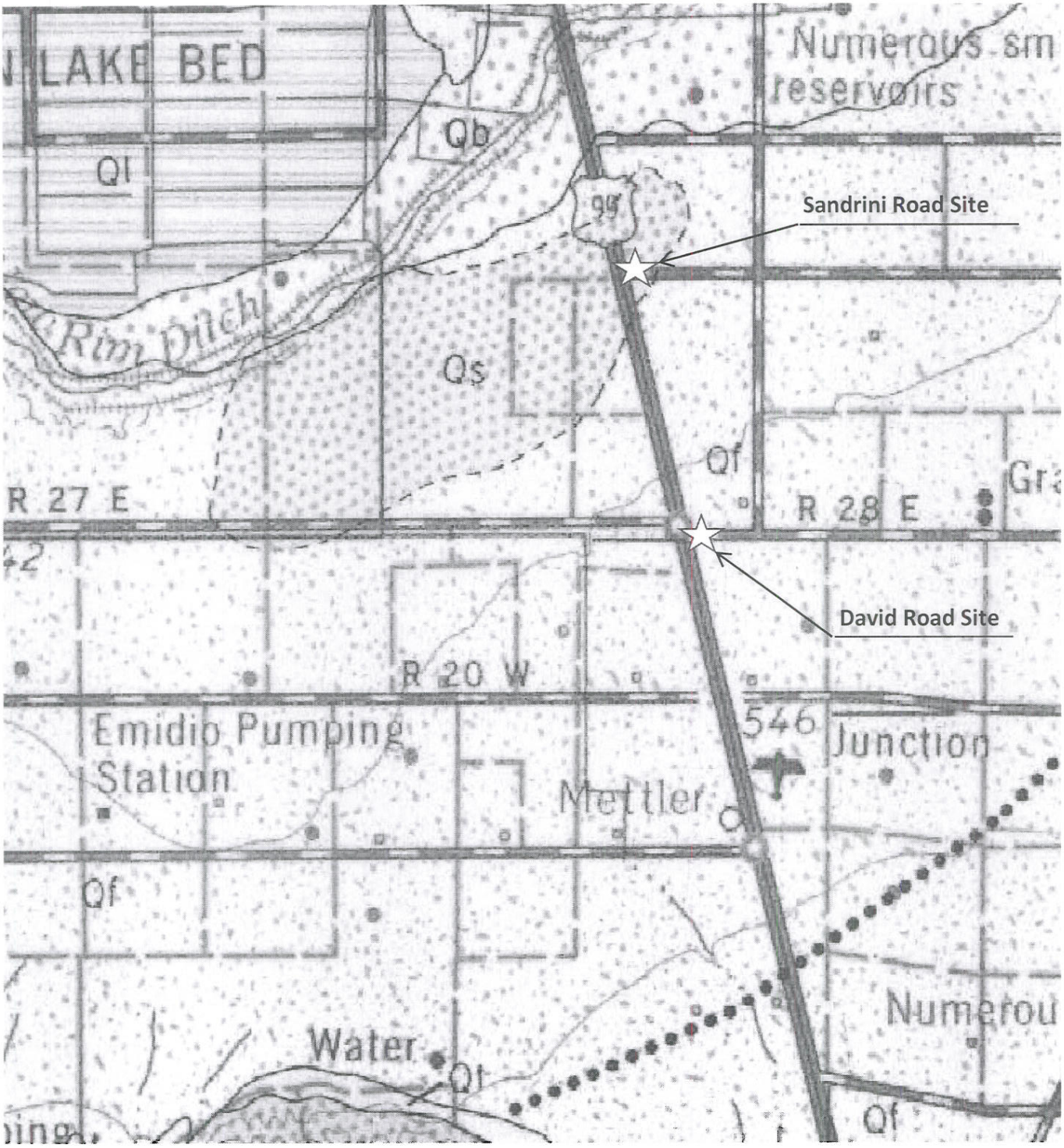
CPT Logs

CPT Soil Behavior Type Legend

Proposed Drainage Profiles



Caltrans	**DEPARTMENT OF TRANSPORTATION** **Division of Engineering Services** **Geotechnical Services** **Office of Geotechncial Design - North (OGDN)**	EA: 06-0E5901 DATE: 1/24/2011	06-KER-99 PM3.99/10.4 VALPREDO PIPE JACKING
		SITE VICINITY MAP	Figure 1



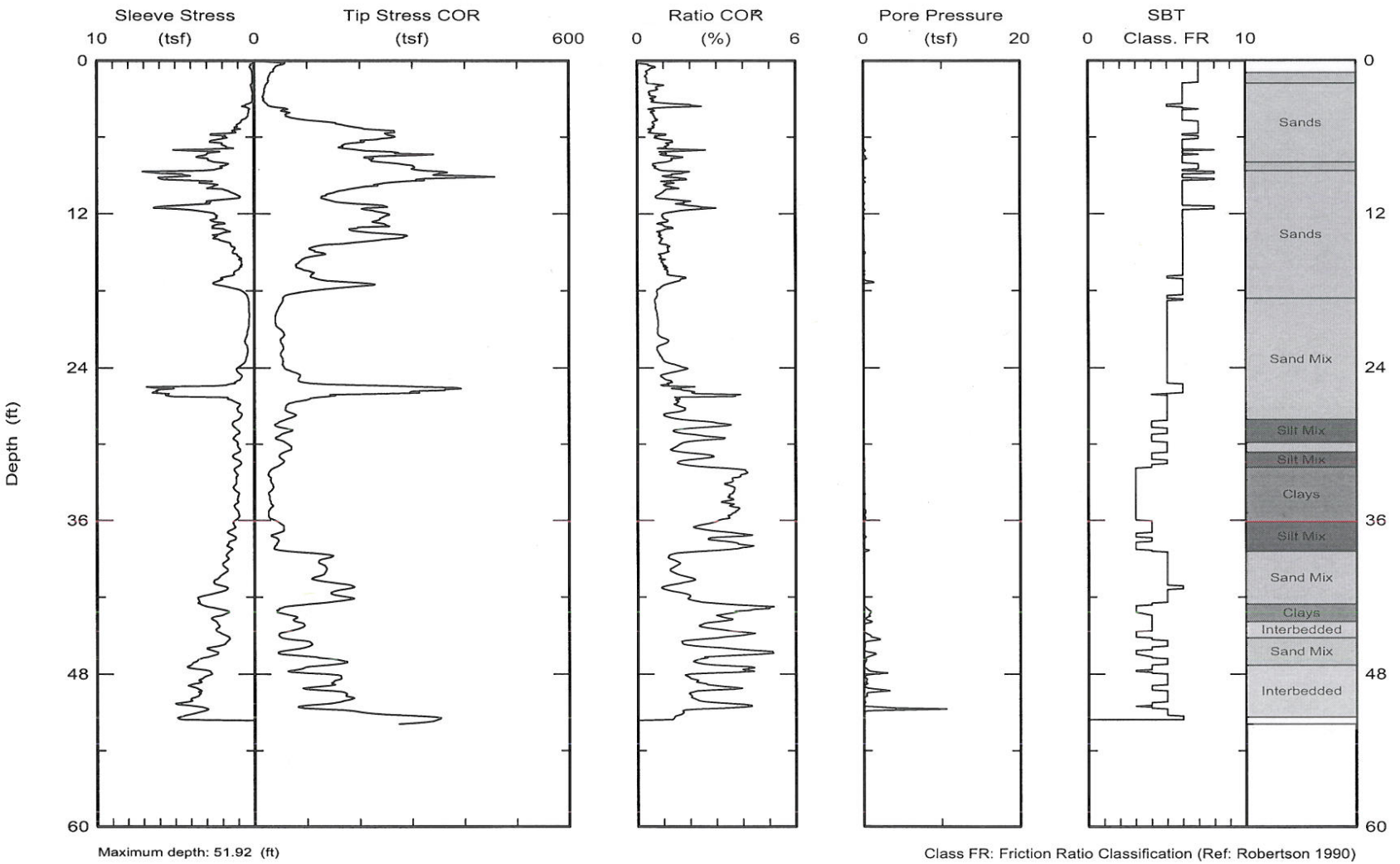
Note:

Qf - Great Valley Fun Deposit

Qs - Dune Sand Deposit

Caltrans	EA: 06-0E5901	06-KER-99 PM 3.99/10.4 VALPREDO PIPE JACKING
	DATE: 1/24/2011	
	DEPARTMENT OF TRANSPORATION Division of Engineering Services Geotechnical Services Office of Geotechnical Design - North (OGDN)	Figure 2

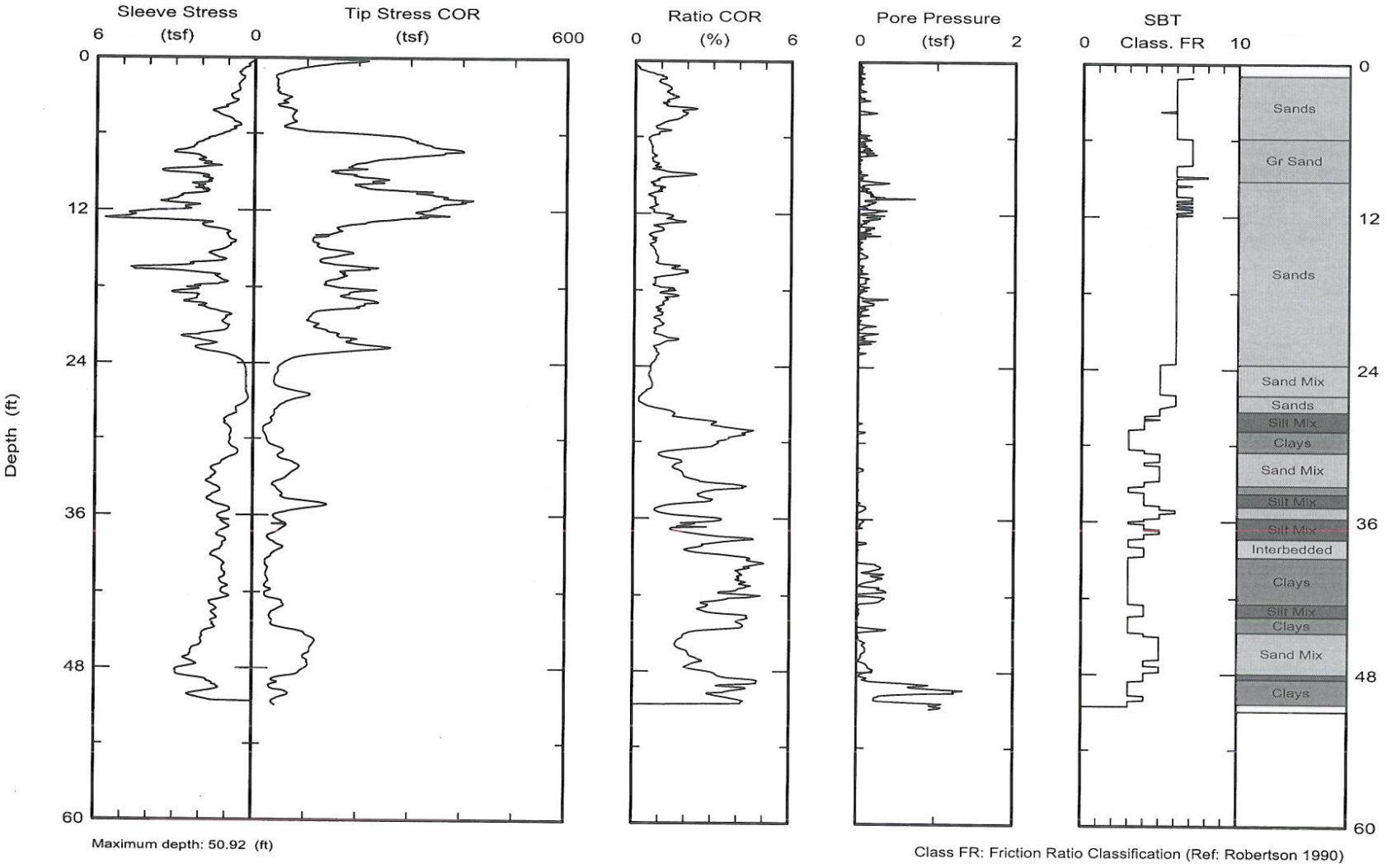
Division of Engineer Service Geotechnical Service 5900 Folsom Blvd. Sac., CA 95819 www.dot.ca.gov	Lat: Lon: Elevation:	Date: 15/Dec/2010 Test ID: 15D01-01 Project: 060E59041
	Customer: TOM SONG Job Site: VALPREDOPIPEJACKING	



Maximum depth: 51.92 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

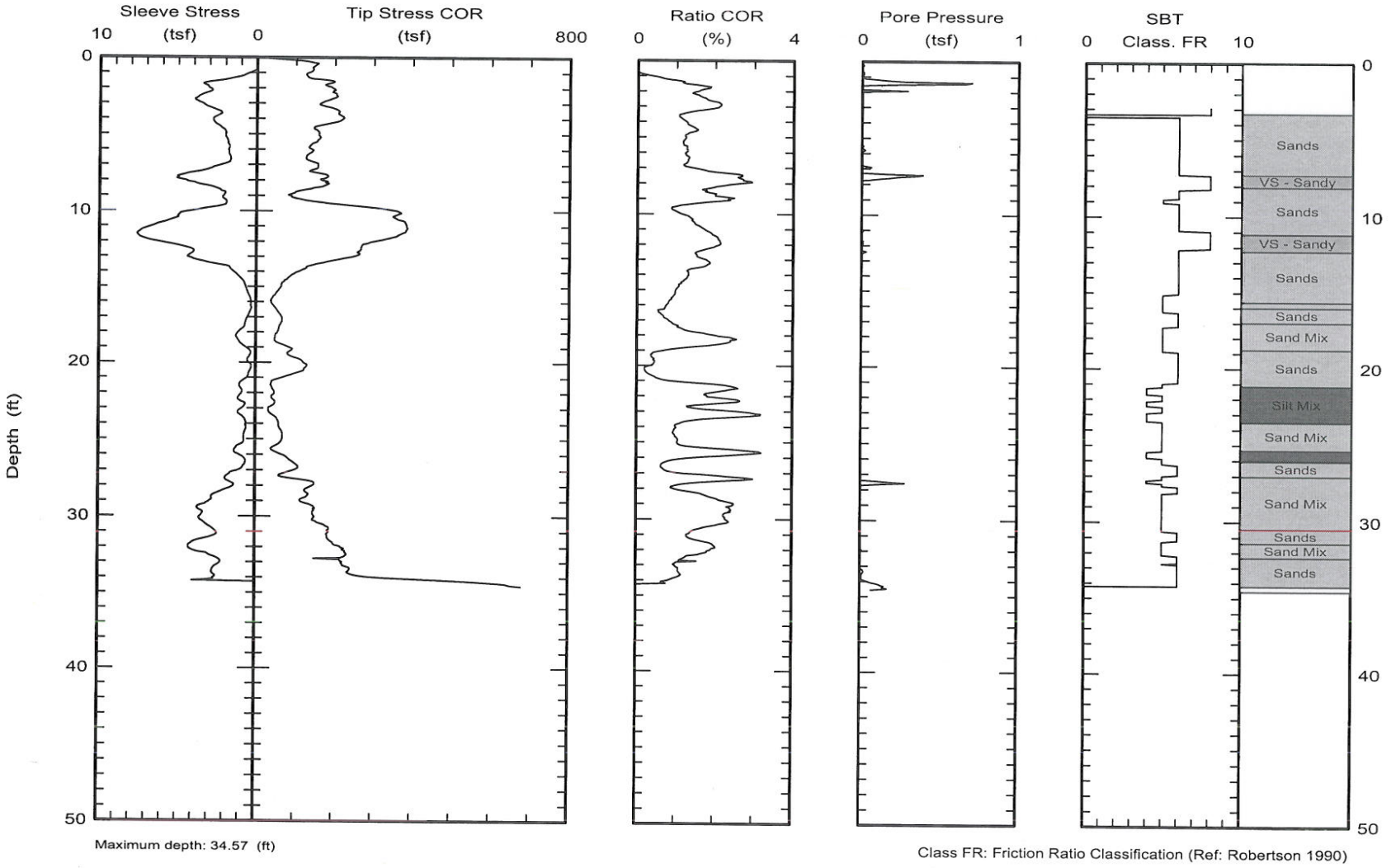
Division of Engineer Service Geotechnical Service 5900 Folsom Blvd. Sac., CA 95819 www.dot.ca.gov	Lat: Lon: Elevation:	Date: 15/Dec/2010 Test ID: 15D02-02 Project: 060E59041
	Customer: TOM SONG Job Site: VALPREDOPIPEJACKING	



Maximum depth: 50.92 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Division of Engineer Service Geotechnical Service 5900 Folsom Blvd. Sac., CA 95819 www.dot.ca.gov	Lat: Lon: Elevation:	Date: 15/Dec/2010 Test ID: 15D03-03 Project: 060E59041
	Customer: TOM SONG Job Site: VALPREDOPIPEJACKING	



Maximum depth: 34.57 (ft)

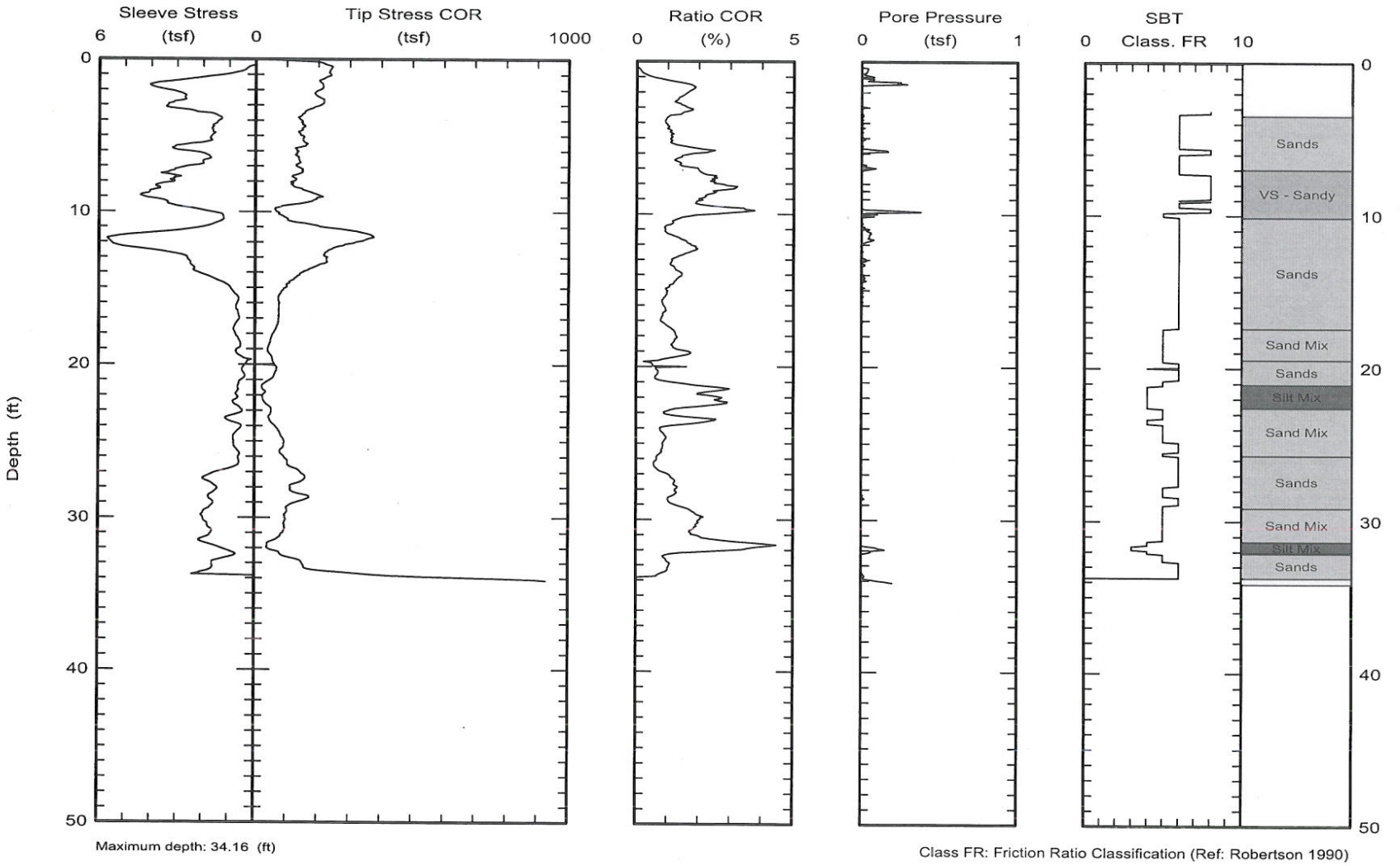
Class FR: Friction Ratio Classification (Ref: Robertson 1990)

Division of Engineer Service
Geotechnical Service
5900 Folsom Blvd. Sac., CA 95819
www.dot.ca.gov

Lat:
Lon:
Elevation:

Date: 15/Dec/2010
Test ID: 15D04-04
Project: 060E59041

Customer: TOM SONG
Job Site: VALPREDOPIPEJACKING

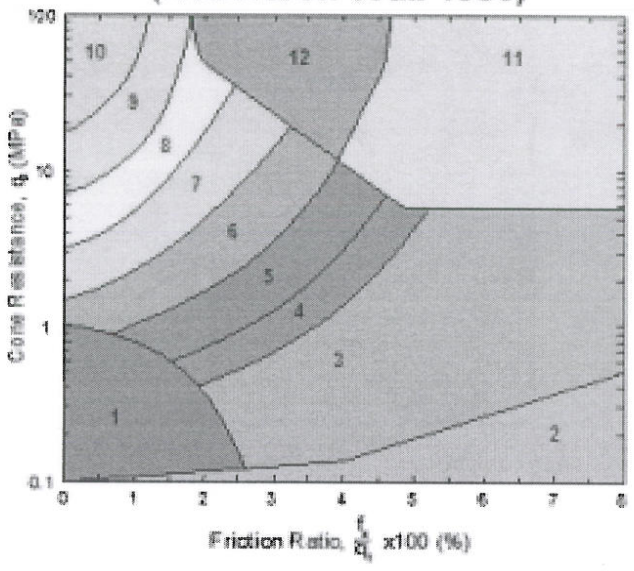


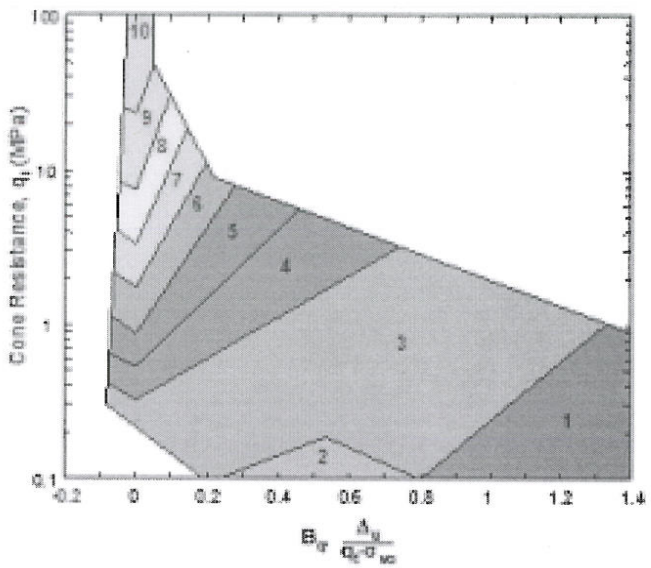
Maximum depth: 34.16 (ft)

Class FR: Friction Ratio Classification (Ref: Robertson 1990)

CPT Soil Behavior Type Legend

(Robertson et al. 1986)

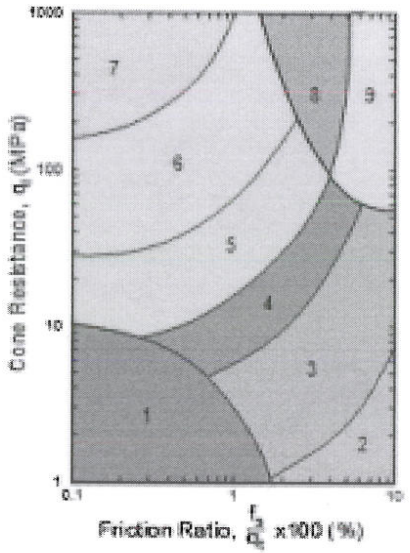


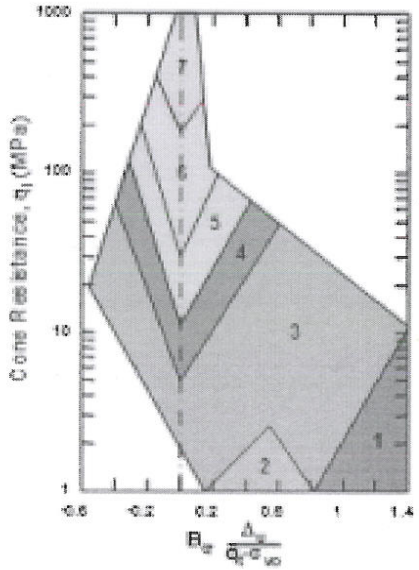


Zone	Soil Behavior Type
1	Sensitive, Fine Grained
2	Organic Material
3	Clay
4	Silty Clay to Clay
5	Clayey Silt to Silty Clay
6	Sandy Silt to Clayey Silt
7	Silty Sand to Sandy Silt
8	Sand to Silty Sand
9	Sand
10	Gravelly Sand to Sand
11	Very Stiff Fine Grained*
12	Sand to Clayey Sand*

*Overconsolidated or Cemented

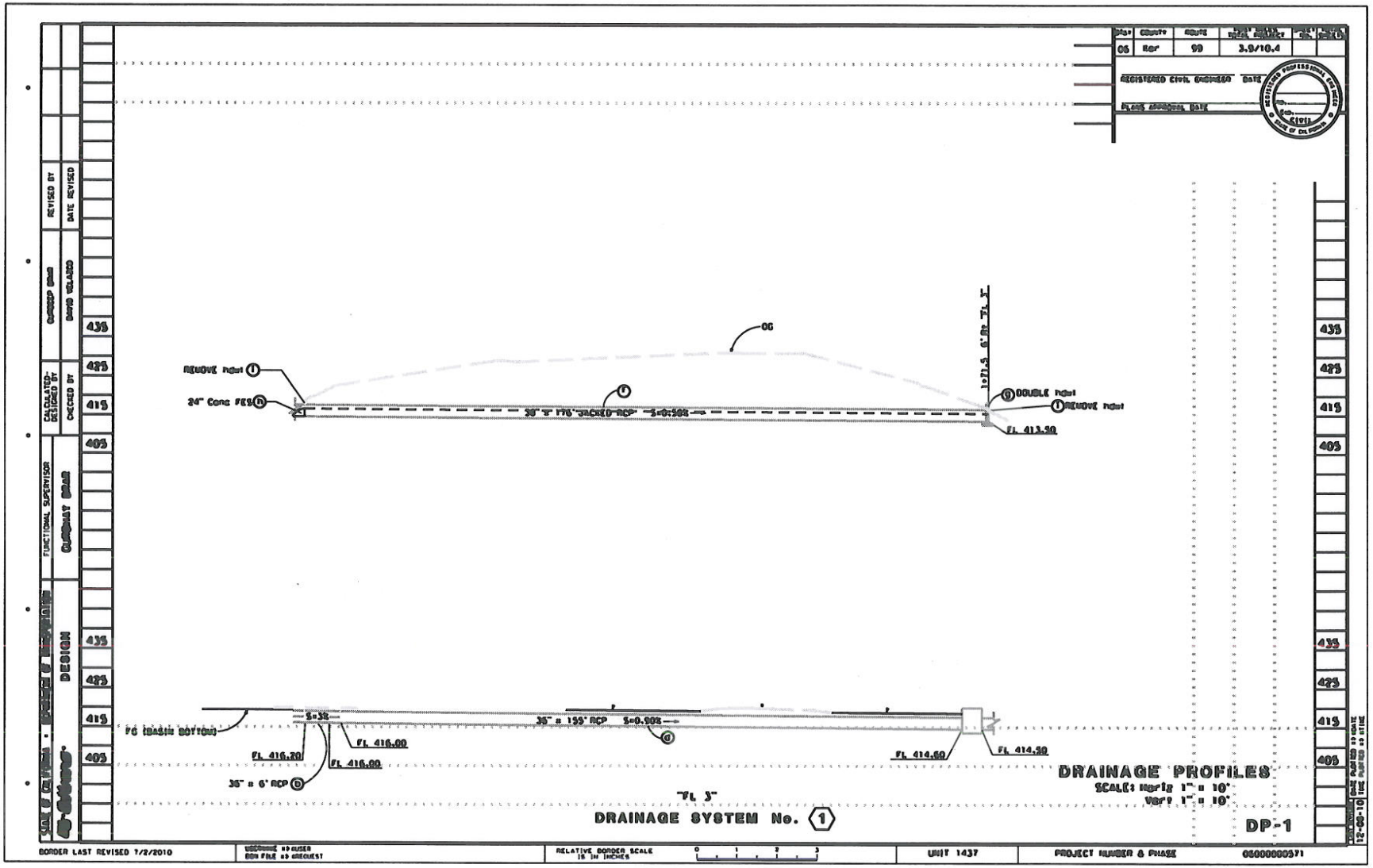
(Robertson et al. 1990)





Zone	Soil Behavior Type
1	Sensitive, Fine Grained
2	Organic Soils-Peats
3	Clays; Clay to Silty Clay
4	Silt Mixtures; Clayey Silt to Silty Clay
5	Sand Mixtures; Silty Sand to Sandy Sil
6	Sands; Clean Sands to Silty Sands
7	Gravelly Sand to Sand
8	Very Stiff Sand to Clayey Sand*
9	Very Stiff Fine Grained*

*Overconsolidated or Cemented



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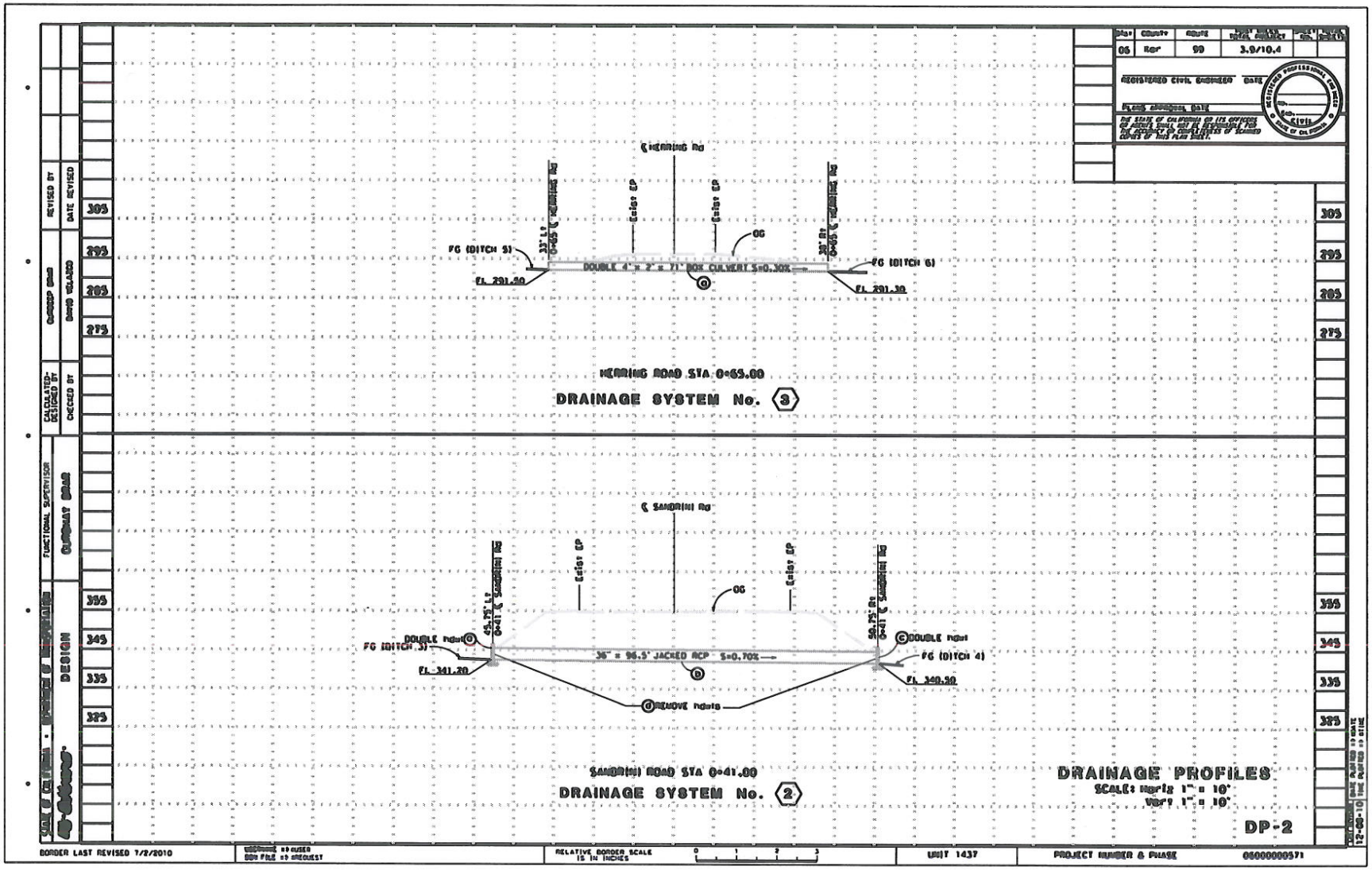

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STATE OF CALIFORNIA
DEPARTMENT OF INDUSTRIAL RELATIONS
DIVISION OF OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
MINING AND TUNNELING UNIT
6150 VAN NUYS BOULEVARD, SUITE 310
VAN NUYS, CA 91401-3333
(818) 901-5420 FAX (818) 901-5579

February 16, 2010

California Department of Transportation
District 6
2015 E. Shields Ave, Suite 100
Fresno, CA 93726

Attention: Steven Milton, P.E.
Project Manager

Subject: Underground Classification Numbers: C070-029-11T & C071-029-11T
DS #1 and DS #2 06- Ker 99-PM 3.9/10.4 06-0E5901

Dear Mr. Milton,

The information provided to this office regarding the above project has been reviewed. On the basis of this analysis, an Underground Classification of "Potentially Gassy" has been assigned to the tunnels identified in your submittal. Please provide true and accurate copies of the Classifications to the Drilling/Excavation/Construction Contractor and insure that copies of the Classification are posted at the job site.

Kindly insure that the Sub-Contractor notify this office to schedule the mandated Pre-job Safety Conference with the Division prior to commencing any activity associated with the project.

Also, be advised 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 us prior to entering such spaces.

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

Sincerely,

James Wittry
District Manager

c: file

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

C070-029-11T

Van Nuys Office R5D2

Underground Classification

06-Ker 99-PM 3.9/10.4 06-0E5901 SR 99 Drainage Culverts
California Department of Transportation
(NAME OF TUNNEL OR MINE AND COMPANY NAME)

of California Department of Transportation - District 6
2015 E. Shields Ave, Suite 100, Fresno, CA 93726
(MAILING ADDRESS)

at State Route 99 at David Road
South of Bakersfield (Kern County), California
(LOCATION)

has been classified as *** POTENTIALLY GASSY ***
(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.

A 36 inch diameter by 155 feet long RCP to be installed by "jack and bore method" at Drainage System # 1 on State Route 99 at David Road, South of Bakersfield, Kern County.

February 16, 2011

Reference: 1) Underground Classification Request & Submital from Caltrans dated 2/08/11.
2) Geotechnical Design Report by Caltrans dated 2/11/11.

State of California

Department of Industrial Relations

DIVISION OF OCCUPATIONAL SAFETY AND HEALTH
MINING AND TUNNELING UNIT

C071-029-11T

Van Nuys Office R5D2

Underground Classification

06-Ker 99-PM 3.9/10.4 06-0E5901 SR 99 Drainage Culverts
California Department of Transportation
(NAME OF TUNNEL OR MINE AND COMPANY NAME)

of California Department of Transportation - District 6
2015 E. Shields Ave, Suite 100, Fresno, CA 93726
(MAILING ADDRESS)

at State Route 99 at Sandrini Road
South of Bakersfield (Kern County), California
(LOCATION)

has been classified as *** POTENTIALLY GASSY ***
(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.

A 36 inch diameter by 97 feet long RCP to be installed by "jack and bore method" at Drainage System # 2 on State Route 99 at Sandrini Road, South of Bakersfield, Kern County.

February 16, 2011

Reference: 1) Underground Classification Request & Submital from Caltrans dated 2/08/11.
2) Geotechnical Design Report by Caltrans dated 2/11/11.