FOR CONTRACT NO. 2640U4

INFORMATION HANDOUT

MATERIALS INFORMATION

TECHNICAL MEMORANDUM FOR SAMPLING AND ANALYSIS OF SOIL AND ROCK SAMPLES FOR NATURALLY OCCURRING ASBESTOS

DATED 8/13/2012

04-Son-101-0.9/3.6

ADDED PER ADDENDUM NUMBER 3 DATED AUGUST 24, 2012

Technical Memorandum

Sampling and Analysis of Soil and Rock Samples For Naturally Occurring Asbestos Along Route 101 From Gunn Drive To Route 101/116 Interchange In And Near Petaluma, California

CONTRACT No. 04-2640U4

04-Son-101-0.9/3.6

Project ID 0412000195

Prepared for

Sonoma County Transportation Authority

August 13, 2012

URS

URS Corporation

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Figures

Figure 1	Site Plan
Figure 2	Boring Location
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This technical memorandum describes the sampling protocol and analytical results for naturally occurring asbestos (NOA) in soil and rock samples collected along Rte 101 from Gunn Dr to Rte 101/116 Interchange in and near Petaluma, California (Figure 1).

Project Background and Purpose

This phase of the project was intended to characterize NOA concentrations in rock and overlying soil and sediment at the project site. The program focused on rock, soil and sediment that would likely be disturbed during future project construction activities. These data would be used to evaluate potential human health risks to onsite workers, nearby residences, and other receptors who could be impacted.

Regulatory Background

The California Air Resources Board (CARB) adopted an Air Toxics Control Measure (ATCM), contained in California Code of Regulations, Title 17, Section 93105 "Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying, and Surface Mining Operations, that regulates grading and excavation activities during construction operations in areas where ultra-mafic rocks are present. The regulation may require that construction activities incorporate specific measures to mitigate associated risks based on short-term and long-term risks to human health.

An exemption from these requirements can be obtained by performing a geologic characterization program that evaluates the presence and distribution of asbestos and asbestos-containing rocks. This technical memorandum describes a program that was carried out to partially characterize geology, the presence and distribution of NOA and NOA-containing rocks, and to address the requirements of the ATCM. A strategy is described in this technical memorandum for addressing these requirements and concurrently addressing partial requirements of the California Division of Occupational Safety and Health (Cal/OSHA) associated with construction operations.

Procedures for selecting, collecting and analyzing samples to address potential issues related to NOA at the site are described in the following sections. Results for NOA analyses are also provided. Where present, asbestos concentrations in soil and rock from the site are compared with applicable regulatory criteria to provide data for assessing potential risk to human health during construction activities.

Regulatory oversight for portions of the project that have the potential to impact air quality include the Bay Area Quality Management District (BAAQMD), the U.S. Occupational Safety and Health Administration (OSHA), and the California Division of Occupational Safety and Health (Cal/OSHA). The scope of work performed as part of this evaluation was developed and performed to address partial requirements of and be consistent with the guidance of each agency.

The BAAQMD will require that construction activities incorporate specific CARB ATCMs to mitigate associated risks based on short-term and long-term risks to human health (e.g., dispersion of asbestos particles in dust generated from soil-disturbing activities). If the potential for such conditions is identified, it is anticipated that air monitoring and implementation of an approved Dust Mitigation Plan (DMP) during field activities will detect and mitigate these risks.

State regulations on asbestos are usually related to demolition and renovations, and waste disposal of asbestos-containing materials. California also has a statewide regulation covering NOA. The Asbestos ATCM for Asbestos-Containing Serpentine, adopted in 1990, prohibited the use of serpentine aggregate for surfacing if the asbestos content was 5 percent or more asbestos. This threshold was lowered to 0.25 percent in 2000 and modified to include ultra-mafic rock.

In addition, BAAQMD may require that samples be collected and analyzed to support the DMP. These samples must be collected and analyzed in accordance with CARB Method 435 and are intended to provide data for adequate characterization of NOA content in materials that will be disturbed by construction activities.

In general, OSHA and Cal/OSHA are concerned with worker safety and potential impacts to human health during field activities. Cal/OSHA established a concentration limit threshold of 0.1 percent asbestos as the minimum amount of asbestos a material may contain, which requires worker training and personal protection. It is anticipated that adopting appropriate work practices and the performance of air monitoring during construction activities, along with other measures, will provide data to address OSHA and Cal/OSHA concerns.

Contractors who conduct asbestos-related work activities including abatement in buildings and excavation of NOA must follow state regulations contained in Title 8 California Code of Regulations (CCR) 1529 and 8 CCR 341.6 through 341.14 where there is asbestos-related work involving 100 square feet or more of asbestos-containing material. Specifically under 8 CCR 341.6, Cal/OSHA must be notified of asbestos-related work activities to be carried out. Contractors must be licensed as an Asbestos Qualified Contractor by the Contractors Licensing Board of the State of California, and registered as such with Cal/OSHA. In addition, a one-time report of the use of carcinogens must be made to Cal/OSHA under 8 CCR Chapter 4, Section 5203.

In July 2001, CARB adopted an ATCM for construction, grading, quarrying, and surface mining operations that regulates grading and excavation activities in areas of serpentine or ultramafic rocks. In 2002, CARB adopted an ATCM for construction-related activities (Title 17 CCR Section 93105). The ATCM protects public health and the environment by requiring the use of best available dust mitigation measures to prevent off-site migration of asbestos-containing dust from road construction and maintenance activities, construction and grading operations and quarrying and surface mining operations in areas of ultra-mafic rock, serpentine, or asbestos. The BAAQMD implements the regulation on behalf of CARB.

For construction activities that will disturb more than 1 acre of land, construction contractors are required to prepare an Asbestos DMP specifying measures that will be taken to prevent or minimize visible dust that crosses the property boundary during construction operations. The DMP must be submitted to and approved by the BAAQMD prior to the beginning of construction operations, and the site operator must implement all specified dust mitigation measures throughout the construction project. In addition, the BAAQMD may require perimeter air monitoring for off-site migration of asbestos dust during construction activities and may change the plan on the basis of the air monitoring results.

REGIONAL GEOLOGY

The project is located along the western margins of the Petaluma Valley within the central portion of the Coast Ranges geomorphic province of California. Northwest-southeast-trending valleys and ridges characterize the regional morphology of the Coast Ranges province. These topographic features are controlled by folds and faults that resulted from the collision of the Farallon and North American plates and subsequent predominantly strike-slip faulting along the San Andreas fault system between the Pacific and North American plates. Regional geologic mapping shows the project alignment to be underlain by manmade fill, Holocene Bay Mud deposits, Holocene alluvial fan deposits, Tertiary age volcanic rocks, and Jurassic-Cretaceous age Franciscan Complex rocks (Wagner et al, 2000; Armstrong, 1980).

SITE GEOLOGY

Geology at the site generally consists of unconsolidated sediments (topsoil, fill, alluvium and colluvium) underlain by Franciscan mélange bedrock. Thick deposits of alluvium and colluvium are present across much of the site, with the greatest thicknesses most likely present within the drainages.

A total of 8 lithologic units have been identified at the site, as discussed below. In the case of the Franciscan mélange, which contains 5 of the units, a lithologic unit consists of a single mineral assemblage or rock type (e.g., serpentinite). The mélange is characterized by a pervasively sheared block-in-matrix fabric consisting of extremely weak to weak, dark gray to black, clayey shale matrix with tectonic inclusion of graywacke, serpentinite, siliceous schist, and greenstone (metabasalt). The graywacke is moderately strong to strong, but typically occurs as smaller gravel to boulder size pieces within the shale matrix. The siliceous schist ranges from weak to strong and the serpentinite is typically very weak and deeply weathered. The 9 lithologic units at the site include:

1. **Topsoil**. The localized presence of topsoil is likely derived from weathering of underlying bedrock rock with some component of aeolian deposits.
2. **Fill**. The lithology of the fill material that is present in localized areas of the site may be derived from Franciscan mélange. The fill is associated with the original grading and construction activities in this area.
3. **Alluvium**. Alluvial deposits consist primarily of silts, sands, gravel and cobbles deposited within and along drainages and former drainage channels. Fragments of Franciscan mélange may be present in several locations in the drainages.
4. **Colluvium**. Colluvial deposits consist primarily of lean clay with sand and gravel. These deposits occur within and along drainages and former drainage channels, and appear to have been reworked and mixed with alluvial deposits.
5. **Greenstone (Franciscan)**. The greenstone is typically a green to olive-green, massive rock with relict rounded pillow lava structure. It was observed only at a single location and in a thin band. Greenstone is generally the hardest rock found in the project area.
6. **Serpentinite (Franciscan)**. Extensive serpentinite zones were observed across the site. Slightly to moderately altered serpentinite was observed as a weak, dark green to bluish-green, intensely sheared, waxy rock. Fresh, as well as strongly weathered serpentinite (as

an extremely weak to friable, light green to white talc-rich mass) were observed. Fibrous varieties of chrysotile and amphibole, such as tremolite and actinolite, are known to naturally occur in serpentinite.

7. **Greywacke (Franciscan)**. The graywacke is a marine sandstone consisting of grains derived from ultra-mafic rocks, as well as silt and clay. Generally, the greywacke occurs within the mélange as moderately strong to strong, smaller gravel to boulder size pieces within the shale matrix.
8. **Shale (Franciscan)**. The shale is generally gray to black, intensely sheared and weak, and constitutes the matrix within the mélange of the Franciscan mélange. The shale is clay-rich and typically has abundant tectonic inclusions of graywacke, serpentinite, siliceous schist, and greenstone (metabasalt). Argillites and shales are both fine-grained sedimentary rocks. Argillites grade into shales when the fissile layering that is usually observed in shales develops. Therefore, for purposes of lithologic grouping, samples of shale and argillite were grouped together as Shale.

SAMPLING

Approximately 60 core borings were advanced across the proposed project area between B Sta 84+50 and A Sta 205+00. Boring depths ranged from about 1.0 to 120.0 feet below the ground surface (bgs). Locations for these borings are shown in Figure 2. Boring logs are provided in Appendix A. Rock cores were contained in labeled sample boxes with depth intervals noted. Unconsolidated sediments and soil were contained in 6-inch long by 2-inch wide sealed brass sleeves.

Sample Selection Methodology

Separate sample sets were received from Caltrans and URS' San Jose office and consolidated in URS' Oakland, California archive. Prior to sampling, each core box was inspected and the appropriate sample interval identified. The interval was designated by placing tape on the core box next to the upper and lower limits of each sample. The designated interval was qualitatively compared for lithologic agreement with the boring log.

Samples were selected for analysis based on the following three criteria:

- An attempt was made to analyze samples from each of the 8 lithologies identified at the site. Statistical considerations require that at least 8 sample analyses be available for calculating summary statistics and evaluating the presence or absence of asbestos in the different lithologic units.
- An attempt was made to analyze samples collected from across the site, with particular focus on areas of planned construction activity. This criterion was designed to produce a set of data that are representative of conditions from different portions of the planned work area.

- An attempt was made to collect samples from vertical horizons that are above the maximum depth of disturbance. Asbestos concentrations present at a depth exceeding the zone of excavation or soil disturbance are of little interest to this evaluation.

A total of 28 samples were thereby collected, representing 9 lithologies. A summary of lithologies that were selected for sampling is provided below.

Lithology	Sample Type	No. of Samples
Sand/Gravel	Unconsolidated	2
Clay	Unconsolidated	8
Graywacke	Rock Core	5
Serpentinite	Rock Core	5
Shale/Argillite	Rock Core	7
Greenstone	Rock Core	1
	Total:	28

It should be noted that, for most lithologic types, insufficient sample material was available for analysis. Core intervals that were vertically contiguous (e.g., 5 feet of continuous greywacke) were only sampled once to avoid producing duplicative data that would bias the statistical results.

Field Sampling Procedures

The sample interval was removed from the core box, placed into 4-mil thickness double plastic bags, and sealed. A hammer and steel chisel, or a rock saw if necessary, was used to separate portions of the core, as necessary. The chisel was washed with distilled water and wiped dry with a paper towel between each sample. Rock and soil core that were not selected for sampling were placed back in the core boxes or brass sleeves.

ANALYTICAL PROCEDURES

The samples were delivered to the analytical laboratory following collection. All sample handling, storage and transport was performed using chain of custody procedures. Chain of custody forms are included in Appendix B.

Sample Preparation

Rock and soil samples were coarse-crushed in the laboratory using a jaw crusher so that all material passed through a 3/8-inch (pea size) sieve. Compositing, homogenization and splitting was performed by "Forensic Analytical Laboratories". Each sample had a minimum volume of 300 to 500 milliliters or about 800 grams. Sample crushing was conducted in an enclosed space designed to minimize loss of fines. The homogenized material had a minimum volume of approximately 1 pint (approximately 500 milliliters), as required by CARB Method 435.

Sample Analysis

The analyses were performed by Forensics Analytical Laboratories of Hayward, California. Analysis of the samples was performed for total percent asbestos using transmission electron microscopy (TEM) according to EPA Method 600/R-93/116. The samples were prepared for TEM analysis according to CARB 435 Test Method. Analytical results were reported in

percentage of asbestos mass per mass of rock or soil matrix (i.e., source material). The laboratory achieved a sensitivity limit of 0.0005 percent for the samples.

Recommendations

According to the lab results, there are 13 of 28 samples that showed traces of NOA. The majority of the positive samples had negligible amounts. We have identified two locations (Boring ID's R-11-016 and R-09-006), on the north bank of the Petaluma River, the site of CIDH piling installation, where the contractor may encounter above normal asbestos concentrations (Type CH). If soil testing and monitoring reveals the presence of asbestos, URS recommends keeping the work area wet and moist during CIDH pile driving operations. The use of "dry impact hammer" method is not advisable since it can cause dust to spew out in the presence of construction workers. In addition, URS recommends following regulatory agency guidelines.

Recordkeeping and Reporting Requirements

Records related to the applicability of the regulation or compliance with the specific provisions of the regulation or the asbestos dust mitigation plan must be kept for seven years. The results of any air monitoring or bulk sampling required by the district, any bulk sampling to document the applicability of, or compliance with, the regulation, and any other records specified in the dust mitigation plan must be reported to the district.

Do not leave NOA surface areas exposed unless these areas are stabilized by being kept wetted or by being treated with a chemical dust palliative. Cover disturbed material containing NOA permanently placed during construction activities with a 3 inch minimum layer of asbestos-free material that has been certified by the Engineer. Survey the locations where material containing NOA is placed using GPS, electronic theodolite, or other methods approved by the Engineer and submit the information to the Engineer.

If NOA material is to be re-used on the job site (burial), the contractor must survey burial locations (at least four to six points per area – bottom of excavation and top of buried soil) and provide the Engineer with a survey report.

Figure 1

SITE PLAN

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	0.9/3.6	.	.

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER NO. EXP. CIVIL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

URS CORPORATION
100 W. SAN FERNANDO St
SUITE 200
SAN JOSE, CA 95113

SCTA
490 MENDOCINO AVENUE
SUITE 206
SANTA ROSA, CA 95401

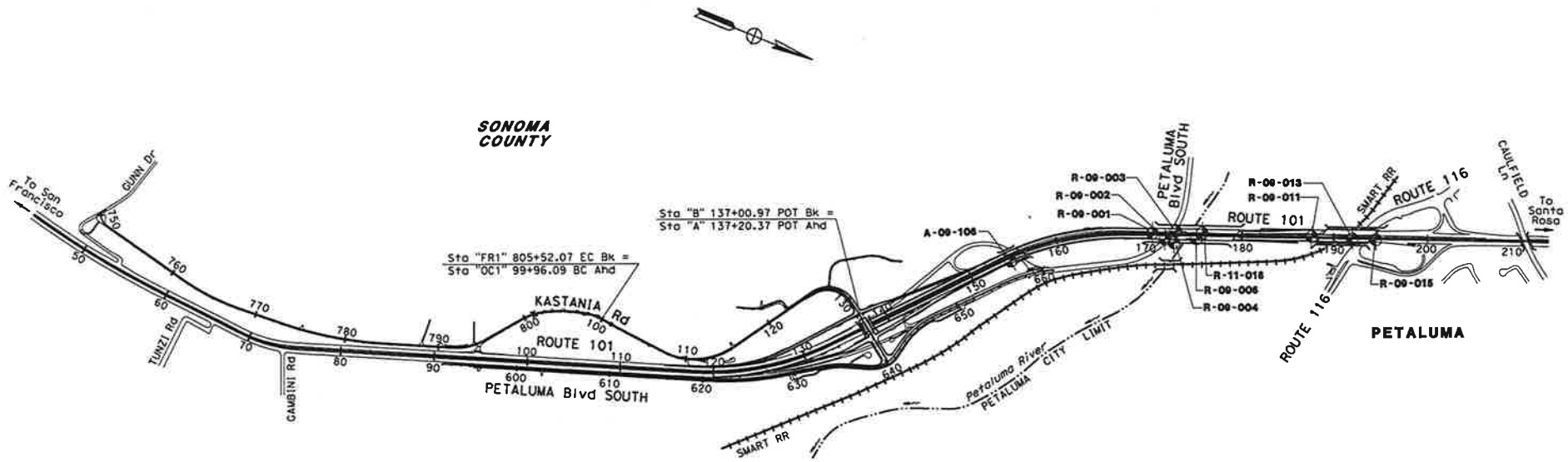


FIGURE 1
SITE PLAN
NO SCALE

CALCULATED-DESIGNED BY	ABHIJEET BHOI	REVISED BY	AB
CHECKED BY	ELIE ABI-JAOUDE	DATE REVISED	11/17/11

CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 11-17-11 | DATE PLOTTED => 8/1/2012 | TIME PLOTTED => 3:46:58 PM

BORDER LAST REVISED 7/2/2010 | USERNAME => virgil_jimenez | DGN FILE => Fig1_SitePlan.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0714 | PROJECT NUMBER & PHASE 04120001951

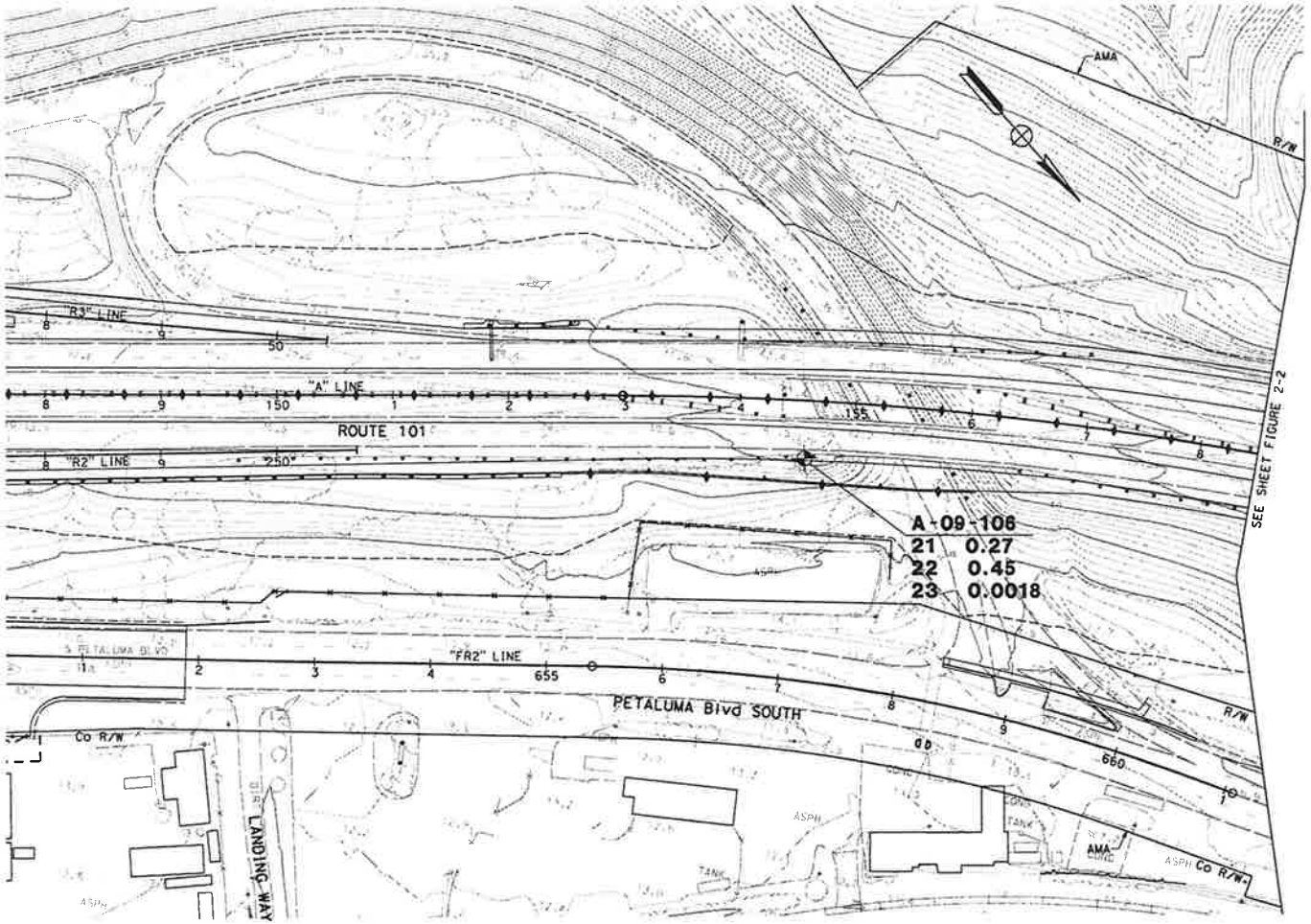
Figure 2

BORING LOCATION

NOTE:
FOR ACCURATE RIGHT OF WAY DATA, CONTACT
RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

LEGEND:

BORING ID
SAMPLE No. ASBESTOS WEIGHT PERCENT



Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	0.9/3.6	.	.

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SUITE 206
SANTA ROSA, CA 95401

FIGURE 2
(SHEET 1 OF 3)
BORING LOCATION
SCALE: 1" = 50'

REVISED BY	DATE REVISED
AB	11/17/11

CALCULATED-DESIGNED BY	ABHIJEET BHOI
CHECKED BY	ELIE ABI-JAOUDE

CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

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Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	0.9/3.6	.	.

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SUITE 206
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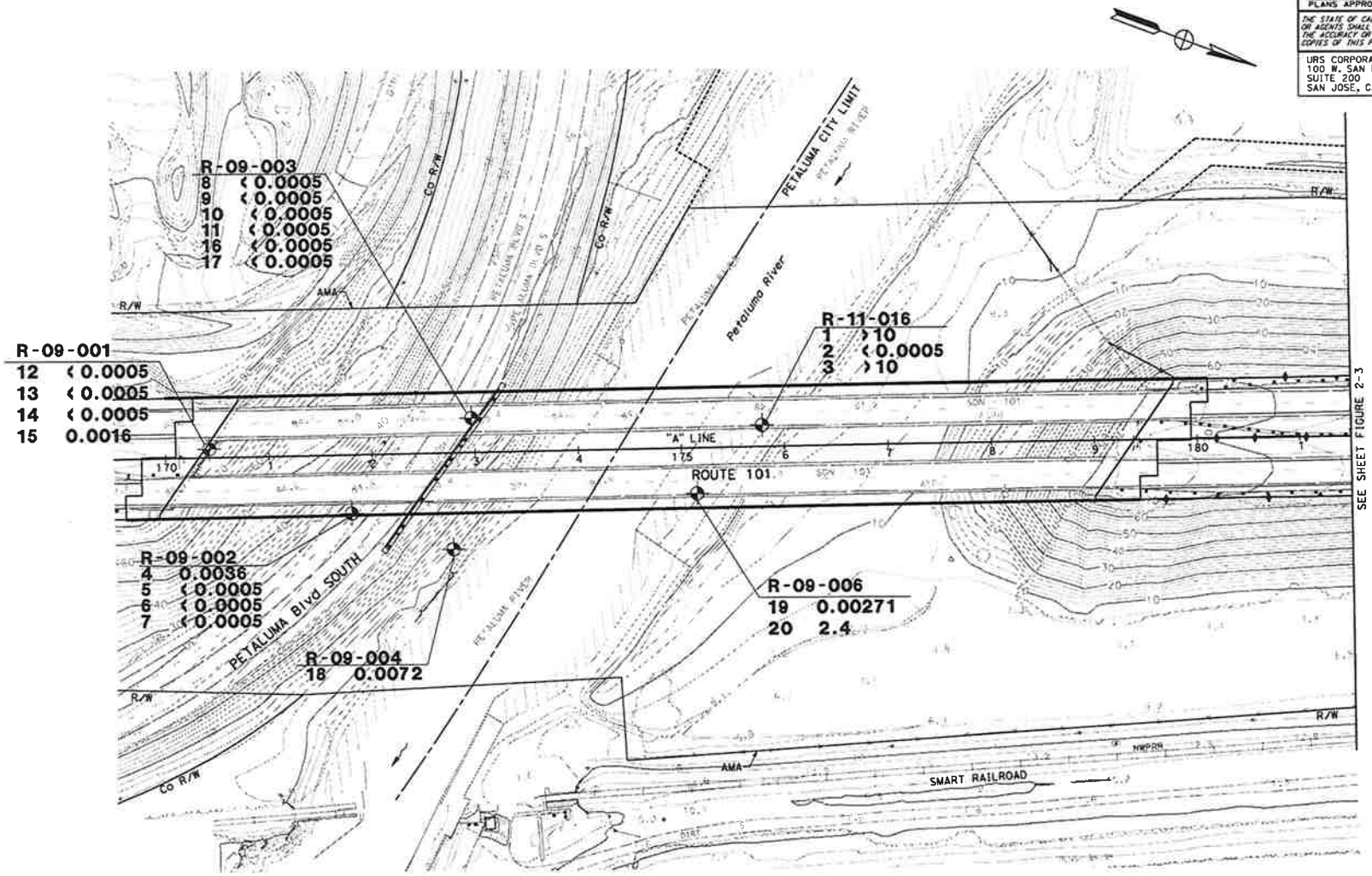

FIGURE 2
(SHEET 2 OF 3)
BORING LOCATION
SCALE: 1" = 50'

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

CALCULATED-DESIGNED BY: ABHIJEET BHOI
CHECKED BY: ELIE ABI-JAOUDE

REVISED BY: AB
DATE REVISED: 11/17/11

LAST REVISION 11-17-11
DATE PLOTTED => 8/1/2012
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BORDER LAST REVISED 7/2/2010

USERNAME => virgil_jimenez
DGN FILE => Fig2_2.dgn

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

UNIT 0714

PROJECT NUMBER & PHASE 04120001951

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	0.9/3.6	.	.

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PETALUMA

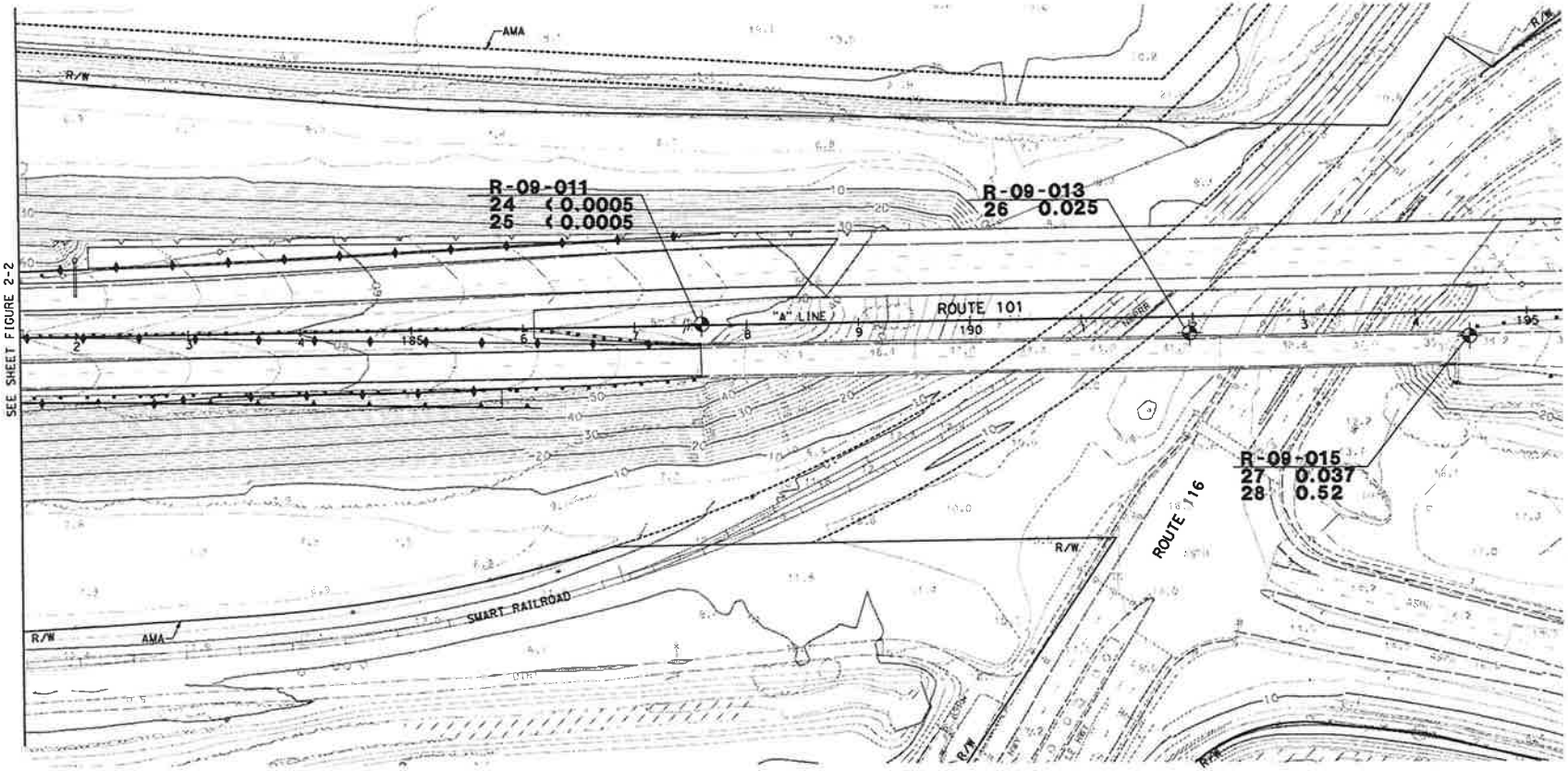

FIGURE 2
(SHEET 3 OF 3)
BORING LOCATION
SCALE: 1" = 50'

REVISED BY	DATE REVISED
AB	11/17/11

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CHECKED BY: ELIE ABI-JAOUDE

CONSULTANT FUNCTIONAL SUPERVISOR: RAMSEY HISSEN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

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APPENDIX A

BORING LOGS

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
M.Schmoll	12-5-11	12-6-11	2276783.6 ft / 5953977.8 ft	R-11-016
DRILLING CONTRACTOR: PC Exploration, Inc			BOREHOLE LOCATION (Offset, Station, Line): 20' Lt Sta 175+79 A	SURFACE ELEVATION: 2 ft
DRILLING METHOD: Rotary Wash with HQ Core Barrel			DRILL RIG: Diedrich D-25	BOREHOLE DIAMETER: 3-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID): SPT (1.44")			SPT HAMMER TYPE: Cat Head 140lb/30in	HAMMER EFFICIENCY, ERi
BOREHOLE BACKFILL AND COMPLETION: None - left open			GROUNDWATER READINGS: DURING DRILLING / AFTER DRILLING (DATE): Varies with Tide N/A	TOTAL DEPTH OF BORING: 79.3 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		Fat CLAY (CH); very soft; dark gray; high plasticity fines; some peat; organic odor [BAY MUD].												Start drilling 1405
	1														3' from barge deck to mud line
0.00	2														
	3														
-2.00	4														
	5														
-4.00	6														
	7		At EL. -4.5 ft, grades to (SILTY SAND) (SM); very loose; gray; wet; fine SAND; Fat Clay interbeds and pods.												
-6.00	8				1	0 1 2	3								
	9														
-8.00	10		Fat CLAY (CH); very soft; dark gray; high plasticity fines; trace of peat [BAY MUD].												
	11														
-10.00	12														
	13				2	2 1 1	2					PP = <0.25			
-12.00	14														
	15														
-14.00	16														
	17														
-16.00	18		With a few, thin Silty Sand interbeds.		3	0 0 1	1								
	19														
-18.00	20														
	21		METAMORPHIC ROCK (SHALE), Serpentinite, light green to dark gray, very intensely weathered, very soft, very intensely fractured, easily breaks down to Sandy Clay (CL) recovered in core barrel [FRANCISCAN COMPLEX MELANGE].												
-20.00	22														
	23				4	21 38 50/4"	88/ 10"								
-22.00	24		METAMORPHIC ROCK (SERPENTINITE), light green to dark greenish gray, moderately weathered,		1			23	0						Sampler advanced 16 in. End 1630 12/5/11 Resume 0701 12/6/11
	25														

(continued)

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 8/1/12

San Jose Office

URS

100 W. San Fernando St, Suite 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				R-11-016
DIST. 04	COUNTY Sonoma	ROUTE 101	POSTMILE 0.9/2.9	EA 04-28645045
PROJECT OR BRIDGE NAME: Petaluma River Bridge				
BRIDGE NUMBER	PREPARED BY L.Phillips	DATE 12-13-11	SHEET 1 of 3	

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25	weathered rock/shale washed out. METAMORPHIC ROCK (Serpentinite) *(continued).*		1			23	0						start coring at 24'
-24.00	26													mud line 5' below deck
	27	Light green to dark greenish gray, very intensely weathered, very soft, sheared fabric, easily breaks down to Sandy lean Clay (CL), with dark gray shale.		2			9	0						
-26.00	28													
	29													
-28.00	30													
	31			5	27 42 50/5.5"	92/ 11.5"								
-30.00	32													
	33	Foliation of shearing dips ~ 40° to 50°.		3			42	0						Sampler advanced 17.5 in. Note - rock does not meet soundness requirement for RQD designation (32 to 57')
-32.00	34	Joint dipping 20°, wavy, smooth, talc infill.												
	35													
-34.00	36	Mostly shale 36.0' to 37.4', dark gray, sheared fabric. Dark gray, shear.		4			58	0						
	37	METAMORPHIC ROCK (SERPENTINITE), dark greenish gray and light green, sheared fabric, trace talc.												
-36.00	38													
	39													
-38.00	40													
	41	METAMORPHIC ROCK (SHALE), dark gray, intensely weathered, very soft, sheared fabric, some serpentinite.		5			24	0						
-40.00	42													
	43													
-42.00	44													
	45	METAMORPHIC ROCK (SHALE), Serpentinite, dark greenish gray and light green, very intensely weathered, very soft, shale dark gray and clayey (CL/CH) [FRANCISCAN COMPLEX MELANGE].												
-44.00	46			6	12 15 20	35								
	47													
-46.00	48	At EL. -46.0 ft, becomes moderately weathered, moderately hard, joint, dipping 70°, planar, smooth to slickensided, trace pyrite infill.		6			32	0						
	49													
-48.00	50													
	51													
-50.00	52	METAMORPHIC ROCK (SHALE), Serpentinite, fine sand to coarse sand, very intensely weathered, very soft, very intensely sheared, easily breaks down to Lean Clay with sand (CL), medium plasticity, with chert, quartz and rock fragments, sand fine to coarse grained.		7			86	0						
	53													
-52.00	54													
	55													

(continued)

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 8/1/12

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REPORT TITLE				HOLE ID
BORING RECORD				**R-11-016**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **Petaluma River Bridge**				
BRIDGE NUMBER	PREPARED BY **L.Phillips**	DATE **12-13-11**	SHEET **2 of 3**	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	55		METAMORPHIC ROCK (Shale) *(continued)*.		7			86	0						mud line 3' below deck
-54.00	56														
	57				8			24	0						
-56.00	58														
	59														
-58.00	60														
	61														
-60.00	62				9			0	0						
	63														
-62.00	64														
	65														
-64.00	66														
	67		METAMORPHIC ROCK (SHALE), dark gray, intensely weathered, very soft, sheared fabric, trace of serpentinite.		7	15 24 29	53								
-66.00	68														
	69				10			8	0						
-68.00	70														
	71														
-70.00	72		Core easily washed out - no recovery.		11			0	0						
	73														
-72.00	74														
	75				12			0	0						
-74.00	76														
	77		METAMORPHIC ROCK (SHALE), Serpentinite, light green to black, very intensely weathered, very soft, sheared fabric, breaks down to Lean Clay with sand (CL).												
-76.00	78														
	79				8	41 50/3"	50/ 3"								
			Bottom of Borehole at 79.3 ft.												Sampler advanced 9 in.
-78.00	80														
	81														
-80.00	82														
	83														
-82.00	84														
	85														

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 8/1/12

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REPORT TITLE				HOLE ID
BORING RECORD				**R-11-016**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **Petaluma River Bridge**				
BRIDGE NUMBER	PREPARED BY **L.Phillips**		DATE **12-13-11**	SHEET **3 of 3**

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	8-18-09	8-18-09	2276436.4 ft / 5954190.8 ft	R-09-002
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
PC Exploration, Inc			56' Rt Sta 171+79 A	34 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Rotary Wash with HQ Core Barrel			Gefco D-444	3-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified CA (1.96"), SPT (1.44")			Auto Hammer 140lb/30in	81%
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING: Dry to 5' AFTER DRILLING (DATE): N/A	TOTAL DEPTH OF BORING
Cement				26.5 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	7 inches Asphalt Concrete over 8 inches Aggregate Base.												
	1													8 inch hollow stem auger to 5 feet
32.00	2	SANDY lean CLAY (CL); stiff; brown; moist; little GRAVEL; [FILL].		1	7 6 8	14	65		19	116				
	3	Aggregate Base? 3/4" max gravel size; moist; [FILL].												
30.00	4													
	5	Lean CLAY (CL); very stiff; black; moist; [COLLUVIUM].		2	6 8 11	19	65		20	110	UC =1.43			Switch to mud rotary
28.00	6													
	7	GRAVELLY lean CLAY with SAND (CL); [COLLUVIUM].												
26.00	8													
	9													
24.00	10			3	14 12 30	42	55							
	11	SANDY lean CLAY (CL); stiff; brown; moist. METAMORPHIC ROCK, Graywacke (Sandstone), yellowish gray to olive black, intensely weathered, very weak, with trace of shale and serpentinite, foliated fabric.												
22.00	12													
	13	[FRANCISCAN COMPLEX].												
20.00	14	At EL. 20.0 ft, becomes dark gray, moderately weathered.												
	15			4	13 25 78/2"	103/ 8"	70							
18.00	16													Sampler advanced 14 in.
	17													
16.00	18													
	19													
14.00	20	At EL. 14.0 ft, becomes dark gray to grayish green, intensely weathered, very weak, increasing shale/serpentinite with a trace of graywacke; breaks down to clayey sand (SC); banded.		5	14 81/4.5"	81/ 4.5"	45							
	21													Sampler advanced 10.5 in.
12.00	22													
	23													
10.00	24													
	25			6	17 25 42	67	85							
8.00	26													
	27	Bottom of Borehole at 26.5 ft.												

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

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REPORT TITLE				HOLE ID
BORING RECORD				R-09-002
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma	101	0.9/2.9	04-28645045
PROJECT OR BRIDGE NAME				
Petalum River Bridge				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	8-20-09	1 of 1	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
S.Manoharan	8-19-09	8-19-09	2276515.0 ft / 5954065.9 ft	R-09-003
DRILLING CONTRACTOR: PC Exploration, Inc			BOREHOLE LOCATION (Offset, Station, Line): 33' Lt Sta 172+97 A	SURFACE ELEVATION: 39 ft
DRILLING METHOD: Rotary Wash with HQ Core Barrel			DRILL RIG: Gefco D-444	BOREHOLE DIAMETER: 3-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID): Modified CA (1.96"), SPT (1.44")			SPT HAMMER TYPE: Auto Hammer 140lb/30in	HAMMER EFFICIENCY, ERi: 81%
BOREHOLE BACKFILL AND COMPLETION: Cement			GROUNDWATER READINGS: DURING DRILLING Dry to 5' / AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 61.5 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	7 inches Asphalt Concrete over 8 inches Aggregate Base.												
	1													8 inch hollow stem auger to 5 feet
37.00	2	CLAYEY GRAVEL with SAND (GC); very dense; brown; moist; [FILL].		1	14 34 28	62	40							
	3													
35.00	4	SANDY lean CLAY with GRAVEL (CL); medium stiff; brown mottled with yellowish brown; moist; [FILL].												
	5			2	5 6 7	13	80							Began rotary wash
33.00	6													
	7	At EL. 32.5 ft, becomes light greenish gray; with black fat CLAY lenses.												
31.00	8													
	9													
29.00	10	Lean CLAY (CL); stiff; dark gray; moist; trace SAND; residual soil.		3	5 7 18	25	100		24	100	UC =0.4			
	11													
27.00	12	METAMORPHIC ROCK, Graywacke (Sandstone), intensely weathered, very weak, intensely fractured, brown; trace of shale; foliated fabric; breaks down to clayey sand (SC).												
	13													
25.00	14	[FRANCISCAN COMPLEX].												
	15			4	16 33 49	82	70							
23.00	16													
	17													
21.00	18	At EL. 21.5 ft, becomes dark greenish gray to dark gray, moderately weathered, some calcite viens; approximately 50% shale and 50% graywacke.												
	19													
19.00	20			5	18 42 55	97	50							
	21													
17.00	22													
	23													
15.00	24													
	25													

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				R-09-003
DIST. 04	COUNTY Sonoma	ROUTE 101	POSTMILE 0.9/2.9	EA 04-28645045
PROJECT OR BRIDGE NAME: Petalum River Bridge				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 8-20-09	SHEET 1 of 3	

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method / Casing Depth	Remarks
	25	At EL. 14.0 ft, becomes dark gray, intensely weathered, very weak, mostly shale with approximately 20% graywacke; highly sheared/foliated fabric. METAMORPHIC ROCK *(continued)*.		6	16 30 42	72	60						
13.00	26												
	27												
11.00	28	[FRANCISCAN COMPLEX].											
	29												
9.00	30	At EL. 9.0 ft, becomes black, mostly shale; breaks down to lean clay (CL) with sand/gravel.		7	6 15 27	42	0						
	31												
7.00	32												
	33												
5.00	34												
	35			8	19 23 41	64	35						
3.00	36												
	37												
1.00	38												
	39												
-1.00	40			9	14 18 33	51	40						
	41												
-3.00	42												
	43												
-5.00	44												
	45	At EL. -6.0 ft, becomes moderately weathered, very weak to weak.		10	30 51 68	119	50		5	148			
-7.00	46												
	47												
-9.00	48												
	49												
-11.00	50			11	36 57 64	121	35						
	51												
-13.00	52												
	53												
-15.00	54												
	55												

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-003**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **Petalum River Bridge**				
BRIDGE NUMBER	PREPARED BY **M.Thummaluru**	DATE **8-20-09**	SHEET **2 of 3**	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	55				12	33 79 50/3"	129/ 9"	40							
-17.00	56														Sampler advanced 15 in.
	57														
-19.00	58														
	59														
-21.00	60				13	41 50 67	117	60							
	61														
-23.00	62		Bottom of Borehole at 61.5 ft.												
	63														
-25.00	64														
	65														
-27.00	66														
	67														
-29.00	68														
	69														
-31.00	70														
	71														
-33.00	72														
	73														
-35.00	74														
	75														
-37.00	76														
	77														
-39.00	78														
	79														
-41.00	80														
	81														
-43.00	82														
	83														
-45.00	84														
	85														

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-003**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **Petalum River Bridge**				
BRIDGE NUMBER	PREPARED BY **M.Thummaluru**	DATE **8-20-09**	SHEET **3 of 3**	

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	8-17-09	8-17-09	2276285.6 ft / 5954179.4 ft	R-09-001
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
PC Exploration, Inc			8' Lt Sta 170+42 A	84 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Rotary Wash with HQ Core Barrel			Gefco D-444	3-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified CA (1.96"), SPT (1.44")			Auto Hammer 140lb/30in	81%
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING: Dry to 5' AFTER DRILLING (DATE): N/A	TOTAL DEPTH OF BORING
Cement				21.5 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	METAMORPHIC ROCK, Graywacke (sandstone), brownish gray, intensely weathered, very weak, intensely fractured, with Lean Clay (CL) infilling along fractures.												
	1			1	17 22 40	62	70							8-inch hollow stem auger to 5 feet
81.50	2	[Franciscan Complex].												
	3													
79.50	4													
	5			2	12 23 33	56	75							Switch to mud rotary
77.50	6	At EL. 77.5 ft, becomes intensely to moderately weathered.												
	7	At EL. 76.5 ft, becomes black to dark gray, intensely weathered, weak to medium strong, little to no clay infilling along joints.												
75.50	8													
	9													
73.50	10	At EL. 73.5 ft, becomes light greenish gray, intensely weathered, very weak, trace of serpentinite, foliated fabric, breaks down to Clayey Sand (SC).		3	17 23 53	76	35							
	11													
71.50	12													
	13													
69.50	14	At EL. 69.5 ft, becomes Greenstone ?(meta-volcanic), dark gray, moderately weathered, medium strong, intensely fractured, (meta-volcanic).												
	15			4	28 50/2"	50/ 2"	100							
67.50	16	[Franciscan Complex].												Sampler advanced 8 in.
	17													
65.50	18													
	19													
63.50	20			5	92/5"	REF	20							Sampler advanced 5 in.
	21													
61.50	22	Bottom of Borehole at 21.5 ft.												
	23													
59.50	24													
	25													

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REPORT TITLE				HOLE ID
BORING RECORD				R-09-001
DIST. 04	COUNTY Sonoma	ROUTE 101	POSTMILE 0.9/2.9	EA 04-28645045
PROJECT OR BRIDGE NAME Petalum River Bridge				
BRIDGE NUMBER	PREPARED BY M.Thummaluru	DATE 8-20-09	SHEET 1 of 1	

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	9-2-09	9-2-09	2276541.2 ft / 5954190.0 ft	R-09-004
DRILLING CONTRACTOR: PC Exploration, Inc			BOREHOLE LOCATION (Offset, Station, Line): 92' Rt Sta 172+77 A	SURFACE ELEVATION: 11 ft
DRILLING METHOD: Rotary Wash with HQ Core Barrel			DRILL RIG: Diedrich D-25	BOREHOLE DIAMETER: 3-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID): Modified CA (1.96"), SPT (1.44")			SPT HAMMER TYPE: Auto Hammer 140lb/30in	HAMMER EFFICIENCY, ERi
BOREHOLE BACKFILL AND COMPLETION: Cement			GROUNDWATER READINGS: DURING DRILLING Dry to 1' AFTER DRILLING (DATE) N/A	TOTAL DEPTH OF BORING: 18.7 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	Lean CLAY (CL); grayish brown.												
	1			1	14 16 22	38	10							8 inch hollow stem auger to 1 feet Switch to mud rotary
9.00	2	METAMORPHIC ROCK, Graywacke with a trace of serpentinite, breaks down to clayey sand, intensely weathered, intensely fractured, bluish gray mottled with brown. [FRANCISCAN COMPLEX].												
	3			2	15 27 25	52	35							
7.00	4													
	5													
5.00	6													
	7													
3.00	8			3	15 20 56	76	0							
	9													
1.00	10													
	11	At EL. 0.0 ft, becomes slightly weathered, very weak.												
-1.00	12													
	13			4	49 96 50/1.5"	146/ 7.5"	40							
-3.00	14													Sampler advanced 13.5 in.
	15													
-5.00	16													
	17													
-7.00	18			5	86 50/2"	50/ 2"	15							
	19	Bottom of Borehole at 18.7 ft.												Sampler advanced 8 in.
-9.00	20													
	21													
-11.00	22													
	23													
-13.00	24													
	25													

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

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REPORT TITLE				HOLE ID
BORING RECORD				R-09-004
DIST. 04	COUNTY Sonoma	ROUTE 101	POSTMILE 0.9/2.9	EA 04-28645045
PROJECT OR BRIDGE NAME: Petalum River Bridge				
BRIDGE NUMBER	PREPARED BY S. Manoharan		DATE 9-8-09	SHEET 1 of 1

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	8-12-09	8-12-09	2276745.7 ft / 5954060.3 ft	R-09-006
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
PC Exploration, Inc			44' Rt Sta 175+14 A	2 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Rotary Wash with HQ Core Barrel			Diedrich D-25	3-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified CA (1.96"), SPT (1.44")			Auto Hammer 140lb/30in	
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement			N/A	N/A	31.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		Fat CLAY (CH); very soft; dark gray; with peat; [BAY MUD].												
	1				1	0 0 0	0	95		97	46	UC =0.03			Mud rotary
-0.50	2														
	3														
-2.50	4														
	5				2	0 0 0	0	95		71	57	UC =0.03			
-4.50	6														
	7														
-6.50	8														
	9		At EL. -7.5 ft, becomes gray.												
-8.50	10				3	1 1 1	2	70		88	49	PP = <0.25 UC =0.15			
	11														
-10.50	12														
	13		SANDY lean CLAY (CL); gray; [ALLUVIUM].												
-12.50	14														
	15				4	5 10 10	20	45							
-14.50	16		CLAYEY SAND (SC); medium dense; gray; with fine to 1/2" gravel; well-rounded; [ALLUVIUM].												
	17														
-16.50	18														
	19		Lean CLAY (CL); stiff; gray; trace fine GRAVEL; trace SAND; [ALLUVIUM].												
-18.50	20				5	5 5 79/5.5"	84/ 11.5'	50							
	21														
-20.50	22		METAMORPHIC ROCK, Shale/Serpentinite, intensely weathered, very weak, intensely fractured, black with light green streaks; highly sheared fabric.												Sampler advanced 17.5 in.
	23														
-22.50	24		[FRANCISCAN COMPLEX].												
	25														

(continued)

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

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REPORT TITLE				HOLE ID
BORING RECORD				R-09-006
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma	101	0.9/2.9	04-28645045
PROJECT OR BRIDGE NAME				
Petalum River Bridge				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	M.Thummaluru	8-14-09	1 of 2	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25		METAMORPHIC ROCK *(continued)*.		6	29 78/4"	78/ 4"	33							
-24.50	26														Sampler advanced 10 in.
	27														
-26.50	28		At EL. -26.5 ft, becomes slightly weathered.												
	29														
-28.50	30				7	42 50/1.5"	50/ 1.5"	30							
	31														Sampler advanced 7.5 in.
-30.50	32		Bottom of Borehole at 31.5 ft.												
	33														
-32.50	34														
	35														
-34.50	36														
	37														
-36.50	38														
	39														
-38.50	40														
	41														
-40.50	42														
	43														
-42.50	44														
	45														
-44.50	46														
	47														
-46.50	48														
	49														
-48.50	50														
	51														
-50.50	52														
	53														
-52.50	54														
	55														

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-006**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **Petalum River Bridge**				
BRIDGE NUMBER	PREPARED BY **M.Thummaluru**	DATE **8-14-09**	SHEET **2 of 2**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	10-29-09	10-29-09	2274980.2 ft / 5955034.5 ft	A-09-106
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
Exploration Geoservices, Inc.			49' Rt Sta 154+58 A	40 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Hollow-Stem Auger			EGI	8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified CA (1.96"), SPT (1.44")			Auto Hammer 140lb/30in	
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING	AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement			Dry to 30'	N/A	30.0 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	5 inches Asphalt Concrete over 12 inches Aggregate Base.												
	1	SANDY lean CLAY (CL); gray; moist; trace GRAVEL [FILL].		1	4 6 7	13	65		15	116	UC =0.94			
38.00	2													
	3													
36.00	4			2	4 4 5	9	65							
	5	At EL. 35.0 ft, becomes grayish brown.												
34.00	6													
	7													
32.00	8													
	9			3	3 4 4	8	65		18	106	UC =0.58			
30.00	10	At EL. 30.0 ft, becomes gray; with gravel.												
	11													
28.00	12													
	13													
26.00	14	Lean CLAY with SAND (CL); grayish brown; moist [FILL].		4	3 4 8	12	65		20	109	UC =0.76			
	15													
24.00	16													
	17													
22.00	18	Fat CLAY with SAND (CH); very stiff; dark gray; moist.												
	19			5	7 9 14	23	50		28	94	UC =1.0			
20.00	20													
	21													
18.00	22													
	23	METAMORPHIC ROCK (SERPENTINITE), dark bluish gray.												
16.00	24			6	19 34 57	91	60							
	25													

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				A-09-106
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma	101	0.9/2.9	04-28645045
PROJECT OR BRIDGE NAME				
Std. Retaining Wall				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	S. Manoharan	11-30-09	1 of 2	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25		METAMORPHIC ROCK (Serpentinite) *(continued)*.												
14.00	26														
	27														
12.00	28														
	29				7	17 26 47	73	60							
10.00	30		Bottom of Borehole at 30.0 ft.												
	31														
8.00	32														
	33														
6.00	34														
	35														
4.00	36														
	37														
2.00	38														
	39														
0.00	40														
	41														
-2.00	42														
	43														
-4.00	44														
	45														
-6.00	46														
	47														
-8.00	48														
	49														
-10.00	50														
	51														
-12.00	52														
	53														
-14.00	54														
	55														

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

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REPORT TITLE				HOLE ID
BORING RECORD				**A-09-106**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **Std. Retaining Wall**				
BRIDGE NUMBER	PREPARED BY **S. Manoharan**	DATE **11-30-09**	SHEET **2 of 2**	

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	6-23-09	6-25-09	2277894.2 ft / 5953576.1 ft	R-09-011
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION
WDC Exploration & Wells			1' Lt Sta 187+60 A	51 ft
DRILLING METHOD			DRILL RIG	BOREHOLE DIAMETER
Rotary Wash			CME 85	4-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID)			SPT HAMMER TYPE	HAMMER EFFICIENCY, ERi
Modified CA (1.96"), SPT (1.44")			Auto Hammer 140lb/30in	84%
BOREHOLE BACKFILL AND COMPLETION			GROUNDWATER READINGS DURING DRILLING / AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING
Cement			Dry to 19' / N/A	119.5 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	SILTY GRAVEL (GM); some asphalt concrete chunks. [FILL].												
	1	Poorly graded GRAVEL (GP); gravel size upto 3 inches. [FILL].												8 inch hollow stem auger to 19 feet
49.00	2													
	3													
47.00	4													
	5	Lean CLAY (CL); grayish brown; [FILL].												
45.00	6	CLAYEY GRAVEL (GC); medium dense; gray; moist.												
	7		X	1	6 15 15	30	50							
43.00	8													
	9		X	2	9 16 11	27	70							
41.00	10													
	11													
39.00	12													
	13													
37.00	14		X	3	20 14 12	26	35							
	15													
35.00	16	CLAYEY GRAVEL (GC/CL); medium dense; bluish gray; moist; with bluish gray Serpentinite gravel. [FILL].												
	17													
33.00	18													
	19		X	4	10 7 8	15	35		8	125				Began rotary wash
31.00	20													
	21													
29.00	22													
	23													
27.00	24		X	5		21	35							
	25													

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REPORT TITLE				HOLE ID
BORING RECORD				R-09-011
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	Sonoma	101	0.9/2.9	04-28645045
PROJECT OR BRIDGE NAME				
U.S. 101/ SR 116 SOH				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	S. Manoharan	6-29-09	1 of 5	

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25	CLAYEY GRAVEL (GC/CL) *(continued)*.			4 8 13									
25.00	26													
	27	SANDY lean CLAY (CL); medium stiff; brown; moist; with bluish sand and trace gravel. [FILL].												
23.00	28			6	3 11 9	20	20							
	29													
21.00	30													
	31													
19.00	32													
	33			7	8 35 16	51	35							
17.00	34	At EL. 17.5 ft, observed 6-inch gravel lense. CLAYEY SAND (SC); medium dense; grayish brown; moist; [FILL].												
	35													
15.00	36													
	37													
13.00	38	SANDY lean CLAY with GRAVEL (CL); grayish brown; moist; [FILL].		8	6 8 10	18	60							
	39													
11.00	40													
	41													
9.00	42													
	43			9	5 9 10	19	30							
7.00	44													
	45	CLAYEY SAND with GRAVEL (SC); medium dense; brown; moist; [FILL].												
5.00	46													
	47													
3.00	48			10	8 8 10	18	10							
	49													
1.00	50													Stop drilling 06/23/09 Resume drilling 06/24/09
	51													
-1.00	52													
	53			11	5 8 12	20	100							
-3.00	54	Lean CLAY (CL); very stiff; grayish brown; moist.							23	103	UC =1.5			
	55													

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-011**
DIST.	COUNTY	ROUTE	POSTMILE	EA
04	**Sonoma**	**101**	**0.9/2.9**	**04-28645045**
PROJECT OR BRIDGE NAME				
U.S. 101/ SR 116 SOH				
BRIDGE NUMBER	PREPARED BY	DATE	SHEET	
	S. Manoharan	**6-29-09**	**2 of 5**	

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	55	Lean CLAY (CL) *(continued)*.												
-5.00	56													
	57													
-7.00	58			12	9 15 19	34	80							
	59	SANDY lean CLAY (CL); very stiff; gray; moist. Lean CLAY (CL); very stiff; grayish brown; moist.							18	119	UC =1.88			
-9.00	60													
	61													
-11.00	62													
	63			13	17 38 50/3"	88/ 9"	70							
-13.00	64	SILTY SAND (SM); very dense; grayish brown; moist.												Sampler advanced 15 in.
	65													
-15.00	66													
	67	Poorly graded SAND (SP); medium dense; grayish brown; moist; trace of fine gravel.												
-17.00	68			14	14 19 24	43	60							
	69	Lean CLAY (CL); hard; grayish brown; moist. At EL. -18.0 ft, becomes bluish gray.							19	110	UC =2.07			
-19.00	70													
	71													
-21.00	72													
	73													
-23.00	74	Poorly graded SAND with SILT (SP-SM); very dense; grayish brown; wet.		15	23 33 41	74	100							
	75	SILTY, CLAYEY SAND (SC-SM); very dense; dark bluish gray; wet; weathered Serpentinite sand.												
-25.00	76													
	77	Lean CLAY (CL); very stiff; dark bluish gray; moist.												
-27.00	78			16	8 11 10	21	70		21	104	UC =1.29			C
	79													
-29.00	80													
	81													
-31.00	82													
	83			17	4 9 12	21	80		18	112				
-33.00	84													
	85	Poorly graded SAND with SILT (SP-SM); dense; dark												

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-011**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **S. Manoharan**	DATE **6-29-09**	SHEET **3 of 5**	

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	85	bluish gray; moist.												
-35.00	86													
	87													
-37.00	88			18	10		60							
	89				15	39								
					24									
-39.00	90													Stop drilling 06/24/09 Resume drilling 06/25/09
	91													
-41.00	92	Lean CLAY (CL); bluish gray; moist.												
	93													
-43.00	94	SANDY lean CLAY (CL); brown; moist.												
	95													
-45.00	96													
	97	CLAYEY GRAVEL (GC); very dense; brown; moist.												
-47.00	98			19	45	50/	50							
	99	METAMORPHIC ROCK (SERPENTINITE), dark greenish gray, intensely weathered.			50/3"	3"								Sampler advanced 9 in.
-49.00	100													
	101													
-51.00	102													
	103													
-53.00	104													
	105													Easy drilling
-55.00	106													
	107													
-57.00	108			20	31	50/	60							
	109				50/4"	4"								Sampler advanced 10 in.
-59.00	110													
	111													
-61.00	112													
	113													Hard drilling
-63.00	114													
	115													

(continued)

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-011**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **S. Manoharan**	DATE **6-29-09**	SHEET **4 of 5**	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	115		METAMORPHIC ROCK (Serpentinite) *(continued)*.												
-65.00	116														
	117														
-67.00	118				21	50 50/1"	50/ 1"	50							
	119														Sampler advanced 7 in.
-69.00	120		Bottom of Borehole at 119.5 ft.												
	121														
-71.00	122														
	123														
-73.00	124														
	125														
-75.00	126														
	127														
-77.00	128														
	129														
-79.00	130														
	131														
-81.00	132														
	133														
-83.00	134														
	135														
-85.00	136														
	137														
-87.00	138														
	139														
-89.00	140														
	141														
-91.00	142														
	143														
-93.00	144														
	145														

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-011**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **S. Manoharan**		DATE **6-29-09**	SHEET **5 of 5**

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
S.Mano/C.Rambo	6-11-09	6-12-09	2278308.1 ft / 5953435.2 ft	R-09-013
DRILLING CONTRACTOR: WDC Exploration & Wells			BOREHOLE LOCATION (Offset, Station, Line): 14' Rt Sta 191+97 A	SURFACE ELEVATION: 10 ft
DRILLING METHOD: Rotary Wash			DRILL RIG: CME 85	BOREHOLE DIAMETER: 4-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID): Modified CA (1.96"), SPT (1.44")			SPT HAMMER TYPE: Auto Hammer 140lb/30in	HAMMER EFFICIENCY, ERi: 85%
BOREHOLE BACKFILL AND COMPLETION: Cement			GROUNDWATER READINGS: DURING DRILLING: Dry to 19' AFTER DRILLING (DATE): N/A	TOTAL DEPTH OF BORING: 86.5 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	CLAYEY SAND with GRAVEL (SC); light brown; moist.												
	1			1	6 7 7	14	35							8 inch hollow stem auger to 21.5 feet
8.00	2	CLAYEY GRAVEL with SAND (GC); grayish brown; moist.												
	3													
6.00	4			2	3 11 3	14	35							
	5	Lean to fat CLAY with SAND (CL/CH/CH); stiff; dark gray; moist.												
4.00	6													Drilling fluid measured at 5.5 feet on 6/11/09 Stabilization fabric at 6 feet
	7													
2.00	8													
	9	Fat CLAY (CH); medium stiff; gray; moist.		3	1 2 3	5	100							
0.00	10													
	11			4	1 2 4	6	100		28	94	UC =0.42			
-2.00	12	At EL. -2.0 ft, with Clayey Sand lenses with some black speckling.												
	13													
-4.00	14	At EL. -4.0 ft, becomes very stiff; mottled with brown.		5	2 4 9	13	80		28	95	UC =1.14			LL=67 PI=45 PI
	15													
-6.00	16													
	17													
-8.00	18													
	19	At EL. -9.0 ft, becomes stiff.		6	2 7 9	16	90		26	97	UC =0.87			
-10.00	20													
	21	SILTY SAND (SM); medium dense; gray; moist.												
-12.00	22													Began rotary wash
	23	SANDY lean CLAY (CL); soft; grayish brown; moist.												
-14.00	24													
	25													

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REPORT TITLE				HOLE ID
BORING RECORD				R-09-013
DIST. 04	COUNTY Sonoma	ROUTE 101	POSTMILE 0.9/2.9	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101/ SR 116 SOH				
BRIDGE NUMBER	PREPARED BY L.Phillips	DATE 6-17-09	SHEET 1 of 4	

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25	SANDY lean CLAY (CL) *(continued)*.		7	2 3 5	8	100		25	100	UC =0.2			
-16.00	26	SILTY SAND (SM); loose; greenish gray; moist.							23	103				+#4=0 -#200=41% PA
	27													
-18.00	28													
	29	Lean CLAY with SAND (CL); medium stiff; bluish gray; moist to wet.		8	1 2 3	5	100							
-20.00	30													
	31													
-22.00	32													
	33													
-24.00	34	At EL. -24.0 ft, becomes stiff; moist.		9	3 4 7	11	60		25	101	UC =0.6			
	35													
-26.00	36													
	37													
-28.00	38													
	39	SANDY lean CLAY (CL); stiff; very dark greenish gray; moist.		10	3 7 7	14	80		22	104	UC =0.8			
-30.00	40													
	41													
-32.00	42													
	43													
-34.00	44	Fat CLAY (CH); stiff; dark bluish gray; moist.		11	4 5 6	11	90		31	91	UC =0.6			
	45													
-36.00	46													
	47													
-38.00	48	SANDY lean CLAY (CL); stiff; very dark greenish gray; moist.												
	49			12	3 9 9	18	90							
-40.00	50	Lean CLAY (CL); stiff; very dark greenish gray; moist.							23	103	UC =0.7			
	51													
-42.00	52													
	53	SANDY lean CLAY with GRAVEL (CL); greenish gray; moist; weathered rock.												
-44.00	54			13		35	25							
	55													

(continued)

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-013**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **L.Phillips**	DATE **6-17-09**	SHEET **2 of 4**	

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	55	SANDY lean CLAY with GRAVEL (CL) *(continued)*.	X		12 20 15									
-46.00	56													
	57													
-48.00	58													
	59	METAMORPHIC ROCK (SERPENTINITE), dark greenish gray, intensely weathered, Lean Clay (CL).	X	14	3 4 6	10	100							
-50.00	60													
	61													
-52.00	62													
	63													
-54.00	64		X	15	16 10 41	51	80							
	65													
-56.00	66	At EL. -55.5 ft, with trace of white talc.												
	67													
-58.00	68													
	69		X	16	26 50/1"	50/ 1"	60							
-60.00	70													Sampler advanced 7 in.
	71													Stop drilling 06/11/09 Resume drilling 06/12/09
-62.00	72													
	73													
-64.00	74													
	75		X	17	50 50/1"	50/ 1"	40							
-66.00	76													Sampler advanced 7 in.
	77													
-68.00	78													
	79													
-70.00	80													
	81													
-72.00	82													
	83													
-74.00	84													
	85													

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REPORT TITLE				HOLE ID
BORING RECORD				**R-09-013**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **L.Phillips**	DATE **6-17-09**	SHEET **3 of 4**	

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	85		METAMORPHIC ROCK (Serpentinite) *(continued)*.		18	42 77 87/4"	164/ 10"								
-76.00	86														Sampler advanced 16 in.
	87		Bottom of Borehole at 86.5 ft.												
-78.00	88														
	89														
-80.00	90														
	91														
-82.00	92														
	93														
-84.00	94														
	95														
-86.00	96														
	97														
-88.00	98														
	99														
-90.00	100														
	101														
-92.00	102														
	103														
-94.00	104														
	105														
-96.00	106														
	107														
-98.00	108														
	109														
-100.00	110														
	111														
-102.00	112														
	113														
-104.00	114														
	115														

URS

San Jose Office

100 W. San Fernando St, Suite 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				**R-09-013**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **L.Phillips**		DATE **6-17-09**	SHEET **4 of 4**

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
C.Rambo	6-16-09	6-17-09	2278545.9 ft / 5953352.3 ft	R-09-015
DRILLING CONTRACTOR: WDC Exploration & Wells			BOREHOLE LOCATION (Offset, Station, Line): 22' Rt Sta 194+49 A	SURFACE ELEVATION: 34 ft
DRILLING METHOD: Rotary Wash			DRILL RIG: CME 85	BOREHOLE DIAMETER: 4-7/8 inch
SAMPLER TYPE(S) AND SIZE(S) (ID): Modified CA (1.96"), SPT (1.44")			SPT HAMMER TYPE: Auto Hammer 140lb/30in	HAMMER EFFICIENCY, ERi: 85%
BOREHOLE BACKFILL AND COMPLETION: Cement			GROUNDWATER READINGS: DURING DRILLING: Dry to 22' AFTER DRILLING (DATE): N/A	TOTAL DEPTH OF BORING: 108.5 ft

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0	SILTY GRAVEL (GM); dense; brown; moist; [FILL].												
	1			1	9 19 24	43	65							8 inch hollow stem auger to 22 feet
32.00	2													
	3													
30.00	4													
	5	SILTY SAND with GRAVEL (SM/ML); medium dense; brown; moist; [FILL].		2	4 7 10	17	65							
28.00	6													
	7													
26.00	8													
	9													
24.00	10			3	4 6 11	17	80		7	128				
	11													
22.00	12													
	13													
20.00	14													
	15	SANDY lean CLAY (CL); stiff; brown; moist; some GRAVEL; [FILL].		4	2 5 7	12	60		12	123				
18.00	16													
	17													
16.00	18													
	19													
14.00	20	At EL. 14.0 ft, becomes medium stiff; moist to wet.		5	1 4 7	11	50							
	21													
12.00	22													Began rotary wash
	23	Lean CLAY (CL); medium stiff; dark gray; moist.												
10.00	24													
	25													

(continued)

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San Jose Office

100 W. San Fernando St, Suite 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				R-09-015
DIST. 04	COUNTY Sonoma	ROUTE 101	POSTMILE 0.9/2.9	EA 04-28645045
PROJECT OR BRIDGE NAME: U.S. 101/ SR 116 SOH				
BRIDGE NUMBER	PREPARED BY L.Phillips	DATE 6-23-09	SHEET 1 of 4	

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25		Lean CLAY (CL) *(continued)*.		6	2 3 6	9	50		22	100	UC =0.45			C
8.00	26														
	27														
6.00	28														
	29														
4.00	30														
	31		At EL. 3.0 ft, becomes stiff; brown.												
2.00	32														
	33														
0.00	34														
	35		Poorly graded SAND with SILT (SP-SM); medium dense; grayish brown; moist.		7	9 11 10	21	70							
-2.00	36		Lean CLAY (CL); stiff; light brown; moist.							19	109				
	37														
-4.00	38														
	39														
-6.00	40														
	41														
-8.00	42														
	43		Poorly graded SAND with SILT (SP-SM); dense; gray; moist.												
-10.00	44														
	45				8	14 24 16	40	80		18	106				
-12.00	46														
	47														
-14.00	48														
	49														
-16.00	50														
	51														
-18.00	52		SILTY, CLAYEY SAND (SC-SM); medium dense; gray; moist.												
	53														
-20.00	54														
	55														

(continued)

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

URS

San Jose Office

100 W. San Fernando St, Suite 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				**R-09-015**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **L.Phillips**	DATE **6-23-09**	SHEET **2 of 4**	

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	55	SILTY, CLAYEY SAND (SC-SM) *(continued)*.												
-22.00	56	Lean CLAY (CL); stiff; gray; moist.		9	9 9 11	20	100							
	57													Stop drilling 6/16/09 Resume drilling 6/17/09
-24.00	58													
	59													
-26.00	60													
	61													
-28.00	62													
	63													
-30.00	64													
	65			10	4 13 22	35	60		21	105	UC =0.81			
-32.00	66													
	67	SILTY, CLAYEY SAND (SC-SM); dense; gray; moist.												
-34.00	68													
	69													
-36.00	70													
	71													
-38.00	72	Fat CLAY (CH); stiff; gray mottled with brown; moist; trace coarse SAND.												
	73													
-40.00	74													
	75			11	4 6 9	15	65		46	75	UC =0.73			LL=78 PI=51 PI
-42.00	76													
	77													
-44.00	78													
	79													
-46.00	80													
	81													
-48.00	82													
	83													
-50.00	84													
	85													

(continued)

URS

San Jose Office

100 W. San Fernando St, Suite 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				**R-09-015**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **L.Phillips**	DATE **6-23-09**	SHEET **3 of 4**	

ELEVATION (ft)	DEPTH (ft)	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per Foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	85	At EL. -51.0 ft, becomes medium stiff. Fat CLAY (CH) *(continued)*.		12	6 9 12	21	70		41	78	UC =0.37			
-52.00	86	SANDY lean CLAY (CL); very stiff; gray; moist.												
	87													
-54.00	88													
	89													
-56.00	90													
	91													
-58.00	92													
	93													
-60.00	94													
	95	SILTY, CLAYEY SAND (SC-SM); very dense; gray; moist.		13	26 50/4"	50/ 4"	0							
-62.00	96													Sampler advanced 10 in.
	97													
-64.00	98													
	99													
-66.00	100			14	19 28 26	54	70							
	101													
-68.00	102													
	103													
-70.00	104													Refusal with drag bit at 107 ft; 5 psi pressure on tip
	105													
-72.00	106													
	107	SANDY lean CLAY (CL); very stiff; gray mottled with brown; moist; trace GRAVEL.		15	9 9 15	24	80							
-74.00	108													
	109	Bottom of Borehole at 108.5 ft.												
-76.00	110													
	111													
-78.00	112													
	113													
-80.00	114													
	115													

URS BORING RECORD 200802 28645040_MSNB4PETRIVER.GPJ SNJ_CT.GLB 11/23/10

URS

San Jose Office

100 W. San Fernando St, Suite 200
San Jose, CA 95113

REPORT TITLE				HOLE ID
BORING RECORD				**R-09-015**
DIST. **04**	COUNTY **Sonoma**	ROUTE **101**	POSTMILE **0.9/2.9**	EA **04-28645045**
PROJECT OR BRIDGE NAME **U.S. 101/ SR 116 SOH**				
BRIDGE NUMBER	PREPARED BY **L.Phillips**		DATE **6-23-09**	SHEET **4 of 4**

APPENDIX B
ANALYTICAL RESULTS
OF ASBESTOS

APPENDIX B - ANALYTICAL RESULTS

Sample No.	Boring ID		Depth Interval (BGS)	Lithology	Asbestos Weight Percent	Asbestos Type
1	R-11-016		37.5 - 38.3	Serpentinite	> 10	chrysotile, amosite
2			41.6 - 42.2	Shale	< 0.0005	
3			57.0 - 57.11	Shale with Serpentinite	> 10	chrysotile
4	R-09-002		25.0 - 25.9	Argillite	0.0036	chrysotile
5			26. - 26.10	Serpentinite	< 0.0005	
6			55.6 - 56.2	Serpentinite	< 0.0005	
7			85.0 - 85.9	Argillite	< 0.0005	
8	R-09-003		5. 0- 5.9	Serpentinite	< 0.0005	
9			63.5 - 64.2	Argillite	< 0.0005	
10			110 - 110.9	Argillite	< 0.0005	
11			115.0 - 115.9	Serpentinite	< 0.0005	
12	R-09-001	1-4	1.5 - 2.0	Graywacke	< 0.0005	
13	"	2-3	5.5 - 6.5	Graywacke	< 0.0005	
14	"	2-4	5.5 - 6.5	Graywacke	< 0.0005	
15	"	4-3	15.5 - 16.5	Greenstone	0.0016	actinolite
16	R-09-003	3-3	10.0 - 10.5	Clay	< 0.0005	
17	"	3-4	10.7 - 11.2	Clay, then Graywacke	< 0.0005	
18	R-09-004	1-4	2.0 - 2.5	Graywacke	0.0072	chrysotile
19	R-09-006	3-4	10.5 - 11.0	Clay	0.0271	tremolite, chrysotile
20	"	5-shoe	21.0-21.5	Shale with Serpentinite	2.4	chrysotile
21	A-09-106	1-3	1.5 - 2.0	Sandy Clay	0.27	chrysotile, tremolite
22	"	2-3	3.5 - 4.0	Sandy Clay	0.45	tremolite
23	"	4-3	14.5 - 15.0	Clay with Sand	0.0018	tremolite
24	R-09-011	5-4	25.0 - 26.0	Clayey Gravel	< 0.0005	
25	"	6-4	28.4 - 29.2	Sandy Clay	< 0.0005	
26	R-09-013	1-4	2.0 - 2.5	Clayey Gravel	0.025	chrysotile, tremolite
27	R-09-015	4-3	15.0- 16.6	Gravelly Clay	0.037	chrysotile, tremolite
28	"	5-4	20.0 - 21.4	Sandy Clay	0.52	chrysotile, tremolite

2.4	Exceeds CalTrans threshold of 0.25 weight % (and OSHA threshold of 0.1%)
Sand/Gravel	2
Clay:	8
Graywacke	5
Serpentine	5
Shale/Argillite	7
Greenstone	1

APPENDIX C
LAB RESULTS &
CHAIN OF CUSTODY FORMS

Forensic Analytical Laboratories

QUANTITATIVE ANALYSIS REPORT
ASBESTOS IN SOIL
Transmission Electron Microscopy*

Client:
URS Corporation
Randy Siegel
1333 Broadway, Suite 800
Oakland CA 94612

Page: 1/2
Client Number: A31496
Report Number: T021134
Date Received: 3/6/12

Job Number: 28645038.09020
Project:
Location:
Date Collected:

Analyst: Hygiea Labs
Date Analyzed: 3/27-29/12
Date Reported: 4/2/12

ANALYTICAL RESULTS

Client Sample Number	Lab Sample Number	**Asbestos Weight Percent****	Asbestos Type(s)***
R-09-001-1-4-1.5-2.0	20086823	<0.0005%	ND
R-09-001-2-3-5.5-6.5	20086824	<0.0005%	ND
R-09-001-2-4-5.5-6.5	20086825	<0.0005%	ND
R-09-001-4-3-15.5-16.5	20086826	0.0016%	AC
R-09-003-3-3-10.0-10.5	20086827	<0.0005%	ND
R-09-003-3-4-10.7-11.2	20086828	<0.0005%	ND
R-09-004-1-4-2.0-2.5	20086829	0.0072%	CH
R-09-006-3-4-10.5-11.0	20086830	0.0271%	TR,CH
R-09-006-5-shoe-21.0-21.5	20086831	2.4%	CH
R-09-106-1-3-1.5-2.0	20086832	0.27%	TR,CH
R-09-106-2-3-3.5-4.0	20086833	0.45%	TR
R-09-106-4-3-14.5-15.0	20086834	0.0018%	TR

Mark S. Floyd, Analytical Microscopy Supervisor

* EPA Test Method 600/R-93/116, Part 2.5: Method for the Determination of Asbestos In Bulk Building Materials.
** Weight percent calculated on a dry weight basis.
*** Asbestos types: CH=chrysotile; AM=amosite; TR=tremolite; AC=actinolite; CR=crocidolite; AN=anthophyllite; FAC=ferroactinolite; LA=Libby amphibole; ND=none detected.

Samples were received in acceptable condition unless otherwise noted. Analytical results and reports are generated by Forensic Analytical Laboratories Inc (FALI) at the request of and for the exclusive use of the person or entity (Client) named on such report. Results, reports or copies of same will not be released by FALI to any third party without prior written request from Client. This report applies only to the sample(s) tested, and results are not blank-corrected unless otherwise noted. Supporting laboratory documentation is available upon request. This report must not be reproduced except in full with approval from FALI. The Client is solely responsible for the use and interpretation of test results and reports requested from FALI. This report must not be used by the Client to claim product endorsement by NVLAP or any U.S. government agency. FALI is unable to assess the degree of hazard resulting from materials analyzed. FALI reserves the right to dispose of all samples after a period of 30 days, according to all state and federal guidelines, unless otherwise specified.

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Forensic Analytical Laboratories

QUANTITATIVE ANALYSIS REPORT
ASBESTOS IN SOIL
Transmission Electron Microscopy*

Client:
URS Corporation
Randy Siegel
1333 Broadway, Suite 800
Oakland CA 94612

Page:	2/2
Client Number:	A31496
Report Number:	T021134
Date Received:	3/6/12

Job Number: 28645038.09020
Project:
Location:
Date Collected:

Analyst:	Hygiea Labs
Date Analyzed:	3/27-28/12
Date Reported:	4/2/12

ANALYTICAL RESULTS

Client Sample Number	Lab Sample Number	**Asbestos Weight Percent****	Asbestos Type(s)***
R-09-011-5-4-25.0-26.0	20086835	<0.0005%	ND
R-09-011-6-4-28.4-29.2	20086836	<0.0005%	ND
R-09-013-1-4-2.0-2.5	20086837	0.025%	TR,CH
R-09-015-4-3-15.0-16.6	20086838	0.037%	TR,CH
R-09-015-5-4-20.0-21.4	20086839	0.52%	TR,CH

* EPA Test Method 600/R-93/116, Part 2.5: Method for the Determination of Asbestos in Bulk Building Materials.
** Weight percent calculated on a dry weight basis.
*** Asbestos types: CH=chrysotile; AM=amosite; TR=tremolite; AC=actinolite; CR=crocidolite; AN=anthophyllite;

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Forensic Analytical Laboratories

QUANTITATIVE ANALYSIS REPORT
ASBESTOS IN SOIL
Transmission Electron Microscopy*

Client:
URS Corporation
Randy Siegel
1333 Broadway, Suite 800
Oakland CA 94612

Page:	1/1
Client Number:	A31496
Report Number:	T021126
Date Received:	3/6/12

Job Number: 28645038.09020
Project:
Location:
Date Collected:

Analyst:	Hygiea Labs
Date Analyzed:	3/23-27/12
Date Reported:	3/28/12

ANALYTICAL RESULTS

Client Sample Number	Lab Sample Number	**Asbestos Weight Percent****	Asbestos Type(s)***
R-11-016-37.5-38.5	20086787	>10%	CH,AC
R-11-016-41.6-42.2	20086788	<0.0005%	CH
R-11-016-57.0-57.11	20086789	>10%	CH
R-09-002-25.0-25.9	20086790	0.0036%	CH
R-09-002-26.1-26.10	20086791	<0.0005%	ND
R-09-002-55.6-56.2	20086792	<0.0005%	ND
R-09-002-85.0-85.9	20086793	<0.0005%	ND
R-09-003-5.0-5.9	20086794	<0.0005%	ND
R-09-003-63.5-64.2	20086795	<0.0005%	ND
R-09-003-110-110.9	20086796	<0.0005%	ND
R-09-003-115.0-115.9	20086797	<0.0005%	ND

Mark S. Floyd, Analytical Microscopy Supervisor

* EPA Test Method 600/R-93/116, Part 2.5: Method for the Determination of Asbestos in Bulk Building Materials.
** Weight percent calculated on a dry weight basis.
*** Asbestos types: CH=chrysotile; AM=amosite; TR=tremolite; AC=actinolite; CR=crocidolite; AN=anthophyllite; FAC=ferroactinolite; LA=Libby amphibole; ND=none detected.

Samples were received in acceptable condition unless otherwise noted. Analytical results and reports are generated by Forensic Analytical Laboratories Inc (FALI) at the request of and for the exclusive use of the person or entity (Client) named on such report. Results, reports or copies of same will not be released by FALI to any third party without prior written request from Client. This report applies only to the sample(s) tested, and results are not blank-corrected unless otherwise noted. Supporting laboratory documentation is available upon request. This report must not be reproduced except in full with approval from FALI. The Client is solely responsible for the use and interpretation of test results and reports requested from FALI. This report must not be used by the Client to claim product endorsement by NVLAP or any U.S. government agency. FALI is unable to assess the degree of hazard resulting from materials analyzed. FALI reserves the right to dispose of all samples after a period of 30 days, according to all state and federal guidelines, unless otherwise specified.

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CHAIN OF CUSTODY RECORD

TO: Forensic Analytical
3777 Depot Rd # 409, Hayward, CA 94545
(510) 887-8828

2 BOXES

FROM: URS Corporation
1333 Broadway Suite #800, Oakland, CA 94612
(510) 874-1783
URS Contact: Randy Siegel
URS Job No.: 28645038.09020

BOX 1

Boring ID	Sample ID: Boring ID	Sample ID: Depth Interval (BGS)	Lithology	Sampler	Laboratory Analysis	Comments
R-11-016	R-11-016	37.5-38.3	Serpentinite	URS	CARB 435 - TEM	
"	R-11-016	41.6-42.2	Shale	URS	CARB 435 - TEM	
"	R-11-016	57.0-57.11	Shale with Serpentinite	URS	CARB 435 - TEM	This is a Shale
R-09-002	R-09-002	25.0-25.9	Argillite	Cal Trans	CARB 435 - TEM	
"	R-09-002	26.1-26.10	Serpentinite	Cal Trans	CARB 435 - TEM	
"	R-09-002	55.6-56.2	Serpentinite	Cal Trans	CARB 435 - TEM	
"	R-09-002	85.0-85.9	Argillite	Cal Trans	CARB 435 - TEM	
R-09-003	R-09-003	5.0-5.9	Serpentinite	Cal Trans	CARB 435 - TEM	
"	R-09-003	63.5-64.2	Argillite	Cal Trans	CARB 435 - TEM	
"	R-09-003	110-110.9	Argillite	Cal Trans	CARB 435 - TEM	
"	R-09-003	115.0-115.9	Serpentinite	Cal Trans	CARB 435 - TEM	

BOX 2

R-09-001	1-4	1.5 - 2.0	Graywacke	URS	CARB 435 - TEM	
"	2-3	5.5 - 6.5	Graywacke	URS	CARB 435 - TEM	
"	2-4	5.5 - 6.5	Graywacke	URS	CARB 435 - TEM	
"	4-3	15.5 - 16.5	Greenstone	URS	CARB 435 - TEM	
R-09-003	3-3	10.0 - 10.5	Clay	URS	CARB 435 - TEM	
"	3-4	10.7 - 11.2	Clay, then Graywacke	URS	CARB 435 - TEM	Use Graywacke
R-09-004	1-4	2.0 - 2.5	Graywacke	URS	CARB 435 - TEM	
R-09-006	3-4	10.5 - 11.0	Clay	URS	CARB 435 - TEM	
"	5-shoe	21.0-21.5	Shale with Serpentinite	URS	CARB 435 - TEM	
R-09-106	1-3	1.5 - 2.0	Sandy Clay	URS	CARB 435 - TEM	
"	2-3	3.5 - 4.0	Sandy Clay	URS	CARB 435 - TEM	
"	4-3	14.5 - 15.0	Clay with Sand	URS	CARB 435 - TEM	
R-09-011	5-4	25.0 - 26.0	Clayey Gravel	URS	CARB 435 - TEM	
"	6-4	28.4 - 29.2	Sandy Clay	URS	CARB 435 - TEM	
R-09-013	1-4	2.0 - 2.5	Clayey Gravel	URS	CARB 435 - TEM	
R-09-015	4-3	15.0- 16.6	Gravelly Clay	URS	CARB 435 - TEM	
"	5-4	20.0 - 21.4	Sandy Clay	URS	CARB 435 - TEM	

Relinquished By: Randy Siegel Date: March 6, 2012 Time: 3:00 PM
Accepted By: ODS courier Date: 3-5-12 Time: 2 PM
Relinquished By: ODS 11 Date: 3-5-12 Time: 0:45 PM
Accepted By: [illegible] Date: 3-6-12 Time: 2:40 pm
Relinquished By: Date: Time:
Accepted By: Date: Time:

CHAIN OF CUSTODY RECORD

TO: Forensic Analytical
3777 Depot Rd # 409, Hayward, CA 94545
(510) 887-8828

2 BOXES

FROM: URS Corporation
1333 Broadway Suite #800, Oakland, CA 94612
(510) 874-1783
URS Contact: Randy Siegel
URS Job No.: 28645038.09020

Boring ID	Sample ID: Boring ID	Sample ID: Depth Interval (BGS)	Lithology	Sampler	Laboratory Analysis	Comments
R-11-016	R-11-016	37.5-38.3	Serpentinite	URS	CARB 435 - TEM	
"	R-11-016	41.6-42.2	Shale	URS	CARB 435 - TEM	
"	R-11-016	57.0-57.11	Shale with Serpentinite	URS	CARB 435 - TEM	This is a Shale
R-09-002	R-09-002	25.0-25.9	Argillite	Cal Trans	CARB 435 - TEM	
"	R-09-002	26.1-26.10	Serpentinite	Cal Trans	CARB 435 - TEM	
"	R-09-002	55.6-56.2	Serpentinite	Cal Trans	CARB 435 - TEM	
"	R-09-002	85.0-85.9	Argillite	Cal Trans	CARB 435 - TEM	
R-09-003	R-09-003	5.0-5.9	Serpentinite	Cal Trans	CARB 435 - TEM	
"	R-09-003	63.5-64.2	Argillite	Cal Trans	CARB 435 - TEM	
"	R-09-003	110-110.9	Argillite	Cal Trans	CARB 435 - TEM	
"	R-09-003	115.0-115.9	Serpentinite	Cal Trans	CARB 435 - TEM	
R-09-001	1-4	1.5 - 2.0	Graywacke	URS	CARB 435 - TEM	
"	2-3	5.5 - 6.5	Graywacke	URS	CARB 435 - TEM	
"	2-4	5.5 - 6.5	Graywacke	URS	CARB 435 - TEM	
"	4-3	15.5 - 16.5	Greenstone	URS	CARB 435 - TEM	
R-09-003	3-3	10.0 - 10.5	Clay	URS	CARB 435 - TEM	
"	3-4	10.7 - 11.2	Clay, then Graywacke	URS	CARB 435 - TEM	Use Graywacke
R-09-004	1-4	2.0 - 2.5	Graywacke	URS	CARB 435 - TEM	
R-09-006	3-4	10.5 - 11.0	Clay	URS	CARB 435 - TEM	
"	5-shoe	21.0-21.5	Shale with Serpentinite	URS	CARB 435 - TEM	
R-09-106	1-3	1.5 - 2.0	Sandy Clay	URS	CARB 435 - TEM	
"	2-3	3.5 - 4.0	Sandy Clay	URS	CARB 435 - TEM	
"	4-3	14.5 - 15.0	Clay with Sand	URS	CARB 435 - TEM	
R-09-011	5-4	25.0 - 26.0	Clayey Gravel	URS	CARB 435 - TEM	
"	6-4	28.4 - 29.2	Sandy Clay	URS	CARB 435 - TEM	
R-09-013	1-4	2.0 - 2.5	Clayey Gravel	URS	CARB 435 - TEM	
R-09-015	4-3	15.0- 16.6	Gravelly Clay	URS	CARB 435 - TEM	
"	5-4	20.0 - 21.4	Sandy Clay	URS	CARB 435 - TEM	

Box 2

Relinquished By:	Randy Siegel	Date: March 6, 2012	Time: 3:00 PM	
Accepted By:	ODS Courier	Date: 3-5-12	Time: 2 PM	
Relinquished By:	ODS "	Date: 3-5-12	Time: 2:45 PM	
Accepted By:	[illegible]	Date: 3-6-12	Time: 2:45 pm 0° C	
Relinquished By:		Date:	Time:	
Accepted By:		Date:	Time:	

APPENDIX D

LOTB

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	Son	101	0.9/3.6	769	918

Ali Kaddoura 06-22-11
REGISTERED CIVIL ENGINEER

4-23-12
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Ali K. Kaddoura 55710 12-31-12 CIVIL STATE OF CALIFORNIA

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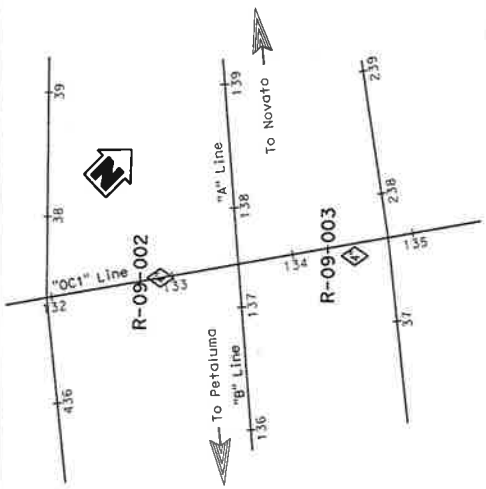
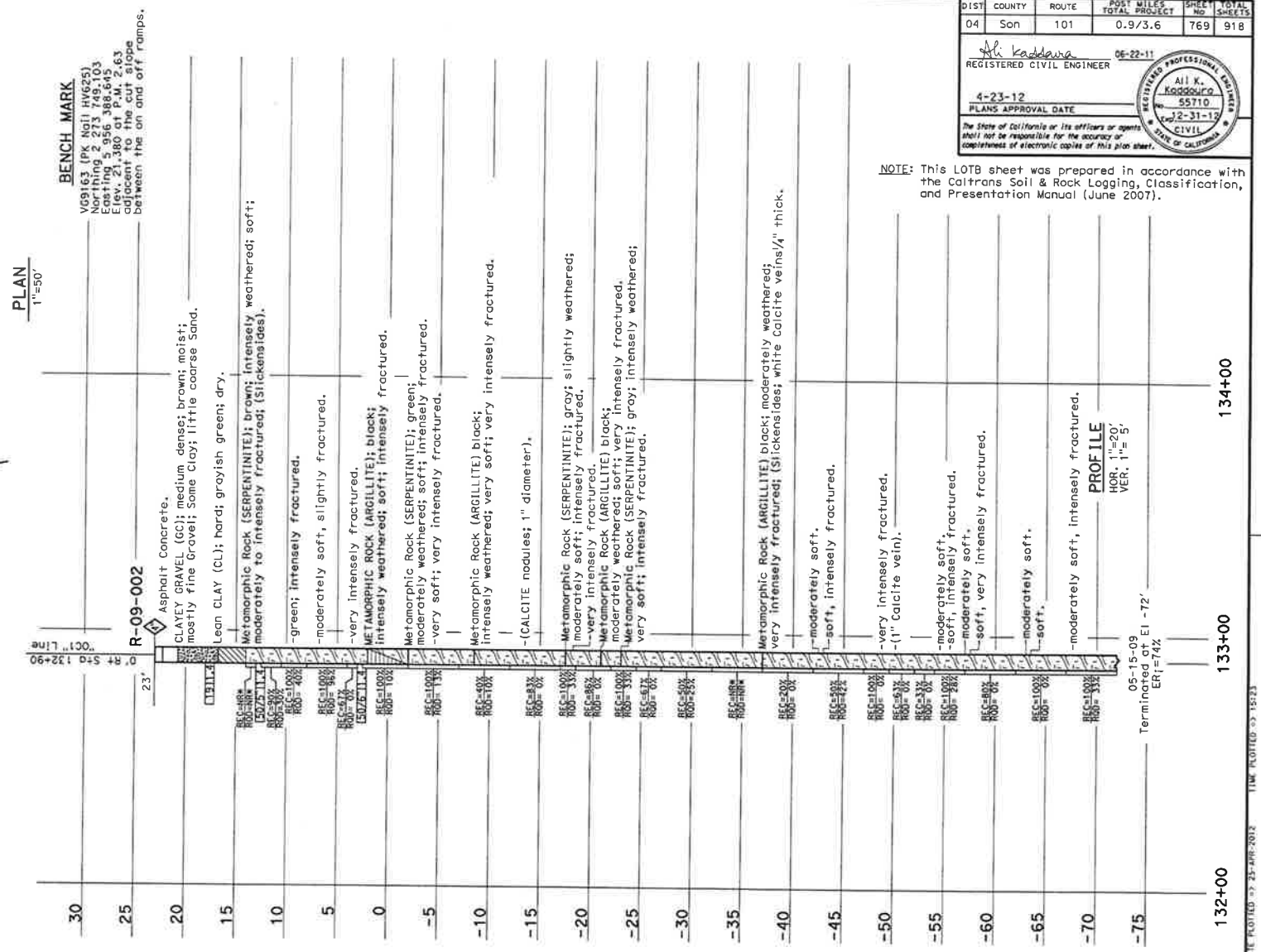
NOTE: This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2007).





ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	GEOTECHNICAL SERVICES OFFICE OF GEOTECHNICAL DESIGN BRANCH 8	BRIDGE NO. 02-0294 / POST MILES 2.6	KASTANIA ROAD OC
FUNCTIONAL SUPERVISOR	DRAWN BY: M. Reynolds 06-09	FIELD INVESTIGATION BY: M. Gaffney			LOG OF TEST BORINGS 1 OF 5
NAME: H. Nikoul	CHECKED BY: C. Risden				

005 CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 0412000195-1 CONTRACT NO.: 04-2640U1

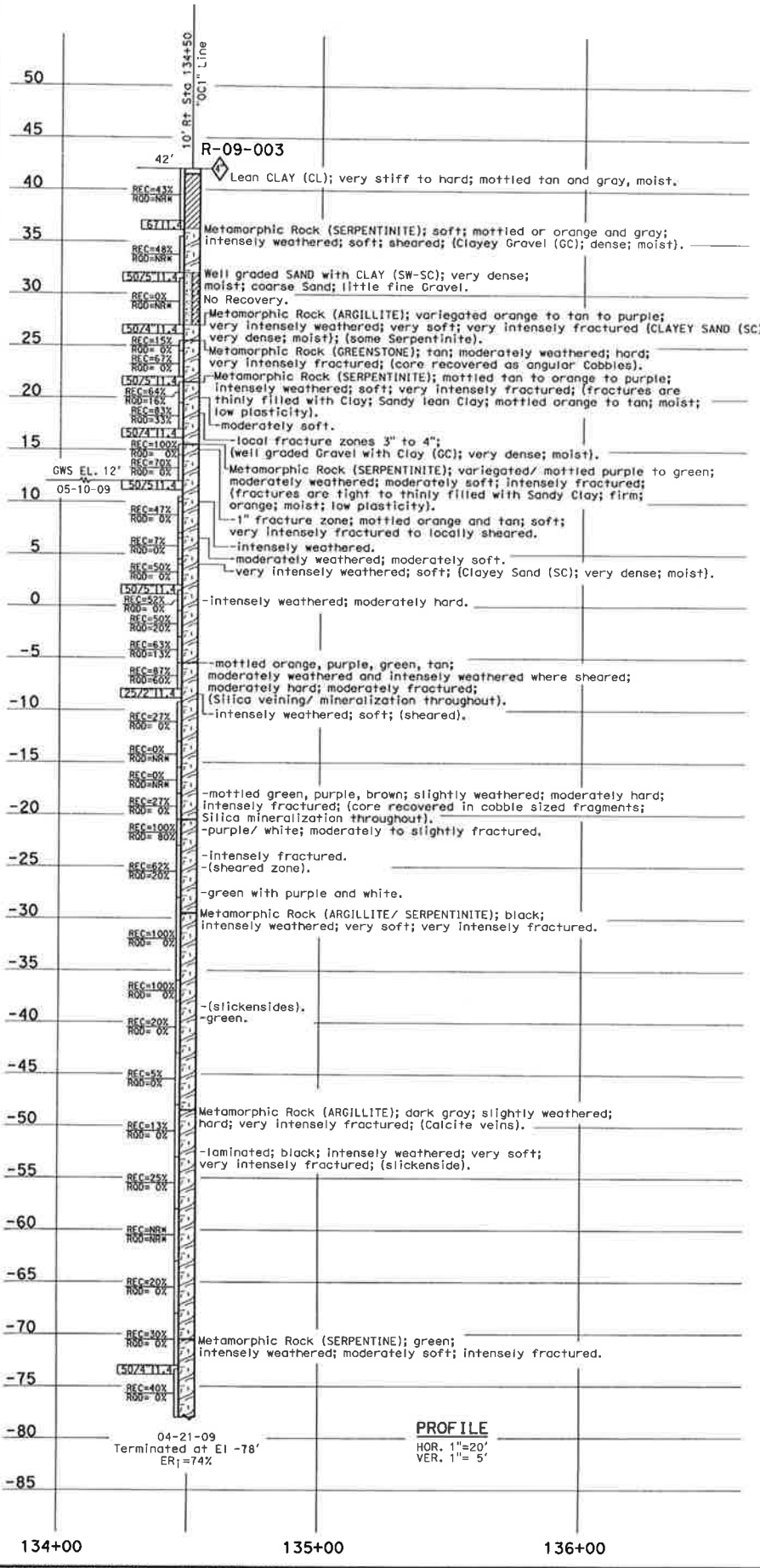
DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 07-16-10 07-26-11 10-25-11 | SHEET 22 OF 26

FILE #SLE => 20-0294-z-lotbl.dgn

USERNAME => s124496 DATE PLOTTED => 25-APR-2012 TIME PLOTTED => 15:23

(For Boring Location See Plan, LOTB Sheet 1 of 5)



NOTE: This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2007).

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	Son	101	0.9/3.6	770	918

REGISTERED CIVIL ENGINEER 06-22-11

PLANS APPROVAL DATE 4-23-12

REGISTERED PROFESSIONAL ENGINEER ALI K. KASHANI 55710 Exp. 12-31-12 CIVIL STATE OF CALIFORNIA

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ENGINEERING SERVICES

FUNCTIONAL SUPERVISOR: H. Nikoui

DRAWN BY: M. Reynolds 06-09

CHECKED BY: C. Risden

GEOTECHNICAL SERVICES

FIELD INVESTIGATION BY: M. Goffney

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

GEOTECHNICAL SERVICES OFFICE OF GEOTECHNICAL DESIGN BRANCH 8

BRIDGE NO. 02-0294 POST MILES 2.6

KASTANIA ROAD OC

LOG OF TEST BORINGS 2 OF 5

UNIT: 0714 PROJECT NUMBER & PHASE: 0412000195-1 CONTRACT NO.: 04-264041

FILE => 20-0294-2-10102.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET 23 OF 26

USERNAME => s124496 DATE PLOTTED => 25-APR-2012 TIME PLOTTED => 15:23

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	Son	101	0.9/3.6	771	918

REGISTERED CIVIL ENGINEER 06-22-11 DATE

4-23-12
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Ali K. Kaddoura No. 55710 Exp. 12-31-13 CIVIL 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.

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

CEMENTATION

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

CONSISTENCY OF COHESIVE SOILS

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

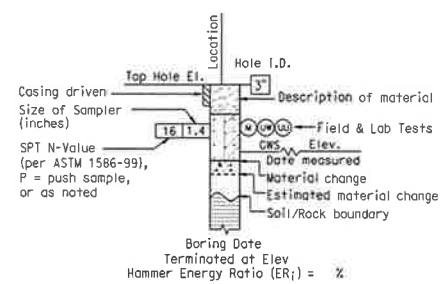
BOREHOLE IDENTIFICATION

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

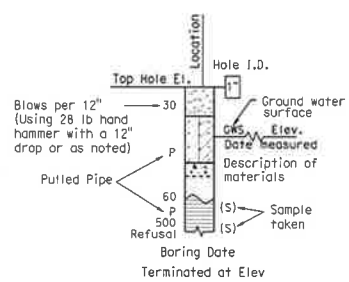
Note: Size in Inches.

PLASTICITY OF FINE-GRAINED SOILS

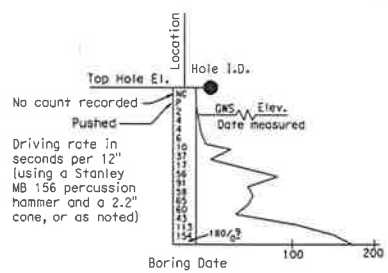
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be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



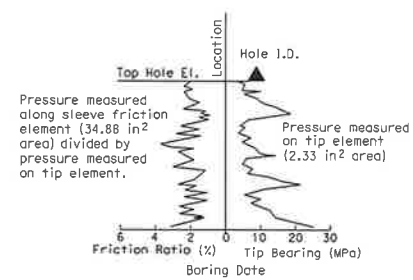
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	GEOTECHNICAL SERVICES OFFICE OF GEOTECHNICAL DESIGN BRANCH 8	BRIDGE NO. 02-0294 / POST MILE 2.6	KASTANIA ROAD OC
	PREPARED BY: M. Reynolds 06-09				LOG OF TEST BORINGS 3 of 5

GS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 0412000195-1 CONTRACT NO.: 04-2640U1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES | SHEET 24 | OF 26

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

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Son	101	0.9/3.6	772	918

REGISTERED CIVIL ENGINEER 06-22-11 DATE

4-23-12
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Ali K. Koddouro No. 55710 Exp. 12-31-12 CIVIL STATE OF CALIFORNIA

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GROUP SYMBOLS AND NAMES

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

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

FIELD AND LABORATORY TESTING

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

APPARENT DENSITY OF COHESIONLESS SOILS

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

MOISTURE

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

PERCENT OR PROPORTION OF SOILS

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

PARTICLE SIZE

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

ENGINEERING SERVICES

GEOTECHNICAL SERVICES
PREPARED BY: M. Reynolds 06-09

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

GEOTECHNICAL SERVICES
OFFICE OF GEOTECHNICAL
DESIGN BRANCH 8

BRIDGE NO. 02-0294
POST MILE 2.6

KASTANIA ROAD OC
LOG OF TEST BORINGS 4 of 5

GS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 0412000195-1 CONTRACT NO.: 04-2640U1

DISREGARD PRINTS BEARING EARLIER REVISION DATES 2-24-09 06-30-11 10-25-11

SHEET 25 OF 26

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

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	San	101	0.9/3.6	773	918

REGISTERED CIVIL ENGINEER — DATE 06-22-11

4-23-12
PLANS APPROVAL DATE

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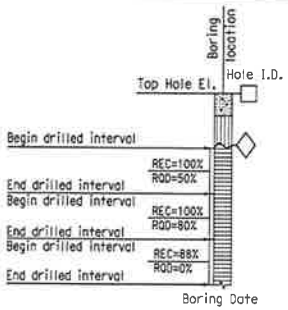
REGISTERED PROFESSIONAL ENGINEER — Ali K. Kaddoura — No. 55710 — Exp. 12-31-12 — CIVIL — STATE OF CALIFORNIA

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

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

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



RELATIVE STRENGTH OF INTACT ROCK

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

BEDDING SPACING

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

LEGEND OF ROCK MATERIALS

- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

ROCK HARDNESS

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

FRACTURE DENSITY

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

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

WEATHERING DESCRIPTORS FOR INTACT ROCK

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

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

ENGINEERING SERVICES

GEOTECHNICAL SERVICES
PREPARED BY: M. Reynolds 06-09

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

GEOTECHNICAL SERVICES
OFFICE OF GEOTECHNICAL
DESIGN BRANCH 8

BRIDGE NO. 02-0294
POST MILE 2.6

KASTANIA ROAD OC
LOG OF TEST BORINGS 5 of 5

DS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 0412000195-1
CONTRACT NO.: 04-2640U1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 7-28-08 02-28-11 10-25-11

SHEET 26 OF 26

FILE => 20-0294-z-lotb5.dgn

USERNAME => s124296 DATE PLOTTED => 25-APR-2012 TIME PLOTTED => 15:24

BENCH MARK:
B.M: JK 121 Elev 81.98'
1" Iron pipe with a plastic plug and tack along the northbound shoulder of State Route 101 across from a "Sonoma-Napa-Right Lane" sign; 10.7 feet easterly of a metal beam guard rail and at top of slope.
NAVD 1988
B.M: JK122 Elev 52.65'
1" Iron pipe with a plastic plug and tack along the northbound median of State Route 101; 50' northerly of a "Petaluma Blvd South-3/4 mile" sign; 16 feet westerly of the edge of pavement and witnessed by a carsonite witness post.
NAVD 1988

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	Son	101	0.9/3.6	878	918

GEOTECHNICAL PROFESSIONAL 10/28/11 DATE

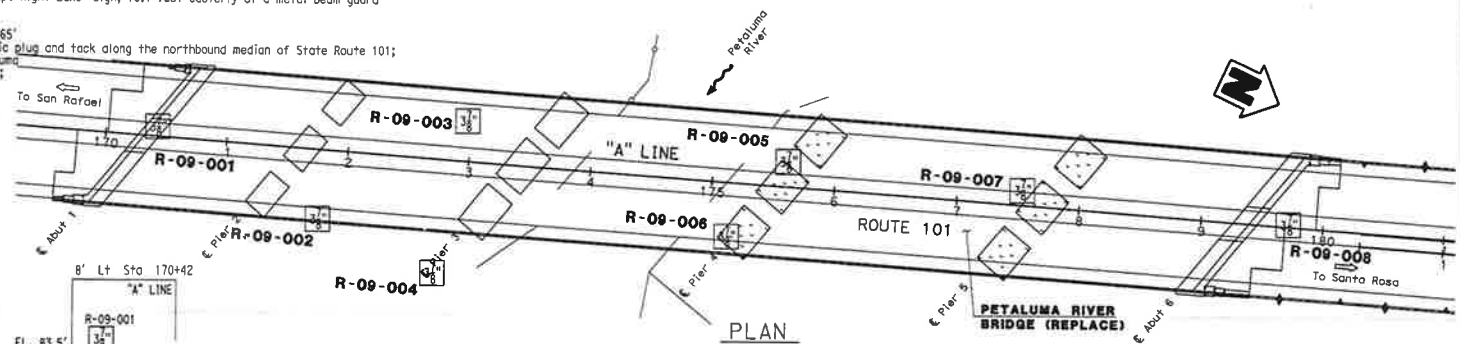
4-23-12
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. C 42289 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

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

URS CORPORATION
100 WEST SAN FERNANDO STREET, SUITE 200
SAN JOSE, CA 95113

SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401



PLAN
1" = 50'

8' Lt Sta 170+42 "A" LINE
R-09-001
EL. 83.5'
METAMORPHIC ROCK, Graywacke (Sandstone), brownish gray, intensely weathered, very weak, intensely fractured, with Lean Clay (CL) infilling along fractures. [Franciscan Complex].
At EL. 77.5 ft, becomes intensely to moderately weathered.
At EL. 76.5 ft, becomes black to dark gray, intensely weathered, weak to medium strong, little to no clay infilling along joints.
At EL. 73.5 ft, becomes light greenish gray, intensely weathered, very weak, trace of serpentinite, foliated fabric, breaks down to Clayey Sand (SC).
At EL. 69.5 ft, becomes Greenstone ?(meta-volcanic), dark gray, moderately weathered, medium strong, intensely fractured, (meta-volcanic). [Franciscan Complex].
Terminated at El. 62.0'
08-17-09
Hammer Efficiency Ratio (ERi) = 81%
Groundwater was not encountered in boring R-09-001

56' Rt Sta 171+79 "A" LINE
R-09-002
EL. 34.0'
7 inches Asphalt Concrete over 8 inches Aggregate Base.
SANDY lean CLAY (CL); stiff; brown; moist; little GRAVEL; [FILL].
Aggregate Base? 3/4" max gravel size; moist; [FILL].
Lean CLAY (CL); very stiff; black; moist; UC=2.86 tsf; [COLLUVIUM].
GRAVELLY lean CLAY with SAND (CL); [COLLUVIUM].
SANDY lean CLAY (CL); stiff; brown; moist.
METAMORPHIC ROCK, Graywacke (Sandstone), yellowish gray to olive black, intensely weathered, very weak, with trace of shale and serpentinite, foliated fabric. [FRANCISCAN COMPLEX].
At EL. 20.0 ft, becomes dark gray, moderately weathered.
At EL. 14.0 ft, becomes dark gray to grayish green, intensely weathered, very weak, increasing shale/serpentinite with a trace of graywacke; breaks down to clayey sand (SC); banded.
Terminated at El. 7.5'
08-18-09
Hammer Efficiency Ratio (ERi) = 81%
Groundwater was not encountered in boring R-09-002

33' Lt Sta 172+96 "A" LINE
R-09-003
EL. 39.0'
7 inches Asphalt Concrete over 8 inches Aggregate Base.
CLAYEY GRAVEL with SAND (GC); very dense; brown; moist; [FILL].
SANDY lean CLAY with GRAVEL (CL); medium stiff; brown mottled with yellowish brown; moist; [FILL].
At EL. 27.5 ft, becomes light greenish gray; with black fat CLAY lenses.
Lean CLAY (CL); stiff; dark gray; moist; trace SAND; UC=0.81 tsf; residual soil.
METAMORPHIC ROCK, Graywacke (Sandstone), intensely weathered, very weak, intensely fractured, brown; trace of shale; foliated fabric; breaks down to clayey sand (SC). [FRANCISCAN COMPLEX].
At EL. 16.5 ft, becomes dark greenish gray to dark gray, moderately weathered, some calcite veins; approximately 50% shale and 50% graywacke.
At EL. 9.0 ft, becomes dark gray, intensely weathered, very weak, mostly shale with approximately 20% graywacke; highly sheared/foliated fabric. [FRANCISCAN COMPLEX].
At EL. 4.0 ft, becomes black, mostly shale; breaks down to lean clay (CL) with sand/gravel.
At EL. -11.0 ft, becomes moderately weathered, very weak to weak.
Terminated at El. -27.5'
08-19-09
Hammer Efficiency Ratio (ERi) = 81%
Groundwater was encountered in boring R-09-003, but elevation was not measured.

Elevation, feet: 90, 80, 70, 60, 50, 40, 30, 20, 10, 0, -10, -20, -30

"A" LINE: 170+00, 171+00, 172+00, 173+00, 174+00, 175+00, 176+00

PROFILE
Ver. 1" = 10'
Hor. 1" = 25'

NOTE:
1. This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification, and Presentation Manual (June 2007).

2. All borings except R-09-005 and R-09-006 were initially started with hollow stem auger and then completed using the rotary wash drilling method. Borings R-09-001, R-09-002, R-09-003, R-09-004, R-09-007 and R-09-008 were dry to depths of 5 feet (Elevation 78.5), 5 feet (Elevation 29), 5 feet (Elevation 34), 1 feet (Elevation 10), 5 feet (Elevation 6) and 5 feet (Elevation 67), respectively. Both of the Borings (R-09-005 and R-09-006) were drilled full depth using the rotary wash drilling method.

3. Standard Penetration Test sampler: I.D. = 1.44 inch (1.4)
Modified California sampler: I.D. = 1.96 inch (2.0)

DESIGN OVERSIGHT Tracy L Barron
11-3-11
SIGN OFF DATE

DRAWN BY A. CHEUNG
CHECKED BY MANOHARAN

C. RAMBO
FIELD INVESTIGATION BY:
DATE:

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. HUANG
PROJECT ENGINEER

BRIDGE NO. 20-0295
POST MILES 3.23

PETALUMA RIVER BRIDGE (REPLACE)
LOG OF TEST BORINGS 1 OF 8

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 0412000195
CONTRACT NO.: 04-2640U1
FILE => 20-0295-z-lrb01.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES 3-29-11 7-29-11 9-9-11 10-28-11
SHEET 105 OF 112

USERNAME => s137516 DATE PLOTTED => 26-APR-2012 TIME PLOTTED => 08:51

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	Son	101	0.9/3.6	879	918

GEOTECHNICAL PROFESSIONAL — DATE 10/28/11

4-23-12
PLANS APPROVAL DATE

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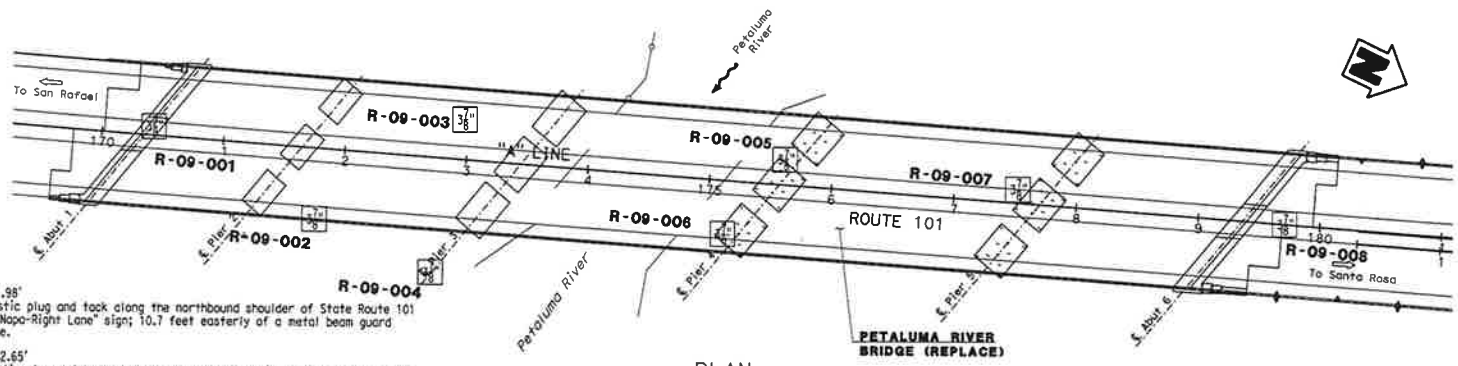
REGISTERED PROFESSIONAL ENGINEER — Stephen Huang — No. C 42289 — Exp. 03/31/12 — GEOTECHNICAL — STATE OF CALIFORNIA

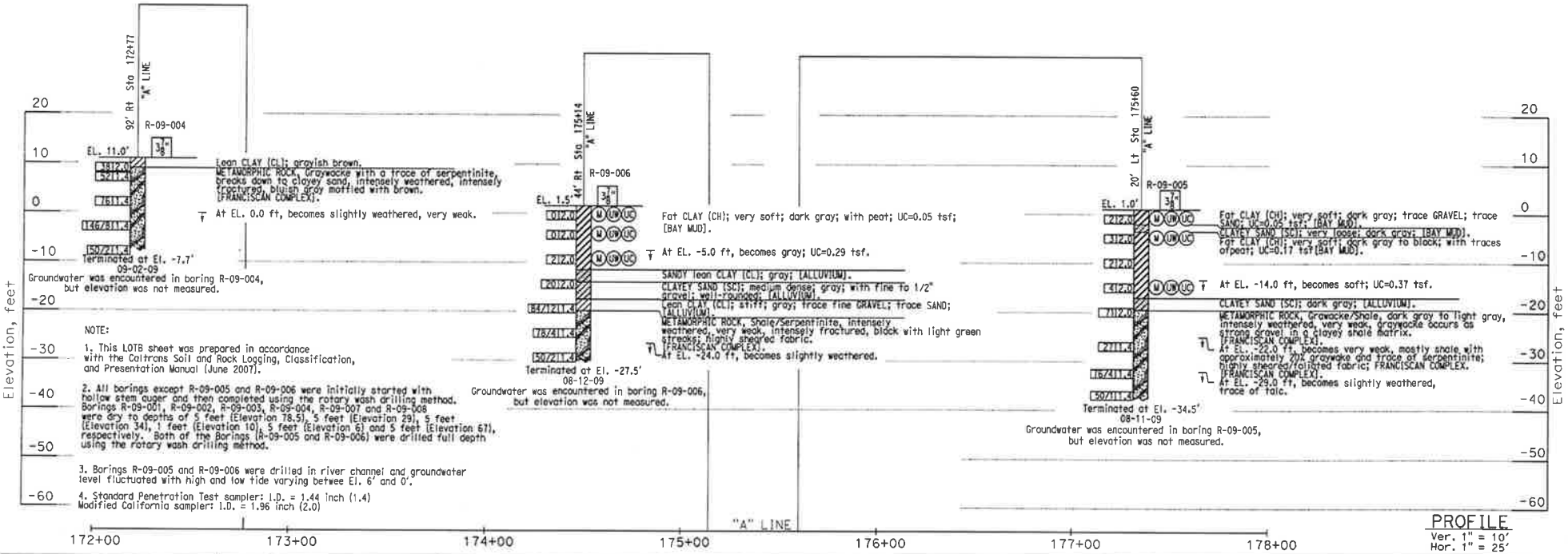
URS CORPORATION
100 WEST SAN FERNANDO STREET, SUITE 200
SAN JOSE, CA 95113

SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401



BENCH MARK:
B.M: JK 121 Elev 81.98'
1" iron pipe with a plastic plug and tack along the northbound shoulder of State Route 101 across from a "Sonoma-Napa-Right Lane" sign; 10.7 feet easterly of a metal beam guard rail and at top of slope.
NAVD 1988
B.M: JK122 Elev 52.65'
1" iron pipe with a plastic plug and tack along the northbound median of State Route 101; 50' northerly of a "Petaluma Blvd South-3/4 mile" sign; 16 feet westerly of the edge of pavement and witnessed by a carsonite witness post.
NAVD 1988

PLAN
1" = 50'



NOTE:

1. This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification, and Presentation Manual (June 2007).
2. All borings except R-09-005 and R-09-006 were initially started with hollow stem auger and then completed using the rotary wash drilling method. Borings R-09-001, R-09-002, R-09-003, R-09-004, R-09-007 and R-09-008 were dry to depths of 5 feet (Elevation 78.5), 5 feet (Elevation 29), 5 feet (Elevation 34), 1 feet (Elevation 10), 5 feet (Elevation 6) and 5 feet (Elevation 67), respectively. Both of the Borings (R-09-005 and R-09-006) were drilled full depth using the rotary wash drilling method.
3. Borings R-09-005 and R-09-006 were drilled in river channel and groundwater level fluctuated with high and low tide varying betwee El. 6' and 0'.
4. Standard Penetration Test sampler: I.D. = 1.44 inch (1.4)
Modified California sampler: I.D. = 1.96 inch (2.0)

PROFILE
Ver. 1" = 10'
Hor. 1" = 25'

DESIGN OVERSIGHT Tracy L Bertron
11-3-11
SIGN OFF DATE

DRAWN BY A. CHEUNG
CHECKED BY MANOHARAN

C. RAMBO
FIELD INVESTIGATION BY:
DATE:

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. HUANG
PROJECT ENGINEER

BRIDGE NO. 20-0295
POST MILES 3.23

PETALUMA RIVER BRIDGE (REPLACE)
LOG OF TEST BORINGS 2 OF 8

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 0412000195
CONTRACT NO.: 04-2640U1
FILE => 20-0295-z-ltb02.dgn

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 3-28-11 3-29-11 3-4-11 10-28-11

SHEET 106 OF 112

USERNAME => s13216h1 DATE PLOTTED => 26-APR-2012 TIME PLOTTED => 08:51

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Son	101	0.9/3.6	880	918

GEOTECHNICAL PROFESSIONAL — DATE 10/28/11

4-23-12
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Stephen Huang — No. C 42289 — Exp. 03/31/12 — GEOTECHNICAL — STATE OF CALIFORNIA

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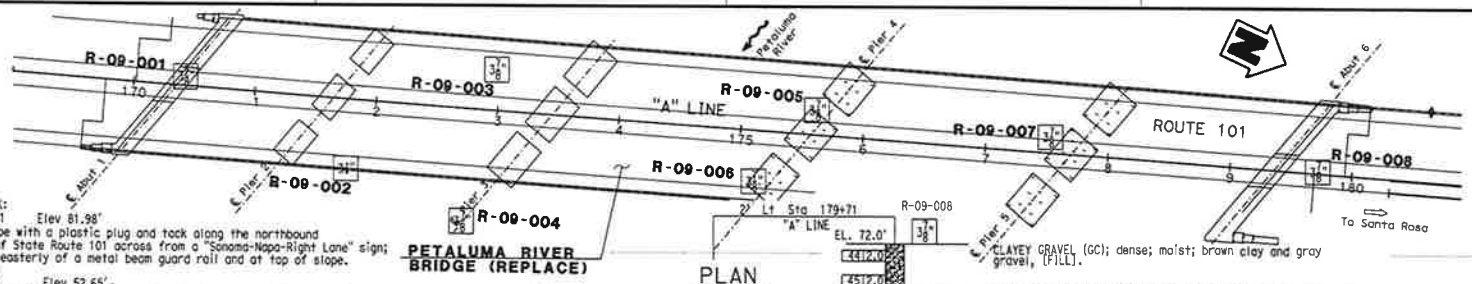
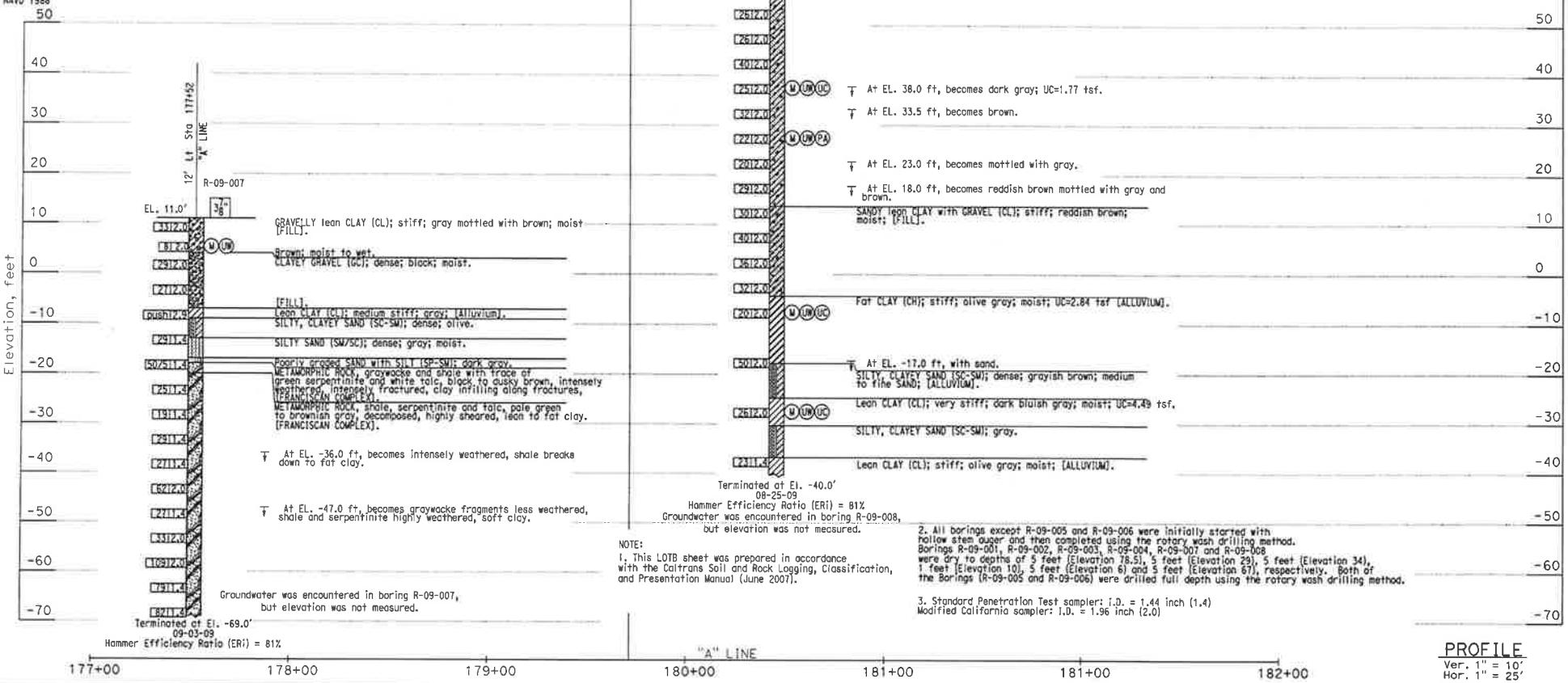
SAN JOSE, CA 95113

SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401



BENCH MARK:
B.M: JK 121 Elev 81.98'
1" iron pipe with a plastic plug and tack along the northbound shoulder of State Route 101 across from a "Sonoma-Napa-Right Lane" sign; 10.7 feet easterly of a metal beam guard rail and at top of slope.
NAVD 1988
B.M: JK122 Elev 52.65'
1" iron pipe with a plastic plug and tack along the northbound median of State Route 101; 50' northerly of a "Petaluma Blvd South-3/4 mile" sign; 16 feet westerly of the edge of pavement and witnessed by a carsonite witness post.
NAVD 1988

PLAN
1" = 50'



NOTE:
1. This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification, and Presentation Manual (June 2007).

2. All borings except R-09-005 and R-09-006 were initially started with hollow stem auger and then completed using the rotary wash drilling method. Borings R-09-001, R-09-002, R-09-003, R-09-004, R-09-007 and R-09-008 were dry to depths of 5 feet (Elevation 78.5), 5 feet (Elevation 29), 5 feet (Elevation 34), 1 feet (Elevation 10), 5 feet (Elevation 6) and 5 feet (Elevation 67), respectively. Both of the Borings (R-09-005 and R-09-006) were drilled full depth using the rotary wash drilling method.

3. Standard Penetration Test sampler: I.D. = 1.44 inch (1.4)
Modified California sampler: I.D. = 1.96 inch (2.0)

PROFILE
Ver. 1" = 10'
Hor. 1" = 25'

DESIGN OVERSIGHT Tracy L Bertron — 11-3-11 — SIGN OFF DATE

DRAWN BY A. CHEUNG
CHECKED BY MANOHARAN
FIELD INVESTIGATION BY: C. RAMBO
DATE:

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. HUANG — PROJECT ENGINEER

BRIDGE NO. 20-0295
POST MILES 3.23

PETALUMA RIVER BRIDGE (REPLACE)
LOG OF TEST BORINGS 3 OF 8

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 0412000195
CONTRACT NO.: 04-2640U1

DISREGARD PRINTS BEARING EARLIER REVISION DATES 3-29-11 3-29-11 3-29-11 10-25-11

REVISION DATES — SHEET 107 OF 112

FILE => 20-0295-2-lrtb03.dgn

USERNAME => s121614 DATE PLOTTED => 26-APR-2012 TIME PLOTTED => 06:52

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	0.9/3.6	881	918

GEOTECHNICAL PROFESSIONAL 3/9/12 DATE

4-23-12
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Stephen Huang No. C 42289 Exp. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

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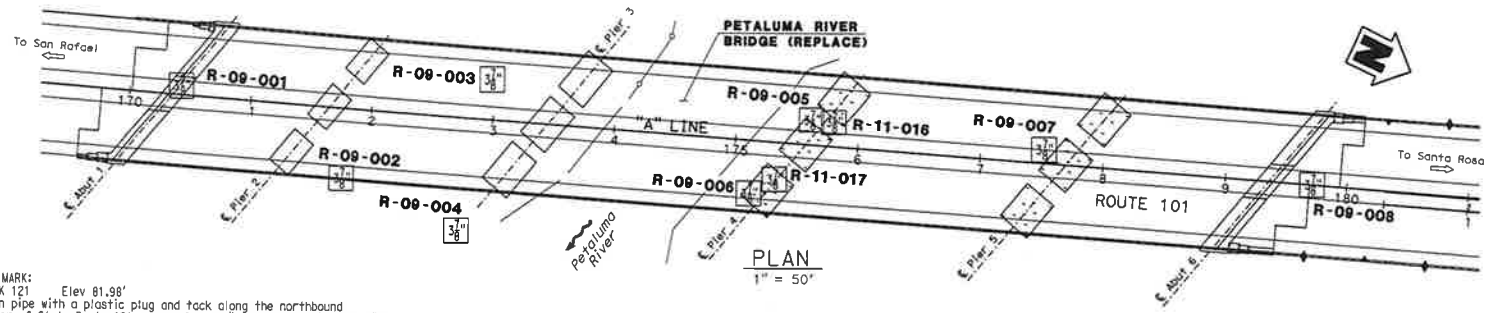
SAN JOSE, CA 95113

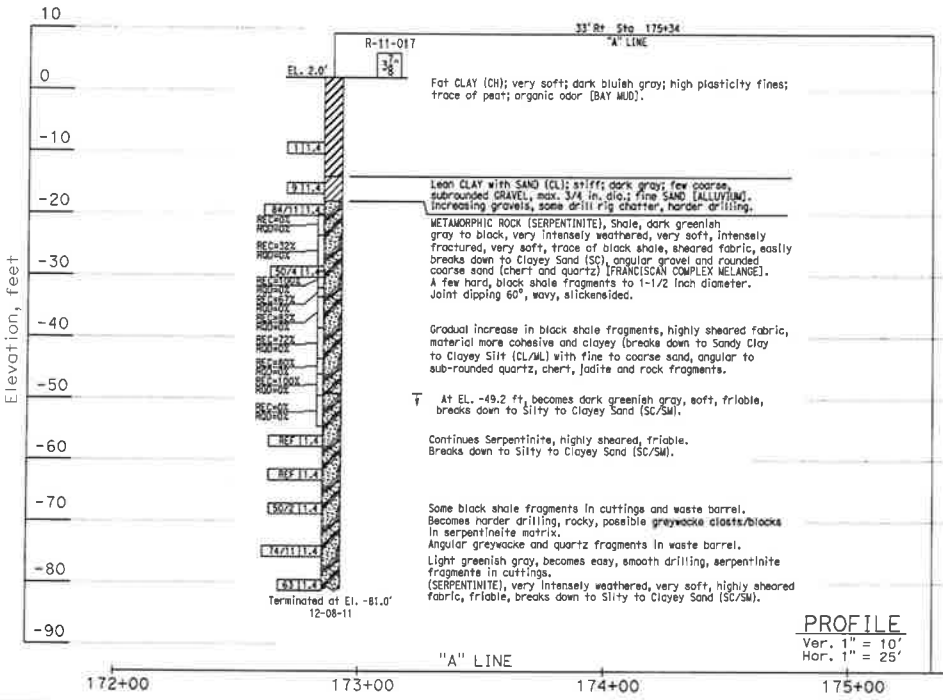
SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401

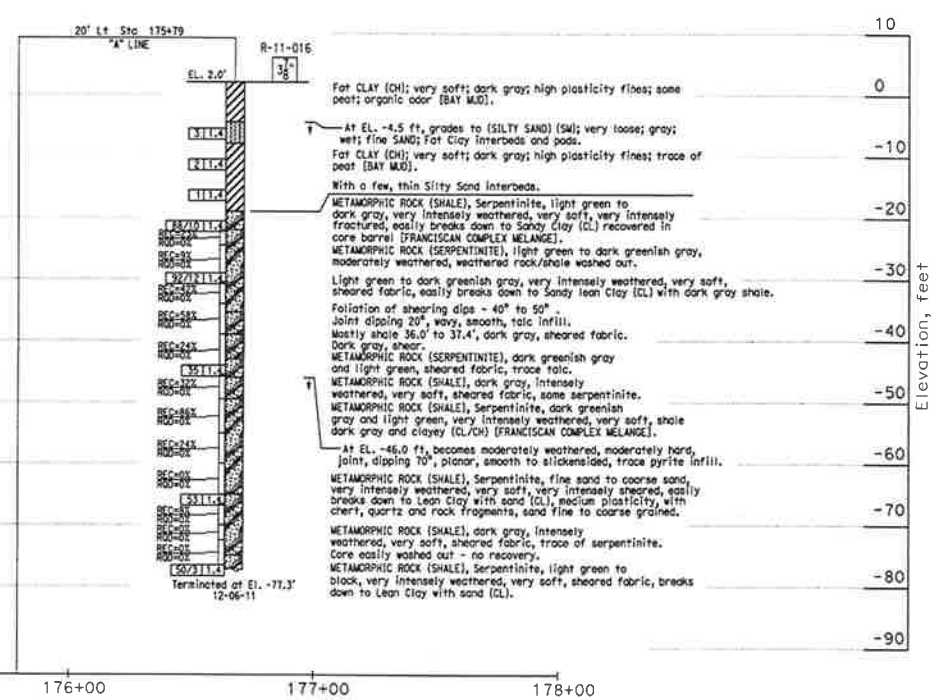


PLAN
1" = 50'

BENCH MARK:
B.M: JK 121 Elev 81.98'
1" iron pipe with a plastic plug and tack along the northbound shoulder of State Route 101 across from a "Sonoma-Napa-Right Lane" sign; 10.7 feet easterly of a metal beam guard rail and at top of slope.
NAVD 1988
B.M: JK122 Elev 52.65'
1" iron pipe with a plastic plug and tack along the northbound median of State Route 101; 50' northerly of a "Petaluma Blvd South-3/4 mile" sign; 15 feet westerly of the edge of pavement and witnessed by a carsonite witness post.
NAVD 1988

NOTE:
1. This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification,and Presentation Manual (June 2007).
2. Standard Penetration Test sampler: I.D. = 1.44 inch (1.4)
Modified California sampler: I.D. = 1.96 inch (2.0)





PROFILE
Ver. 1" = 10'
Hor. 1" = 25'

"A" LINE
172+00 173+00 174+00 175+00 176+00 177+00 178+00

DESIGN OVERSIGHT Tracy L Barton
3-19-12
SIGN OFF DATE

DRAWN BY M. THUMMALURU
CHECKED BY S. HUANG

M. SCHMOLL
FIELD INVESTIGATION BY:
DATE:

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. HUANG
PROJECT ENGINEER

BRIDGE NO. 20-0295
POST MILES 3.23

PETALUMA RIVER BRIDGE (REPLACE)
LOG OF TEST BORINGS 4 OF 8

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/18/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 0412000195
CONTRACT NO.: 04-2640U1

DISREGARD PRINTS BEARING EARLIER REVISION DATES 3-9-12

SHEET 108 OF 112

FILE => 20-0295-z-ltb04.dgn

USERNAME => s812616 DATE PLOTTED => 26-APR-2012 TIME PLOTTED => 09:52

F-0195 (1) Unit 2

To accompany plans dated 4-23-12

Boring	Station	Offset from ℄ Line
B-11	170+80	23.4 Rt
B-12	171+34	20.5 Lt
B-1	171+55	26.9 Rt
B-5	172+68	13 Lt
B-14	174+30	35.0 Lt
B-13	175+61	37.3 Lt
B-10	175+20	13.6 Rt
B-11	175+95	13.6 Rt
B-12	177+06	26.3 Rt
B-8	177+38	30.7 Lt
B-7	177+61	1.0 Rt
B-18	177+96	37.4 Rt
B-9	178+44	33.6 Rt
B-13	178+88	45.1 Lt
B-3	179+4	33.3 Lt
B-15	179+44	31.1 Rt
B-16	180+06	48.5 Lt
B-1	188+73	30.3 Rt
B-2	190+49	13.3 Lt
B-3	192+80	38.5 Rt
B-4	192+93	32.1 Lt
B-6	191+19	28.1 Rt
B-7	192+81	28.5 Lt
B-4	193+12	37.2 Rt
B-2	194+05	14.1 Lt
B-5	194+20	31.9 Rt

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 stamp signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	POST MILES-TOTAL PROJECT	Sheet No.	Total Sheets
04	Son	101	0.9/3.6	882	918

REGISTERED GEOTECHNICAL ENGINEER 3/9/12 DATE

PETALUMA RIVER BRIDGE (REPLACE)

LOG OF TEST BORINGS 5 OF 8

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

UNIT: 0714
PROJECT NUMBER & PHASE: 0412000195

BRIDGE No.	Sheet	of
20-0295	109	112

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

REGISTERED PROFESSIONAL ENGINEER Stephen Huong No. C 42289 EXP. 03/31/12 GEOTECHNICAL STATE OF CALIFORNIA

AS BUILT PLANS
Contract No. 04-4TC19
Date Completed
Document No. 40002276

AS BUILT
CORRECTIONS BY
DATE

PLAN
Scale 1" to 40'

PROFILE
Scale 1" Horiz. 1" to 40'
Vert. 1" to 10'

Relationship of Tidal Elev & MSL Data

MICROFILMED

BRIDGE DEPARTMENT

Classification of Material Based on Standard Grade Size Limits

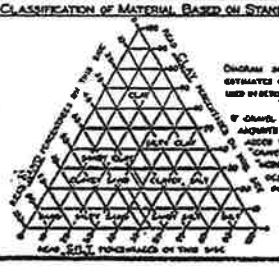


Diagram showing the basis for estimates of grain size distribution used in determination of class names.

If gravel is present in appreciable amounts the term "gravelly" may be added to the class name, the "gravelly sand", the terms "coarse", "medium" and "fine" may be used to describe gravel, sand and silt prior to standard grain size limits.

Legend of Earth Materials

- Gravel
- Sand
- Silt
- Clay
- Sandy Clay or Clayey Sand
- Sandy Silt or Silty Sand
- Silty Clay or Clayey Silt
- Peat and/or Organic Clay
- Fruad Material
- Igneous Rock
- Sedimentary Rock
- Metamorphic Rock

Legend of Boring Operations

- Plan of air boring
- Penetrometer
- 2½" Cone penetrometer
- Sampler boring (DRY)
- Rotary boring (WET)
- Auger boring (DRY)
- Jet boring
- Core boring
- Test pit

1" Soil Tube

Rotary Boring

Notes

The contractor's attention is directed to Section 2, Article (c) of the standard specifications and to the special provisions accompanying this 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. Penetrometer borings having a rate of penetration measured in seconds per foot are driven with a 140 Hammer-Terry air hammer at 115 PSI.

BRIDGE ACROSS PETALUMA CREEK

LOG OF TEST BORINGS

Scale As Noted | Date 20-1-10 | Sheet 1 | Drawing 7-619-23

I hereby certify that this is a true and accurate copy of the above ... under my direction and control on this date to the ...

20-0295-z-1tb05.tif

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

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	0.9/3.6	883	918

GEOTECHNICAL PROFESSIONAL — DATE 3/9/12

4-23-12
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Stephen Huang — No. C 42289 — Exp. 03/31/12 — GEOTECHNICAL — STATE OF CALIFORNIA

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SAN JOSE, CA 95113

SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401

CEMENTATION

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

CONSISTENCY OF COHESIVE SOILS

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

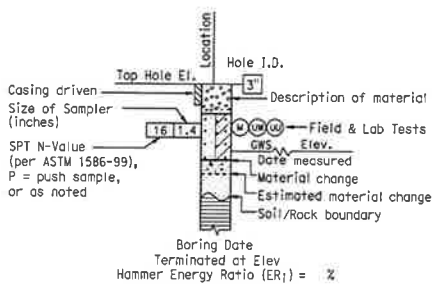
BOREHOLE IDENTIFICATION

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

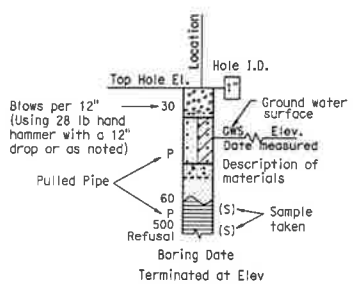
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

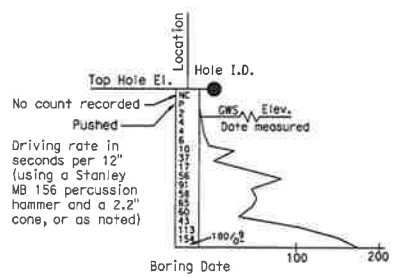
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be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



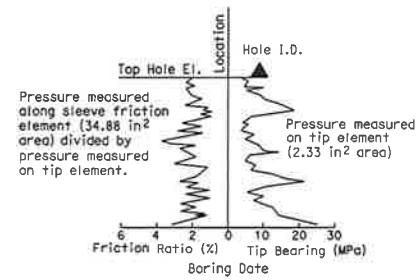
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

SOIL LEGEND

DESIGN OVERSIGHT Tracy L Bertron — 3-19-12 SIGN OFF DATE

DRAWN BY A. CHEUNG — CHECKED BY MANOHARAN

C. RAMBO — FIELD INVESTIGATION BY — DATE:

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. HUANG — PROJECT ENGINEER

BRIDGE NO. 20-0295 — POST MILES 3.23

PETALUMA RIVER BRIDGE (REPLACE)

LOG OF TEST BORINGS 6 OF 8

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 0412000195
CONTRACT NO.: 04-2640U1

DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES — SHEET 110 OF 112

FILE => 20-0295-2-rtt006.dgn

USERNAME => s127614 — DATE PLOTTED => 26-APR-2012 — TIME PLOTTED => 06:52

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

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	0.9/3.6	884	918

GEOTECHNICAL PROFESSIONAL — DATE 3/9/12

4-23-12
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Stephen Huang — No. C 42289 — Exp. 03/31/12 — GEOTECHNICAL — STATE OF CALIFORNIA

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URS CORPORATION
100 WEST SAN FERNANDO STREET, SUITE 200
SAN JOSE, CA 95113

SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401

GROUP SYMBOLS AND NAMES

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

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

FIELD AND LABORATORY TESTING

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

APPARENT DENSITY OF COHESIONLESS SOILS

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

MOISTURE

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

PERCENT OR PROPORTION OF SOILS

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

PARTICLE SIZE

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

SOIL LEGEND

DESIGN OVERSIGHT Tracy L. Bertram — 3-19-12 — SIGN OFF DATE

DRAWN BY A. CHEUNG — CHECKED BY MANOHARAN — FIELD INVESTIGATION BY: C. RAMBO — DATE:

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

S. HUANG — PROJECT ENGINEER

BRIDGE NO. 20-0295 — POST MILES 3.23

PETALUMA RIVER BRIDGE (REPLACE)

LOG OF TEST BORINGS 7 OF 8

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 0412000195 — CONTRACT NO.: 04-2640U1

DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES 1-30-11 3-9-11 10-26-11 1-9-12 — SHEET 111 OF 112

FILE => 20-0295-z-rt807.dgn

USERNAME => s121614 DATE PLOTTED => 26-APR-2012 TIME PLOTTED => 08:52

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

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	Son	101	0.9/3.6	885	918

GEOTECHNICAL PROFESSIONAL — DATE 3/9/12

4-23-12
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Stephen Huang — No. C 42289 — Exp. 03/31/12 — GEOTECHNICAL — STATE OF CALIFORNIA

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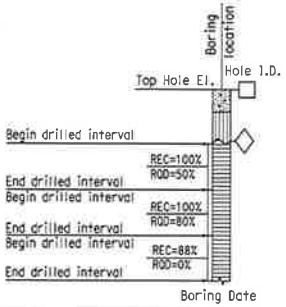
100 WEST SAN FERNANDO STREET, SUITE 200
SAN JOSE, CA 95113

SONOMA COUNTY TRANSPORTATION AUTHORITY
490 MENDOCINO AVENUE, SUITE 206
SANTA ROSA, CA 95401

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

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

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



RELATIVE STRENGTH OF INTACT ROCK

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

BEDDING SPACING

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

LEGEND OF ROCK MATERIALS

- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

ROCK HARDNESS

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

FRACTURE DENSITY

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

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

WEATHERING DESCRIPTORS FOR INTACT ROCK

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

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

ROCK LEGEND

DESIGN OVERSIGHT: Tracy L. Barrom — 3-19-12 — SIGN OFF DATE

DRAWN BY: A. CHEUNG — CHECKED BY: MANOHARAN — FIELD INVESTIGATION BY: C. RAMBO — DATE:

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

PROJECT ENGINEER: S. HUANG

BRIDGE NO. 20-0295 — POST MILES 3.23

PETALUMA RIVER BRIDGE (REPLACE)

LOG OF TEST BORINGS 8 OF 8

GS GEOTECHNICAL LOG OF TEST BORINGS SHEET (ENGLISH) (REV. 7/16/10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS: 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 0412000195
CONTRACT NO.: 04-2640U1

DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES: 1-28-11 3-4-11 10-28-11 3-9-12

SHEET 112 OF 112

FILE => 20-0295-z-ltb08.dgn

USERNAME => s121614 DATE PLOTTED => 26-APR-2012 TIME PLOTTED => 08:52

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	Son	101	0.9/3.6	913	918

REGISTERED CIVIL ENGINEER — DATE 10/28/11

4-23-12
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Ali K. Kaddoura — No. 55710 — Exp. 12-31-12 — CIVIL — STATE OF CALIFORNIA

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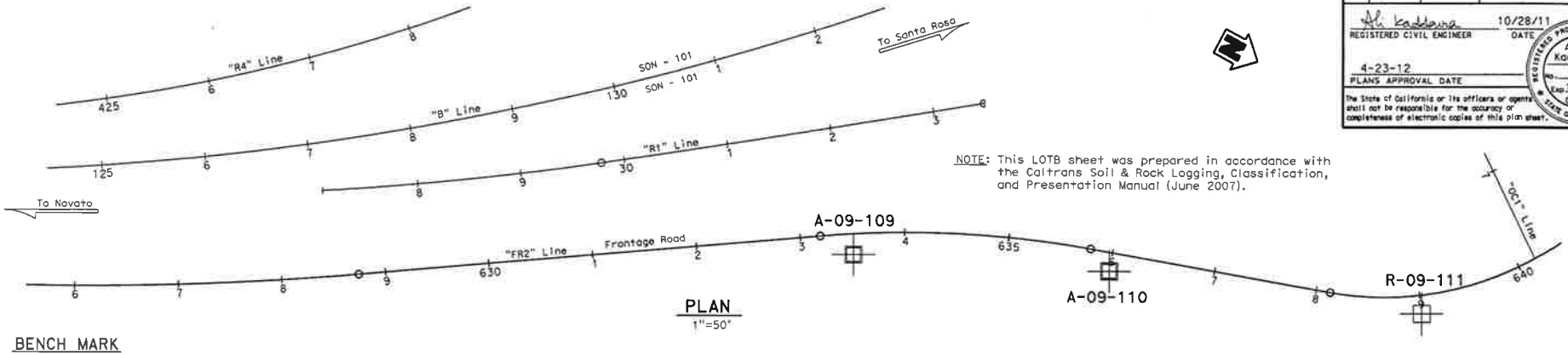
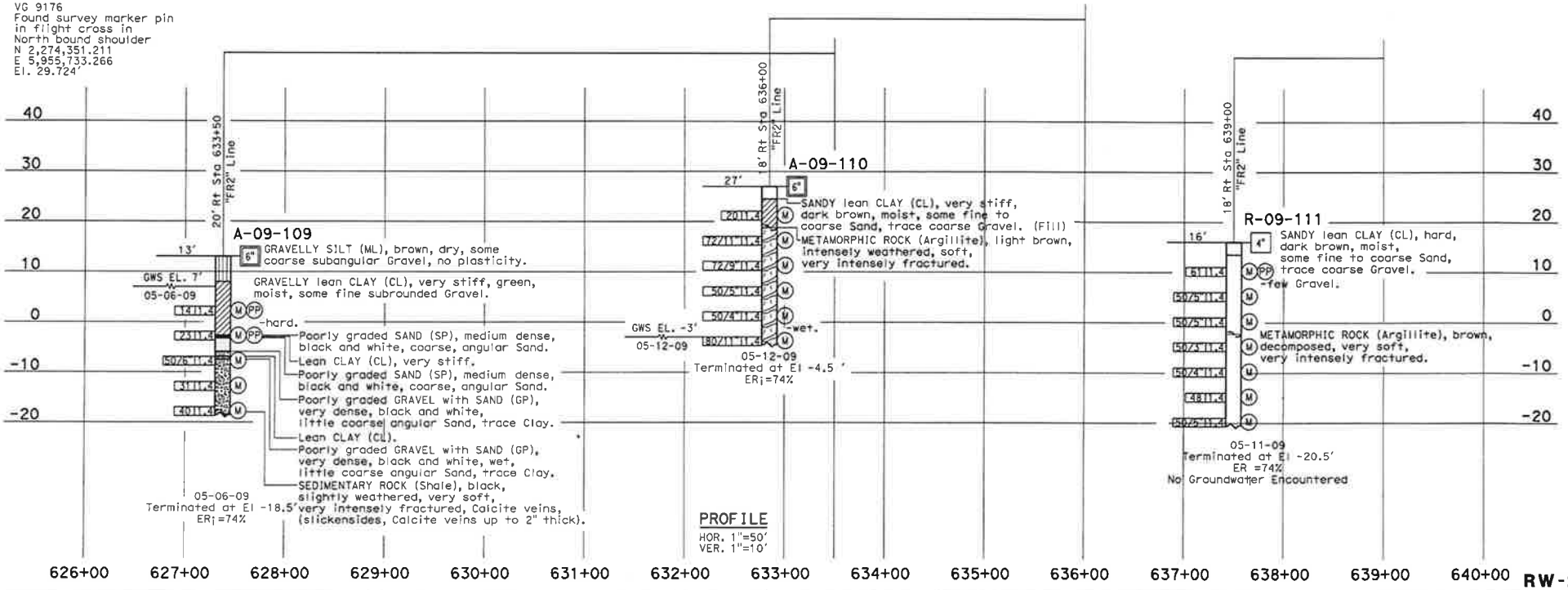


NOTE: This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2007).

PLAN
1"=50'

BENCH MARK

VG 9176
Found survey marker pin in flight cross in North bound shoulder
N 2,274,351.211
E 5,955,733.266
El. 29.724'



PROFILE
HOR. 1"=50'
VER. 1"=10'

RW-28

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES OFFICE OF GEOTECHNICAL DESIGN BRANCH	BRIDGE NO. / POST MILES	RETAINING WALL No. 2 LOG OF TEST BORINGS 1 of 6
FUNCTIONAL SUPERVISOR NAME: H. Nikoui	DRAWN BY: M. Reynolds 06-09 CHECKED BY: C. Risden	FIELD INVESTIGATION BY: M. Gaffney A. Kaddoura			

UNIT: 0714
PROJECT NUMBER & PHASE: 04120001951
CONTRACT NO.: 04-2640U1
DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES: 3-24-11 03-25-11 04-25-11 3-24-11 10-28-11
SHEET 28 OF 33

OGS CIVIL LOG OF TEST BORINGS SHEET
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3
FILE => 23Erw-2-1rb01.dgn

USERNAME => s114640 DATE PLOTTED => 26-APR-2012 TIME PLOTTED => 08:58

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	Son	101	0.9/3.6	914	918

REGISTERED CIVIL ENGINEER — DATE 10/28/11

4-23-12
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Ali K. Kaddoura — No. 55710 — Exp. 12-31-12 — CIVIL — STATE OF CALIFORNIA

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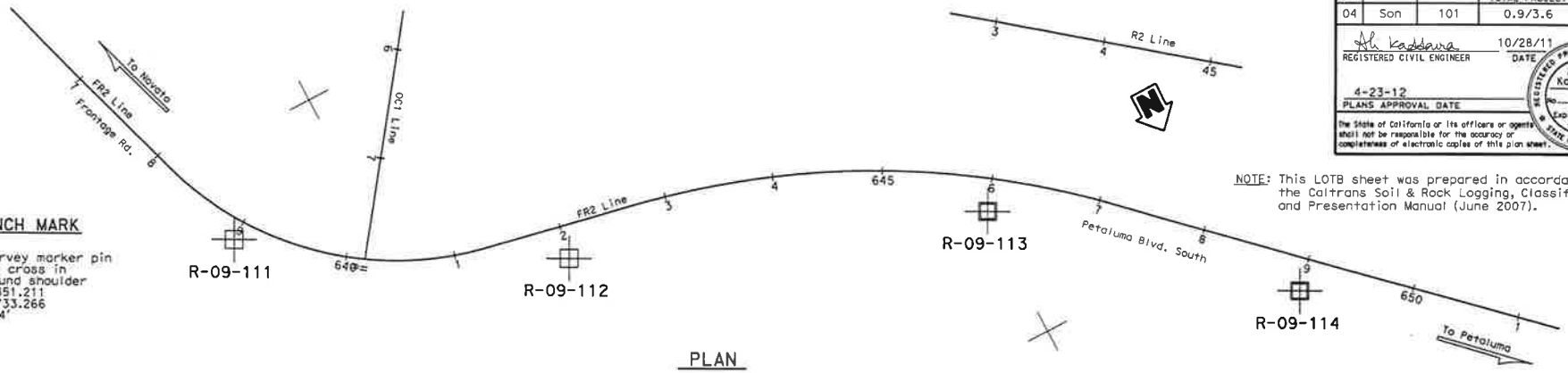
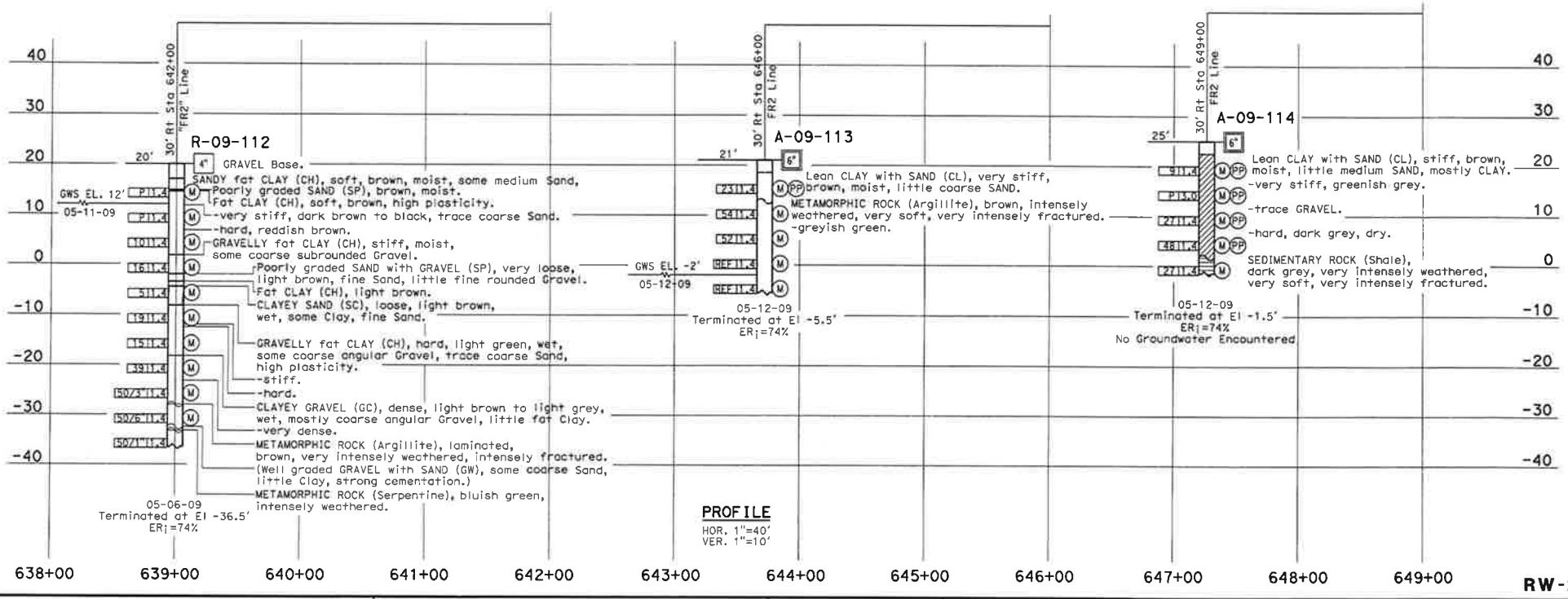
NOTE: This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2007).

BENCH MARK

VG 9176
Found survey marker pin in flight cross in North bound shoulder
N 2,274,351.211
E 5,955,733.266
El. 29.724'



PLAN
1"=50'



PROFILE
HOR. 1"=40'
VER. 1"=10'

RW-29

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES OFFICE OF GEOTECHNICAL DESIGN BRANCH	BRIDGE NO. / POST MILES	RETAINING WALL No. 2 LOG OF TEST BORINGS 2 of 6
FUNCTIONAL SUPERVISOR NAME: H. Nikoui	DRAWN BY: M. Reynolds 06-09 / CHECKED BY: C. Risden	FIELD INVESTIGATION BY: M. Gaffney, A. Kaddoura			

DGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 04120001951
CONTRACT NO.: 04-2640U1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES: 3-24-11 03-09-11 3-24-11 10-28-11

SHEET 29 OF 33

FILE => 23Crw-2-11b02.dgn

USERNAME => s114946 DATE PLOTTED => 26-APR-2012 TIME PLOTTED => 08:58

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
04	Son	101	0.9/3.6	915	918

REGISTERED CIVIL ENGINEER — DATE 10/28/11

4-23-12
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Ali K. Kaddoura — No. 55710 — Exp. 12-31-12 — CIVIL — STATE OF CALIFORNIA

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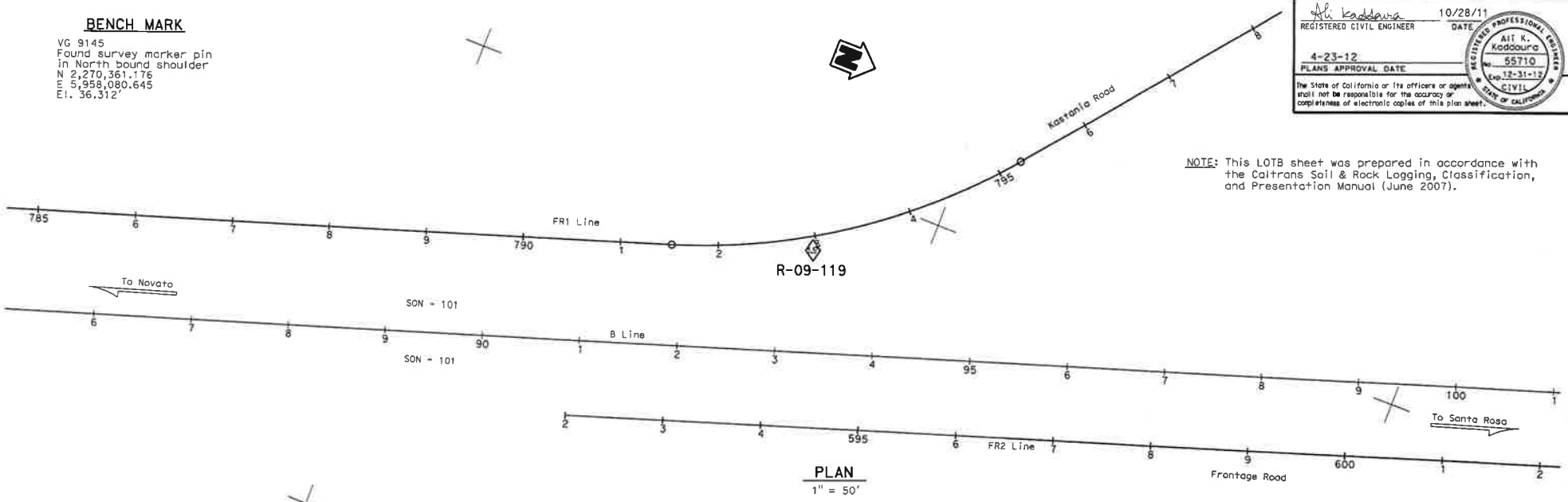
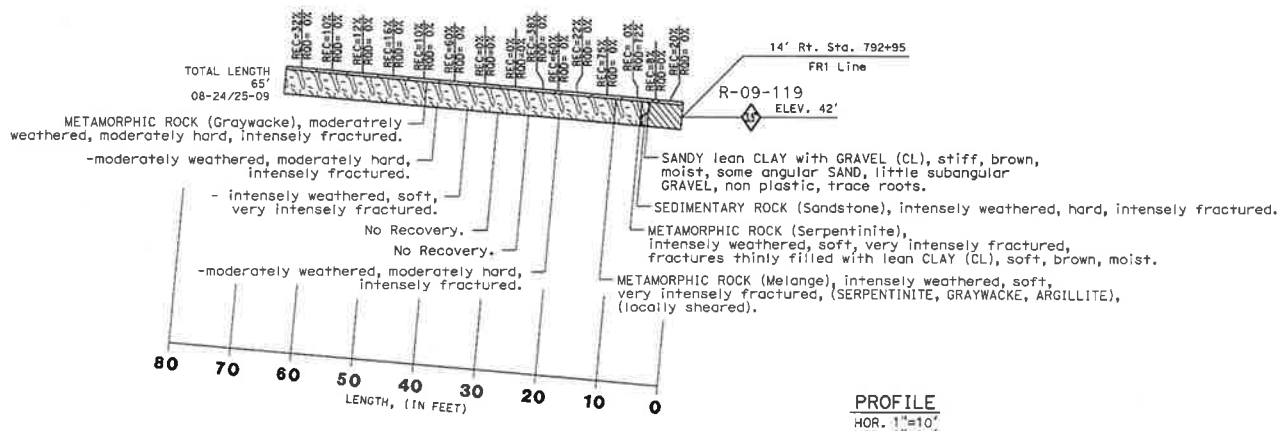
BENCH MARK

VG 9145
Found survey marker pin
in North bound shoulder
N 2,270,361.176
E 5,958,080.645
El. 36.312'

NOTE: This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (June 2007).



PLAN
1" = 50'



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

RW-30

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES OFFICE OF GEOTECHNICAL DESIGN BRANCH	BRIDGE NO. 20-0294	SOIL NAIL WALL (RW No. 3) RETAINING WALL No. 3
FUNCTIONAL SUPERVISOR	DRAWN BY: M. Reynolds 10-09	FIELD INVESTIGATION BY:		POST MILES	LOG OF TEST BORINGS 3 of 6
NAME: H. Nikoui	CHECKED BY: C. Risden	A. Kaddoura			

OES CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 04120001951 CONTRACT NO.: 04-2640U1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 3-9-11 10-28-11 10-28-11 3-9-11 10-28-11

SHEET 30 OF 33

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

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
04	San	101	0.9/3.6	916	918

REGISTERED CIVIL ENGINEER — DATE 10/28/11

4-23-12
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Ali K. Kaddoura — No. 55710 — Exp. 12-31-12 — CIVIL — STATE OF CALIFORNIA

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CEMENTATION

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

CONSISTENCY OF COHESIVE SOILS

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

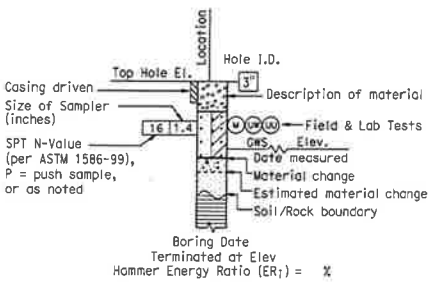
BOREHOLE IDENTIFICATION

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

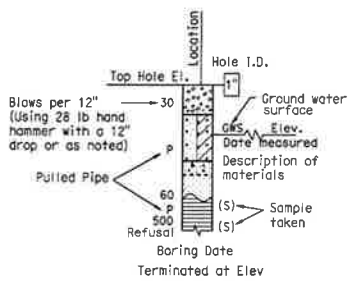
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

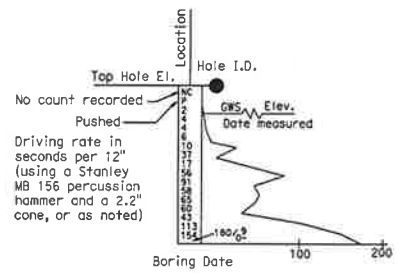
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be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



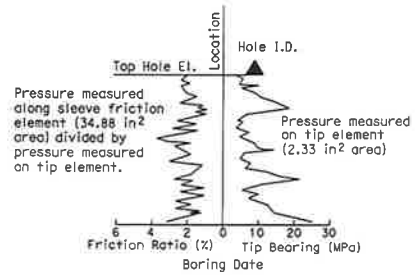
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

RW-31

ENGINEERING SERVICES		GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES OFFICE OF GEOTECHNICAL DESIGN BRANCH	BRIDGE NO. / POST MILE	SOIL LEGEND
FUNCTIONAL SUPERVISOR	PREPARED BY M. Reynolds 06-09					LOG OF TEST BORINGS 4 of 6
NAME: H. Nikoui	CHECKED BY C. Risden	M. Gaffney, A. Kaddoura				

05 LOTB SOIL LEGEND — ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 — UNIT: 0714 — PROJECT NUMBER & PHASE: 04120001951 — CONTRACT NO.: 04-2640U1 — DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES — SHEET 31 OF 33

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

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
04	San	101	0.9/3.6	917	918

REGISTERED CIVIL ENGINEER — DATE 10/28/11

4-23-12
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — Ali K. Kaddoura — No. 55710 — Exp. 12-31-12 — CIVIL — STATE OF CALIFORNIA

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GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names	Graphic/Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND	CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND		
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and SAND	CL-ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
GW-GC	Well-graded GRAVEL with CLAY (or SILTY CLAY) Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GP-GM	Poorly graded GRAVEL with SILT Poorly graded GRAVEL with SILT and SAND	ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
GP-GC	Poorly graded GRAVEL with CLAY (or SILTY CLAY) Poorly graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GM	SILTY GRAVEL SILTY GRAVEL with SAND	OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND		
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND	OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
SW	Well-graded SAND Well-graded SAND with GRAVEL		
SP	Poorly graded SAND Poorly graded SAND with GRAVEL	CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
SW-SM	Well-graded SAND with SILT Well-graded SAND with SILT and GRAVEL		
SW-SC	Well-graded SAND with CLAY (or SILTY CLAY) Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
SP-SM	Poorly graded SAND with SILT Poorly graded SAND with SILT and GRAVEL		
SP-SC	Poorly graded SAND with CLAY (or SILTY CLAY) Poorly graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
SM	SILTY SAND SILTY SAND with GRAVEL		
SC	CLAYEY SAND CLAYEY SAND with GRAVEL	OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL		
PT	PEAT	OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND
	COBBLES COBBLES and BOULDERS BOULDERS		

FIELD AND LABORATORY TESTING

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

APPARENT DENSITY OF COHESIONLESS SOILS

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

MOISTURE

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

PERCENT OR PROPORTION OF SOILS

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

PARTICLE SIZE

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

RW-32

ENGINEERING SERVICES			GEOTECHNICAL SERVICES
FUNCTIONAL SUPERVISOR	PREPARED BY	M. Reynolds 06-09	
NAME: H. Nikoui	CHECKED BY	C. Risden	M. Gaffney, A. Kaddoura

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES OFFICE OF GEOTECHNICAL DESIGN BRANCH

BRIDGE NO. / POST MILE

SOIL LEGEND
LOG OF TEST BORINGS 5 of 6

SS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 04120001951
CONTRACT NO.: 04-2640U1

DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES 2-24-11 03-25-11 03-25-11 3-9-11 10-28-11

SHEET 32 OF 33

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

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
04	Son	101	0.9/3.6	918	918

Ali Kaddoura 10/28/11
REGISTERED CIVIL ENGINEER DATE

4-23-12
PLANS APPROVAL DATE

Ali K. Kaddoura No. 55710 Exp. 12-31-12 CIVIL STATE OF CALIFORNIA REGISTERED PROFESSIONAL ENGINEER

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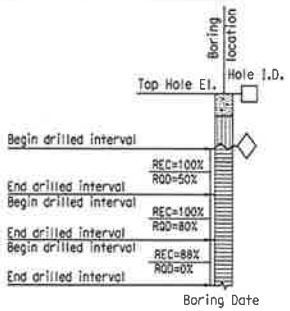
PERCENT CORE RECOVERY (REC) & ROCK QUALITY DESIGNATION (RQD)

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

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



RELATIVE STRENGTH OF INTACT ROCK

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

BEDDING SPACING

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

LEGEND OF ROCK MATERIALS

- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

ROCK HARDNESS

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

FRACTURE DENSITY

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

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

WEATHERING DESCRIPTORS FOR INTACT ROCK

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

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

RW-33

ENGINEERING SERVICES		GEOTECHNICAL SERVICES
FUNCTIONAL SUPERVISOR	PREPARED BY M. Reynolds 06-09	FIELD INVESTIGATION BY:
NAME: H. Nikoul	CHECKED BY C. Risden	M. Gaffney, A. Kaddoura

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES OFFICE OF GEOTECHNICAL DESIGN BRANCH

BRIDGE NO. / POST MILE

ROCK LEGEND
LOG OF TEST BORINGS 6 of 6

GS LOTB ROCK LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 0714
PROJECT NUMBER & PHASE: 04120001951
CONTRACT NO.: 04-2640U1

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES 2-24-11 03-25-11 03-25-11 5-9-11 10-28-11

SHEET 33 OF 33

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