PARIKH
Practicing in the Geosciences

Geotechnical ■
Environmental ■
Materials Testing ■
Construction Inspection ■

BKF Engineers
4670 Willow Road, Suite 250
Pleasanton, CA 94588

Job No. 2007-119-PH2
March 13, 2012

Attn: Mr. Gordon Sweet

Subject: Preliminary Geotechnical Information Memo
State Route 1/Route 9 Intersection Project
City of Santa Cruz, Santa Cruz County, California

Dear Mr. Sweet:

As requested, we are providing preliminary geotechnical information, which includes geology, topography, subsurface conditions, seismic information, and potential of liquefaction for the proposed State Route 1/Route 9 Intersection Project in Santa Cruz County, California. The approximate project location is shown on Plate 1.

Proposed Project

The project would improve traffic operations at the existing Route 1/9 intersection by widening the existing intersection to accommodate additional turning vehicle lanes, bicycle lanes, and shoulders. The additional turning lanes would alleviate congestion at the intersection and provide safety benefits. The project would be funded with local, State Transportation Improvement Program, and Federal Transportation Improvement Program funds.

Geology and Subsurface Conditions

General geologic features pertaining to the site were evaluated with reference to the "Geologic Map of Santa Cruz County, California," compiled by E.E. Brabb and prepared by S. Graham et al. Based on the published map, the subsoils at the project site are situated on Alluvial Deposits, undifferentiated (Holocene) (Qal). A geologic map of the general project area is shown on Plate 2. Description of the main geologic unit is as follows:

- Qal – Alluvial deposits, undifferentiated (Holocene) – Unconsolidated heterogeneous, moderately sorted silt and sand containing discontinuous lenses of clay and silty clay. Locally includes large amounts of gravel.

Based on the borings drilled by PARIKH in 2007 and Caltrans as-built borings drilled in 1954, located approximately 600 feet east of the site, the subsurface conditions consist of predominantly medium dense to very dense sand and gravel. The sand grades from silty sand to poorly-graded

sand/well-graded sand.

Based on the borings, groundwater level was encountered between Elev. 1 to Elev. 7 feet, approximately 5 to 15 feet below grade. The groundwater level is anticipated to vary with the passage of time due to seasonal groundwater fluctuation, surface and subsurface flows into the San Lorenzo River, ground surface run-off, and other factors that may not be present at the time of the previous investigation.

Topography and drainage

The project is located along the northern coast of Monterey Bay. The overall regional terrain trends towards south. The terrain starts sloping downward from crest of the Santa Cruz Mountains to the northern coast of Monterey Bay. It appears that surface water runoff is collected through local drainage systems and flows towards Monterey Bay.

Normal maintenance of surface drainage and slope maintenance is important and should be incorporated in the project plans. Landscaping should be planned to protect any new slopes. Construction of sediment ponds or siltation basins may be considered to retain water during heavy rainfall periods. These basins should be connected to storm drainage system.

Earthquake Considerations

Potential seismic hazards may arise from three sources: surface fault rupture, ground shaking and liquefaction.

Fault Rupture. The site is located approximately 7.1 miles northeast of the nearest active fault, Monterey Bay-Tularcitos (Monterey Bay section) fault with a Maximum Moment Magnitude (Mmax) of 7.3. The site is also located approximately 9.1 mi west of the Zayante-Vergales fault zone (Mmax=7.0), 10.3 mi east of the San Gregorio fault zone (San Gregorio section) (Mmax=7.0), and 10.7 miles west of the San Andreas fault zone (Santa Cruz Mountains section) (Mmax=7.9). The site is not located within the Alquist-Priolo Earthquake Fault Zone. Therefore, fault rupture is not considered a substantial hazard and should have no impact on the project. A Fault Map is shown on Plate 3.

Ground Shaking. The project site is located in a seismically active part of northern California. Many faults in the area are capable of producing earthquakes, which may cause strong ground shaking at the site. Based on the research conducted on the earthquake probabilities in the San Francisco Bay region: 2002-2031 by the "Northern California Working Group for Earthquake Probabilities (WGCEP)", the San Andreas Fault has a 21% probability of one or more major (M>=6.7) earthquakes during the coming 30 years. According to the same study, there is a 62% probability of at least one magnitude 6.7 or greater earthquake striking the San Francisco Bay region before 2031.

The project design should incorporate Caltrans standards and construction methods in order to minimize the potential risks associated with strong ground shaking and reduce the effect to a less-than-significant level.

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

The site is not mapped in the California Geological Survey or Liquefaction Susceptibility Map of the San Francisco Bay Area. Therefore, we have referred to available data within proximity of the project site.

Based on the boring data drilled by PARIKH in 2007, submerged medium dense sand was encountered at approximate Elev. 5 ft to 10 ft in Borings 07-B-1, 07-B-2, and 07-B-3. In Boring 07-B-1, the material between Elev. -5 and -10 ft may also be subject to liquefaction. It is our opinion that the liquefaction potential of the project site is moderate.

The project design should incorporate Caltrans standards and construction methods in order to minimize the potential risks associated with potential liquefaction hazards and reduce the effect to a less-than-significant level.

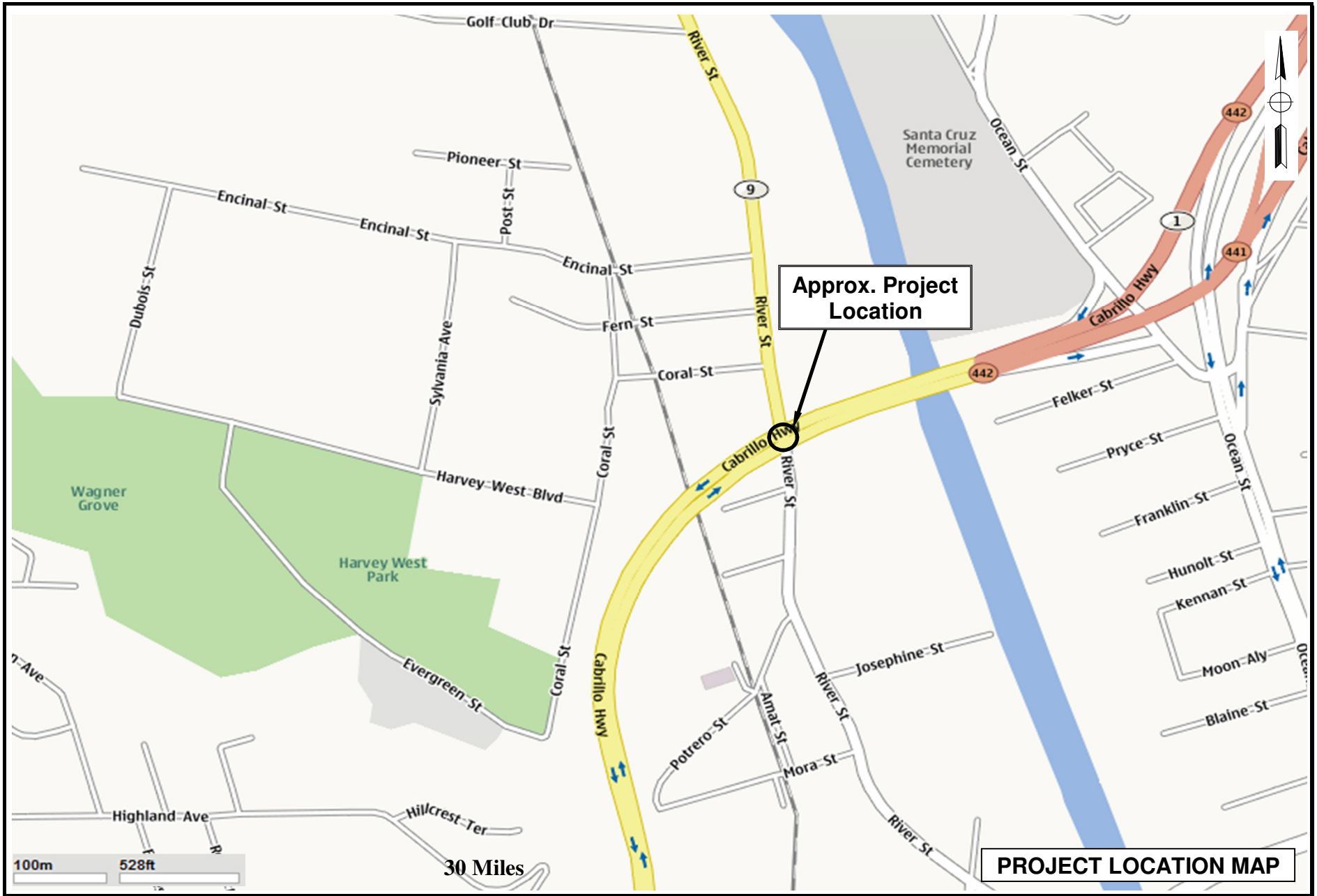
Please be advised that we are performing a professional service and that our conclusions and findings are professional opinions only. All work done and all recommendations made are in accordance with generally accepted geotechnical engineering principles and practices. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work.

Very truly yours,
PARIKH CONSULTANTS, INC.

Lam Tran Cruz, P.E. 78164
Senior Staff Engineer

Gary Parikh, P.E., G.E., 666
Project Manager

Attachments: Project Location Map
Geologic Map
Fault Map
As-built Log of Test Borings



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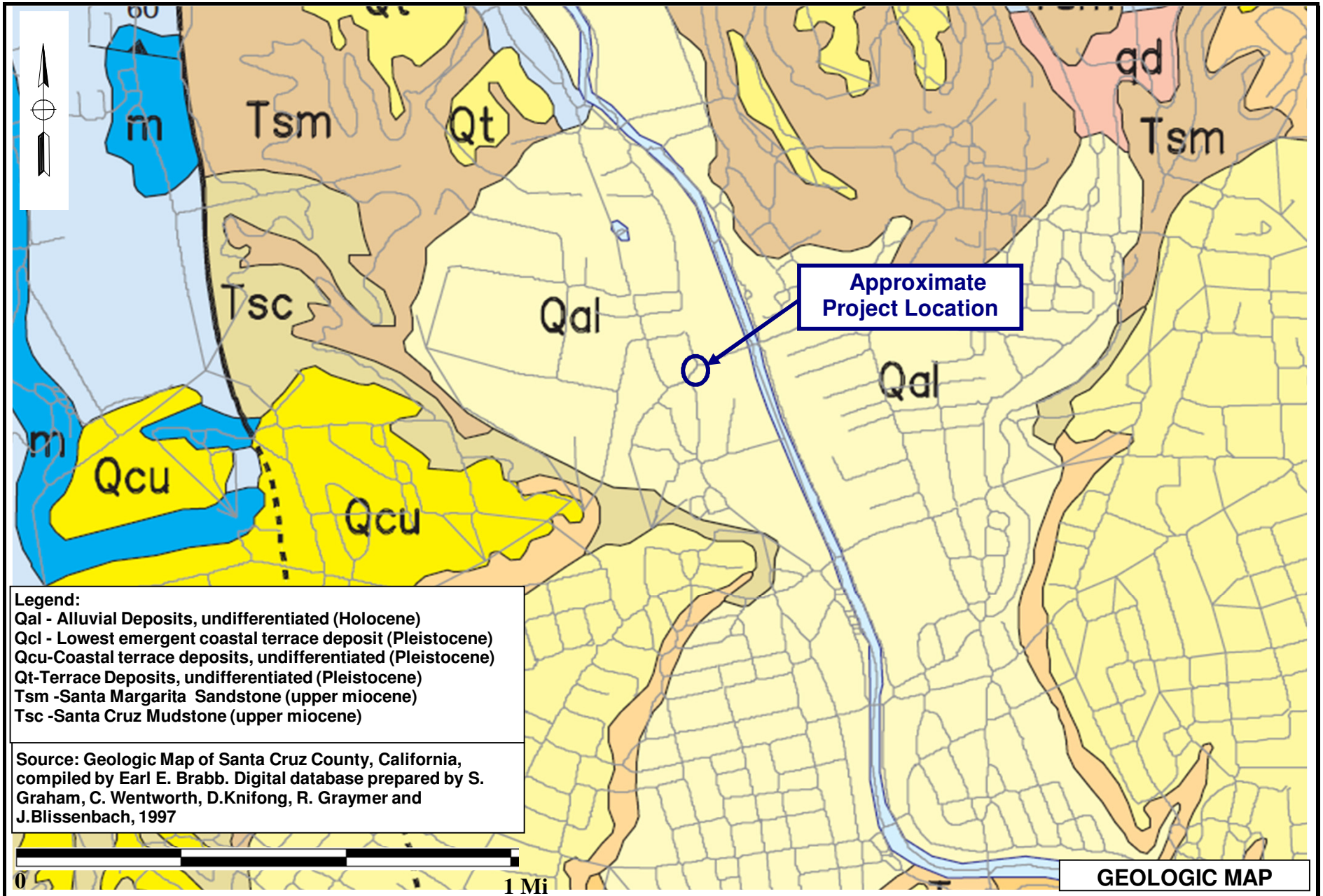
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

STATE ROUTE 1 / ROUTE 9 INTERSECTION PROJECT
CITY OF SANTA CRUZ, SANTA CRUZ COUNTY, CALIFORNIA

JOB NO.: 2007-119-PH2

PLATE NO.: 1



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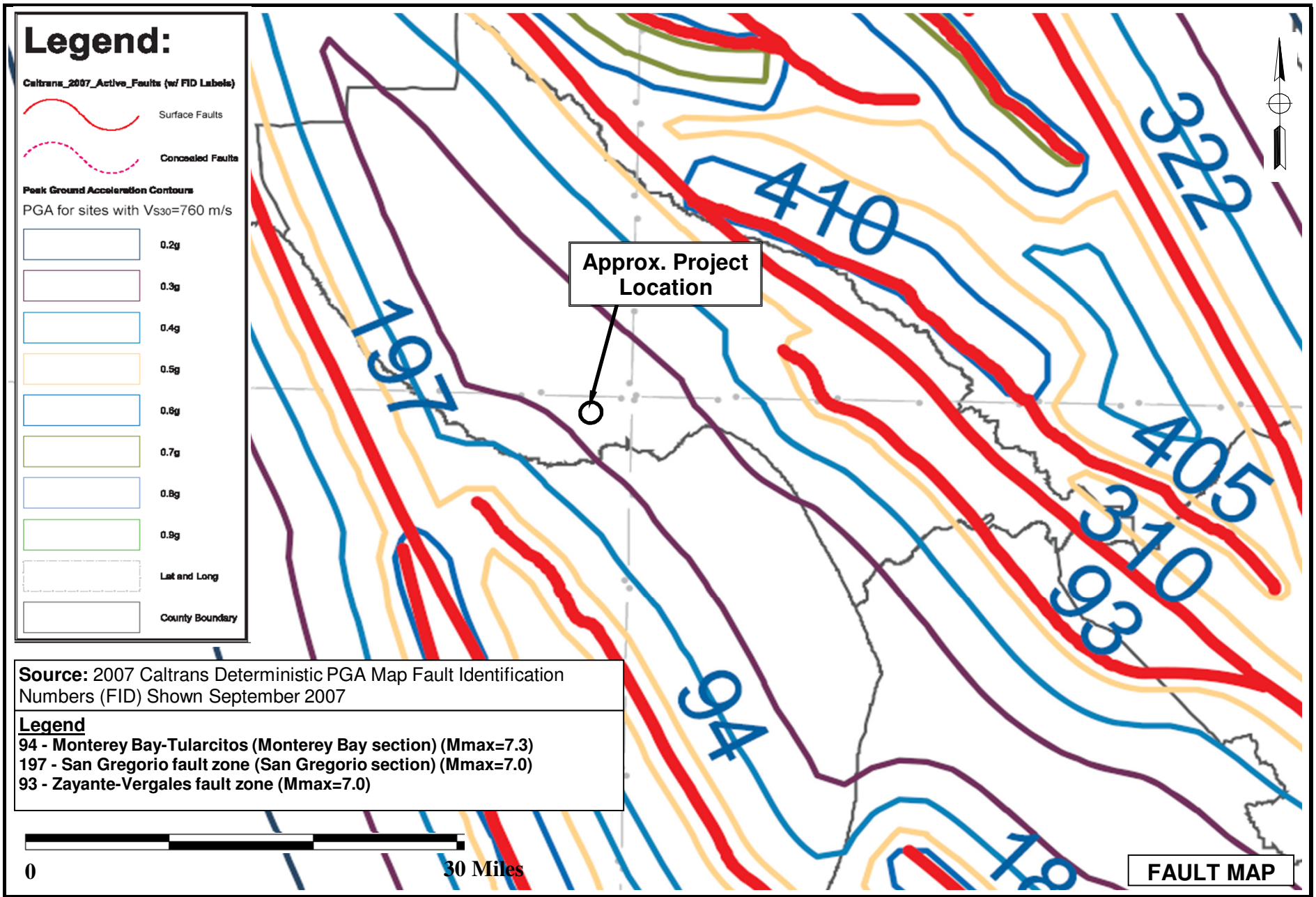
GEOTECHNICAL CONSULTANTS
MATERIALS TESTING

STATE ROUTE 1 / ROUTE 9 INTERSECTION PROJECT
CITY OF SANTA CRUZ, SANTA CRUZ COUNTY, CALIFORNIA

JOB NO.: 2007-119-PH2

PLATE NO.: 2



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MATERIALS TESTING

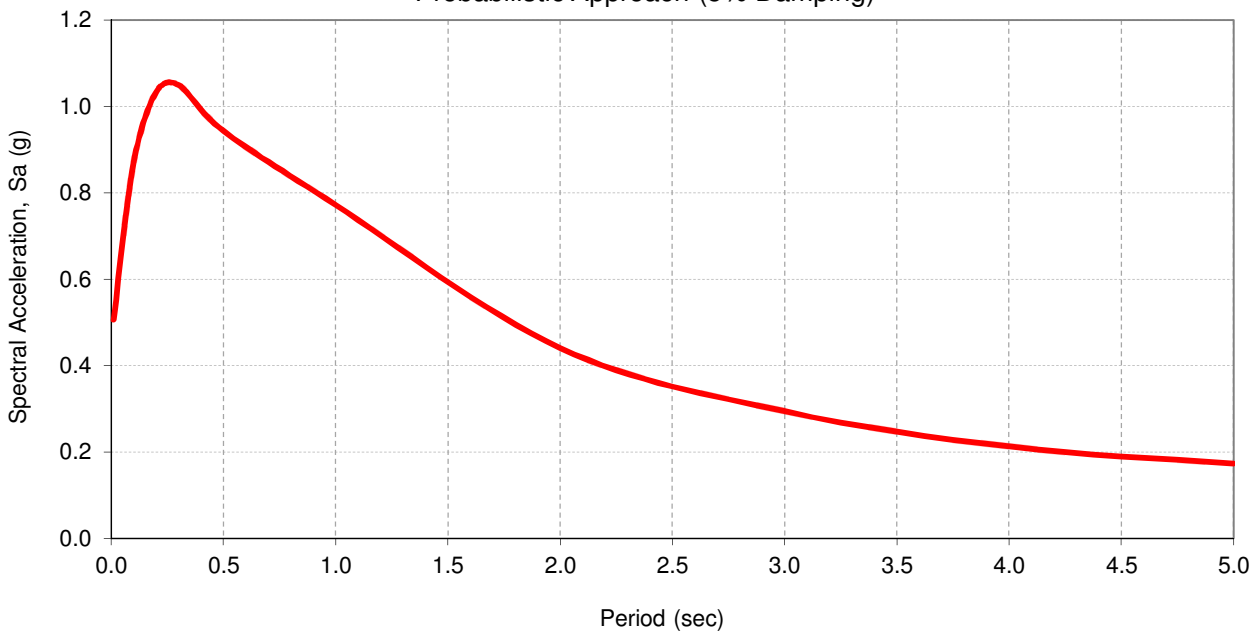
STATE ROUTE 1 / ROUTE 9 INTERSECTION PROJECT
CITY OF SANTA CRUZ, SANTA CRUZ COUNTY, CALIFORNIA

JOB NO.: 2007-119-PH2

PLATE NO.: 3

RECOMMENDED ACCELERATION RESPONSE SPECTRUM

Probabilistic Approach (5% Damping)



Site Information

Latitude:	36.9843
Longitude	-122.0298
V_{S30} (m/s) =	320
$Z_{1.0}$ (m) =	N/A
$Z_{2.5}$ (km) =	N/A
Near Fault Factor, Derived from USGS Deagg. Dist (km) =	14.3

Governing Curve:

Caltrans ARS Online Probablistic Curve

Recommended Response Spectrum				
Period (sec)	Caltrans Online Spectral Acceleration (g)	Adjusted for Near Fault Effect	Adjusted For Basin Effect	Final Adjusted Spectral Acceleration (g)
0.0	0.506	1.000	1.000	0.506
0.1	0.869	1.000	1.000	0.869
0.2	1.033	1.000	1.000	1.033
0.3	1.049	1.000	1.000	1.049
0.5	0.943	1.000	1.000	0.943
1.0	0.643	1.200	1.000	0.772
2.0	0.367	1.200	1.000	0.440
3.0	0.245	1.200	1.000	0.294
4.0	0.177	1.200	1.000	0.212
5.0	0.144	1.200	1.000	0.173

Source:

1. Caltrans ARS Online tool (V.1.0.4, http://dap3.dot.ca.gov/shake_stable/)
2. USGS Deaggregation 2008 beta (http://eqint.cr.usgs.gov/deaggint/2008/index.php)
3. Caltrans Geotechnical Services Design Manual (Version 1.0)

Note:

Refer to "Probablistic Response Spectum Spreadsheet" (attached) for development of the recommended ARS curve.

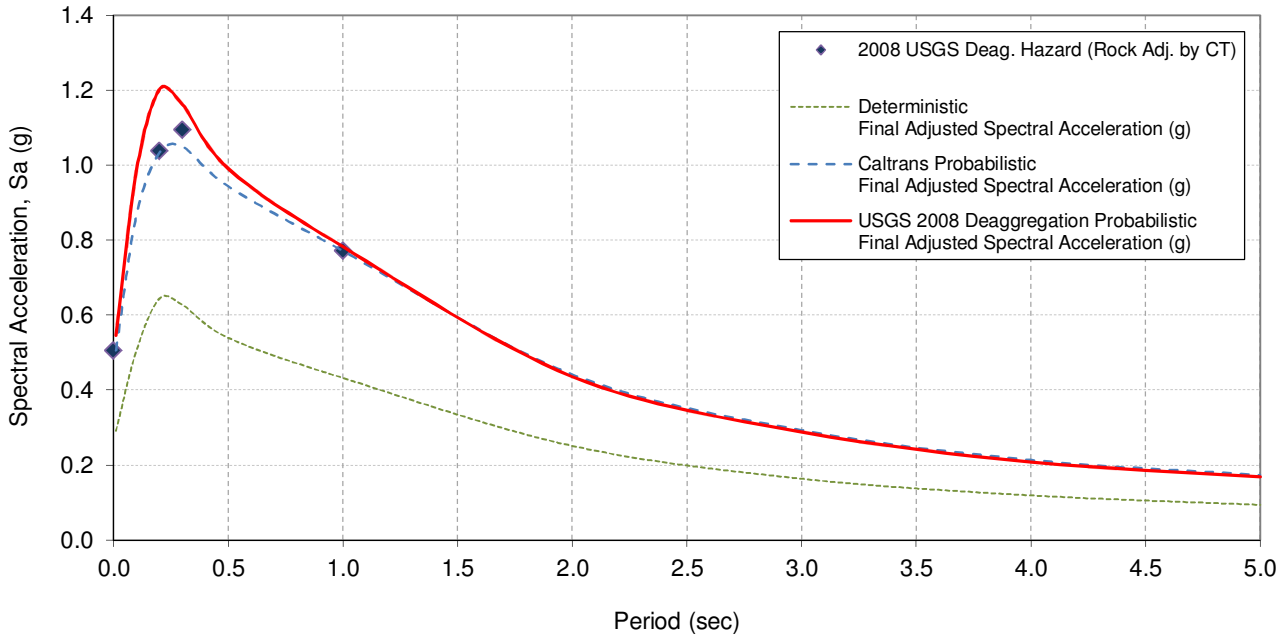
PARIKH CONSULTANTS, INC.
GEOTECHNICAL ENGINEERING
MATERIALS TESTING

STATE ROUTE 1 / ROUTE 9 INTERSECTION PROJECT
CITY OF SANTA CRUZ, SANTA CRUZ COUNTY, CALIFORNIA

Project No.: 2007-119-PH2 | **Plate No.: 4A**

ACCELERATION RESPONSE SPECTRUM COMPARISON

(Deterministic & Probablistic Curves)



Site Information

Latitude:	36.9843
Longitude	-122.0298
V_{S30} (m/s) =	320
$Z_{1.0}$ (m) =	N/A
$Z_{2.5}$ (km) =	N/A
Near Fault Factor, Derived from USGS Deagg. Dist (km) =	14.3

Period (sec)	Deterministic Final Adjusted Spectral Acceleration (g)	Caltrans Probabilistic Final Adjusted Spectral Acceleration (g)	USGS 2008 Deaggregation Probabilistic Final Adjusted Spectral Acceleration (g)
0.0	0.291	0.506	0.545
0.1	0.507	0.869	0.986
0.2	0.644	1.033	1.202
0.3	0.627	1.049	1.162
0.5	0.539	0.943	0.990
1.0	0.432	0.771	0.782
2.0	0.251	0.441	0.436
3.0	0.163	0.293	0.288
4.0	0.119	0.213	0.208
5.0	0.094	0.173	0.168

Source:

1. Caltrans ARS Online tool (V.1.0.4, http://dap3.dot.ca.gov/shake_stable/)
2. USGS Deaggregation 2008 beta (http://eqint.cr.usgs.gov/deaggint/2008/index.php)
3. Caltrans Geotechnical Services Design Manual (Version 1.0)

Note:

Refer to "Probablistic Response Spectum Spreadsheet" (attached) for development of the recommended ARS curve.

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
05	SCR	–	–		

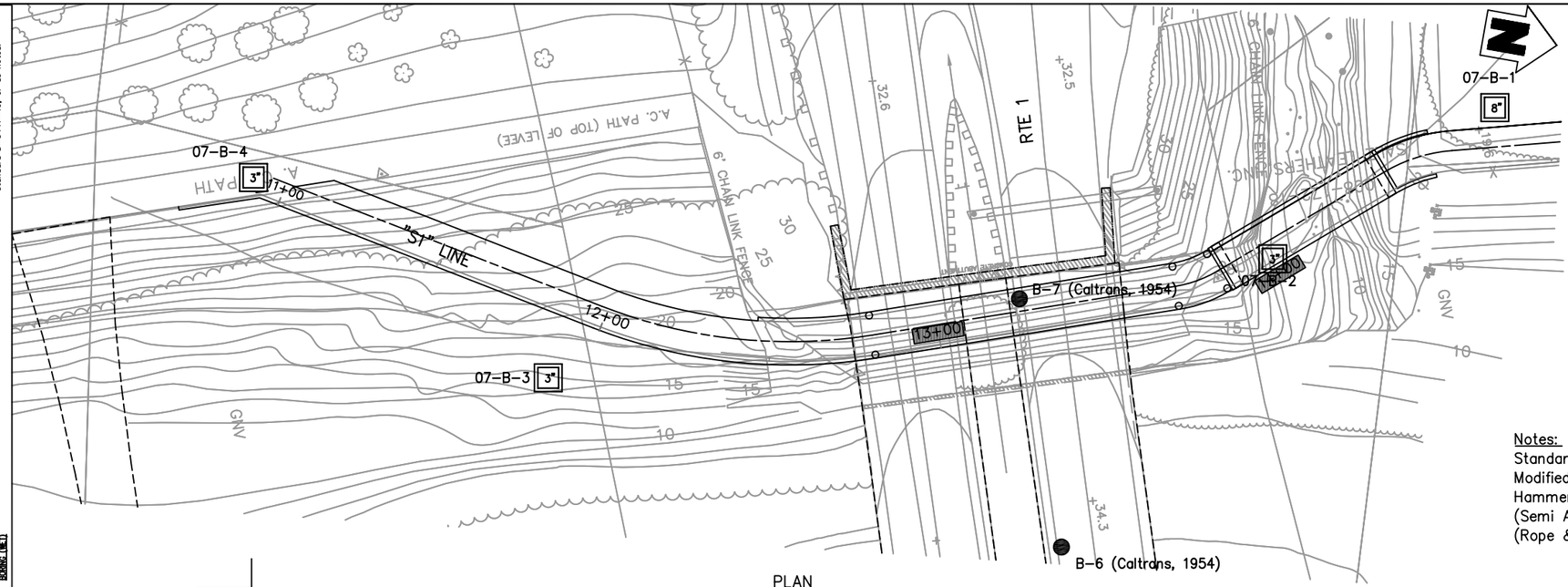
REGISTERED ENGINEER–GEOTECHNICAL

PLANS APPROVAL DATE

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

PARIKH CONSULTANTS, INC.
356 SOUTH MILPITAS BLVD
MILPITAS CA 95035

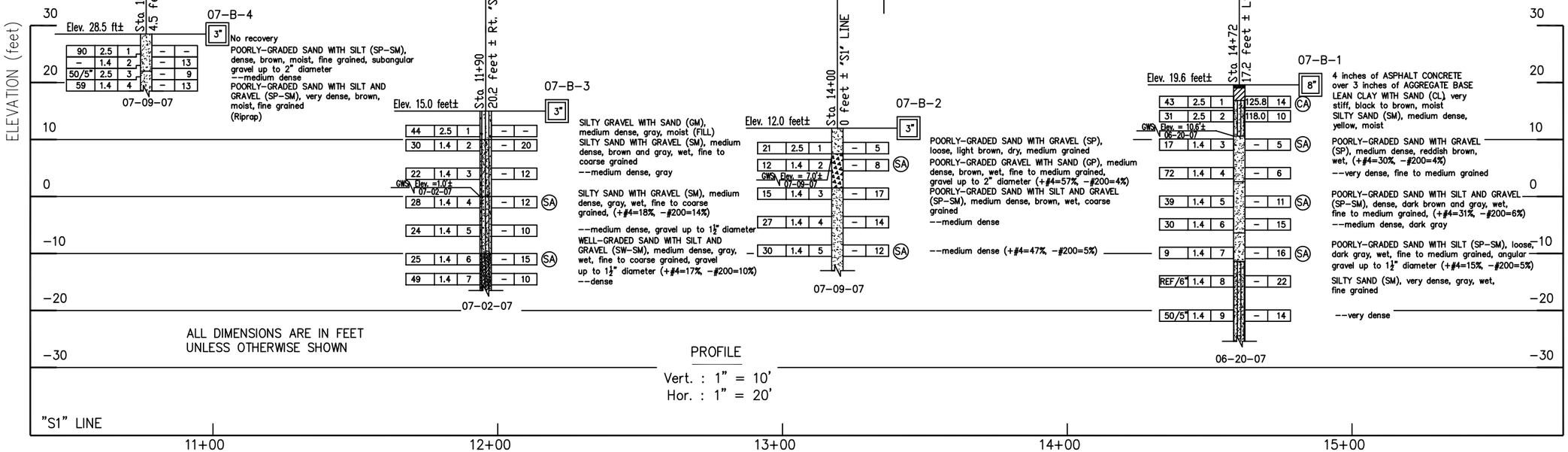
The City of Santa Cruz and its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.



PLAN
1" = 20'

B-4 (Caltrans, 1954)

B-5 (Caltrans, 1954)



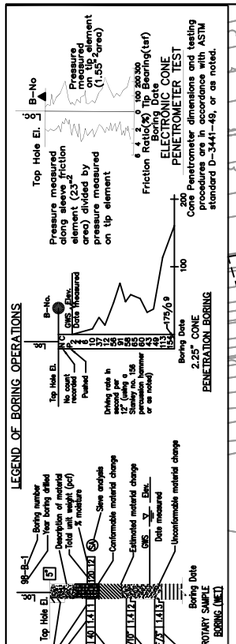
ALL DIMENSIONS ARE IN FEET
UNLESS OTHERWISE SHOWN

PROFILE
Vert. : 1" = 10'
Hor. : 1" = 20'

"S1" LINE
11+00 12+00 13+00 14+00 15+00

Notes:
Standard Penetration Test Sampler: I.D. = 1.4"; O.D. = 2"
Modified California Sampler: I.D. = 2.5"; O.D. = 3"
Hammer Assembly: A 140 lb hammer with a 30" drop
(Semi Automatic Hammer: 07–B–1)
(Rope & Pulley: 07–B–2, 07–B–3, & 07–B–4)

LEGEND OF BORING OPERATIONS



IN-SITU, LAB & FIELD TEST DESIGNATIONS
ATTERBERG LIMITS (4)
CHEMICAL ANALYSIS (5)
CONSOLIDATION (6)
CONSOLIDATED UNDRAINED TRIAXIAL (7)
DIRECT SHEAR (8)
MAX. DRY DENSITY (9)
POCKET PENETROMETER (10)
SIEVE ANALYSIS (11)
TORVANE (12)
UNCONFINED COMPRESSION (13)
UNCONSOLIDATED UNDRAINED TRIAXIAL (14)
VANE SHEAR (15)

TYPES OF BORINGS
2.25" CONE PENETRATION
ROTARY WASH (RW)
ELECTRONIC CONE PENETROMETER (ECP)
AUGER BORING (DRY) (AB)
TEST PIT (TP)
DIAMOND CORE BORING (DCB)
SOIL TUBE (ST)

LEGEND OF EARTH MATERIALS (USCS) BASED ON ASTM D2487, D2488
FILL MATERIAL
PEAT, HUMUS, MUCK & OTHER HIGHLY ORGANIC SOILS (PT)
COBBLES/BOULDERS
IGNEOUS ROCK
SEDIMENTARY ROCK
METAMORPHIC ROCK
POORLY-GRADED GRAVEL (GP)
WELL-GRADED GRAVEL (GW)
POORLY-GRADED SAND (SP)
WELL-GRADED SAND (SW)
SILTY GRAVEL (GM)
CLAYEY GRAVEL (GC)
SILTY SAND (SM)
CLAYEY SAND (SC)
LEAN CLAY (CL)
ORGANIC SILT (OL)
FAT CLAY (CH)
ELASTIC SILT (MH)
ORGANIC CLAY (OH)

CONSISTENCY CLASSIFICATION FOR SOILS According to the Standard Penetration Test (ASTM D-1586)

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

NOTE: Visual classifications of earth materials are based on field inspection and or confirmed or revised with laboratory test results as necessary.

DESIGN OVERSIGHT

SIGN OFF DATE

DESIGN By: L. TRAN

CHECKED By: P. CHAN

Field Investigation by: L. BHANGOO/ G. TRIPATHI

PREPARED FOR THE CITY OF SANTA CRUZ

D. WANG
PROJECT ENGINEER

STRUCTURE NO. 36-0071Z

KILO POST (PM)

SAN LORENZO RIVER MULTIPURPOSE PATH BRIDGE

LOG OF TEST BORINGS 1 OF 2

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 4 5

CU 05
EA 937700

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY)						SHEET	OF
8/19/08						8	9

PLATE A-1

FED ROAD DIV NO	STATE	PROJ NO	FISCAL YEAR	SHEET NO	TOTAL SHEETS
7	CAL.	U-0481(11)		90	98

DIST.	COUNTY	ROUTE	SECTION	SHEET NO	TOTAL SHEETS
IV	SCr	56	5C	7	7

DATE APPROVED June 13, 1955

TO ROUTE 5

SAN LORENZO RIVER

"B" LINE
S 71°18'09"W

TO MISSION STREET

OFFICE OF STRUCTURE FOUNDATIONS – ENGINEERING SERVICE CENTER					
As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.					
DIST.	COUNTY	ROUTE	KILOMETER POST - TOTAL PROJECT	Sheet No.	Total Sheets
05	SCR	-			
CERTIFIED ENGINEERING GEOLOGIST					
SAN LORENZO RIVER MULTIPURPOSE PATH BRIDGE					
LOG OF TEST BORINGS 2 OF 2					
NOTE: A COPY OF THIS LOG OF TEST BORINGS IS AVAILABLE AT OFFICE OF STRUCTURE MAINTENACE AND INVESTIGATIONS, SACRAMENTO, CALIFONIA			CU: 05 EA: 937700		BRIDGE NO. 36-0071Z

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

B-1 B-2 B-3 B-4 B-5 B-6 B-7

EXISTING GROUND LINE

B-2: 23' Rt. 28" Sta. 31+10; 22' Lt. 28" Sta. 31+37; El. 16.2; GWS El. 9.2 6-12-54; Closed tip driven; Refusal at 6-10-54; Very dense light brown silty sand grey sandstone fragments in tip 6-5-54

B-1: El. 16.2; GWS El. 9.2 6-12-54

B-3: 15' Lt. 28" Sta. 32+21; El. 7.2; GWS El. 9.2 6-12-54; Closed tip driven; Refusal at 6-10-54; Very dense grey fine sand & gravel Grey sandstone fragments in tip

B-4: GWS El. 9.2 6-12-54; El. 5.1

B-5: 11' Lt. 28" Sta. 32+25; 30' Rt. 28" Sta. 32+35; El. 5.2; Silty sand & gravel & small cobbles; Grey clean sand & gravel streaks; Grey fairly clean fine-coarse sand wet; Grey fairly clean fine-coarse sand wet-some thin grey silt streaks with organic material; Grey very fine to medium sand thin silt layers & wood particles; Green silt bound sand & gravel wet; Greenish brown silt bound sand & gravel wet; Very dense fine sand-damp; Closed tip driven; Refusal at 6-11-54; Very dense green silty sand with grey sandstone fragments in tip 6-5-54

B-6: 25' Rt. 28" Sta. 33+10; El. 5.2; GWS El. 9.2 6-12-54; Closed tip driven; Refusal at 6-12-54; Very dense blue green fine sand-damp

B-7: 8' Rt. 28" Sta. 33+80; El. 19.3; GWS El. +6.5 6-13-54; Sand/Silt; Graphic representation of driving rate

BM #81 Sta. 33+28.68 P.I. "P2" Line H & T - Elev. 16.48

AS BUILT PLANS
Contract No. 56-4TC15
Date Completed
Document No. 40002354

CONTRACT No. 56-4TC15-F.P
DATE ACCEPTED 12-2-54
AS BUILT
RESIDENT ENGINEER R.J. Nassis
REVIEWED BY J.W. BECK DATE 1/13/54

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

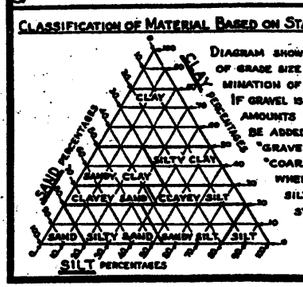


DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION USED IN DETERMINATION OF CLASS NAMES.

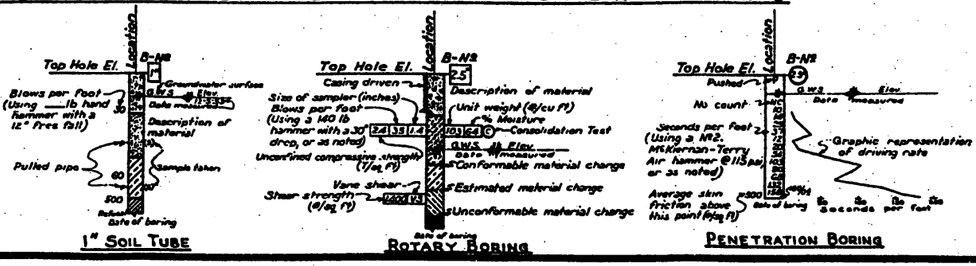
IF GRAVEL IS PRESENT IN APPRECIABLE AMOUNTS THE TERM "GRAVELLY" MAY BE ADDED TO THE CLASS NAME, VIZ. "GRAVELLY SAND." THE TERMS "COARSE", "MEDIUM" AND "FINE" WHEN USED TO DESCRIBE SAND, SILT AND GRAVEL REFER TO STANDARD GRADE SIZE LIMITS.

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 MATTER
- FILL MATERIAL
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

LEGEND OF BORING OPERATIONS

- PLAN OF ANY BORING
- PENETROMETER
- 2½" CONE PENETROMETER
- SAMPLER BORING (DRY)
- ROTARY BORING (WET)
- AUGER BORING (DRY)
- JET BORING
- CORE BORING
- TEST PIT



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.

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

BRIDGE ACROSS SAN LORENZO RIVER

LOG OF TEST BORINGS

SCALE 1" = 10' | BRIDGE 36-71 R/L | FILE | DRAWING C-3833-7

C-3833-10