APPENDIX A.3

Log of Test Borings

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007), EXCEPT AS NOTED IN APPENDIX A.1 OF THE FINAL GEOTECHNICAL SUMMARY REPORT, SR-710 TUNNEL TECHNICAL STUDY, LOS ANGELES COUNTY, CALIFORNIA, DATED APRIL, 2010.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

GEOTECHNICAL ENGINEER — 3/18/10 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — GEOTECHNICAL — STATE OF CALIFORNIA

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CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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.

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

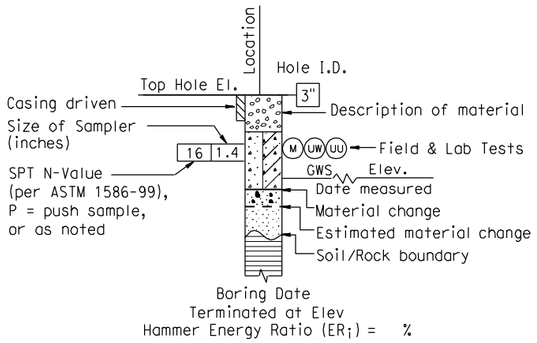
Note: Size in inches.

CONSISTENCY OF COHESIVE SOILS

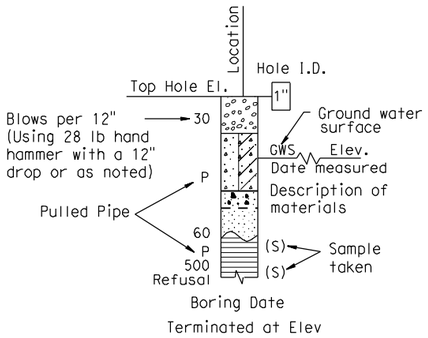
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff	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

PLASTICITY OF FINE-GRAINED SOILS

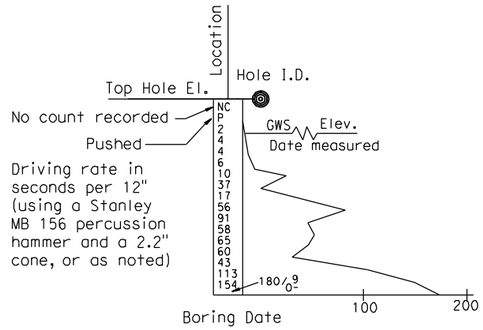
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be 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.



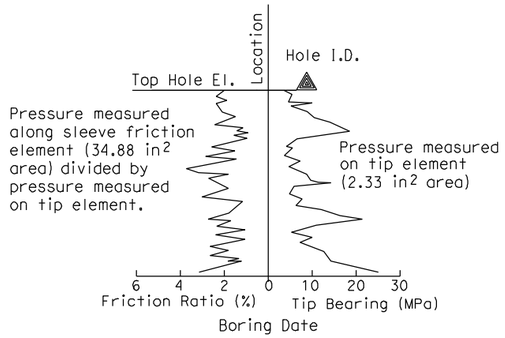
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SOIL LEGEND
PREPARED BY	KATHLEEN REYES		DESIGN BRANCH	N/A	LOG OF TEST BORINGS 1 OF 2
CHECKED BY	DAN JANKLY			POST MILES N/A	

GS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

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REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (JUNE 2007), EXCEPT AS NOTED IN APPENDIX A.1 OF THE FINAL GEOTECHNICAL SUMMARY REPORT, SR-710 TUNNEL TECHNICAL STUDY, LOS ANGELES COUNTY, CALIFORNIA, DATED APRIL, 2010.

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)
- (CAI) Cerchar Abrasivity Index
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CS&EM) Compressive Strength and Elastic Moduli of Rock Core (ASTM D 7012)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (EM) Elastic Moduli of Rock Core in Uniaxial Compression (ASTM D 3148)
- (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
- (PTS) Petrographic Thin Section Analysis
- (R) R-Value (CTM 301)
- (SD) Slake Durability (ASTM D 4644)
- (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)

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

GEOTECHNICAL ENGINEER — 3/18/10 DATE

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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	KATHLEEN REYES
CHECKED BY	DAN JANKLY

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN
DESIGN BRANCH

BRIDGE NO. N/A
POST MILES N/A

SOIL LEGEND
LOG OF TEST BORINGS 2 OF 2

GS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

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7	LA	710	N/A		

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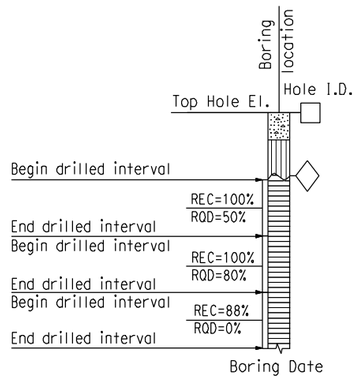
SANTA ANA, CA 92707

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

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

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



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
- FAULT GOUGE

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: Chemical Weathering-Discoloration and/or oxidation — Body of Rock	Diagnostic features: Chemical Weathering-Discoloration and/or oxidation — Fracture Surfaces	Diagnostic features: Mechanical Weathering-Grain boundary conditions (disaggregation) primarily for granitics and some coarse-grained sediments	Diagnostic features: Texture and Solutioning — Texture	Diagnostic features: Texture and Solutioning — Solutioning	General Characteristics
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	KATHLEEN REYES
CHECKED BY	DAN JANKLY

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN
DESIGN BRANCH

BRIDGE NO. N/A
POST MILES N/A

ROCK LEGEND
LOG OF TEST BORINGS

GS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

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GEOTECHNICAL ENGINEER — 3/18/10 DATE

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — GEOTECHNICAL — STATE OF CALIFORNIA

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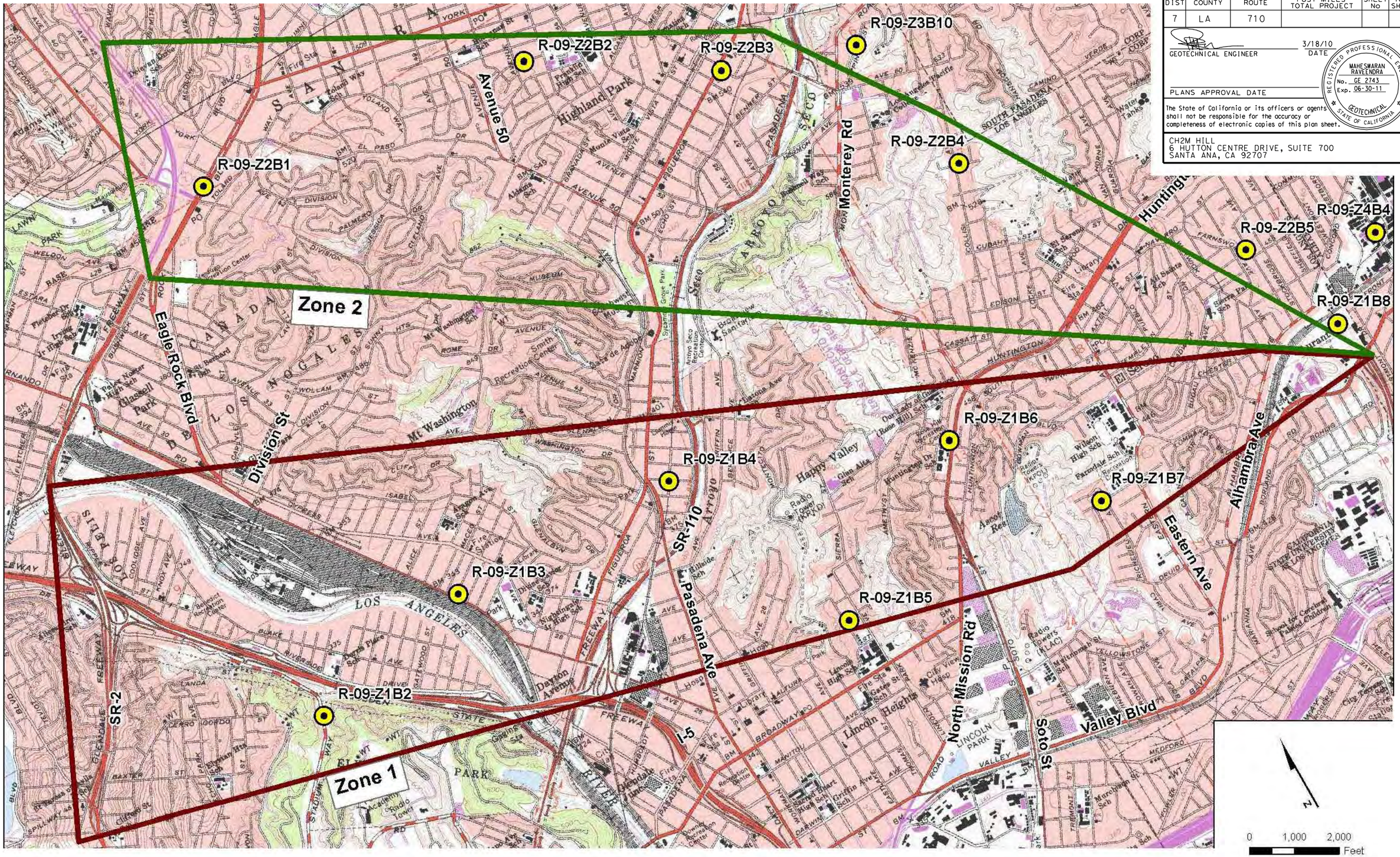

DEREK HIGA DESIGN OVERSIGHT ENGINEER	DRAWN BY:	KATHLEEN REYES	FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MAHESWARAN RAVEENDRA PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY:	DAN JANKLY	DATE:		

BRIDGE NO.

POST MILES

SR-710 TUNNEL TECHNICAL STUDY

BORING LOCATION PLAN 1 OF 2

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

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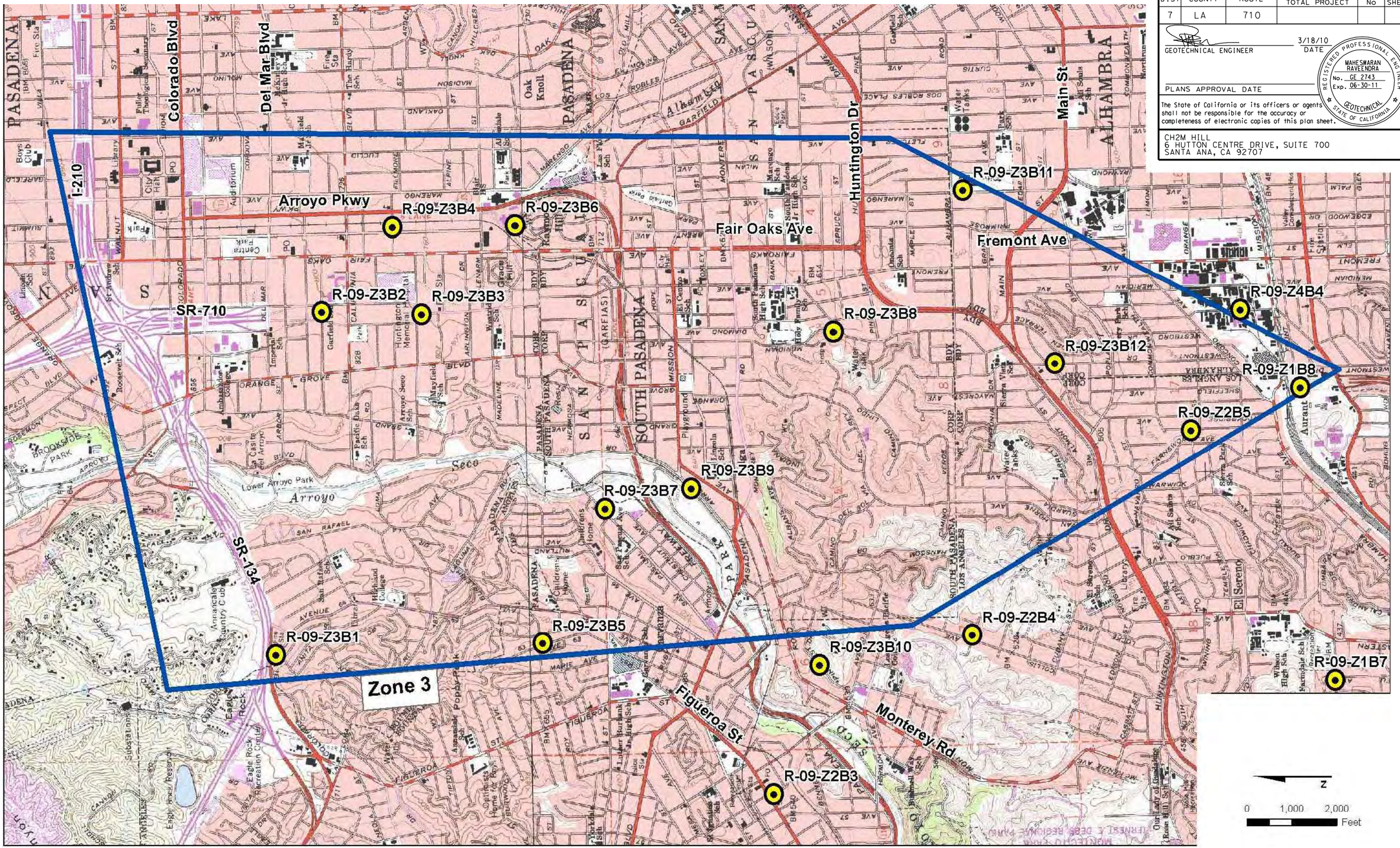

DEREK HIGA DESIGN OVERSIGHT ENGINEER	DRAWN BY:	KATHLEEN REYES	FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MAHESWARAN RAVEENDRA PROJECT ENGINEER	BRIDGE NO.
SIGN OFF DATE	CHECKED BY:	DAN JANKLY	DATE:			POST MILES

SR-710 TUNNEL TECHNICAL STUDY

BORING LOCATION PLAN 2 OF 2

OGS CIVIL LOG OF TEST BORINGS SHEET	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3	CU EA 07-187900	DISREGARD PRINTS BEARING EARLIER REVISION DATES →	REVISION DATES	SHEET OF
		FILE => $REQUEST			

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

BENCHMARK:

NGS Benchmark used. Pt MF 36F: N1847799.06, E6512460.75, Elevation 407.29
MF36F: A 3" Brass disk stamped "Metropolitan Water Deistrict of Southern California MF 36F 1989, set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on North American Vertical Datum 1988.
Pt 0153: N1845410.50, E6509860.21
Pt 0617: N1858044.30, E6491094.23

Units are in U.S survey feet.

NOTES:

1) This LOTB sheet (Boring Record) was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) HQ&PQ core samplers were used to obtain soil and rock samples.

3) Boring is inclined at 60°from Horizontal, bedding and structural measurements are relative to core axis, depth is down hole distance.

4) Plan view shown on Boring Location Plan sheet 1 of 2.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
7	LA	710	.	.	.

Jody A. Castle 3/18/09
PROFESSIONAL GEOLOGIST DATE

PROFESSIONAL GEOLOGIST — J. CASTLE — No. PG 8162 — Exp. 12-31-10 — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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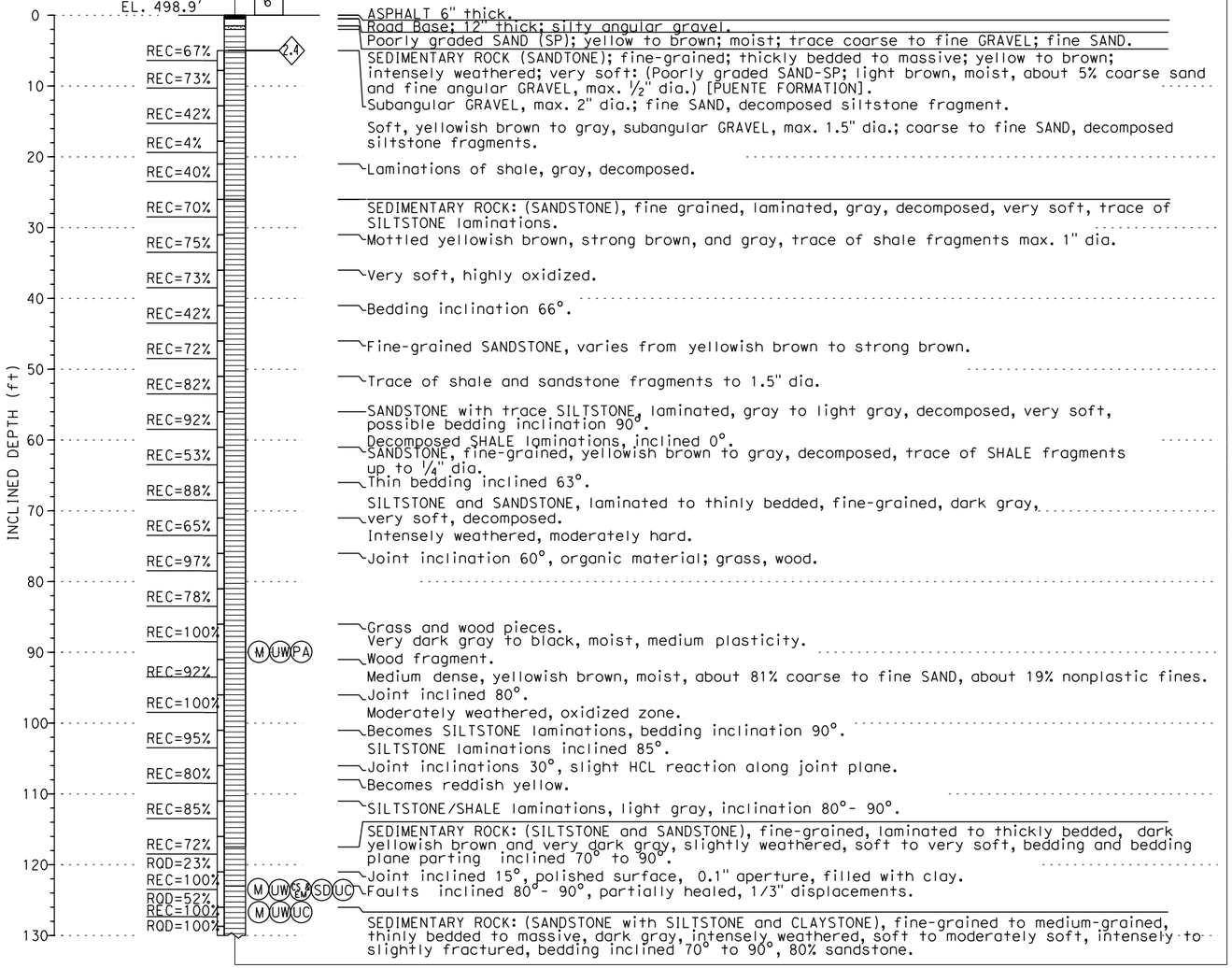
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION, DISTRICT-7
100 S. MAIN STREET, LOS ANGELES, CA 90012

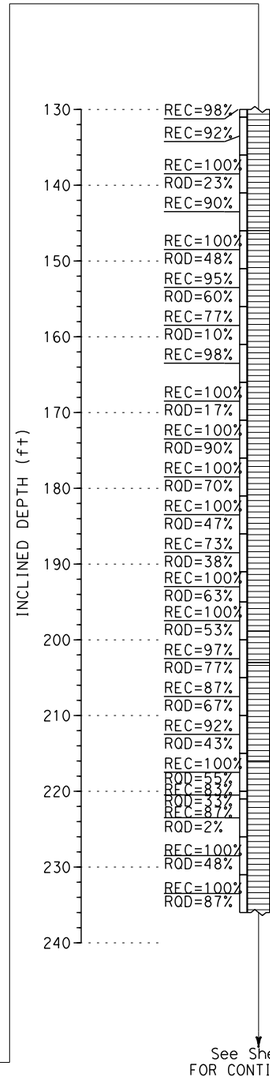
EARTH MECHANICS, INC.
17660 NEWHOPE STREET, SUITE E
FOUNTAIN VALLEY, CA 92708

R-09-Z1B2

N 1854817.64
E 6488834.09
EL. 498.9'



ASPHALT 6" thick.
Road Base; 12" thick; silty angular gravel.
Poorly graded SAND (SP); yellow to brown; moist; trace coarse to fine GRAVEL; fine SAND.
SEDIMENTARY ROCK (SANDTONE); fine-grained; thickly bedded to massive; yellow to brown; intensely weathered; very soft: (Poorly graded SAND-SP; light brown, moist, about 5% coarse sand and fine angular GRAVEL, max. ½" dia.) [PUENTE FORMATION].
Subangular GRAVEL, max. 2" dia.; fine SAND, decomposed siltstone fragment.
Soft, yellowish brown to gray, subangular GRAVEL, max. 1.5" dia.; coarse to fine SAND, decomposed siltstone fragments.
Laminations of shale, gray, decomposed.
SEDIMENTARY ROCK: (SANDSTONE), fine grained, laminated, gray, decomposed, very soft, trace of SILTSTONE laminations.
Mottled yellowish brown, strong brown, and gray, trace of shale fragments max. 1" dia.
Very soft, highly oxidized.
Bedding inclination 66°.
Fine-grained SANDSTONE, varies from yellowish brown to strong brown.
Trace of shale and sandstone fragments to 1.5" dia.
SANDSTONE with trace SILTSTONE, laminated, gray to light gray, decomposed, very soft, possible bedding inclination 90°.
Decomposed SHALE laminations, inclined 0°.
SANDSTONE, fine-grained, yellowish brown to gray, decomposed, trace of SHALE fragments up to ¼" dia.
Thin bedding inclined 63°.
SILTSTONE and SANDSTONE, laminated to thinly bedded, fine-grained, dark gray, very soft, decomposed.
Intensely weathered, moderately hard.
Joint inclination 60°, organic material; grass, wood.
Grass and wood pieces.
Very dark gray to black, moist, medium plasticity.
Wood fragment.
Medium dense, yellowish brown, moist, about 81% coarse to fine SAND, about 19% nonplastic fines.
Joint inclined 80°.
Moderately weathered, oxidized zone.
Becomes SILTSTONE laminations, bedding inclination 90°.
SILTSTONE laminations inclined 85°.
Joint inclinations 30°, slight HCL reaction along joint plane.
Becomes reddish yellow.
SILTSTONE/SHALE laminations, light gray, inclination 80°- 90°.
SEDIMENTARY ROCK: (SILTSTONE and SANDSTONE), fine-grained, laminated to thickly bedded, dark yellowish brown and very dark gray, slightly weathered, soft to very soft, bedding and bedding plane parting inclined 70° to 90°.
Joint inclined 15°, polished surface, 0.1" aperture, filled with clay.
Faults inclined 80°- 90°, partially healed, 1/3" displacements.
SEDIMENTARY ROCK: (SANDSTONE with SILTSTONE and CLAYSTONE), fine-grained to medium-grained, thinly bedded to massive, dark gray, intensely weathered, soft to moderately soft, intensely to slightly fractured, bedding inclined 70° to 90°, 80% sandstone.



FeO lined bedding joint.
Minor faults inclined 75°, sand filling.
Zones of very soft and moderately hard sandstone, ½' to 2' thick between 135'-141' depth.
SEDIMENTARY ROCK: (SANDSTONE with SILTSTONE), fine-grained to medium-grained thinly bedded to massive, yellowish brown to dark gray, moderately weathered to fresh, intensely to slightly fractured, sandstone 85%.
Becomes light gray, hard, fresh zone 1.5' thick.
Becomes brown to yellowish brown oxidation 1' .75" thick on each side of joint, inclination 25°.
Becomes moderately soft, slightly fractured, bedding inclination 25°.
Bedding inclination 65°.
SILTSTONE bed, gray to dark yellowish brown, slightly weathered, moderately soft, bedding inclination 80°- 88°.
Becomes medium to fine-grained, light gray, moderately hard, slightly fractured.
Concretion, fine SANDSTONE, light gray to yellowish brown, slightly weathered, hard, strong reaction to HCL. Laminations inclined 75°.
SILTSTONE laminations, gray, slightly weathered, soft, bedding and bedding plane parting inclined 75° to 80°, soft sediment deformation and worm burrows.
Becomes gray, slightly weathered to fresh.
Siltstone/sandstone lamination, 4" thick.
Bedding inclined 60°.
Bedding inclination 90°, joint inclination 25°.
SEDIMENTARY ROCK: (SANDSTONE), fine-grained to medium-grained, moderately bedded, gray, fresh, hard, strong reaction to HCL, concretion.
Becomes soft.
Bedding inclined 75°, joint inclined 80°.
SEDIMENTARY ROCK (SILTSTONE/CLAYSTONE), fine-grained, laminated siltstone, thinly to thickly bedded, dark gray to very dark gray, fresh, soft, moderately fractured, bedding inclined 75°- 90°, sandstone 50% interbedded with siltstone 50%.
Siltstone rip-up fragments.
Joint inclined 20°.
SEDIMENTARY ROCK (SANDSTONE with SILTSTONE), fine grained to medium-grained, laminated to thinly bedded, gray to light gray, fresh, soft to moderately hard, slightly to moderately fractured, 90% of Sandstone, trace of hard zone, bedding and bedding plane parting inclined 70°- 90°.
Becomes coarse-grained zone, graded bedding, joints inclined 10° to 50°.
Siltstone laminations inclined 60°.
Graded bedding, coarse to fine-grained zone.
Joints inclined 30° to 35°, rough surfaces.
Soft zone, joints inclined 35°, weak HCL reaction, slightly rough to moderately rough surfaces.
Hard cemented zone, calcite cement, healed calcite, joints inclined 35°.
Siltstone laminations inclined 70°, coarse to medium-grained zone.
Joint inclined 20°.

See Sheet 2
FOR CONTINUATION

PROFILE
VERTICAL 1" = 10'

DEREK HIGA	DRAWN BY:	K. THANT	B. SCHELL, J. CASTLE	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. LAW	BRIDGE NO. N/A	SR-710 TUNNEL TECHNICAL STUDY
DESIGN OVERSIGHT ENGINEER			FIELD INVESTIGATION BY:		PROJECT ENGINEER	POST MILE N/A	LOG OF TEST BORING SHEET 1 OF 2
.	CHECKED BY:	B. SCHELL	3/25/09 - 4/3/09		CU . EA 07-187900	DISREGARD PRINTS BEARING EARLIER REVISION DATES →	REVISION DATES (PRELIMINARY STAGE ONLY) — SHEET 1 OF 2
SIGN OFF DATE			DATE:				

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => TIME PLOTTED => $TIME

BENCHMARK:

NGS Benchmark used. Pt MF 36F: N1847799.06, E6512460.75, Elevation 407.29
MF36F: A 3" Brass disk stamped "Metropolitan Water Deistrict of Southern California MF 36F 1989, set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on North American Vertical Datum 1988.
Pt 0153: N1845410.50, E6509860.21
Pt 0617: N1858044.30, E6491094.23

Units are in U.S survey feet.

NOTES:

1) This LOTB sheet (Boring Record) was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.4 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) HQ&PQ core samplers were used to obtain soil and rock samples.

3) Boring is inclined at 60°from Horizontal, bedding and structural measurements are relative to core axis, depth is down hole distance.

4) Plan view shown on Boring Location Plan sheet 1 of 2.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
7	LA	710	.	.	.

Jody A. Castle 3/18/10
PROFESSIONAL GEOLOGIST DATE

PROFESSIONAL GEOLOGIST — J. CASTLE — No. PG 8162 — Exp. 12-31-10 — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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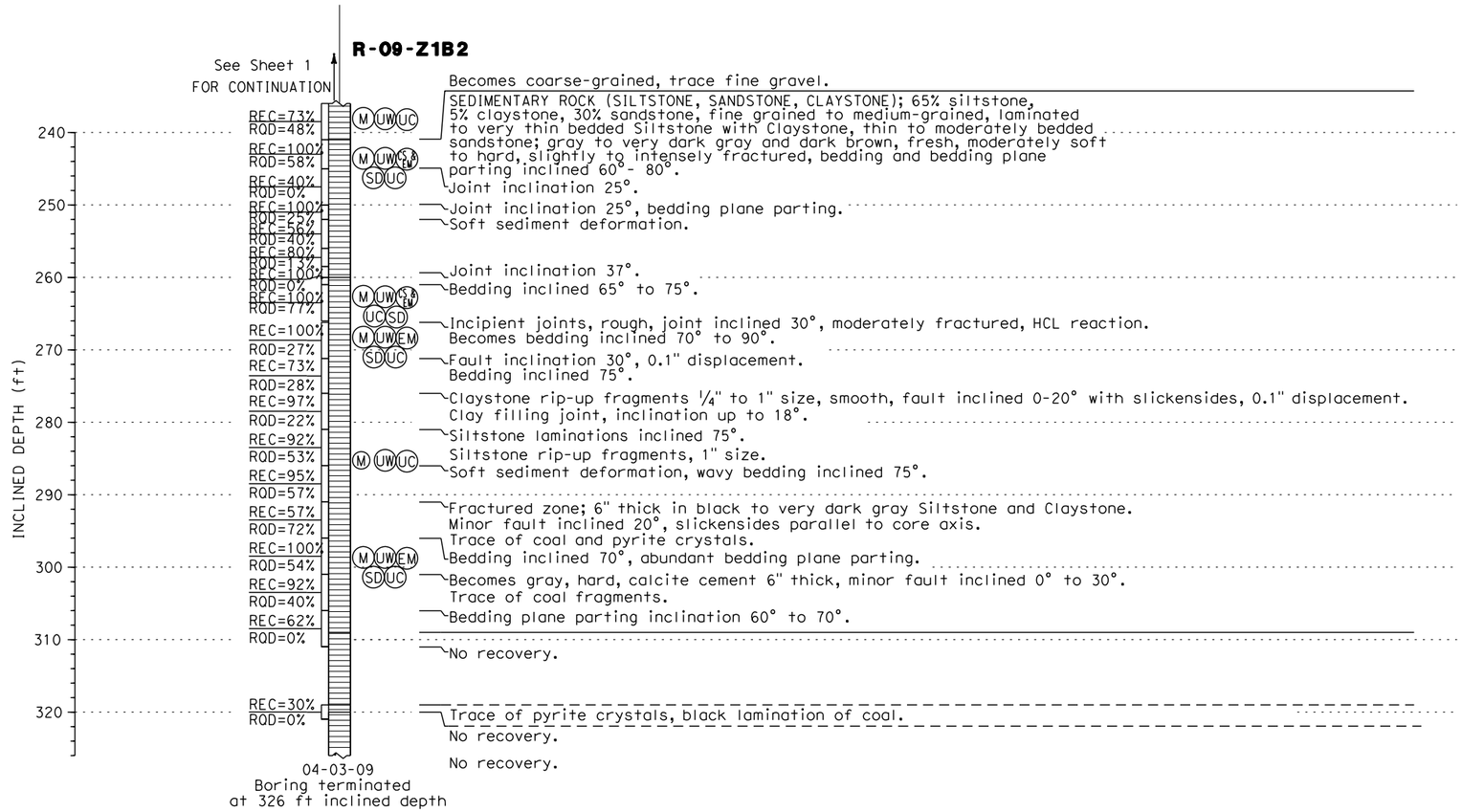
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION, DISTRICT-7
100 S. MAIN STREET, LOS ANGELES, CA 90012

EARTH MECHANICS, INC.
17660 NEWHOPE STREET, SUITE E
FOUNTAIN VALLEY, CA 92708



PROFILE
VERTICAL 1" = 10'

DEREK HIGA DESIGN OVERSIGHT ENGINEER	DRAWN BY:	K. THANT	B. SCHELL, J. CASTLE FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. LAW PROJECT ENGINEER
. SIGN OFF DATE	CHECKED BY:	B. SCHELL	3/25/09 - 4/3/09 DATE:		

BRIDGE NO. N/A
POST MILE N/A

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 2 OF 2

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU .
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 2 OF 2

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => TIME PLOTTED => $TIME

BENCHMARK:

NGS Benchmark used. Pt MF 36F: N1847799.06, E6512460.75, Elevation 407.29
MF36F: A 3" Brass disk stamped "Metropolitan Water Deistrict of Southern California MF 36F 1989, set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68′ west of the center of the south bound lanes of the freeway, 25′ north of the centerline of Hellman Avenue, 13′ east of the west end of the bridge, 1′ north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on North American Vertical Datum 1988.
Pt 0153: N1845410.50, E6509860.21
Pt 0617: N1858044.30, E6491094.23

Units are in U.S survey feet.

NOTES:

1) This LOTB sheet (Boring Record) was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 1 of 2.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
7	LA	710	N/A	.	.

Jody A. Castle 3/18/10
PROFESSIONAL GEOLOGIST DATE

PROFESSIONAL GEOLOGIST — J. CASTLE — No. PG 8162 — Exp. 12-31-10 — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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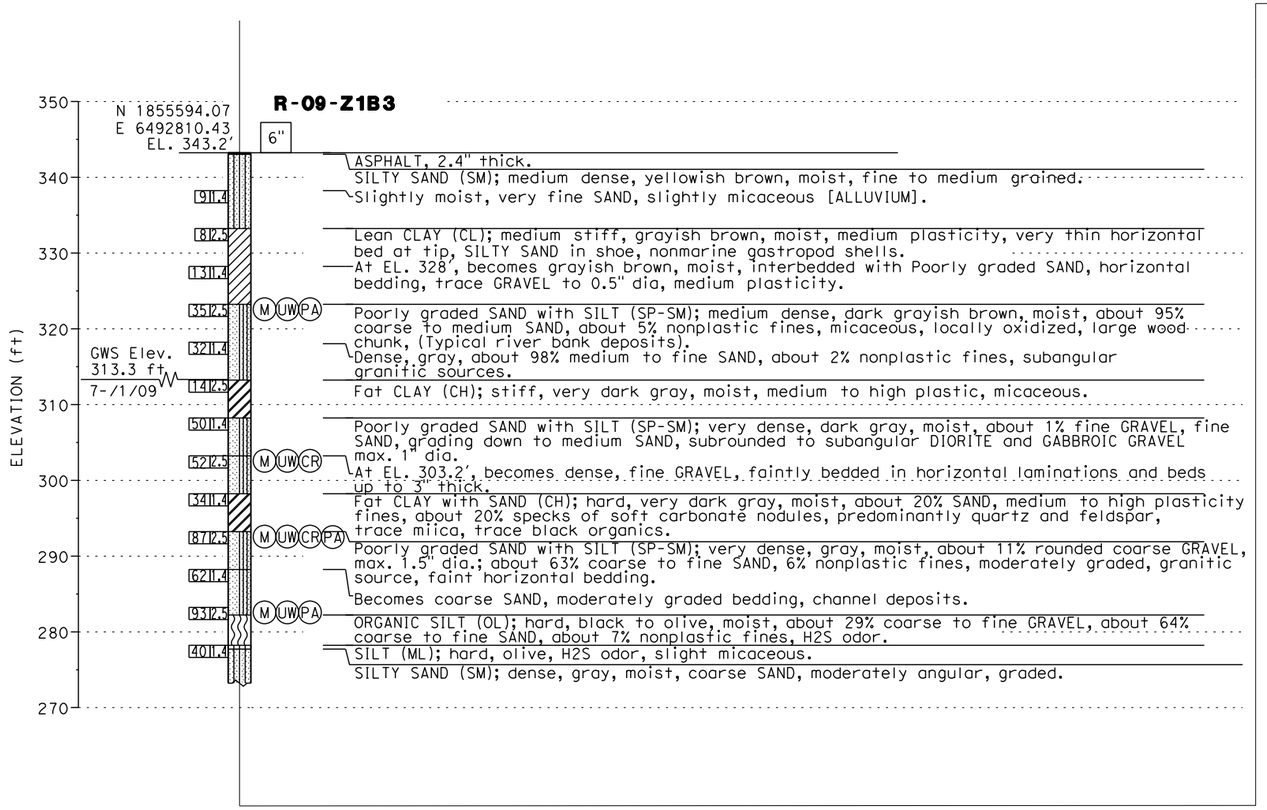
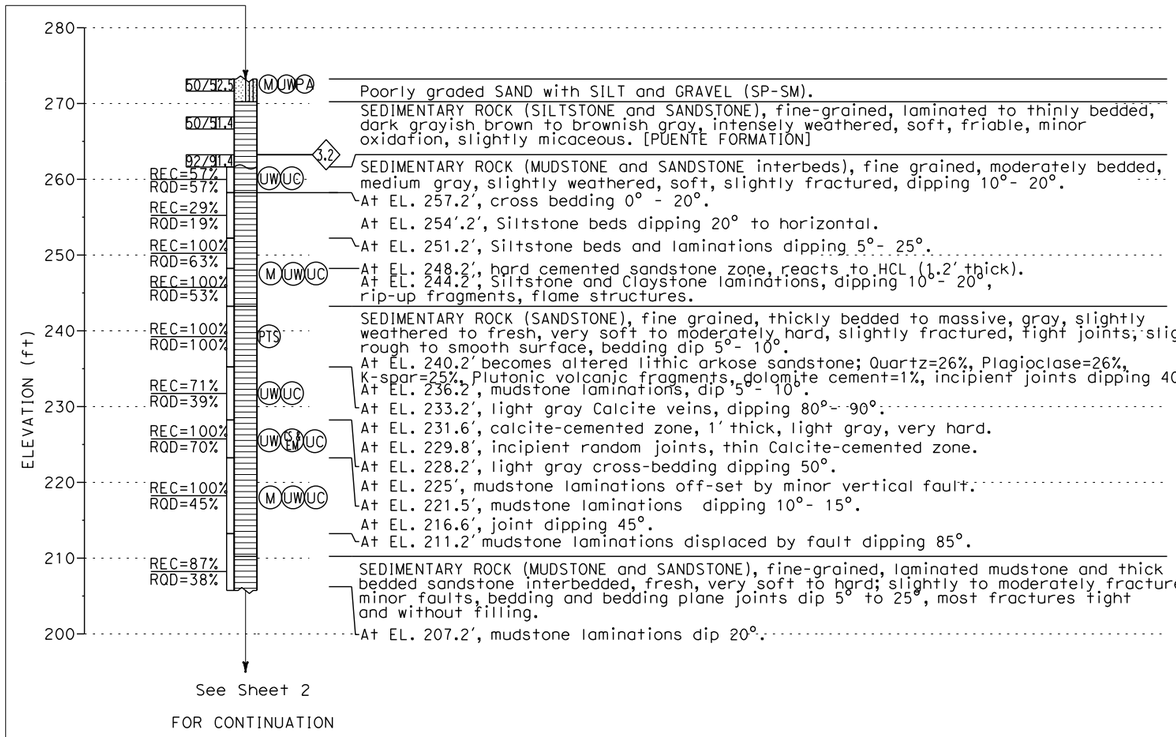
DEPARTMENT OF TRANSPORTATION, DISTRICT-7
100 S. MAIN STREET, LOS ANGELES, CA 90012

EARTH MECHANICS, INC.
17660 NEWHOPE STREET, SUITE E
FOUNTAIN VALLEY, CA 92708





See Sheet 2
FOR CONTINUATION

PROFILE
VERTICAL 1" = 10′

DESIGN OVERSIGHT ENGINEER: DEREK HIGA	DRAWN BY:	K. THANT	FIELD INVESTIGATION BY: B. SCHELL, J. CASTLE	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	PROJECT ENGINEER: H. LAW	BRIDGE NO. N/A	SR-710 TUNNEL TECHNICAL STUDY
SIGN OFF DATE: .	CHECKED BY:	B. SCHELL	DATE: 1/23/09 - 1/31/09			POST MILE N/A	LOG OF TEST BORING SHEET 1 OF 2
OGS CIVIL LOG OF TEST BORINGS SHEET	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3				CU . EA 07-187900	DISREGARD PRINTS BEARING EARLIER REVISION DATES →	REVISION DATES (PRELIMINARY STAGE ONLY) / SHEET 1 OF 2

FILE => $REQUEST
DATE PLOTTED => $TIME
USERNAME => $USER

BENCHMARK:

NGS Benchmark used. Pt MF 36F: N1847799.06, E6512460.75, Elevation 407.29
MF36F: A 3" Brass disk stamped "Metropolitan Water Deistrict of Southern California MF 36F 1989, set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on North American Vertical Datum 1988.
Pt 0153: N1845410.50, E6509860.21
Pt 0617: N1858044.30, E6491094.23

Units are in U.S survey feet.

NOTES:

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2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 1 of 2.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
7	LA	710	N/A	.	.

Jody A. Castle 3/18/10
PROFESSIONAL GEOLOGIST DATE

PROFESSIONAL GEOLOGIST — J. CASTLE — No. PG 8162 — Exp. 12-31-10 — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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17660 NEWHOPE STREET, SUITE E
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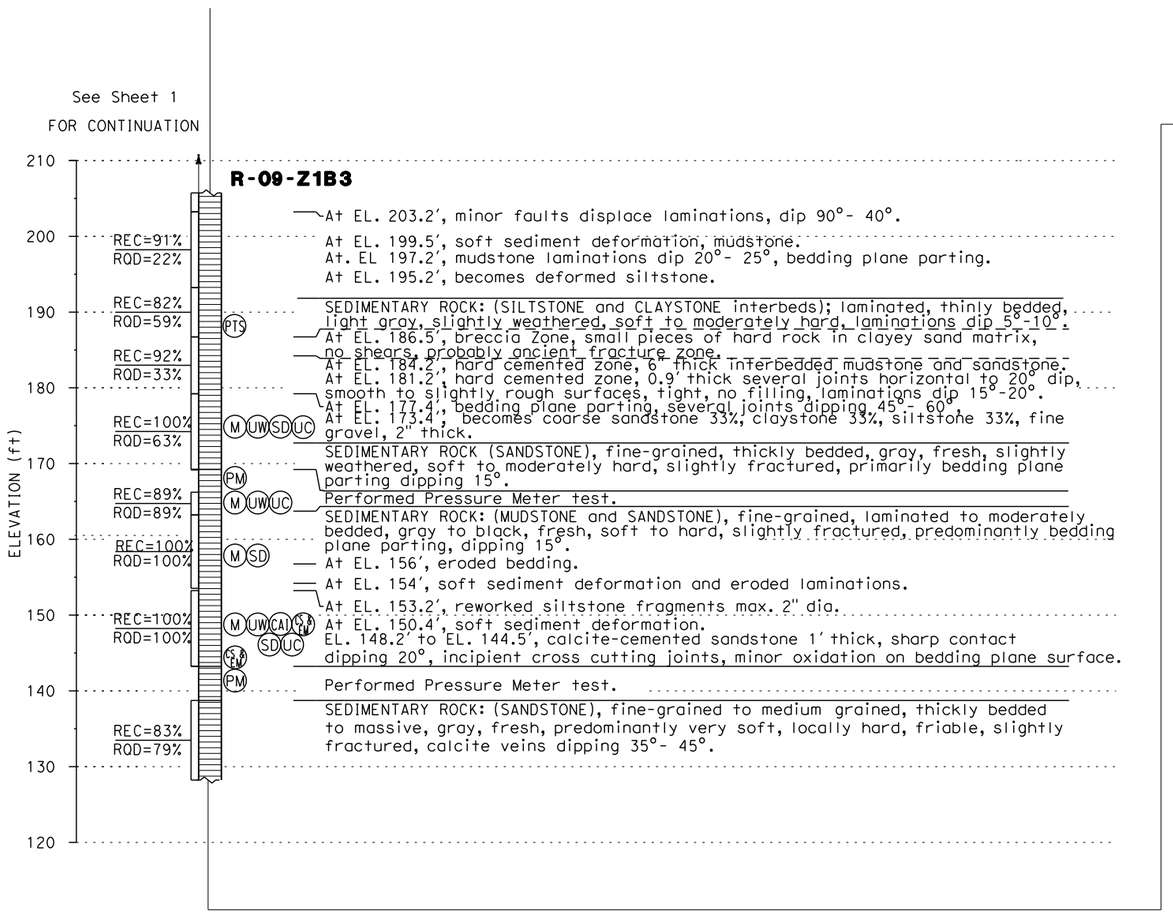

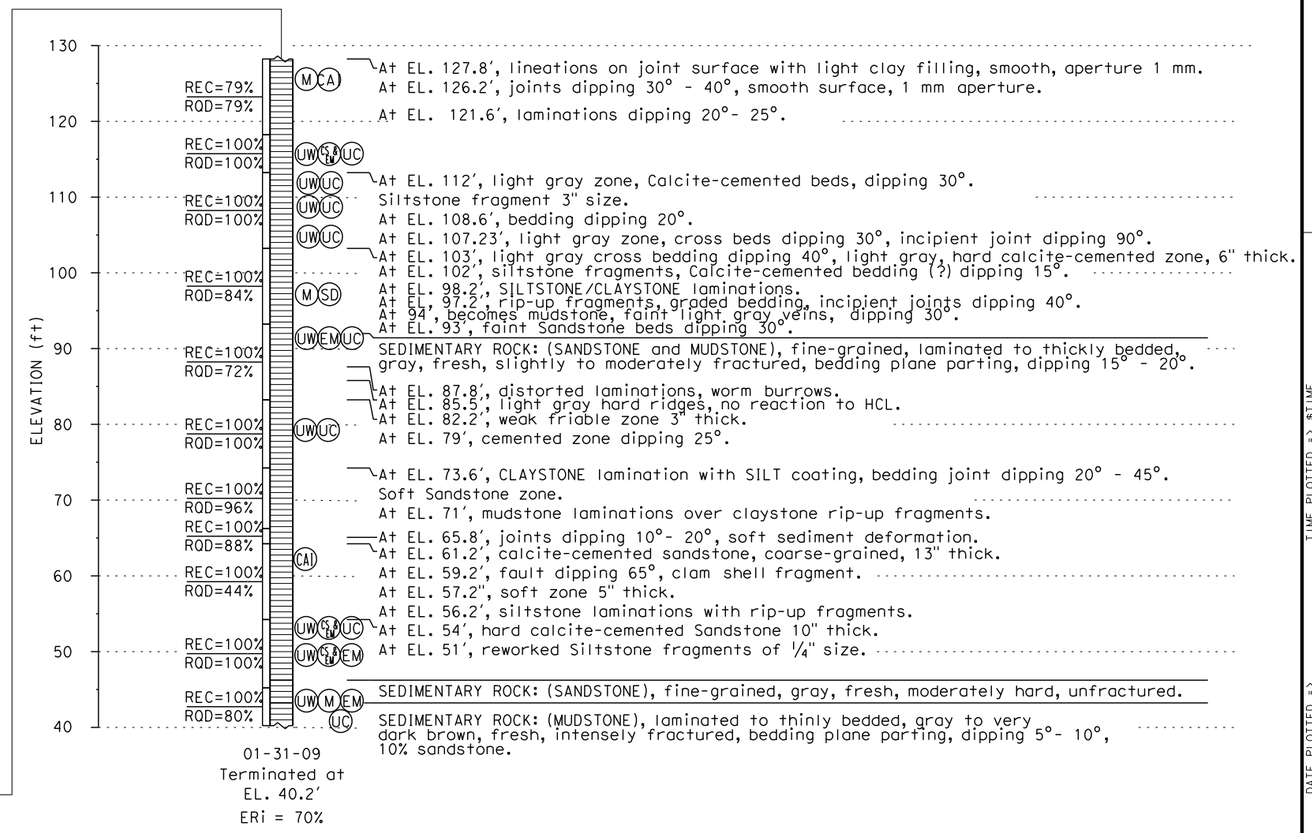

PROFILE
VERTICAL 1" = 10'

DEREK HIGA	DRAWN BY:	K. THANT	B. SCHELL, J. CASTLE	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. LAW	BRIDGE NO. N/A	SR-710 TUNNEL TECHNICAL STUDY
DESIGN OVERSIGHT ENGINEER			FIELD INVESTIGATION BY:		PROJECT ENGINEER	POST MILE N/A	LOG OF TEST BORING SHEET 2 OF 2
.	CHECKED BY:	B. SCHELL	1/23/09 - 1/31/09				
SIGN OFF DATE			DATE:				

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU . EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 2 OF 2

FILE => $REQUEST

DATE PLOTTED => TIME PLOTTED => $TIME

USERNAME => $USER

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Kristopher Barker 3/18/10
CERTIFIED ENGINEERING GEOLOGIST DATE

PROFESSIONAL GEOLOGIST
KRISTOPHER P. BARKER
No. CEG 2383
Exp. 8/31/2011
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

PLANS APPROVAL DATE

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BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

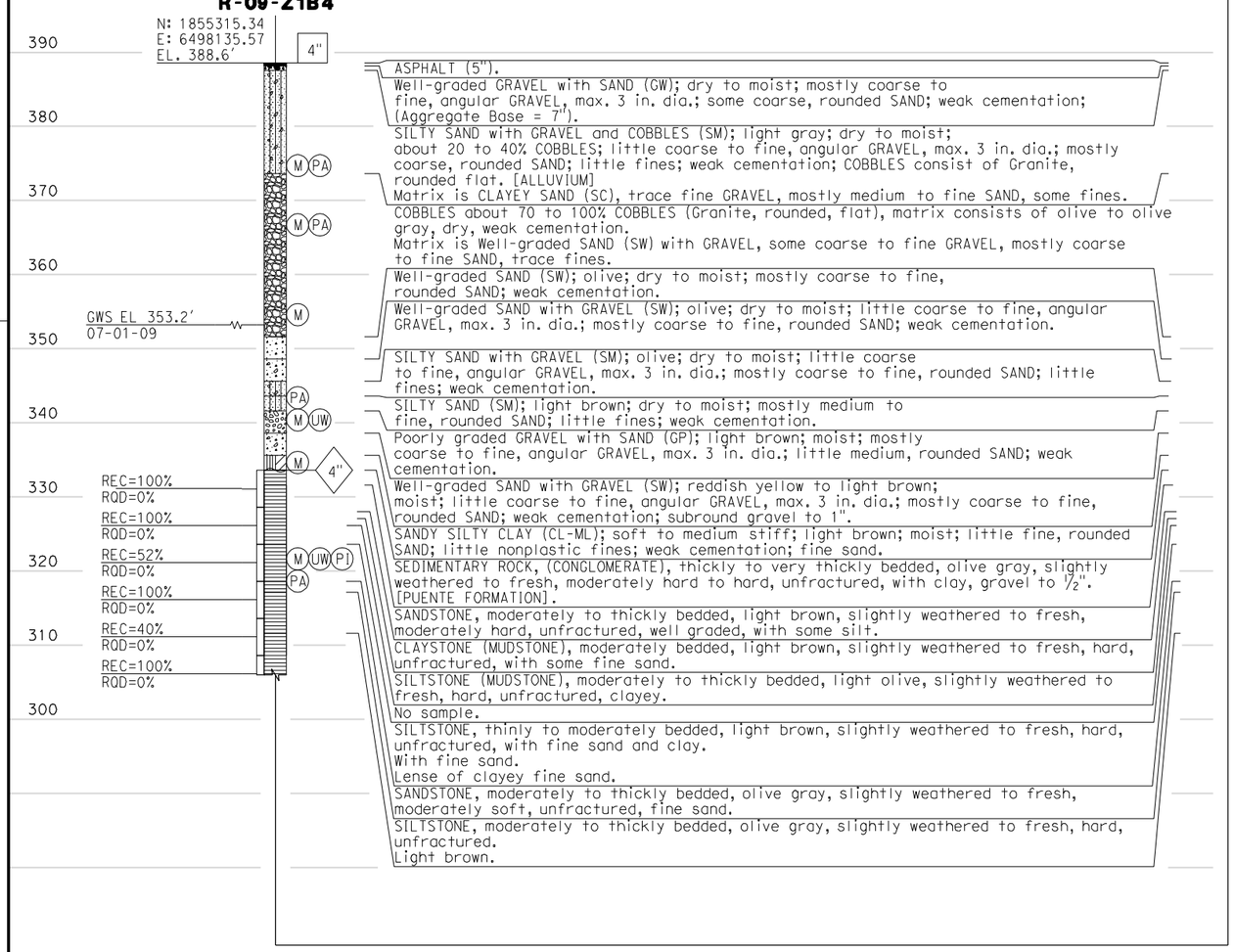
4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 1 of 2.

R-09-Z1B4

N: 1855315.34
E: 6498135.57
EL. 388.6'



ASPHALT (5").
Well-graded GRAVEL with SAND (GW); dry to moist; mostly coarse to fine, angular GRAVEL, max. 3 in. dia.; some coarse, rounded SAND; weak cementation; (Aggregate Base = 7").
SILTY SAND with GRAVEL and COBBLES (SM); light gray; dry to moist; about 20 to 40% COBBLES; little coarse to fine, angular GRAVEL, max. 3 in. dia.; mostly coarse, rounded SAND; little fines; weak cementation; COBBLES consist of Granite, rounded flat. [ALLUVIUM]
Matrix is CLAYEY SAND (SC), trace fine GRAVEL, mostly medium to fine SAND, some fines.
COBBLES about 70 to 100% COBBLES (Granite, rounded, flat), matrix consists of olive to olive gray, dry, weak cementation.
Matrix is Well-graded SAND (SW) with GRAVEL, some coarse to fine GRAVEL, mostly coarse to fine SAND, trace fines.
Well-graded SAND (SW); olive; dry to moist; mostly coarse to fine, rounded SAND; weak cementation.
Well-graded SAND with GRAVEL (SW); olive; dry to moist; little coarse to fine, angular GRAVEL, max. 3 in. dia.; mostly coarse to fine, rounded SAND; weak cementation.
SILTY SAND with GRAVEL (SM); olive; dry to moist; little coarse to fine, angular GRAVEL, max. 3 in. dia.; mostly coarse to fine, rounded SAND; little fines; weak cementation.
SILTY SAND (SM); light brown; dry to moist; mostly medium to fine, rounded SAND; little fines; weak cementation.
Poorly graded GRAVEL with SAND (GP); light brown; moist; mostly coarse to fine, angular GRAVEL, max. 3 in. dia.; little medium, rounded SAND; weak cementation.
Well-graded SAND with GRAVEL (SW); reddish yellow to light brown; moist; little coarse to fine, angular GRAVEL, max. 3 in. dia.; mostly coarse to fine, rounded SAND; weak cementation; subround gravel to 1".
SANDY SILTY CLAY (CL-ML); soft to medium stiff; light brown; moist; little fine, rounded SAND; little nonplastic fines; weak cementation; fine sand.
SEDIMENTARY ROCK, (CONGLOMERATE), thickly to very thickly bedded, olive gray, slightly weathered to fresh, moderately hard to hard, unfractured, with clay, gravel to ½". [PUENTE FORMATION].
SANDSTONE, moderately to thickly bedded, light brown, slightly weathered to fresh, moderately hard, unfractured, well graded, with some silt.
CLAYSTONE (MUDSTONE), moderately bedded, light brown, slightly weathered to fresh, hard, unfractured, with some fine sand.
SILTSTONE (MUDSTONE), moderately to thickly bedded, light olive, slightly weathered to fresh, hard, unfractured, clayey.
No sample.
SILTSTONE, thinly to moderately bedded, light brown, slightly weathered to fresh, hard, unfractured, with fine sand and clay.
With fine sand.
Lense of clayey fine sand.
SANDSTONE, moderately to thickly bedded, olive gray, slightly weathered to fresh, moderately soft, unfractured, fine sand.
SILTSTONE, moderately to thickly bedded, olive gray, slightly weathered to fresh, hard, unfractured.
Light brown.

No sample.
CLAYSTONE, very thinly bedded, dark gray, slightly weathered to fresh, soft, unfractured.
SANDSTONE, thickly bedded, light gray, slightly weathered to fresh, moderately hard to hard, unfractured, silty.
CLAYSTONE, thinly bedded, moderate brown, slightly weathered to fresh, soft, unfractured, dipping 42°.
SILTSTONE, thinly to moderately bedded, light olive gray, slightly weathered to fresh, moderately hard to hard, unfractured, sandy, fine sand.
CLAYSTONE, thinly bedded, moderate brown, slightly weathered to fresh, soft, unfractured, bedding plane separation dipping 62°.
SILTSTONE, moderately to thickly bedded, light olive gray, slightly weathered to fresh, moderately hard to hard, unfractured, sandy, fine sand.
Slightly to very slightly fractured, joint (CL, not healed), dipping 45°.
CLAYSTONE, moderately bedded, light olive gray, slightly weathered to fresh, moderately hard, slightly to very slightly fractured.
SANDSTONE, thickly bedded, light gray, slightly weathered to fresh, moderately hard, slightly to very slightly fractured, fine to medium sand.
No sample.
SANDSTONE, thickly bedded, light olive gray, slightly weathered to fresh, hard, slightly fractured, silty, fine sand, some medium sand.
Joint (CL, not healed), dipping 60°.
No sample.
SANDSTONE, moderately bedded, light olive gray, slightly weathered to fresh, hard, slightly fractured, silty, fine to medium sand.
Dipping 55°.
Soft, joint (CL, not healed), dipping 61°.
No sample.
SANDSTONE, moderately bedded, light olive gray, slightly weathered to fresh, soft, slightly fractured.
Joint (CL, not healed), dipping 54°.
Incipient fracture dipping 90°.
Incipient fracture dipping 67°.
No sample.
SANDSTONE, thickly bedded, light olive gray, slightly weathered to fresh, soft, slightly fractured.
CLAYSTONE, thinly bedded, light brown, slightly weathered to fresh, hard, slightly fractured.
SANDSTONE, moderately to thickly bedded, light gray, slightly weathered to fresh, hard, slightly fractured, silty, fine sand.
Joint (CL, not healed), dipping 42°.
Joint (CL, not healed), dipping 15°.
Joint (CL, not healed), dipping 15°.
Joint (CL, not healed), dipping 15°.
Soft.
No sample.
SANDSTONE, moderately to thickly bedded, light olive gray, slightly weathered to fresh, soft, slightly fractured, silty, fine sand, with some medium sand.
Joint (CL, not healed), dipping 64°.
No sample.

See Sheet 2
FOR CONTINUATION

PROFILE
Vert: 1"=10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES	
FUNCTIONAL SUPERVISOR NAME: SHIVA KARIMI	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: K. BARKER/ M. SALISBURY	
	CHECKED BY: J. PRATT	DATE: 2/12/09 - 2/27/09	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH

BRIDGE NO. N/A
POST MILES N/A

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 1 OF 3

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 1 OF 3

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Kristopher Barker
CERTIFIED ENGINEERING GEOLOGIST DATE

PROFESSIONAL GEOLOGIST
KRISTOPHER P. BARKER
No. CEG 2383
Exp. 8/31/2011
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

PLANS APPROVAL DATE

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

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 1 of 2.

R-09-Z1B4

See Sheet 1 FOR CONTINUATION

270
260
250
240
230

REC=100% RQD=100%
REC=95% RQD=95%
REC=100% RQD=100%
REC=93% RQD=93%
REC=100% RQD=100%
REC=83% RQD=0%
REC=83% RQD=83%
M UW PA

SANDSTONE, moderately bedded, light olive gray, slightly weathered to fresh, soft, slightly fractured, fine sand, some medium sand.
Shear (CL, not healed), dipping 42°, moist, plastic.
Shear (CL, not healed), dipping 63°.
CLAYSTONE, thinly bedded, moderate brown, slightly weathered to fresh, moderately hard to hard, slightly fractured.
SANDSTONE, thinly to moderately bedded, light brown to light olive brown, slightly weathered to fresh, moderately hard to hard, slightly fractured, silty, fine sand.
Shear (CL, not healed), dipping 65°.
Shear (CL, not healed).
Shear (CL, not healed), dipping 62°.
Soft to moderately soft, with some silt.
Dark gray.
CLAYSTONE, thinly bedded, moderate brown, slightly weathered to fresh, soft to moderately soft, slightly fractured.
SANDSTONE, moderately bedded, dark gray, slightly weathered to fresh, soft to moderately soft, slightly fractured.
CLAYSTONE, thinly bedded, moderate brown, slightly weathered to fresh, soft to moderately soft, slightly fractured.
SANDSTONE, thinly to moderately bedded, light gray to dark gray, slightly weathered to fresh, soft to moderately soft, slightly fractured.
Shear (CL, not healed), dipping 15°.
Shear (CL, not healed), dipping 15°.
Light olive gray, silty, fine sand with some medium sand.
Moderately hard to hard.
Light gray.
Extremely hard.
No sample.
SANDSTONE, moderately to thickly bedded, light olive gray, slightly weathered to fresh, extremely hard, slightly fractured, silty, fine sand.
CLAYSTONE, thinly bedded, moderate brown, slightly weathered to fresh, moderately soft, slightly fractured.
SANDSTONE, thinly bedded, light gray, slightly weathered to fresh, moderately soft, slightly fractured, silty, fine sand.
Medium sand with some fine sand.
SILTSTONE, thinly bedded, moderate brown, slightly weathered to fresh, hard to very hard, slightly fractured.
No sample.
SANDSTONE, moderately bedded, light olive gray, slightly weathered to fresh, hard to very hard, slightly fractured, silty, fine sand.
CLAYSTONE, thinly bedded, moderate brown, slightly weathered to fresh, hard to very hard, slightly fractured, sandy, fine sand.

REC=80% RQD=80%
REC=100% RQD=100%
REC=100% RQD=63%
REC=93% RQD=68%
REC=100% RQD=50%
REC=80% RQD=70%
REC=98% RQD=75%
REC=97% RQD=97%
REC=38% RQD=38%
REC=100% RQD=95%
M UW UU
CR PI
M UW SD
UC
M UW EM

230
220
210
200
190
180

SANDSTONE, moderately to thickly bedded, light gray, slightly weathered to fresh, hard to very hard, slightly fractured, silty, medium sand with some fine sand.
No sample.
SANDSTONE, thinly to moderately bedded, light olive gray, slightly weathered to fresh, hard to very hard, slightly fractured.
CLAYSTONE, thinly bedded, moderate brown, slightly weathered to fresh, soft to moderately soft, slightly fractured, shear (CL, not healed), dipping 60°.
SANDSTONE, moderately to thickly bedded, light gray, slightly weathered to fresh, moderately hard to hard, slightly fractured.
CLAYSTONE, thinly bedded, moderate brown, slightly weathered to fresh, soft to moderately soft, slightly fractured.
SANDSTONE, moderately to thickly bedded, light gray, slightly weathered to fresh, moderately hard to hard, slightly fractured, silty, fine sand.
No sample.
SANDSTONE, moderately bedded, light gray, slightly weathered to fresh, moderately hard to hard, slightly fractured, medium sand.
SILTSTONE, thickly to very thickly bedded, moderate brown, slightly weathered to fresh, moderately hard to hard, slightly fractured, sandy, fine sand.
CLAYSTONE, thinly bedded, slightly weathered to fresh, very weak, moderately hard to hard, slightly to very slightly fractured, fractured parallel to bedding.
CLAYSTONE (MUDSTONE), laminated, olive gray to olive black, slightly weathered, moderately soft to moderately hard, slightly fractured, joint (not healed), dipping 45 to 50°, smooth, very thin, no filling, scattered 3" fine sandstone lenses.
SANDSTONE, slightly weathered, very hard, unfractured.
CLAYSTONE (MUDSTONE), laminated, olive gray to olive black, slightly weathered, moderately hard, unfractured.
SANDSTONE, slightly weathered, very hard, unfractured.
SILTSTONE (MUDSTONE), laminated, olive gray to olive black, slightly weathered, moderately hard, slightly fractured, shear dipping 50°, slightly rough, very thin, no filling, 6" fracture zone at 172.8'.
At EL. 213.6 ft, becomes intensely fractured, slightly rough, very thin, no filling.
SANDSTONE, slightly weathered, moderately hard, unfractured.
SILTSTONE (MUDSTONE), laminated, olive gray to olive black, slightly weathered, moderately hard, intensely fractured, slightly rough, very thin, no filling.
At EL. 211.6 ft, becomes moderately fractured, dipping 50°, smooth, no filling.
SANDSTONE, slightly weathered, moderately hard, unfractured.
SILTSTONE (MUDSTONE), laminated, olive gray to olive black, slightly weathered, moderately hard, slightly fractured, dipping 60°, smooth, no filling.
SANDSTONE, fine-grained, massive, dark greenish gray, slightly weathered, moderately hard, unfractured.
At EL. 205.3 ft, observed 2-3" siltstone lense.
At EL. 203.3 ft, becomes soft.
At EL. 199.9 ft, becomes moderately hard.
At EL. 197.6 ft, becomes very hard.
At EL. 196.3 ft, becomes hard.
At EL. 185.9 ft, observed shear, dipping 70°, slickensided, tight. Unit is very weak.
At EL. 185.6 ft, becomes laminated.
SILTSTONE (MUDSTONE), laminated, olive gray, slightly weathered, moderately hard.

See Sheet 3 FOR CONTINUATION

PROFILE
Vert: 1"=10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR	DRAWN BY: EDELYNE MIGUEL	FIELD INVESTIGATION BY: K. BARKER/ M. SALISBURY			DESIGN BRANCH	N/A	LOG OF TEST BORING SHEET 2 OF 3
NAME: SHIVA KARIMI	CHECKED BY: JOSEPH PRATT	DATE: 2/12/09 - 2/27/09				POST MILES N/A	

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 2 OF 3

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Kristopher Barker 3/18/10
CERTIFIED ENGINEERING GEOLOGIST DATE

PROFESSIONAL GEOLOGIST
KRISTOPHER P. BARKER
No. CEG 2383
Exp. 8/31/2011
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

PLANS APPROVAL DATE

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BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29′
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68′ west of the center of the south bound lanes of the freeway, 25′ north of the centerline of Hellman Avenue, 13′ east of the west end of the bridge, 1′ north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
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2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

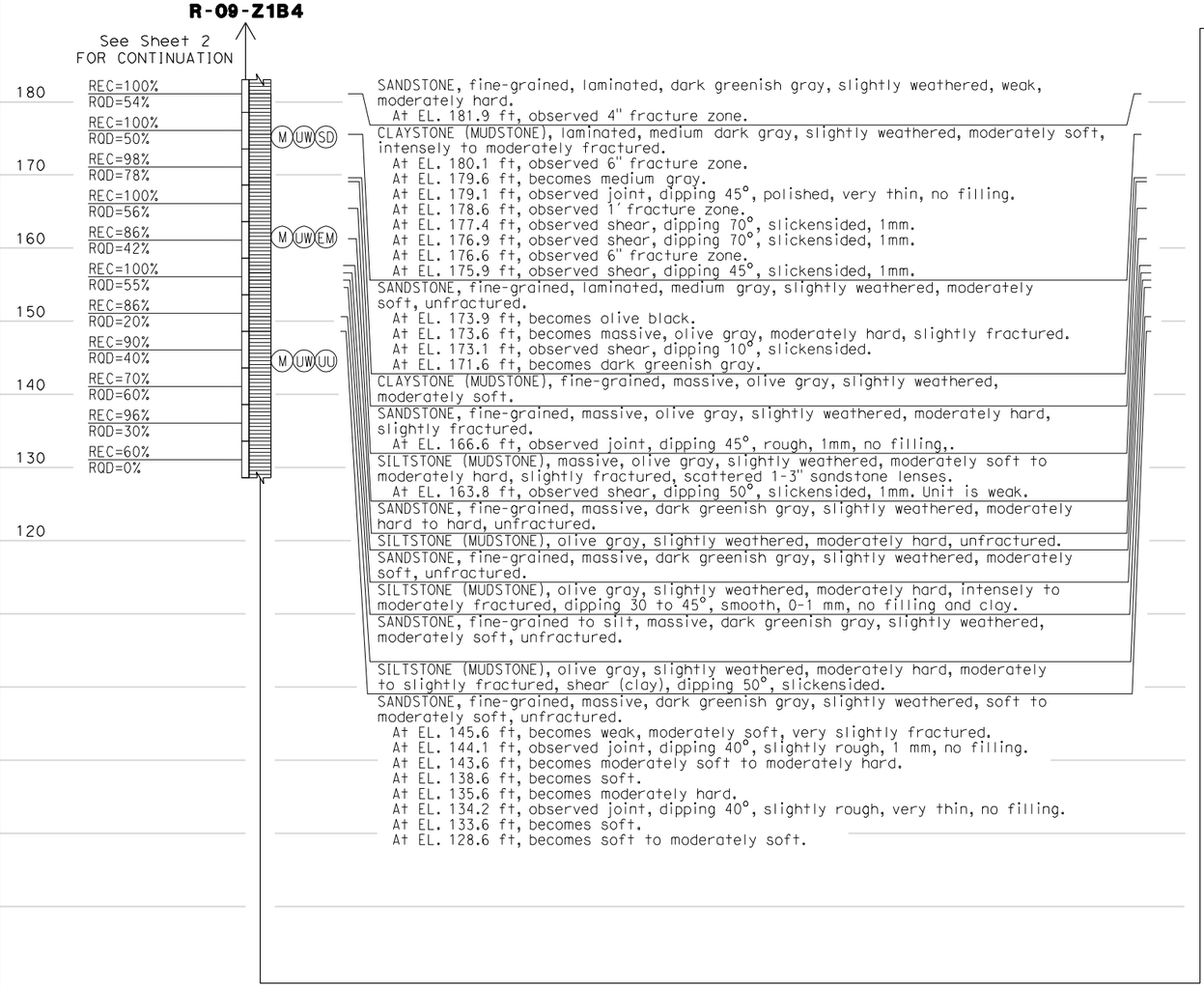
4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

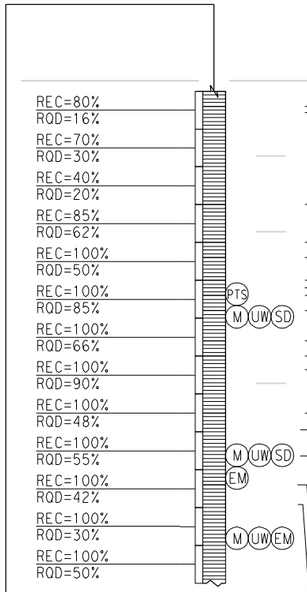
5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 1 of 2.

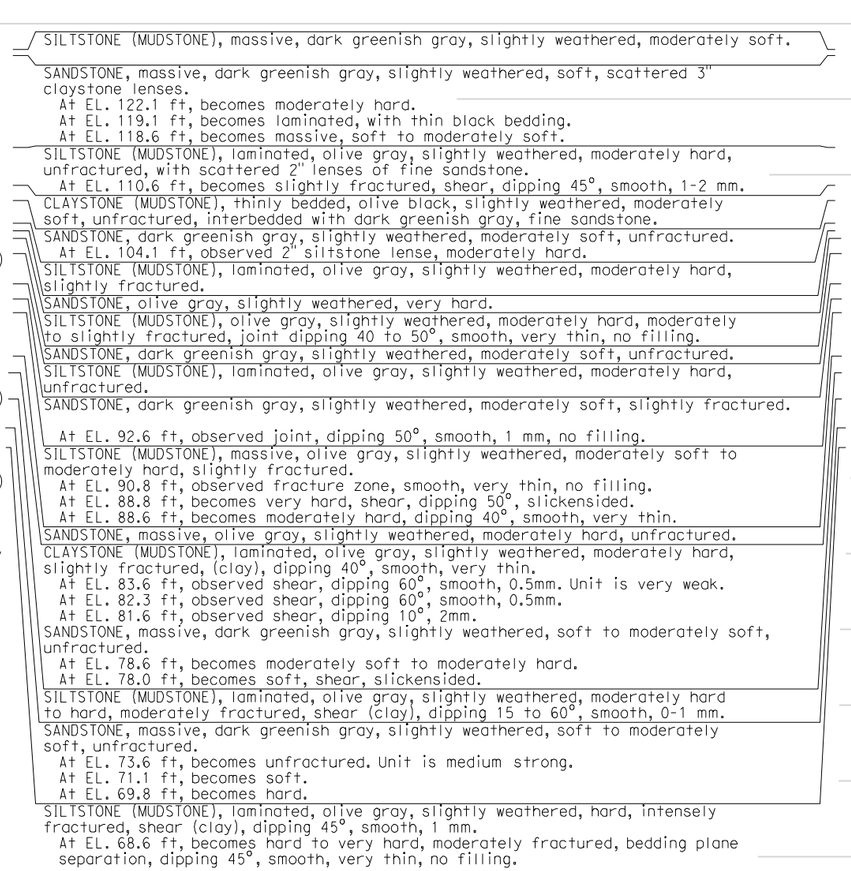
R-09-Z1B4

See Sheet 2 FOR CONTINUATION





02-27-09
Terminated at EL. 63.6′
ER_I = 84%



PROFILE
Vert: 1"=10′

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO. N/A	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR NAME: SHIVA KARIMI	DRAWN BY: EDELYNE MIGUEL	FIELD INVESTIGATION BY: K. BARKER/ M. SALISBURY			DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 3 OF 3
	CHECKED BY: JOSEPH PRATT	DATE: 2/12/09 - 2/27/09					

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 3 OF 3

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29′
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68′ west of the center of the south bound lanes of the freeway, 25′ north of the centerline of Hellman Avenue, 13′ east of the west end of the bridge, 1′ north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

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6) Plan view shown on Boring Location Plan sheet 1 of 2.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

GEOTECHNICAL ENGINEER — 3/18/10 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — GEOTECHNICAL — STATE OF CALIFORNIA

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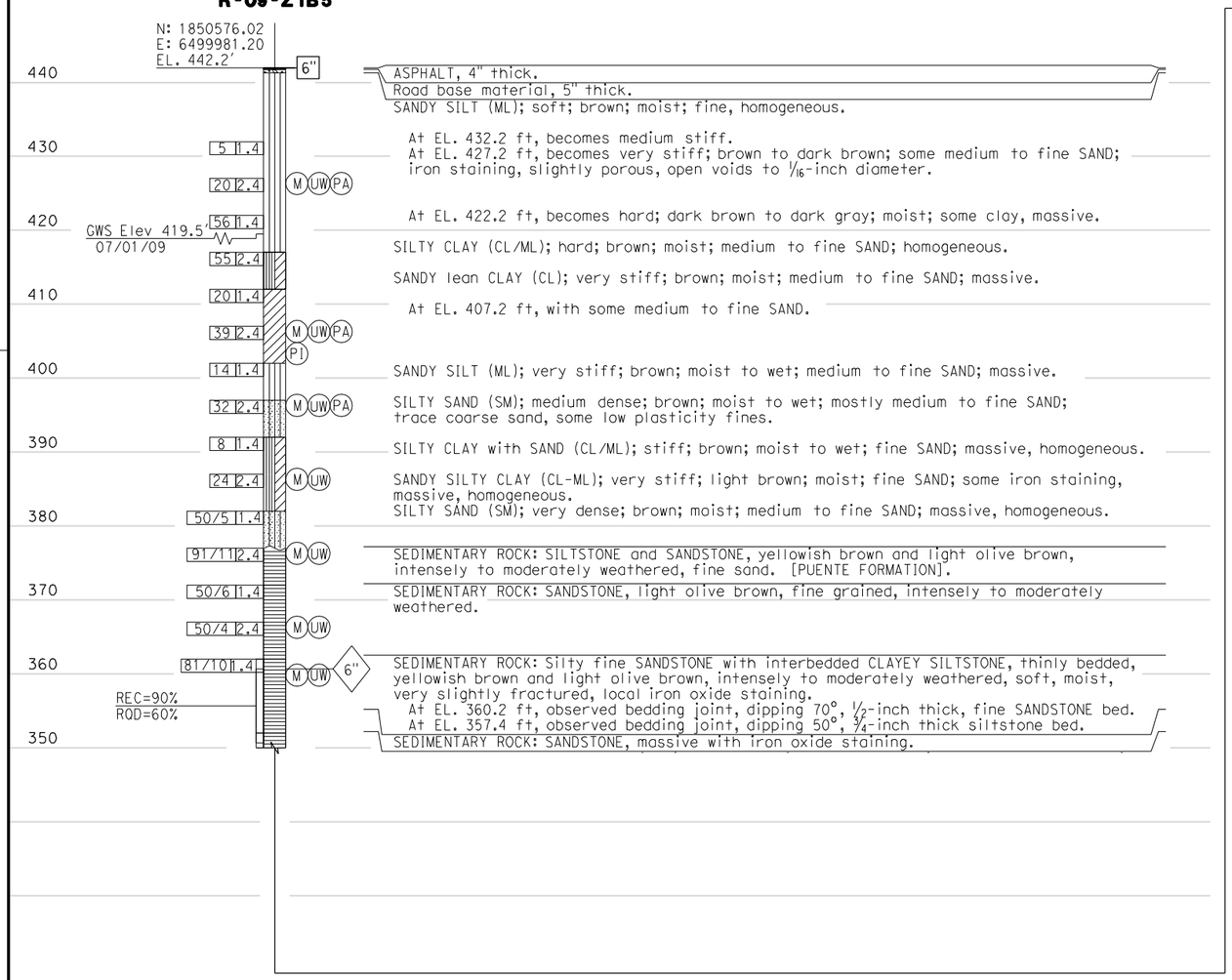
CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

R-09-Z1B5

N: 1850576.02
E: 6499981.20
EL. 442.2′



ASPHALT, 4" thick.
Road base material, 5" thick.
SANDY SILT (ML); soft; brown; moist; fine, homogeneous.

At EL. 432.2 ft, becomes medium stiff.
At EL. 427.2 ft, becomes very stiff; brown to dark brown; some medium to fine SAND; iron staining, slightly porous, open voids to 1/16-inch diameter.

At EL. 422.2 ft, becomes hard; dark brown to dark gray; moist; some clay, massive.

SILTY CLAY (CL/ML); hard; brown; moist; medium to fine SAND; homogeneous.

SANDY lean CLAY (CL); very stiff; brown; moist; medium to fine SAND; massive.

At EL. 407.2 ft, with some medium to fine SAND.

SANDY SILT (ML); very stiff; brown; moist to wet; medium to fine SAND; massive.

SILTY SAND (SM); medium dense; brown; moist to wet; mostly medium to fine SAND; trace coarse sand, some low plasticity fines.

SILTY CLAY with SAND (CL/ML); stiff; brown; moist to wet; fine SAND; massive, homogeneous.

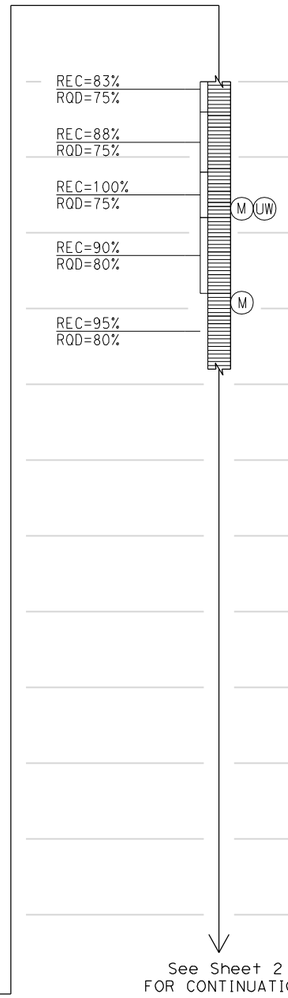
SANDY SILTY CLAY (CL-ML); very stiff; light brown; moist; fine SAND; some iron staining, massive, homogeneous.
SILTY SAND (SM); very dense; brown; moist; medium to fine SAND; massive, homogeneous.

SEDIMENTARY ROCK: SILTSTONE and SANDSTONE, yellowish brown and light olive brown, intensely to moderately weathered, fine sand. [PUENTE FORMATION].

SEDIMENTARY ROCK: SANDSTONE, light olive brown, fine grained, intensely to moderately weathered.

SEDIMENTARY ROCK: Silty fine SANDSTONE with interbedded CLAYEY SILTSTONE, thinly bedded, yellowish brown and light olive brown, intensely to moderately weathered, soft, moist, very slightly fractured, local iron oxide staining.
At EL. 360.2 ft, observed bedding joint, dipping 70°, 1/2-inch thick, fine SANDSTONE bed.
At EL. 357.4 ft, observed bedding joint, dipping 50°, 3/4-inch thick siltstone bed.

SEDIMENTARY ROCK: SANDSTONE, massive with iron oxide staining.



SEDIMENTARY ROCK: SILTSTONE with interbedded fine SANDSTONE, olive gray to pale yellowish brown, laminated to thinly bedded, occasional diatomaceous laminations to 3/8-inch thick.
At EL. 347.2 ft, observed bedding joint, dipping 40°.

SEDIMENTARY ROCK: SANDSTONE, fine to medium grained, massive, pale yellowish brown, intensely to moderately weathered.
At EL. 344.7 ft, observed fault, dipping 70°, polished with paper thin clay lining, juxtaposes SANDSTONE above with laminated SILTSTONE below.

SEDIMENTARY ROCK: SILTSTONE with interbedded DIATOMACEOUS SILTSTONE, thinly bedded, olive gray.

SEDIMENTARY ROCK: SANDSTONE, fine to medium grained, pale yellowish brown, bedding joint, dipping 55°, Upper 1" to 2" of bed is black, pale yellowish brown below.

SEDIMENTARY ROCK: Interbedded SILTSTONE, CLAYEY SILTSTONE and DIATOMACEOUS SILTSTONE, laminated to very thinly bedded, olive gray, intensely to moderately weathered, soft to moderately soft, very slightly fractured to unfractured.

SEDIMENTARY ROCK: SANDSTONE, fine to medium grained, pale yellowish brown, moderately soft, oxidized.

SEDIMENTARY ROCK: SILTSTONE as EL. 338.7 ft, bedding joint, dipping 50°.

SEDIMENTARY ROCK: SANDSTONE, fine to medium grained, pale yellowish brown.

SEDIMENTARY ROCK: SILTSTONE, as EL. 338.5 ft.

SEDIMENTARY ROCK: SANDSTONE, fine grained, pale yellowish brown, in upper 6", black from EL. 332.7 ft to 332.2 ft.

SEDIMENTARY ROCK: Interbedded SILTSTONE, fine SANDSTONE and DIATOMACEOUS SILTSTONE, thinly bedded, olive gray to pale yellowish brown, intensely to moderately weathered.

SEDIMENTARY ROCK: SANDSTONE, fine to medium grained, massive, bedding joint, dipping 30°, bedding shallows, 60° dip at EL. 330.2 ft, 30° at EL. 329.7 ft at top of SANDSTONE bed. Beds pinch and swell.

SEDIMENTARY ROCK: SILTSTONE as EL. 338.5 ft, bedding joint, dipping 50°.

SEDIMENTARY ROCK: SANDSTONE, fine to medium grained, with irregular, undulatory laminations, possible soft sediment deformation. Possible charcoal fleck, 1/8-inch diameter at EL. 325.8 ft.

SEDIMENTARY ROCK: SILTSTONE as EL. 338.5 ft, grading to black (becoming unoxidized), bedding joint, dipping 55°.

SEDIMENTARY ROCK: SILTSTONE with interbedded fine SANDSTONE, thinly bedded, black to grayish blue, moderately weathered, moderately soft, very slightly fractured.
At EL. 322.0 to 310.5 ft, observed highly disturbed and folded rock, 1.5-foot thick disturbed SILTSTONE and SANDSTONE.
At EL. 321.2 ft, observed bedding joint, dipping 45°.

SEDIMENTARY ROCK: SANDSTONE, fine grained, thickly bedded light olive brown, moderately weathered, very soft to soft; beds dipping 25° to vertical, continuous, folded.
At EL. 314.0 ft, bedding joint, dipping 60°, 3-inch thick SANDSTONE bed.

See Sheet 2
FOR CONTINUATION

PROFILE
Vert: 1"=10′

DEREK HIGA DESIGN OVERSIGHT ENGINEER	DRAWN BY:	EDELYNE MIGUEL	D. JANKLY FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MAHESWARAN RAVEENDRA PROJECT ENGINEER	BRIDGE NO. N/A	SR-710 TUNNEL TECHNICAL STUDY
SIGN OFF DATE	CHECKED BY:	DAN JANKLY	DATE: 2/16/09 - 2/24/09			POST MILES	LOG OF TEST BORING SHEET 1 OF 4

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET 1 OF 4

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

GEOTECHNICAL ENGINEER — DATE 3/18/10

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
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Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
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Pt 0153 N1845410.50, E6509860.21,
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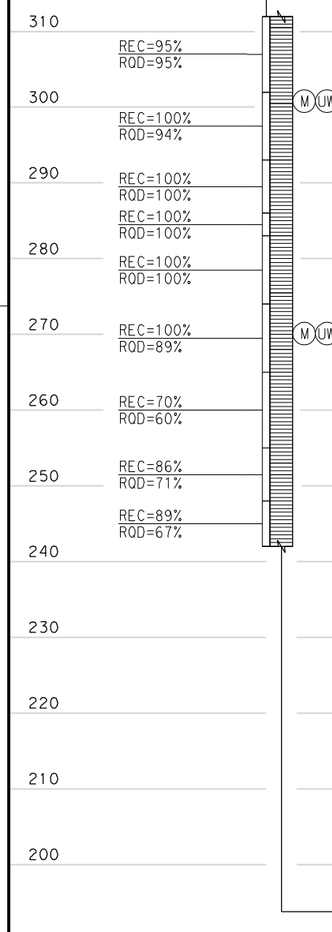
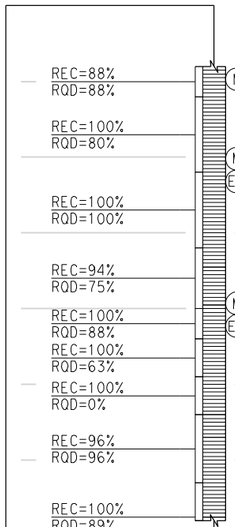
6) Plan view shown on Boring Location Plan sheet 1 of 2.

R-09-Z1B5

See Sheet 1 FOR CONTINUATION



At EL. 310.7 ft, bedding joint, dipping 50°.
At EL. 308.2 ft, observed bedding joint, dipping 50°, olive brown above, black below.
At EL. 302.2 ft, becomes fine to medium grained, some soft sediment deformation.
SEDIMENTARY ROCK: Interbedded SILTSTONE and fine SANDSTONE, very thinly bedded, dark greenish gray to dark bluish gray, fresh, moderately soft to moderately hard, slightly fractured, sandstone beds pinch and swell.
At EL. 299.2 ft, observed bedding joint, dipping 60°.
At EL. 297.5 ft, observed 6-inch thick SILTSTONE bed, intensely fractured.
At EL. 293.6 ft, observed bedding joint, dipping 55°, faint black lamination.
At EL. 293.2 ft, observed SEDIMENTARY ROCK: Interbedded SILTSTONE and fine SANDSTONE,
At EL. 292.2 ft, observed bedding joint, dipping 45°.
At EL. 290.2 ft, observed 6-inch thick SANDSTONE bed, depositionally irregular contact at base.
At EL. 288.9 ft, observed SANDSTONE bed, fine grained, with numerous siltstone rip-up clasts dipping parallel to bedding. Possible charcoal flecks at base of bed.
At EL. 286.2 ft, observed bedding joint, dipping 60°, Decreasing SILTSTONE.
At EL. 283.7 ft, observed bedding joint, dipping 50°.
SEDIMENTARY ROCK: SANDSTONE with occasional SILTSTONE beds and rip-up clasts, sand is fine to medium grained.
At EL. 281.2 ft, observed bedding joint, dipping 45°, SILTSTONE with interbedded SANDSTONE.
At EL. 279.9 ft, becomes SANDSTONE with some SILTSTONE rip-up clasts at top.
SEDIMENTARY ROCK: Interbedded SILTSTONE and fine SANDSTONE, as EL. 293.0 ft.
At EL. 274.6 ft, observed 0.4' thick cemented fine SANDSTONE bed, moderately hard, bedding dipping 45° at base.
At EL. 270.8 ft, observed Silty fine to medium grained SANDSTONE with siltstone rip-up clasts. Unit is very weak.
At EL. 269.2 ft, observed shear, vertical juxtaposes SANDSTONE and SILTSTONE. Material highly disturbed as EL. 268.5 ft.
SEDIMENTARY ROCK: SANDSTONE, thickly bedded to very thickly bedded, dark greenish gray, fresh, soft to moderately soft, slightly fractured, very moist, bedding joint, dipping 50°, on black SANDSTONE laminations.
At EL. 265.2 ft, becomes Silty fine SANDSTONE, occasional cross beds.
At EL. 262.2 ft, observed bedding joint, dipping 35°, SANDSTONE bed, 5-inches thick, very hard, fine to medium grained.
At EL. 258.7 ft, observed SANDSTONE bed, 5-inches thick, very hard, fine to medium grained, joint in center, tight, rough, dipping 60-70°.
At EL. 255.2 ft, becomes fine to medium grained.
SEDIMENTARY ROCK: SILTSTONE, laminated, dipping 40°, Bed offset (reverse)2.5-inches by tight fault with fine sand lining. Fault dipping 60°.
At EL. 252.2 ft, observed Fault, undulatory, roughly 30° dip, tight, polished, striated along strike, unknown offset.
SEDIMENTARY ROCK: SANDSTONE, thickly bedded to very thickly bedded, dark greenish gray, fresh, soft to moderately soft, slightly fractured, very moist, bedding joint, dipping 50 to 30°, cross bedded.
At EL. 248.2 ft, becomes Silty fine SANDSTONE.
At EL. 247.7 ft, observed bedding joint, dipping 45°, locally fractured, joints dipping 70°, 30°, and 20°.
At EL. 246.2 ft, becomes very thickly bedded to massive, bedding joint, dipping 40°, on 1/8-inch thick SILTSTONE bed.
At EL. 245.7 ft, observed bedding joint, dipping 20°, tight, faint, no lining.
At El. 242.2 ft, becomes very thickly bedded, locally laminated, soft.
At EL. 241.2 ft, observed bedding joint, dipping 45°, on 1/8-inch thick SILTSTONE lens.



At EL. 238.2 ft, observed moderately soft to hard, 6-inch thick section of silt fine SANDSTONE.
At EL. 236.9 ft, observed bedding joint, dipping 30°, very faint, cemented SANDSTONE lamination.
At EL. 236.2 ft, becomes moderately soft.
At EL. 235.2 ft, becomes soft, massive SANDSTONE.
At EL. 233.9 ft, observed fault, dipping 30°, truncates 1/8-inch thick SILTSTONE lamination, fault has 1/8-inch thick brown, slightly clayey gouge, unknown offset.
At EL. 233.2 ft, observed fault, dipping 50°, 1/8-inch thick, brown, slightly clayey gouge, unknown offset.
At EL. 231.2 ft, becomes moderately soft, bedding joint, dipping 40°, faint SANDSTONE lamination.
At EL. 230.2 ft, becomes moderately soft to moderately hard, massive SANDSTONE, medium strong.
At EL. 229.7 ft, becomes soft to moderately soft, joint, dipping 60°, tight, planar, no lining.
SEDIMENTARY ROCK: SANDY SILTSTONE, laminated, bedding joint, dipping 45°.
At EL. 219.2 ft, observed 4-inch thick interbedded SILTSTONE and fine SANDSTONE, depositionally chaotic, folded, sandstone to 6" below has siltstone rip-ups.
At EL. 216.2 ft, observed fault, dipping 70°, tight, no lining, silty fine SANDSTONE above and fine to medium SANDSTONE below.
SEDIMENTARY ROCK: Interbedded SILTSTONE and fine sandy SILTSTONE, thinly to moderately bedded, moderately soft to moderately hard, local beds with soft sediment deformation, pinch, swell and folded.
At EL. 211.2 ft, observed to be very weak, bedding joint dipping 55°.
SEDIMENTARY ROCK: Silty SANDSTONE, bedding joint, dipping 55°.
SEDIMENTARY ROCK: SILTSTONE with interbedded fine SANDSTONE.
At EL. 209.7 ft, observed bedding joint, dipping 60°.
At EL. 209.2 ft, observed shear, dipping 30°, slightly polished, below is roughly 1.5 thick silty fine sandstone bed with soft sediment deformation (tightly folded siltstone beds, rip-ups).
At EL. 207.2 ft, observed fault, dipping 70°, 1-inch to 2-inch thick gouge zone of intensely fractured SILTSTONE and soft SANDSTONE, material highly disturbed adjacent to fault.
At EL. 202.2 ft, observed bedding, dipping 50°, locally slightly brittle, intensley fractured.
At EL. 200.7 ft, observed bedding joint, dipping 60°, material highly broken, fragments are moderately hard.
SEDIMENTARY ROCK: Interbedded SILTSTONE and fine SANDSTONE, laminated to thinly bedded.
At EL. 195.7 ft, observed bedding joint, dipping 50°.
At EL. 194.7 ft, observed joint, dipping 55°, conjugate to bedding.
SEDIMENTARY ROCK: Silty fine SANDSTONE, beds highly folded above contact, soft sediment deformation.
At EL. 192.2 ft, observed fault, dipping 70°, very tight, striated perpendicular to dip, unknown offset, 2" thick SILTSTONE fragment observed adjacent to fault.
At EL. 188.3 ft, observed bedding joint, dipping 55°, on 4" thick SILTSTONE bed.
At EL. 187.4 ft, observed 1.5' thick laminated SILTSTONE bed.
At EL. 184.2 ft, observed shear, dipping 40 to 0°, undulatory, 1/8-inch thick, soft clay lining.
SEDIMENTARY ROCK: SILTSTONE, laminated, bedding joint, dipping 50°, on contact to SILTSTONE.
At EL. 181.2 ft, observed bedding joint, dipping 60°, Some interbedded fine SANDSTONE.

See Sheet 3 FOR CONTINUATION

PROFILE
Vert: 1"-10'

DEREK HIGA DESIGN OVERSIGHT ENGINEER	DRAWN BY:	EDELYNE MIGUEL	D. JANKLY FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MAHESWARAN RAVEENDRA PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY:	DAN JANKLY	DATE: 2/16/09 - 2/24/09		

BRIDGE NO. N/A
POST MILES N/A

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 2 OF 4

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 2 OF 4

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

GEOTECHNICAL ENGINEER — 3/18/10 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — 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.

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
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2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 1 of 2.

R-09-Z1B5

See Sheet 2 FOR CONTINUATION

180
170
160
150
140
130
120

REC=100% RQD=67% — M UW UU

SEDIMENTARY ROCK: SANDSTONE, fine to medium grained, very thickly bedded, dark bluish gray, fresh, very weak, moderately soft to moderately hard, very slightly fractured, bedding joint, dipping 55°, on contact to SANDSTONE.
At EL. 177.8 ft, observed bedding joint, dipping 55°, on 6" thick section of SILTSTONE with interbedded fine SANDSTONE, laminated to thinly bedded.
At EL. 177.4 ft, observed SANDSTONE laminations with abundant black detritus.

REC=100% RQD=100%
REC=93% RQD=93%

SEDIMENTARY ROCK: SILTSTONE, laminated, local soft sediment deformation, bedding joint, dipping 55°.
SEDIMENTARY ROCK: SANDSTONE, fine to medium grained, very thickly bedded, dark bluish gray.
At EL. 171.2 ft, becomes soft, saturated, some black staining.
At EL. 169.0 ft to 160.1 ft, Pressuremeter test.
At EL. 160.2 ft, observed bedding joint, dipping 55°, 1-inch thick SILTSTONE lamination. Material is locally cemented, hard.
At EL. 157.6 ft, observed joint, dipping 90 to 60°, numerous irregular, black lined joints, tight.

REC=100% RQD=95%

SEDIMENTARY ROCK: SANDSTONE with some interbedded SILTSTONE, thickly to very thickly bedded, sandstone is dark bluish gray, siltstone is dark greenish gray, fresh, moderately soft to moderately hard, slightly fractured.
Sandstone is fine to coarse.
At EL. 155.4 ft, observed bedding joint, dipping 60°, on 5" thick CLAYEY SILTSTONE bed. Rock to 6-inches below is depositionally chaotic mix of SILTSTONE and SANDSTONE.
At EL. 153.2 ft, observed 4" thick cemented SANDSTONE bed, hard.
At EL. 150.8 ft, observed bedding joint, dipping 50°, 2" thick SILTSTONE bed. Some rip-up clasts below.
At EL. 148.4 ft, observed bedding joint, dipping 60°, 8" thick brown SILTSTONE sequence with some internal light gray fine SANDSTONE laminations.

REC=90% RQD=89%

SEDIMENTARY ROCK: Interbedded SILTSTONE and fine SANDSTONE, laminated to thinly bedded, some soft sediment deformation, local rip-ups and beds that pinch and swell, bedding joint, dipping 60°.
At EL. 139.0 ft, observed shear, dipping 40 to 20°, 1/2-inch normal offset, tight.

REC=100% RQD=100% — M UW UL

SEDIMENTARY ROCK: SANDSTONE with some interbedded SILTSTONE, thickly to very thickly bedded, sandstone is dark bluish gray, siltstone is dark greenish gray, fresh, moderately soft to moderately hard, slightly fractured. Sandstone is fine to coarse, bedding joint, dipping 60°.
SEDIMENTARY ROCK: SANDSTONE, thickly to very thickly bedded, dark bluish gray, fresh, moderately soft to moderately hard, slightly fractured, fine to medium grained.
At EL. 131.2 ft, observed bedding joint, dipping 55°, 3-inch thick SILTSTONE sequence, beds are locally polished along bedding planes.
At EL. 130.7 ft, observed bedding joint, dipping 55°, faint tight shear with 3/8-inch reverse offset.
At EL. 129.2 ft, observed to be very weak.
At EL. 126.2 ft, observed bedding joint, dipping 55°, 2-inch thick laminated SILTSTONE bed. Material is soft to moderately soft.
At EL. 121.2 ft, observed light brown, joint, dipping 50°, faint, 1/8-inch thick, moist, silty clay lining.

REC=63% RQD=63% — M UW UC EM

At EL. 119.6 ft, observed to be weak.
At EL. 115.2 ft to EL. 107.7 ft, observed numerous shears, dipping 20° to 90°; typically 1/16-inch thick, silt lined, unknown offsets.

REC=100% RQD=58%

At EL. 113.0 ft, observed bedding joint, dipping 60 to 50°, 3-inches thick, laminated, faulted SILTSTONE bed, 1/2-inch reverse offset by shear dipping 50 to 30°, 1/16-inch thick, silt lined.

REC=100% RQD=100%

At EL. 109.7 ft, observed bedding joint, dipping 90 to 0°, folded and overturned laminations.
At EL. 106.7 ft, observed scour mark with siltstone rip-ups below.
At EL. 106.5 ft, observed bedding joint, dipping 60°, 6" thick CLAYEY SILTSTONE bed, brown, very faintly laminated.
At EL. 101.5 ft to 95.0 ft, Pressuremeter test.
At EL. 95.7 ft, becomes soft to moderately soft.

REC=20% RQD=20%
REC=94% RQD=94% — M SD

SEDIMENTARY ROCK: Interbedded SILTSTONE and fine SANDSTONE.
At EL. 90.2 ft, observed bedding joint, dipping 60°, local siltstone rip-ups.
SEDIMENTARY ROCK: SANDSTONE, thickly to very thickly bedded, gray, fresh, soft to moderately soft, slightly fractured, fine to medium grained.

REC=80% RQD=80%

SEDIMENTARY ROCK: SANDSTONE, massive, well cemented, irregular, undulatory contact.
At EL. 81.1 ft, observed joint, dipping 60°, black lining, rough.
SEDIMENTARY ROCK: Interbedded SILTSTONE and fine SANDSTONE, highly sheared, bedding joint, dipping 60°.
At EL. 79.2 ft, observed bedding joint, dipping 70°, material is folded and faulted, unknown offset, tight, tight massive, moderately fractured. Fine grained sandstone below.

REC=92% RQD=77%
REC=94% RQD=88% — M UW UU

SEDIMENTARY ROCK: SANDSTONE, thickly to very thickly bedded, gray, fresh, soft to moderately soft, slightly fractured, fine to medium grained, shear, dipping 40 to 30°, faint sheers, tight silty lining.
At EL. 76.7 ft, observed shear, dipping 70°, faint shear 1/8-inch thick brown silty clay lining, within soft, very moist sandstone.

REC=100% RQD=100%

SEDIMENTARY ROCK: SANDY SILTSTONE sequence, soft, moist, massive, locally sheared.
At EL. 72.5 ft, observed bedding joint, dipping 60°, on 3/4-inch thick SILTSTONE bed.
At EL. 72.2 ft, observed Silty fine SANDSTONE, gray, very weak, moderately soft.
At EL. 70.7 ft, grades to fine to medium grained SANDSTONE, moderately soft to moderately hard.
At EL. 66.0 ft, observed 3-inch thick cemented SANDSTONE bed, hard.
At EL. 65.2 ft, observed bedding joint, dipping 55°, 0.3' thick SILTSTONE bed, 1.5" thick, 4" long rip-up clast below.
At EL. 64.9 ft, grades to fine grained SANDSTONE, moist, moderately soft to moderately hard.
At EL. 60.8 ft, observed bedding joint, dipping 60°, on 1-inch thick SILTSTONE bed, fractured, consistent sandstone above and below.

REC=53% RQD=47%

SEDIMENTARY ROCK: Interbedded SILTSTONE and fine SANDSTONE, laminated to thinly bedded, fault, dipping 90 to 80°, three subparallel faults with roughly 3" total reverse offset, paper thin black clay lining, adjacent bedding dipping 60°.
At EL. 56.7 ft, observed bedding joint, dipping 50°, SANDSTONE bed truncated by fault above, beds are locally folded to EL. 56.0 ft.
At EL. 55.2 ft, observed bedding joint, dipping 50°, 1/8" thick SILTSTONE bed truncated by fault dipping 50°. Fault is tight with paper thin clay lining. Locally intensely fractured.
At EL. 50.0 ft to 43.0 ft, Pressuremeter Test.

120
110
100
90
80
70
60
50
40

See Sheet 4 FOR CONTINUATION

PROFILE
Vert: 1"-10'

DEREK HIGA DESIGN OVERSIGHT ENGINEER	DRAWN BY:	EDELYNE MIGUEL	D. JANKLY FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MAHESWARAN RAVEENDRA PROJECT ENGINEER	BRIDGE NO. N/A POST MILES N/A	SR-710 TUNNEL TECHNICAL STUDY
SIGN OFF DATE	CHECKED BY:	DAN JANKLY	DATE: 2/16/09 - 2/24/09				LOG OF TEST BORING SHEET 3 OF 4

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 3 OF 4

FILE => $REQUEST

DATE PLOTTED => $DATE TIME PLOTTED => $TIME
USERNAME => $USER

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

GEOTECHNICAL ENGINEER — DATE 3/18/10

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — 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.

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
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2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

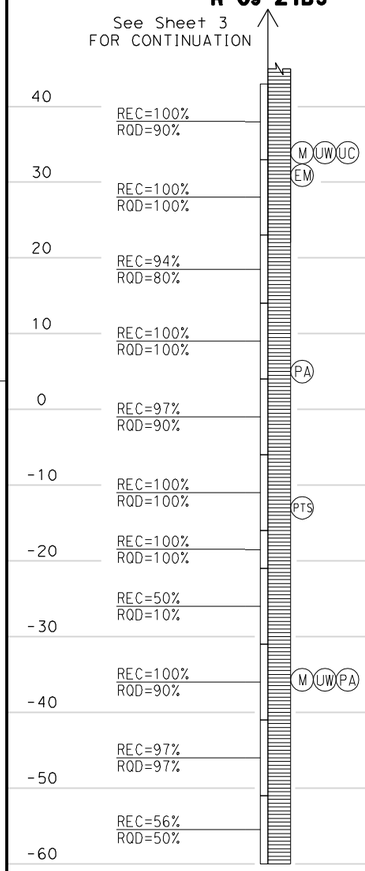
4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 1 of 2.

R-09-Z1B5

See Sheet 3 FOR CONTINUATION



SEDIMENTARY ROCK: SANDSTONE, thickly to very thickly bedded, gray, fresh, soft to moderately soft, slightly fractured, fine to coarse grained, shear, dipping 60 to 55°, tight, light gray silty lining.
At EL. 42.2 ft, observed bedding joint, dipping 65 to 55°, on dark gray SANDSTONE lamination.
At EL. 40.3 ft to EL. 23.0 ft, observed numerous shears, dipping 20° to 70°; typically tight, with 1/16-inch to 1/4-inch thick light gray silty lining.
At EL. 36.7 ft, becomes moderately soft to moderately hard.
At EL. 35.2 ft, becomes soft.
At EL. 34.2 ft, becomes weak, moderately hard.
At EL. 34.0 ft, observed bedding joint, dipping 55°, 3" thick sequence of interbedded SILTSTONE and SANDSTONE, faulted, intensely fractured.
At EL. 28.2 ft, observed numerous SILTSTONE fragments, juxtaposed to massive SANDSTONE.
At EL. 26.9 ft, observed SANDSTONE, dark bluish gray, fine grained, moist.
SEDIMENTARY ROCK: SANDSTONE with some interbedded SILTSTONE, massive to thickly bedded, dark bluish gray, fresh, moderately soft, moist to saturated. Sand is fine to medium grained.
At EL. 12.2 ft, observed fresh, moderately soft.
At EL. 10.2 ft, observed bedding joint, dipping 65°, on 2-inch thick SILTSTONE bed, SANDSTONE to 1.2' below is soft, tightly folded, soft sediment deformation.
At EL. 6.7 ft, observed shear, dipping 20°, faint, tight gray silty lining.
At EL. -1.6 ft, observed bedding joint, dipping 65°, Siltstone rip-up clasts to 1-inch thick, some fine SANDSTONE laminations below are depositionally folded.
SEDIMENTARY ROCK: SANDSTONE, massive, dark bluish gray, fresh, moderately soft, moist to saturated. Sand is fine to medium grained.
At EL. -4.3 ft, observed bedding joint, dipping 70°, 2-inch thick SILTSTONE bed.
At EL. -5.8 ft, grades to SILTY fine SANDSTONE, as above.
At EL. -8.6 ft, observed bedding joint, dipping 50°, 1/2-inch to 1-inch thick SILTSTONE bed, offset 3/4-inch by two shears which are very faint, no lining, dipping 40 and 50°.
At EL. -13.0, PTS: Coarse-grained granitic arkosic SANDSTONE with crystal and rock fragments up to 3mm in size, in a predominantly calcite matrix (50%).
At EL. -12.8 ft, observed 7" thick SANDSTONE bed, moderately hard.
At EL. -13.5 ft, observed bedding joint, dipping 60°, on silty bed at base of cemented SANDSTONE above.
At EL. -14.4 ft to EL. -23.8 ft, observed numerous shears, dipping 15° to 55°, typically with 1/16" to 1/8" thick silty lining.
At EL. -17.8 ft, observed possible bedding plane (dipping 60°) on contact from fine to medium grained SANDSTONE above to fine SANDSTONE below, faint.
At EL. -40.8 ft to EL. -58.4, observed numerous shears, dipping 70 to 10°, typically faint, with up to 1/4" thick clay lining.
At EL. -42.3 ft, observed possible bedding (dipping 65°) on black sand bed which pinches out.
At EL. -44.3 ft, Unit grades to Silty fine SANDSTONE, gray, massive, soft, moist.
At EL. -46.3 ft, observed fault, dipping 55°, clay lined to 1/16" thick, 1" reverse offset of 1" thick SILTSTONE bed dipping 50°.
At EL. -48.8 ft, observed bedding joint, dipping 55°, on 3/4-inch thick laminated SILTSTONE and fine SANDSTONE bed.
At EL. -50.8 ft, becomes very soft.
At EL. -54.8 ft, observed 3.5" thick SANDSTONE bed, hard. Below is SANDSTONE, greenish gray to gray, very soft to soft, fine to medium grained, moist to very moist.

02-24-09
Terminated at
EL. -59.8'
ER_f = 70%

PROFILE
Vert: 1"-10'

DEREK HIGA, DESIGN OVERSIGHT ENGINEER	DRAWN BY:	EDELYNE MIGUEL	D. JANKLY, FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MAHESWARAN RAVEENDRA, PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY:	DAN JANKLY	DATE: 2/16/09 - 2/24/09		

BRIDGE NO. N/A — POST MILES N/A

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 4 OF 4

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 4 OF 4

FILE => $REQUEST

DATE PLOTTED => $DATE TIME PLOTTED => $TIME USERNAME => $USER

BENCHMARK:

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Pt 0617 N1858044.3, E6491094.23.

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6) Plan view shown on Boring Location Plan sheet 1 of 2.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

GEOTECHNICAL ENGINEER — 3/18/10 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — 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.

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

R-09-Z1B6

N: 1852836.59
E: 6503970.85
EL. 447.2'

6" ASPHALT, 6" thick
Road base material, 6" thick

SANDY SILT (ML); medium stiff; dark brown; moist; fine SAND; few fine GRAVEL; low to medium plasticity fines.

CLAYEY SAND (SC); medium dense; olive yellow; moist; fine SAND; medium plasticity fines.

No Recovery.

GWS Elev 425.7' 07/01/09

SANDY SILT (ML); very stiff; brown mottled with olive gray; moist; fine SAND; low plasticity fines.
dark brown; trace mica.

Lean CLAY (CL); very stiff; dark brown mottled with olive gray; moist; trace mica.

Hard.

Sandy.

SILTY SAND (SM); dense; olive yellow; moist; fine SAND; low plasticity fines; trace mica.

SILTY CLAY with SAND (CL-ML); hard; olive yellow; moist; fine SAND; low plasticity fines; trace mica.

SANDY SILT (ML); hard; olive yellow; moist; fine SAND; low plasticity fines.

SEDIMENTARY ROCK: (SANDY SILTSTONE), massive, light olive mottled with greenish gray, decomposed, very soft, unfractured, friable, no reaction to diluted HCL, micaceous, decreasingly weathered with depth. (SANDY SILT (ML), very stiff, moist, fine sand, low plasticity fines, friable). [PUENTE FORMATION]

At EL. 354.0 ft, becomes laminated to thinly bedded, greenish gray, moderately weathered.

At EL. 341.0 ft, observed bedding joint, dipping 60°.

REC=0% RQD=0%
REC=36% RQD=36%
REC=50% RQD=50%
REC=80% RQD=78%
REC=65% RQD=65%
REC=87% RQD=63%
REC=83% RQD=83%
REC=100% RQD=100%
REC=100% RQD=100%
REC=100% RQD=93%
REC=86% RQD=80%

SEDIMENTARY ROCK: (SILTSTONE) with interbedded SILTY SANDSTONE, laminated to very thinly bedded, dark greenish gray and light greenish gray, slightly weathered, soft, slightly to very slightly fractured, fine sand.
At EL. 339.4 ft, observed fault dipping 50°, ¼" thick clay lining.
At EL. 339.5 ft, observed bedding joint, dipping 60°.
At EL. 337.0 ft, Unit is fresh.
At EL. 332.0 ft, observed bedding plane separation, dipping 45°, locally bedding becomes thinly bedded to laminated. Interbedded SILTSTONE, parting along bedding, strong reaction to diluted HCL.
At EL. 330.0 ft, observed bedding joint, dipping 45°.
At EL. 326.5 ft, observed bedding joint, dipping 70°.
At 326.1 ft, observed 1 ft thick Siliceous Siltstone bed, moderately bedded, light greenish gray, fresh, hard, healed short and discontinuous fractures, no reaction to diluted HCL, bedding plane separation dipping 45°.
At EL. 327.1 ft, soft to moderately soft, very slightly fractured to unfractured.
At EL. 325.0 ft, with very thin interbeds of black SHALE.
At EL. 319.5 ft, observed bedding joint, dipping 55°.
At EL. 316.8 ft, observed joint, dipping 35°.
At EL. 316.5 ft, observed bedding joint, dipping 50°.
At EL. 314.5 ft, observed bedding joint, dipping 55°.
At EL. 313.5 ft, observed joint, dipping 20°.
At EL. 312.0 ft, observed joint, dipping 30°.
At EL. 311.3 ft, observed joint, dipping 20°.
At EL. 308.7 ft, observed bedding joint, dipping 60°, strong brown phosphatic nodule.
At EL. 307.9 ft, observed bedding joint, dipping 60°, 5" thick, SILTY SANDSTONE interbed, light greenish gray.
At EL. 306.5 ft, observed bedding joint, dipping 60°, 1" thick SILTY SANDSTONE interbed.
At EL. 304.5 ft, observed 10" thick SILTY SANDSTONE bed.
At EL. 302.1 ft, observed 1" thick SILTY SANDSTONE bed.
At EL. 300.8 ft, observed joint, dipping 30°, through 4" thick SILTY SANDSTONE bed.
At EL. 299.9 ft, observed bedding joint, dipping 60°, 3" thick SILTY SANDSTONE bed.
At EL. 299.5 ft, observed joint, dipping 35°.
At EL. 298.0 ft, observed joint, dipping 30°, bedding dipping 60° on 1-inch thick SILTY SANDSTONE bed.
At EL. 296.4 ft, observed 1.5" thick SILTY SANDSTONE bed.
At EL. 295.5 ft, observed bedding joint, dipping 60°, 3" thick SILTY SANDSTONE bed.
At EL. 295.0 ft, observed bedding joint, dipping 60°, 1.5" thick SILTY SANDSTONE bed.
At EL. 289.7 ft, observed bedding joint, dipping 50°.
At EL. 288.2 ft, observed ½" thick SILTY SANDSTONE bed.
At EL. 287.7 ft, observed 1" thick SILTY SANDSTONE bed.
At EL. 286.6 ft, observed joint, dipping 80 to 45°, two joints.
At EL. 286.0 ft, observed bedding joint, dipping 50°.

See Sheet 2
FOR CONTINUATION

PROFILE
Vert: 1"-10'

DEREK HIGA, DESIGN OVERSIGHT ENGINEER	DRAWN BY:	EDELYNE MIGUEL	D. JANKLY/R. CHAVEZ, FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MAHESWARAN RAVEENDRA, PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY:	DAN JANKLY	DATE: 1/30/09 - 2/10/09		

BRIDGE NO. N/A
POST MILES N/A

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 1 OF 3

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 1 OF 3

FILE => $REQUEST

TIME PLOTTED => $TIME
DATE PLOTTED => $DATE
USERNAME => $USER

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

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3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 1 of 2.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

GEOTECHNICAL ENGINEER — 3/18/10 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — GEOTECHNICAL — STATE OF CALIFORNIA

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CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

R-09-Z1B6

See Sheet 1 FOR CONTINUATION

Elev	REC / RQD		Description
280	REC=100% RQD=100%		At EL. 283.6 ft, observed 1.5" thick SILTY SANDSTONE bed. At EL. 282.8 ft, observed 1.5" thick SILTY SANDSTONE bed. At EL. 282.0 ft, observed bedding joint, dipping 60°, 3" thick Silty Sandstone bed. At EL. 281.2 ft, observed 1" thick SILTY SANDSTONE bed. At EL. 278.6 ft, observed 1" thick SILTY SANDSTONE bed. At EL. 278.0 ft, observed bedding joint, dipping 60°.
270	REC=100% RQD=100%		At EL. 277.0 ft, observed 1" thick SILTY SANDSTONE bed. At EL. 269.0 ft, observed bedding joint, dipping 50°.
260	REC=100% RQD=100%		At EL. 264.5 ft, observed 4" thick SILTY SANDSTONE bed. At EL. 260.6 ft, observed joint, dipping 45°. At EL. 259.0 ft, observed bedding joint, dipping 50°.
250	REC=100% RQD=100%		At EL. 249.2 ft to 243.7 ft, Pressuremeter test. At EL. 243.5 ft, observed bedding joint, dipping 50°. At EL. 242.9 ft, observed to be very weak.
240	REC=90% RQD=75%	M UW UC	
230	REC=100% RQD=95%		At EL. 236.5 ft, observed joint, dipping 70°. At EL. 231.0 ft, observed shear, dipping 90 to 75°, 1-inch wide sheared zone, 1/8-inch thick clay lining in center, faintly polished 1/16-inch to 1/4-inch offset. Consistent bedding dipping 50°.
220	REC=95% RQD=90%		At EL. 227.0 ft, observed joint, dipping 70°. At EL. 225.0 ft, observed bedding joint, dipping 45°. At EL. 221.5 ft, observed bedding joint, dipping 40°. At EL. 220.0 ft, observed 2" thick bed with abundant soft sediment deformation. At EL. 214.0 ft, observed bedding joint, dipping 40°. At EL. 213.5 ft, with local interbedded DIATOMACEOUS SILTSTONE beds less than 1/8-inch thick. At EL. 212.8 ft, observed bedding joint, dipping 45°.
210	REC=93% RQD=93%	M UW UU M UW UC EM SD	At EL. 209.7 ft and 208.7 ft, observed to be very weak. At EL. 207.8 ft, observed possible charcoal fleck, 1/8" dia. At EL. 207.0 ft, observed bedding joint, dipping 50°. At EL. 205.2 ft to 200.2 ft, Pressuremeter test.
200	REC=100% RQD=92%		At EL. 199.5 ft, observed phosphate nodule, occasional DIATOMACEOUS SILTSTONE beds up to 1/4-inch thick. At EL. 197.5 ft, observed bedding joint, dipping 45°. At EL. 193.0 ft, observed bedding joint, dipping 45°.
190	REC=100% RQD=95%		At EL. 192.3 ft, observed 3-inch thick, fine to medium grained SANDSTONE sequence. At EL. 189.0 ft, observed bedding joint, dipping 40°. At EL. 187.0 ft, observed bedding joint, dipping 45°. At EL. 182.8 ft, observed bedding joint, dipping 45°.
180	REC=100% RQD=100% REC=100% RQD=100%	M UW UC EM SD	At EL. 179.5 ft, observed to be very weak. At EL. 179.0 ft, observed bedding joint, dipping 40°. At EL. 176.5 ft, observed bedding joint, dipping 45°.
170			

Elev	REC / RQD		Description
	REC=98% RQD=96%	M UW UU	As EL. 325.0 ft, SILTSTONE beds are dark greenish gray, SANDSTONE beds are dark bluish gray. At EL. 172.0 ft, observed bedding joint, dipping 40°.
170	REC=98% RQD=98%		At EL. 167.4 ft, observed to be very weak. At EL. 163.3 ft, observed moderately fractured zone with 1/16" thick clay film along bedding. At EL. 159.0 ft, observed bedding joint, dipping 40°.
160	REC=100% RQD=80%	M UW UC EM SD	At EL. 156.5 ft, observed bedding joint, dipping 45°. At EL. 155.2 ft, observed shear, dipping 20°, 1/8-inch thick clay lining, tight, slightly polished, less than 1-inch offset. At EL. 151.5 ft, observed shear dipping to 10 to 20°, 1/2-inch offset along two bisecting shear planes, very tight.
150	REC=92% RQD=80%	M UW UU CR	At EL. 148.0 ft, observed shear, dipping 90 to 70°, tight, 1/16-inch to 1/4-inch clay lining. At EL. 146.9 ft, observed to be weak. At EL. 146.0 ft, observed bedding joint, dipping 50°. At EL. 145.0 ft, observed bedding joint, dipping 50°, on 1/2-inch thick, very soft, plastic, CLAY seam.
140	REC=78% RQD=70%		At EL. 143.3 ft, observed shear, dipping 20°, tight, less than 1/16-inch clay lining, less than 1-inch offset. At EL. 142.0 ft, observed bedding joint, dipping 45°.
130	REC=100% RQD=100%	PTS	At EL. 139.0 ft, observed bedding joint, dipping 40°, Shear also observed, tight, less than 1/16-inch clay lining, less than 1-inch offset. Unit is very weak. At EL. 137.0 ft, observed 2-inch thick SHALE bed. At EL. 135.3 ft, observed bedding joint, dipping 40°, 2-inch thick, moderately hard, DIATOMACEOUS SHALE bed. At EL. 135.0 ft, observed 2-inch thick, moderately hard, DIATOMACEOUS SHALE bed.
120	REC=100% RQD=100%	M UW UC EM SD	At EL. 133.5 ft, observed shear, dipping 20°, tight, 1/16-inch thick clay lining, 1/4-inch offset. At EL. 132.0 ft, observed bedding joint, dipping 45°. At EL. 122.8 ft, PTS - Finely bedded SILTSTONE, bedded at millimeter scale, alternating iron oxide rich and poor bands.
110	REC=100% RQD=100%		At EL. 121.2 ft to 114.2 ft, Pressuremeter test. At EL. 113.3 ft, observed to be very weak.
100	REC=100% RQD=100%		At EL. 112.5 ft, observed bedding joint, dipping 45°. At EL. 108.0 ft, observed bedding joint, dipping 45°, 2-inch thick, moderately cemented sequence of medium to coarse grained SANDSTONE, 1/8-inch thick laminations.
90	REC=100% RQD=100%		At EL. 105.5 ft, observed bedding joint, dipping 45°. At EL. 103.0 ft, observed bedding joint, dipping 50°. At EL. 100.0 ft, observed bedding joint, dipping 45°. At EL. 99.0 ft, observed steepened bedding between EL. 99.2 ft and shear below at EL. 97.3 ft, beds dipping 60°. At EL. 97.3 ft, observed shear, dipping 70°, tight, paper thin clay lining, 1/4-inch normal offset. At EL. 96.0 ft, observed bedding joint, dipping 45°.

See Sheet 3 FOR CONTINUATION

PROFILE
Vert: 1"-10'

DEREK HIGA DESIGN OVERSIGHT ENGINEER	DRAWN BY:	EDELYNE MIGUEL	D. JANKLY/R. CHAVEZ FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MAHESWARAN RAVEENDRA PROJECT ENGINEER	BRIDGE NO. N/A POST MILES N/A
SIGN OFF DATE	CHECKED BY:	DAN JANKLY	DATE: 1/30/09 - 2/10/09			

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 2 OF 3

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 2 OF 3

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

GEOTECHNICAL ENGINEER — DATE 3/18/10

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
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2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

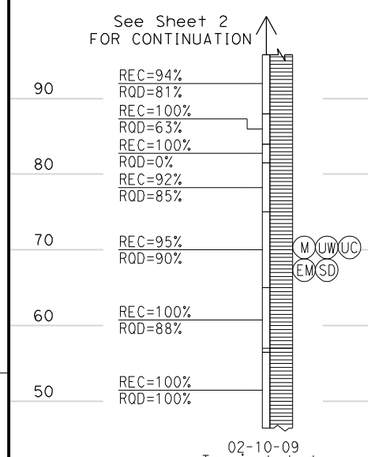
3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 1 of 2.

R-09-Z1B6



At EL. 93.7 ft, observed shear/fault zone, dipping 90 to 70°, ¼-inch to ½-inch thick clay lining, irregular, undulatory shear, bedrock within shear zone is moderately contorted, beds are folded and irregular, beds dip up to 60°.
At EL. 91.0 ft, observed bedding joint, dipping 45°.
At EL. 89.0 ft, observed shear, dipping 65°, tight, paper-thin clay lining.
At EL. 88.0 ft, observed bedding joint, dipping 50°, interbedded fine SANDSTONE and SHALE, gradually increasing cemented, moderately hard to EL. 81.7 ft.
At EL. 86.0 ft, observed bedding joint, dipping 55°, well cemented, moderately fractured.
At EL. 85.0 ft, observed local bedding planes with chrome colored minerals.
At EL. 83.0 ft, observed roughly 1.5' thick, moderately hard, laminated, SILTSTONE bed, moderately fractured.
At EL. 81.5 ft, observed bedding joint, dipping 45°, soft to moderately soft.
At EL. 70.5 ft, Unit is very weak.
At EL. 68.5 ft, observed 3-inch thick moderately cemented zone, moderately hard.
At EL. 63.0 ft, observed bedding joint, dipping 45°, occasional SHALE beds up to ¼-inch thick.
At EL. 61.5 ft, observed ¾-inch thick, cross-bedded, fine SANDSTONE bed, pinches and swells. Increasing SANDSTONE beds.
At EL. 61.0 ft, observed ¾-inch thick, cross-bedded, fine SANDSTONE bed, pinches and swells.
At EL. 60.5 ft, observed 2" thick SANDSTONE bed, laminated.
At EL. 59.5 ft, observed bedding joint, dipping 50°.
At EL. 57.0 ft, observed 1.5" diameter granitic clast, subrounded.
At EL. 56.6 ft, becomes moderately soft to moderately hard, SANDSTONE is light greenish gray, SILTSTONE is black.
At EL. 54.5 ft, observed bedding joint, dipping 45°, 2" thick SANDSTONE bed, well cemented, ¼-inch thick SILTSTONE lamination in center.
At EL. 53.0 ft, observed 1-inch thick SANDSTONE bed, pinches out at center of core.
At EL. 52.5 ft, observed bedding joint, dipping 50°, SANDSTONE beds exhibit soft sediment deformation: cross bedding, pinch and swell.
At EL. 49.5 ft, observed bedding joint, dipping 45°.
At EL. 47.0 ft, observed bedding joint, dipping 50°.

PROFILE
Vert: 1"-10'

DEREK HIGA, DESIGN OVERSIGHT ENGINEER	DRAWN BY:	EDELYNE MIGUEL	D. JANKLY/R. CHAVEZ, FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MAHESWARAN RAVEENDRA, PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY:	DAN JANKLY	DATE: 1/30/09 - 2/10/09		

BRIDGE NO. N/A — POST MILES N/A

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 3 OF 3

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 3 OF 3

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

GEOTECHNICAL ENGINEER — DATE 3/18/10

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — GEOTECHNICAL — STATE OF CALIFORNIA

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CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29′
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6) Plan view shown on Boring Location Plan sheet 1 of 2.

R-09-Z1B7

N: 1849941.30
E: 6506175.09
EL. 480.5′

480 — 6" — ASPHALT, 6" thick
Road base material, 6" thick
SANDY lean CLAY (CL); stiff; olive yellow; moist; fine SAND; medium plasticity fines [OLDER ALLUVIUM].

470 — 9 11.4
Lean CLAY with SAND (CL); hard; dark brown; moist; medium plasticity fines.
At EL. 460.5 ft, micaceous.
At EL. 455.5 ft, little medium to fine SAND.

38 12.4

460 — 22 11.4
Lean CLAY (CL); hard; brown to dark brown.
At EL. 445.5 ft, lean CLAY with SAND; hard; brown to dark brown; moist; little medium to fine SAND.
At EL. 433.7 ft, Olive gray; friable.

31 12.4 — M UW PA

450 — 67/12 11.4 — PI
SEDIMENTARY ROCK: DIATOMACEOUS SILTSTONE, massive, olive to white, decomposed, very soft, oxidized. [PUENTE FORMATION]
At EL. 440.3 ft, SEDIMENTARY ROCK: DIATOMACEOUS SILTSTONE with some SHALE interbeds, laminated to very thinly bedded, pale olive to, pale yellow, intensely weathered, very soft, carbonate nodules.

REC=100% 50/4 12.4 — M UW — 6"
RQD=100% — PA PI
At EL. 440.0 ft, observed bedding joint, dipping 5°.
At EL. 438.0 ft, observed bedding joint, dipping 15°.
At EL. 435.3 ft, observed bedding joint, dipping 15°.

440 — GWS Elev 440.5′ 07/01/09
At EL. 435.0 ft, becomes very pale brown to brownish yellow, moderately weathered, soft, with carbonate veins and nodules.
REC=100%
RQD=100%
REC=93%
At EL. 432.5 ft, observed light gray to light olive brown, 2" thick SANDSTONE bed, fine grained, dipping 20°, friable, no reaction to HCL.

430 — RQD=93%
REC=100% — M UW PI
RQD=80%
At EL. 429.7 ft, observed SANDSTONE bed, 3" thick, fine grained, friable, dipping 20°.
At EL. 429.3 ft, observed light greenish gray, SANDSTONE bed, 1" thick, fine grained, friable, dipping 20°.
REC=73%

420 — RQD=59%
At EL. 427.9 ft, observed SANDSTONE bed, 2" thick, fine grained, friable, dipping 20°.
At EL. 426.3 ft, observed bedding joint, dipping 20°, 0.6' thick SANDY SILTSTONE bed.
REC=100%
RQD=100%
At EL. 424.0 ft, observed SANDSTONE bed, 3" thick, fine grained, friable, dipping 20°.
At EL. 421.0 ft, observed SANDSTONE bed, 3" thick, fine grained, friable, dipping 20°.
At EL. 420.3 ft, observed SANDSTONE bed, 4" thick, fine grained, friable, dipping 20°.
At EL. 420.0 ft, becomes DIATOMACEOUS SILTSTONE with fine SANDSTONE laminations, light greenish gray, locally contorted and bioturbated. Bedding dipping 20°.

410 — REC=100%
RQD=100% — M UW PA
At EL. 418.0 ft, grades to DIATOMACEOUS SILTSTONE, lacks sandstone.
At EL. 415.0 ft, observed bedding joint, dipping 20°.
At EL. 412.0 ft, observed joint, dipping 70°, tight, calcite lining.
REC=92%
SEDIMENTARY ROCK: SILTSTONE, laminated to very thinly bedded, very dark gray, slightly weathered, soft, slightly fractured, mostly non-plastic fines. Contact between oxidized and unoxidized. At EL 408.0 ft, grades to SANDY SILTSTONE, very dark gray, massive, unfractured, unoxidized, fine frained, no reaction to HCL. [PUENTE FORMATION]

400 — RQD=92%
REC=87%
RQD=87%
At EL. 410.5 ft, observed bedding joint, dipping 10°.
At EL. 405.0 ft, becomes intensely weathered, soft to moderately soft.
At EL. 400.0 ft, becomes thinly bedded to laminated.
At EL. 398.5 ft, observed bedding joint, dipping 40°.
At EL. 398.0 ft, observed bedding joint, dipping 40°.
At EL. 397.5 ft, becomes massive.

390

REC=100% RQD=100%
REC=80% RQD=80%
REC=82% RQD=67% — M UW PA PI
REC=98% RQD=98%
REC=98% RQD=98%
REC=87% RQD=87%
REC=82% RQD=32%
REC=77% RQD=68%
REC=100% RQD=100%
REC=100% RQD=100% — PA
REC=100% RQD=100% — M PA
REC=100% RQD=100%

At EL. 395.5 ft, becomes SILTSTONE with thin interbeds of SILTY SANDSTONE, laminated, slightly weathered, soft, very slightly fractured, mostly low plasticity, reaction to HCL.
At EL. 390.0 ft to 384.0 ft, Pressuremeter test.
At EL. 383.6 ft, observed bedding joint, dipping 10°.
At EL. 381.2 ft, observed bedding joint, dipping 10°.
At EL. 379.8 ft, observed fault, dipping 90°.
At EL. 379.0 ft, observed bedding joint, dipping 20°.
At EL. 377.0 ft, observed joint, dipping 45°.
At EL. 375.4 ft, observed bedding joint, dipping 20°.
At EL. 375.1 ft, observed bedding joint, dipping 20°.
At EL. 374.5 ft to 369.0 ft, Pressuremeter test.
At EL. 368.2 ft, observed joint, dipping 60°, tight, no lining.
At EL. 366.2 ft, observed bedding joint, dipping 80°.
At EL. 363.0 ft, observed bedding joint, dipping 80°.
SEDIMENTARY ROCK: SILTY SANDSTONE, very thickly bedded to massive, very dark grayish brown, slightly weathered, soft; with scattered, very thin SILTSTONE interbeds.
At EL. 358.5 ft, observed SILTSTONE bed, 1.5′ thick, thinly bedded, very dark grayish brown, low plasticity, weak reaction to HCL solution.
At EL. 352.8 ft, observed bedding joint, dipping 15°, SILTSTONE bed, 1.5′ thick, thinly bedded, very dark grayish brown, low plasticity, weak reaction to HCL solution.
At EL. 349.5 ft to 369.0 ft, Pressuremeter test.
At EL. 341.5 ft, observed bedding joint, dipping 80°, local CLAY beds.
At EL. 338.5 ft, observed bedding joint, dipping 80°, ½-inch thick SILTSTONE interbed.
At EL. 337.7 ft, observed bedding joint, dipping 80°, 1½-inch thick SILTSTONE interbed.
At EL. 335.0 ft, observed, 3′ ft thick section of SILTSTONE, laminated to very thinly bedded, very dark gray, fresh, soft, weak, with scattered very thin interbeds of SANDY SILTSTONE. Unoxidized, mostly non-plastic, moderate reaction to HCL.
SILTY SANDSTONE, as EL. 360.0 ft, fresh.
At EL. 331.5 ft, observed bedding joint, dipping 45°.
SEDIMENTARY ROCK: SILTSTONE, laminated to very thinly bedded, very dark gray, fresh, soft; with scattered, very thin interbeds of SANDY SILTSTONE. Unoxidized, mostly non-plastic, moderate reaction to HCL.
At EL. 330.5 ft, observed bedding joint, dipping 45°.
At EL. 328.5 ft, observed bedding joint, dipping 70°.
At EL. 325.0 ft, observed bedding joint, dipping 80°, locally intensely weathered and moderately soft.
At EL. 323.7 ft, observed 6" thick calcareous concretion, fresh, hard, moderate reaction to HCL solution.
At EL. 320.4 ft, observed bedding joint, dipping 80°.

See Sheet 2
FOR CONTINUATION

PROFILE
Vert: 1"-10′

DEREK HIGA — DESIGN OVERSIGHT ENGINEER	DRAWN BY:	EDELYNE MIGUEL	R. CHAVEZ — FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MAHESWARAN RAVEENDRA — PROJECT ENGINEER	BRIDGE NO. N/A	SR-710 TUNNEL TECHNICAL STUDY
SIGN OFF DATE	CHECKED BY:	DAN JANKLY	DATE: 1/19/09 - 1/23/09			POST MILES N/A	LOG OF TEST BORING SHEET 1 OF 2

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 1 OF 2

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

GEOTECHNICAL ENGINEER — 3/18/10 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — 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.

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 1 of 2.

R-09-Z1B7

See Sheet 1 FOR CONTINUATION

320 — REC=100% RQD=100%
REC=100% RQD=100% (PL)
310 — REC=100% RQD=100%
REC=100% RQD=100% (M)(UW)(PL)
300 — REC=98% RQD=67%
REC=83% RQD=0%
290 — REC=125% RQD=0%
REC=100% RQD=80% (M)(UW)(PL)
REC=80% RQD=72%
280 — REC=100% RQD=100% (M)(UW)(SD)
REC=100% RQD=100% (UC)
270 — REC=100% RQD=100% (M)(PL)(SD)
REC=100% RQD=100%
260 — REC=100% RQD=100%
REC=100% RQD=100%
250 — REC=100% RQD=16%

At EL. 316.5 ft, observed 2 ft thick LIMESTONE bed, very thinly to thinly bedded, dark olive gray, fresh, medium strong, unfractured, unoxidized, moderate reaction to HCL solution. Bedding dipping 80°.
At EL. 315.4 ft, observed bedding joint, dipping 80°.
At EL. 311.0 ft, observed 1.5 ft thick LIMESTONE bed, light greenish gray, fresh, hard, unfractured, unoxidized, strong reaction to HCL solution.
At EL. 309.5 ft, observed 2' thick bed of SILTY SANDSTONE, laminated, very dark gray, fresh, moderately soft, unfractured; with laminations of light bluish gray fine SANDSTONE. Micaceous, unoxidized.
At EL. 307.5 ft, observed bedding joint, dipping 80°. Unit is weak.
At EL. 306.0 ft, observed bedding joint, dipping 80°, 1 inch thick, calcareous interbed, white.
At EL. 304.3 ft, observed 2.9 ft thick bed of SANDY SILTSTONE to SILTY SANDSTONE, moderately to thickly bedded, very dark gray brown, fresh, soft, unfractured, unoxidized, sand is fine grained, micaceous, no reaction to HCL solution.
SEDIMENTARY ROCK: SILTSTONE/SHALE with fine SANDSTONE laminations, laminated to very thinly bedded, very dark gray, (light bluish gray sandstone beds), fresh, unfractured, tar impregnated bedding.
At EL. 301.4 ft, observed bedding joint, dipping 80°.
At EL. 298.5 ft, observed bedding joint, dipping 80°.
At EL. 293.8 ft, observed bedding joint, dipping 70°.
At EL. 289.0 ft, observed bedding joint, dipping 80°, 2 inch thick, medium strong, hard, calcareous bed, strong reaction to diluted HCL.
At EL. 284.8 ft, observed bedding joint, dipping 70°, interval with abundant very thin interbeds of light bluish gray, friable, fine-grained SANDSTONE beds between EL. 284.5 ft to EL. 272.5 ft.
At EL. 280.0 ft, observed bedding joint, dipping 70°, 1½-inch thick fine grained sand, light bluish gray.
At EL. 278.5 ft, observed tar impregnated bedding plane. Unit is very weak.
At EL. 274.0 ft, observed bedding joint, dipping 70°. Unit is weak.
At EL. 272.2 ft, observed 5.7 ft thick section of SHALE, very thinly bedded to laminated, very dark gray, fresh, moderately soft, unfractured, moderate reaction to HCL solution, unoxidized, mostly low plasticity, no SANDSTONE laminations.
At EL. 269.5 ft, observed bedding joint, dipping 70°. Unit is very weak.
At EL. 266.5 ft, observed 2.3 ft thick bed of SILTY SANDSTONE, massive, very dark gray, fresh, soft, mostly fine grained, friable, weak reaction to HCl, unoxidized, unfractured.
At EL. 264.2 ft, observed 1.7 ft thick bed of LIMESTONE, light greenish gray, fresh, hard, unfractured, unoxidized, strong reaction to HCL solution.
At EL. 264.0 ft, observed bedding joint, dipping 70°.
At EL. 261.0 ft, observed bedding joint, dipping 70°.
At EL. 252.7 ft, observed bedding joint, dipping 70°.

REC=80% RQD=0% (M)(UW)(UC)
REC=100% RQD=100%
REC=100% RQD=100%
REC=100% RQD=100% (M)(UW)(UC)
REC=60% RQD=50% (PL)(PTS)
REC=100% RQD=100% (M)(UW)
REC=100% RQD=100% (UL)
REC=100% RQD=100%
REC=100% RQD=100%
REC=80% RQD=80%
REC=100% RQD=100%
REC=100% RQD=100%
REC=100% RQD=100%
REC=100% RQD=100% (M)(UW)
REC=100% RQD=100% (UC)(PL)
REC=100% RQD=100%
REC=100% RQD=100%
REC=100% RQD=100%

01-23-09
Terminated at EL. 180.5'
ER_I = 75%

250 — SILTY SANDSTONE, laminated, very dark gray, fresh, extremely weak, moderately soft, unfractured; with laminations of light bluish gray, fine grained SANDSTONE impregnated with tar.
Micaceous, unoxidized.
At EL. 244.0 ft, observed bedding joint, dipping 70°.
240 — At EL. 236.0 ft, observed bedding joint, dipping 70°, 2" thick SILTSTONE bed.
At EL. 232.5 ft, unit is very weak.
230 — At EL. 231.2 ft, PTS - Arkosic SANDSTONE, biotite rich.
At EL. 229.3 ft, observed 0.9' thick SILTSTONE/SHALE bed, dipping 70°.
At EL. 228.0 ft, unit is extremely weak.
220 — At EL. 227.9 ft, observed 1' thick SILTSTONE/SHALE bed, dipping 70°.
At EL. 221.0 ft, with with gravel-sized SILTSTONE/SHALE fragments.
At EL. 219.7 ft, observed 0.9' thick SILTSTONE/SHALE bed, dipping 70°.
SILTSTONE/SHALE with fine SANDSTONE laminations, laminated to very thinly bedded, very dark gray, (light bluish gray sandstone beds), fresh, moderately soft, unfractured.
210 — At EL. 206.7 ft, observed bedding joint, dipping 80°.
At EL. 205.8 ft, observed bedding joint, dipping 70°.
At EL. 203.0 ft, becomes very hard.
At EL. 200.0 ft, observed bedding joint, dipping 80°.
At EL. 195.6 ft, unit is weak.
200 — At EL. 193.7 ft, observed bedding joint, dipping 80°, LIMESTONE bed, 2 inches thick.
SILTY SANDSTONE, laminated, very dark gray, fresh, moderately soft, unfractured; with laminations of light bluish gray, fine grained SANDSTONE, micaceous, unoxidized.
At EL. 192.5 ft, becomes locally bioturbated.
190 — At EL. 186.0 ft, observed bedding joint, dipping 70°, on 6-inch thick LIMESTONE bed.
180

PROFILE
Vert: 1"-10'

DEREK HIGA, DESIGN OVERSIGHT ENGINEER	DRAWN BY:	EDELYNE MIGUEL	R. CHAVEZ, FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MAHESWARAN RAVEENDRA, PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY:	DAN JANKLY	DATE: 1/19/09 - 1/23/09		

BRIDGE NO. N/A — POST MILES N/A

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 2 OF 2

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 2 OF 2

FILE => $REQUEST

USERNAME => $USER — DATE PLOTTED => $DATE — TIME PLOTTED => $TIME

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29′
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68′ west of the center of the south bound lanes of the freeway, 25′ north of the centerline of Hellman Avenue, 13′ east of the west end of the bridge, 1′ north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 1 of 2.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Kristopher Barker 3/18/10
CERTIFIED ENGINEERING GEOLOGIST DATE

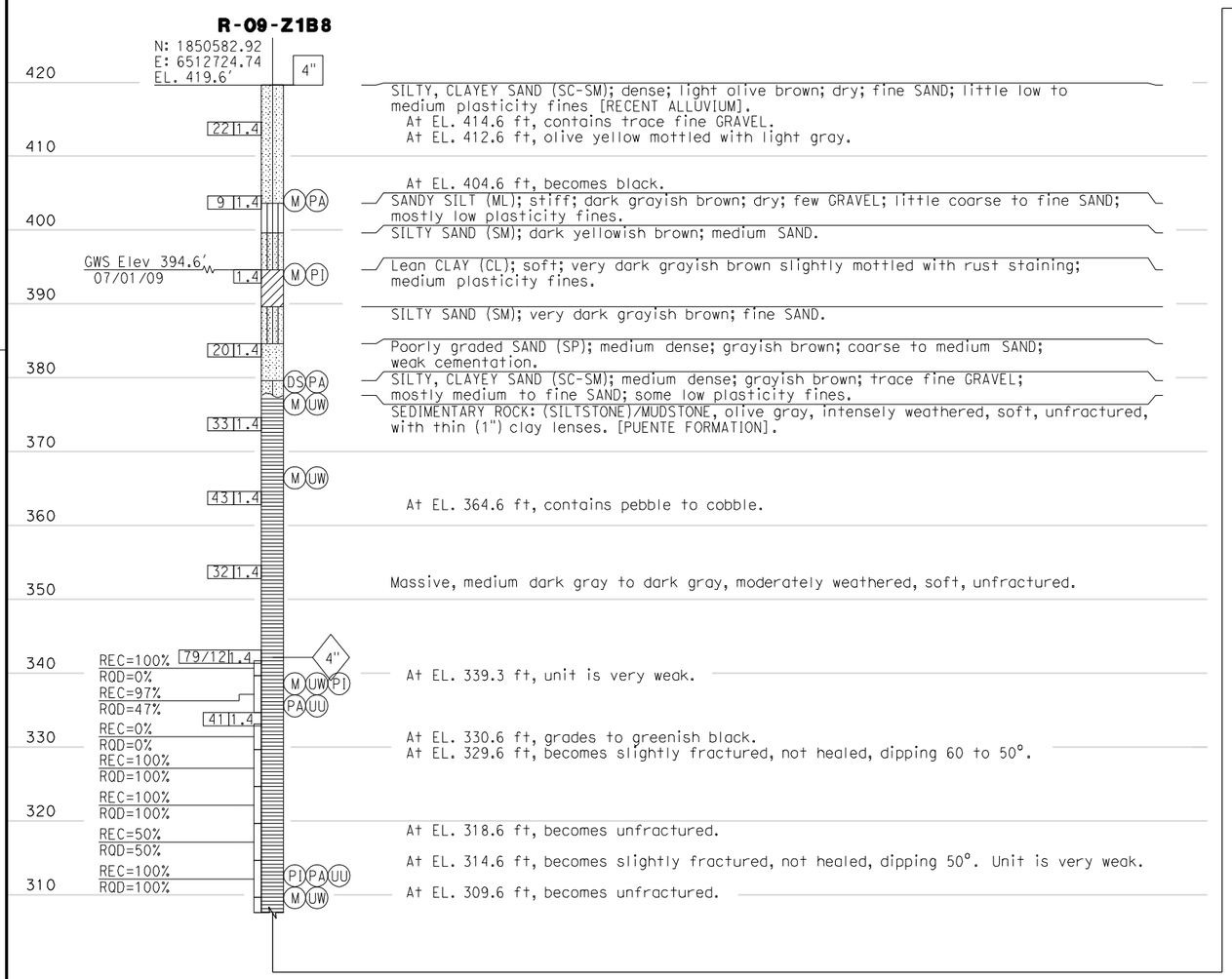
PLANS APPROVAL DATE

PROFESSIONAL GEOLOGIST — KRISTOPHER P. BARKER — No. CEG 2383 — Exp. 8/31/2011 — CERTIFIED ENGINEERING GEOLOGIST — 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.

R-09-Z1B8

N: 1850582.92
E: 6512724.74
EL. 419.6′



01-12-09
Terminated at EL. 219.6′
ER_i = 87%

PROFILE
Vert: 1"=10′

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR	DRAWN BY: E. MIGUEL		FIELD INVESTIGATION BY: K. BARKER			N/A	
NAME: SHIVA KARIMI	CHECKED BY: J. PRATT		DATE: 1/06/09 - 1/12/09		DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 1 OF 1

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES											SHEET	OF
											1	1

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

BENCHMARK:

NGS Benchmark used. Pt MF 36F: N1847799.06, E6512460.75, Elevation 407.29
MF36F: A 3" Brass disk stamped "Metropolitan Water Deistrict of Southern California MF 36F 1989, set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on North American Vertical Datum 1988.
Pt 0153: N1845410.50, E6509860.21
Pt 0617: N1858044.30, E6491094.23

Units are in U.S survey feet.

NOTES:

1) This LOTB sheet (Boring Record) was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 1 of 2.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
7	LA	710	N/A	.	.

Jody A. Castle 3/18/10
PROFESSIONAL GEOLOGIST DATE

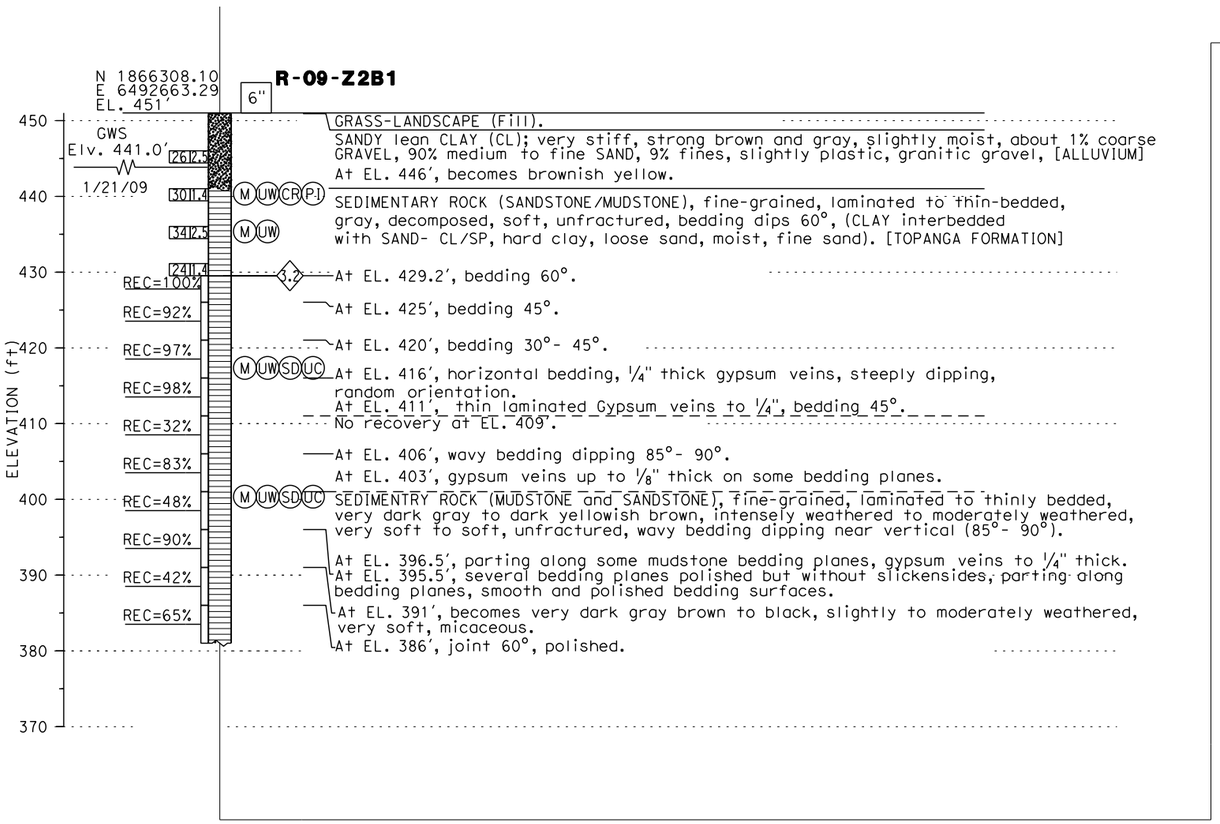
PLANS APPROVAL DATE

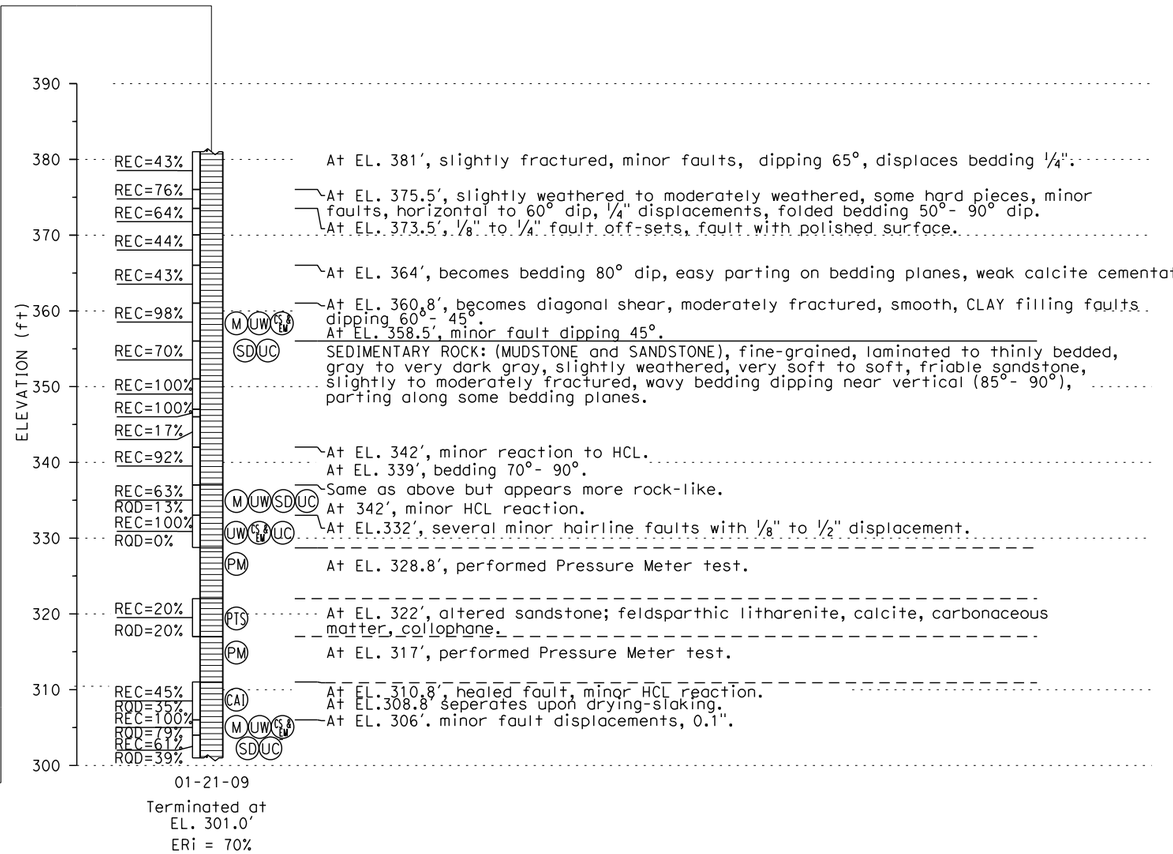
PROFESSIONAL GEOLOGIST — J. CASTLE — No. PG 8162 — Exp. 12-31-10 — STATE OF CALIFORNIA

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.

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION, DISTRICT-7
100 S. MAIN STREET, LOS ANGELES, CA 90012

EARTH MECHANICS, INC.
17660 NEWHOPE STREET, SUITE E
FOUNTAIN VALLEY, CA 92708





PROFILE
VERTICAL 1" = 10'

DEREK HIGA DESIGN OVERSIGHT ENGINEER	DRAWN BY:	K. THANT	B. SCHELL, J. CASTLE FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. LAW PROJECT ENGINEER	BRIDGE NO. N/A POST MILE N/A	SR-710 TUNNEL TECHNICAL STUDY LOG OF TEST BORING SHEET 1 OF 1
. SIGN OFF DATE	CHECKED BY:	B. SCHELL	1/13/09 - 1/21/09 DATE:				

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU .
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 1 OF 1

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

CERTIFIED ENGINEERING GEOLOGIST — 3/18/10 DATE

PLANS APPROVAL DATE

PROFESSIONAL GEOLOGIST — MICHAEL A. SALISBURY — No. CEG 2462 — Exp. 2/28/2011 — CERTIFIED ENGINEERING GEOLOGIST — 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.

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

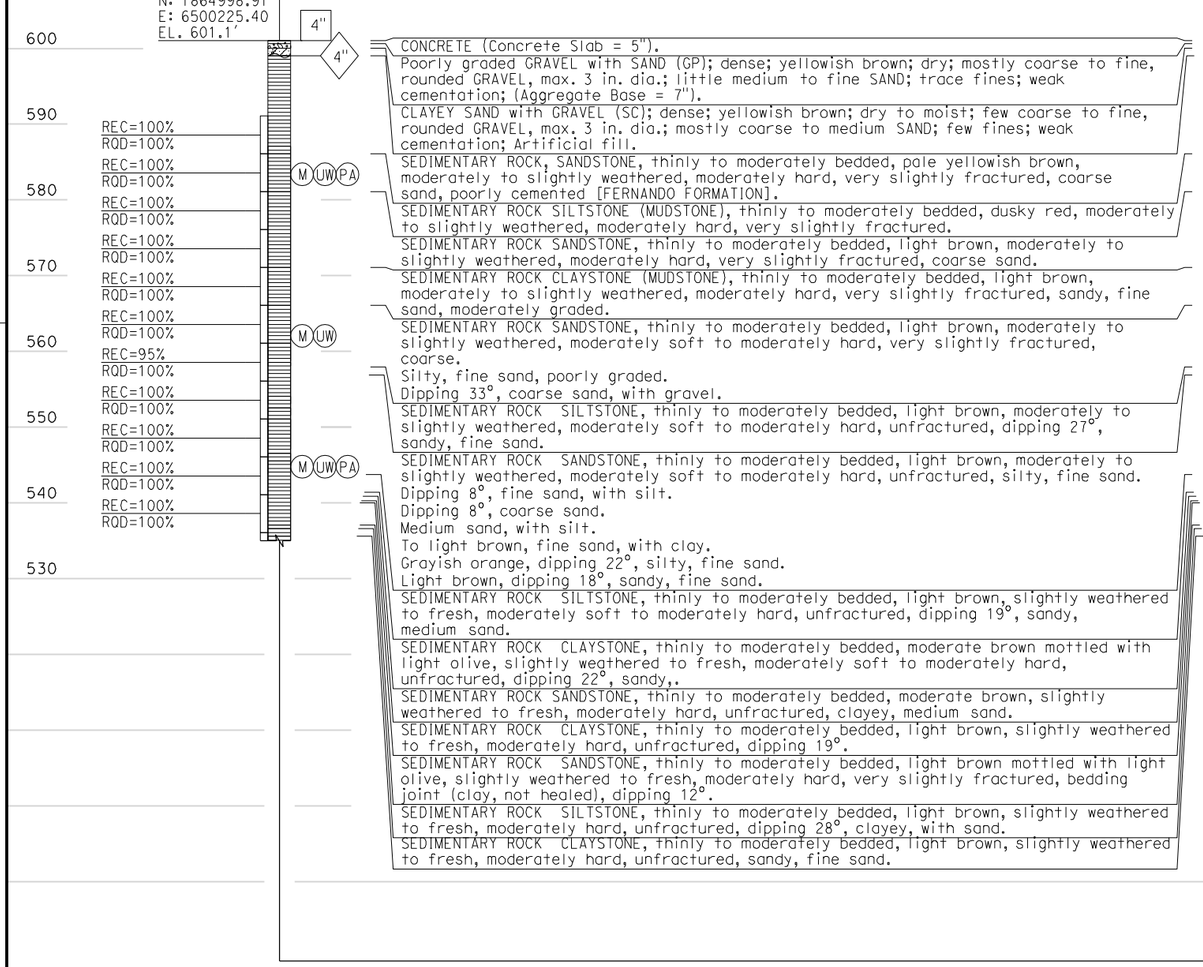
4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

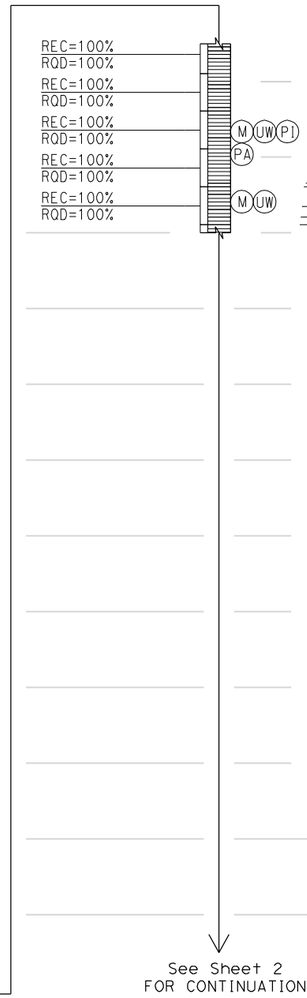
6) Plan view shown on Boring Location Plan sheet 1 of 2.

R-09-Z2B2

N: 1864998.91
E: 6500225.40
EL. 601.1'



CONCRETE (Concrete Slab = 5").
Poorly graded GRAVEL with SAND (GP); dense; yellowish brown; dry; mostly coarse to fine, rounded GRAVEL, max. 3 in. dia.; little medium to fine SAND; trace fines; weak cementation; (Aggregate Base = 7").
CLAYEY SAND with GRAVEL (SC); dense; yellowish brown; dry to moist; few coarse to fine, rounded GRAVEL, max. 3 in. dia.; mostly coarse to medium SAND; few fines; weak cementation; Artificial fill.
SEDIMENTARY ROCK, SANDSTONE, thinly to moderately bedded, pale yellowish brown, moderately to slightly weathered, moderately hard, very slightly fractured, coarse sand, poorly cemented [FERNANDO FORMATION].
SEDIMENTARY ROCK SILTSTONE (MUDSTONE), thinly to moderately bedded, dusky red, moderately to slightly weathered, moderately hard, very slightly fractured.
SEDIMENTARY ROCK SANDSTONE, thinly to moderately bedded, light brown, moderately to slightly weathered, moderately hard, very slightly fractured, coarse sand.
SEDIMENTARY ROCK CLAYSTONE (MUDSTONE), thinly to moderately bedded, light brown, moderately to slightly weathered, moderately hard, very slightly fractured, sandy, fine sand, moderately graded.
SEDIMENTARY ROCK SANDSTONE, thinly to moderately bedded, light brown, moderately to slightly weathered, moderately soft to moderately hard, very slightly fractured, coarse.
Silty, fine sand, poorly graded.
Dipping 33°, coarse sand, with gravel.
SEDIMENTARY ROCK SILTSTONE, thinly to moderately bedded, light brown, moderately to slightly weathered, moderately soft to moderately hard, unfractured, dipping 27°, sandy, fine sand.
SEDIMENTARY ROCK SANDSTONE, thinly to moderately bedded, light brown, moderately to slightly weathered, moderately soft to moderately hard, unfractured, silty, fine sand.
Dipping 8°, fine sand, with silt.
Dipping 8°, coarse sand.
Medium sand, with silt.
To light brown, fine sand, with clay.
Grayish orange, dipping 22°, silty, fine sand.
Light brown, dipping 18°, sandy, fine sand.
SEDIMENTARY ROCK SILTSTONE, thinly to moderately bedded, light brown, slightly weathered to fresh, moderately soft to moderately hard, unfractured, dipping 19°, sandy, medium sand.
SEDIMENTARY ROCK CLAYSTONE, thinly to moderately bedded, moderate brown mottled with light olive, slightly weathered to fresh, moderately soft to moderately hard, unfractured, dipping 22°, sandy,.
SEDIMENTARY ROCK SANDSTONE, thinly to moderately bedded, moderate brown, slightly weathered to fresh, moderately hard, unfractured, clayey, medium sand.
SEDIMENTARY ROCK CLAYSTONE, thinly to moderately bedded, light brown, slightly weathered to fresh, moderately hard, unfractured, dipping 19°.
SEDIMENTARY ROCK SANDSTONE, thinly to moderately bedded, light brown mottled with light olive, slightly weathered to fresh, moderately hard, very slightly fractured, bedding joint (clay, not healed), dipping 12°.
SEDIMENTARY ROCK SILTSTONE, thinly to moderately bedded, light brown, slightly weathered to fresh, moderately hard, unfractured, dipping 28°, clayey, with sand.
SEDIMENTARY ROCK CLAYSTONE, thinly to moderately bedded, light brown, slightly weathered to fresh, moderately hard, unfractured, sandy, fine sand.



SEDIMENTARY ROCK SANDSTONE, thinly to moderately bedded, light brown, slightly weathered to fresh, moderately hard, very slightly fractured, dipping 12°, silty, fine sand.
Dipping 14°, silty, clayey.
Joint (clay, not healed), dipping 25°.
Grayish orange, coarse sand.
SEDIMENTARY ROCK SILTSTONE, thinly to moderately bedded, grayish orange, slightly weathered to fresh, moderately hard, unfractured, dipping 22°, sandy, fine sand.
SEDIMENTARY ROCK SANDSTONE, thinly to moderately bedded, light brown to grayish orange, slightly weathered to fresh, moderately hard, slightly to very slightly fractured, dipping 15°, medium sand.
Dipping 10°, coarse.
Joint (clay, not healed), dipping 10°, clayey.
SEDIMENTARY ROCK CLAYSTONE, thinly to moderately bedded, light brown, slightly weathered to fresh, moderately hard, unfractured, sandy, medium to coarse sand.
SEDIMENTARY ROCK SILTSTONE, thinly to moderately bedded, light brown, slightly weathered to fresh, moderately hard, unfractured, dipping 11°, sandy.
SEDIMENTARY ROCK CLAYSTONE, thinly to moderately bedded, light brown, slightly weathered to fresh, moderately hard, unfractured, sandy.
SEDIMENTARY ROCK SILTSTONE, thinly to moderately bedded, light brown, slightly weathered to fresh, moderately hard, slightly fractured, dipping 12°, sandy.
Light olive to light brown, dipping 11°, sandy, fine to medium sand.
Concretion ~ 1" diameter.
Concretion ~ 0.5" diameter.
Concretion ~ 1" diameter.
Joint (clay, not healed), dipping 30°.
Concretion ~3" diameter.
SEDIMENTARY ROCK CLAYSTONE, thinly to moderately bedded, light olive, slightly weathered to fresh, moderately hard, slightly to very slightly fractured, sandy, fine sand.
Joint dipping 38°.
Joint (clay, not healed), dipping 8°, 1/4" thick clay.
Concretion ~ 3" diameter.
SEDIMENTARY ROCK SILTSTONE, thinly to moderately bedded, light olive, slightly weathered to fresh, moderately hard, unfractured, with coarse sand.
SEDIMENTARY ROCK CLAYSTONE, thinly to moderately bedded, light olive, slightly weathered to fresh, moderately hard, unfractured, sandy, medium to coarse sand, some gravel to ¾".
SEDIMENTARY ROCK SANDSTONE, thinly to moderately bedded, light olive mottled with light brown, slightly weathered to fresh, moderately hard, unfractured, silty, medium to coarse sand.
Concretion ~ 1" diameter.
Grayish orange, dipping 12°, coarse sand.
SEDIMENTARY ROCK SILTSTONE, moderately to thickly bedded, light brown, slightly weathered to fresh, moderately hard, unfractured, with fine sand,.
Sandy, coarse sand.
Concretion ~ 3" diameter.
SEDIMENTARY ROCK SANDSTONE, thinly to moderately bedded, grayish orange, slightly weathered to fresh, moderately hard, unfractured, medium to coarse sand.

See Sheet 2
FOR CONTINUATION

PROFILE
Vert: 1"=10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: M. SALISBURY			DESIGN BRANCH	N/A	
NAME: SHIVA KARIMI	CHECKED BY: K. BARKER	DATE: 1/26/09 - 2/11/09				POST MILES N/A	LOG OF TEST BORING SHEET 1 OF 4

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 1 OF 4

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

CERTIFIED ENGINEERING GEOLOGIST 3/18/10 DATE

PLANS APPROVAL DATE

PROFESSIONAL GEOLOGIST — MICHAEL A. SALTSBURY — No. CEG 2462 — Exp. 2/28/2011 — CERTIFIED ENGINEERING GEOLOGIST — 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.

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 1 of 2.

R-09-Z2B2

See Sheet 1 FOR CONTINUATION

510
500
490
480
470

REC=100% ROD=100%
REC=100% ROD=100%
REC=98% ROD=98%
REC=100% ROD=100%
REC=100% ROD=100%
REC=100% ROD=100%
M UW

SEDIMENTARY ROCK SILTSTONE, thinly to moderately bedded, light brown, slightly weathered to fresh, moderately hard, unfractured, dipping 24°, sandy, fine sand.
SEDIMENTARY ROCK SANDSTONE, thickly bedded, light brown, slightly weathered to fresh, moderately hard, unfractured, dipping 20°, clayey, medium to coarse sand.
Concretion ~ 1" diameter.
Dipping 11°.
Concretion ~½" diameter.
SEDIMENTARY ROCK CLAYSTONE, thinly bedded, light brown, slightly weathered to fresh, moderately hard, unfractured, sandy, coarse sand.
SEDIMENTARY ROCK SANDSTONE, very thinly bedded, grayish orange, slightly weathered to fresh, moderately hard, unfractured, medium sand.
SEDIMENTARY ROCK CLAYSTONE, thinly to moderately bedded, light brown, slightly weathered to fresh, moderately hard, slightly to very slightly fractured, dipping 32°, sandy, coarse sand, gravel to ½".
Joint (not healed), dipping 15°.
Concretion ~ 3" diameter.
Concretion ~ 2" diameter.
SEDIMENTARY ROCK SANDSTONE, thinly bedded, light olive, slightly weathered to fresh, moderately hard, unfractured, coarse sand with some silt.
SEDIMENTARY ROCK CLAYSTONE, thinly to moderately bedded, light brown and light olive, slightly weathered to fresh, hard, unfractured, dipping 22°, sandy, coarse sand.
SEDIMENTARY ROCK SANDSTONE, moderately to thickly bedded, grayish orange, slightly weathered to fresh, moderately hard, unfractured, dipping 28°, silty, coarse sand.
Light brown, clayey, fine sand.
Grayish orange, dipping 27°, some silt, trace gravel to 1/2".
SEDIMENTARY ROCK SILTSTONE, thinly bedded, light brown mottled with light olive, slightly weathered to fresh, hard, unfractured, sandy, fine sand.
SEDIMENTARY ROCK CLAYSTONE, thickly bedded, light brown, slightly weathered to fresh, moderately soft to moderately hard, unfractured, sandy, medium sand.
SEDIMENTARY ROCK SILTSTONE, moderately to thickly bedded, light brown, slightly weathered to fresh, hard, unfractured, sandy, fine sand.
SEDIMENTARY ROCK SANDSTONE, moderately to thickly bedded, grayish orange, slightly weathered to fresh, moderately soft to moderately hard, unfractured, coarse sand.
SEDIMENTARY ROCK SILTSTONE, moderately to thickly bedded, light brown mottled with light olive, slightly weathered to fresh, hard, unfractured, dipping 35°, sandy.
SEDIMENTARY ROCK CLAYSTONE, moderately bedded, light brown, slightly weathered to fresh, moderately soft to moderately hard, unfractured, dipping 28°, sandy, coarse sand.
SEDIMENTARY ROCK SANDSTONE, moderately bedded, grayish orange, slightly weathered to fresh, hard, unfractured, dipping 30°, coarse sand.
SEDIMENTARY ROCK CLAYSTONE, thinly to moderately bedded, light brown, slightly weathered to fresh, hard, unfractured, sandy, coarse sand.
SEDIMENTARY ROCK SANDSTONE, thickly bedded, dark yellowish brown to pale olive, slightly weathered to fresh, hard, unfractured, dipping 22°, coarse.
Laminated to very thinly bedded.
SEDIMENTARY ROCK SILTSTONE, moderately bedded, dark yellowish brown, slightly weathered to fresh, hard, unfractured.
SEDIMENTARY ROCK SANDSTONE, thinly bedded, dusky yellow, slightly weathered to fresh, moderately soft to moderately hard, unfractured, dipping 39°, medium to coarse sand.

REC=100% ROD=100%
REC=100% ROD=100%
REC=0% ROD=%
REC=100% ROD=100%
REC=78% ROD=0%
REC=100% ROD=0%
REC=100% ROD=167%
REC=79% ROD=75%
REC=86% ROD=67%
M UW
PA UU

SEDIMENTARY ROCK CONGLOMERATE, moderately bedded, grayish orange, slightly weathered to fresh, moderately soft to moderately hard, unfractured, clast supported, sand matrix, gravel to 3", cobbles to 4".
SEDIMENTARY ROCK CLAYSTONE, thickly bedded, light brown to light olive, slightly weathered to fresh, hard, unfractured, sandy, coarse sand.
SEDIMENTARY ROCK SANDSTONE, moderately bedded, light brown, slightly weathered to fresh, moderately soft to moderately hard, unfractured, silty, clayey, coarse sand.
SEDIMENTARY ROCK SILTSTONE, moderately bedded, light brown, slightly weathered to fresh, hard, unfractured, sandy, fine sand.
SEDIMENTARY ROCK SANDSTONE, thickly bedded, light brown, slightly weathered to fresh, moderately soft to moderately hard, unfractured, clayey, coarse sand.
Dusky yellow, dipping 32°, coarse sand.
Light brown to light olive, hard, coarse sand, with silt.
No sample.
SEDIMENTARY ROCK CONGLOMERATE, thinly to moderately bedded, grayish orange, slightly weathered to fresh, hard, unfractured, clast supported, coarse sand matrix, gravel to ½".
SEDIMENTARY ROCK SILTSTONE, thinly to moderately bedded, light olive, slightly weathered to fresh, hard, unfractured, sandy, fine sand.
SEDIMENTARY ROCK CLAYSTONE, thinly to moderately bedded, light brown, slightly weathered to fresh, moderately hard, unfractured, sandy, coarse sand.
SEDIMENTARY ROCK SANDSTONE, thinly to moderately bedded, dusky yellow green, slightly weathered to fresh, very weak, moderately hard, unfractured, coarse sand.
SEDIMENTARY ROCK CLAYSTONE, thickly bedded, light brown, slightly weathered to fresh, moderately hard, very slightly fractured, sandy, coarse sand.
Light brown mottled with light olive, joint (CL, not healed), dipping 38°.
SEDIMENTARY ROCK SILTSTONE, thinly to moderately bedded, light olive, slightly weathered to fresh, moderately hard, unfractured, sandy, fine sand.
SEDIMENTARY ROCK CLAYSTONE, very thinly to thinly bedded, light brown, slightly weathered to fresh, moderately hard, unfractured.
SEDIMENTARY ROCK SANDSTONE, thickly bedded, grayish orange to dusky yellow green, slightly weathered to fresh, moderately hard, unfractured, with silt and clay, coarse sand with subround gravel to 1".
SEDIMENTARY ROCK CONGLOMERATE, moderately to thickly bedded, dusky yellow green, slightly weathered to fresh, moderately hard, unfractured, clast supported, coarse sand matrix, gravel to ½".
SEDIMENTARY ROCK SANDSTONE, thickly bedded, pale yellowish brown to grayish orange, slightly weathered to fresh, moderately soft, unfractured, dipping 32°.
Coarse sand with subround gravel to ½".
Fine sand.
Grayish orange, coarse sand with subround gravel to ½".
SEDIMENTARY ROCK CONGLOMERATE, moderately to thickly bedded, grayish orange, slightly weathered to fresh, moderately soft, unfractured, round gravel to 2", clast supported, coarse sand matrix.
SEDIMENTARY ROCK SANDSTONE, thickly bedded, grayish orange, slightly weathered to fresh, moderately soft, unfractured, coarse sand.
SEDIMENTARY ROCK CONGLOMERATE, moderately to thickly bedded, yellowish gray, slightly weathered to fresh, moderately soft, unfractured, matrix supported subround gravel to 1", medium to coarse sand matrix.

480
470
460
450
440
430

See Sheet 3 FOR CONTINUATION

PROFILE
Vert: 1"=10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: M. SALISBURY				N/A	
NAME: SHIVA KARIMI	CHECKED BY: K. BARKER	DATE: 1/26/09 - 2/11/09			DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 2 OF 4

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES	SHEET	OF
	2	4

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

CERTIFIED ENGINEERING GEOLOGIST 3/18/10 DATE

PLANS APPROVAL DATE

PROFESSIONAL GEOLOGIST — MICHAEL A. SALISBURY — No. CEG 2462 — Exp. 2/28/2011 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 1 of 2.

R-09-Z2B2

See Sheet 2 FOR CONTINUATION

440
430
420
410
400
390

REC=100% RQD=0%
REC=100% RQD=58%
REC=100% RQD=100%
REC=100% RQD=67%
REC=100% RQD=100%
REC=100% RQD=100%
REC=100% RQD=100%
REC=100% RQD=100%
REC=100% RQD=100%
REC=92% RQD=100%
REC=100% RQD=0%
REC=100% RQD=0%
REC=100% RQD=0%

M UW UU
M UW
M UW SD
EM UC

SEDIMENTARY ROCK SILTSTONE, thickly bedded, light brown, slightly weathered to fresh, very weak, soft, very slightly fractured to unfractured, with some fine sand.

SEDIMENTARY ROCK SANDSTONE, thickly bedded, light brown, slightly weathered to fresh, very to extremely hard, unfractured, strongly cemented, fine sand.
Light gray, soft, moderately to slightly fractured, clayey, fine to medium sand.

SEDIMENTARY ROCK SILTSTONE, thickly bedded, light brown, slightly weathered to fresh, moderately soft to moderately hard, slightly fractured, clayey with some fine sand.

SEDIMENTARY ROCK SANDSTONE, moderately bedded, light brown, slightly weathered to fresh, moderately soft to moderately hard, slightly fractured, fine to medium sand, with gravel.

SEDIMENTARY ROCK SILTSTONE, thickly bedded, olive gray, slightly weathered to fresh, moderately soft to moderately hard, slightly fractured, with fine to medium gravel.
Light olive, clayey, with coarse round gravel.

SEDIMENTARY ROCK CONGLOMERATE, moderately bedded, light gray, slightly weathered to fresh, very hard, intensely to moderately fractured, clast supported subround gravel to 3", granite clasts.

SEDIMENTARY ROCK SANDSTONE, very thickly bedded, light brown, slightly weathered to fresh, soft, slightly to very slightly fractured, medium to coarse sand.
Fine sand.
Coarse sand.
Light olive gray, fine sand.
With clay and gravel to 1/2".
Dusky yellow, silty, coarse sand.

SEDIMENTARY ROCK CLAYSTONE, thickly bedded, light brown mottled with light olive, slightly weathered to fresh, extremely weak, moderately hard, slightly to very slightly fractured.
Light brown.
Light brown mottled with light olive, with well graded sand.

SEDIMENTARY ROCK CONGLOMERATE, thinly bedded, light brown, slightly weathered to fresh, moderately hard, slightly to very slightly fractured, dipping 50°, subround clast supported gravel to 1", coarse sand matrix.

SEDIMENTARY ROCK SANDSTONE, moderately to thickly bedded, grayish orange, slightly weathered to fresh, moderately hard, slightly to very slightly fractured, coarse sand, well graded.

SEDIMENTARY ROCK SILTSTONE, thinly to moderately bedded, light brown, slightly weathered to fresh, moderately hard, slightly to very slightly fractured, sandy, fine sand.
With coarse sand.

SEDIMENTARY ROCK SANDSTONE, thinly to moderately bedded, light brown to light olive, slightly weathered to fresh, moderately soft, slightly to very slightly fractured, silty, fine sand.

SEDIMENTARY ROCK CLAYSTONE, thinly to moderately bedded, light brown, slightly weathered to fresh, moderately soft, slightly to very slightly fractured, dipping 33°, sandy, coarse sand.
Concretion ~ 2" diameter.

SEDIMENTARY ROCK SILTSTONE, moderately to thickly bedded, light brown, slightly weathered to fresh, moderately soft, unfractured, sandy, fine sand.

REC=90% RQD=0%
REC=90% RQD=90%
REC=100% RQD=0%
REC=100% RQD=0%
REC=100% RQD=0%
REC=100% RQD=95%
REC=100% RQD=0%
REC=63% RQD=0%

M UW EM
UC SD
M UW UU
M UW CR
UC PTS
M UW

400
390
380
370
360
350

Light brown mottled with light olive, very weak.
Medium sand.

SEDIMENTARY ROCK SANDSTONE, moderately to thickly bedded, light brown, slightly weathered to fresh, moderately soft, unfractured, clayey, coarse sand.
Grayish orange to light olive, silty, coarse sand.

SEDIMENTARY ROCK CONGLOMERATE, moderately bedded, grayish orange, slightly weathered to fresh, moderately soft, unfractured, clast supported sub round gravel to 3/4", clayey fine sand matrix.

SEDIMENTARY ROCK SANDSTONE, moderately to thickly bedded, light brown, slightly weathered to fresh, very weak, moderately soft, unfractured, clayey, coarse sand.
Light brown to light olive, lithic fragments (angular volcanic clasts).
Grayish olive, silty, coarse to medium sand, with some gravel to 3/8".

SEDIMENTARY ROCK SILTSTONE, moderately bedded, light brown mottled with light olive, slightly weathered to fresh, moderately soft, unfractured, sandy, coarse sand.

SEDIMENTARY ROCK CONGLOMERATE, thinly bedded, light brown, slightly weathered to fresh, moderately soft, unfractured, clast supported gravel to 1/2".

SEDIMENTARY ROCK SANDSTONE, thickly bedded, light brown, slightly weathered to fresh, moderately soft, unfractured, silty, fine sand.
Grayish orange, silty, coarse sand.
Dipping 42°.
Light brown, silty, fine to medium sand.
To grayish orange, silty, coarse sand, with some rounded gravel to 1".

SEDIMENTARY ROCK SILTSTONE, thinly bedded, light brown, slightly weathered to fresh, moderately soft, unfractured, sandy, medium sand.

SEDIMENTARY ROCK CLAYSTONE, thinly to moderately bedded, light brown, slightly weathered to fresh, soft, unfractured, dipping 37°, plastic, moist.
To grayish orange, moderately hard, sandy, coarse sand.

SEDIMENTARY ROCK SANDSTONE, very thinly bedded, light brown to pale yellowish brown, slightly weathered to fresh, moderately hard, unfractured, dipping 35°, clayey, coarse sand.

SEDIMENTARY ROCK SILTSTONE, very thinly bedded, light brown to light olive gray, slightly weathered to fresh, moderately hard, unfractured, coarse sand.

SEDIMENTARY ROCK CLAYSTONE, very thinly bedded, light brown, slightly weathered to fresh, moderately hard, unfractured.

SEDIMENTARY ROCK SILTSTONE, very thinly to thinly bedded, light brown, slightly weathered to fresh, very weak, moderately hard, unfractured.

SEDIMENTARY ROCK CLAYSTONE, very thinly to thinly bedded, light brown, slightly weathered to fresh, moderately hard, unfractured.

SEDIMENTARY ROCK SILTSTONE, thinly bedded, light brown mottled with light olive, slightly weathered to fresh, moderately hard, unfractured, sandy, well graded sand.

SEDIMENTARY ROCK CLAYSTONE, thinly bedded, light brown, slightly weathered to fresh, soft, unfractured, plastic, moist.

SEDIMENTARY ROCK SANDSTONE, thinly bedded, light olive, slightly weathered to fresh, soft, unfractured, silty, fine to medium sand.
Medium sand.
Fine sand.
Dusky yellow green, moderately hard, coarse sand, with subround gravel to 3/4".

See Sheet 4 FOR CONTINUATION

PROFILE
Vert: 1"=10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: M. SALISBURY				N/A	
NAME: SHIVA KARIMI	CHECKED BY: K. BARKER	DATE: 1/26/09 - 2/11/09			DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 3 OF 4
OGS CIVIL LOG OF TEST BORINGS SHEET	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3			CU EA 07-187900		DISREGARD PRINTS BEARING EARLIER REVISION DATES →	REVISION DATES / SHEET 3 / OF 4

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

CERTIFIED ENGINEERING GEOLOGIST 3/18/10 DATE

PLANS APPROVAL DATE

PROFESSIONAL GEOLOGIST — MICHAEL A. SALISBURY — No. CEG 2462 — Exp. 2/28/2011 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

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BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
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Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

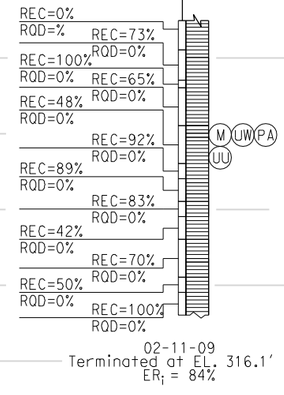
4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 1 of 2.

R-09-Z2B2

See Sheet 3 FOR CONTINUATION



No sample.
Silty, medium to coarse sand, with some subround gravel to 1/2".
SEDIMENTARY ROCK CLAYSTONE, moderately to thickly bedded, light brown, slightly weathered to fresh, very weak, moderately hard, unfractured, sandy, coarse sand.
SEDIMENTARY ROCK SANDSTONE, moderately bedded, dusky yellow green, slightly weathered to fresh, soft, unfractured, dipping 44°, silty, medium sand.
SEDIMENTARY ROCK CONGLOMERATE, thinly bedded, dusky yellow green, slightly weathered to fresh, soft, unfractured, clast supported subround gravel to 1", medium sand matrix.
SEDIMENTARY ROCK SANDSTONE, thickly bedded, dusky yellow green, slightly weathered to fresh, soft, unfractured, medium sand, with subround gravel to 1/2".
SEDIMENTARY ROCK CONGLOMERATE, thinly to moderately bedded, dusky yellow green, slightly weathered to fresh, soft, unfractured, clast supported subround gravel to 1", medium sand matrix.
SEDIMENTARY ROCK SANDSTONE, thickly bedded, dusky yellow green, slightly weathered to fresh, soft, unfractured, fine sand.
Silty.
Dusky green, silty, coarse sand, moist to wet.
SEDIMENTARY ROCK CONGLOMERATE, thinly bedded, dusky green, slightly weathered to fresh, soft, unfractured, clast supported round gravel to 1", coarse sand matrix.
SEDIMENTARY ROCK SANDSTONE, very thickly bedded, dusky green, slightly weathered to fresh, soft, unfractured, silty, coarse sand.
Silty, fine sand.
Medium sand.
Fine sand.
Dusky yellow green, silty, fine sand.

PROFILE
Vert: 1"=10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: M. SALISBURY				N/A	
NAME: SHIVA KARIMI	CHECKED BY: K. BARKER	DATE: 1/26/09 - 2/11/09			DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 4 OF 4

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 4 OF 4

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29′
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68′ west of the center of the south bound lanes of the freeway, 25′ north of the centerline of Hellman Avenue, 13′ east of the west end of the bridge, 1′ north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 1 of 2.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710			

Kristopher Barker 3/18/10
CERTIFIED ENGINEERING GEOLOGIST DATE

PLANS APPROVAL DATE

PROFESSIONAL GEOLOGIST
KRISTOPHER P. BARKER
No. CEG 2383
Exp. 8/31/2011
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

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R-09-Z2B3

N: 1862540.15
E: 6503890.18
EL. 546.9′

4" ASPHALT (8"- 9").
SANDY SILT (ML); light gray; dry; contains few cobbles and little coarse gravel [FILL].

SILTY SAND (SM); very dense; yellowish brown; moist; little coarse to fine GRAVEL; mostly coarse to fine SAND. [RECENT ALLUVIUM]
Little coarse to fine GRAVEL; mostly coarse to fine SAND; little low plasticity fines.

82/11.4 (M)(PA)
114/12/1.4
62/1.4 (M)(PA)
50/6/1.4
19/1.4

At EL. 522.9 ft, observed boulders and cobbles.
At EL. 521.9 ft, becomes dark gray to yellowish brown; little coarse to fine GRAVEL; mostly coarse to fine SAND; little low plasticity fines.
At EL. 517.4 ft, observed cobbles (29.5′- 30′).
At EL. 516.9 ft, becomes brown.

4" SILTY CLAY (CL/ML); stiff to very stiff; dark yellowish brown; moist.

SEDIMENTARY ROCK, SILTSTONE, laminated to very thinly bedded, grayish orange to moderate yellowish brown, moderately weathered, very soft, very intensely to intensely fractured, bedding joint (partially healed), beds dip 20°, partly FeO lined, strong very closely spaced fractures. [TOPANGA FORMATION]

REC=100% RQD=0%
REC=100% RQD=0%
REC=100% RQD=0%
REC=100% RQD=0%
REC=100% RQD=0%
REC=100% RQD=50%
REC=100% RQD=40%
REC=100% RQD=7%
REC=100% RQD=0%
REC=100% RQD=17%
REC=100% RQD=35%
REC=100% RQD=40%
REC=100% RQD=42%
REC=100% RQD=80%
REC=100% RQD=90%
REC=100% RQD=80%
REC=100% RQD=25%

(M)(UW)(PA)

SILTSTONE (MUDSTONE), very thinly bedded, dark yellowish brown and moderate yellowish brown, moderately weathered, moderately hard, very intensely fractured, fracture zone (FE), dipping 0 to 90°, slightly rough, thin.

GWS Elev 498.9′ 07/01/09

(M)(UW) At EL. 491.9 ft, becomes weak, hard, intensely fractured, bedding joint, dipping 15°, slightly rough, thin, zones of very intensely fractured.

At EL. 481.9 ft, becomes very intensely fractured, dipping 80 to 15°.

At EL. 471.9 ft, becomes very intensely to intensely fractured, bedding joint, dipping 15°.
At EL. 468.9 ft, observed no fracture filling.
At EL. 466.9 ft, becomes intensely to moderately fractured.
At EL. 461.9 ft, becomes dark yellowish brown and dusky yellowish brown, hard to very hard, intensely fractured.
At EL. 456.9 ft, becomes olive gray, moderately hard to hard.
At EL. 455.4 ft, becomes moderately soft, intensely fractured, joint, dipping 45 to 15°.
At EL. 451.9 ft, becomes slightly fractured, dipping 45°.

At EL. 449.9 ft, becomes dusky yellowish brown.
At EL. 446.9 ft, becomes moderately soft to moderately hard, slightly fractured, bedding joint, dipping 30°.

(M)(UW)(PI) At EL. 437.9 ft, becomes intensely fractured, fracture zone, dipping 45 to 30°, rough, slightly open.

REC=100% RQD=50%
REC=100% RQD=22%
REC=100% RQD=55%
REC=100% RQD=39%
REC=100% RQD=17%
REC=100% RQD=0%
REC=100% RQD=0%
REC=100% RQD=30%
REC=100% RQD=7%
REC=100% RQD=0%
REC=100% RQD=18%
REC=100% RQD=15%
REC=100% RQD=0%
REC=100% RQD=8%
REC=100% RQD=23%
REC=100% RQD=7%
REC=100% RQD=18%
REC=100% RQD=13%
REC=100% RQD=28%
REC=100% RQD=25%
REC=100% RQD=22%
REC=100% RQD=19%
REC=100% RQD=0%
REC=100% RQD=32%
REC=100% RQD=52%

(M)(UW)
(PL)
(SD)
(M)(UW)
(PL)
(UC)(PL)
(M)(UW)(UC)
(PL)

SILTSTONE (MUDSTONE), laminated, moderate yellowish brown, moderately weathered, weak, hard, intensely fractured, bedding joint (FE, MN), dipping 20°, slightly rough, thin.

At EL. 421.9 ft, becomes fracture zone, dipping 80 to 20°, locally moderately soft, bedding joints at 20 degrees.
At EL. 420.4 ft, becomes dusky yellowish brown and dark yellowish brown.

At EL. 411.9 ft, becomes dusky yellowish brown, hard, intensely fractured, joint, dipping 50 to 20°, slightly rough, slightly open.

At EL. 406.9 ft, becomes locally moderately soft.

At EL. 402.4 ft, becomes hard, very intensely fractured, fracture zone, slightly rough, thin, also bedding joints, some calcite cementation.

At EL. 396.9 ft, becomes very intensely to intensely fractured, dipping 80 to 20°, slightly rough, slightly open, clean.

At EL. 381.9 ft, becomes locally moderately soft.

At EL. 356.9 ft, becomes intensely fractured, bedding joint, dipping 10°.

At EL. 349.7 ft, unit is medium strong.
At EL. 346.9 ft, becomes very intensely to intensely fractured, fracture zone, with bedding joints.

At EL. 336.9 ft, becomes intensely fractured, bedding joint, dipping 10°.

At EL. 331.9 ft, becomes locally moderately soft, unit is weak.

At EL. 326.9 ft, becomes bedding joints dip 5°.

550 540 530 520 510 500 490 480 470 460 450 440 430 420 410 400 390 380 370 360 350 340 330 320

See Sheet 2
FOR CONTINUATION

PROFILE
Vert: 1"-10′

ENGINEERING SERVICES		GEOTECHNICAL SERVICES				
FUNCTIONAL SUPERVISOR NAME: SHIVA KARIMI	DRAWN BY: K. REYES	FIELD INVESTIGATION BY: K. LAI, T. HALDA, K. BAKER	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. N/A	SR-710 TUNNEL TECHNICAL STUDY
	CHECKED BY: M. SALISBURY	DATE: 3/3/09 - 3/12/09			POST MILES N/A	LOG OF TEST BORING SHEET 1 OF 2

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES | SHEET | OF

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710			

Kristopher Barker 3/18/10
CERTIFIED ENGINEERING GEOLOGIST DATE

PLANS APPROVAL DATE

PROFESSIONAL GEOLOGIST
KRISTOPHER P. BARKER
No. CEG 2383
Exp. 8/31/2011
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

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BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29′
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68′ west of the center of the south bound lanes of the freeway, 25′ north of the centerline of Hellman Avenue, 13′ east of the west end of the bridge, 1′ north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

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1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

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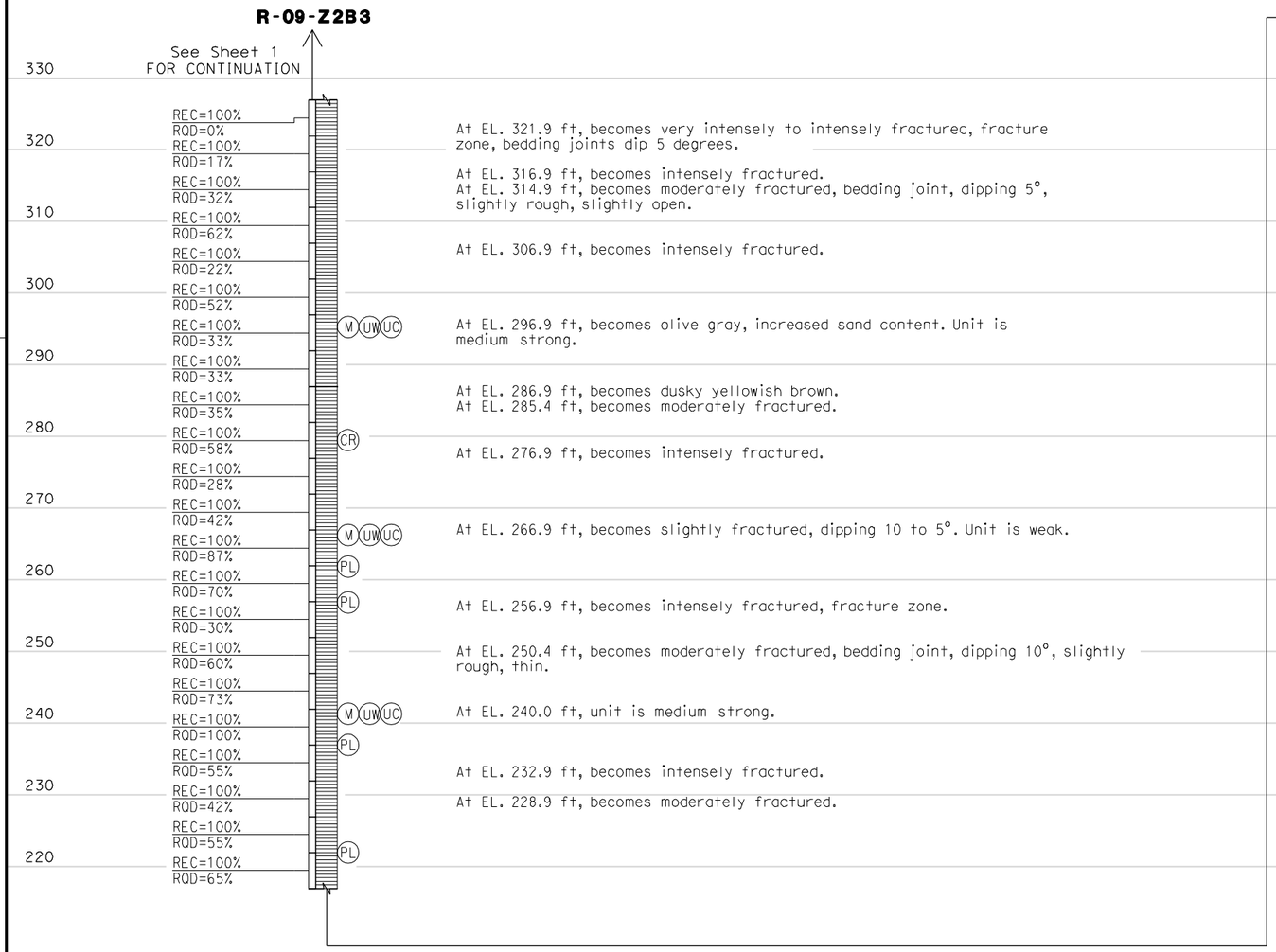
3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 1 of 2.



PROFILE
Vert: 1"-10′

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR NAME: SHIVA KARIMI	DRAWN BY: K. REYES	FIELD INVESTIGATION BY: K. LAI, T. HALDA, K. BAKER			DESIGN BRANCH	N/A	
	CHECKED BY: M. SALISBURY	DATE: 3/3/09 - 3/12/09				POST MILES N/A	LOG OF TEST BORING SHEET 2 OF 2

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES	SHEET	OF

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

BENCHMARK:

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MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

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Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
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Units are in U.S. survey feet.

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1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).
2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.
3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.
4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.
5) All bedding and other structural angles are measured from horizontal.
6) Plan view shown on Boring Location Plan sheet 1 of 2.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Kristopher Barker 3/18/10
CERTIFIED ENGINEERING GEOLOGIST DATE

PROFESSIONAL GEOLOGIST — KRISTOPHER P. BARKER — No. CEG 2383 — Exp. 8/31/2011 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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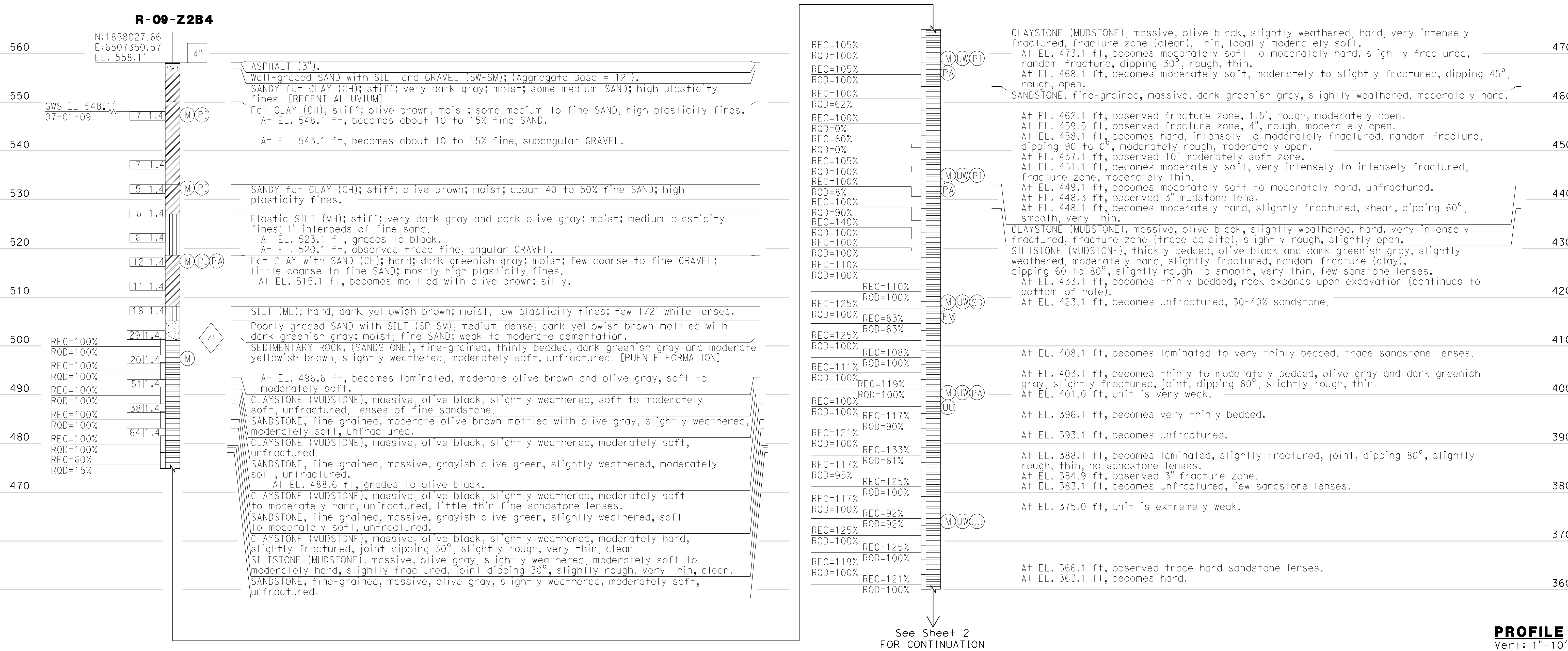

R-09-Z2B4
N:1858027.66
E:6507350.57
EL. 558.1'
4"
GWS EL 548.1'
07-01-09
560
550
540
530
520
510
500
490
480
470
7 1.4 M PI
7 1.4
5 1.4 M PI
6 1.4
6 1.4
12 1.4 M PI PA
11 1.4
18 1.4
29 1.4
4"
20 1.4 M
51 1.4
38 1.4
64 1.4
REC=100% RQD=100%
REC=100% RQD=100%
REC=100% RQD=100%
REC=100% RQD=100%
REC=100% RQD=100%
REC=60% RQD=15%
ASPHALT (3").
Well-graded SAND with SILT and GRAVEL (SW-SM); (Aggregate Base = 12").
SANDY fat CLAY (CH); stiff; very dark gray; moist; some medium SAND; high plasticity fines. [RECENT ALLUVIUM]
Fat CLAY (CH); stiff; olive brown; moist; some medium to fine SAND; high plasticity fines.
At EL. 548.1 ft, becomes about 10 to 15% fine SAND.
At EL. 543.1 ft, becomes about 10 to 15% fine, subangular GRAVEL.
SANDY fat CLAY (CH); stiff; olive brown; moist; about 40 to 50% fine SAND; high plasticity fines.
Elastic SILT (MH); stiff; very dark gray and dark olive gray; moist; medium plasticity fines; 1" interbeds of fine sand.
At EL. 523.1 ft, grades to black.
At EL. 520.1 ft, observed trace fine, angular GRAVEL.
Fat CLAY with SAND (CH); hard; dark greenish gray; moist; few coarse to fine GRAVEL; little coarse to fine SAND; mostly high plasticity fines.
At EL. 515.1 ft, becomes mottled with olive brown; silty.
SILT (ML); hard; dark yellowish brown; moist; low plasticity fines; few 1/2" white lenses.
Poorly graded SAND with SILT (SP-SM); medium dense; dark yellowish brown mottled with dark greenish gray; moist; fine SAND; weak to moderate cementation.
SEDIMENTARY ROCK, (SANDSTONE), fine-grained, thinly bedded, dark greenish gray and moderate yellowish brown, slightly weathered, moderately soft, unfractured. [PUENTE FORMATION]
At EL. 496.6 ft, becomes laminated, moderate olive brown and olive gray, soft to moderately soft.
CLAYSTONE (MUDSTONE), massive, olive black, slightly weathered, soft to moderately soft, unfractured, lenses of fine sandstone.
SANDSTONE, fine-grained, moderate olive brown mottled with olive gray, slightly weathered, moderately soft, unfractured.
CLAYSTONE (MUDSTONE), massive, olive black, slightly weathered, moderately soft, unfractured.
SANDSTONE, fine-grained, massive, grayish olive green, slightly weathered, moderately soft, unfractured.
At EL. 488.6 ft, grades to olive black.
CLAYSTONE (MUDSTONE), massive, olive black, slightly weathered, moderately soft to moderately hard, unfractured, little thin fine sandstone lenses.
SANDSTONE, fine-grained, massive, grayish olive green, slightly weathered, soft to moderately soft, unfractured.
CLAYSTONE (MUDSTONE), massive, olive black, slightly weathered, moderately hard, slightly fractured, joint dipping 30°, slightly rough, very thin, clean.
SILTSTONE (MUDSTONE), massive, olive gray, slightly weathered, moderately soft to moderately hard, slightly fractured, joint dipping 30°, slightly rough, very thin, clean.
SANDSTONE, fine-grained, massive, olive gray, slightly weathered, moderately soft, unfractured.
REC=105% RQD=100%
REC=105% RQD=100%
REC=100% RQD=62%
REC=100% RQD=0%
REC=80% RQD=0%
REC=105% RQD=100%
REC=100% RQD=8%
REC=100% RQD=90%
REC=140% RQD=100%
REC=100% RQD=100%
REC=110% RQD=100%
REC=110% RQD=100%
REC=125% RQD=100%
REC=83% RQD=83%
REC=125% RQD=100%
REC=108% RQD=100%
REC=111% RQD=100%
REC=119% RQD=100%
REC=100% RQD=100%
REC=117% RQD=90%
REC=121% RQD=100%
REC=133% RQD=81%
REC=117% RQD=95%
REC=125% RQD=100%
REC=117% RQD=100%
REC=92% RQD=92%
REC=125% RQD=100%
REC=125% RQD=100%
REC=119% RQD=100%
REC=121% RQD=100%
M UW PI PA
M UW PI PA
M UW SD EM
M UW PA UU
M UW UU
See Sheet 2 FOR CONTINUATION
CLAYSTONE (MUDSTONE), massive, olive black, slightly weathered, hard, very intensely fractured, fracture zone (clean), thin, locally moderately soft.
At EL. 473.1 ft, becomes moderately soft to moderately hard, slightly fractured, random fracture, dipping 30°, rough, thin.
At EL. 468.1 ft, becomes moderately soft, moderately to slightly fractured, dipping 45°, rough, open.
SANDSTONE, fine-grained, massive, dark greenish gray, slightly weathered, moderately hard.
At EL. 462.1 ft, observed fracture zone, 1.5', rough, moderately open.
At EL. 459.5 ft, observed fracture zone, 4", rough, moderately open.
At EL. 458.1 ft, becomes hard, intensely to moderately fractured, random fracture, dipping 90 to 0°, moderately rough, moderately open.
At EL. 457.1 ft, observed 10" moderately soft zone.
At EL. 451.1 ft, becomes moderately soft, very intensely to intensely fractured, fracture zone, moderately thin.
At EL. 449.1 ft, becomes moderately soft to moderately hard, unfractured.
At EL. 448.3 ft, observed 3" mudstone lens.
At EL. 448.1 ft, becomes moderately hard, slightly fractured, shear, dipping 60°, smooth, very thin.
CLAYSTONE (MUDSTONE), massive, olive black, slightly weathered, hard, very intensely fractured, fracture zone (trace calcite), slightly rough, slightly open.
SILTSTONE (MUDSTONE), thickly bedded, olive black and dark greenish gray, slightly weathered, moderately hard, slightly fractured, random fracture (clay), dipping 60 to 80°, slightly rough to smooth, very thin, few sanstone lenses.
At EL. 433.1 ft, becomes thinly bedded, rock expands upon excavation (continues to bottom of hole).
At EL. 423.1 ft, becomes unfractured, 30-40% sandstone.
At EL. 408.1 ft, becomes laminated to very thinly bedded, trace sandstone lenses.
At EL. 403.1 ft, becomes thinly to moderately bedded, olive gray and dark greenish gray, slightly fractured, joint, dipping 80°, slightly rough, thin.
At EL. 401.0 ft, unit is very weak.
At EL. 396.1 ft, becomes very thinly bedded.
At EL. 393.1 ft, becomes unfractured.
At EL. 388.1 ft, becomes laminated, slightly fractured, joint, dipping 80°, slightly rough, thin, no sandstone lenses.
At EL. 384.9 ft, observed 3" fracture zone.
At EL. 383.1 ft, becomes unfractured, few sandstone lenses.
At EL. 375.0 ft, unit is extremely weak.
At EL. 366.1 ft, observed trace hard sandstone lenses.
At EL. 363.1 ft, becomes hard.
470
460
450
440
430
420
410
400
390
380
370
360

PROFILE
Vert: 1"-10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO. N/A	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR NAME: SHIVA KARIMI	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: K. BARKER		DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 1 OF 2
	CHECKED BY: M. SALISBURY	DATE: 3/19/09 - 4/3/09				

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET 1 OF 2

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

BENCHMARK:

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Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

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6) Plan view shown on Boring Location Plan sheet 1 of 2.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Kristopher Barker — CERTIFIED ENGINEERING GEOLOGIST — 3/18/10 DATE

PLANS APPROVAL DATE

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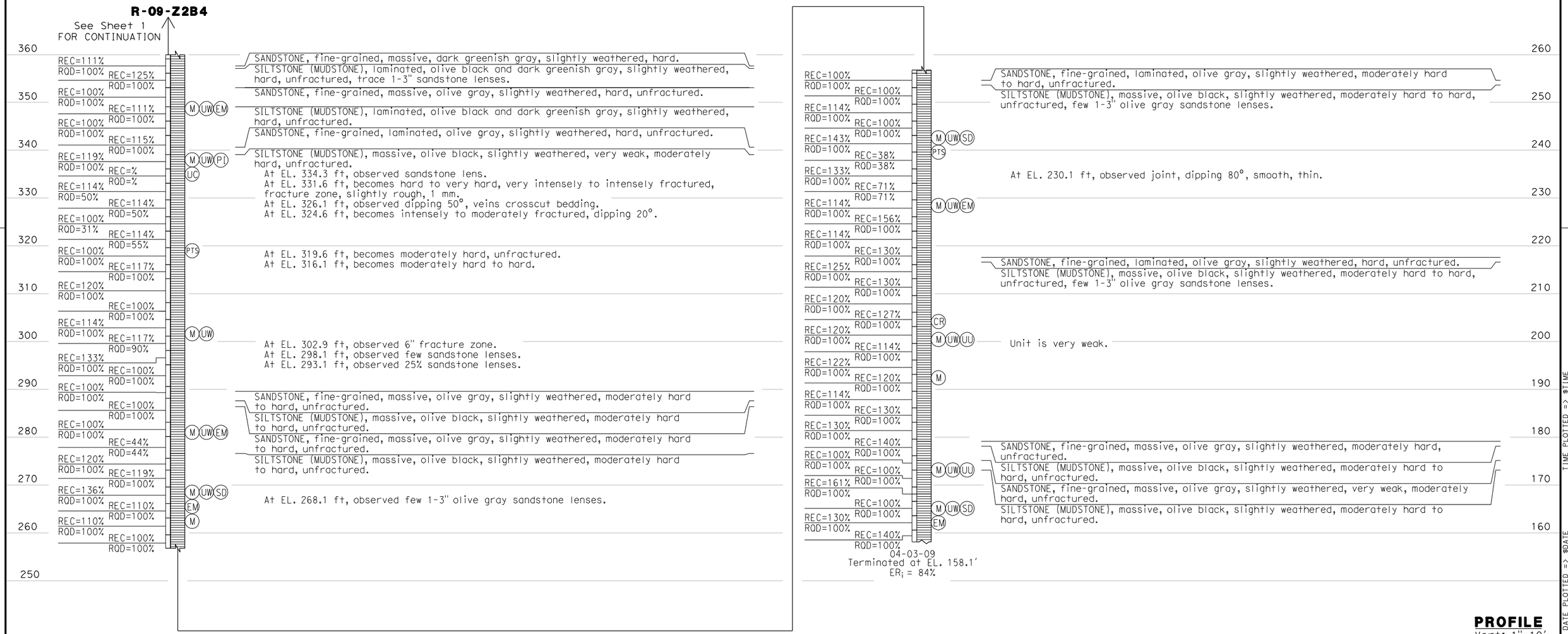
PROFESSIONAL GEOLOGIST — KRISTOPHER P. BARKER — No. CEG 2383 — Exp. 8/31/2011 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA



PROFILE
Vert: 1"=10′

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR	DRAWN BY: E. MIGUEL			N/A	
NAME: SHIVA KARIMI	CHECKED BY: M. SALISBURY		DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 2 OF 2
	FIELD INVESTIGATION BY: K. BARKER				
	DATE: 3/19/09 - 4/3/09				

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES | SHEET 2 | OF 2

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Kristopher Barker 3/18/10
CERTIFIED ENGINEERING GEOLOGIST DATE

PROFESSIONAL GEOLOGIST KRISTOPHER P. BARKER No. CEG 2383 Exp. 8/31/2011 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

PLANS APPROVAL DATE

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:

1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).
2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.
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6) Plan view shown on Boring Location Plan sheet 1 of 2.

R-09-Z2B5

N: 1853050.81
E: 6511831.88
EL. 452.4'

GWS EL 441.6'
07-01-09

Elev.	Blows / Length	Tests	Description
450	4"		ASPHALT (4").
			SILTY CLAY (CL/ML); soft to medium stiff; dark brown; moist; low plasticity fines. [ALLUVIUM]
	14 / 1.4		SANDY SILT (ML); medium stiff; dark brown; moist; fine SAND; nonplastic fines.
440	7 / 1.4	M PI	Lean CLAY with SAND (CL); stiff; dark brown; moist.
	32 / 1.4	M	SILTY SAND (SM); dense; yellowish brown; moist; fine SAND.
430	33 / 1.4		At EL. 431.4 ft, contains coarse to fine SAND.
	22 / 1.4		SANDY SILT (ML); hard; light brown; moist; some fine SAND; mostly nonplastic to low plasticity fines; interbedded with silty sand (SM).
420	19 / 1.4	M PA	SILTY SAND (SM); medium dense; yellowish brown; moist; medium to fine SAND; nonplastic fines.
	14 / 1.4		
410	13 / 1.4		
	18 / 1.4		SANDY SILT (ML); stiff to very stiff; olive gray; moist; few fine GRAVEL; fine SAND; nonplastic to low plasticity fines.
400	18 / 1.4	M PA	SILTY SAND (SM); medium dense; light brown; moist; little fine GRAVEL; fine SAND. At EL. 401.4 ft, with trace fine GRAVEL; mostly fine SAND; some low plasticity fines.
	34 / 1.4		At EL. 397.4 ft, grades to medium to fine SAND.
390	19 / 1.4		SILTY CLAY (CL/ML); stiff to very stiff; olive brown to olive gray; moist; low plasticity fines.
	14 / 1.4		
380	24 / 1.4		
	20 / 1.4	M PI	Fat CLAY (CH); very stiff; olive gray; moist; medium to high plasticity fines.
370	12 / 1.4		SILTY CLAY (CL/ML); stiff to very stiff; light brown; moist; low plasticity fines.
	20 / 1.4	M	
360	17 / 1.4		very stiff; olive gray; low to medium plasticity fines.
	16 / 1.4		
350	22 / 1.4	PA C UU / M UW PI	At EL. 347.4 ft, with few fine SAND.
340			

Elev.	Core / Blows	Tests	Description
340	14 / 1.4		CLAYEY SAND (SC); medium dense; light brown; moist; fine SAND; nonplastic to low plasticity fines.
	11 / 1.4		SANDY lean CLAY (CL); stiff; light brown to light gray; moist to wet; fine SAND; low plasticity fines.
330	14 / 1.4		At EL. 332.4 ft, grades to very stiff.
		M UW PI UU	Fat CLAY (CH); very stiff; light brown to light gray; moist to wet.
320	27 / 1.4		SANDY lean CLAY (CL); very stiff; light brown to light gray; moist to wet.
	43 / 1.4; REC=100% RQD=100%	4"	very stiff to hard
	REC=100% RQD=100%		SEDIMENTARY ROCK: CLAYSTONE (MUDSTONE), thinly bedded, moderate olive brown and olive gray, slightly weathered, extremely weak, very soft, unfractured. [PUENTE FORMATION].
310	REC=90% RQD=90%		At EL. 312.4 ft, becomes laminated, soft. At EL. 307.4 ft, becomes slightly fractured, joint, not healed, dipping 30°.
	REC=100% RQD=100%	M UW UU PI PA	At EL. 302.4 ft, becomes unfractured.
300	REC=100% RQD=84%		
	REC=100% RQD=88%		At EL. 297.9 ft, becomes soft to moderately soft.
	REC=100% RQD=100%		SEDIMENTARY ROCK: CLAYSTONE (MUDSTONE), massive, black, slightly weathered, soft to moderately soft, unfractured.
290	REC=120% RQD=80%		At EL. 287.4 ft, becomes very slightly fractured, shear, dipping 45°.
	REC=100% RQD=100%		At EL. 282.4 ft, becomes moderately soft, unfractured.
280	REC=108% RQD=80%		
	REC=100% RQD=20%	M UW UC	At EL. 277.4 ft, becomes very slightly fractured, joint, dipping 70°, few subhorizontal silty laminations. Extremely weak.
270	REC=100% RQD=33%		
	REC=100% RQD=100%		
	REC=100% RQD=83%	M UW UC	At EL. 264.4 ft, unit is very weak.
260	REC=104% RQD=100%		At EL. 258.4 ft, contains about 50% siltstone, weakly subvertically laminated.
	REC=100% RQD=75%		At EL. 253.4 ft, becomes unfractured.
250	REC=106% RQD=100%		

See Sheet 2
FOR CONTINUATION

PROFILE
Vert: 1"-10'

ENGINEERING SERVICES	GEOTECHNICAL SERVICES				
FUNCTIONAL SUPERVISOR NAME: SHIVA KARIMI	DRAWN BY: E. MIGUEL; CHECKED BY: M. SALISBURY	FIELD INVESTIGATION BY: K. LAI, M.ISLAM, K. BARKER; DATE: 4/06/09 - 4/14/09	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN — DESIGN BRANCH	BRIDGE NO. N/A; POST MILES N/A

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 1 OF 2

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Kristopher Barker 3/18/10
CERTIFIED ENGINEERING GEOLOGIST DATE

PLANS APPROVAL DATE

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PROFESSIONAL GEOLOGIST
KRISTOPHER P. BARKER
No. CEG 2383
Exp. 8/31/2011
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

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MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

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6) Plan view shown on Boring Location Plan sheet 1 of 2.

R-09-Z2B5

See Sheet 1 FOR CONTINUATION

250
REC=100% ROD=100% — M UW UC — At EL. 249.0 ft, unit is extremely weak.
REC=100% ROD=100%
SEDIMENTARY ROCK: SILTSTONE (MUDSTONE), laminated, black, slightly weathered, moderately soft, unfractured, subvertical laminations.
240
REC=100% ROD=100%
REC=100% ROD=100%
REC=100% ROD=100% — M UW UU — At EL. 234.9 ft, unit is extremely weak.
230
REC=100% ROD=82%
At EL. 229.4 ft, observed fine grained sand lenses.
REC=104% ROD=73%
At EL. 224.4 ft, becomes dark greenish gray.
REC=100% ROD=75%
220
REC=92% ROD=92% — PTS — At EL. 218.4 ft, becomes slightly fractured, shear, dipping 80°.
At EL. 215.8 ft, observed 2-3" gravel lens, fine, rounded and sub-angular.
REC=94% ROD=40%
REC=100% ROD=100% — M UW UC — At EL. 211.9 ft, unit is very weak.
210
REC=100% ROD=92%
At EL. 204.4 ft, becomes very soft.
REC=88% ROD=79%
At EL. 200.9 ft, observed breccia lens, fine gravel, sub-rounded, black siltstone matrix.
REC=42% ROD=10%
200
REC=89% ROD=0%
SEDIMENTARY ROCK: SANDSTONE, fine-grained, massive, dark greenish gray, slightly weathered, very soft, unfractured.
REC=30% ROD=0%
190

REC=67% ROD=16%
REC=111% ROD=83% — M UW UU
REC=111% ROD=33%
REC=42% ROD=0%
REC=100% ROD=40%
REC=90% ROD=0%
REC=135% ROD=40%
REC=107% ROD=50%
REC=100% ROD=92% — M UW UC
REC=120% ROD=80%
REC=100% ROD=80%

04-14-09
Terminated at
EL. 152.4'
ER_I = 84%

190
SEDIMENTARY ROCK: SILTSTONE (MUDSTONE), laminated, dark gray, slightly weathered, extremely weak, moderately soft, unfractured.
At EL. 187.4 ft, observed 1' lens of little coarse sand and trace fine gravel.
180
SEDIMENTARY ROCK: CONGLOMERATE, coarse sand to cobble, dark gray, slightly weathered, very soft, unfractured, sand and clay matrix, clasts are very hard, sub-rounded and sub-angular, metamorphosed granitics, trace shell fragments, (possible shear zone).
SEDIMENTARY ROCK: CLAYSTONE (MUDSTONE), massive, dark gray, slightly weathered, moderately soft, with lenses of siltstone.
170
SEDIMENTARY ROCK: SANDSTONE, fine-grained, dark gray, slightly weathered, hard, slightly fractured, joint dipping 45°.
At EL. 172.4 ft, observed little coarse and fine gravels, sub-rounded, granitic.
160
SEDIMENTARY ROCK: SILTSTONE (MUDSTONE), laminated to very thinly bedded, dark gray, slightly weathered, very weak, moderately soft, slightly fractured, locally very soft, with sandstone laminations.
At EL. 159.9 ft, observed 1' bed of little fine to coarse gravels, sub-angular.
150

PROFILE
Vert: 1"=10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR NAME: SHIVA KARIMI	DRAWN BY: E. MIGUEL CHECKED BY: M. SALISBURY	FIELD INVESTIGATION BY: K. LAI, M.ISLAM, K. BARKER DATE: 4/06/09 - 4/14/09			DESIGN BRANCH	N/A POST MILES N/A	LOG OF TEST BORING SHEET 2 OF 2

OGS CIVIL LOG OF TEST BORINGS SHEET — ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 — CU EA 07-187900 — DISREGARD PRINTS BEARING EARLIER REVISION DATES → — REVISION DATES — SHEET 2 OF 2

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

BENCHMARK:

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

GEOTECHNICAL ENGINEER — 3/18/10 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — GEOTECHNICAL — STATE OF CALIFORNIA

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CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

R-09-Z3B1

N: 1873601.92
E: 6507232.68
EL. 885.1′

6" ASPHALT (2") and Concrete (6").

SILTY SAND (SM): medium dense; brown; moist; trace fine GRAVEL; mostly medium to fine SAND; few coarse sand; some low plasticity fines; possible iron oxide staining. [OLDER ALLUVIUM]
At EL. 870.0 ft, becomes dense, dark brown.
At EL. 865.0 ft, becomes dark medium dense; trace fine GRAVEL; mostly medium to fine SAND; some low plasticity fines.

Poorly graded SAND with SILTY CLAY; very dense; brownish yellow; moist; coarse to fine, subrounded SAND; medium plasticity fines.
At EL. 855.0 ft, becomes very pale brown.

SEDIMENTARY ROCK: SANDSTONE, fine sand to coarse sand, pale brown, moderately weathered, moderately soft to moderately hard slightly fractured, slight iron oxide staining. [TOPANGA FORMATION]
At EL. 853.0 ft, grades to light yellowish brown with iron oxide staining.
At EL. 852.5 ft, observed fault, dipping 75°, Bedding joint dipping 15°.
At EL. 851.7 ft, observed fault, dipping 80°, dark gray clay lining.
At EL. 851.2 ft, observed 15 mm thick clay seam, dipping 15°, yellowish red.
At EL. 851.0 ft, becomes medium sand to coarse sand, dusky brown, intensely to moderately weathered, moderately hard.
At EL. 849.6 ft, becomes very thinly to thinly bedded, bedding joint, dipping 15 to 0°, clay lined, 1 to 2 mm aperture.
At EL. 849.0 ft, contains bedding joint, dipping 15°, 1" thick, gray silty clay seam.
At EL. 848.5 ft, contains fault, dipping 65°, clay lined.
At EL. 847.8 ft, contains fault, dipping 55°, calcite lined.
At EL. 847.5 ft, contains bedding joint, dipping 15°.
At EL. 846.5 ft, contains 2" thick silty sand lens, light gray, very moist.

SEDIMENTARY ROCK, CONGLOMERATE, granule to cobble, massive, light gray, moderately weathered, recovered as pebble-sized clasts of intrusive rock, clasts are very hard.
At EL. 840.0 ft, observed moderately hard, sandstone, as EL. 855′. Numerous joints.
At EL. 839.3 ft, observed extremely hard, cobble-sized intrusive clast.
At EL. 836.0 ft, becomes pebble to granule, intensely to moderately weathered, moderately hard, intensely to moderately fractured, bedding joint, dipping 5°, Matrix is fine to coasre sand, clasts are angular to subangular, diorite derived.
At EL. 830.2 ft, becomes dark reddish brown, moderately weathered, Local highly fractured siltstone lens, soft, gray.
At EL. 829.8 ft, observed coarse sand lens, abundant iron oxide staining, intensely weathered.
At EL. 824.5 ft, observed bedding joint, dipping 5 to 2°.
At EL. 821.0 ft, becomes soft to moderately soft.
At EL. 819.1 ft, observed bedding joint, dipping 5°, Intensely weathered, very thinly bedded siltstone. Unit is intensely fractured.
At EL. 816.0 ft, becomes intensely to moderately weathered.
At EL. 814.7 ft, contains gray sandstone bed, non-indurated, 0.3′ thick.
No recovery at El. 811 to 806 ft due to drilling error.
At EL. 806.0 ft, observed light bluish gray mottled with pale brown, moderately to slightly weathered, soft, iron oxide staining.
At EL. 804.9 ft, becomes light olive brown, moderately weathered.
At EL. 803.4 ft, observed dusky blue, slightly weathered, moderately hard, calcite cement.
At EL. 800.2 ft, observed slightly weathered to fresh, dark yellowish brown becoming dark bluish gray below.
At EL. 789.6 ft, becomes soft to moderately soft, granule to pebble-sized clasts in fine to coarse sand matrix. Clasts are subrounded to angular.
At EL. 788.0 ft, observed shear, dipping 60°, 5 mm aperture, clay lined, slickensided.
At EL. 787.1 ft, contains joint, dipping 0°.
At EL. 784.0 ft, observed fine to very coarse grained sand matrix, clasts are subangular.
At EL. 779.6 ft, contains granule to cobble, very thickly bedded to massive, intensely to moderately fractured.
At EL. 778.3 ft, contains joint, dipping 80°, 2" aperture.
At EL. 776.2 ft, contains shear, dipping 20°, 1" to 1.5" aperture, slickensided.
At EL. 775.6 ft, observed four joints dipping 0, 20, 45, and 80°.
At EL. 774.5 ft, becomes moderately soft to moderately hard, numerous horizontal joints, likely due to drilling.
At EL. 772.1 ft, observed possible 2" sheared zone - infilled sand is decomposed to silt. Local zones with calcite cement.
At EL. 768.6 ft, contains possible fracture zone, 5" thick.
At EL. 768.0 ft, becomes very intensely fractured, joint, dipping 40°.
At EL. 767.1 ft, observed joint, dipping 20°, slickensided with chlorite alteration.
At EL. 762.0 ft, observed dark gray mottled with white, slightly weathered to fresh, intersected igneous clasts. Numerous joints dipping 0 to 70°, apertures up to 3 mm.
At EL. 758.5 ft, becomes intensely fractured, Numerous joints dipping 0 to 15°. Shear dipping 50°, slight clay lining.
At EL. 755.7 ft, observed random fracture, dipping 90°.
At EL. 755.4 ft, observed random fracture, dipping 60 to 20°.
At EL. 754.3 ft, observed medium to very coarse sandstone lens, 2.5" thick.
At EL. 753.9 ft, becomes fresh, soft, numerous joints dipping 0 to 50°.
At EL. 752.0 ft, observed numerous joints dipping 50 to 80°, 1 to 2mm aperture, calcite infill.
At EL. 743.9 ft, observed local slickensided surfaces on diorite clasts.
At EL. 741.0 ft, observed numerous joints dipping 0 to 90°.
At EL. 738.9 ft, observed fine to very coarse sand matrix, clasts up to 3" observed, local slickensided joint faces dipping 70 to 80°.
At EL. 735.9 ft, observed 4" thick section of possible gouge.
At EL. 734.9 ft, observed joint, dipping 75°, coarse grained sand matrix.
At EL. 732.9 ft, observed 1′ thick section of sandstone with granule to pebble sized clasts, dark gray, clasts are angular to subrounded.
At EL. 728.9 ft, becomes fresh, moderately soft, very slightly fractured, clasts are easily friable.
At EL. 725.9 ft, observed zone with light greenish gray sand and fragments of hardened clay, possibly gouge.
At EL. 723.9 ft, becomes very thickly bedded to massive, soft, very intensely fractured, unit observed as granule to cobble sized clasts with fine to coarse grained sand matrix, clasts are subangular.
At EL. 718.9 ft, becomes soft to moderately soft.
At EL. 713.0 ft, becomes intensely to moderately fractured, contains numerous joints dipping 0 to 20°. Unit is very weak.
At EL. 712.3 ft, observed joint, dipping 10°.
At EL. 711.4 ft, observed joint, dipping 10°. Strong clast observed.
At EL. 711.0 ft, PTS - Coarse grained arkosic Sandstone with crystal and rock fragments to 2mm, fragments composed of diorite and sandstone. Fine to medium grained calcite matrix.
At EL. 710.9 ft, observed joint, dipping 20°. Unit is strong.
At EL. 708.9 ft, becomes very intensely fractured, intersected clasts up to 7", abundant joints dipping 0 to 65°.
At EL. 707.3 ft, observed joint, dipping 45°.
At EL. 706.5 ft, PTS - Quartz Diorite clast: Plutonic rock with allotriomorphic-granular texture.

See Sheet 2
FOR CONTINUATION

PROFILE
Vert: 1"=10′

DEREK HIGA, DESIGN OVERSIGHT ENGINEER	DRAWN BY:	EDELYNE MIGUEL	M. TORSIELLO, FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MAHESWARAN RAVEENDRA, PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY:	DAN JANKLY	DATE: 3/12/09 - 3/24/09		

BRIDGE NO. N/A | POST MILES N/A

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 1 OF 2

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 1 OF 2

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

GEOTECHNICAL ENGINEER — DATE 3/18/10

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

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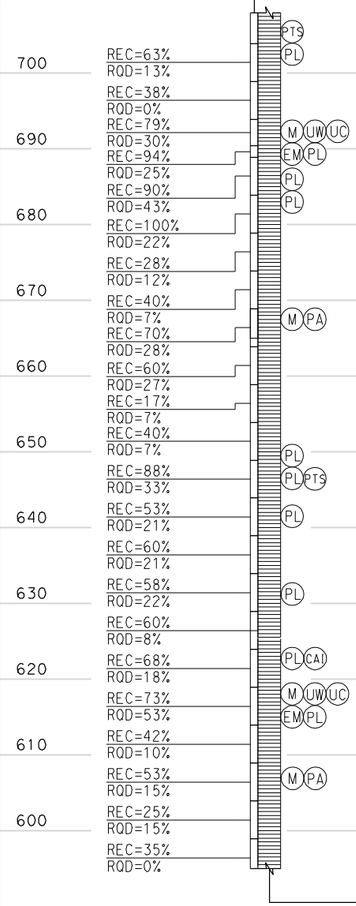
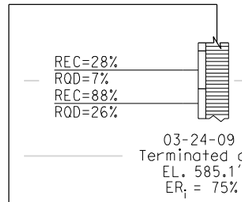
R-09-Z3B1

See Sheet 1 FOR CONTINUATION



At EL. 705.9 ft, observed joint, dipping 45°.
At EL. 705.3 ft, observed joint, dipping 65°.
At EL. 702.7 ft, observed joint, dipping 60°, slickensided. Unit exhibits numerous joints dipping from 0 to 60 degrees, joints are typically rough, aperture uncertain due to intensely fractured nature of the unit. Unit is weak.
At EL. 698.9 ft, becomes slightly weathered to fresh, very intensely to intensely fractured, Numerous clay lined, slickensided joints at EL. 699 to 698 ft dipping 70 to 85°.
At EL. 693.9 ft, becomes granule to boulder sized. At EL. 692.9 ft, intersected 1.7' long diorite boulder. Boulder is intensely fractured, medium strong.
At EL. 688.4 ft, observed joint, dipping 30°, unit becomes granule to pebble sized.
At EL. 687.9 ft, observed joint, dipping 35°.
At EL. 685.8 ft, observed joint, dipping 20°. Unit is medium strong.
At EL. 683.9 ft, becomes moderately soft to moderately hard, moderately hard zones due to calcite cementation.
At EL. 683.5 ft, observed joint, dipping 30 to 10°.
At EL. 681.0 ft, observed joint, dipping 80°, roughly 2 foot long. Unit is very weak to weak.
At EL. 677.9 ft, observed joint, dipping 45°.
At EL. 671.9 ft, observed joint, dipping 45°.
At EL. 668.9 ft, observed numerous slickensided joints dipping from 0 to 60°.
At EL. 664.0 ft, becomes granule to cobble sized clasts.
At EL. 662.9 ft, observed joint, dipping 50°.
At EL. 661.4 ft, observed joint, dipping 85°.
At EL. 658.7 ft, observed joint, dipping 45°.
At EL. 653.9 ft, observed numerous joints dipping 0 to 20°, 1mm aperture. Unit consists of angular to subrounded clasts of diorite and gneiss to 3" dia with fine to very coarse sand matrix. Soft to moderately soft, intensely fractured.
At EL. 648.9 ft, observed predominantly diorite clasts. Unit is weak.
At EL. 647.7 ft, observed bedding joint, dipping 10°, 4" thick zone, thinly bedded.
At EL. 646.0 ft, PTS - Highly fractured and altered clast of brecciated Quartz Monzonite.
At EL. 643.9 ft, observed numerous joints dipping 0 to 20°, 1mm aperture.
At EL. 638.9 ft, observed clasts up to 5.5".
At EL. 638.5 ft, observed numerous joints dipping 0 to 45°.
At EL. 631.4 ft. Unit is weak.
At EL. 623.9 ft, observed 1.7' thick sandstone bed with some clasts, medium to coarse grained, increasingly coarse with depth.
At EL. 622.2 ft, observed joint, dipping 45°, at base of sandstone.
At EL. 620.9 ft, observed joint, dipping 65°.
At EL. 618.9 ft, becomes intensely to moderately fractured; intersected clasts up to 8", strong.
At EL. 613.8 ft, becomes very intensely fractured, with numerous slickensided surfaces. Unit is very weak.
At EL. 607.9 ft, observed shear, dipping 70°.
At EL. 606.9 ft, observed joint, dipping 65°.
At EL. 603.5 ft, observed bedding joint, dipping 10°, clasts up to 2" observed.



03-24-09
Terminated at
EL. 585.1'
ER_i = 75%

At EL. 588.9 ft, observed pebble to cobble sized clasts.
At EL. 588.4 ft, observed numerous joints dipping 0 to 80°.

PROFILE
Vert: 1"=10'

DEREK HIGA, DESIGN OVERSIGHT ENGINEER	DRAWN BY:	EDELYNE MIGUEL	M. TORSIELLO, FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MAHESWARAN RAVEENDRA, PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY:	DAN JANKLY	DATE: 3/12/09 - 3/24/09		

BRIDGE NO. N/A
POST MILES N/A

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 2 OF 2

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 2 OF 2

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

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5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 2 of 2.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Joseph S. Pratt 3/18/10
CERTIFIED ENGINEERING GEOLOGIST DATE

PLANS APPROVAL DATE

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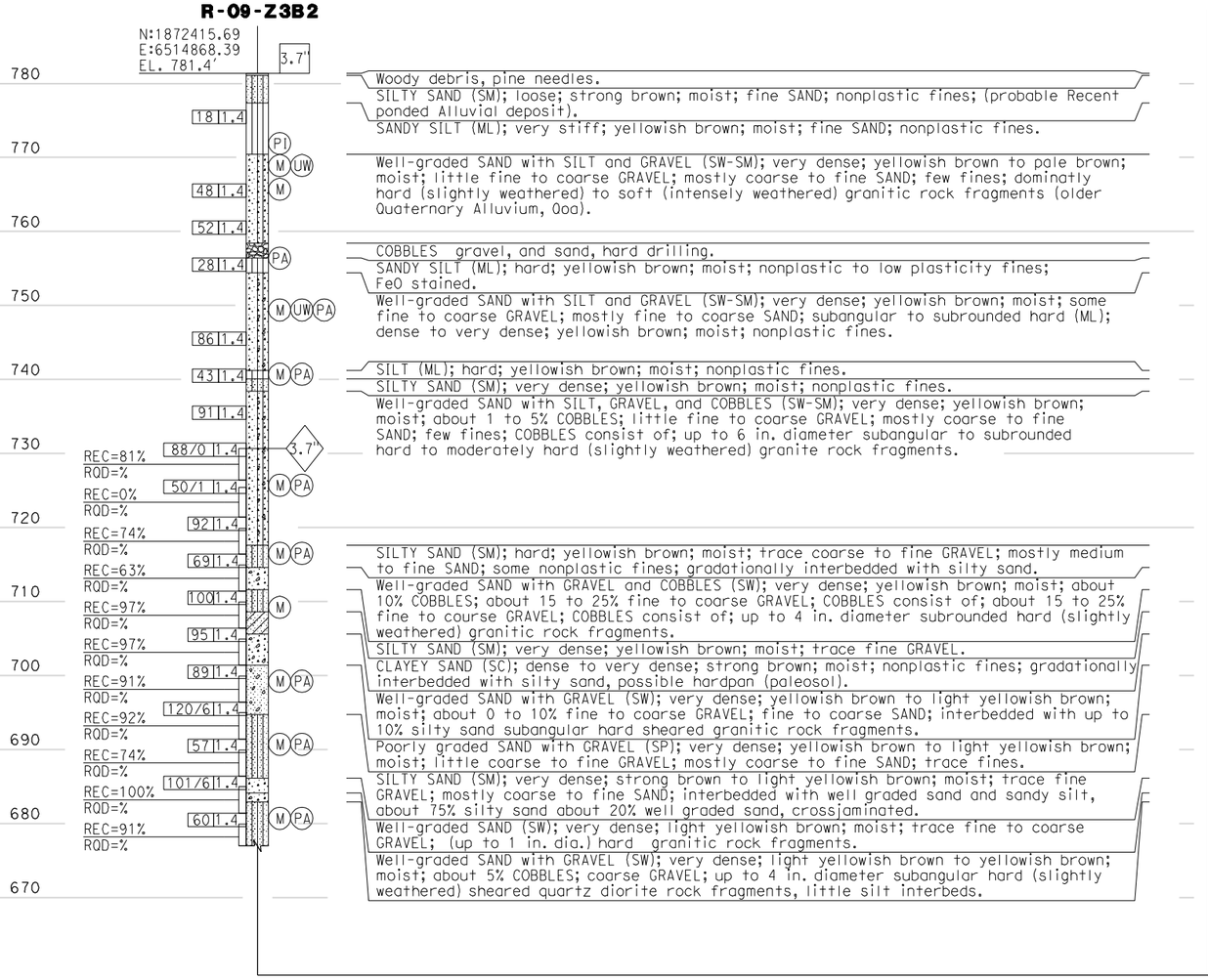
PROFESSIONAL GEOLOGIST — JOSEPH S. PRATT — No. CEG 2141 — Exp. 9/31/2011 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

R-09-Z3B2

N:1872415.69
E:6514868.39
EL. 781.4'



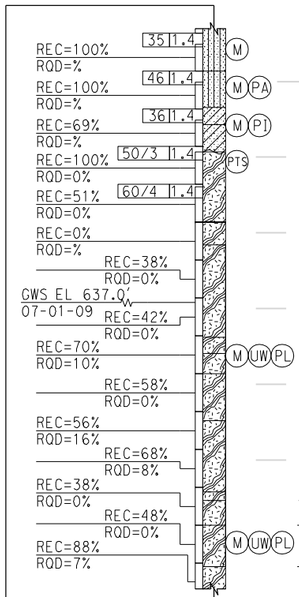
Woody debris, pine needles.
SILTY SAND (SM); loose; strong brown; moist; fine SAND; nonplastic fines; (probable Recent ponded Alluvial deposit).
SANDY SILT (ML); very stiff; yellowish brown; moist; fine SAND; nonplastic fines.

Well-graded SAND with SILT and GRAVEL (SW-SM); very dense; yellowish brown to pale brown; moist; little fine to coarse GRAVEL; mostly coarse to fine SAND; few fines; dominatly hard (slightly weathered) to soft (intensely weathered) granitic rock fragments (older Quaternary Alluvium, Qoa).

COBBLES gravel, and sand, hard drilling.
SANDY SILT (ML); hard; yellowish brown; moist; nonplastic to low plasticity fines; FeO stained.
Well-graded SAND with SILT and GRAVEL (SW-SM); very dense; yellowish brown; moist; some fine to coarse GRAVEL; mostly fine to coarse SAND; subangular to subrounded hard (ML); dense to very dense; yellowish brown; moist; nonplastic fines.

SILT (ML); hard; yellowish brown; moist; nonplastic fines.
SILTY SAND (SM); very dense; yellowish brown; moist; nonplastic fines.
Well-graded SAND with SILT, GRAVEL, and COBBLES (SW-SM); very dense; yellowish brown; moist; about 1 to 5% COBBLES; little fine to coarse GRAVEL; mostly coarse to fine SAND; few fines; COBBLES consist of; up to 6 in. diameter subangular to subrounded hard to moderately hard (slightly weathered) granite rock fragments.

SILTY SAND (SM); hard; yellowish brown; moist; trace coarse to fine GRAVEL; mostly medium to fine SAND; some nonplastic fines; gradationally interbedded with silty sand.
Well-graded SAND with GRAVEL and COBBLES (SW); very dense; yellowish brown; moist; about 10% COBBLES; about 15 to 25% fine to coarse GRAVEL; COBBLES consist of; about 15 to 25% fine to course GRAVEL; COBBLES consist of; up to 4 in. diameter subrounded hard (slightly weathered) granitic rock fragments.
SILTY SAND (SM); very dense; yellowish brown; moist; trace fine GRAVEL.
CLAYEY SAND (SC); dense to very dense; strong brown; moist; nonplastic fines; gradationally interbedded with silty sand, possible hardpan (paleosol).
Well-graded SAND with GRAVEL (SW); very dense; yellowish brown to light yellowish brown; moist; about 0 to 10% fine to coarse GRAVEL; fine to coarse SAND; interbedded with up to 10% silty sand subangular hard sheared granitic rock fragments.
Poorly graded SAND with GRAVEL (SP); very dense; yellowish brown to light yellowish brown; moist; little coarse to fine GRAVEL; mostly coarse to fine SAND; trace fines.
SILTY SAND (SM); very dense; strong brown to light yellowish brown; moist; trace fine GRAVEL; mostly coarse to fine SAND; interbedded with well graded sand and sandy silt, about 75% silty sand about 20% well graded sand, crossjaminated.
Well-graded SAND (SW); very dense; light yellowish brown; moist; trace fine to coarse GRAVEL; (up to 1 in. dia.) hard granitic rock fragments.
Well-graded SAND with GRAVEL (SW); very dense; light yellowish brown to yellowish brown; moist; about 5% COBBLES; coarse GRAVEL; up to 4 in. diameter subangular hard (slightly weathered) sheared quartz diorite rock fragments, little silt interbeds.



SILTY SAND (SM); dense to very dense; strong brown to reddish brown; moist; trace GRAVEL; mostly coarse to fine SAND; little nonplastic to low plasticity fines; interbedded with about 20% well graded sand 25% silt, intensely weathered soil and quartz diorite and schist rock fragments.
SILTY SAND (SM); very dense; yellowish brown to reddish brown; moist; few fine GRAVEL; mostly coarse to fine SAND; some nonplastic to low plasticity fines; gradationally interbedded with clayey sand, subangular hard (slightly weathered) to soft (intensely weathered) quartz diorite and schist rock fragments, intensely weathered zone (paleosol).
CLAYEY SAND (SC); dense to very dense; very stiff to hard; yellowish brown to reddish brown mottled; moist; nonplastic to low plasticity fines; to sandy lean clay, intensely weathered (paleosol or regolith).
CLAYEY SAND (SC); very dense; very stiff; light yellowish brown to yellowish red mottled; moist to wet; nonplastic to low plasticity fines; wet between EL 663.1 to 662.6 ft, minor weakly calcite cemented sand, intensely weathered soft (palesol/regolith).
METAMORPHIC ROCK: GNEISS; medium-grained to aphanitic; thinly to moderately foliated (0.2 to 1.0 ft), foliations dip 20°, dark yellowish orange to light brown, decomposed to intensely weathered; very soft to soft; intensely fractured; joints dip from 60 to 80°, very thin slightly open fractures partly filled with clay and FeO (forms rubble), moderately thin totally silica healed fractures below EL +654.4 ft fractures moderately rough; friable (Well graded SAND with CLAY (SW-SC), very dense) [Wilson Quartz Diorite (wgm) BEDROCK].
METAMORPHIC ROCK: GNEISS; coarse-grained to very coarse-grained; generally foliated, pale yellowish brown to yellowish gray, intensely weathered, moderately soft to moderately hard, very intensely fractured, joints dips 55°, thin moderately open fractures partly healed with clay and FeO, some think fractures is (3 to 5 mm thick) moderately healed with silica or feldspar and dip 25 to 30°, and 55°; friable; estimated upper contact.
METAMORPHIC ROCK: GNEISS; medium-grained; generally foliated, pale yellowish brown to dark gray, intensely weathered, decomposed below EL 635.1 ft; moderately hard to hard; intensely fractured; below EL 635.1 ft, very soft (decomposed gneiss altered to clay with slickensides); rubble.
METAMORPHIC ROCK: GNEISS; generally foliated, light brownish gray to white, intensely weathered, moderately hard to hard, very intensely to intensely fractured, joints dip 60°, 75°, and 40 to 25°, very closely spaced fractures (7 mm spacing) below EL 633.4 ft; seams infilled with FeO and intensely weathered to decomposed mica (weathered to clay); fractures not healed.
METAMORPHIC ROCK: GNEISS;, light brownish gray to white, intensely weathered, moderately hard to hard, intensely to moderately fractured, joints dip 65 to 75°, closely to moderately spaced (0.4 to 0.1 ft), FeO and clay lined, not healed.
Below EL 629.2 ft,, aphanitic to medium-grained, very intensely to intensely fractured, joints dip 25-30° and 65-75° (jointsets), very close to closely spaced (0.05 to 0.3 ft), subvertical joints not healed (FeO and clay infill); low angle joints moderately to totally healed with FeO and silica (0.5 to 10 mm thick).
METAMORPHIC ROCK: GNEISS; generally foliated, light gray to brownish gray, hard, intensely fractured, (decomposed seams); joints dip 80°, 50-55°, 65-25°, FeO and silica lined fractures are moderately healed to not healed; wet clay lined fractures (1 to 10 mm thick) not healed, slightly rough, slickensides on low angle shears, 5 to 30 mm fracture [spacing, lots rubble].
METAMORPHIC ROCK: GNEISS; intensely weathered, hard, very intensely to intensely fractured, fracture zone , forms rubble.
METAMORPHIC ROCK: GNEISS; decomposed to intensely weathered, very soft to soft, possible veins/dike, seams weathered to clay (Well graded SAND with CLAY (SW-SC)).
METAMORPHIC ROCK: GNEISS; possibly thinly foliated (0.1 to 0.3 ft), yellowish gray, intensely weathered, hard, intensely fractured, continuous joints dip 60 to 70° and 25 to 40°, partly healed with silica and infilled with clay, slightly rough surfaces.

See Sheet 2
FOR CONTINUATION

PROFILE
Vert: 1"=10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: J. PRATT, T. HALDA				N/A	
NAME: SHIVA KARIMI	CHECKED BY: K. BARKER	DATE: 1/13/09 - 1/22/09			DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 1 OF 3

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES | SHEET 1 | OF 3

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Joseph S. Pratt — CERTIFIED ENGINEERING GEOLOGIST — 3/18/10 DATE

PLANS APPROVAL DATE

JOSEPH S. PRATT No. CEG 2141 Exp. 5/31/2011 CERTIFIED ENGINEERING GEOLOGIST — PROFESSIONAL GEOLOGIST — STATE OF CALIFORNIA

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BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

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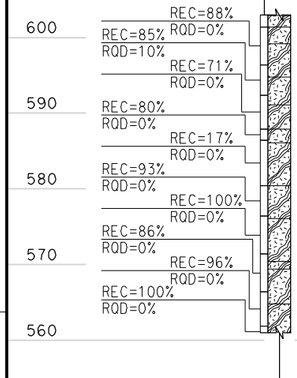
6) Plan view shown on Boring Location Plan sheet 2 of 2.

R-09-Z3B2

See Sheet 1 FOR CONTINUATION



METAMORPHIC ROCK: SCHIST; fine- to medium-grained; intensely foliated (<3mm); intensely weathered to decomposed (possible altered mafic dike), dark gray, intensely weathered to decomposed (possible altered mafic dike); moderately hard; intensely to moderately fractured; fractures very closely spaced (10 to 15 mm), partly silica healed, remainder infilled with soft clay (not healed), [slightly to moderately open fractures (0.5 to 3 mm)].

METAMORPHIC ROCK: SCHIST; Chloritic, dark greenish gray, decomposed, very soft to soft, (decomposed to Lean CLAY (CL), medium plasticity, moist)).

METAMORPHIC ROCK: GNEISS; very thinly foliated, light gray to pale yellowish brown, intensely weathered to decomposed; mostly hard to some soft; very intensely to intensely fractured; soft clay lined fractures not healed (slightly open to moderately open, 0.5 to 2 mm), forms rubble (some Poorly graded GRAVEL with CLAY and SAND (GP-GC)).

METAMORPHIC ROCK: GNEISS;, medium light gray, intensely weathered, hard, intensely fractured, joint sets dip 80 to 70°, 60°, and 30°, fractures partly healed with silica and remainder infilled with soft clay (not healed, moderately open, 1 to 2 mm), slightly rough to smooth surfaces; rubble.

METAMORPHIC ROCK: GNEISS;, fine-grained to medium-grained, medium light gray, intensely weathered to decomposed; hard to some very soft; very intensely to intensely fractured; joints dip 70° to 20°, very closely spaced (10 to 20 mm fracture spacing), siliceous & clay lined (1 to 2 mm), slightly rough to smooth surfaces [breaks down to rubble and coarse sand (some Poorly graded GRAVEL with SAND (GP))].

METAMORPHIC ROCK: GNEISS;, white to dark greenish gray, decomposed to intensely weathered; very soft to moderately soft; very intensely fractured; very closely spaced fractures (10 mm spacing) dip 70°, altered clay material is moist to wet (mostly Poorly graded GRAVEL with CLAY and SAND (GP-GC), moist to wet).

METAMORPHIC ROCK: GNEISS; fine-grained to aphanitic; thinly to moderately foliated (0.2 to 0.4 ft), greenish gray to medium bluish gray, intensely to moderately weathered, hard, intensely fractured, fractures dip 20 to 30°, and 50°, closely spaced (0.2 to 0.3 ft), chlorite and slickensides on shear and fracture surfaces, fractures/shears partly calcite healed.

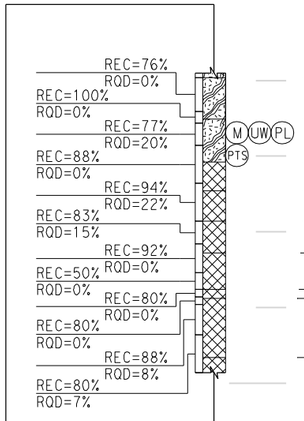
METAMORPHIC ROCK: GNEISS;, medium gray to white, mostly decomposed (80%) to intensely weathered; mostly very soft to little hard; intensely fractured; chloritic alteration, (mostly Poorly graded GRAVEL with CLAY and SAND (GP-GC); Pressure meter test (195-201 ft depth).

METAMORPHIC ROCK: GNEISS;, medium-grained to fine-grained, medium gray to medium light gray, mostly moderately to intensely weathered (75%) with little thin (0.1 to 0.3 ft) decomposed intervals (25%); mostly hard to little very soft; intensely fractured, joints dip 75-70°, 50° and 25°, [closely spaced (0.1 to 0.3 ft), continuous, partly healed with silica, clay lined (not healed), slightly rough surfaces (little Poorly graded SAND with CLAY (SP-SC))].

METAMORPHIC ROCK: GNEISS;, medium-grained, medium gray to medium light gray, mostly intensely weathered (70%) to some decomposed (30%); mostly moderately hard to some very soft; very intensely to intensely fractured; joints dip 70-80°, 50°, & 25 to 35°, very thin subvertical fractures very closely spaced (7 mm) [and totally silica healed, remaining lower angle joints are partly healed with silica and calcite and not healed with clay infill, slickensides plunge 20° on subvertical shears (some Lean CLAY with SAND (CL))].

METAMORPHIC ROCK: GNEISS;, medium gray to medium dark gray, decomposed, very soft to soft, (Lean CLAY (CL), soft).

METAMORPHIC ROCK: GNEISS; medium-grained to fine-grained; very thinly to thinly foliated (dip 20°), medium gray to medium light gray, intensely to moderately weathered, moderately hard to hard, very intensely to intensely fractured, irregular discontinuous fractures dip 60 to 70° and 20°, fractures partly healded with chlorite and silica, slighly rough surfaces, 35% rubble.



See Sheet 3 FOR CONTINUATION

560
550
540
530
520

METAMORPHIC ROCK: GNEISS;, medium-grained, medium light gray to medium gray, mostly intensely to moderately weathered (80%) to little decomposed (20%); mostly moderately hard to little very soft; intensely fractured; joints dip 75°, 50°, and 25°, subvertical joints are very closely spaced (30 mm), low angle joints [are closely spaced (60 to 70 mm), continuous not healed fractures are lined with minor chlorite and rare calcite, moderately to slightly rough surfaces (little Lean CLAY (CL))].

METAMORPHIC ROCK: GNEISS; medium-grained; foliated, medium light gray to medium gray, mostly moderately to intensely weathered (5% decomposed); mostly moderately hard to few soft; very intensely to intensely fractured; joints dip 70° and 20°, closely to very closely spaced (<0.1 to 0.2 ft) [subvertical very thin (0.5 mm thick) fractures moderately healed with silica, moderately rough surfaces].
Below EL 559.2 ft becomes, dark gray, (Pressuremeter test from 221.0 to 227.0 ft depth).

METAMORPHIC ROCK: GNEISS; medium-grained; foliated, medium light gray to medium gray, moderately to intensely weathered; moderately hard; very intensely to intensely fractured; joints dip 70 to 80° & 20-25°, continuous subvertical joints partly healed with silica and not healed with clay infill [slightly rough surfaces, 80% soft decomposed below EL 551.4 ft].

IGNEOUS ROCK QUARTZ DIORITE; medium-grained, medium light gray, moderately to slightly weathered, hard to very hard, intensely fractured, low angle moderately open joints lined with waxey chlorite, slickensides show 65° rake from horizontal in 50° dip shear planes; continuous joints dip 75°, 50°, and 20°, closely (40 mm) to very closely (10 mm) spaced, [moderate and low angle joints closely spaced, subvertical joints very closely spaced and moderately healed with very thin silica (0.5 to 1 mm thick)].

METAMORPHIC ROCK MARBLE (partly replaced with QUARTZ DIORITE in patches); medium- to coarse-grained, light gray to medium light gray, moderately to intensely weathered; moderately hard; intensely fractured, low angle moderately open joints lined with waxey chlorite, high and low angle fractures moderately healed with calcite [fractures very closely spaced (20 to 25 mm), possible crinoidal debris in recrystalized mass].
At EL. 542.4 ft, becomes dark greenish gray, intensely fractured, joints dip 70°, 50 to 45°, and 20°, joints partly healed with calcite and chlorite infill to totally healed with calcite, 10% very soft decomposed interval altered to clay (few Lean CLAY (CL)).

METAMORPHIC ROCK: MARBLE (partly replaced with QUARTZ DIORITE in patches); medium-grained, dark greenish gray to light brownish gray, moderately to intensely weathered; moderately soft; intensely fractured, joints dip 80°, 50°, and 20°, partly to totally healed with calcite, moderately thin (1 to 2 mm) subvertical calcite veins very closely spaced (15 mm).

METAMORPHIC ROCK: MARBLE (partly replaced with QUARTZ DIORITE in mixed patches and layers); medium- to coarse-grained, medium light gray to greenish gray, intensely to moderately weathered, moderately soft to moderately hard, intensely fractured, joints dip 75 to 60°, 50°, and 20°, joints partly to totally calcite healed (1 to 2 mm calcite veins), all continuous, some clay lined not healed open joints.

METAMORPHIC ROCK: MARBLE;, medium-grained, greenish gray, intensely to moderately weathered, moderately hard, very intensely to intensely fractured, joints dip 20 to 30° and 60°, subvertical joints very closely spaced, low angle joints closely spaced, partly to totally calcite healed.

IGNEOUS ROCK DIORITE to QUARTZ DIORITE; medium- to coarse-grained, medium gray, intensely to moderately weathered, hard to very hard, intensely fractured, continuous joints dip 85 to 70° and 30°, very closely spaced subvertical joints partly healed with calcite and some infilled with clay and slightly open, low angle joints partly healed to totally healded with calcite (1 to 2mm thick).

PROFILE
Vert: 1"=10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES				
FUNCTIONAL SUPERVISOR NAME: SHIVA KARIMI	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: J. PRATT, T. HALDA	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO. N/A	SR-710 TUNNEL TECHNICAL STUDY
	CHECKED BY: K. BARKER	DATE: 1/13/09 - 1/22/09		DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 2 OF 3

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

FILE => $REQUEST

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 2 OF 3

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Joseph S. Pratt — CERTIFIED ENGINEERING GEOLOGIST — 3/18/10 DATE

PLANS APPROVAL DATE

PROFESSIONAL GEOLOGIST — JOSEPH S. PRATT — No. CEG 2141 — Exp. 5/31/2011 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

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Vertical control based on NAVD-88.
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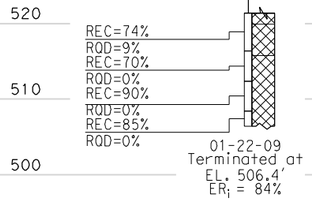
6) Plan view shown on Boring Location Plan sheet 2 of 2.

R-09-Z3B2

See Sheet 2 FOR CONTINUATION



IGNEOUS ROCK DIORITE to QUARTZ DIORITE; medium- to coarse-grained, medium gray, moderately to intensely weathered; hard; moderately to intensely fractured; continuous subvertical joints dip approximately 70°.

IGNEOUS ROCK DIORITE to QUARTZ DIORITE; medium- to coarse-grained, light olive gray to greenish gray, decomposed, very soft, (Lean CLAY (CL), stiff to hard clay (PP=1.0 to >4.5 tsf).

IGNEOUS ROCK DIORITE to QUARTZ DIORITE; medium- to coarse-grained, medium dark gray to medium light gray, intensely to moderately weathered, few (8%) decomposed intervals sometimes along fractures; moderately hard to hard (few zones very soft); intensely to moderately fractured, shear dipping 45° is waxey clay lined with slickensides showing 70° rake from horizontal on fracture plane, [slightly rough surface, joints dip 80 to 70°, 50°, and 20°, subvertical joints very closely spaced, low angle joints moderately to closely spaced, partly healed to not healed with calcite clay lined (few Lean CLAY (CL) intervals)].

PROFILE
Vert: 1"-10′

ENGINEERING SERVICES		GEOTECHNICAL SERVICES				
FUNCTIONAL SUPERVISOR NAME: SHIVA KARIMI	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: J. PRATT, T. HALDA	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO. N/A	SR-710 TUNNEL TECHNICAL STUDY
	CHECKED BY: K. BARKER	DATE: 1/13/09 - 1/22/09		DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 3 OF 3

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 3 OF 3

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

BENCHMARK:

NGS Benchmark used. Pt MF 36F: N1847799.06, E6512460.75, Elevation 407.29
MF36F: A 3" Brass disk stamped "Metropolitan Water Deistrict of Southern California MF 36F 1989, set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68′ west of the center of the south bound lanes of the freeway, 25′ north of the centerline of Hellman Avenue, 13′ east of the west end of the bridge, 1′ north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on North American Vertical Datum 1988.
Pt 0153: N1845410.50, E6509860.21
Pt 0617: N1858044.30, E6491094.23

Units are in U.S survey feet.

NOTES:

1) This LOTB sheet (Boring Record) was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 1 of 2.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
7	LA	710	N/A	.	.

Jody A. Castle 3/18/10
PROFESSIONAL GEOLOGIST DATE

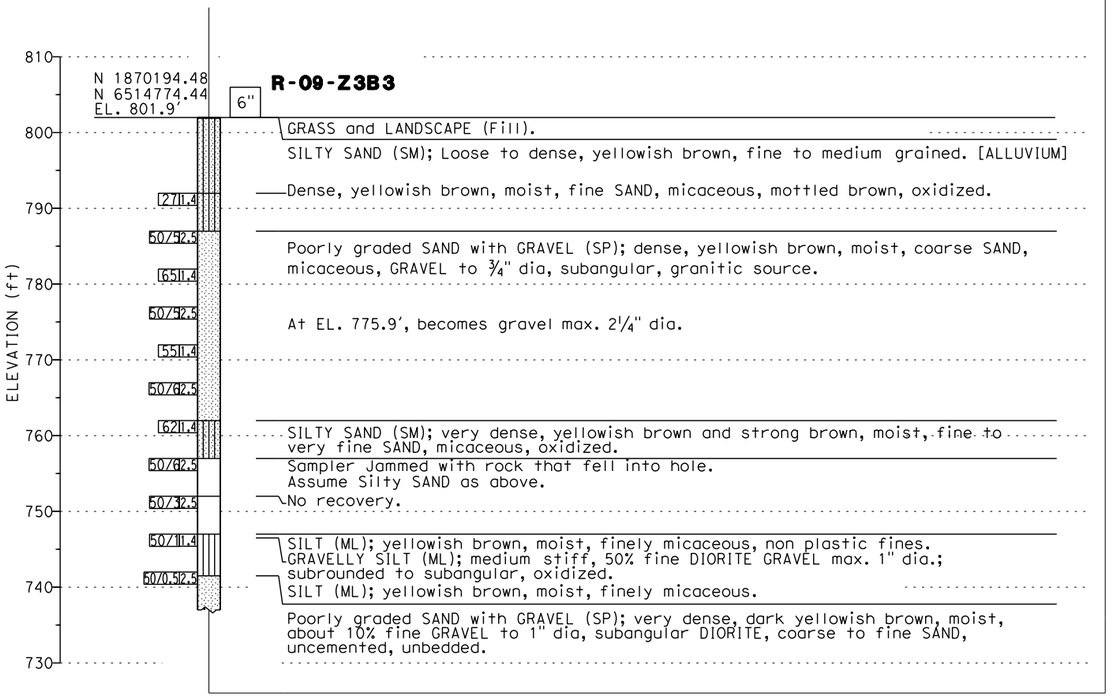
PROFESSIONAL GEOLOGIST — J. CASTLE — No. PG 8162 — Exp. 12-31-10 — STATE OF CALIFORNIA

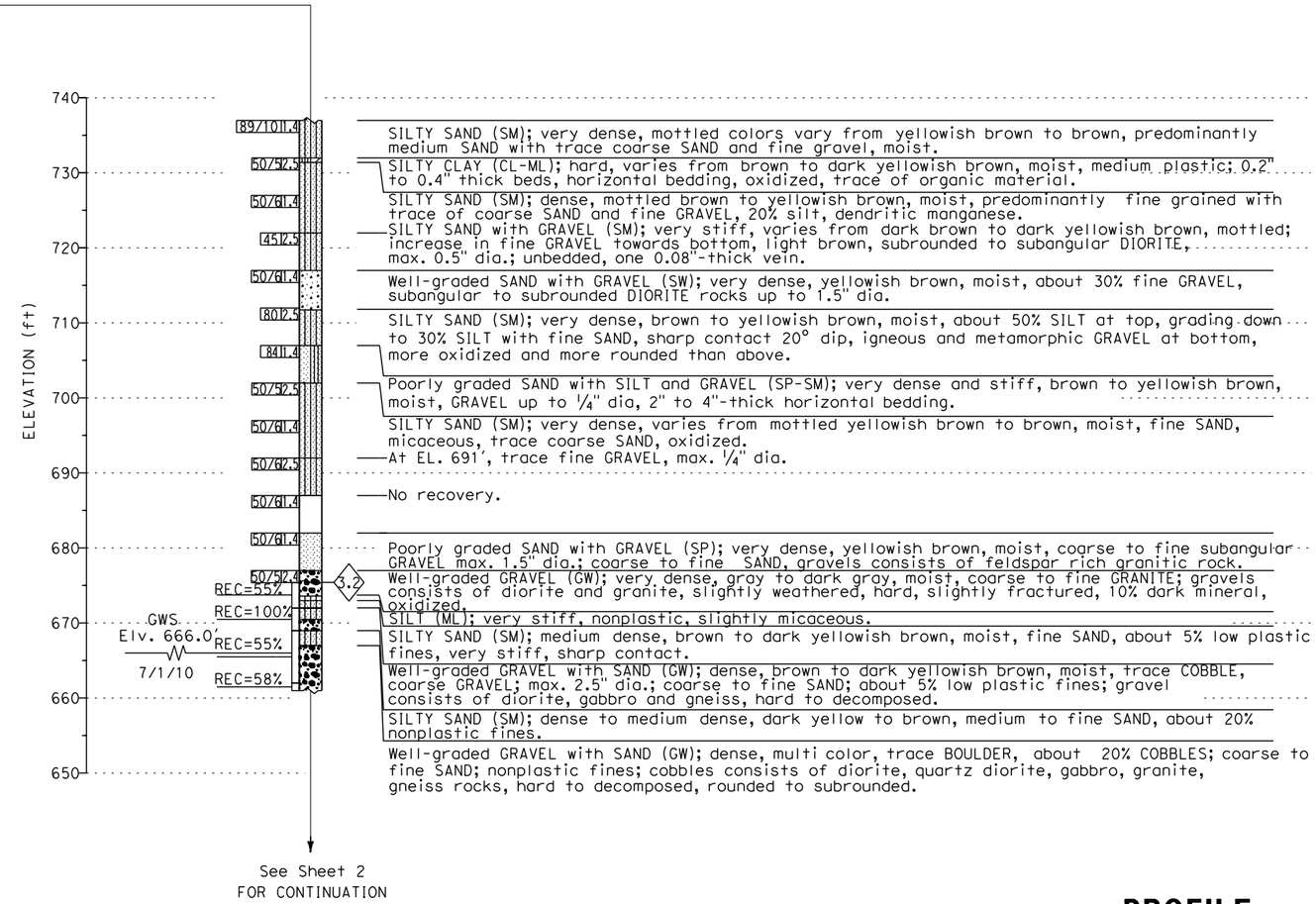
PLANS APPROVAL DATE

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

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION, DISTRICT-7
100 S. MAIN STREET, LOS ANGELES, CA 90012

EARTH MECHANICS, INC.
17660 NEWHOPE STREET, SUITE E
FOUNTAIN VALLEY, CA 92708





See Sheet 2
FOR CONTINUATION

PROFILE
VERTICAL 1" = 10′

DEREK HIGA DESIGN OVERSIGHT ENGINEER	DRAWN BY:	K. THANT	B. SCHELL, J. CASTLE FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. LAW PROJECT ENGINEER	BRIDGE NO. N/A POST MILE N/A	SR-710 TUNNEL TECHNICAL STUDY
. SIGN OFF DATE	CHECKED BY:	B. SCHELL	2/4/09 - 2/13/09 DATE:				LOG OF TEST BORING SHEET 1 OF 2
OGS CIVIL LOG OF TEST BORINGS SHEET	ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3				CU . EA 07-187900	DISREGARD PRINTS BEARING EARLIER REVISION DATES →	REVISION DATES (PRELIMINARY STAGE ONLY) — SHEET 1 OF 2

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => TIME PLOTTED => $TIME

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Vertical control based on North American Vertical Datum 1988.
Pt 0153: N1845410.50, E6509860.21
Pt 0617: N1858044.30, E6491094.23

Units are in U.S survey feet.

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6) Plan view shown on Boring Location Plan sheet 1 of 2.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
7	LA	710	N/A	.	.

Jody A. Castle 3/18/10
PROFESSIONAL GEOLOGIST DATE

PROFESSIONAL GEOLOGIST — J. CASTLE — No. PG 8162 — Exp. 12-31-10 — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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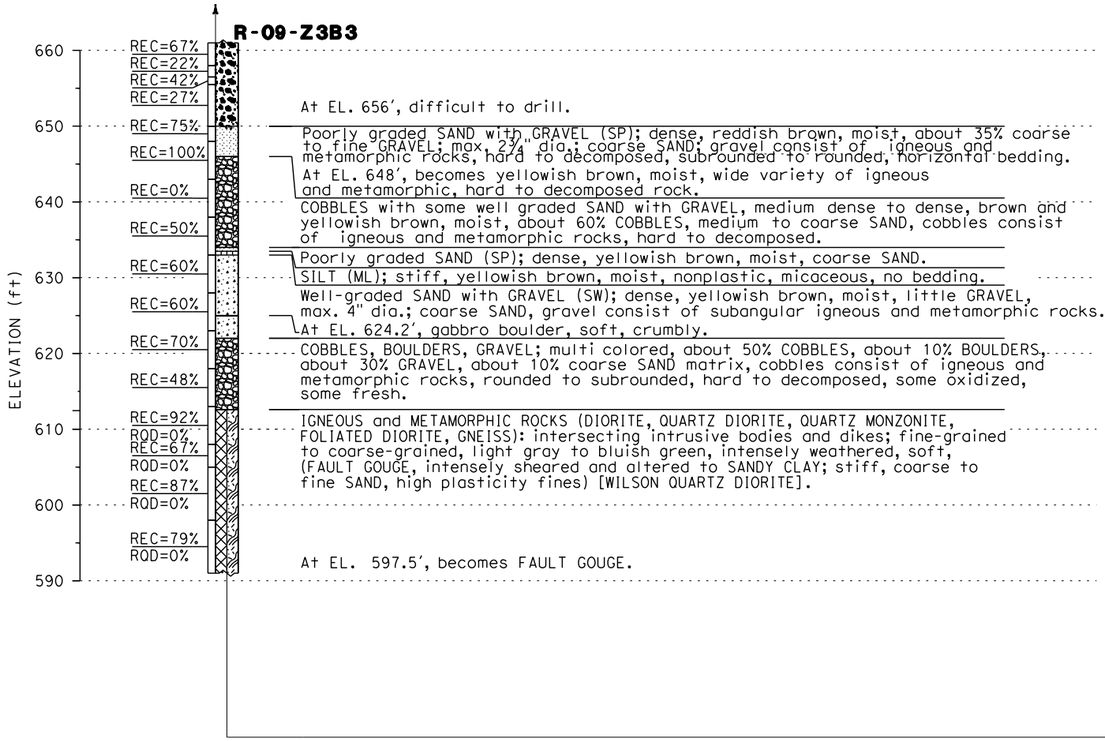
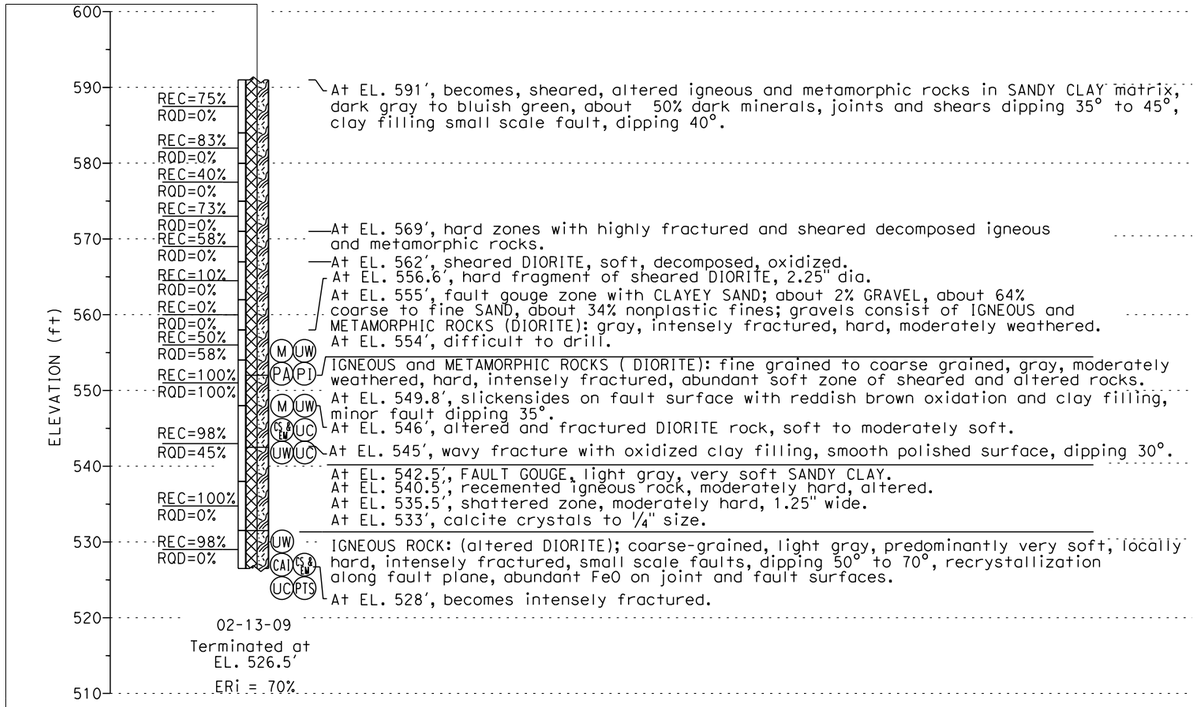
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION, DISTRICT-7
100 S. MAIN STREET, LOS ANGELES, CA 90012

EARTH MECHANICS, INC.
17660 NEWHOPE STREET, SUITE E
FOUNTAIN VALLEY, CA 92708

See Sheet 1
FOR CONTINUATION





PROFILE
VERTICAL 1" = 10'

DEREK HIGA	DRAWN BY:	K. THANT	B. SCHELL, J. CASTLE	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	H. LAW	BRIDGE NO. N/A	SR-710 TUNNEL TECHNICAL STUDY
DESIGN OVERSIGHT ENGINEER			FIELD INVESTIGATION BY:		PROJECT ENGINEER	POST MILE N/A	LOG OF TEST BORING SHEET 2 OF 2
.	CHECKED BY:	B. SCHELL	2/4/09 - 2/13/09		CU . EA 07-187900	DISREGARD PRINTS BEARING EARLIER REVISION DATES →	REVISION DATES (PRELIMINARY STAGE ONLY) — SHEET 2 OF 2
SIGN OFF DATE			DATE:				

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

FILE => $REQUEST

DATE PLOTTED => $TIME
TIME PLOTTED => $TIME
USERNAME => $USER

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

GEOTECHNICAL ENGINEER — 3/18/10 DATE

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
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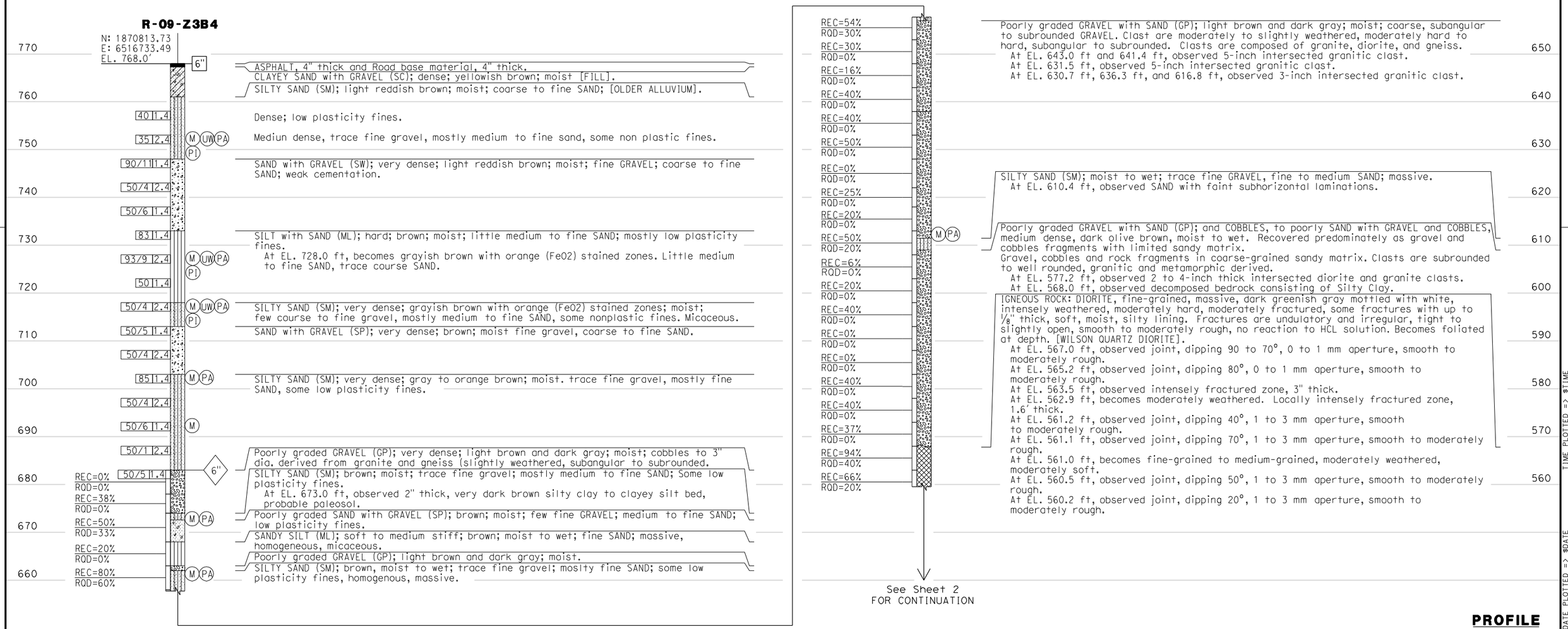
6) Plan view shown on Boring Location Plan sheet 2 of 2.



PROFILE
Vert: 1"-10'

DEREK HIGA, DESIGN OVERSIGHT ENGINEER	DRAWN BY:	EDELYNE MIGUEL	D. JANKLY, FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MAHESWARAN RAVEENDRA, PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY:	DAN JANKLY	DATE: 3/02/09 - 3/06/09		

BRIDGE NO. N/A
POST MILES N/A

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 1 OF 2

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 1 OF 2

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

GEOTECHNICAL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — GEOTECHNICAL — STATE OF CALIFORNIA

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CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

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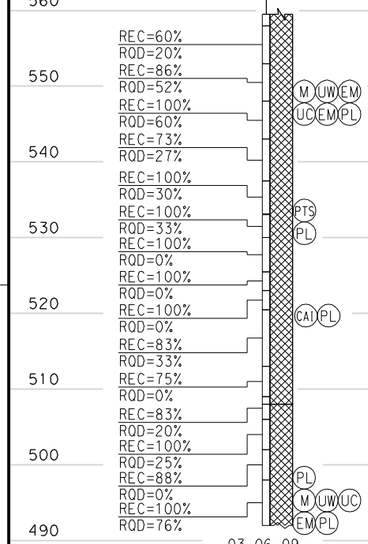
4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 2 of 2.

R-09-Z3B4

See Sheet 1 FOR CONTINUATION



03-06-09
Terminated at
EL. 492.0'
ER_1 = 70%

At EL. 557.5 ft, observed shear, dipping 50 to 5°, undulatory, irregular shear, dusky red, paperthin clay lining, striated along strike, parallels faint foliations 4" above and 4" below.
At EL. 556.9 ft, observed shear, dipping 40°, tight, moderately rough, 1/8" thick clay lining.
At EL. 556.3 ft, observed shear, dipping 45°, tight, moderately rough, 1/8" thick clay lining, intensely fractured below shear.
At EL. 556.2 ft, becomes intensely weathered, soft, intensely fractured.
At EL. 552.2 ft, observed shear/fault zone, dipping 30°, 3" thick, highly sheared zone with dusky red clay lining along sub parallel shears, polished and striated, medium plasticity.
At EL. 551.9 ft, becomes coarse-grained, moderately weathered, moderately soft, intensely fractured.
At EL. 551.0 ft, becomes intensely to moderately fractured, joint, dipping 60 to 50°, 3 mm aperture, moderately rough.
At EL. 549.5 ft, observed faint clay lined discontinuity, possible shear, irregular and undulatory, dipping 70° to vertical. Clay is greenish gray, soft, wet, low to medium plasticity. Unit is very weak.
At EL. 547.0 ft, observed intensely fractured, joint, dipping 60°, smooth. Unit is very weak.
At EL. 546.0 ft, observed shear, dipping 60°, polished and striated.
At EL. 545.5 ft, observed shear, dipping 90 to 45°, tight, 1/16" to 1/8" thick dusky red clay lining, undulatory.
At EL. 545.0 ft, becomes intensely weathered, soft.
At EL. 544.0 ft, observed shear, dipping 90 to 60°, 1/8" thick dusky red clay lining, undulatory.
At EL. 541.5 ft, becomes moderately weathered, moderately hard.
At EL. 540.2 ft and 539.6 ft, observed joint, dipping 60°, 2mm aperture, moderately rough.
At EL. 535.7 ft, observed fault, dipping 50°, paperthin clay lining, 1-2mm thick, smooth. Below fault, unit is very dark gray, slightly weathered, hard, moderately to intensely fractured.
At EL. 534.0 ft, observed shear, dipping 40°, paperthin dusky red clay lining, striated roughly downdip. Vein dipping 70° with 1/8" thick carbonate infill.
At EL. 533.2 ft, observed shear, dipping 25°, paperthin dusky red clay lining, striated roughly downdip. Unit becomes very dark mottled with white, moderately to slightly weathered, moderately hard, moderately to intensely fractured.
At El. 533.0 ft, PTS - Quartz Diorite, Plutonic Rock with allotriomorphic-granular texture.
At EL. 532.7 ft, becomes moderately to slightly weathered, hard, intensely to moderately fractured.
At EL. 532.4 ft, observed fault, dipping 70°, 3/8" reverse offset, tight, striated roughly downdip, offsets 1/16" thick carbonate lined vein.
At EL. 531.6 ft, observed shear, dipping 50 to 45°, two shears with paperthin dusky red clay lining. Unit is medium strong.
At EL. 530.9 ft, observed shear, dipping 70 to 25°, undulatory, dusky red clay lining, striated roughly parallel to strike.
At EL. 530.5 ft, observed shear, dipping 65 to 25°, three shears with paperthin, dusky red clay lining.
At EL. 529.2 ft, becomes very intensely fractured.
At EL. 528.3 ft, observed shear, dipping 75 to 65°, 3-4mm aperture with dusky red clay film, slightly to moderately rough.
At EL. 527.3 ft, observed shear, dipping 70°, 2-3mm aperture, striated with paperthin dusky red clay lining.
At EL. 526.0 ft, observed shear, dipping 90 to 70°, 2-3mm aperture, paperthin dusky red clay lining.
At EL. 525.2 ft, observed shear, dipping 90 to 80°, 4mm aperture, 1/8" thick dusky red clay lining.
At EL. 523.5 ft, observed shear, dipping 40 to 20°, three shears and numerous fractures from EL. 523.8 ft to 523.0 ft, with yellowish red and dark red lining.
At EL. 522.0 ft, observed shear, dipping 50 to 40°, three shears from EL. 522.2 ft EL. 521.5 ft, clay lined.
At EL. 521.5 ft, becomes soft to moderately soft from EL. 521.5 ft to 520.5 ft.
At EL. 520.5 ft, observed shear, dipping 65°, 2mm aperture, clay lined, striated downdip.
At EL. 520.0 ft, becomes fine-grained, dark greenish gray to light greenish gray, slightly weathered, hard, intensely to moderately fractured.
At EL. 519.5 ft, observed joint, dipping 30°. Unit is weak.
At EL. 518.8 ft, observed joint, dipping 30 to 20°.
At EL. 518.1 ft, observed shear, dipping 60 to 40°, 2mm aperture, dusky red clay lining.
At EL. 516.8 ft, observed shear, dipping 30°, 2mm aperture, clay lined, moderately rough.
At EL. 508.5 ft, observed foliation joint, dipping 40°, faint.
At EL. 507.8 ft, observed numerous carbonate lined joint faces, scattered dusky red lined joints and shears.
At EL. 505.7 ft, observed shear/fault zone, dipping 45°, roughly 1' thick gouge zone with highly polished fault plane at EL. 505.0 ft, striated down dip. Gouge consists of light greenish gray bentonitic clay with abundant diorite gravel to 1/4" dia. Gouge is moist, stiff, highly plastic.
At EL. 503.9 ft, becomes moderately fractured, shear, dipping 40°, clay lined.
At EL. 503.5 ft, observed fault, dipping 65°, 1/4" thick, soft clay gouge, striated down dip.
At EL. 502.5 ft, observed faint, undulatory, subhorizontal foliations.
At EL. 502.0 ft, observed intensely fractured, shear, dipping 60°, 2mm aperture, clay lined, striated downdip.
At EL. 501.0 ft, becomes very intensely fractured, remnant dusky red lined shears.
At EL. 499.2 ft, observed shear, dipping 50°, dusky red clay and carbonate infill.
At EL. 497.5 ft, becomes moderately fractured, joint, dipping 50 to 20°, numerous joints to El. 496.0 ft bgs, generally 1 mm aperture, slightly to moderately rough. Unit is weak.
At EL. 497.0 ft, observed foliation joint, dipping 40 to 30°, faint.
At EL. 496.0 ft, observed shear, dipping 60°, tight, dusky red, 1/16" thick clay lined shear, truncates foliations.
At EL. 495.5 ft, observed shear, dipping 30°, tight, dusky red, 1/16" thick clay lined shear. Unit is weak.
At EL. 495.2 ft, becomes locally very intensely fractured.
At EL. 495.0 ft, observed foliation joint, dipping 40°, faint.
At EL. 494.0 ft, observed shear, dipping 50°, very tight, dusky red, 1/16" thick clay lined shear, truncates foliations.
At EL. 493.5 ft, contains foliation joint, dipping 45°, faint foliation.
At EL. 493.0 ft, observed shear, dipping 50°, tight, dusky red, 1/16" thick clay lined shear, truncates foliations above, massive below.

PROFILE
Vert: 1"-10'

DEREK HIGA DESIGN OVERSIGHT ENGINEER	DRAWN BY:	EDELYNE MIGUEL	D. JANKLY FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MAHESWARAN RAVEENDRA PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY:	DAN JANKLY	DATE: 3/02/09 - 3/06/09		

BRIDGE NO. N/A
POST MILES N/A

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 2 OF 2

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES	SHEET	OF
	2	2

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

BENCHMARK:

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Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

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6) Plan view shown on Boring Location Plan sheet 2 of 2.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Joseph S. Pratt — 3/18/10
CERTIFIED ENGINEERING GEOLOGIST — DATE

PLANS APPROVAL DATE

PROFESSIONAL GEOLOGIST — JOSEPH S. PRATT — No. CEG 2141 — Exp. 6/31/2011 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

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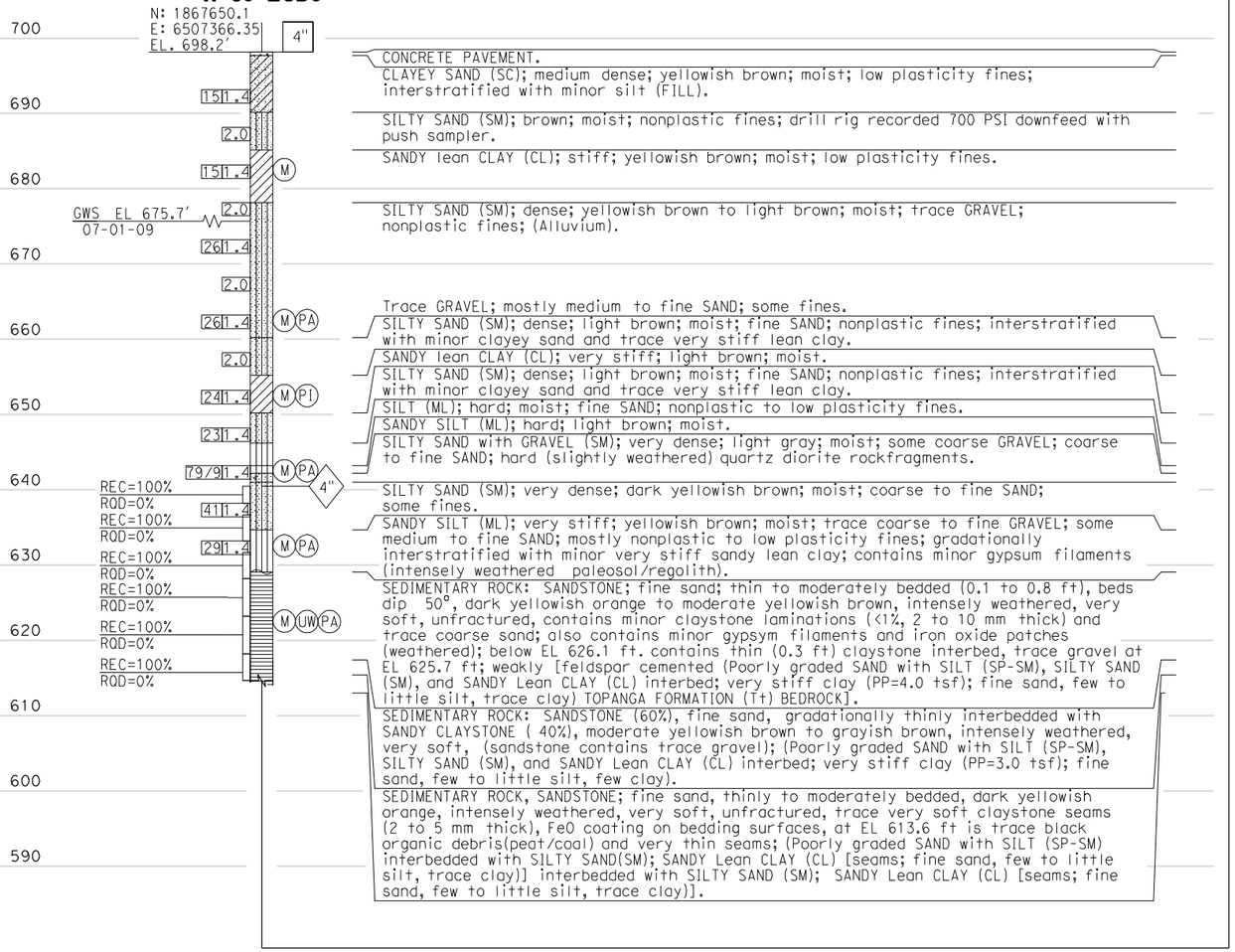
R-09-Z3B5

N: 1867650.1
E: 6507366.35
EL. 698.2′



CONCRETE PAVEMENT.

CLAYEY SAND (SC); medium dense; yellowish brown; moist; low plasticity fines; interstratified with minor silt (FILL).

SILTY SAND (SM); brown; moist; nonplastic fines; drill rig recorded 700 PSI downfeed with push sampler.

SANDY lean CLAY (CL); stiff; yellowish brown; moist; low plasticity fines.

SILTY SAND (SM); dense; yellowish brown to light brown; moist; trace GRAVEL; nonplastic fines; (Alluvium).

Trace GRAVEL; mostly medium to fine SAND; some fines.
SILTY SAND (SM); dense; light brown; moist; fine SAND; nonplastic fines; interstratified with minor clayey sand and trace very stiff lean clay.

SANDY lean CLAY (CL); very stiff; light brown; moist.

SILTY SAND (SM); dense; light brown; moist; fine SAND; nonplastic fines; interstratified with minor clayey sand and trace very stiff lean clay.

SILT (ML); hard; moist; fine SAND; nonplastic to low plasticity fines.

SANDY SILT (ML); hard; light brown; moist.

SILTY SAND with GRAVEL (SM); very dense; light gray; moist; some coarse GRAVEL; coarse to fine SAND; hard (slightly weathered) quartz diorite rockfragments.

SILTY SAND (SM); very dense; dark yellowish brown; moist; coarse to fine SAND; some fines.

SANDY SILT (ML); very stiff; yellowish brown; moist; trace coarse to fine GRAVEL; some medium to fine SAND; mostly nonplastic to low plasticity fines; gradationally interstratified with minor very stiff sandy lean clay; contains minor gypsum filaments (intensely weathered paleosol/regolith).

SEDIMENTARY ROCK: SANDSTONE; fine sand; thin to moderately bedded (0.1 to 0.8 ft), beds dip 50°, dark yellowish orange to moderate yellowish brown, intensely weathered, very soft, unfractured, contains minor claystone laminations (<1%, 2 to 10 mm thick) and trace coarse sand; also contains minor gypsym filaments and iron oxide patches (weathered); below EL 626.1 ft. contains thin (0.3 ft) claystone interbed, trace gravel at EL 625.7 ft; weakly [feldspar cemented (Poorly graded SAND with SILT (SP-SM), SILTY SAND (SM), and SANDY Lean CLAY (CL) interbed; very stiff clay (PP=4.0 tsf); fine sand, few to little silt, trace clay) TOPANGA FORMATION (Tt) BEDROCK].

SEDIMENTARY ROCK: SANDSTONE (60%), fine sand, gradationally thinly interbedded with SANDY CLAYSTONE (40%), moderate yellowish brown to grayish brown, intensely weathered, very soft, (sandstone contains trace gravel); (Poorly graded SAND with SILT (SP-SM), SILTY SAND (SM), and SANDY Lean CLAY (CL) interbed; very stiff clay (PP=3.0 tsf); fine sand, few to little silt, few clay).

SEDIMENTARY ROCK, SANDSTONE; fine sand, thinly to moderately bedded, dark yellowish orange, intensely weathered, very soft, unfractured, trace very soft claystone seams (2 to 5 mm thick), FeO coating on bedding surfaces, at EL 613.6 ft is trace black organic debris(peat/coal) and very thin seams; (Poorly graded SAND with SILT (SP-SM) interbedded with SILTY SAND(SM); SANDY Lean CLAY (CL) [seams; fine sand, few to little silt, trace clay)] interbedded with SILTY SAND (SM); SANDY Lean CLAY (CL) [seams; fine sand, few to little silt, trace clay)].

SEDIMENTARY ROCK: PEAT/COAL layer, black, very soft, organic (PEAT (PT), highly organic soil, hard (PP>4.5 tsf).

SEDIMENTARY ROCK: SANDSTONE; fine to medium sand, thinly to moderately bedded, dark yellowish orange to light brownish gray, intensely weathered, very soft, unfractured, contains trace to little sporadic fine to coarse gravel; very soft to moderately soft (intensely to moderately weathered) quartz diorite rock fragments; feldspar grains and FeO grains intensely weathered; uncemented to weakly feldspar cemented (SILTY SAND [(SM); few to little silt)].

SEDIMENTARY ROCK: SANDSTONE with 25% scattered cobbles (6" diameter), fine to medium sand, thinly to moderately bedded, medium gray to light gray, intensely weathered, very soft, unfractured, trace thin claystone seams (1 to 3 mm thick); subrounded, moderately soft to moderately hard, (moderately to slightly weathered) quartz diorite rock fragments; weakly calcite cemented (Poorly graded SAND with SILT (SP-SM); Lean CLAY with SAND (CL) seams).

SEDIMENTARY ROCK: SANDSTONE, contains few scattered fine gravel; fine to medium sand; thinly to moderately bedded (0.2 to 0.5 ft), beds dip ~50°, light gray to medium light gray, intensely weathered, very soft to soft, slightly fractured, at EL 597.2 ft is 3 mm thick black peat/coal lamination and incipient clay lined bedding plane fracture (dip 55°) with slickensides (rake 70° from horizontal), incipient fractures dip from 50° (bedding plane) to 15° below EL 600.7 ft; weakly to moderately [calcite cemented (Poorly graded SAND graded SAND with SILT SP-SM)].

SEDIMENTARY ROCK: SANDSTONE, contains few sporadic subrounded gravel, fine to medium sand, medium light gray, intensely to moderately weathered, very soft to soft, moderately fractured, when sporadically cemented, incipient fractures dip 65° subparallel to bedding planes; at EL 595.7 ft raised linear ridges show a rake angle of 40° on a clay lined fracture plane (mostly Poorly graded SAND with SILT (SP-SM).

SEDIMENTARY ROCK: CLAYSTONE, black to grayish olive green, soft, incipient clay lined fracture dips 35°, slightly rough surface.

SEDIMENTARY ROCK: SANDSTONE; contains little fine gravel, few coarse gravel, 10% cobbles (up to 5 in. diameter); fine to medium sand, medium light gray, intensely weathered, very soft to soft, unfractured, contains trace claystone seams (laminations); hard (slightly weathered) quartz diorite rock fragments, cobble below EL 589.8 ft; weakly cemented (SILTY SAND with GRAVEL (SM); contains 10% cobbles).

SEDIMENTARY ROCK: SANDSTONE (85%), fine sand, thinly to moderately interbedded with MUDSTONE/CLAYSTONE (15%); beds dip 50°, medium light gray, intensely weathered, very soft to soft, intensely to moderately fractured, almost all continuous incipient bedding plane fractures with clay seams dipping from 50 to 75°, smooth surfaces with faint slickensides with 30° rake angle at EL 580.7 ft; weakly to moderately calcite cemented (Poorly graded SAND with SILT (SP-SM) [; very stiff to hard clay (PP=4.0 to >4.5 tsf)].

SEDIMENTARY ROCK: SANDSTONE, trace fine to coarse gravel (5%); fine to medium sand, thinly to moderately bedded, medium light gray to light gray, intensely weathered, very soft to soft, slightly fractured, incipient fractures are generally claystone lined and dip from 40 to 80°, at EL 568.5 ft slickensides show 20° rake angle on fracture dipping 80°; angular hard (slightly weathered) quartz diorite rock fragments, below EL 568.2 ft is black peat/coal debris; weakly to moderately calcite cemented; (Poorly graded SAND with SILTY SAND (SM) grading to SILTY SAND (SM); Lean CLAY with SAND (CL) lining, hard clay (PP>4.5 tsf)].

See Sheet 2
FOR CONTINUATION

PROFILE
Vert: 1"-10′

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: K. LAI/J. PRATT				N/A	
NAME: SHIVA KARIMI	CHECKED BY: K. BARKER	DATE: 4/15/09 - 5/1/09			DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 1 OF 5

OGS CIVIL LOG OF TEST BORINGS SHEET — ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 — CU EA 07-187900 — DISREGARD PRINTS BEARING EARLIER REVISION DATES → — REVISION DATES — SHEET 1 OF 5

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Joseph S. Pratt — CERTIFIED ENGINEERING GEOLOGIST — 3/18/10 DATE

PLANS APPROVAL DATE

PROFESSIONAL GEOLOGIST — JOSEPH S. PRATT — No. CEG 2141 — Exp. 5/31/2011 — CERTIFIED ENGINEERING GEOLOGIST — 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.

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 2 of 2.

R-09-Z3B5

See Sheet 1 FOR CONTINUATION

570
560
550
540
530
520
510
500
490
480
470
460

REC=100% RQD=0% (M UW PA)

SEDIMENTARY ROCK: SANDSTONE (94%), fine sand, interbedded with MUDSTONE/SILTSTONE (6%); beds dip 40 to 50°, continuous clay lined incipient fractures dip 65 to 70° between EL 564.7 and 563.9 ft, thinly to moderately bedded, medium gray to light gray, intensely weathered, very soft to soft, moderately to slightly fractured, unfractured below EL 558, incipient clay lined fractures dip 20 to 25° at EL 566.5 and 559 ft (slickensides show 25° rake), black peat/coal laminations (3 to 4 mm thick) and debris occur sporadically above EL 561 ft; clay seams cross eachother (different [orientations); weakly to minor strongly calcite cemented (Poorly graded SAND with SILT (SP-SM) interbedded with SILTY SAND (SM) and SILT (ML) to Lean CLAY with SAND (CL); hard silt to clay (PP>4.5 tsf)].

REC=100% RQD=8%
REC=100% RQD=8%
REC=100% RQD=40%
REC=100% RQD=36% (M UW UC)

SEDIMENTARY ROCK: SANDSTONE; fine to medium sand; moderately soft to very soft, intensely to moderately fractured, fractures dip 60 to 70° with chlorite on fracture surfaces, strongly to weakly calcite cemented.

REC=100% RQD=72%

SEDIMENTARY ROCK: Clayey SANDSTONE; fine sand, brownish gray, intensely weathered, very soft to soft, weakly to strongly calcite cemented (mostly CLAYEY SAND (SC), little clay).

REC=100% RQD=44%
REC=100% RQD=0% (PA)

SEDIMENTARY ROCK: SANDSTONE; fine sand; beds dip ~40°, medium light gray to brownish gray, intensely to moderately weathered, very soft to soft, moderately fractured, incipient fractures dip from 40 (parallel to bedding) to 70°; crosslaminated; predominantly weakly to minor strongly calcite cemented (mostly Poorly graded SAND with SILT (SP-SM).

REC=100% RQD=86%

SEDIMENTARY ROCK: SANDSTONE; fine sand; moderately bedded, beds dip 35 to 40°, brownish gray, very soft, moderately fractured, at EL 545.8 ft fracture dips 55°, slickensides show 30° rake angle on bedding planes and fractures; contains thin organic black peat/coal seams and debris; weakly calcite cemented (SILTY SAND (SM); little to some silt).

SEDIMENTARY ROCK: SANDSTONE; fine to medium sand; thinly to moderately bedded (0.1 to 0.8 ft), beds dip 45 to 55°, penecontemporaneous faulting (soft sediment deformation) at EL 541.1 ft, medium light gray, intensely weathered, very weak, very soft to moderately soft; moderately to slightly fractured; continuous incipient clay lined bedding plane fractures dip 45 to 55°; at EL 541.1 ft fracture dips 45° and contains raised ridges with 40° rake angle, crosscuts bedding ; [unfractured below EL 538.2 ft with few to little fine gravel; weakly to moderately calcite cemented (minor strongly cemented); (partly Poorly graded SAND with SILT (SP-SM) interbedded with minor SILTY SAND (SM)].

SEDIMENTARY ROCK: Cobble/Boulder CONGLOMERATE with silty sandstone matrix, fine sand; 70% cobbles/boulders with 30% sandstone matrix, boulder (12.5 in diameter) and cobbles (9 to 10 in. diameter), brownish gray, unfractured, subrounded moderately hard to moderately soft (slightly to intensely weathered) quartz diorite rock fragments; fine sandstone matrix is intensely weathered, very soft, weakly cemented (COBBLES and BOULDERS in SILTY SAND (SM) matrix; mostly sand, little [silt)].

SEDIMENTARY ROCK: SANDSTONE; contains trace fine gravel; fine to medium sand; dominantly moderately bedded (minor thinly to thickly bedded), beds dip ~30°, medium light gray, intensely to moderately weathered, very soft to moderately soft; very slightly fractured to unfractured; incipient fractures on bedding planes dip 30°; some fractures moderately to totally healed with silica (0.5 mm thick) and minor clay infill, slightly rough; [thin claystone seams; arkosic; predominantly strongly and minor weakly to moderately calcite cemented (minor Poorly graded SAND with SILT interbedded with SILTY SAND (SM); few to little silt)].

REC=100% RQD=70%
REC=100% RQD=20%
REC=100% RQD=0%
REC=100% RQD=0%
REC=100% RQD=80%
REC=100% RQD=46% (M UW UC)
REC=100% RQD=30%
REC=100% RQD=100%

520
510
500
490
480
470

SEDIMENTARY ROCK: isolated cobble (11 in. diameter) within SANDSTONE matrix, fine sand, subrounded moderately hard (moderately weathered) quartz diorite rock fragment.

SEDIMENTARY ROCK: SANDSTONE, fine to medium sand, dominantly moderately bedded (minor thin to thick bedded), beds dip ~30°, medium light gray, intensely to moderately weathered, very soft to soft, very slightly fractured to unfractured, between EL 518.4 and 513.2 ft fractures dip 75 to 70°; unfractured above and below; scattered few coarse gravel (1 to 3 in. diameter); thin irregular claystone seams (1 to 2 mm thick); chlorite in matrix; weakly to strongly calcite cemented [(predominantly Poorly graded SAND with SILT (SP-SM)].

SEDIMENTARY ROCK: SANDSTONE; fine to coarse; moderately to thickly bedded (0.3 to 1.4 ft), beds dip ~30 to 40°, very soft to soft, slightly fractured, incipient bedding plane fractures dip 30 to 60° and are lined with chlorite; chlorite in matrix; contains few fine gravel; weakly cemented (SILTY SAND (SM) grading to Poorly graded SAND with SILT (SP-SM).

SEDIMENTARY ROCK: MUDSTONE/CLAYEY SILTSTONE; organic, brownish gray to brownish black, very soft, (SILT (ML) to Lean CLAY with SAND (CL), hard (PP>4.5 tsf).

SEDIMENTARY ROCK: SANDSTONE; fine to medium sand; moderately to thinly bedded, beds dip ~40°, soft, very slightly fractured, chlorite in matrix; lithic arkose composition; predominantly moderately to strongly calcite cemented (minor weakly cemented).

SEDIMENTARY ROCK: SANDSTONE; fine sand, very soft, unfractured, chlorite in matrix; weakly calcite cemented (SILTY SAND (SM).

SEDIMENTARY ROCK: SANDSTONE; fine to medium sand; weak, beds dip ~25 to 30°, very slightly fractured to unfractured, predominantly moderately to little strongly calcite cemented (some weakly cemented) (partly Poorly graded SAND with SILT (SP-SM) interbedded with SILTY SAND (SM).

SEDIMENTARY ROCK: SANDSTONE (60%), fine to medium sand, interbedded with MUDSTONE/SILTSTONE, brownish gray, very soft, unfractured, mudstone interbeds are organic rich; weakly cemented (SILTY SAND (SM) interbedded with SANDY SILT (ML) and Lean CLAY (CL), very stiff to hard clay (PP=4.0 to >4.5 tsf).

SEDIMENTARY ROCK: SANDSTONE; fine to medium sand; beds dominantly moderately bedded but range from thinly to thickly bedded (0.2 to 1.1 ft thick), beds dip ~30°, medium light gray, very soft to soft, dominantly slightly fractured (minor intensely fractured), mostly incipient fractures on bedding planes, at EL 490.6 ft fractures dip 75°; predominantly weakly to minor moderately calcite cemented (predominantly Poorly graded SAND with SILT (SP-SM) [grading to SILTY SAND (SM)].

See Sheet 3 FOR CONTINUATION

PROFILE
Vert: 1"-10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR NAME: SHIVA KARIMI	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: K. LAI/J.PRATT			DESIGN BRANCH	N/A	LOG OF TEST BORING SHEET 2 OF 5
	CHECKED BY: K. BARKER	DATE: 4/15/09 - 5/1/09				POST MILES N/A	

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES | SHEET 2 | OF 5

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Joseph S. Pratt — CERTIFIED ENGINEERING GEOLOGIST — 3/18/10 DATE

PLANS APPROVAL DATE

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PROFESSIONAL GEOLOGIST — JOSEPH S. PRATT — No. CEG 2141 — Exp. 5/31/2011 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

BENCHMARK:

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Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

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4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 2 of 2.

R-09-Z3B5

See Sheet 2 FOR CONTINUATION

480
- REC=100% ROD=32%
- REC=100% ROD=0%

470
- REC=106% ROD=44%
- REC=100% ROD=0%

460
- REC=100% ROD=66%
- REC=102% ROD=60%

450
- REC=104% ROD=58%

440

430

420

410

400

390

380

370

EM UC

M UW UC

SEDIMENTARY ROCK: SANDSTONE (95%), fine sand, with thin MUDSTONE/CLAYSTONE (5%) interbeds and laminae (0.3 to 1 mm), dominantly thickly bedded (1.9 ft thick), beds dip ~30°, medium light gray to moderate brown, weak, soft to moderately soft, very slightly fractured to unfractured, at EL 484.6 ft beds dip 30° and incipient bedding plane fracture has slickensides with 30° rake angle; moderately to strongly cemented.

SEDIMENTARY ROCK: MUDSTONE/CLAYSTONE, thin bed, moderate brown, very soft, (Lean CLAY with SAND (CL), hard clay (PP>4.5 tsf).

SEDIMENTARY ROCK:isolated boulder (16 in. diameter) within SANDSTONE matrix, subrounded hard quartz diorite rock fragment, igneous boulder contains numerous calcite veins; FeO stained.

SEDIMENTARY ROCK: SANDSTONE; fine to medium sand; moderately bedded; intensely to moderately weathered; moderately soft to very soft, slightly fractured, incipient fractures dip 60°; contains thin irregular claystone seams; predominantly strongly cemented to some weakly cemented (partly Poorly graded SAND with SILT (SP-SM) grading to SILTY SAND (SM).

SEDIMENTARY ROCK: MUDSTONE/SANDY CLAYSTONE, moderate brown, soft.

SEDIMENTARY ROCK: SANDSTONE; fine sand; domingntly moderately bedded (0.3 to 0.4 ft thick) and minor thickly bedded, beds dip ~30°, medium light gray, intensely weathered, very soft to soft, slightly fractured, incipient bedding plane fractures; predominantly weakly to minor moderately calcite cemented (Poorly graded SAND with SILT (SP-SM) grading to SILTY SAND (SM).

SEDIMENTARY ROCK: MUDSTONE/SANDY CLAYSTONE; contains few charcoal or coal debris, thinly bedded, (SANDY lean CLAY (CL), hard (PP>4.5 tsf).

SEDIMENTARY ROCK: SANDSTONE, fine to medium sand; contains a cobble (7%, 4 in. diameter) below EL 471 ft, medium light gray, soft to moderately soft, very slightly fractured to unfractured, trace coarse gravel; moderately hard quartz diorite rock fragments; strongly to weakly calcite cemented (some Poorly graded SAND with SILT (SP-SM).

SEDIMENTARY ROCK: Coarse Gravel/Cobble CONGLOMERATE with fine to medium sandstone matrix, cobbles (up to 12 in. diameter), beds dip ~25°, medium light gray, moderately weathered, unfractured, some very soft to moderately soft sandstone matrix; subrounded to angular, moderately hard, (moderately weathered) quartz diorite and minor soft mudstone rock fragments; weakly to moderately calcite cemented matrix (GRAVEL and COBBLES with SILTY SAND [(SM) matrix)].

SEDIMENTARY ROCK: SANDSTONE; fine sand; thinly interbedded (0.1 ft) with SANDY MUDSTONE/CLAYSTONE, medium light gray to brownish gray, intensely to moderately weathered, moderately soft to very soft; unfractured; predominantly moderately to minor weakly cemented (partly Poorly graded SAND with SILT (SP-SM) interbedded with SANDY fat CLAY (CH); hard clay (PP>4.5 tsf) is waxey).

SEDIMENTARY ROCK: SANDSTONE (60%), fine to medium sand; moderately interbedded with Gravel/Cobble CONGLOMERATES (40%), extremely weak, cobbles (up to 6 in. diameter), beds dip ~40 to 50°, medium light gray, unfractured, contains thin irregular mudstone beds and seams (0.2 ft to 1 mm thick); subrounded moderately soft to moderately hard quartz diorite rock fragments; intensely weathered feldspar grains; predominantly strongly to some weakly calcite cemented (partly [Poorly graded SAND with SILT (SP-SM)]].

SEDIMENTARY ROCK: SANDSTONE (80%); contains 11% cobbles (up to 5 in. diameter) and few gravel; fine to medium sand; moderately to thinly interbedded with MUDSTONE/SILTSTONE, medium light gray to brownish gray, intensely weathered, soft to moderately soft, unfractured, subrounded quartz diorite rock fragments; predominantly moderately to strongly calcite cemented (some weakly cemented); (partly Poorly graded SAND with SILT (SP-SM) and SILT (ML) interbeds, hard silt (PP>4.5 tsf)).

SEDIMENTARY ROCK: SANDSTONE (80%); contains 11% cobbles (up to 5 in. diameter) and few gravel; fine to medium sand; moderately to thinly interbedded with MUDSTONE/SILTSTONE, medium light gray to brownish gray, intensely weathered, soft to moderately soft, unfractured, subrounded quartz diorite rock fragments; predominantly moderately to strongly calcite cemented (some weakly cemented); (partly Poorly graded SAND with SILT (SP-SM) and SILT (ML) interbeds, hard silt (PP>4.5 tsf)).

450
- REC=102% ROD=36%
- REC=104% ROD=64%
- REC=102% ROD=38%
- REC=102% ROD=34%
- REC=125% ROD=50%
- REC=125% ROD=50%

440

430

420

410

400

M UW

M UW

SEDIMENTARY ROCK: Coarse Gravel/Cobble CONGLOMERATE with fine SANDSTONE matrix, cobbles (up to 10 in. diameter), moderately bedded, unfractured, soft to very soft matrix; contains claystone seams; subrounded to subangular moderately hard quartz diorite rock fragments; predominantly moderately to minor weakly cemented matrix (partly Poorly graded SAND with SILT (SP-SM).

SEDIMENTARY ROCK: SANDSTONE (85%); fine to medium sand; thinly to moderately interbedded with MUDSTONE/CLAYSTONE (15%), beds dip ~40°, medium light gray to brownish gray, intensely weathered, very soft to moderately soft; very slightly fractured to unfractured; at EL 439.6 ft moderately spaced incipient fractures dip 60 to 65° and lined with clay (3 to 5 mm thick); pervasive irregular mudstone seams; mudstone very soft to soft; bioturbated; [weakly to strongly calcite cemented (partly SILTY SAND (SM) interbedded with Poorly graded SAND with SILT (SP-SM) and SANDY lean CLAY (CL); hard clay (PP.4.5 tsf)].

SEDIMENTARY ROCK: SANDSTONE; fine sand; moderately to thinly bedded (0.5 to 0.2 ft thick), beds dip ~40°, medium gray, very soft to soft, very slightly fractured, at EL 435 ft incipient fracture dips 60° and is clay lined and smooth; thin (2 to 3 mm) clay seams are truncated by opposite dipping clay seams; weakly to moderately cemented (partly Poorly graded SAND with SILT (SP-SM)).

SEDIMENTARY ROCK: SANDY MUDSTONE/SANDY CLAYSTONE with minor thin SANDSTONE interbed, thinly bedded, soft, contains minor sporadic very thin (1 to 2 mm thick) tar or organic seams.

SEDIMENTARY ROCK: SANDSTONE (60%); fine to medium sand; thinly to moderately interbedded with MUDSTONE/SILTSTONE grading to CLAYSTONE with SAND, medium gray to brownish gray, very soft to soft, unfractured, contains irregular claystone seams; bioturbated; predominantly weakly to some moderately calcite cemented (mostly Poorly graded SAND with SILT (SP-SM) grading to SILTY SAND (SM) interbedded with SILT (ML) and lean CLAY with SAND (CL); hard clay and silt [(PP>4.5 tsf)); vuggy zone between EL +432.2 to 431.2 ft].

SEDIMENTARY ROCK: SANDSTONE (80%); fine sand; thinly interbedded with MUDSTONE/CLAYSTONE/SILTSTONE (20%), beds dip ~45°, medium light gray to brownish gray, very soft to soft, moderately fractured, incipient bedding plane fractures dip 60 to 65°; strongly to weakly calcite cemented (partly SILTY SAND (SM) grading to Poorly graded SAND with SILT (SP-SM) interbedded with Lean CLAY with SAND (CL) to SILT (ML); very stiff to hard clay and silt [(PP=4.0 to >4.5 tsf))].

SEDIMENTARY ROCK: MUDSTONE/CLAYSTONE (60%) thinly interbedded (0.1 to 0.2 ft thick) with SANDSTONE (40%), fine sand; beds dip ~60°, medium light gray to brownish gray, very soft to moderately soft; unfractured; irregular thin beds, laminations, and mudstone seams (seams are roughly parallel to and also crosscut bedding), contains laminated mudstone rip-up clasts and also bioturbated beds between EL 422.3 to 421.2 ft; [predominantly weakly to minor moderately calcite cemented (partly SILTY SAND (SM) grading to Poorly graded SAND with SILT (SP-SM))].

SEDIMENTARY ROCK: SANDSTONE (60%), fine sand, thinly interbedded with MUDSTONE/SILTSTONE/CLAYSONE with SAND (40%), beds dip ~50 to 60°, medium light gray to brownish gray, intensely weathered, predominantly moderately soft to minor very soft; unfractured; contains sporadic black coal and possibly trace organic tar seams (laminae) between EL 419.9 to 417.9 ft, predominantly strongly to minor weakly calcite cemented (partly SILTY SAND (SM) [grading to Poorly graded SAND with SILT (SP-SM))].

See Sheet 4 FOR CONTINUATION

PROFILE
Vert: 1"-10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES	
FUNCTIONAL SUPERVISOR NAME: SHIVA KARIMI	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: K. LAI/J. PRATT	
	CHECKED BY: K. BARKER	DATE: 4/15/09 - 5/1/09	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH

BRIDGE NO. N/A
POST MILES N/A

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 3 OF 5

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 3 OF 5

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Joseph S. Pratt
CERTIFIED ENGINEERING GEOLOGIST 3/18/10 DATE

PLANS APPROVAL DATE

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

PROFESSIONAL GEOLOGIST — JOSEPH S. PRATT — No. CEG 2141 — Exp. 9/31/2011 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 2 of 2.

R-09-Z3B5

See Sheet 3 FOR CONTINUATION

420
410
400
390
380
370
360
350
340
330
320
310

REC=107%
RQD=83%
REC=100%
RQD=52%
REC=95%
RQD=88%
REC=120%
RQD=68%
REC=100%
RQD=93%
REC=100%
RQD=60%
REC=108%
RQD=50%
REC=113%
RQD=50%
REC=95%
RQD=50%
REC=100%
RQD=48%

M UW
M UW UC

SEDIMENTARY ROCK: SANDSTONE (65%), fine sand, thinly interbedded with MUDSTONE/CLAYSTONE (35%), beds dip ~60°, mudstone also laminated, medium light gray to brownish gray, soft to moderately soft, predominantly moderately soft to minor very soft; between EL 414.5 to 413.5 ft laminations and thin beds are offset along small fault dipping 75° (possible penecontemporaneous faulting/soft sediment deformation); thin coal seam at EL 414 ft; bioturbated [below EL 412.2 ft; predominantly strongly to minor weakly calcite cemented (partly SILTY SAND (SM) interbeds)].

SEDIMENTARY ROCK: SANDSTONE, fine to medium sand; few coarse sand, moderately bedded, medium light gray, moderately soft to moderately hard, unfractured, strongly calcite cemented.

SEDIMENTARY ROCK: MUDSTONE/CLAYSTONE (90%) thinly interbedded with SANDSTONE (10%), fine sand; also laminated, beds dip up to ~70°, brownish gray, moderately soft to moderately hard, slightly fractured, mudstone lined fracture at EL 408.4 ft dips 70° in opposite direction of bedding dip (crosscuts bedding).

SEDIMENTARY ROCK: SANDSTONE (85%), fine to medium sand, moderately to thinly interbedded with MUDSTONE (15%), beds dip ~70°, medium dark gray to medium light gray, predominantly moderately hard to minor very soft; sporadic trace black organic/coal patches and debris between EL 407.2 to 405 ft; thin mudstone seams; predominantly strongly to moderately calcite cemented (minor weakly cemented) (minor SILTY SAND (SM) [interbeds)].

SEDIMENTARY ROCK: SANDSTONE, fine to medium sand; thinly to moderately bedded, beds dip ~65°, light brownish gray to brownish gray, moderately hard to hard, intensely fractured, very closely spaced to closely spaced (20 to 60 mm spaced) fractures dip 25, 40, and 60°, moderately thin (1 to 1.5 mm) fractures are totally healed with calcite; strongly calcite cemented; organic brown film appeared in drilling mud tub at EL 404.2 ft.

SEDIMENTARY ROCK: SANDSTONE (55%), fine sand; thinly interbedded with MUDSTONE/CLAYSTONE (45%), mudstone is dominantly laminated, soft to moderately soft, unfractured, irregular claystone seams, strongly calcite cemented below EL 400.2 ft, predominantly moderately to minor weakly cemented above (minor SILTY SAND (SM)).

SEDIMENTARY ROCK: MUDSTONECLAYSTONE (75%) interbedded with SANDSTONE (25%); contains few sporadic fine to coarse gravel (1 in. length); beds dip ~70°, brownish gray to medium light gray, soft to very soft; unfractured; black organic patches at EL 397.2 ft, bioturbated, irregular laminations, moderately to weakly calcite cemented (partly SILTY SAND (SM) interbeds).

SEDIMENTARY ROCK: SANDSTONE (65%), fine to medium sand, interbedded with MUDSTONE/CLAYSTONE (35%), thinly bedded to laminated, some moderately bedded, beds dip ~50 to 70°, extremely weak, dominantly soft to moderately soft (minor very soft), medium light gray to brownish gray, intensely weathered, unfractured, organic coal seam at EL 392.7 ft; sporadically bioturbated; strongly to weakly calcite cemented (some SILTY SAND (SM)).

SEDIMENTARY ROCK: SANDSTONE (80%),fine interbedded with MUDSTONE/CLAYSTONE (20%), sandstone is moderately to thinly bedded (0.5 to 0.1 ft thick) and mudstone is thinly bedded to laminated (0.1 ft to 5 mm thick), beds dip 60 to 70°, medium light gray to brownish gray, very soft to moderately soft; unfractured; moderately to weakly calcite cemented (partly SILTY SAND (SM) interbedded with Lean CLAY with SAND (CL), hard clay (PP>4.5 tsf).

SEDIMENTARY ROCK: SANDSTONE, fine sand; contains few gravel (rounded fine sandstone rock fragments), medium light gray, very soft to soft, unfractured, black coal patches and thin layers (0.2 to 0.3 ft thick); moderately to weakly calcite cemented (partly SILTY SAND (SM) interbeds).

REC=105%
RQD=53%
REC=100%
RQD=48%
REC=78%
RQD=0%
REC=113%
RQD=75%
REC=119%
RQD=60%
REC=37%
RQD=0%
REC=86%
RQD=0%
REC=56%

EM UC

SEDIMENTARY ROCK: SANDSTONE (80%), fine sand, interbedded with SILTSTONE/CLAYSTONE (20%), thinly to moderately bedded, beds dip ~70°, medium light gray to brownish gray, very soft to soft, unfractured, moderately to weakly calcite cemented (some Poorly graded SAND with SILT (SP-SM) and SILTY SAND (SM)).

SEDIMENTARY ROCK: SANDSTONE (70%), fine sand, interbedded with MUDSTONE/SHALE (30%), beds generally thinly bedded to laminated, some moderately bedded sandstone, beds dip ~50 to 70°, medium light gray to brownish gray, intensely weathered, very soft to soft, very slightly fractured to unfractured, below EL. 368.5 ft. is incipient bedding plane fracture dipping 50° (slightly rough surface); truncated bedding at EL 371.8 ft. (possibly erosional); bioturbated; weakly to moderately calcite cemented (partly SILTY SAND (SM) interbeds).

SEDIMENTARY ROCK: SANDSTONE, fine sand, moderately bedded, medium light gray to brownish gray, moderately hard, unfractured, predominantly moderately hard to minor very soft; predominantly strongly to minor weakly calcite cemented (minor SILTY SAND (SM) interbeds).

SEDIMENTARY ROCK: CLAYSTONE/SILTSTONE (65%) interlaminated with SANDSTONE (35%), fine sand; laminae dip 70 °, medium light gray to brownish gray, soft to very soft; slightly fractured; at EL 364.5 ft fracture dips 30° (smooth surface); at EL 363.8 ft incipient bedding plane fracture dips 60°; some penecontemporaneous faulting with minor offsets (soft sediment deformation); [moderately to weakly calcite cemented (partly SILTY SAND (SM) to Poorly graded SAND with SILT (SP-SM))].

SEDIMENTARY ROCK: SANDSTONE (94%), fine sand, interbedded with CLAYSTONE/SHALE (6%); moderately bedded to laminated; moderately hard to moderately soft, minor very soft weakly cemented sandstone between EL 363.2 to 362.5 ft, medium light gray to brownish gray, unfractured, strongly to weakly cemented (partly SILTY SAND (SM)).

SEDIMENTARY ROCK: MUDSTONE/CLAYSTONE (75%) interbedded with SANDSTONE (25%), fine sand; laminated to very thinly bedded, beds dip ~70°, dark gray to brownish gray, very soft to soft, very slightly fractured to unfractured, at EL 359.5 ft incipient fracture dips 50°; weakly calcite cemented (predominantly Lean CLAY with SAND (CL) interbedded with little SILTY SAND (SM); very stiff to hard clay (PP=3.0 to >4.5 tsf)).

SEDIMENTARY ROCK: SANDSTONE (80%), fine to medium sand, interbedded with MUDSTONE/CLAYSTONE (20%), dominantly moderately to thinly bedded, minor laminated, very weak, moderately hard to very soft;, medium light gray to brownish gray, moderately fractured, below EL 353.3 ft fracture sets dip 20 and 70° and are totally healed with calcite; between EL 353.3 to 352.8 ft small scale faulting/slippage at truncated mudstone and sandstone beds; weakly to strongly calcite cemented (SILTY SAND (SM)).

SEDIMENTARY ROCK: MUDSTONE/CLAYSTONE/SILTSTONE (85%) very thinly interbedded with SANDSTONE (15%), fine sand; also laminated mudstone (5 to 10 mm thick), beds dip ~75°, very soft, at EL 350.1 ft calcite cemented laminations in siltstone (Lean CLAY with SAND (CL) interbedded with SILT (ML) and minor SILTY SAND (SM); very stiff to hard clay and silt (PP=3.0 to>4.5 tsf)).

See Sheet 5 FOR CONTINUATION

PROFILE
Vert: 1"-10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR	DRAWN BY: E. MIGUEL		FIELD INVESTIGATION BY: K. LAI/J. PRATT			N/A	
NAME: SHIVA KARIMI	CHECKED BY: K. BARKER		DATE: 4/15/09 - 5/1/09		DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 4 OF 5

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES | SHEET 4 | OF 5

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Joseph S. Pratt 3/18/10
CERTIFIED ENGINEERING GEOLOGIST DATE

PLANS APPROVAL DATE

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PROFESSIONAL GEOLOGIST — JOSEPH S. PRATT — No. CEG 2141 — Exp. 6/31/2011 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 2 of 2.

R-09-Z3B5

See Sheet 4 FOR CONTINUATION

350
340
330
320
310
300
290
280
270
260
250
240

REC=123%
RQD=0%
REC=120%
RQD=33%
REC=108%
RQD=12%
REC=98%
RQD=84%
REC=100%
RQD=48%
REC=96%
RQD=26%

M UW

M UW UC

EM

SEDIMENTARY ROCK: SANDSTONE (50%), fine sand, thinly interbedded with laminated MUDSTONE/CLAYSTONE (50%), medium light gray to brownish gray, very soft, unfractured, between EL 348 to 347.4 ft black coal seams and patches; uncemented to weakly cemented (SILTY SAND (SM) interbedded with Poorly graded SAND with SILT (SP-SM) and Lean CLAY with SAND (CL); very stiff to hard clay (PP=3.0 to>4.5 tsf)).

SEDIMENTARY ROCK: SANDSTONE, fine sand, hard, intensely to moderately fractured, intensely weathered feldspar grains; strongly calcite cemented.

SEDIMENTARY ROCK: SANDSTONE (80%), fine to medium sand, interbedded with MUDSTONE/SILTSTONE/CLAYSTONE (20%), moderately bedded to laminated, beds dip ~70°, medium light gray to brownish gray, very soft to soft, unfractured, predominantly weakly to minor moderately calcite cemented (mostly Poorly graded SAND with SILT (SP-SM) interbedded with minor SILTY SAND (SM)).

SEDIMENTARY ROCK: SANDSTONE (85%),fine sand, interbedded with MUDSTONE/CLAYSTONE (15%), moderately bedded to very thinly bedded and laminated, beds dip~65°, moderately soft to soft (soft to very soft below EL 331.1 ft), light brownish gray to brownish gray, intensely to moderately weathered, intensely to moderately fractured, unfractured above EL 335 ft, below EL 335 ft very thin (0.5 to 1 mm) totally calcite healed fractures dip 60°, 40° & 25°; one continuous fracture dips 75° below EL 331.1 ft with moderately rough surface; predominantly strongly to minor weakly calcite [cemented (little Poorly graded SAND with SILT (SP-SM))].

SEDIMENTARY ROCK: MUDSTONE/CLAYSTONE (50%) interbedded with SANDSTONE (50%), fine sand; moderately bedded to laminated, very weak, dominantly moderately hard to moderately soft (minor soft above EL328.2 ft), light brownish gray to brownish gray, slightly fractured, incipient bedding plane fractures are clay lined, predominantly weakly to minor strongly calcite cemented (predominantly SILTY SAND (SM)).

SEDIMENTARY ROCK: SANDSTONE (85%), fine sand, interbedded with MUDSTONE/CLAYSTONE (15%), moderately to thinly bedded (minor laminated), irregular beds dip ~60 to 45°, light brownish gray to medium light gray, intensely to moderately weathered, very soft to soft, very slightly fractured to unfractured, below EL 324 ft irregular black coal laminations are offset and show minor slippage (small scale faulting); sporadic black coal/tar patches; predominantly weakly to minor moderately cemented (mostly Poorly graded SAND with SILT (SP-SM) grading to [SILTY SAND (SM))].

SEDIMENTARY ROCK: CLAYSTONE interbedded with SANDSTONE, fine sand; laminated (8 mm thick), irregular beds dip ~40 to 60°, brownish gray to medium light gray, very soft, moderately fractured, incipient bedding plane fracture dips 40° with slickensides rake angle 75° on fracture plane (small scale 5 to 10 mm offsets of laminations and 1 to 2 mm thick coal seams, mostly dip-slip); slightly rough to smooth surfaces; weakly cemented (SILTY SAND [(SM)].

SEDIMENTARY ROCK: SANDSTONE, fine sand, moderately bedded, light brownish gray to medium light gray, intensely to moderately weathered, very soft to soft, unfractured, contains irregular mudstone seams (1 to 2 mm thick); predominantly weakly to minor moderately calcite cemented (SILTY SAND (SM) grading to Poorly graded SAND with SILT (SP-SM)).

SEDIMENTARY ROCK: SANDSTONE (65%), fine sand, interbedded with MUDSTONE/CLAYSTONE (35%), thinly bedded to laminated (20 to 5 mm thick), beds dip ~70°, light brownish gray to medium light gray, intensely to moderately weathered, very soft to soft, irregular beds show ripple crosslaminations and possible bioturbation; above EL 319.6 ft mudstone laminations are truncated (possibly by soft sediment deformation, erosion, or slippage of soft beds); weakly to moderately calcite cemented (Poorly graded [SAND with SILT (SP-SM))].

REC=100%
RQD=42%
REC=100%
RQD=6%
REC=98%
RQD=28%
REC=100%
RQD=24%
REC=98%
RQD=34%

M UW UC

05-01-09
Terminated
at EL. 296.1'
ER_I = 87%

320
310
300
290
280
270

SEDIMENTARY ROCK: MUDSTONE/SHALE (50%) interbedded with SEDIMENTARY BRECCIA (35%) and SANDSTONE (15%), fine sand; breccia layers with mudstone clasts and sand and mudstone matrix; laminated to thinly bedded, beds dip ~60 to 70°, brownish gray to light brownish gray, very soft to soft, moderately to slightly fractured, between EL 316.9 to 316.1 ft laminations are truncated and offset 10-20 mm on small shears (healed with silica) which dip from 50 to 60° and show reverse movement; probable debris flow breccias with flat and elongated angular siliceous mudstone clasts; [weakly to moderately cemented sandstone and matrix (SILTY SAND (SM))].

SEDIMENTARY ROCK: MUDSTONE/SILTSTONE/CLAYSTONE (65%) interbedded with SANDSTONE (35%), fine sand; laminated to moderately bedded, laminations dip ~55°, brownish gray to brownish black, moderately weathered, very soft to soft, moderately fractured, above EL 315.3 ft fractures dip 75 to 80° in sandstone and are partly healed with calcite and infilled with clay; below are incipient fractures on clay lined smooth bedding plane surfaces; bioturbated and ripple crosslaminated; predominantly weakly to [minor moderately calcite cemented (mostly Lean CLAY with SAND (CL) interbedded with SILT (ML) and Poorly graded SAND with SILT (SP-SM), hard clay and silt (PP>4.5 tsf))].

SEDIMENTARY ROCK: SANDSTONE (90%), fine sand, interbedded with MUDSTONE/CLAYSTONE (10%), thinly bedded to laminated, beds dip ~50 to 70°, medium light gray to light brownish gray, very soft to soft, moderately fractured, fractures dip 40° with slickensides rake angle 40° on fracture surface, calcite and chlorite lined fractures - partly healed; sporadic trace black organic material below EL 311.9 ft, predominantly weakly to minor moderately calcite cemented (mostly Poorly [graded SAND with SILT (SP-SM) grading to SILTY SAND (SM)].

SEDIMENTARY ROCK: SANDSTONE (60%), fine sand, interbedded with MUDSTONE (40%), beds dip ~60°, medium light gray to light brownish gray, very soft to soft, unfractured, between EL 308.1 to 307.7 ft is sporadic coal; flame structures in mudstone (depositional shear); weakly to minor moderately calcite cemented (mostly Poorly graded SAND with SILT (SP-SM)).

SEDIMENTARY ROCK: SANDSTONE (90%), fine sand, interbedded with MUDSTONE/SILTSTONE (10%), moderately bedded to laminated, beds dip ~70°, very soft to soft, unfractured, predominantly weakly to minor moderately calcite cemented (Poorly graded SAND with SILT (SP-SM) interbedded with minor silt (ML), hard silt (PP>4.5 tsf)).

SEDIMENTARY ROCK: MUDSTONE/CLAYSTONE/SILTSTONE (60%) interbedded with SANDSTONE (40%), fine sand; thinly bedded (0.2 ft) to laminated (5 to 10 mm thick), beds dip ~65°, brownish gray to light brownish gray, moderately weathered, extremely weak, very soft to soft, slightly fractured, incipient fractures on bedding planes dip 65°; weakly cemented (mostly Lean CLAY with SAND (CL) interbedded with SILT (ML) and Poorly graded SAND with SILT (SP-SM); hard clay and silt (PP>4.5 tsf).

SEDIMENTARY ROCK: SANDSTONE (97%), fine sand, with trace MUDSTONE/CLAYSTONE laminations (3%); dominantly moderately bedded (0.5 ft thick) and minor laminations (1 to 2 mm), beds dip ~ 70 to 55°, light brownish gray, very soft to soft, slightly fractured, (parallel to bedding); between EL 299.3 to 298.9 ft incipent fracture parallel to bedding dips 55° with faint slickensides rake angle 45° on fracture surface; thin clay seams; predominantly weakly to minor moderately calcite cemented (mostly Poorly [graded SAND with SILT (SP-SM) and SILTY SAND (SM))].

PROFILE
Vert: 1"=10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES	
FUNCTIONAL SUPERVISOR NAME: SHIVA KARIMI	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: K. LAI/J. PRATT	
	CHECKED BY: K. BARKER	DATE: 4/15/09 - 5/1/09	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH

BRIDGE NO. N/A
POST MILES N/A

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 5 OF 5

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

FILE => $REQUEST

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 5 OF 5

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

GEOTECHNICAL ENGINEER — DATE 3/18/10

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

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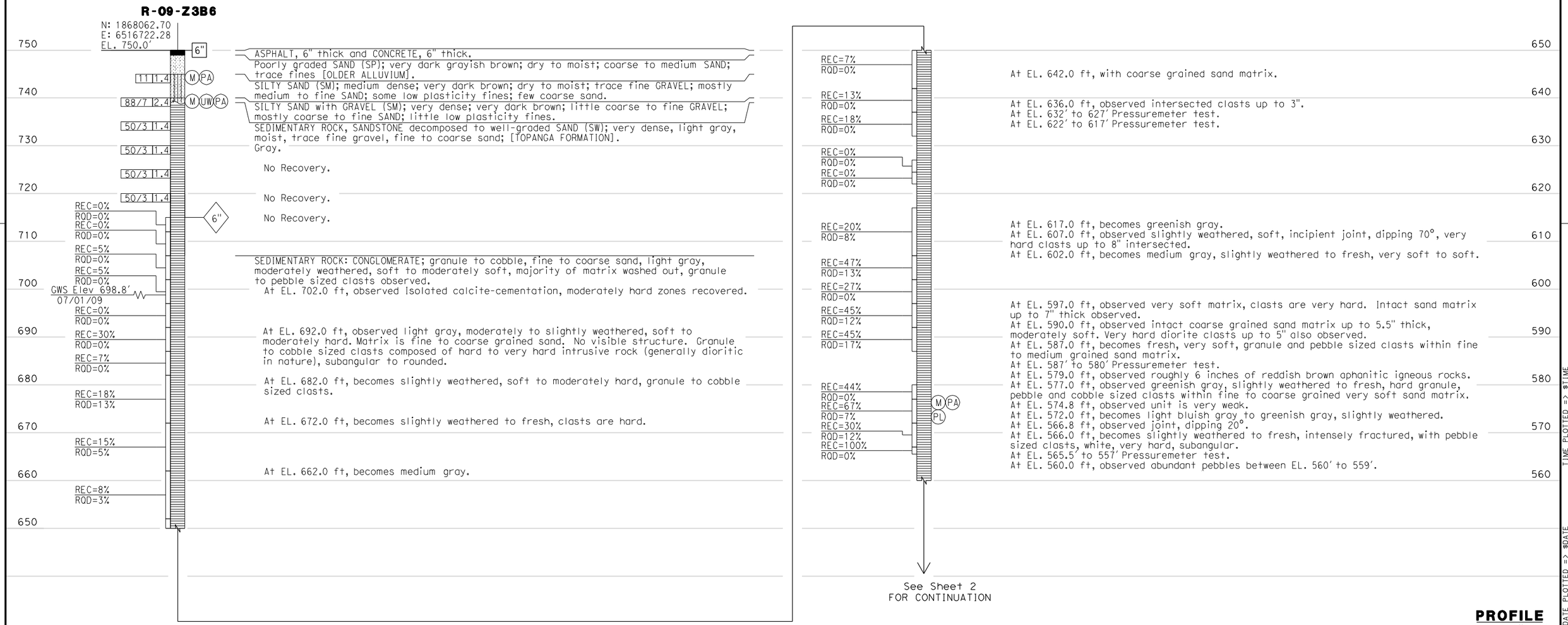
3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 2 of 2.



PROFILE
Vert: 1"-10'

DEREK HIGA DESIGN OVERSIGHT ENGINEER	DRAWN BY:	EDELYNE MIGUEL	M. TORSIELLO FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MAHESWARAN RAVEENDRA PROJECT ENGINEER	BRIDGE NO. N/A POST MILES N/A
SIGN OFF DATE	CHECKED BY:	DAN JANKLY	DATE: 2/17/09 - 3/11/09			SR-710 TUNNEL TECHNICAL STUDY LOG OF TEST BORING SHEET 1 OF 2

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 1 OF 2

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

GEOTECHNICAL ENGINEER — 3/18/10 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — GEOTECHNICAL — STATE OF CALIFORNIA

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CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

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MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68′ west of the center of the south bound lanes of the freeway, 25′ north of the centerline of Hellman Avenue, 13′ east of the west end of the bridge, 1′ north of the north curb face. NGS PID EW9453.

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Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

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3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

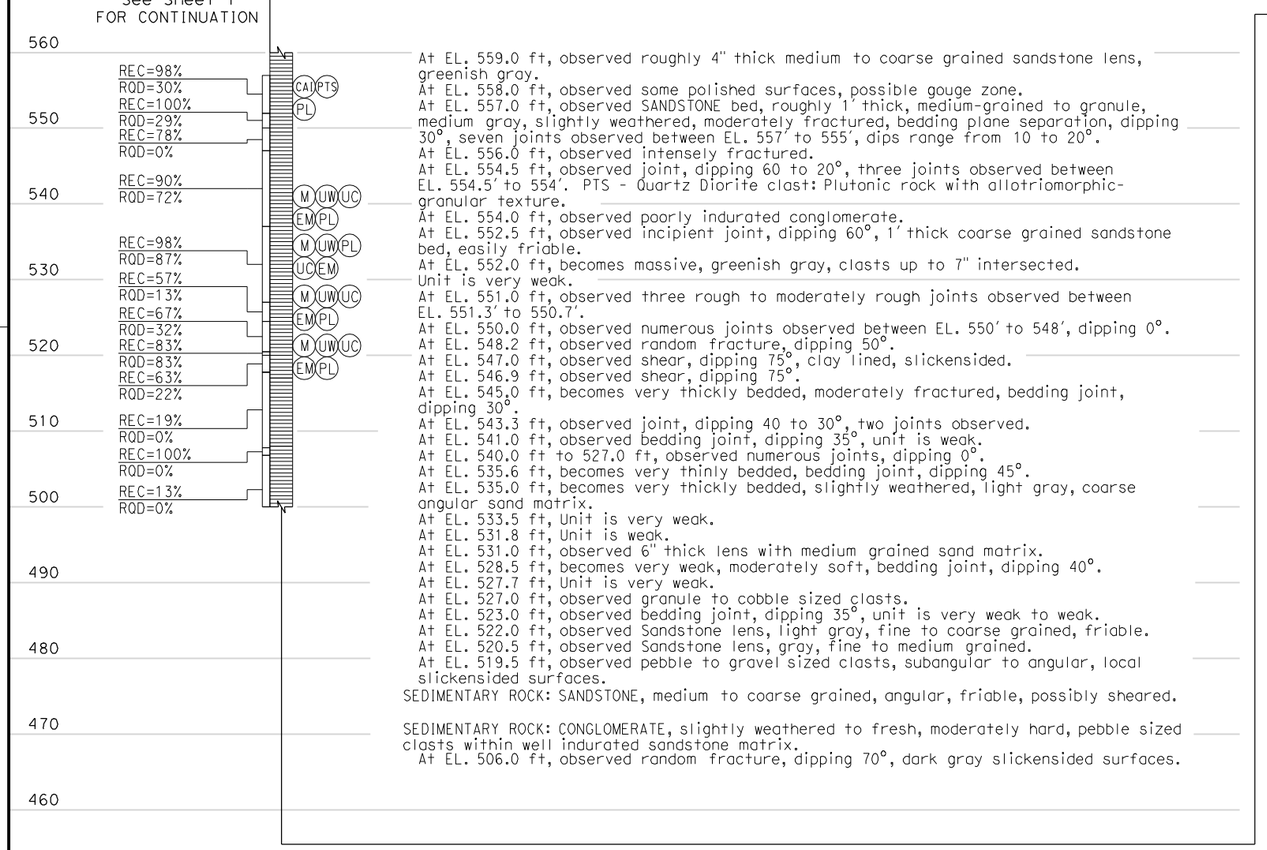
4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 2 of 2.

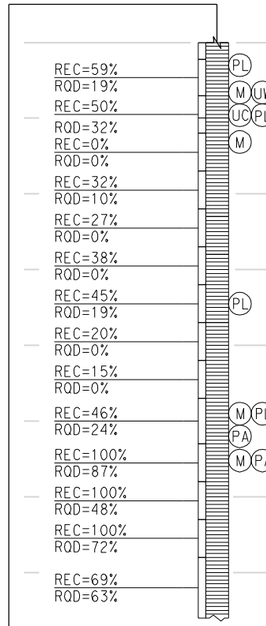
R-09-Z3B6

See Sheet 1 FOR CONTINUATION



At EL. 559.0 ft, observed roughly 4" thick medium to coarse grained sandstone lens, greenish gray.
At EL. 558.0 ft, observed some polished surfaces, possible gouge zone.
At EL. 557.0 ft, observed SANDSTONE bed, roughly 1′ thick, medium-grained to granule, medium gray, slightly weathered, moderately fractured, bedding plane separation, dipping 30°, seven joints observed between EL. 557′ to 555′, dips range from 10 to 20°.
At EL. 556.0 ft, observed intensely fractured.
At EL. 554.5 ft, observed joint, dipping 60 to 20°, three joints observed between EL. 554.5′ to 554′. PTS - Quartz Diorite clast: Plutonic rock with allotriomorphic-granular texture.
At EL. 554.0 ft, observed poorly indurated conglomerate.
At EL. 552.5 ft, observed incipient joint, dipping 60°, 1′ thick coarse grained sandstone bed, easily friable.
At EL. 552.0 ft, becomes massive, greenish gray, clasts up to 7" intersected. Unit is very weak.
At EL. 551.0 ft, observed three rough to moderately rough joints observed between EL. 551.3′ to 550.7′.
At EL. 550.0 ft, observed numerous joints observed between EL. 550′ to 548′, dipping 0°.
At EL. 548.2 ft, observed random fracture, dipping 50°.
At EL. 547.0 ft, observed shear, dipping 75°, clay lined, slickensided.
At EL. 546.9 ft, observed shear, dipping 75°.
At EL. 545.0 ft, becomes very thickly bedded, moderately fractured, bedding joint, dipping 30°.
At EL. 543.3 ft, observed joint, dipping 40 to 30°, two joints observed.
At EL. 541.0 ft, observed bedding joint, dipping 35°, unit is weak.
At EL. 540.0 ft to 527.0 ft, observed numerous joints, dipping 0°.
At EL. 535.6 ft, becomes very thinly bedded, bedding joint, dipping 45°.
At EL. 535.0 ft, becomes very thickly bedded, slightly weathered, light gray, coarse angular sand matrix.
At EL. 533.5 ft, Unit is very weak.
At EL. 531.8 ft, Unit is weak.
At EL. 531.0 ft, observed 6" thick lens with medium grained sand matrix.
At EL. 528.5 ft, becomes very weak, moderately soft, bedding joint, dipping 40°.
At EL. 527.7 ft, Unit is very weak.
At EL. 527.0 ft, observed granule to cobble sized clasts.
At EL. 523.0 ft, observed bedding joint, dipping 35°, unit is very weak to weak.
At EL. 522.0 ft, observed Sandstone lens, light gray, fine to coarse grained, friable.
At EL. 520.5 ft, observed Sandstone lens, gray, fine to medium grained.
At EL. 519.5 ft, observed pebble to gravel sized clasts, subangular to angular, local slickensided surfaces.
SEDIMENTARY ROCK: SANDSTONE, medium to coarse grained, angular, friable, possibly sheared.

SEDIMENTARY ROCK: CONGLOMERATE, slightly weathered to fresh, moderately hard, pebble sized clasts within well indurated sandstone matrix.
At EL. 506.0 ft, observed random fracture, dipping 70°, dark gray slickensided surfaces.



03-11-09
Terminated at
EL. 424.0′
ER_1 = 75%

At EL. 497.5 ft, observed joint, dipping 65°, slickensided.
At EL. 497.0 ft, observed calcite veins.
At EL. 495.7 ft, observed joint, dipping 70°, slickensided. Unit is weak.
At EL. 492.3 ft, observed unit is weak to medium strong.
At EL. 492.2: PTS - coarse grained arkosic conglomerate with grains cemented by calcite.
At EL. 492.0 ft, observed Intersected 3" clast.
At EL. 491.8 ft, Unit is weak.
At EL. 483.0 ft, becomes slightly weathered, Clasts are ½" to 1" dia., diorite pebbles, very hard, some slickensided surfaces.
At EL. 482.0 ft, observed joint, dipping 70°, slickensided.
At EL. 481.9 ft, observed Intersected 6" clast.
SEDIMENTARY ROCK: SANDSTONE, dark bluish gray, moderately soft, fine to medium grained, subangular to angular, poorly cemented.
At EL. 473.0 ft, observed Sandstone as above with few diorite derived pebbles.
SEDIMENTARY ROCK: CONGLOMERATE, pebble sized clasts within sand matrix.
At EL. 471.4 ft, observed bedding joint, dipping 35°.
At EL. 468.0 ft, observed joint, dipping 35°.
At EL. 467.8 ft, observed joint, dipping 70°, Well cemented, fine grained matrix.
At EL. 467.0 ft, observed Decreased cementation, moderately soft.
At EL. 466.0 ft, observed Intersected 4" clast. Unit is very weak.
SEDIMENTARY ROCK: SANDSTONE, soft, fine to medium grained, poorly cemented.
At EL. 462.3 ft, observed some angular to subangular pebbles.
At EL. 458.0 ft, becomes moderately soft, joint, dipping 75°, slickensided.
SHEAR ZONE AT El. 453′ to El. 424′.
At EL. 452.8 ft, becomes massive, bluish gray, moderately to slightly weathered, extremely weak, very soft to soft, mostly fine to medium sand. Little fine to coarse, angular gravel. Little fines.
At EL. 450.0 ft, observed sheared and friable bedrock.
At EL. 446.3 ft, observed bedding joint, dipping 20°, Sandstone, white with black minerals, appears decomposed due to shearing.

At EL. 444.0 ft, observed joint, dipping 77°, slickensided.
At EL. 442.0 ft, observed joint, dipping 80°, Unit is friable, highly sheared, black gouge within joints.
At EL. 439.0 ft, observed bedding joint, dipping 25°, Unit is sheared, continuing from El. 453′.
At EL. 438.0 ft, becomes very soft and friable, pebbles within sandstone are decomposed and easily friable, numerous slickensided surfaces.
At EL. 437.0 ft, becomes moderately to slightly weathered, soft, sandstone to siltstone, numerous near vertical slickensided surfaces 80 to 90° dip.
At EL. 435.5 ft, observed bedding joint, dipping 25°, Local ⅜" thick beds of sandstone and siltstone.
At EL. 434.8 ft, observed possibly decomposed diorite, very dark gray. Numerous gray, clay lined slickensided surfaces which are friable.
At EL. 433.0 ft, observed numerous joints, likely continuation of shear zone from El. 453′.
At EL. 432.0 ft, observed Sandstone with some pebbles, gray to dark gray, friable, numerous slickensided surfaces.
At EL. 431.0 ft, becomes moderately soft.
At EL. 429.0 ft, observed bedding joint, dipping 30°, Likely continuation of shear zone from El. 453′.
At EL. 428.5 ft, becomes soft.

PROFILE
Vert: 1"=10′

DEREK HIGA DESIGN OVERSIGHT ENGINEER	DRAWN BY:	EDELYNE MIGUEL	M. TORSIELLO FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MAHESWARAN RAVEENDRA PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY:	DAN JANKLY	DATE: 2/17/09 - 3/11/09		

BRIDGE NO. N/A
POST MILES N/A

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 2 OF 2

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 2 OF 2

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Joseph S. Pratt 3/18/10
CERTIFIED ENGINEERING GEOLOGIST DATE

PLANS APPROVAL DATE

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PROFESSIONAL GEOLOGIST — JOSEPH S. PRATT — No. CEG 2141 — Exp. 6/31/2011 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
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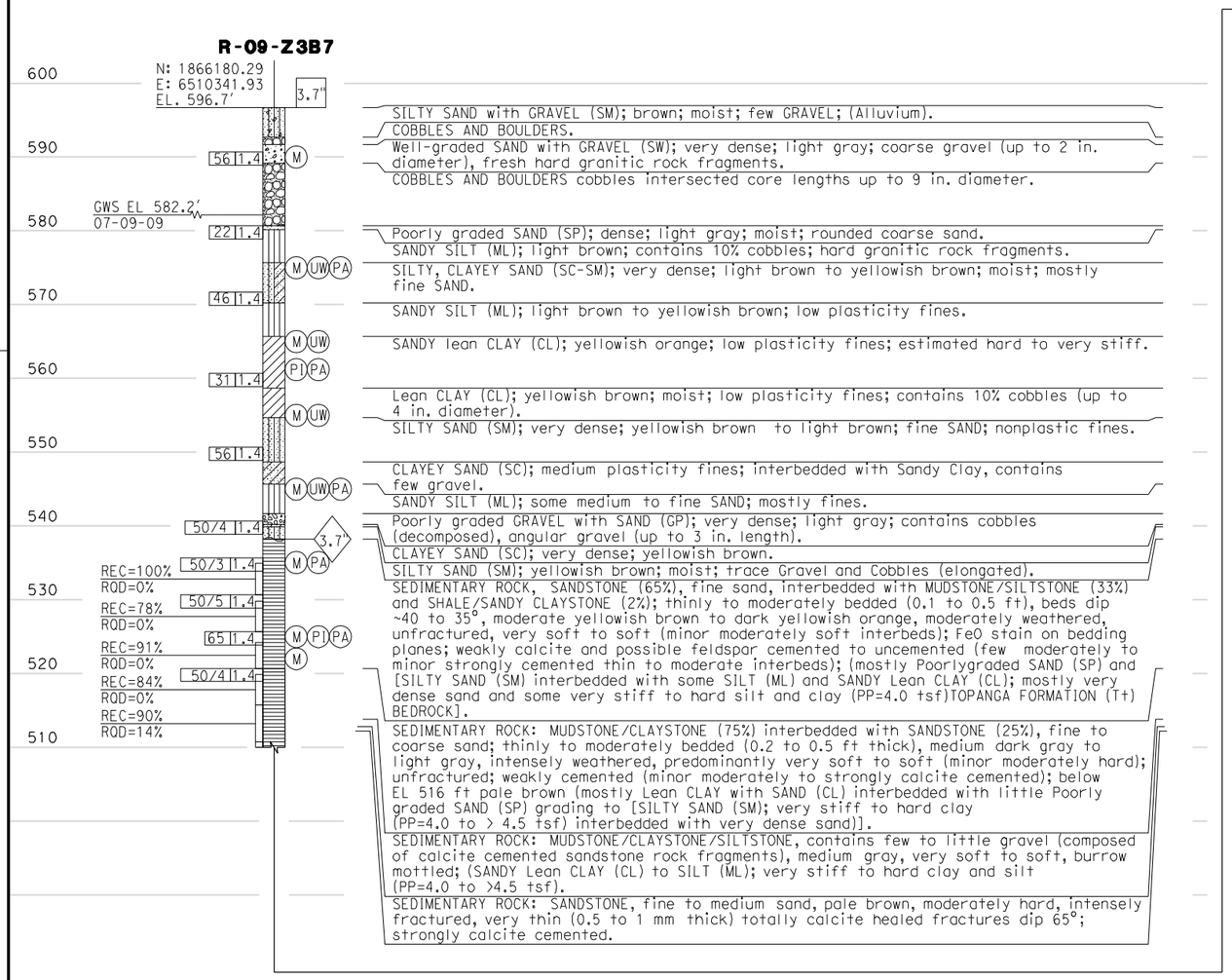

See Sheet 2 FOR CONTINUATION

PROFILE
Vert: 1"=10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO. N/A	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR NAME: SHIVA KARIMI	DRAWN BY: E. MIGUEL CHECKED BY: K. BARKER	FIELD INVESTIGATION BY: J. PRATT/A. TSEGIE DATE: 1/29/09 - 2/20/09			DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 1 OF 5

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 1 OF 5

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Joseph S. Pratt 3/18/10
CERTIFIED ENGINEERING GEOLOGIST DATE

PROFESSIONAL GEOLOGIST — JOSEPH S. PRATT — No. CEG 2141 — Exp. 6/31/2011 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

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Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
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Pt 0617 N1858044.3, E6491094.23.

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6) Plan view shown on Boring Location Plan sheet 2 of 2.

R-09-Z3B7

See Sheet 1 FOR CONTINUATION

480
470
460
450
440

REC=100%
RQD=54%
REC=100%
RQD=22%
REC=98%
RQD=28%
REC=100%
RQD=54%
REC=100%
RQD=50%
REC=90%
RQD=54%

M UW UU

SEDIMENTARY ROCK: SANDSTONE (85%), medium to fine sand, interbedded with MUDSTONE/CLAYEY SILTSTONE (15%), dominantly moderately to thinly bedded (1.0 to 0.1 ft thick), minor laminated, beds dip ~40 to 50°, medium light gray to brownish gray, mostly soft to moderately soft sandstone; mudstone very soft to soft; very slightly fractured to unfractured; possible incipient clay lined fractures dip 80° with faint slickensides; above EL 473.6 ft lenticular bedding; weakly to moderately calcite [cemented (some SILTY SAND (SM) and Poorly graded SAND with SILT (SP-SM) interbedded with few SILT (ML); very stiff to hard silt (PP=3.5 to >4.5 tsf))].

SEDIMENTARY ROCK: SANDSTONE (80%), fine to medium sand, interbedded with MUDSTONE/CLAYSTONE/CLAYEY SILTSTONE (20%), thinly bedded (0.1 to 0.3 ft), beds dip ~40°, medium light gray to brownish gray, mostly very soft (little moderately hard); unfractured; bioturbated and possible ball and pillow structures; mostly weakly to little strongly cemented (mostly SILTY SAND (SM) and Poorly graded SAND with SILT (SP-SM) interbedded with few SANDY Lean CLAY [(CL) and SILT (ML); hard clay and silt (PP>4.5 tsf))].

SEDIMENTARY ROCK: SANDSTONE (95%), fine to coarse, interbedded with MUDSTONE/CLAYSTONE (5%), thinly to moderately bedded (0.2 to 0.8 ft), few laminations and irregular seams (3 to 8 mm thick), medium light gray to brownish gray, mostly very soft to some moderately soft to moderately hard; moderately to slightly fractured; moderately fractured between EL 463.5 to 462.5 ft with totally calcite healed continuous fractures dip 60°; below EL 460.7 ft fractures dip 60° and 20 to 30° [and generally moderately fractured; mostly weakly to some strongly calcite cemented (mostly Poorly graded SAND with SILT (SP-SM) grading to SILTY SAND (SM) interbedded with few Lean CLAY with SAND (CL); hard clay (PP>4.5 tsf))].

SEDIMENTARY ROCK: MUDSTONE/CLAYEY SILTSTONE/CLAYSTONE thinly interbedded with SANDSTONE, very soft, uncemented sandstone (mostly SILT (ML) interbedded with Fat CLAY (CH) and some SILTY SAND (SM); hard silt and clay (PP>4.5 tsf)).

SEDIMENTARY ROCK: SANDSTONE (92%), fine to medium sand, interbedded with MUDSTONE/CLAYSTONE; dominantly moderately bedded, beds dip ~40°, medium light gray to brownish gray, very weak, moderately hard to very soft; intensely to moderately fractured; between EL 455.3 to 454.2 ft 60 to 70° dip clay lined fractures and between EL 453.9 to 453.3 ft 60 to 70° clay lined and 20 to 30° unlined fractures; (minor unfractured above EL 455.3 ft [and between EL 454.2 to 453.9 ft); some strongly to some weakly calcite cemented (some Poorly graded SAND (SP) and SILTY SAND (SM) interbedded with few SANDY Lean CLAY (CL); hard clay (PP>4.5 tsf))].

SEDIMENTARY ROCK: SANDSTONE (85%), fine to medium sand, interbedded with MUDSTONE/CLAYSTONE (15%); dominantly moderately bedded to minor thickly bedded (0.4 to 1.5 ft), medium light gray to brownish gray, mostly moderately hard to moderately soft (little very soft mudstone); slightly fractured above EL 451.8 ft with incipient clay lined fractures; unfractured below; bioturbated below EL 450 ft; mostly moderately to some weakly calcite cemented (some [Poorly graded SAND with SILT (SP-SM) and SILTY SAND (SM) interbedded with little Lean CLAY with SAND (CL); hard clay (PP>4.5 tsf))].

SEDIMENTARY ROCK: SANDSTONE, fine to medium sand, moderately bedded (0.3 to 0.9 ft), medium light gray, mostly moderately soft (very soft below EL 446.7 ft); moderately fractured; above EL 447.9 ft fractures dip 85° and are moderately thin (2 mm thick) and not healed (clay lined); unfractured below; mostly moderately to little weakly cemented (little Poorly [graded SAND (SP))].

REC=98%
RQD=76%
REC=100%
RQD=80%
REC=100%
RQD=10%
REC=100%
RQD=36%
REC=100%
RQD=54%
REC=100%
RQD=44%
REC=96%
RQD=58%
REC=100%
RQD=0%
REC=83%
RQD=0%
REC=100%
RQD=0%
REC=0%
RQD=%

M UW UC
EM
M UW UC
M UW UU

SEDIMENTARY ROCK: SANDSTONE (95%), fine to medium sand, interbedded with MUDSTONE/SILTSTONE (5%), thickly to moderately bedded (2.5 to 0.3 ft), minor thin wavey bedding below EL 443 ft, medium light gray to brownish gray, slightly weathered, mostly moderately hard to hard, little very soft; moderately fractured above EL 443 ft, unfractured below; mostly strongly to little weakly calcite cemented (little Poorly graded SAND (SP)).

SEDIMENTARY ROCK: SANDSTONE (95%), fine to medium sand, interbedded with MUDSTONE/CLAYSTONE (5%), moderately bedded to minor laminated, medium light gray to brownish gray, very weak moderately hard above EL 438.5 ft, soft below; moderately fractured above EL 439.5 ft; between EL 441.5 to 441 ft discontinuous fracture dips 70° with 15° rake angle for slickensides; incipient fractures dip 60 to 55° between EL 441 to 439.5 ft; [unfractured below; moderately to strongly calcite cemented above EL 438 ft, little weakly cemented sand interbeds (little Poorly graded SAND (SP))].

SEDIMENTARY ROCK: SANDSTONE (98%), fine to medium sand, interbedded with MUDSTONE/CLAYSTONE (2%), thinly to moderately bedded (minor laminated), beds dip ~40 to 50°, medium light gray to medium gray, intensely weathered, mostly soft to very soft (few to little moderately hard); unfractured; mostly weakly to few to little strongly calcite cemented (mostly Poorly graded SAND with SILT (SP-SM) grading to SILTY SAND (SM)).

SEDIMENTARY ROCK: SANDSTONE (92%), fine to medium sand, interbedded with MUDSTONE/SILTSTONE (8%), moderately to thinly bedded, minor laminated (1 mm), beds dip ~40 to 50°, medium light gray to brownish gray, intensely to moderately weathered, extremely weak, mostly moderately soft to very soft (little moderately hard); moderately to slightly fractured; incipient very thin clay lined fractures above EL 429.6 ft; continuous fracture with rough surface dips 60° between 427.1 to 426.8 ft; @ EL 425.6 ft rough [fracture dips 40° with raised ridges rake 10°; incipient clay lined fractures dip 70° (EL 425 to 423 ft); mostly moderately to weakly cemented (little strongly cemented); (some Poorly graded SAND with SILT (SP-SM))].

SEDIMENTARY ROCK: BRECCIA with mudstone matrix interbedded with SANDSTONE, fine sand, thinly bedded to laminated, contains soft sandstone clasts, brownish gray to light gray, mostly very soft breccia and some hard sandstone interbeds; intensely fractured; sandstone between EL 419.3 to 418.9 ft with continuous fractures dip 80° closely spaced and slickensides 40° rake; breccia may possibly represent debris flow; mostly strongly [to weakly cemented (some SILTY SAND (SM) to Poorly graded SAND (SP))].

SEDIMENTARY ROCK: SANDSTONE (98%), fine to medium sand, interbedded with CLAYSTONE (2%), moderately to thinly bedded, minor irregular laminations, medium light gray to brownish gray, mostly moderately hard to little very soft; moderately fractured; incipient clay lined fractures dip 75 to 80°; mostly moderately to little weakly cemented (little SILTY SAND (SM) interbedded with trace Fat CLAY (CH); hard clay (PP>4.5 tsf)).

SEDIMENTARY ROCK: SANDSTONE (95%), fine to medium sand, interbedded with MUDSTONE/CLAYSTONE (5%) with soft sandstone clasts, thinly to thickly (0.1 to 2.0 ft) bedded, medium light gray to brownish gray, very weak, mostly moderately hard to some very soft; very slightly fractured to unfractured; irregular subvertical claystone seams are closely to moderately spaced; mostly moderately to some weakly cemented (some Poorly graded SAND with SILT (SP-SM) interbedded with [few Lean CLAY with SAND (CL), hard clay (PP>4.5 tsf))].

SEDIMENTARY ROCK: SANDSTONE (95%), fine to medium sand, interbedded with MUDSTONE (5%), thinly to moderately bedded, medium gray to medium light gray, soft to moderately soft, little very soft; moderately thin to thin claystone seams (1 to 4 mm) dip 60 to 70°, and 20°; mostly moderately to little weakly calcite cemented (little Poorly graded SAND with SILT (SP-SM).

SEDIMENTARY ROCK: SANDSTONE, fine to medium sand, light gray, intensely weathered, very soft, no claystone seams; uncemented (Poorly graded SAND with SILT (SP-SM) grading to SILTY SAND (SM)).

440
430
420
410
400

See Sheet 3 FOR CONTINUATION

PROFILE
Vert: 1"=10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR	DRAWN BY: E. MIGUEL		FIELD INVESTIGATION BY: J. PRATT/A. TSEGIE			N/A	
NAME: SHIVA KARIMI	CHECKED BY: K. BARKER		DATE: 1/29/09 - 2/20/09		DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 2 OF 5

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 2 OF 5

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Joseph S. Pratt 3/18/10
CERTIFIED ENGINEERING GEOLOGIST DATE

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6) Plan view shown on Boring Location Plan sheet 2 of 2.

R-09-Z3B7

See Sheet 2 FOR CONTINUATION

400 / 390 / 380 / 370 / 360

REC=6% RQD=0% REC=90% RQD=40% REC=100% RQD=20% REC=100% RQD=100% REC=100% RQD=15% REC=89% RQD=9% REC=100% RQD=0% REC=100% RQD=60% REC=100% RQD=47% REC=100% RQD=60% REC=86% RQD=71%

M UW UC EM M UW PL

SEDIMENTARY ROCK: SANDSTONE (95%), fine to medium sand, interbedded with MUDSTONE/CLAYSTONE (5%), thinly to moderately bedded (minor laminations), light gray to brownish gray, very soft, contains thin claystone seams; mostly weakly cemented to uncemented, few moderately cemented; *between EL 407 to 402.5 ft rotten seaweed or rotten egg odor (mostly SILTY SAND (SM) interbedded with Poorly graded SAND with SILT (SP-SM) and few Lean CLAY [with SAND (CL); very stiff to hard clay (PP=2.75 to > 4.5 tsf))].

SEDIMENTARY ROCK: SANDSTONE (95%), fine to medium sand, interbedded with MUDSTONE/SILTSTONE (5%), thinly to moderately bedded, minor very thinly bedded (15 to 20 mm), beds dip ~40°, medium light gray to greenish black, mostly very soft to little moderately hard; unfractured above EL 393.2 ft, slightly fractured below; @ EL 393.1 ft discontinuous fracture dips 85°; @ EL 391.5 ft fractures dip 50°, with slickensides 40° rake angle; mostly weakly to moderately calcite [cemented, little strongly cemented (mostly Poorly graded SAND with SILT (SP-SM) interbedded with SILTY SAND (SM) and few SILT (ML); PP>4.5 tsf))].

SEDIMENTARY ROCK: SANDSTONE (95%), fine to coarse sand, interbedded with MUDSTONE/CLAYSTONE (5%), thinly to moderately bedded, medium light gray to brownish gray, mostly moderately soft to little very soft; unfractured; little sandstone above EL 390.7 ft is uncemented, mostly strongly calcite cemented below (little Poorly graded SAND with SILT (SP-SM) and few SANDY Lean CLAY (CL); hard clay (PP>4.5 tsf)).

SEDIMENTARY ROCK: SANDSTONE, fine to coarse sand, light gray, intensely weathered, extremely weak, very soft, unfractured, weakly calcite cemented to uncemented; between EL 388 to 387.5 ft smells like rotten eggs (SILTY SAND (SM)grading to Poorly graded SAND with SILT (SP-SM)).

SEDIMENTARY ROCK: SANDSTONE, fine to medium sand, light gray, soft to moderately soft, unfractured, mostly moderately to few strongly calcite cemented.

SEDIMENTARY ROCK: SANDSTONE, fine to medium sand; moderately to thickly bedded, beds dip ~35 to 40°, light gray to medium light gray, very soft to soft, unfractured above EL 380.9 ft, intensely fractured below; mostly uncemented to weakly calcite cemented above EL 380.9 ft, some moderately to weakly cemented between EL 383.9 to 383.5 ft and below EL 380.9 ft (mostly Poorly graded SAND with SILT (SP-SM) [interbedded with SILTY SAND (SM))].

SEDIMENTARY ROCK: SANDSTONE (95%), fine to medium sand, interbedded with MUDSTONE/CLAYSTONE (5%), moderately to thinly bedded, minor clay lamination and seams (3 to 5 mm), beds dip 40°, medium light gray to brownish gray, mostly moderately soft to moderately hard (some very soft); moderately to slightly fractured, incipient bedding fractures and claystone seams dip 75 to 90° above EL 378.1 ft and between EL 376.1 to 375.8 ft; @ EL 376.6 ft [slickensides on clay lined bedding planes with rake angle 80 to 90°; mostly strongly to moderately calcite cemented (some weakly cemented)].

SEDIMENTARY ROCK: SANDSTONE (55%), fine sand, interbedded with MUDSTONE/SILTSTONE/CLAYSTONE (45%), thinly bedded to laminated, beds dip 40°, convoluted bedding below EL 374.6 ft, medium light gray to brownish gray, very soft to soft, very slightly fractured to unfractured, irregular claystone seams/incipient fractures (1 to 5 mm thick) dip 50 to 60°; sporadically bioturbated; few soft sandstone clasts at base of unit; moderately to weakly calcite cemented (little Poorly graded SAND with SILT (SP-SM) interbedded with little [SANDY Lean CLAY (CL) and SILT (ML); hard clay and silt (PP>4.5 tsf)].

SEDIMENTARY ROCK: SANDSTONE (80%), fine sand, interbedded with MUDSTONE/SILTSTONE (20%), thinly bedded to laminated (0.1 to 0.3 ft, 5 to 1 mm), medium light gray to brownish gray, very soft to soft, moderately to slightly fractured, incipient fractures clay lined and subparallel to bedding planes; sandstone mostly moderately to weakly cemented; uncemented below EL 369.5 ft (SILTY SAND (SM)).

REC=98% RQD=62% REC=100% RQD=68% REC=94% RQD=60% REC=100% RQD=% REC=97% RQD=47% REC=100% RQD=40% REC=97% RQD=50% REC=98% RQD=36%

M UW UC EM M UW UC EM M UW UU CR

SEDIMENTARY ROCK: SANDSTONE (90%), fine to coarse sand, interbedded with MUDSTONE/SILTSTONE/CLAYSTONE (10%), thinly to moderately bedded, minor laminations, beds dip ~40°, medium light gray to brownish gray, intensely weathered, extremely weak soft to very soft above EL 365.7 ft, moderately hard to moderately soft below; moderately to slightly fractured, incipient fractures (claystone seams) dip 40 to 80° and increase below EL 363.5 ft; mostly moderately to little weakly cemented above [EL 365.7 ft, moderately to strongly calcite cemented below (little SILTY SAND (SM) interbedded with few SILT (ML) and Lean CLAY with SAND (CL); hard silt and clay (PP>4.5 tsf))].

SEDIMENTARY ROCK: SANDSTONE (95%), fine to coarse sand, interbedded with MUDSTONE/CLAYSTONE (5%), moderately to thinly bedded (1 to 0.1 ft), minor laminated, beds dip ~40°, medium light gray to brownish gray, intensely weathered, mostly moderately hard, few claystone laminations very soft; very slightly fractured to unfractured, incipient fractures (claystone seams) dip 60°; contains a cobble (6 in. diameter) below EL 361.7 ft (subrounded hard granitic rock fragment); [mostly moderately to strongly calcite cemented, some weakly cemented (some Poorly graded SAND with SILT (SP-SM) interbedded with few Lean CLAY with SAND (CL), hard clay)].

SEDIMENTARY ROCK: SANDSTONE (90%), fine to coarse sand, interbedded with MUDSTONE/CLAYSTONE (10%), thinly bedded (50 to 60 mm), beds dip ~40°, contains a cobble (10 in diameter) and coarse gravel below EL 354.3 ft, light gray to brownish gray, very weak, moderately soft to moderately hard, slightly fractured to unfractured; @ EL 356.9 ft incipient bedding plane fracture dips 40°, slickenside rake 30°; @ EL 357.2 ft penecontemporaneous faulting (soft sediment deformation) with minor offset [subrounded hard quartz diorite rock fragments; mostly moderately to some strongly calcite cemented].

SEDIMENTARY ROCK: SANDSTONE (90%), fine to medium, interbedded with MUDSTONE/CLAYSTONE (10%), thinly to moderately bedded, minor laminated, beds dip ~50°, light gray to brownish gray, intensely weathered, mostly moderately soft to little moderately hard above EL 350.1 ft, very soft to moderately soft below; very slightly fractured to unfractured; incipient fractures dip 60 to 70°; penecontemporaneous faulting (soft sediment deformation) between EL 350.7 to [350.1 ft, moderately to strongly calcite cemented above EL 350.1 ft, moderately to weakly cemented below (below EL 350.1 ft, some SILTY SAND (SM) interbedded with Lean CLAY with SAND (CL); hard clay (PP>4.5 tsf))].

SEDIMENTARY ROCK: SANDSTONE (90%), fine to medium sand, interbedded with MUDSTONE/SILTSTONE (10%), contains a boulder (35%, 14 in. diameter) below EL 345.7 ft, thinly to moderately bedded, light gray to brownish gray, very weak mostly very soft to some moderately hard; unfractured; subrounded very soft decomposed quartz diorite rock fragment (weathered to clays, medium dark gray); mostly weakly to some strongly calcite cemented (mostly Poorly graded SAND with SILT (SP-SM) [interbedded with SILT (ML))].

SEDIMENTARY ROCK: SANDSTONE (90%), fine to medium sand, interbedded with MUDSTONE/SILTSTONE (10%), thinly to moderately bedded, medium gray to brownish gray, mostly very soft above EL 342.2 ft, moderately hard below; unfractured; minor oil/tar @ EL 341.1 ft; mostly weakly calcite cemented above EL 342.2 ft, strongly to moderately calcite cemented below (above EL 342.2 ft mostly Poorly graded SAND with SILT [(SP-SM) grading to SILTY SAND (SM) interbedded with few SILT (ML); hard silt (PP>4.5 tsf))].

SEDIMENTARY ROCK: SANDSTONE (92%), fine to coarse sand, interbedded with MUDSTONE/SILTSTONE (8%); moderately to thinly bedded 0.2 to 1.0 ft), minor laminated; beds dip ~50°, light brownish gray to medium light gray, mostly very soft to some moderately hard; unfractured; weakly to moderately calcite cemented (little strongly cemented); (mostly Well graded SAND with SILT (SW-SM) interbedded with few SILT (ML); hard silt (PP>4.5 tsf)).

360 / 350 / 340 / 330

See Sheet 4 FOR CONTINUATION

PROFILE
Vert: 1"=10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: J. PRATT/A. TSEGIE			DESIGN BRANCH	N/A	LOG OF TEST BORING SHEET 3 OF 5
NAME: SHIVA KARIMI	CHECKED BY: K. BARKER	DATE: 1/29/09 - 2/20/09				POST MILES N/A	

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES											SHEET	OF
											3	5

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Joseph S. Pratt 3/18/10
CERTIFIED ENGINEERING GEOLOGIST DATE

PLANS APPROVAL DATE

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

PROFESSIONAL GEOLOGIST
JOSEPH S. PRATT
No. CEG 2141
Exp. 5/31/2011
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 2 of 2.

R-09-Z3B7

See Sheet 3 FOR CONTINUATION

340
330
320
310

REC=100%
RQD=74%
REC=100%
RQD=100%
REC=90%
RQD=23%
REC=93%
RQD=0%
REC=100%
RQD=59%
REC=100%
RQD=74%
REC=98%
RQD=44%

M UW UC PT EM PL
M UW UC EM

SEDIMENTARY ROCK: SANDSTONE (92%), fine to coarse sand, interbedded with MUDSTONE/SILTSTONE (8%), moderately to thinly bedded, minor laminated (2 mm), beds dip ~40°, light brownish gray to medium light gray, mostly moderately hard to hard, little very soft; very slightly fractured to unfractured; @ 331.3 ft bioturbated beds; mostly strongly to moderately calcite cemented, little weakly cemented (little Well graded SAND with SILT (SW-SM) interbedded with few [SILT (ML); hard silt (PP>4.5 tsf))].

SEDIMENTARY ROCK: SANDSTONE (92%), fine to medium sand, interbedded with MUDSTONE/SILTSTONE (8%), moderately to thinly bedded (0.7 to 0.1 ft), beds dip ~40°, light gray to brownish gray, very soft to moderately soft interbeds; unfractured; weakly to moderately cemented (mostly SILTY SAND (SM) grading to Poorly graded SAND with SILT (SP-SM) interbedded with few SILT (ML)).

SEDIMENTARY ROCK: SANDSTONE (92%), medium to coarse sand, interbedded with MUDSTONE/SILTSTONE (8%), thinly to moderately bedded, light gray to brownish gray, very weak, very soft, unfractured, bioturbated below EL 324.7 ft; mostly weakly to little moderately cemented (mostly Poorly graded SAND with SILT (SP-SM) interbedded with few SILT (ML); hard silt (PP>4.5 tsf)).

SEDIMENTARY ROCK: SANDSTONE (96%), fine to medium sand, interbedded with MUDSTONE/SILTSTONE (4%); moderately bedded (0.3 to 0.5 ft), minor laminations and irregular seams, beds dip 30 to 40°, medium light gray to brownish gray, moderately soft to very soft; very slightly fractured to unfractured; between EL 324.1 to 323.8 ft incipient clay lined fractures (irregular seams) dip 70 to 80°; mostly moderately to weakly calcite cemented (some Poorly graded SAND with SILT (SP-SM) [interbedded with SILT (ML); hard silt (PP>4.5 tsf))].

SEDIMENTARY ROCK: Boulder/Cobble CONGLOMERATE; contains 14 to 10 in. diameter boulders and cobbles, medium gray, unfractured, subrounded moderately soft to moderately hard (intensely to moderately weathered) quartz diorite rock fragments; no matrix apparent.

SEDIMENTARY ROCK: SANDSTONE (95%), medium sand, interbedded with MUDSTONE/SILTSTONE (5%), thin siltstone seams, medium gray to brownish gray, soft, unfractured, mostly moderately to little strongly cemented.

SEDIMENTARY ROCK: Gravel CONGLOMERATE with mudstone matrix, medium gray to brownish gray, soft, unfractured, rounded soft intensely weathered medium sandstone clasts in a soft mudstone/siltstone matrix, probable depositional conglomerate.

SEDIMENTARY ROCK: SANDSTONE (95%), medium to fine sand, interbedded with MUDSTONE/SILTSTONE (5%), contains a thin (0.2 ft thick) Gravel CONGLOMERATE layer below EL 315.9 ft, thinly to moderately bedded, beds dip ~35 to 50°, medium gray to brownish gray, intensely weathered, extremely weak, mostly moderately soft to moderately hard, little very soft; unfractured; gravel conglomerate has a medium sandstone matrix; contains few laminations; mostly moderately to little strongly calcite cemented, little uncemented to weakly cemented (little [Poorly graded SAND with SILT (SP-SM) interbedded with few SILT (ML); hard silt (PP>4.5 tsf))].

SEDIMENTARY ROCK: Cobble CONGLOMERATE, contains 7 in. diameter cobbles, no matrix apparent, very light gray, contains subangular to subrounded hard (slightly weathered) to moderately hard (intensely weathered) quartz diorite rock fragments; unfractured; upper cobble is slightly foliated; uncemented (Cobbles).

SEDIMENTARY ROCK: SANDSTONE (96%), fine to medium sand, interbedded with MUDSTONE/CLAYSTONE (4%), dominantly thinly to moderately bedded (30 to 110 mm), minor laminated (1 to 7 mm), beds dip ~30 to 50°, very light gray to brownish gray, very weak, moderately soft, intensely to moderately fractured, closely to moderately spaced incipient fractures (claystone seams) cross eachother, moderately to weakly calcite cemented (some Poorly graded SAND with SILT (SP-SM) interbedded with trace Lean CLAY with SAND (CL); hard clay (PP>4.5 tsf)).

REC=100%
RQD=38%
REC=100%
RQD=50%
REC=98%
RQD=32%
REC=100%
RQD=32%

M UW UL

310
300
290
280

SEDIMENTARY ROCK: Boulder CONGLOMERATE, boulder 22 in. diameter, (may be just singular boulder isolated in sandstone above and below), subrounded soft (intensely weathered) quartz diorite rock fragment.

SEDIMENTARY ROCK: SANDSTONE (96%), fine to coarse sand, interbedded with MUDSTONE/CLAYSTONE (4%), moderately to thinly bedded, beds dip ~40 to 55°, medium light gray to brownish gray, very weak, mostly moderately soft to some very soft, little moderately hard; intensely to moderately fractured; incipient clay lined fractures (mudstone seams) dip from 40 to 75° and cross eachother; mostly moderately to some weakly calcite cemented, little [strongly cemented (some Well graded SAND with SILT (SW-SM) interbedded with trace Lean CLAY with SAND (CL); hard clay (PP>4.5 tsf))].

SEDIMENTARY ROCK: Coarse Gravel and Cobble CONGLOMERATES (50%) thinly to moderately interbedded with SANDSTONE (50%), cobbles (4 in. diameter) and gravel (2 in. diameter), fine sand, medium light gray, very soft to moderately soft sandstone; cobbles and gravel are composed of subrounded moderately hard (intensely weathered) quartz diorite rock fragments; weakly to moderately cemented (some cobbles and gravel interbedded with few Poorly graded SAND with [SILT (SP-SM))].

SEDIMENTARY ROCK: SANDSTONE (85%), fine to coarse sand, interbedded with MUDSTONE/CLAYSTONE (7%) and Coarse Gravel CONGLOMERATE (8%, below EL 296.3 ft), thinly to moderately bedded, medium light gray to brownish gray, intensely weathered, soft to very soft; unfractured; coarse gravel composed of moderately hard quartz diorite rock fragments; trace thin shelled pelecypod (clam) debris (composed of high Mg calcite or aragonite-fizzes vigorously with HCL) is scattered between EL 298.9 to [296.3 ft; mostly moderately to weakly cemented, little strongly cemented (Well graded SAND with SILT (SW-SM) interbedded with few Poorly graded Gravel (GP) and few Lean CLAY with SAND (CL); hard clay (PP>4.5 tsf))].

SEDIMENTARY ROCK: SANDSTONE (92%), fine sand, interbedded with MUDSTONE/SILTSTONE (8%); thinly bedded to laminated, medium light gray to brownish gray, very soft to soft, unfractured, contains irregular thin siltstone laminations; mostly weakly to some moderately cemented (mostly Poorly graded SAND with SILT (SP-SM) interbedded with few SILT (ML), very stiff to hard silt (PP=3.75 to >4.5 tsf)).

SEDIMENTARY ROCK: SANDSTONE, medium sand, thinly to moderately bedded, medium light gray, vuggy, mostly moderately hard to little very soft; unfractured; mostly strongly to little weakly calcite cemented, pelecypod shell debris below EL 292.7 ft (little Poorly graded SAND with SILT (SP-SM)).

See Sheet 5 FOR CONTINUATION

PROFILE
Vert: 1"=10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES				
FUNCTIONAL SUPERVISOR	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: J. PRATT/A. TSEGIE	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO. N/A	SR-710 TUNNEL TECHNICAL STUDY
NAME: SHIVA KARIMI	CHECKED BY: K. BARKER	DATE: 1/29/09 - 2/20/09		DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 4 OF 5

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 4 OF 5

FILE => $REQUEST

DATE PLOTTED => $DATE TIME PLOTTED => $TIME USERNAME => $USER

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Joseph S. Pratt 3/18/10
CERTIFIED ENGINEERING GEOLOGIST DATE

PLANS APPROVAL DATE

PROFESSIONAL GEOLOGIST — JOSEPH S. PRATT — No. CEG 2141 — Exp. 9/31/2011 — CERTIFIED ENGINEERING GEOLOGIST — 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.

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29′
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68′ west of the center of the south bound lanes of the freeway, 25′ north of the centerline of Hellman Avenue, 13′ east of the west end of the bridge, 1′ north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 2 of 2.

R-09-Z3B7

See Sheet 4 FOR CONTINUATION

290
REC=98%
RQD=32%
REC=94%
RQD=36%
280
REC=98%
RQD=38%
REC=100%
RQD=78%
270
M UW UC EM

02-20-09
Terminated at EL. 270.7′
ER_i = 87%

SEDIMENTARY ROCK: SANDSTONE (96%), fine to medium sand, interbedded with MUDSTONE/CLAYSTONE (4%), moderately to thinly bedded, beds dip 45 to 55°, medium light gray to brownish gray, vuggy, very soft to soft; unfractured; pelecypod debris @ EL 288.8 ft; weakly to moderately calcite cemented (mostly Poorly graded SAND with SILT (SP-SM) interbedded with trace Lean CLAY with SAND (CL); hard clay (PP>4.5 tsf)).

SEDIMENTARY ROCK: SANDSTONE (96%), medium sand, interbedded with MUDSTONE/SILTSTONE (4%), moderately to thinly bedded, beds dip ~45 to 60°, medium light gray to brownish gray, mostly moderately soft to little very soft; mostly moderately to little strongly calcite cemented, little weakly cemented; calcite nodules just above basal contact (little Poorly graded SAND with SILT (SP-SM) interbedded with trace SILT (ML)).

SEDIMENTARY ROCK: Gravel BRECCIA with sandstone and mudstone matrix; contains coarse gravel and trace cobbles (5 in length), thinly to moderately bedded, brownish gray to medium light gray, vuggy, very soft to soft intensely weathered matrix; unfractured; angular hard sandstone rock fragments (dominantly coarse gravel to trace cobble size); may represent cataclastic breccia with gouge; weakly to moderately cemented (Poorly graded GRAVEL with SILT [and SAND and COBBLES (GP-GM) grading to Poorly graded gravel with CLAY and SAND (GP-GC))].

SEDIMENTARY ROCK: SANDSTONE (64%), fine to medium sand, interbedded with Cobble-Gravel CONGLOMERATE (33%) and MUDSTONE/SILTSTONE (3%); cobbles (30%, up to 6 in. diameter) and trace coarse gravel, thinly to moderately bedded, medium light gray to brownish gray, slightly weathered, some moderately hard to some very soft; very soft below EL 279.9 ft; unfractured; contains sporadic subrounded hard (slightly weathered) quartz diorite rock fragments; mostly moderately to weakly calcite cemented, some uncemented conglomerate; very hard [drilling (mostly Poorly graded SAND with SILT (SP-SM) interbedded with some cobbles and gravel and trace SILT (ML))].

SEDIMENTARY ROCK: SANDSTONE, medium sand; moderately to thinly bedded (0.3 to 0.6 ft), light gray to medium light gray, moderately hard to hard, very intensely to intensely fractured, very closely spaced (10 to 30 mm) moderately thin (2 to 3 mm) discontinuous totally calcite healed fractures dip 70 to 75°; strongly calcite cemented.

SEDIMENTARY ROCK: SANDSTONE (96%), fine to medium sand, interbedded with MUDSTONE/SILTSTONE (4%), thinly to moderately bedded, minor laminated (2 mm), light gray to brownish gray, mostly very soft to some moderately hard interbeds; contains a thin calcite layer @ EL 277.7 ft; mostly weakly to some strongly calcite cemented (mostly Poorly graded SAND with SILT (SP-SM) interbedded with trace SILT (ML); very stiff silt (PP=3.75 tsf)).

SEDIMENTARY ROCK: SANDSTONE (96%), medium sand, interbedded with MUDSTONE/CLAYSTONE (4%), thinly to thickly bedded, beds dip ~40 to 55°, medium gray to light gray, weak, mostly hard to little very soft; moderately to slightly fractured (0.7 to 1.9 ft), clay lined fractures dip 60 to 75°; crosslaminated between EL 274.5 to 273.3 ft; minor fossil debris; clean; clay seams cross eachother; mostly strongly to little weakly [calcite cemented (little Poorly graded SAND with SILT (SP-SM) interbedded with trace Lean CLAY with SAND (CL); hard clay (PP>4.5 tsf))].

PROFILE
Vert: 1"=10′

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: K. BARKER				N/A	
NAME: SHIVA KARIMI	CHECKED BY: K. BARKER	DATE: 2/12/09 - 2/27/09			DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 5 OF 5

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 5 OF 5

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

CERTIFIED ENGINEERING GEOLOGIST — 3/18/10 DATE

PLANS APPROVAL DATE

PROFESSIONAL GEOLOGIST — MICHAEL A. SALISBURY — No. CEG 2462 — Exp. 2/28/2011 — CERTIFIED ENGINEERING GEOLOGIST — 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.

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

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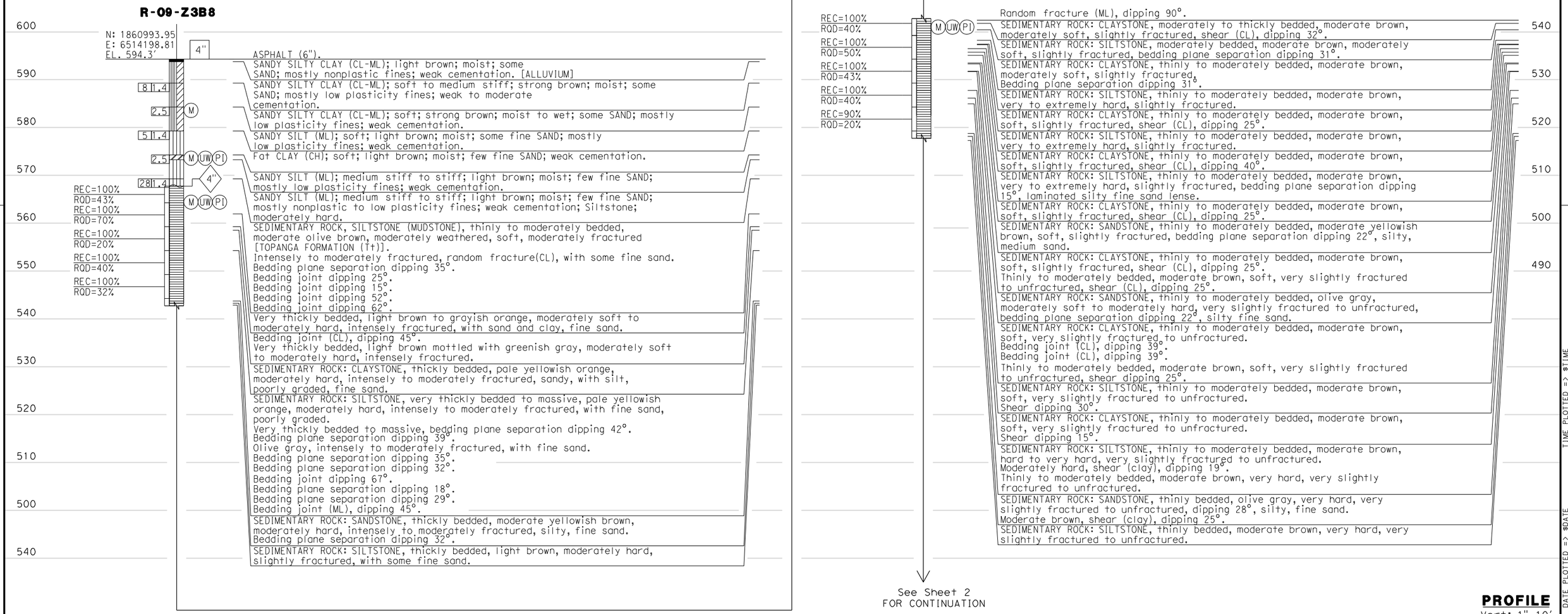
5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 2 of 2.



See Sheet 2
FOR CONTINUATION

PROFILE
Vert: 1"-10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR	DRAWN BY: K. REYES		FIELD INVESTIGATION BY: M. SALISBURY			N/A	
NAME: SHIVA KARIMI	CHECKED BY: J. PRATT		DATE: 3/11/09 - 3/25/09		DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 1 OF 5

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 1 OF 5

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

CERTIFIED ENGINEERING GEOLOGIST 3/18/10 DATE

PLANS APPROVAL DATE

PROFESSIONAL GEOLOGIST — MICHAEL A. SALISBURY — No. CEG 2462 — Exp. 2/28/2011 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

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BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control basedon American Vertical Datum 1988.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

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4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 2 of 2.

R-09-Z3B8

See Sheet 1 FOR CONTINUATION

520
510
500
490
480
470
460
450
440
430
420
400

REC=100%
RQD=10%
REC=100%
RQD=42%
REC=71%
RQD=25%
REC=93%
RQD=67%
REC=92%
RQD=0%
REC=100%
RQD=0%
REC=100%
RQD=0%
REC=100%
RQD=89%
REC=100%
RQD=50%
REC=100%
RQD=0%

M UW

SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, moderately hard, very slightly fractured to unfractured, shear (clay), dipping 22°.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, very hard, very slightly fractured to unfractured.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, very hard, very slightly fractured to unfractured.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, hard, intensely to moderately fractured, sandy, fine sand.
Olive gray, dipping 35°.
Moderate brown.
Very intensely to intensely fractured, dipping 15°.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, moderately hard, very intensely to intensely fractured, shear.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, hard, very intensely to intensely fractured.
Intensely to moderately fractured, trace fine sand.
Dipping 15°.
Moderate brown to light gray, sandy, find sand.
Moderate brown, slightly fractured.
Thinly bedded, light gray, dipping 10°.
Moderate brown.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, soft to moderately soft, slightly fractured, dipping 25°.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, soft to moderately soft, slightly fractured.
Laminated to very thinly bedded, hard, dipping 25°.
Moderately hard, shear (clay), dipping 25°.
SEDIMENTARY ROCK: SILTSTONE, laminated to very thinly bedded, moderate brown, moderately hard, slightly fractured.
Bedding joint dipping 25°, with some fine sand.
Trace fine sand.
With some fine sand.
SEDIMENTARY ROCK: CLAYSTONE, laminated to very thinly bedded, moderate brown, moderately hard, slightly fractured.
SEDIMENTARY ROCK: SILTSTONE, laminated to very thinly bedded, moderate brown, moderately hard, intensely fractured.
SEDIMENTARY ROCK: SANDSTONE, laminated to very thinly bedded, moderate brown, very to extremely hard, intensely fractured, dipping 10°, silty, fine sand.
SEDIMENTARY ROCK: CLAYSTONE, laminated to very thinly bedded, moderate brown, very to extremely hard, slightly fractured, dipping 10°.
SEDIMENTARY ROCK: SILTSTONE, laminated to very thinly bedded, moderate brown, very to extremely hard, slightly fractured.
Laminated to very thinly bedded, hard, bedding joint dipping 20°.
Intensely to moderately fractured.
Joint (clay), dipping 48°.
Dipping 17°.
Joint dipping 30°.
SEDIMENTARY ROCK: CLAYSTONE, laminated to very thinly bedded, moderate brown, moderately hard, intensely to moderately fractured.
Joint dipping 30°.
SEDIMENTARY ROCK: SILTSTONE, laminated to very thinly bedded, moderate brown, moderately hard, intensely to moderately fractured.
Moderate brown mottled with light gray, hard, trace fine sand.
Joint dipping 50°.
Bedding joint dipping 25°.
With fine sand.

REC=93%
RQD=18%
REC=100%
RQD=22%
REC=100%
RQD=45%
REC=98%
RQD=0%
REC=100%
RQD=20%

M UW

480
470
460
450
440
430

SEDIMENTARY ROCK: CLAYSTONE, laminated to very thinly bedded, moderate brown, hard, intensely to moderately fractured.
SEDIMENTARY ROCK: SILTSTONE, laminated to very thinly bedded, moderate brown, hard, intensely to moderately fractured.
Dipping 25°.
SEDIMENTARY ROCK: SANDSTONE, laminated to very thinly bedded, moderate brown, hard, intensely to moderately fractured, dipping 24°.
SEDIMENTARY ROCK: SILTSTONE, laminated to very thinly bedded, moderate brown, hard, intensely to moderately fractured, dipping 25°, excellent bedding contact.
SEDIMENTARY ROCK: CLAYSTONE, laminated to very thinly bedded, moderate brown, hard, intensely to moderately fractured.
SEDIMENTARY ROCK: SILTSTONE, laminated to very thinly bedded, moderate brown, hard, intensely to moderately fractured.
SEDIMENTARY ROCK: CLAYSTONE, laminated to very thinly bedded, moderate brown, hard, intensely to moderately fractured, dipping 25°.
SEDIMENTARY ROCK: SILTSTONE, laminated to very thinly bedded, moderate brown, hard, intensely to moderately fractured.
Dipping 18°, trace fine sand.
Moderate brown to light gray, hard, intensely to moderately fractured.
SEDIMENTARY ROCK: CLAYSTONE, laminated to very thinly bedded, moderate brown, hard, intensely to moderately fractured, random fracture (moderately healed), dipping 90°.
SEDIMENTARY ROCK: SILTSTONE, laminated to very thinly bedded, moderate brown, hard, intensely to moderately fractured.
SEDIMENTARY ROCK: CLAYSTONE, laminated to very thinly bedded, moderate brown, hard, intensely to moderately fractured.
SEDIMENTARY ROCK: SILTSTONE, laminated to very thinly bedded, moderate brown, hard, intensely to moderately fractured.
Laminated, moderate brown to light gray, sandy, fine sand.
Dipping 16°.
Dipping 18°.
Thinly bedded, moderate brown.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, hard, intensely to moderately fractured.
SEDIMENTARY ROCK: SILTSTONE, laminated, moderate brown, hard, intensely to moderately fractured, dipping 18°, with fine sand.
SEDIMENTARY ROCK: CLAYSTONE, laminated, moderate brown, hard, intensely to moderately fractured.
SEDIMENTARY ROCK: SILTSTONE, laminated, moderate brown, hard, intensely to moderately fractured, dipping 28°, sandy.
SEDIMENTARY ROCK: CLAYSTONE, laminated, moderate brown, hard, intensely to moderately fractured.
SEDIMENTARY ROCK: SILTSTONE, laminated, moderate brown, hard, intensely to moderately fractured.
SEDIMENTARY ROCK: CLAYSTONE, laminated, moderate brown, hard, intensely to moderately fractured.

See Sheet 3 FOR CONTINUATION

PROFILE
Vert: 1"-10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR	DRAWN BY: K. REYES		FIELD INVESTIGATION BY: M. SALISBURY			N/A	
NAME: SHIVA KARIMI	CHECKED BY: J. PRATT		DATE: 3/11/09 - 3/25/09		DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 2 OF 5

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET 2 OF 5

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

CERTIFIED ENGINEERING GEOLOGIST 3/18/10 DATE

PLANS APPROVAL DATE

PROFESSIONAL GEOLOGIST — MICHAEL A. SALISBURY — No. CEG 2462 — Exp. 2/28/2011 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

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Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control basedon American Vertical Datum 1988.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

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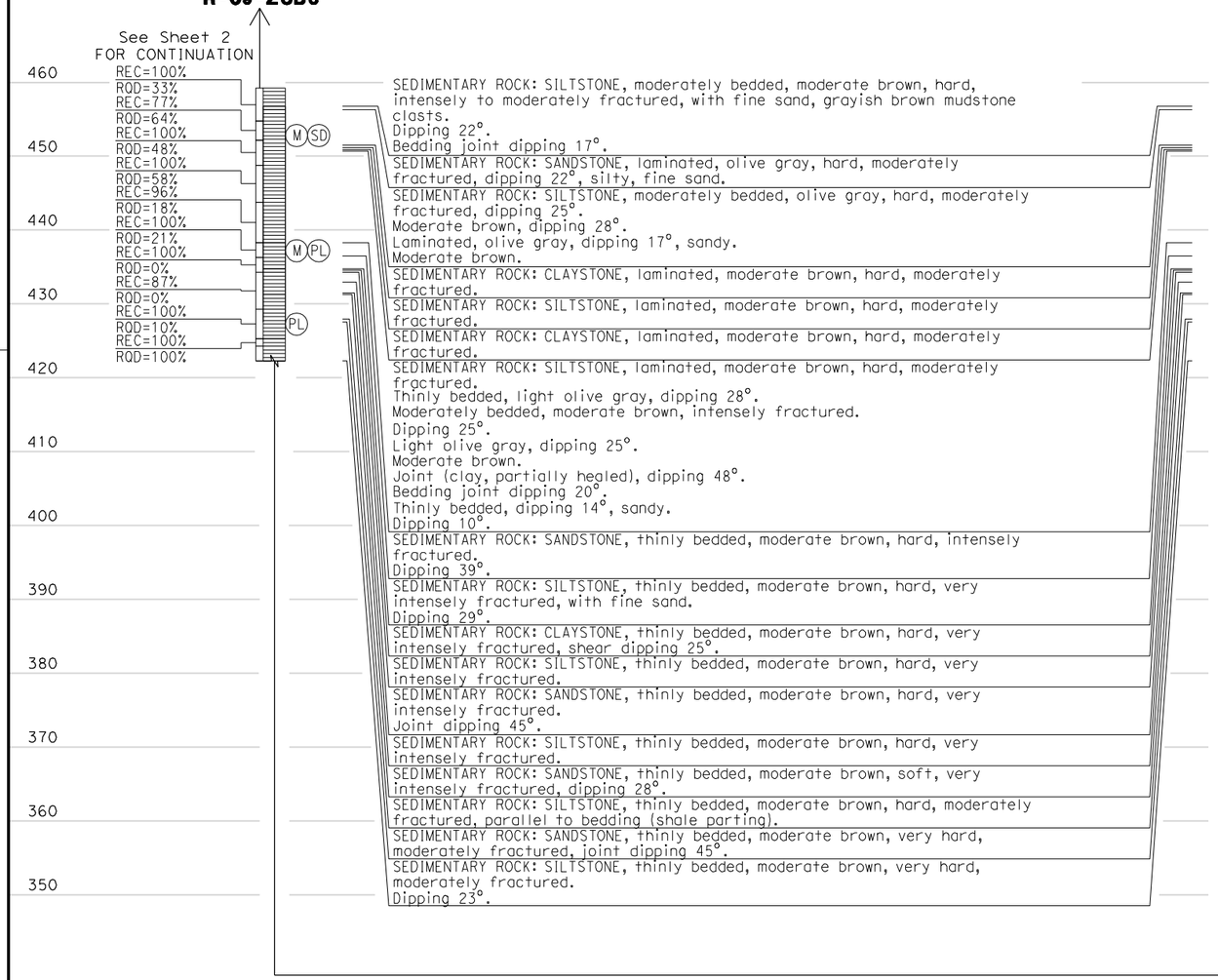
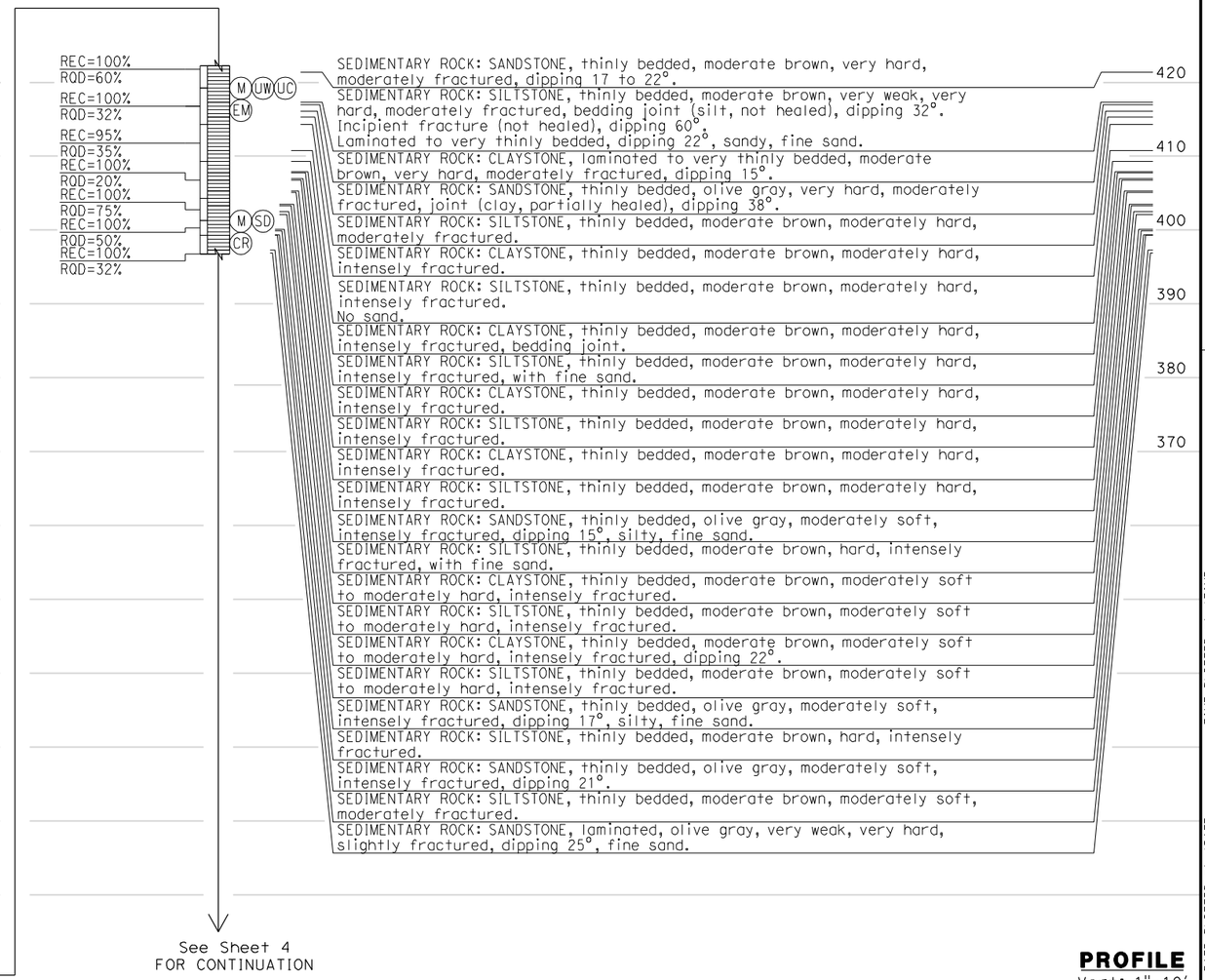
6) Plan view shown on Boring Location Plan sheet 2 of 2.

R-09-Z3B8

See Sheet 2 FOR CONTINUATION





See Sheet 4 FOR CONTINUATION

PROFILE
Vert: 1"-10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR	DRAWN BY: K. REYES		FIELD INVESTIGATION BY: M. SALISBURY			N/A	
NAME: SHIVA KARIMI	CHECKED BY: J. PRATT		DATE: 3/11/09 - 3/25/09		DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 3 OF 5

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES											SHEET	OF
											3	5

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
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CERTIFIED ENGINEERING GEOLOGIST 3/18/10 DATE

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PROFESSIONAL GEOLOGIST
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No. CEG 2462
Exp. 2/28/2011
CERTIFIED ENGINEERING GEOLOGIST
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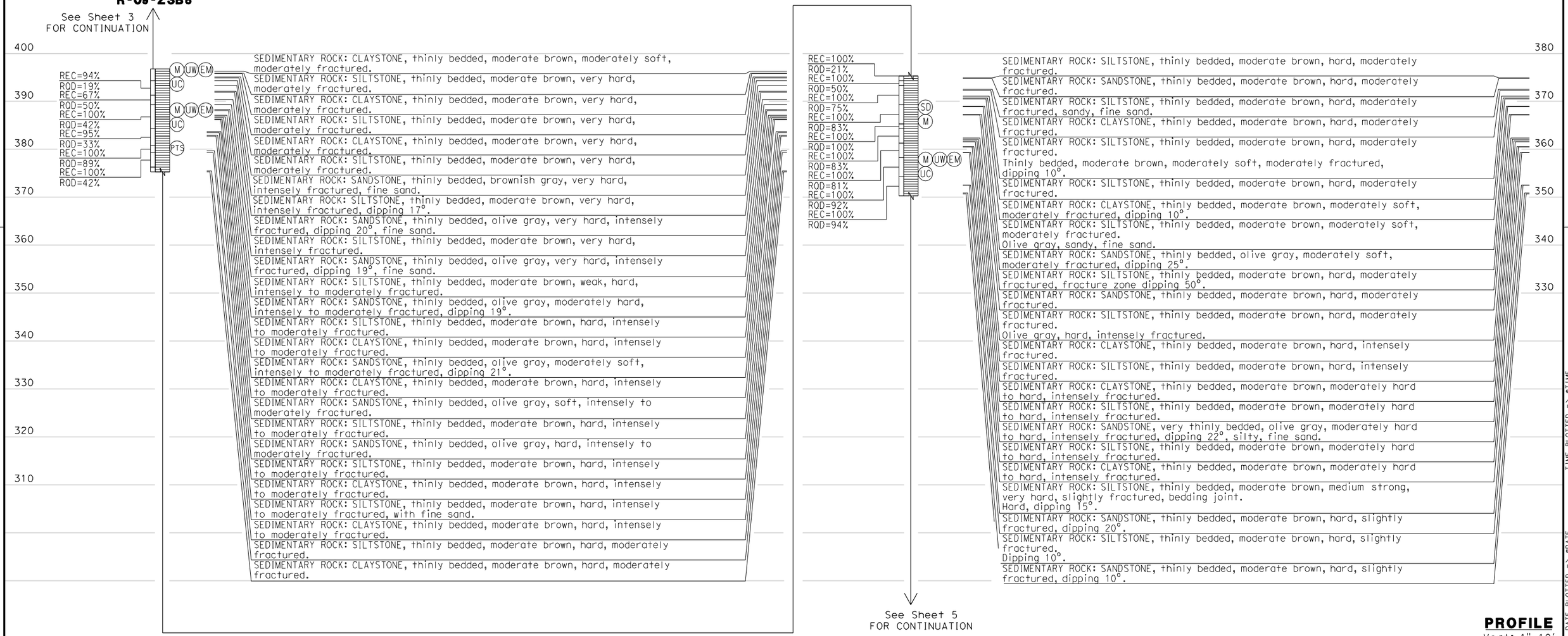
R-09-Z3B8

See Sheet 3 FOR CONTINUATION



See Sheet 5 FOR CONTINUATION

PROFILE
Vert: 1"=10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES			
FUNCTIONAL SUPERVISOR	DRAWN BY: K. REYES	FIELD INVESTIGATION BY: M. SALISBURY	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO. N/A
NAME: SHIVA KARIMI	CHECKED BY: J. PRATT	DATE: 3/11/09 - 3/25/09		DESIGN BRANCH	POST MILES N/A

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 4 OF 5

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET 4 OF 5

FILE => $REQUEST

DATE PLOTTED => $DATE TIME PLOTTED => $TIME USERNAME => $USER

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

CERTIFIED ENGINEERING GEOLOGIST 3/18/10 DATE

PLANS APPROVAL DATE

PROFESSIONAL GEOLOGIST — MICHAEL A. SALISBURY — No. CEG 2462 — Exp. 2/28/2011 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

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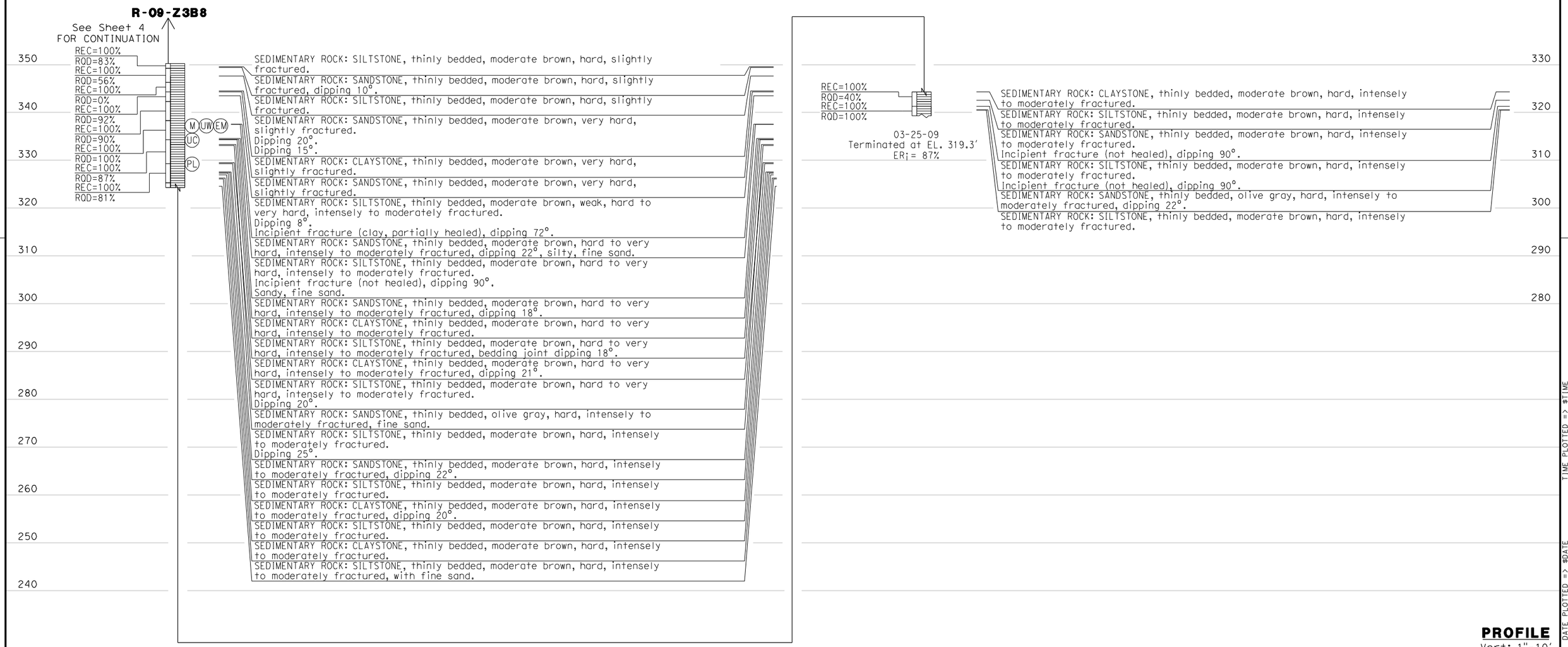

PROFILE
Vert: 1"-10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR NAME: SHIVA KARIMI	DRAWN BY: K. REYES	FIELD INVESTIGATION BY: M. SALISBURY			DESIGN BRANCH	N/A	LOG OF TEST BORING SHEET 5 OF 5
	CHECKED BY: J. PRATT	DATE: 3/11/09 - 3/25/09				POST MILES N/A	

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 5 OF 5

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

CERTIFIED ENGINEERING GEOLOGIST — 3/18/10 DATE

PLANS APPROVAL DATE

MICHAEL A. SALISBURY
No. CEG 2462
Exp. 2/28/2011
CERTIFIED ENGINEERING GEOLOGIST
PROFESSIONAL GEOLOGIST
STATE OF CALIFORNIA

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6) Plan view shown on Boring Location Plan sheet 2 of 2.

R-09-Z3B9

N: 1864258.22
E: 6510756.22
EL. 624.3'

4"

620
- 23 | 1.4 — ASPHALT (4").
- Well-graded GRAVEL with SILT (GW-GM); greenish gray; dry; mostly coarse, subrounded GRAVEL, max. 2 in. dia.; little fines; weak cementation; (Aggregate Base = 8").
- 50/6 | 1.4 — SILTY GRAVEL (GM); light brown to light gray; dry to moist; mostly coarse, subrounded GRAVEL, max. 2 in. dia.; little fines; weak cementation. [ALLUVIUM]

610
- Poorly graded SAND with GRAVEL (SP); dense; light brown to light gray; dry to moist; little coarse to fine, subangular to subrounded GRAVEL, max. 2 in. dia.; mostly SAND; weak cementation.
- 2.5 | M UW PA — Poorly graded SAND with SILT (SP-SM); very dense; light brown to light gray; dry to moist; mostly coarse SAND; few fines; weak cementation.
- 99 | 1.4 — Well-graded GRAVEL with SILT and SAND (GW-GM); dense; olive to light brown; moist; mostly coarse, subrounded GRAVEL, max. 2 in. dia.; trace SAND; trace fines; weak cementation.

600
- 50/6 | 1.4 — Poorly graded SAND with SILT and GRAVEL (SP-SM); loose; light brown; moist; some coarse to fine, subrounded GRAVEL, max. 2 in. dia.; mostly coarse to fine SAND; few fines; weak cementation.
  At EL. 606.8 ft, contains about 10 to 25% COBBLES.
- 50/6 | 1.4 — COBBLES very dense; light brown to light bluish gray; moist; about 20% little coarse GRAVEL, max. 3 in. dia.; coarse SAND; weak cementation; Diorite Porphyry, extremely hard.

590
- 79 | 1.4 — SILTY GRAVEL with SAND (GM); brown; dry to moist; mostly coarse to fine, subrounded GRAVEL, max. 3 in. dia.; few coarse to medium SAND; some fines; weak cementation.

580
- SILTY SAND (SM); very dense; brown; moist; mostly SAND; some fines; weak cementation.
- 91 | 1.4 — Well-graded SAND with GRAVEL (SW); very dense; brown to light brown; moist; few coarse to fine, subrounded GRAVEL, max. 3 in. dia.; mostly coarse SAND; weak cementation.
  At EL. 577.3 ft, contains medium SAND.

570
- Well-graded SAND with SILT (SW-SM); very dense; light brown; moist; mostly fine SAND; little fines; weak cementation.
- 46 | 1.4 — M PA — Yellowish brown.

560
- SILTY SAND (SM); very dense; yellowish brown to olive brown; moist; mostly fine SAND; some fines; weak cementation.
- Poorly graded SAND with SILT (SP-SM); yellowish brown; moist; mostly fine SAND; few fines; weak cementation.
- 94 | 1.4 — Poorly graded SAND (SP); very dense; yellowish brown; moist; mostly coarse SAND; weak cementation.

550 — GWS EL 550.4' 07-01-09

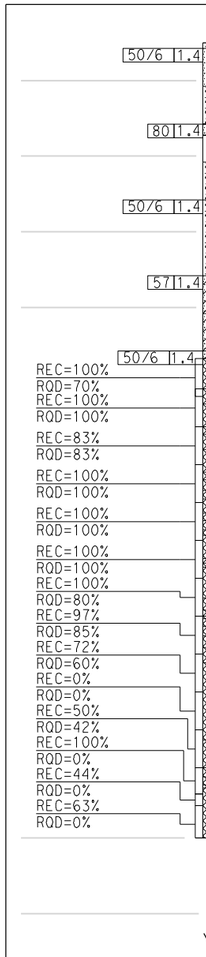
- 78 | 1.4 — SILTY SAND (SM); light brown; moist; mostly SAND; some fines; weak cementation.

540
- Poorly graded SAND (SP); light brown; moist; mostly coarse SAND; weak cementation.
- 47 | 1.4 — M PA — SILTY SAND (SM); very dense; yellowish brown; moist; mostly fine SAND; some fines; weak cementation.

530
- Well-graded SAND with GRAVEL (SW); very dense; yellowish brown to brown; moist; little coarse, subrounded GRAVEL, max. 1 in. dia.; mostly coarse SAND; weak cementation.
- 64 | 1.4

520
- SILTY SAND (SM); yellowish brown; moist; mostly fine SAND; some fines; weak cementation.
- 50/6 | 1.4 — Well-graded SAND with GRAVEL (SW); very dense; yellowish brown; dry to moist; few coarse, subrounded GRAVEL, max. 3 in. dia.; mostly fine SAND; weak cementation.

510



- SILTY SAND (SM); very dense; yellowish brown to dark yellowish brown; dry to moist; mostly fine SAND; some fines; weak cementation.
- Well-graded SAND with GRAVEL (SW); very dense; yellowish brown; dry to moist; few coarse, subrounded GRAVEL, max. 3 in. dia.; mostly fine SAND; weak cementation.

500
- SILTY SAND (SM); very dense; yellowish brown; moist; mostly fine SAND; some fines; weak cementation.

490
- SANDY SILT (ML); stiff; yellowish brown; moist; some fine SAND; some nonplastic to low plasticity fines; weak cementation.
- Well-graded SAND with SILT and GRAVEL (SW-SM); dense to very dense; yellowish brown to light brown; moist; few coarse, subrounded GRAVEL, max. 3 in. dia.; mostly coarse to fine SAND; few fines; weak cementation.

480
- Well-graded SAND with GRAVEL (SW); dense to very dense; yellowish brown; moist; few coarse, subrounded GRAVEL, max. .75 in. dia.; mostly coarse to fine SAND; weak cementation.
- CLAYEY SAND (SC); very dense; reddish brown; moist; mostly medium to fine SAND; some low plasticity fines; weak cementation.
  At EL. 469.3 ft, grades to olive gray.
  At EL. 464.3 ft, grades to reddish brown; moist.

470
- IGNEOUS ROCK, DIORITE, pale reddish brown to grayish orange, decomposed, soft, very intensely fractured, fracture zone dipping 36°. [WILSON QUARTZ DIORITE (wqm)]

460
- Pale reddish brown, fracture zone dipping 36°.
- Pale yellowish brown, fracture zone dipping 36°.
- Grayish orange, random fracture dipping 42°.
- Pale yellowish brown, fracture zone dipping 28°.

450
- Fracture zone dipping 60°.
- Fracture zone dipping 70°.
- Fracture zone dipping 45°.
- Fracture zone dipping 38°.
- Fracture zone dipping 35°.

440
- Shear dipping 45°.
- Shear dipping 45°.
- Fracture zone dipping 90°.

430
- Shear dipping 45°.
- Fracture zone dipping 51°.
- Fracture zone dipping 42°.
- Fracture zone dipping 45°.
- Fracture zone dipping 35°.
- Fracture zone dipping 25°.
- Grayish brown.

420
- Fracture zone dipping 45°.
- Fracture zone dipping 40°.
- Fracture zone dipping 42°.
- Fracture zone dipping 60°.
- Fracture zone dipping 30°.

410
- Light olive gray, fracture zone dipping 45°, soft clay matrix.
- Light bluish gray, moderately soft to moderately hard.
- Fracture zone dipping 62°.
- Fracture zone dipping 50°.

400

See Sheet 2 FOR CONTINUATION

PROFILE
Vert: 1"=10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: M. SALISBURY			DESIGN BRANCH	N/A	LOG OF TEST BORING SHEET 1 OF 2
NAME: SHIVA KARIMI	CHECKED BY: J. PRATT	DATE: 3/26/09 - 4/10/09				POST MILES N/A	

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 1 OF 2

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

CERTIFIED ENGINEERING GEOLOGIST — 3/18/10 DATE

PLANS APPROVAL DATE

MICHAEL A. SALISBURY
No. CEG 2462
Exp. 2/28/2011
CERTIFIED ENGINEERING GEOLOGIST
PROFESSIONAL GEOLOGIST
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.

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

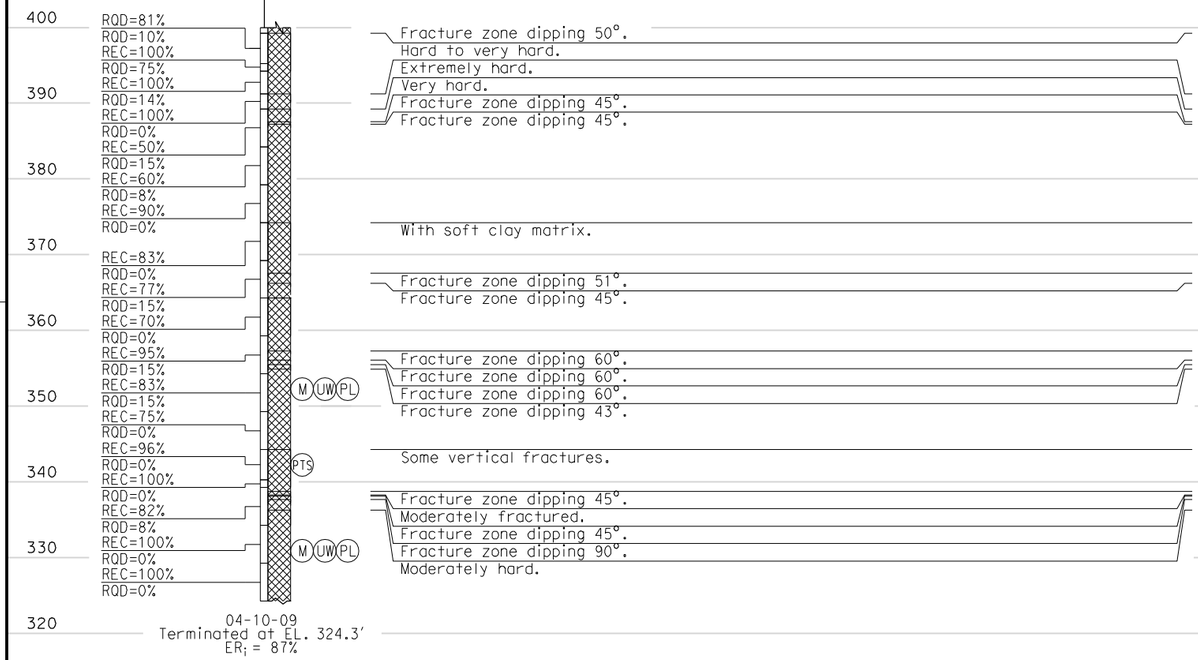
4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 2 of 2.

R-09-Z3B9

See Sheet 1 FOR CONTINUATION



PROFILE
Vert: 1"-10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES			DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: M. SALISBURY	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION		DESIGN BRANCH	N/A	LOG OF TEST BORING SHEET 2 OF 2
NAME: SHIVA KARIMI	CHECKED BY: J. PRATT	DATE: 3/26/09 - 4/10/09				POST MILES N/A	

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 2 OF 2

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

CERTIFIED ENGINEERING GEOLOGIST 3/18/10 DATE

PLANS APPROVAL DATE

MICHAEL A. SALISBURY No. CEG 2462 Exp. 2/28/2011 CERTIFIED ENGINEERING GEOLOGIST — PROFESSIONAL GEOLOGIST — STATE OF CALIFORNIA

BENCHMARK:

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Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:

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2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 2 of 2.

R-09-Z3B10

N: 1861458.74
E: 6506754.81
EL. 626.8'

Elevations: 630, 620, 610, 600, 590, 580, 570, 560, 550, 540

4"

5 | 1.4
push | 2.5 (M)(UW)
17 | 1.4
push | 2.5
19 | 1.4 (M)(PI)(PA)
push | 2.5
19 | 1.4
push | 2.5
13 | 1.4
GWS EL 578.3' 07-01-09
push | 2.5 (M)(UW)(PI)
10 | 1.4
push | 2.5

4" (M)(UW)(PI)(PA)

REC=100% RQD=100%
REC=100% RQD=100%
REC=100% RQD=100%
REC=100% RQD=80%

ASPHALT (6").
Poorly graded GRAVEL (GP); medium dense to dense; brown; dry; mostly coarse, angular to subangular GRAVEL, max. 2 in. dia.; weak cementation; (Aggregate Base = 6").
SANDY SILT (ML); medium stiff; brown; dry to moist; some fine SAND; mostly nonplastic to low plasticity fines; weak cementation.
SILTY CLAY (CL-ML); medium stiff; yellowish brown; dry to moist; nonplastic fines; weak cementation.
SILTY CLAY with SAND (CL-ML); soft to medium stiff; yellowish brown; moist; few fine SAND; mostly medium to low plasticity fines; weak cementation.
SANDY SILT (ML); medium stiff; yellowish brown; dry to moist; few fine SAND; mostly nonplastic fines; weak cementation.
Fat CLAY with SAND (CH); soft to medium stiff; yellowish brown; moist; mostly weak cementation.
SILTY CLAY with GRAVEL (CL-ML); medium stiff; yellowish brown mottled with dark gray; moist; about 25% few fine, subangular GRAVEL, max. 1 in. dia.; about 10% medium SAND; mostly medium to low plasticity fines; weak cementation.
CLAYEY SAND with GRAVEL (SC); medium stiff; yellowish brown mottled with dark gray; moist; about 20% few fine, subangular GRAVEL, max. 1 in. dia.; about 45% mostly fine SAND; some fines; weak cementation.
SILTY CLAY (CL-ML); soft to medium stiff; olive gray; moist; mostly medium to low plasticity fines; weak cementation; wood fragments.
SILTY CLAY with SAND (CL/ML); medium stiff; yellowish brown; dry to moist; few fine SAND; mostly nonplastic to low plasticity fines; weak cementation. About 15% fine GRAVEL, max. ¾in. dia.
SANDY SILTY CLAY (CL/ML); medium stiff; yellowish brown mottled with dark gray; moist; little medium SAND; medium to low plasticity fines; weak cementation; wood fragments.
SILTY CLAY with SAND (CL/ML); medium stiff to stiff; brownish yellow; moist; few fine SAND; mostly medium to low plasticity fines; weak cementation.
Lean CLAY (CL); hard; yellowish brown; dry to moist; few fine SAND; mostly medium to low plasticity fines; weak cementation; > 4.0 TSF.
1.5 TSF.
Lean CLAY with SAND (CL); very stiff; yellowish brown; dry; few fine SAND; mostly nonplastic to low plasticity fines; weak cementation; 3.5 TSF, fragments of strongly cemented olive gray silty fine sandstone.
SANDY SILT (ML); hard; yellowish brown; dry; some fine SAND; mostly nonplastic fines; weak cementation; > 4 TSF.
SEDIMENTARY ROCK, SILTSTONE (MUDSTONE), moderately bedded, moderate yellowish brown and dark gray, slightly weathered, moderately hard, slightly fractured, sandy, fine sand. [TOPANGA FORMATION].
Very thinly bedded, pale yellowish brown, dipping 22°.
Dark gray.
Laminated, olive gray, dipping 18°.
Moderately bedded, dark gray, incipient fracture (not healed), dipping 90°.
Moderate brown.
Joint (CL, not healed), dipping 25°.
Joint (CL, not healed), dipping 24°.
Joint (CL, not healed), dipping 32°.
Joint (CL, not healed), dipping 29°, bedding dipping 19.
Joint (CL, not healed), dipping 35°.
Joint (CL, not healed), dipping 31°.

Elevations: 550, 540, 530, 520, 510

REC=100% RQD=92%
REC=100% RQD=0%
REC=63% RQD=20%
REC=100% RQD=70%
REC=100% RQD=100%
REC=100% RQD=100%
(M)(UW)

Very thinly interbedded lenses of weakly cemented silty fine sandstone.
Joint (CL, not healed), dipping 31°.
SEDIMENTARY ROCK: SANDSTONE, moderately bedded, light gray, hard, slightly fractured, silty.
Very to extremely hard.
Wet.
SEDIMENTARY ROCK: SILTSTONE, moderately bedded, moderate brown to dusky brown, very to extremely hard, slightly fractured, dipping 17°.
SEDIMENTARY ROCK: CLAYSTONE, moderately bedded, light brown, moderately hard, slightly fractured, dipping 18°, sandy, fine sand.
Moderate brown, moderately soft.
SEDIMENTARY ROCK: SILTSTONE, moderately bedded, moderate brown, moderately soft, slightly fractured, sandy, fine sand.
Light gray.
Moderate brown.
SEDIMENTARY ROCK: CLAYSTONE, moderately bedded, moderate brown, moderately soft, slightly fractured, sandy, fine sand.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, light brown, moderately soft, slightly fractured, dipping 12°.
CLAYSTONE, moderately bedded, moderate brown, moderately soft, slightly fractured, sandy, fine sand.
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, light gray, very hard, slightly fractured, dipping 47°, fine sand, some medium sand.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, hard, slightly fractured, bedding joint (clay), dipping 42°.
SEDIMENTARY ROCK: SANDSTONE, moderately bedded, moderate brown, moderately hard, slightly fractured, medium sand, moderately graded.
Silty, fine sand.
SEDIMENTARY ROCK: SILTSTONE, moderately bedded, moderate brown to light brown, moderately hard, slightly fractured, sandy, fine sand.
SEDIMENTARY ROCK: SANDSTONE, moderately bedded, moderate brown, moderately hard, slightly fractured, dipping 28°, fine sand.
SEDIMENTARY ROCK: SILTSTONE, moderately bedded, moderate brown, moderately hard, slightly fractured.
SEDIMENTARY ROCK: SANDSTONE, moderately bedded, moderate brown, moderately hard, slightly fractured, dipping 27°.
SEDIMENTARY ROCK: SILTSTONE, moderately bedded, moderate brown, moderately hard, slightly fractured.
SEDIMENTARY ROCK: CLAYSTONE, moderately bedded, moderate brown, moderately hard, slightly fractured.
SEDIMENTARY ROCK: SILTSTONE, moderately bedded, moderate brown, moderately hard, slightly fractured.
SEDIMENTARY ROCK: SANDSTONE, very thinly bedded, light gray, very to extremely hard, slightly fractured.
SEDIMENTARY ROCK: CLAYSTONE, thinly to moderately bedded, moderate brown, moderately hard, slightly fractured.
SEDIMENTARY ROCK: SILTSTONE, thinly to moderately bedded, moderate brown, moderately hard, slightly fractured, with fine sand.

See Sheet 2 FOR CONTINUATION

PROFILE
Vert: 1"-10'

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO. N/A	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR NAME: SHIVA KARIMI	DRAWN BY: E. MIGUEL / CHECKED BY: J. PRATT / FIELD INVESTIGATION BY: M. SALISBURY / DATE: 2/23/09 - 3/11/09		DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 1 OF 6

OGS CIVIL LOG OF TEST BORINGS SHEET — ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 — CU EA 07-187900 — DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES — SHEET 1 OF 6

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

CERTIFIED ENGINEERING GEOLOGIST — 3/18/10 DATE

PLANS APPROVAL DATE

PROFESSIONAL GEOLOGIST — MICHAEL A. SALISBURY — No. CEG 2462 — Exp. 2/28/2011 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

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Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

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3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 2 of 2.

R-09-Z3B10

See Sheet 1 FOR CONTINUATION

520 / 510 / 500 / 490 / 480

REC=100%
RQD=100%
REC=100%
RQD=100%
REC=100%
RQD=100%
REC=113%
RQD=93%
REC=94%
RQD=39%
REC=167%
RQD=58%
REC=100%
RQD=0%
REC=88%
RQD=75%
REC=100%
RQD=100%

M UW PI PA

SEDIMENTARY ROCK: SANDSTONE, thinly to moderately bedded, light gray, moderately hard, slightly fractured, silty with some clay, fine sand,.
SEDIMENTARY ROCK: CLAYSTONE, thinly to moderately bedded, moderate brown, very hard, slightly fractured, bedding joint (CL, not healed), dipping 28°.
SEDIMENTARY ROCK: SILTSTONE, thinly to moderately bedded, moderate brown, very hard, slightly fractured, sandy, fine sand.
Light gray, dipping 18°, with fine sand.
SEDIMENTARY ROCK: SANDSTONE, moderate brown.
SEDIMENTARY ROCK: CLAYSTONE, laminated, dark gray, moderately hard, slightly fractured, dipping 18°, fine sand.
SEDIMENTARY ROCK: SILTSTONE, thinly to moderately bedded, moderate brown, moderately hard, slightly fractured, with some fine sand.
SEDIMENTARY ROCK: SANDSTONE, thinly to moderately bedded, moderate brown, hard, slightly fractured, sandy, fine sand.
SEDIMENTARY ROCK: CLAYSTONE, thinly to moderately bedded, light gray, soft, slightly fractured, fine sand.
SEDIMENTARY ROCK: SILTSTONE, thinly to moderately bedded, moderate brown, hard, slightly fractured.
Thinly to moderately bedded, moderate brown, hard, slightly fractured.
Dark gray, dipping 25°.
Moderate brown.
Bedding joint (CL, not healed), dipping 17°.
SEDIMENTARY ROCK: SANDSTONE, laminated, light gray, hard, slightly fractured, silty, fine sand.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, hard, slightly fractured.
SEDIMENTARY ROCK: SANDSTONE, very thinly bedded, light gray, hard, slightly fractured, dipping 38°, silty, fine sand.
SEDIMENTARY ROCK: SILTSTONE, thinly to moderately bedded, moderate brown, hard, slightly fractured.
SEDIMENTARY ROCK: SANDSTONE, laminated, light gray, hard, slightly fractured, dipping 26°, silty, fine sand.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, hard, slightly fractured.
SEDIMENTARY ROCK: SANDSTONE, laminated, light gray, hard, slightly fractured, dipping 25°, silty, fine sand.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, hard, slightly fractured.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, hard, slightly fractured, bedding joint dipping 24°.
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, light gray, hard, slightly fractured.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, hard, slightly fractured.
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, light gray, moderately hard, slightly fractured, silty, fine sand.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, moderately hard, slightly fractured, bedding joint dipping 17°.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, moderately hard, very slightly fractured.
Dipping 12°.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, moderately hard, very slightly fractured, shear (CL), dipping 18°.

REC=93%
RQD=90%
REC=100%
RQD=100%
REC=100%
RQD=100%
REC=75%
RQD=75%
REC=100%
RQD=100%
REC=97%
RQD=97%
REC=92%
RQD=92%
REC=100%
RQD=100%
REC=100%
RQD=94%
REC=108%
RQD=100%

M UW

M UW

490 / 480 / 470 / 460 / 450

SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, moderately hard, very slightly fractured.
SEDIMENTARY ROCK: SANDSTONE, very thinly bedded, light gray, moderately hard, very slightly fractured, dipping 24°.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, hard, slightly fractured.
SEDIMENTARY ROCK: SANDSTONE, laminated to very thinly bedded, light gray, hard, slightly fractured, fine sand.
Dipping 17°.
Laminated, bedding joint dipping 42°.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, hard, slightly fractured, sandy, fine sand.
Bedding joint dipping 29°.
Very hard, bedding joint dipping 29°.
SEDIMENTARY ROCK: SANDSTONE, laminated to very thinly bedded, moderate brown to light gray, hard, slightly fractured, fine sand.
Dipping 27°.
Dipping 26°.
SEDIMENTARY ROCK: CLAYSTONE, laminated to very thinly bedded, moderate brown, hard, slightly fractured, shear (CL, not healed), dipping 32°, slightly plastic.
SEDIMENTARY ROCK: SANDSTONE, laminated to very thinly bedded, moderate brown, hard, slightly fractured.
SEDIMENTARY ROCK: CLAYSTONE, laminated to very thinly bedded, moderate brown, hard, slightly fractured.
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, olive gray, moderately hard to hard, slightly fractured, fine sand.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, hard, slightly fractured, sandy, fine sand.
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, light gray, moderately hard to hard, slightly fractured, dipping 42°, silty, fine sand, poorly graded.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, moderately hard, slightly fractured.
Thinly bedded, moderate brown, hard, slightly fractured, sandy, fine sand, poorly graded.
Hard to very hard, bedding joint dipping 36°.
SEDIMENTARY ROCK: SANDSTONE, laminated, light gray to olive gray, hard, slightly fractured, dipping 52°, fine sand.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, moderately soft to moderately hard, slightly fractured.
SEDIMENTARY ROCK: SILTSTONE, laminated, moderate brown, moderately soft to moderately hard, slightly fractured, dipping 36°, sandy, fine sand.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, moderately hard, slightly fractured.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, light gray mottled with moderate brown, hard to very hard, slightly to very slightly fractured, sandy, fine sand.
Moderate brown.
Incipient fracture dipping 90°.
SEDIMENTARY ROCK: SANDSTONE, laminated, light gray, moderately hard, slightly to very slightly fractured, bedding joint (gypsum, not healed), dipping 12°.
SEDIMENTARY ROCK: SILTSTONE, laminated, moderate brown, hard, slightly to very slightly fractured.

See Sheet 3 FOR CONTINUATION

PROFILE
Vert: 1"=10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES			
FUNCTIONAL SUPERVISOR	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: M. SALISBURY	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO. N/A
NAME: SHIVA KARIMI	CHECKED BY: J. PRATT	DATE: 2/23/09 - 3/11/09		DESIGN BRANCH	POST MILES N/A

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 2 OF 6

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 2 OF 6

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29′
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68′ west of the center of the south bound lanes of the freeway, 25′ north of the centerline of Hellman Avenue, 13′ east of the west end of the bridge, 1′ north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

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3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 2 of 2.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

CERTIFIED ENGINEERING GEOLOGIST 3/18/10 DATE

PROFESSIONAL GEOLOGIST — MICHAEL A. SALISBURY — No. CEG 2462 — Exp. 2/28/2011 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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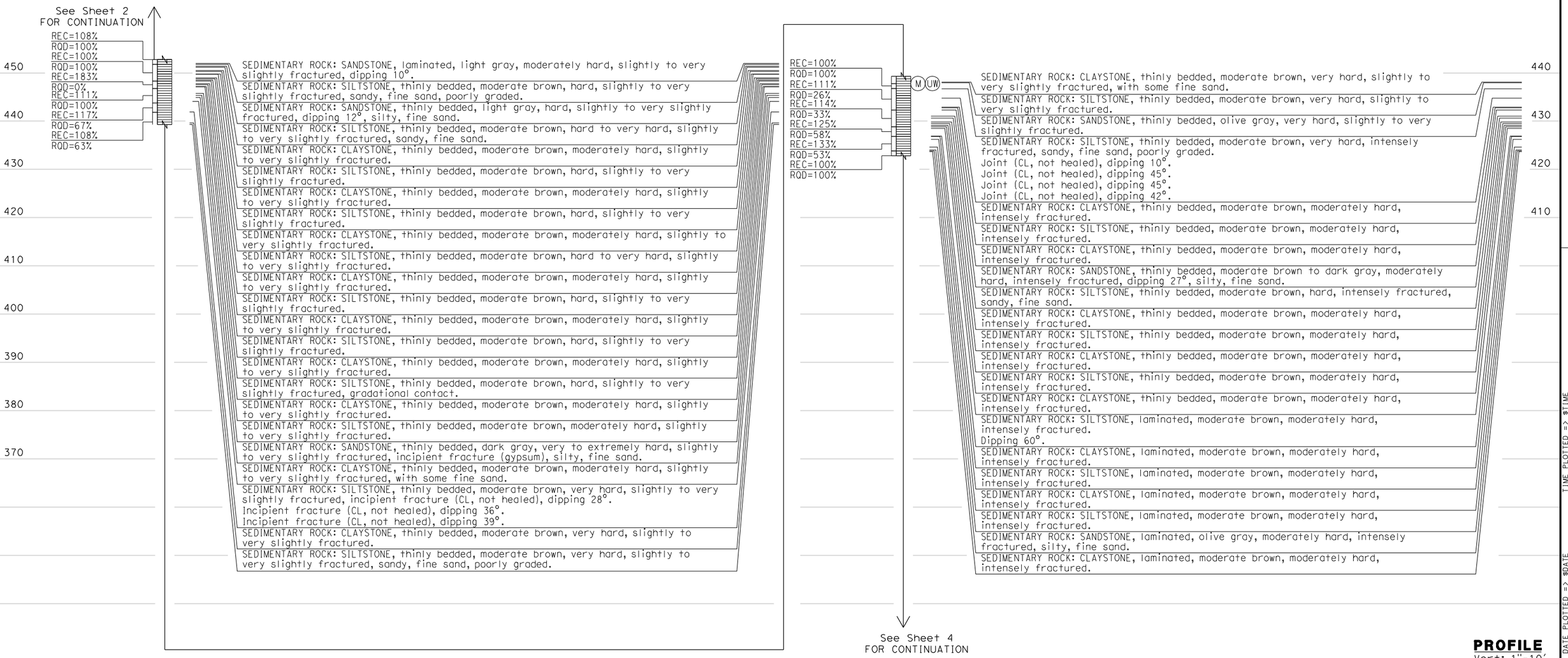
R-09-Z3B10

See Sheet 2 FOR CONTINUATION



See Sheet 4 FOR CONTINUATION

PROFILE
Vert: 1"=10′

ENGINEERING SERVICES		GEOTECHNICAL SERVICES	
FUNCTIONAL SUPERVISOR NAME: SHIVA KARIMI	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: M. SALISBURY	
	CHECKED BY: J. PRATT	DATE: 2/28/09 - 3/11/09	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH

BRIDGE NO. N/A
POST MILES N/A

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 3 OF 6

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 3 OF 6

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

CERTIFIED ENGINEERING GEOLOGIST — 3/18/10 DATE

PLANS APPROVAL DATE

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Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
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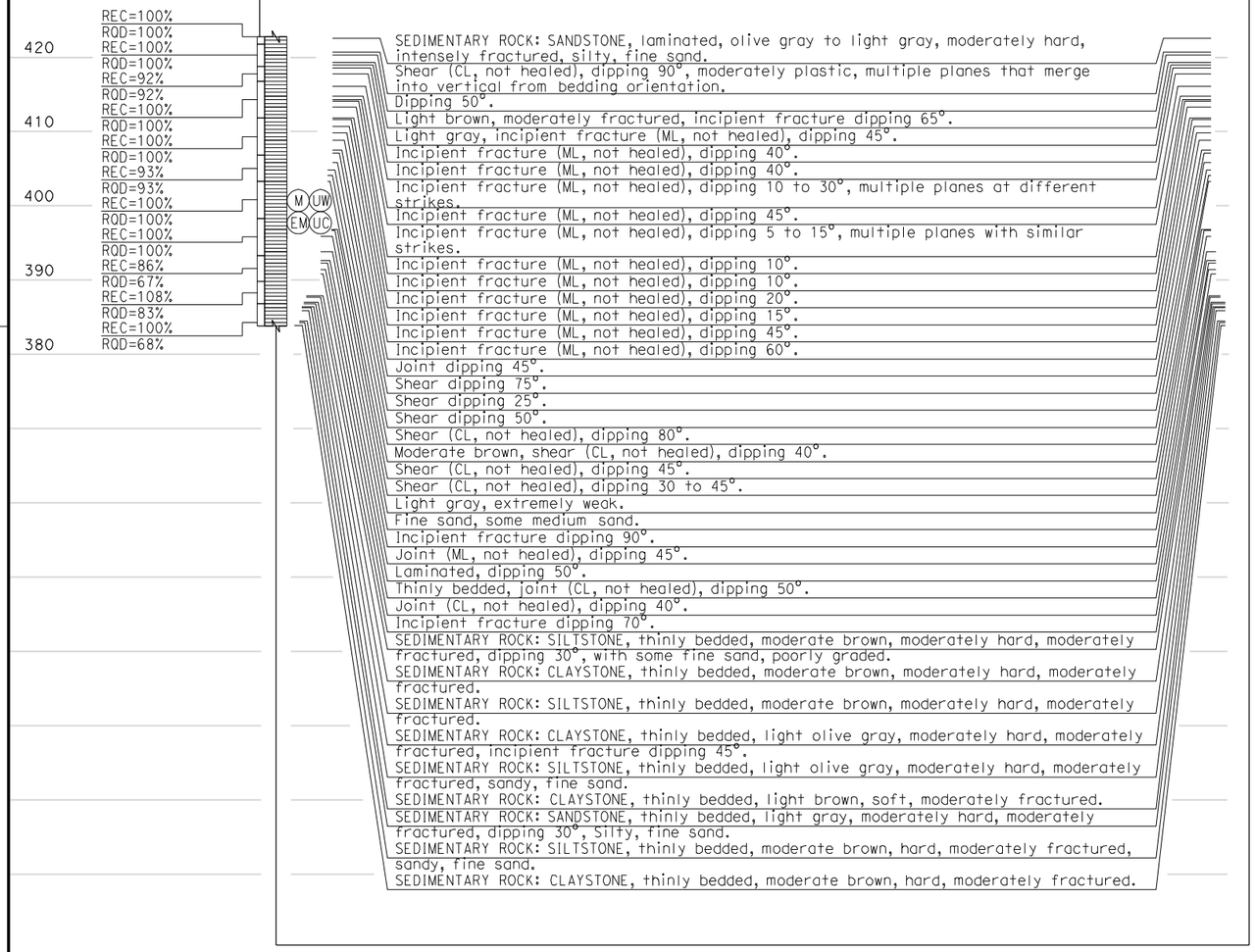
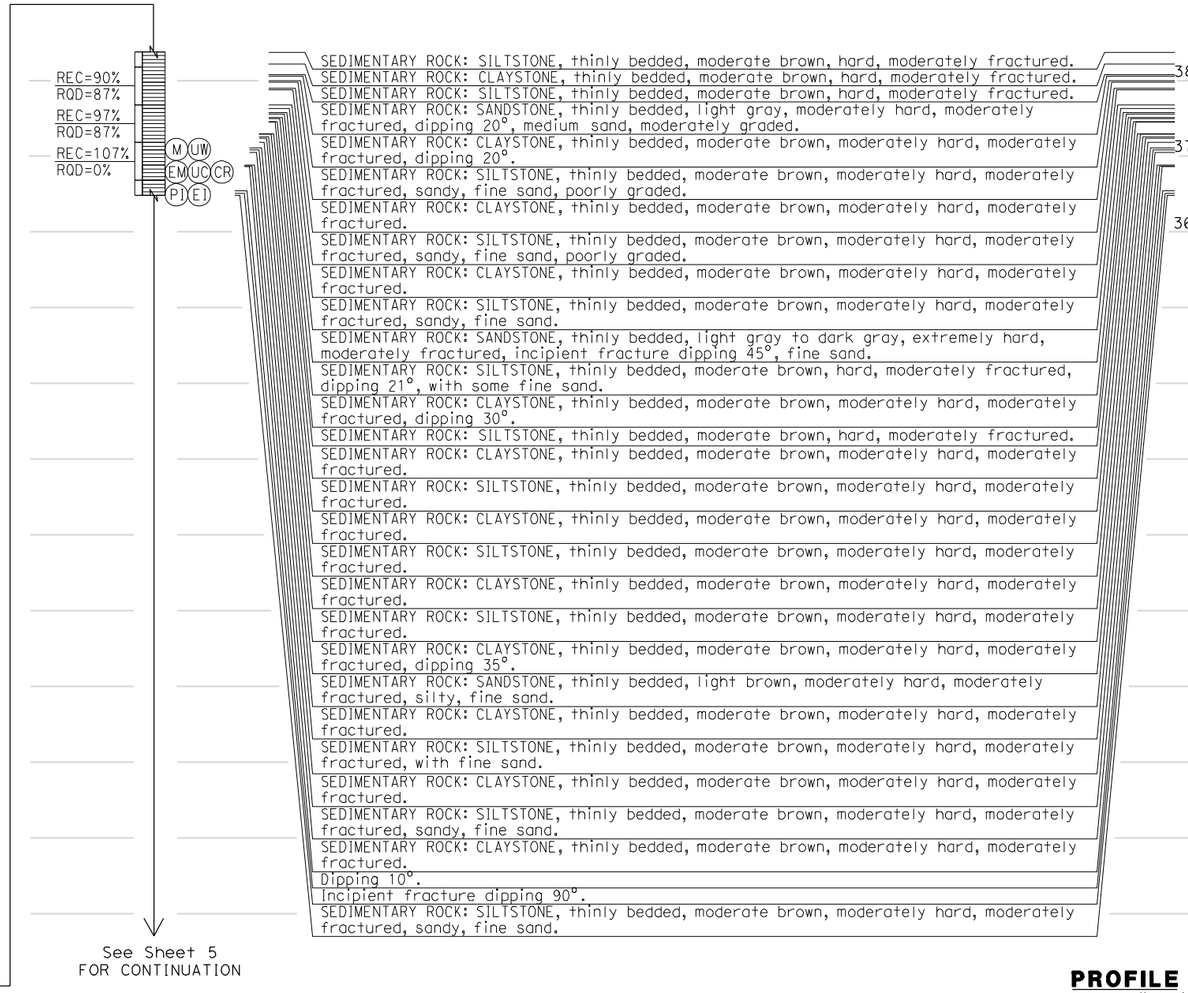
R-09-Z3B10

See Sheet 3 FOR CONTINUATION





See Sheet 5 FOR CONTINUATION

PROFILE
Vert: 1"=10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: M. SALISBURY				N/A	
NAME: SHIVA KARIMI	CHECKED BY: J. PRATT	DATE: 2/28/09 - 3/11/09			DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 4 OF 6

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES										SHEET	OF
										4	6

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

CERTIFIED ENGINEERING GEOLOGIST 3/18/10 DATE

PLANS APPROVAL DATE

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PROFESSIONAL GEOLOGIST
MICHAEL A. SALISBURY
No. CEG 2462
Exp. 2/28/2011
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

BENCHMARK:

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Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
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6) Plan view shown on Boring Location Plan sheet 2 of 2.

R-09-Z3B10

See Sheet 4 FOR CONTINUATION

360
REC=100%
ROD=72%
REC=100%
ROD=80%
REC=100%
ROD=92%
REC=100%
350
ROD=0%
REC=75%
ROD=0%
REC=100%
ROD=87%
340
REC=100%
ROD=79%
REC=111%
ROD=83%
REC=100%
330
ROD=90%

(SD) (EM) (UC)
(M) (UW)

Shear (ML, not healed), dipping 15°.
Patches of petroleum?.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, moderately hard, moderately fractured, dipping 40°.
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, light gray, moderately hard, moderately fractured.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, moderately hard, moderately fractured, dipping 60°, clasts of light brown to dark gray silty fine sandstone and moderate brown claystone.
Patches of petroleum?.
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, light gray, moderately hard, moderately fractured, medium sand with some fine sand.
Incipient fracture (gypsum, not healed), dipping 40°.
Incipient fracture (gypsum, not healed), dipping 50°, silty, fine sand.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, moderately hard, moderately fractured.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, light olive, moderately hard, moderately fractured, sandy, fine sand, with lenses of moderate brown claystone.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, moderately hard, moderately fractured, dipping 40°.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, moderately hard, moderately fractured, sandy, fine sand.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, moderately hard, moderately fractured.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, hard, moderately fractured, dipping 70°.
Laminated, dipping 40°.
SEDIMENTARY ROCK: CLAYSTONE, laminated, moderate brown, hard, moderately fractured.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, light gray, hard, moderately fractured, sandy, fine sand.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, hard, moderately fractured, dipping 25°.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, hard, moderately fractured.
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, light brown, hard, moderately fractured, fine sand.
Incipient fracture (ML), dipping 10°.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, very hard, moderately fractured, bedding joint dipping 40°.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, very hard, moderately fractured.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, very hard, moderately fractured, fine sand.
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, light gray, very hard, moderately fractured, bedding joint dipping 30°.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, very hard, moderately fractured.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, very hard, moderately fractured.
Incipient fracture (ML), dipping 30°.
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, light brown, weak, very hard, moderately fractured.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, very hard, moderately fractured.
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, moderate brown, very hard, moderately fractured, dipping 50°, fine sand.

REC=100%
ROD=90%
REC=100%
ROD=100%
REC=100%
ROD=80%
REC=100%
ROD=100%
(PTS)
REC=87%
ROD=0%
REC=124%
ROD=0%
(M) (UW)
REC=110%
ROD=0%
(EM) (UC)
REC=100%
ROD=0%
REC=100%
ROD=0%
REC=100%
ROD=100%
(M) (UW) (SD)
(EM) (UC)
ROD=95%
REC=95%
ROD=100%
(PI)
REC=100%
ROD=50%
REC=120%
ROD=0%

See Sheet 6 FOR CONTINUATION

330
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, very hard, moderately fractured, bedding joint dipping 50°.
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, moderate brown, very hard, moderately fractured, fault dipping 20°.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, very hard, moderately fractured.
320
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, moderate brown, very hard, moderately fractured, fault dipping 45°.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, very hard, moderately fractured.
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, moderate brown, very hard, moderately fractured, dipping 40°.
310
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, very hard, moderately fractured.
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, light gray, very hard, moderately fractured.
Joint dipping 30°, fine sand, some medium.
Dipping 70°.
Shear (ML, not healed), dipping 60°.
300
Incipient fracture (ML, not healed), dipping 15°.
Extremely hard, incipient fracture dipping 70°.
Bedding joint dipping 45°.
Moderately hard.
Very to extremely hard, intensely fractured.
Incipient fracture dipping 60°, Unit is very weak.
290
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, very to extremely hard, intensely fractured, dipping 20°.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, pale olive, very to extremely hard, intensely fractured, sandy, fine sand.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, pale olive, very to extremely hard, intensely fractured.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, pale olive, very to extremely hard, intensely fractured.
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, dark gray, very to extremely hard, intensely fractured, dipping 15°.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, very to extremely hard, intensely fractured, dipping 45°.
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, light brown, moderately hard, intensely fractured, dipping 30°.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, extremely weak, hard, intensely fractured.
Shear (CL), dipping 40°.
Shear (CL), dipping 60°.
Shear (CL), dipping 40°.
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, light gray to light olive, moderately hard, intensely fractured, dipping 25°.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, hard to very hard, intensely fractured.
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, light gray to light olive, hard to very hard, intensely fractured, dipping 20°.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, hard to very hard, intensely fractured.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, hard to very hard, intensely fractured, with fine sand.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, hard to very hard, intensely fractured.
Light olive.
280

PROFILE
Vert: 1"=10'

ENGINEERING SERVICES		GEOTECHNICAL SERVICES			
FUNCTIONAL SUPERVISOR	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: M. SALISBURY	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO. N/A
NAME: SHIVA KARIMI	CHECKED BY: J. PRATT	DATE: 2/28/09 - 3/11/09		DESIGN BRANCH	POST MILES N/A

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 5 OF 6

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET	OF
5	6

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

CERTIFIED ENGINEERING GEOLOGIST 3/18/10 DATE

PLANS APPROVAL DATE

PROFESSIONAL GEOLOGIST — MICHAEL A. SALISBURY — No. CEG 2462 — Exp. 2/28/2011 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

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BENCHMARK:

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Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

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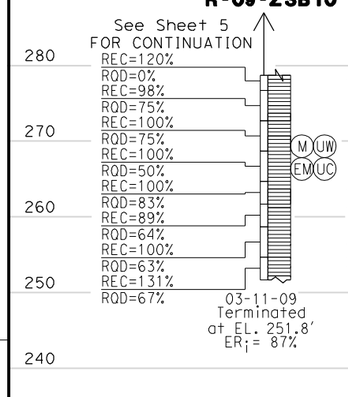
R-09-Z3B10



SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, light olive mottled with dark greenish gray, hard to very hard, intensely fractured, dipping 12°, with fine sand.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, light olive mottled with dark greenish gray, hard to very hard, intensely fractured.
Light olive.
Moderately soft to moderately hard, shear (CL), dipping 50°.
Hard.
Very hard.
Sandy, medium sand with some fine sand.
Light gray.
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, light gray, very weak, extremely hard, intensely fractured, silty, medium sand with some coarse sand.
Moderately hard.
SEDIMENTARY ROCK: CLAYSTONE, thinly bedded, moderate brown, hard, intensely fractured, dipping 15°, with fine sand.
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, grayish brown, very hard, intensely fractured, bedding joint dipping 50°, with silt, fine sand.
Light gray, moderately hard.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown, moderately hard, intensely fractured.
Incipient fracture dipping 50°.
Joint (CL, not healed), dipping 45°.
SEDIMENTARY ROCK: SANDSTONE, thinly bedded, light gray, extremely hard, intensely fractured, dipping 20°, fine sand.
SEDIMENTARY ROCK: SILTSTONE, thinly bedded, moderate brown to light olive, extremely hard, intensely fractured, dipping 40°, sandy, fine sand.
Dipping 25°.
Joint (CL, not healed), dipping 40°.
Dipping 20°.

PROFILE
Vert: 1"=10′

ENGINEERING SERVICES		GEOTECHNICAL SERVICES				
FUNCTIONAL SUPERVISOR	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: M. SALISBURY	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO. N/A	SR-710 TUNNEL TECHNICAL STUDY
NAME: SHIVA KARIMI	CHECKED BY: J. PRATT	DATE: 2/28/09 - 3/11/09		DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 6 OF 6

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 6 OF 6

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

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DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Kristopher Barker — CERTIFIED ENGINEERING GEOLOGIST — 3/18/10 DATE

PROFESSIONAL GEOLOGIST — KRISTOPHER P. BARKER — No. CEG 2383 — Exp. 8/31/2011 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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R-09-Z3B11

N: 1858032.01
E: 6517296.60
EL. 533.1′

4"

ASPHALT (6").

SILTY, CLAYEY SAND (SC-SM); medium dense; very dark brown; dry; few fine GRAVEL; medium to fine SAND [ALLUVIUM].

CLAYEY SAND (SC); medium dense; olive brown; moist; medium to fine SAND.

SILTY SAND (SM); medium dense; olive brown; moist; trace fine GRAVEL; mostly medium to fine SAND.

At EL. 516.1 ft, observed 0.5′ lens of (Poorly graded SAND) (SP); coarse SAND.

At EL. 512.1 ft, contains few fine, subangular GRAVEL.

At EL. 508.1 ft, with 0.5′ to 1′ interbeds of (SANDY SILT) (ML/SM); fine SAND.

Poorly graded SAND with SILT (SP-SM); medium dense; olive brown; moist; mostly medium to fine SAND.

SILTY SAND with GRAVEL (SM); medium dense; olive brown; moist; little fine GRAVEL; fine SAND.

Well-graded SAND with SILT and GRAVEL (SW-SM); very dense; olive brown; moist; fine GRAVEL; coarse to fine SAND; weak cementation.
At EL. 473.1 ft, contains 1′ lens of trace coarse GRAVEL; moderate cementation.
At EL. 472.1 ft, becomes dense; little coarse to fine GRAVEL; mostly coarse to fine SAND; few low plasticity fines.

SANDY elastic SILT (MH); very stiff; olive brown; moist; some fine SAND; medium plasticity, low dry strength, low toughness fines.

SILTY SAND (SM); dense; olive brown; moist; fine GRAVEL; mostly fine SAND; some low plasticity fines; weak cementation.

SANDY elastic SILT (MH); very stiff; olive brown; moist; some fine SAND; medium plasticity, low dry strength, low toughness fines.

Poorly graded SAND (SP); medium dense; olive brown; moist; medium to fine SAND; few fines.

SANDY SILT (ML); very stiff; dark yellowish brown; moist; some fine SAND; mostly low to medium plasticity fines.

CLAYEY SAND (SC); very stiff to hard; dark yellowish brown; moist; trace fine GRAVEL; some fine SAND; medium plasticity, very high dry strength, high toughness fines.

SILTY SAND with GRAVEL (SM); dense to very dense; dark yellowish brown mottled with very pale brown and moderate yellowish brown; moist; some coarse to fine, subangular GRAVEL; weak cementation; gravels are granodiorite, fine to medium grained, dark yellowish brown, intensely weathered, hard.
At EL. 422.1 ft, becomes about 10% COBBLES; about 20 to 30% GRAVEL.
At EL. 417.1 ft, observed little coarse to fine GRAVEL; mostly coarse to fine SAND.

SILTY SAND (SM); dense; yellowish brown; moist; trace fine GRAVEL; mostly medium to fine SAND; little fines; weak cementation.
At EL. 409.1 ft, contains trace fine, subangular GRAVEL.
At EL. 407.1 ft, observed no gravel.

SANDY lean CLAY (CL); stiff; yellowish brown; moist; trace fine GRAVEL; some medium to fine SAND; mostly medium plasticity fines.

CLAYEY SAND (SC); dense to very dense; dark yellowish brown; moist; trace fine, subangular GRAVEL; coarse to medium SAND.

Poorly graded SAND with SILT and GRAVEL (SP-SM); dense; dark yellowish brown mottled with yellowish brown and pale orange; moist; few coarse to fine, subangular GRAVEL; fine SAND; few fines.
At EL. 388.1 ft, contains trace fine GRAVEL.
At EL. 384.6 ft, observed 6" lens cobbles.

Well-graded SAND with SILT (SW-SM); dense; dark yellowish brown mottled with yellowish brown and pale orange; moist; few fine GRAVEL; mostly medium to fine SAND.
At EL. 380.6 ft, becomes some coarse to fine GRAVEL.
At EL. 380.1 ft, becomes trace GRAVEL; coarse SAND.
At EL. 379.1 ft, becomes about 10 to 15% coarse to fine GRAVEL.
At EL. 378.1 ft, becomes trace GRAVEL.

GWS EL 375.1′
07-01-09

Poorly graded SAND with GRAVEL and COBBLES (SP); dense; dark yellowish brown; moist; about 20% COBBLES; coarse SAND; COBBLES consist of.

Elastic SILT (MH); very stiff; brown and dark yellowish brown; moist; medium plasticity fines.

REC=100%
RQD=35%
REC=100%
RQD=40%
REC=100%
RQD=80%
REC=100%
RQD=70%

SEDIMENTARY ROCK, SILTSTONE (MUDSTONE), laminated, dark yellowish brown, intensely weathered, moderately soft to moderately hard,intensely fractured, shear (silt, moderately healed), dipping 20 to 45°. [TOPANGA FORMATION]
At EL. 369.6 ft, becomes soft to moderately soft.
At EL. 365.1 ft, becomes very intensely fractured, moderately healed.
At EL. 361.1 ft, becomes slightly mottled with greenish gray, extremely weak, moderately soft, slightly fractured, shear, dipping 45°.
At EL. 358.6 ft, contains fine sandstone lenses.
At EL. 357.1 ft, becomes moderately to slightly fractured, dipping 90 to 20°.
At EL. 355.1 ft, contains 6" fracture zone.
At EL. 352.1 ft, contains 6" fracture zone.

SILTSTONE (MUDSTONE) with fine sandstone lenses, massive, moderate yellowish brown mottled with olive gray, moderately weathered, soft to moderately soft, slightly fractured, fault (moderately healed), dipping 40°.
At EL. 349.6 ft, contains 4" fracture zone.

See Sheet 2
FOR CONTINUATION

PROFILE
Vert: 1"=10′

ENGINEERING SERVICES		GEOTECHNICAL SERVICES		STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN	BRIDGE NO.	SR-710 TUNNEL TECHNICAL STUDY
FUNCTIONAL SUPERVISOR	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: K. BARKER				N/A	
NAME: SHIVA KARIMI	CHECKED BY: M. SALISBURY	DATE: 1/13/09 - 1/21/09			DESIGN BRANCH	POST MILES N/A	LOG OF TEST BORING SHEET 1 OF 2

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 1 OF 2

FILE => $REQUEST

DATE PLOTTED => $DATE
TIME PLOTTED => $TIME
USERNAME => $USER

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29′
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68′ west of the center of the south bound lanes of the freeway, 25′ north of the centerline of Hellman Avenue, 13′ east of the west end of the bridge, 1′ north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 2 of 2.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

Kristopher Barker 3/18/10
CERTIFIED ENGINEERING GEOLOGIST DATE

PLANS APPROVAL DATE

PROFESSIONAL GEOLOGIST — KRISTOPHER P. BARKER — No. CEG 2383 — Exp. 8/31/2011 — CERTIFIED ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

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R-09-Z3B11

See Sheet 1 FOR CONTINUATION

350
REC=110%, RQD=100% — M UW UC
SILTSTONE (MUDSTONE), laminated, moderate yellowish brown, intensely weathered, extremely weak, moderately soft, moderately fractured, (carbonate), dipping 40°.
At EL. 348.2 ft, contains 5" fracture zone.
At EL. 347.1 ft, becomes moderately soft to moderately hard, incipient joint.
REC=80%, RQD=70%
340
At EL. 342.8 ft, contains 6" shear/fault zone, dipping 55°.
REC=100%, RQD=95%
At EL. 342.1 ft, becomes soft to moderately soft, slightly fractured, partially healed, dipping 45°.
REC=100%, RQD=95%
At EL. 339.1 ft, contains 4" lens hard.
330
REC=100%, RQD=100%
At EL. 336.7 ft, contains 4" lens hard.
At EL. 334.1 ft, becomes moderately hard, unfractured.
REC=100%, RQD=100%
At EL. 331.3 ft, contains 2" lens hard.
At EL. 331.1 ft, becomes dark brown.
REC=100%, RQD=100% — M UW PTS
At EL. 327.1 ft, becomes slightly fractured, dipping 50 to 45°.
320
REC=100%, RQD=90% — SD EM UC
At EL. 323.6 ft, contains lenses of fine sandstone, 1-3" thick. Unit is extremely weak.
At EL. 323.1 ft, observed shear, dipping 45°.
At EL. 322.3 ft, observed shear/fault zone, dipping 50°.
REC=100%, RQD=100% — M UW UU
At EL. 322.1 ft, contains 6" slightly weathered, hard, fracture zone, not healed.
At EL. 321.6 ft, becomes moderately soft, slightly fractured, dipping 45°.
SANDSTONE, fine-grained, massive, dark reddish brown, intensely weathered, moderately soft, unfractured.
310
REC=110%, RQD=80%
SILTSTONE (MUDSTONE), laminated, dark reddish brown, intensely weathered, moderately soft, slightly fractured.
At EL. 316.3 ft, becomes intensely weathered, moderately soft, moderately to slightly fractured, incipient fracture, dipping 60 to 30°, with lenses of fine sandstone.
REC=110%, RQD=50% — M UW EM UC PTS
300
REC=110%, RQD=80%
At EL. 314.3 ft, contains 2" slightly weathered, hard, fracture zone, not healed. Unit is extremely weak.
REC=110%, RQD=60%
SILTSTONE (MUDSTONE), laminated, dusky yellowish brown and dark greenish gray, intensely weathered, moderately hard, very intensely to intensely fractured, (moderately healed), dipping 40 to 80°, swells when excavated.
290
REC=120%, RQD=90%
At EL. 307.1 ft, becomes totally healed, Unit is extremely weak.
REC=110%, RQD=80% — M UW SD EM PI UC
At EL. 304.1 ft, becomes fresh, hard, intensely fractured, random fracture, totally healed, dipping 30°.
REC=100%, RQD=60%
280
At EL. 303.3 ft, becomes intensely weathered, moderately hard, very intensely fractured, incipient joint.
REC=100%, RQD=90% — UU PI
At EL. 302.1 ft, becomes intensely fractured, partially healed, with light gray sandstone lenses, 1-2" thick, 1′ spacing.
At EL. 298.3 ft, contains 3" lens of fresh, very hard.
270
At EL. 290.8 ft, contains 6" fracture zone, not healed, dipping 45 to 30°.
At EL. 290.3 ft, becomes moderately soft, intensely fractured, shear, moderately healed. Unit is extremely weak.
At EL. 282.1 ft, becomes soft, unfractured.
SANDSTONE, fine-grained, massive, medium gray, intensely weathered, very soft.
260
SILTSTONE (MUDSTONE), thickly to very thickly bedded, dark greenish gray, intensely weathered, extremely weak,moderately soft, unfractured, incipient joint.
At EL. 278.1 ft, contains 3" lens of fine-grained sandstone.
250

REC=100%, RQD=100%
REC=115%, RQD=80%
REC=120%, RQD=75%
REC=138%, RQD=100% — M UW UC EM

01-21-09
Terminated at EL. 258.1′
ER_i = 87%

SANDSTONE, fine-grained, massive, light gray, slightly weathered, hard, unfractured.
SILTSTONE (MUDSTONE), dark greenish gray, extremely weak, intensely weathered, moderately soft.
SANDSTONE, fine-grained, light gray, fresh, very hard.
SILTSTONE (MUDSTONE), laminated, dark greenish gray, intensely weathered, extremely weak, moderately soft, very intensely fractured, shear (totally healed), with fine-grained sandstone laminations.
At EL. 272.1 ft, contains 3" lens of fracture zone.
At EL. 271.9 ft, becomes extremely weak, soft, slightly fractured, moderately healed, dipping 45 to 0°.
At EL. 267.1 ft, becomes moderately soft, very intensely fractured, moderately healed, dipping 45°.
At EL. 262.6 ft, becomes moderately hard.
At EL. 262.1 ft, becomes very intensely fractured, totally healed.

PROFILE
Vert: 1"=10′

ENGINEERING SERVICES		GEOTECHNICAL SERVICES	
FUNCTIONAL SUPERVISOR	DRAWN BY: E. MIGUEL	FIELD INVESTIGATION BY: K. BARKER	
NAME: SHIVA KARIMI	CHECKED BY: M. SALISBURY	DATE: 1/13/09 - 1/21/09	

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH

BRIDGE NO. N/A
POST MILES N/A

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 2 OF 2

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 2 OF 2

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 2 of 2.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

GEOTECHNICAL ENGINEER — 3/18/10 DATE

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — GEOTECHNICAL — STATE OF CALIFORNIA

PLANS APPROVAL DATE

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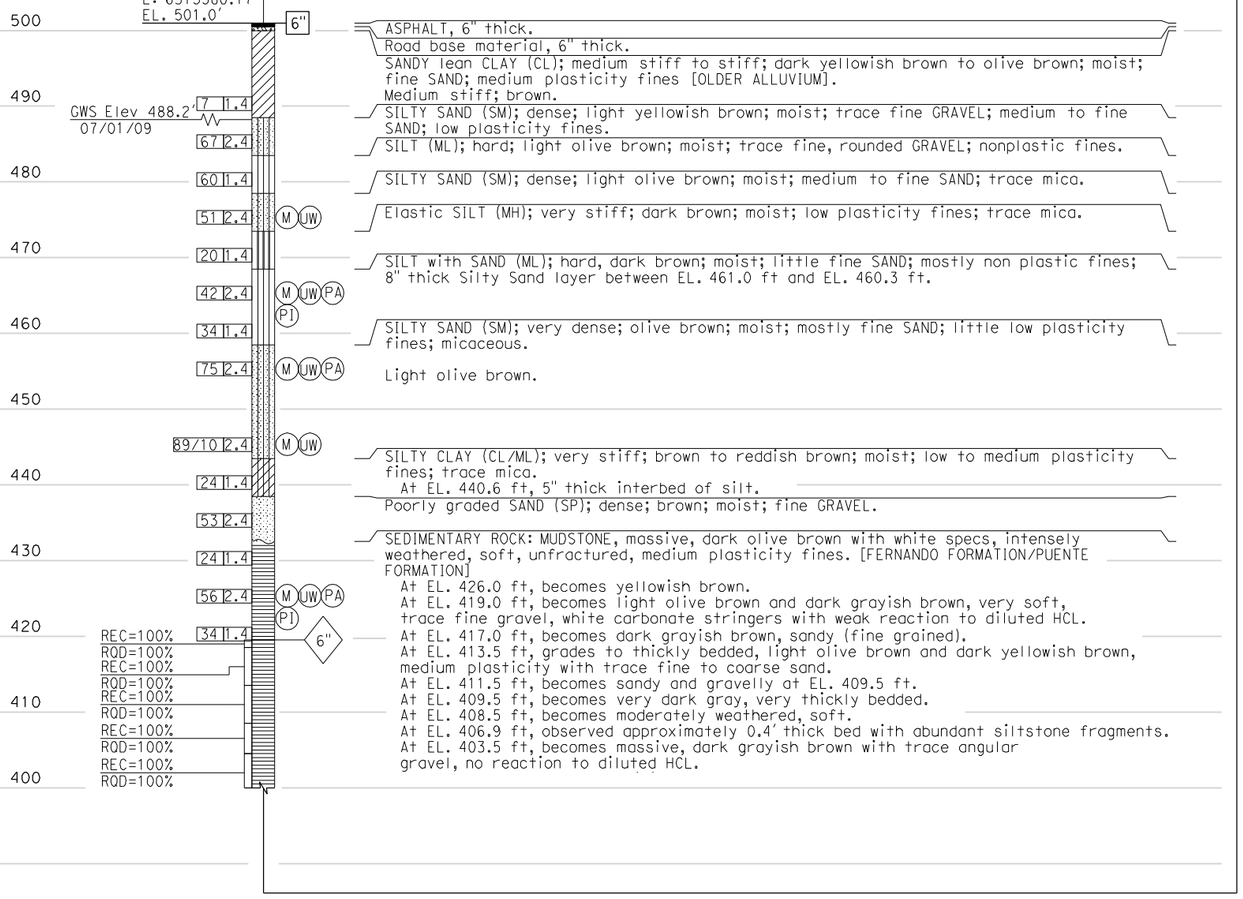
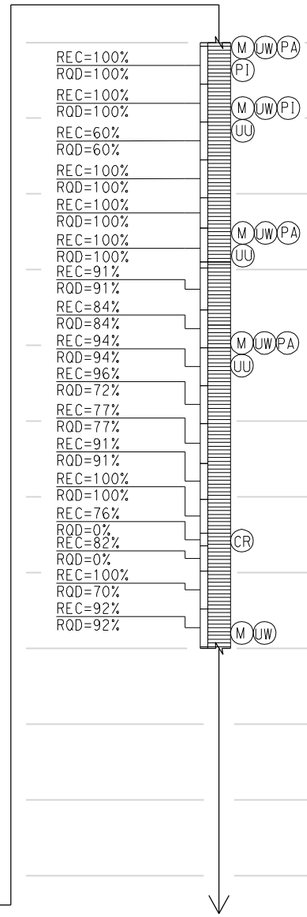
CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

R-09-Z3B12

N: 1856063.15
E: 6513380.17
EL. 501.0'



ASPHALT, 6" thick.
Road base material, 6" thick.
SANDY lean CLAY (CL); medium stiff to stiff; dark yellowish brown to olive brown; moist; fine SAND; medium plasticity fines [OLDER ALLUVIUM].
Medium stiff; brown.
SILTY SAND (SM); dense; light yellowish brown; moist; trace fine GRAVEL; medium to fine SAND; low plasticity fines.
SILT (ML); hard; light olive brown; moist; trace fine, rounded GRAVEL; nonplastic fines.
SILTY SAND (SM); dense; light olive brown; moist; medium to fine SAND; trace mica.
Elastic SILT (MH); very stiff; dark brown; moist; low plasticity fines; trace mica.
SILT with SAND (ML); hard, dark brown; moist; little fine SAND; mostly non plastic fines; 8" thick Silty Sand layer between EL. 461.0 ft and EL. 460.3 ft.
SILTY SAND (SM); very dense; olive brown; moist; mostly fine SAND; little low plasticity fines; micaceous.
Light olive brown.
SILTY CLAY (CL/ML); very stiff; brown to reddish brown; moist; low to medium plasticity fines; trace mica.
At EL. 440.6 ft, 5" thick interbed of silt.
Poorly graded SAND (SP); dense; brown; moist; fine GRAVEL.
SEDIMENTARY ROCK: MUDSTONE, massive, dark olive brown with white specs, intensely weathered, soft, unfractured, medium plasticity fines. [FERNANDO FORMATION/PUENTE FORMATION]
At EL. 426.0 ft, becomes yellowish brown.
At EL. 419.0 ft, becomes light olive brown and dark grayish brown, very soft, trace fine gravel, white carbonate stringers with weak reaction to diluted HCL.
At EL. 417.0 ft, becomes dark grayish brown, sandy (fine grained).
At EL. 413.5 ft, grades to thickly bedded, light olive brown and dark yellowish brown, medium plasticity with trace fine to coarse sand.
At EL. 411.5 ft, becomes sandy and gravelly at EL. 409.5 ft.
At EL. 409.5 ft, becomes very dark gray, very thickly bedded.
At EL. 408.5 ft, becomes moderately weathered, soft.
At EL. 406.9 ft, observed approximately 0.4' thick bed with abundant siltstone fragments.
At EL. 403.5 ft, becomes massive, dark grayish brown with trace angular gravel, no reaction to diluted HCL.



At EL. 398.5 ft, becomes oxidized, strong brown.
At EL. 397.5 ft, becomes dark grayish brown and light olive gray, unfractured, low plasticity fines with trace fine gravel.
At EL. 394.5 ft, becomes thickly bedded, with occasional olive brown, thin beds of coarse grained sandstone, unfractured.
At EL. 392.0 ft, observed bedding joint, dipping 30°, 2" thick coarse grained clayey sandstone bed with some well rounded gravel. Unit is extremely weak.
At EL. 391.0 ft, observed bedding joint, dipping 20°; 1" thick, fine to coarse grained, clayey sandstone interbed, dipping 20 to 30°.
At EL. 390.0 ft, observed 1" thick, fine to coarse grained clayey SANDSTONE bed.
At EL. 389.5 ft, becomes dark grayish brown, lacks sand and gravel, no reaction to diluted HCL.
At EL. 387.5 ft, observed 2" thick sandstone bed, brown, fine grained with some gravel.
At EL. 384.8 ft, becomes slightly weathered, very dark gray with scattered well rounded GRAVEL, highly plastic, unfractured.
At EL. 380.5 ft, becomes fresh.
At EL. 375.5 ft, observed to be extremely weak.
At EL. 374.5 ft, becomes moderately weathered, olive brown, low plasticity, with few elongated gravel.
At EL. 370.0 ft, contains white calcareous gravel. Unit is massive..
SEDIMENTARY ROCK: SILTSTONE, thickly bedded, pale olive mottled with white, moderately weathered, extremely weak, moderately soft, unfractured, mostly non plastic; moderate reaction to diluted HCL. [PUENTE FORMATION]
At EL. 362.6 ft, observed bedding joint, dipping 30°, roughly 2" thick calcareous bed with strong reaction to HCL solution.
SEDIMENTARY ROCK, SHALE with interbedded SILTSTONE, DIATOMACEOUS SILTSTONE, and CALCAREOUS SILTSTONE, laminated to very thinly bedded, pale olive to olive gray, fresh, very slightly fractured, calcareous interbeds are white and hard. Bedding dipping 40°.
At EL. 359.5 ft, observed joint, dipping 80°, tight.
At EL. 354.7 ft, becomes soft to hard.
At EL. 349.0 ft, becomes soft, unfractured, bedding joint, dipping 45°, breaks along bedding plane, slightly calcareous.
At EL. 344.4 ft, becomes very slightly fractured.
At EL. 343.0 ft, observed bedding joint, dipping 50°.
At EL. 340.4 ft, observed joint, dipping 30°, tight, smooth.
At EL. 339.9 ft, observed joint, dipping 40°, tight, smooth.
At EL. 337.4 ft, observed bedding joint, dipping 60°.
At EL. 336.7 ft, observed joint, dipping 60°, tight, smooth. Decreasing shale, becomes predominately SILTSTONE and DIATOMACEOUS SILTSTONE.
At EL. 335.0 ft, becomes soft with local hard interval of calcareous/dolomitic interbeds, unfractured.
At EL. 330.2 ft, becomes yellowish brown, oxidized, intensely weathered, soft, very intensely fractured (between EL. 330.2 ft to EL. 329.0 ft). Possible faulted zone.
At EL. 329.0 ft, observed bedding joint, dipping 60°, on hard, siliceous interbed.
At EL. 328.5 ft, becomes slightly fractured, joint, dipping 30°, moderately rough.
At EL. 325.9 ft, observed joint, dipping 70°, tight, iron oxide stained, slightly rough.
SEDIMENTARY ROCK: SHALE, very thinly to thinly bedded, olive gray and light gray, fresh, soft, very slightly fractured, oxidized bedding plane joints, no clay seams.
At EL. 323.0 ft, observed bedding joint, dipping 60°.
At EL. 321.7 ft, observed color change to very dark gray with gray banding.
At EL. 321.0 ft, observed sydepositional erosional features to EL. 320.8 ft.
At EL. 320.0 ft, becomes laminated to very thinly bedded, black, moderately fractured, low plasticity.

See Sheet 2
FOR CONTINUATION

PROFILE
Vert: 1"=10'

DEREK HIGA DESIGN OVERSIGHT ENGINEER	DRAWN BY:	EDELYNE MIGUEL	R. CHAVEZ FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MAHESWARAN RAVEENDRA PROJECT ENGINEER
SIGN OFF DATE	CHECKED BY:	DAN JANKLY	DATE: 1/06/09 - 1/13/09		

BRIDGE NO. N/A
POST MILES N/A

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 1 OF 2

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 1 OF 2

FILE => $REQUEST

DATE PLOTTED => $DATE TIME PLOTTED => $TIME
USERNAME => $USER

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

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2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

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6) Plan view shown on Boring Location Plan sheet 2 of 2.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

GEOTECHNICAL ENGINEER — 3/18/10 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — GEOTECHNICAL — STATE OF CALIFORNIA

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CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

R-09-Z3B12

See Sheet 1 FOR CONTINUATION

320	REC=50%		At EL. 318.0 ft, observed bedding joint, dipping 50°.
	RQD=0%		At EL. 315.2 ft, becomes black and light greenish gray, extremely weak, unfractured, unoxidized, with thin interbeds hard, siliceous material, weak reaction to diluted HCL.
	REC=72%	M UW UC	At EL. 312.8 ft, observed bedding joint, dipping 70°.
	RQD=50%		At EL. 310.2 ft, becomes moderately soft, well bedded.
310	REC=100%		At EL. 309.5 ft, observed phosphatic nodule, strong brown.
	RQD=100%	M UW SD	At EL. 308.5 ft, observed bedding joint, dipping 60°, weak reaction to diluted HCL, breaks along bedding.
	REC=79%		At EL. 305.5 ft, observed bedding joint, dipping 60°, Scattered 1/8" thick phosphate nodules.
	RQD=79%		At EL. 305.2 ft, becomes moderately soft to moderately hard, moderately fractured.
	REC=83%		At EL. 302.9 ft, observed three joints dipping 10 degrees, tight, stepped.
300	RQD=61%		At EL. 302.7 ft, observed bedding joint, dipping 60°.
	REC=100%	M UW UC	At EL. 299.3 ft, observed bedding joint, dipping 55°, fish scales present. Unit is extremely weak.
	RQD=100%		At EL. 297.0 ft, observed bedding joint, dipping 60°, weak reaction to diluted HCL, scattered 1/8" dia. phosphatic nodules.
	REC=100%		At EL. 294.0 ft, observed bedding joint, dipping 60°.
290	RQD=100%		At EL. 291.5 ft, with scattered 1/8" dia. phosphate nodules.
	REC=100%		At EL. 288.6 ft, observed bedding joint, dipping 60°, on 1/2" thick CLAY seam, along bedding, highly plastic, smooth, tight.
	RQD=100%		At EL. 286.5 ft, observed bedding joint, dipping 60°. Unit is very weak.
	REC=61%	M UW UC	At EL. 284.3 ft, observed bedding joint, dipping 60°.
	RQD=61%		At EL. 283.2 ft, observed two joints dipping 30 and 40 degrees, tight, smooth.
	REC=83%	EM SD	At EL. 280.8 ft, observed bedding joint, dipping 60°.
280	RQD=37%		At EL. 277.8 ft, observed bedding joint, dipping 60°.
	REC=52%		At EL. 275.8 ft, becomes very slightly fractured to unfractured.
	RQD=52%		At EL. 275.2 ft, observed bedding joint, dipping 65°, tight, smooth.
	REC=52%		At EL. 272.7 ft, observed bedding joint, dipping 65°, tight, smooth.
	RQD=52%		At EL. 271.0 ft, becomes olive gray to light olive gray.
	REC=80%		At EL. 269.0 ft, observed 4" thick siliceous bed, hard, very intensely fractured, no reaction to HCL solution.
	RQD=0%		At EL. 268.3 ft, observed bedding joint, dipping 65°.
270	REC=89%		At EL. 267.8 ft, observed joint, dipping 30°, tight, calcite lined, slightly rough.
	RQD=62%		At EL. 263.8 ft, observed bedding joint, dipping 60°.
	REC=68%	CR	At EL. 259.5 ft, observed bedding joint, dipping 60°.
	RQD=68%		At EL. 257.0 ft, observed joint, dipping 90°, tight moderately rough, approximately 1' long.
	REC=68%	PTS	At EL. 256.3 ft, observed bedding joint, dipping 60°.
260	RQD=68%		At EL. 254.7 ft, observed bedding joint, dipping 60°.
	REC=100%		At EL. 252.2 ft, observed bedding joint, dipping 60°. Unit is very weak.
	RQD=100%		At EL. 250.0 ft, observed bedding joint, dipping 60°.
	REC=100%		At EL. 249.5 ft, observed shear/fault zone, 3" thick, highly plastic, clay infilling, intensely fractured, parallel to bedding.
	RQD=100%		At EL. 243.2 ft, observed bedding joint, dipping 60°.
250	REC=76%	M UW UC	
	RQD=60%	EM	
	REC=63%		
	RQD=63%		
	REC=56%		
240	RQD=56%		

	REC=100%		At EL. 241.2 ft, observed bedding joint, dipping 60°.
	RQD=100%		At EL. 240.5 ft, observed bedding joint, dipping 60°.
	REC=100%	M UW UC	At EL. 236.5 ft, observed bedding joint, dipping 60°.
	RQD=90%		At EL. 235.9 ft, observed bedding joint, dipping 60°.
	REC=98%		At EL. 235.2 ft, observed fault, dipping 80°, 1/8" thick, soft clay lining, rough, 7" offset.
	RQD=98%	M SD	At EL. 233.0 ft, observed fine grained sandstone lamination, friable. Unit is very weak.
	REC=100%		At EL. 227.5 ft, observed bedding joint, dipping 70°.
	RQD=100%		At EL. 226.7 ft, observed joint, dipping 40°, tight, polished and striated with clay film.
	01-13-09 Terminated at EL. 226.0' ER_I = 75%		

PROFILE
Vert: 1"=10'

DEREK HIGA DESIGN OVERSIGHT ENGINEER	DRAWN BY:	EDELYNE MIGUEL	R. CHAVEZ FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MAHESWARAN RAVEENDRA PROJECT ENGINEER	BRIDGE NO. N/A POST MILES N/A
SIGN OFF DATE	CHECKED BY:	DAN JANKLY	DATE: 1/06/09 - 1/13/09			

SR-710 TUNNEL TECHNICAL STUDY
LOG OF TEST BORING SHEET 2 OF 2

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES											SHEET	OF
											2	2

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

GEOTECHNICAL ENGINEER — 3/18/10 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — GEOTECHNICAL — STATE OF CALIFORNIA

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
Vertical control based on NAVD-88.
Pt 0153 N1845410.50, E6509860.21,
Pt 0617 N1858044.3, E6491094.23.

Units are in U.S. survey feet.

NOTES:
1) This LOTB sheet was prepared in accordance with the Caltrans Soil and Rock Logging, Classification and Presentation Manual (June 2007) except as noted in Appendix A.1 of the Final Geotechnical Summary Report SR-710 Tunnel Technical Study Los Angeles County, California dated (April, 2010).

2) California ring, standard penetration test, and HQ&PQ core samplers were used to obtain soil and rock samples.

3) An automatic trip hammer system consisting of a hammer weight of 140 lbs falling a distance of 30" was used to advance the drive samplers.

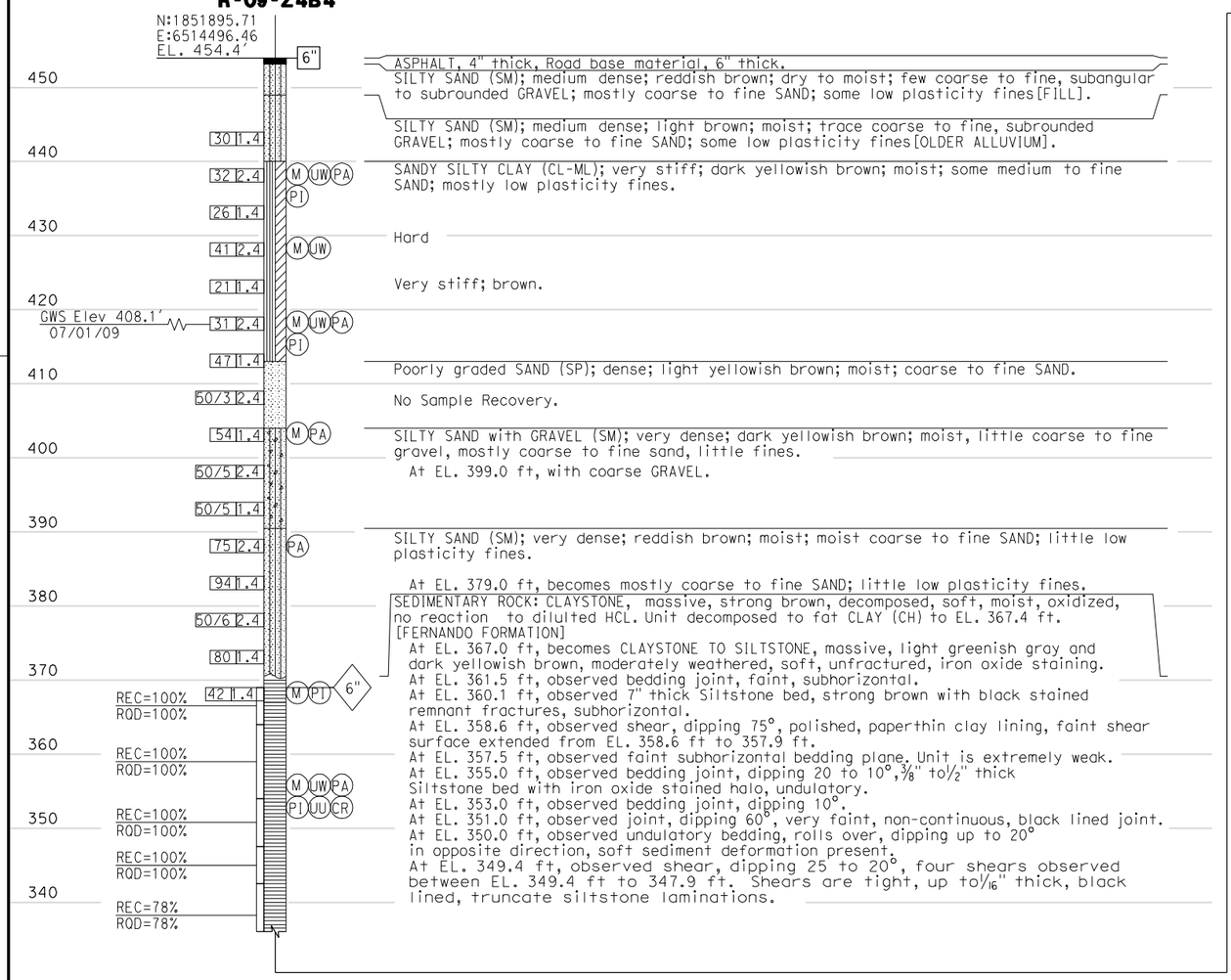
4) To convert from California ring sampler blow count to equivalent standard penetration test sampler blow count, for granular and cohesive soil, multiply by 0.67.

5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 2 of 2.

R-09-Z4B4

N:1851895.71
E:6514496.46
EL. 454.4'



6" ASPHALT, 4" thick, Road base material, 6" thick.

SILTY SAND (SM); medium dense; reddish brown; dry to moist; few coarse to fine, subangular to subrounded GRAVEL; mostly coarse to fine SAND; some low plasticity fines[FILL].

SILTY SAND (SM); medium dense; light brown; moist; trace coarse to fine, subrounded GRAVEL; mostly coarse to fine SAND; some low plasticity fines[OLDER ALLUVIUM].

SANDY SILTY CLAY (CL-ML); very stiff; dark yellowish brown; moist; some medium to fine SAND; mostly low plasticity fines.

Hard

Very stiff; brown.

Poorly graded SAND (SP); dense; light yellowish brown; moist; coarse to fine SAND.

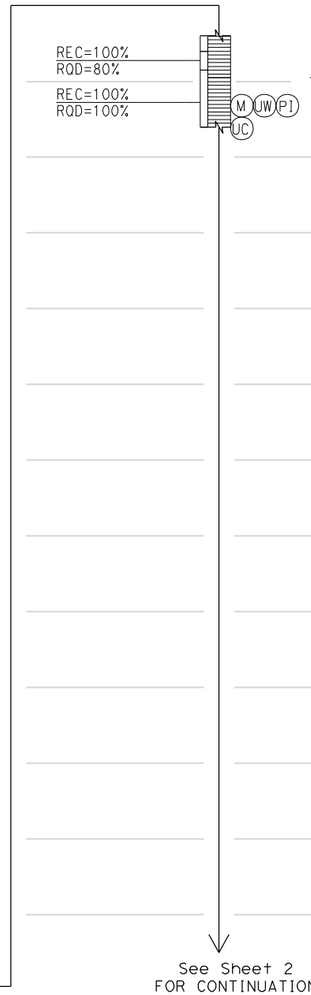
No Sample Recovery.

SILTY SAND with GRAVEL (SM); very dense; dark yellowish brown; moist, little coarse to fine gravel, mostly coarse to fine sand, little fines.
At EL. 399.0 ft, with coarse GRAVEL.

SILTY SAND (SM); very dense; reddish brown; moist; moist coarse to fine SAND; little low plasticity fines.

At EL. 379.0 ft, becomes mostly coarse to fine SAND; little low plasticity fines.

SEDIMENTARY ROCK: CLAYSTONE, massive, strong brown, decomposed, soft, moist, oxidized, no reaction to diluted HCL. Unit decomposed to fat CLAY (CH) to EL. 367.4 ft. [FERNANDO FORMATION]
At EL. 367.0 ft, becomes CLAYSTONE TO SILTSTONE, massive, light greenish gray and dark yellowish brown, moderately weathered, soft, unfractured, iron oxide staining.
At EL. 361.5 ft, observed bedding joint, faint, subhorizontal.
At EL. 360.1 ft, observed 7" thick Siltstone bed, strong brown with black stained remnant fractures, subhorizontal.
At EL. 358.6 ft, observed shear, dipping 75°, polished, paperthin clay lining, faint shear surface extended from EL. 358.6 ft to 357.9 ft.
At EL. 357.5 ft, observed faint subhorizontal bedding plane. Unit is extremely weak.
At EL. 355.0 ft, observed bedding joint, dipping 20 to 10°, 3/8" to 1/2" thick Siltstone bed with iron oxide stained halo, undulatory.
At EL. 353.0 ft, observed bedding joint, dipping 10°.
At EL. 351.0 ft, observed joint, dipping 60°, very faint, non-continuous, black lined joint.
At EL. 350.0 ft, observed undulatory bedding, rolls over, dipping up to 20° in opposite direction, soft sediment deformation present.
At EL. 349.4 ft, observed shear, dipping 25 to 20°, four shears observed between EL. 349.4 ft to 347.9 ft. Shears are tight, up to 1/16" thick, black lined, truncate siltstone laminations.



At EL. 347.5 ft, observed joint, dipping 30 to 25°, numerous black lined joints, iron oxide stained, some iron oxide stained Siltstone lenses.
At EL. 346.5 ft, becomes light brownish gray, very slightly fractured.
At EL. 346.0 ft, observed shear, dipping 60°, faintly polished shear, bedding is undulatory, subhorizontal.
At EL. 344.9 ft, observed shear, dipping 40°, 1mm aperture, moderately rough.
At EL. 344.6 ft, observed bedding joint, dipping 10°, 3/8" thick iron oxide stained bed with abundant black staining.
At EL. 344.0 ft, observed bedding joint, dipping 10 to 5°.
At EL. 343.2 ft, observed bedding joint, dipping 25°, bedding is undulatory, locally folded, soft sediment deformation.
At EL. 343.1 ft, observed shear, dipping 45°.
At EL. 341.6 ft, observed bedding joint, dipping 40°, local faint laminations.
At EL. 341.4 ft, observed joint, dipping 70°, tight.
At EL. 341.2 ft, observed bedding joint, dipping 45°, possible bedding on strong brown and light brown gray contact.
At EL. 341.0 ft, becomes greenish black, contact between light greenish gray above and greenish black dipping 60°, moderately weathered.
At EL. 338.2 ft, observed shear, dipping 70 to 45°, two very faint shears.
At EL. 337.5 ft, observed joint, dipping 60 to 50°, aperture 2mm, moderately rough.
At EL. 336.5 ft, observed bedding joint, dipping 25°, bedding on contact between strong brown and light brownish gray beds.
At EL. 336.0 ft, observed joint, dipping 50°.
At EL. 334.0 ft, grades to unoxidized. Unit is micaceous, no reaction to HCL solution.
At EL. 333.6 ft, observed bedding joint, dipping 40°, local iron oxide stained bed.
At EL. 333.4 ft, observed shear, dipping 70°.
At EL. 332.9 ft, observed irregular gradational contact from EL. 333.4 ft to 332.3 ft dipping 65 degrees to vertical, greenish black above, light gray below.
At EL. 331.7 ft, observed shear, dipping 70°, iron oxide stained below shear, light brownish gray above.
At EL. 331.1 ft, observed bedding joint, dipping 60°, 1" diameter concretionary nodule, beds folded around nodule.

SEDIMENTARY ROCK, SILTSTONE, massive, greenish black to black, slightly weathered to fresh, moderately soft, unfractured, with scattered rip-up clasts, micaceous, unoxidized.
At EL. 329.5 ft, observed 8" thick strong brown zone.
At EL. 327.5 ft, unit is very weak.
At EL. 325.0 ft, observed scattered black rip-up clasts, randomly oriented, bedding unknown.

See Sheet 2
FOR CONTINUATION

PROFILE
Vert: 1"=10'

DEREK HIGA DESIGN OVERSIGHT ENGINEER	DRAWN BY:	EDELYNE MIGUEL	D. JANKLY FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MAHESWARAN RAVEENDRA PROJECT ENGINEER	BRIDGE NO. N/A POST MILES N/A	SR-710 TUNNEL TECHNICAL STUDY
SIGN OFF DATE	CHECKED BY:	DAN JANKLY	DATE: 3/10/09 - 3/16/09				LOG OF TEST BORING SHEET 1 OF 2

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU
EA 07-187900

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES

SHEET 1 OF 2

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
7	LA	710	N/A		

GEOTECHNICAL ENGINEER — DATE 3/18/10

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — MAHESWARAN RAVEENDRA — No. GE 2743 — Exp. 06-30-11 — 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.

CH2M HILL
6 HUTTON CENTRE DRIVE, SUITE 700
SANTA ANA, CA 92707

BENCHMARK:

NGS Benchmark used. Pt MF36F: N1847799.06, E6512460.75, Elevation 407.29'
MF 36F: A 3" Brass disk stamped "Metropolitan Water District of Southern California MF 36F 1989", set in the top of the bridge curb at the northwest corner of the Hellman Avenue overcrossing of the Long Beach Freeway (I-710). 68' west of the center of the south bound lanes of the freeway, 25' north of the centerline of Hellman Avenue, 13' east of the west end of the bridge, 1' north of the north curb face. NGS PID EW9453.

Horizontal coordinates are CCS NAD-83, Zone 5, 1991.35 epoch.
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Pt 0153 N1845410.50, E6509860.21,
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5) All bedding and other structural angles are measured from horizontal.

6) Plan view shown on Boring Location Plan sheet 2 of 2.

R-09-Z4B4

See Sheet 1 FOR CONTINUATION

320 — REC=100% RQD=100%
At EL. 321.0 ft, observed 1.5' thick zone with very faint black siltstone rip-up clasts and very faint laminations indicating possible subhorizontal bedding (<10°).
At EL. 319.0 ft, unit becomes, fresh, very weak, moderately soft to moderately hard, micaceous.

REC=90% RQD=83% (M) (UW) (JU)
At EL. 317.5 ft, observed charcoal fragment, 1/8"x 3/8".
At EL. 312.0 ft, observed shear, dipping 70°, polished, tight, faint clay lining.

310 — REC=100% RQD=100%
At EL. 311.0 ft, observed shear, dipping 70°, tight shear with 1/16" clay lining, black.
At EL. 309.8 ft, contains black siltstone rip-up clasts.

(M) (SD)
At EL. 307.5 ft, observed shear, dipping 65°, tight shear with 1/16" clay lining, faint.
At EL. 306.5 ft, observed 2" thick soft zone, no visible shearing observed.

300 — REC=100% RQD=100%
At EL. 303.0 ft, observed shear, dipping 70 to 50°, two shears, tight, very faint, 1/16" thick clay lining.

(M) (UW) (UC) (EM)
At EL. 302.0 ft, observed shear, dipping 75 to 70°, tight, 1/16"- 1/8" thick, fat clay lining.
At EL. 299.5 ft, observed black siltstone rip-up clasts.
At EL. 299.2 ft, observed shear, dipping 60°, Aperture 1mm, clay lined, moderately rough.

290 — REC=100% RQD=100%
At EL. 297.7 ft, unit is very weak.
At EL. 288.7 ft, observed abundant rip-up clasts, randomly oriented.
At EL. 287.5 ft, observed possible 10° bedding on numerous similarly oriented rip-up clasts.

REC=95% RQD=95%
At EL. 284.8 ft, observed charcoal fleck 1/8"x 3/8".

280 — REC=100% RQD=100%
At EL. 282.4 ft, observed fine, white lined nodules up to 1/8" thick and 3/8" long. Possible shells/shell fragments.
At EL. 278.5 ft, observed scattered charcoal flecks < 1/8" diameter and scattered white lined nodules as EL. 282.4 ft.

REC=100% RQD=100%
At EL. 275.0 ft, observed 1/4" x 1-1/2" bluish gray, subhorizontal lens.

270 — REC=100% RQD=100%
At EL. 274.4 ft, observed 3/8" x 5" laminated lens dipping 50°, non-continuous around core.
At EL. 273.8 ft, observed 3/8" diameter concretionary nodule.

(PI)
At EL. 273.4 ft, observed abundant rip-up clasts, randomly oriented, from EL. 273.4 ft to 269.4 ft.

260 — REC=100% RQD=100%
At EL. 265.5 ft, observed white lined nodules as EL. 282.4 ft.
At EL. 257.0 ft, observed faint white lens, 4" long x 1/8" thick, dipping 60°, non-continuous around core.

(M) (UW) (PTS) (UC) (SD) (EM)
At EL. 254.5 ft, observed black siltstone rip-up clasts. Unit is very weak.
At EL. 253.5 ft, PTS - Siltstone with red-brown iron oxide rich matrix (86%).
At EL. 253.3 ft, observed 1" long x 1/8" thick white nodule.

250 — REC=100% RQD=100%
At EL. 252.0 ft, observed scattered charcoal flecks < 1/8" diameter, from EL. 253.1 to 249.4 ft.
At EL. 251.5 ft, observed 1" x 3/4" stone in center of core, polished, rectangular.
At EL. 248.9 ft, observed possible bedding dip of 10°, scarce charcoal flecks < 1/8" dia.
At EL. 245.5 ft, observed 1" x 1/2" lens of fine to medium grained silty sandstone, dipping 10°.

REC=100% RQD=100%
At EL. 241.8 ft, observed siltstone rip-up clasts.
At EL. 239.2 ft, observed irregular lenses of bluish gray silt, subhorizontal.

240 — At EL. 239.0 ft, observed some fine white lined nodules as EL. 282.4 ft.
At EL. 233.8 ft, observed scarce siltstone rip-up clasts. Scattered charcoal flecks at EL. 233.9 to 231.9 ft. Unit is very weak.

REC=100% RQD=100% (M) (UW) (JU) (CR)
At EL. 231.0 ft, observed 3/4" x 3/8" bluish gray rip-up clast, internally laminated, subhorizontal.

230 — REC=100% RQD=100%
At EL. 227.9 ft, observed siltstone rip-up clasts.
At EL. 226.0 ft, observed white lined nodules as EL. 282.4 ft, generally subhorizontally dipping.

(M) (UC) (EM) (SD)
At EL. 225.7 ft, observed 3/8" x 1/8" charcoal fleck.

220 — REC=100% RQD=100%
At EL. 224.4 ft, contains siltstone rip-up clasts.
At EL. 223.5 ft, observed faint, 3" x 3/8" sandy lens dipping 20°, dips against faint 10° fabric in rock (possible bedding dipping 10°).

REC=100% RQD=100%
At EL. 223.0 ft, observed dark greenish gray, hard, 4" thick limestone bed, highly reactive to HCL solution, some very tight internal fractures with possible calcite lining. Upper contact dipping 20°, lower contact is undulatory, subhorizontal.

210 — At EL. 221.0 ft, observed bluish gray siltstone rip-up clast.
At EL. 219.9 ft, unit is very weak.

REC=97% RQD=97%
At EL. 217.7 ft, observed 1-1/2" x 3/8" charcoal/remnant wood fragment.

200 — At EL. 216.0 ft, observed scattered charcoal flecks.
At EL. 216.0 ft, observed faint siltstone fabric indicates possible subhorizontal bedding.
At EL. 211.0 ft, observed possible subhorizontal bedding based on siltstone rip-up clast orientation.

REC=100% RQD=100%
At EL. 208.5 ft, observed faint siltstone fabric, possible subhorizontal bedding.

190 — At EL. 207.0 ft, observed shear, dipping 60°, tight, paperthin clay lining, polished.
At EL. 206.4 ft, with scattered fine (< 1/16" diameter) white flecks at EL. 206.4 to 200.4 ft.
At EL. 203.0 ft, observed scarce charcoal flecks up to 1/8" dia.
At EL. 201.5 ft, observed siltstone rip-up clast.

(M) (UW)
At EL. 200.0 ft, observed local fabric dipping 50°, adjacent and parallel to 1/16" to 1/8" thick very fine sand lens, possible soft sediment deformation.

180 — At EL. 191.5 ft, unit is very weak.
At EL. 198.4 ft, unit as EL. 330.9 ft with trace fine sand. Siltstone fabric indicates subhorizontal bedding.

REC=100% RQD=100%
At EL. 197.5 ft, observed siltstone rip-up clasts.

170 — At EL. 197.4 ft, observed scattered charcoal flecks between EL. 197.4 ft and 189.4 ft.
At EL. 187.5 ft, observed 1/8" - 1/4" thick bluish gray silt lens.
At EL. 185.2 ft, observed bedding joint, dipping 5 to 0°, 1" thick section with bluish gray, very fine sand lenses, subhorizontal.

REC=100% RQD=100%
At EL. 183.0 ft, observed shear, dipping 70°, polished, faint clay lining.
At EL. 180.7 ft, observed siltstone rip-up clast and bluish gray very fine sand lens.
At EL. 178.5 ft, observed shear, dipping 65°, very tight, 1/16" thick clay lining.

03-16-09
Terminated at EL. 177.4'
ER_i = 70%

PROFILE
Vert: 1"=10'

DEREK HIGA, DESIGN OVERSIGHT ENGINEER	DRAWN BY:	EDELYNE MIGUEL	D. JANKLY, FIELD INVESTIGATION BY:	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	MAHESWARAN RAVEENDRA, PROJECT ENGINEER	BRIDGE NO. N/A	SR-710 TUNNEL TECHNICAL STUDY
SIGN OFF DATE	CHECKED BY:	DAN JANKLY	DATE: 3/10/09 - 3/16/09			POST MILES N/A	LOG OF TEST BORING SHEET 2 OF 2

OGS CIVIL LOG OF TEST BORINGS SHEET — ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3 — CU EA 07-187900 — DISREGARD PRINTS BEARING EARLIER REVISION DATES → — REVISION DATES — SHEET 2 OF 2

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME