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FOUNDATION INVESTIGATION

Weber Creek Bridge (Widen)
Bridge No. 25-05R/L
Phase 1
U.S. Route 50/Missouri Flat Road Interchange Project
El Dorado County, California
03-ED-50, Post km 23.2/25.4
EA 4E2801

El Dorado County
Lead Agency

Quincy Engineering, Inc.
Design Engineer

1P2/399/296-1.2W
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Taber Consultants
Engineers and Geologists

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Introduction

A study of foundation conditions has been completed at the above site in accordance with the agreement between Quincy Engineering, Inc. and Taber Consultants. The purpose of this investigation is to provide earth materials criteria for use in design of proposed new bridge foundations. This study specifically addresses Phase 1 project elements for the proposed widening.

Earth materials criteria for design of other Phase 1 project elements have been addressed in separate reports prepared by this office. Discussion/recommendations for proposed retaining walls at approaches to the Weber Creek Bridge are included with this report and will also be presented in the project geotechnical design report with supporting documentation. Limitations of study are discussed below and in the attached "General Conditions."

This project is the subject of our "Geologic/Geotechnical Review" (dated March 26, 2001) and "Addendum No. 1 to Geologic/Geotechnical Review" (dated July 24, 2001). Information from these documents is incorporated herein, as appropriate.

Site Description

The existing parallel bridge structures at Weber Creek are located approximately 650 m northeast of the Missouri Flat Road Interchange in El Dorado County, California (see Figure-1).

Weber Creek at the project location flows northwesterly. At the south bank, the natural slope is fairly uniform at 1(v):2(h). Natural slope at the north bank rises 7.5±m from channel level at an approximate slope of 1(v):2.75(h) then continues at a gentler slope on order of 1(v):4(h).

The old U.S. Route 50 (US50) Highway Bridge (constructed in 1937) is located about 34±m upstream (east) of the existing bridge. It is a five-span concrete arch structure with bridge approaches established in about 6±m of fill at the south and 12±m of fill at the north. Deck grade varies from elev. 492.81±m at the south abutment to elev. 491.17±m at the north abutment. The 1937 bridge is presently not in use, nor is it maintained.

At least two generations of fill are assumed present at this site, associated with the construction of the 1937 and 1963 bridges. As much as 6±m of approach embankment fill has been placed at the south bank and as much as 18±m has been placed at the north bank, at slopes of about 1(v):1.5(h).

To limit fill encroachment onto the old US50 highway, a 35±m long by 4±m high metal crib wall near Abutment-5 was reportedly constructed in 1963 along the east side of the existing bridge (approximately located 26-27 m right of "US50" Sta. 156+87 to 157+22). Details of the metal crib wall are not known. It is understood that this wall will be left in-place.

Project Description

The existing left and right bridge structures were reportedly constructed in 1963 and each structure consists of a 10.4±m wide and 167.84±m long four-span (42.164±m – 41.758±m – 41.758±m – 42.164±m) steel plate girder bridge. Existing deck grade is 36-37±m above low channel level. Substructure of each bridge consists of wall abutments supported on spread footings established in approach embankments and 1.83±m by 3.66±m single column bents extended into bedrock. The bridges are proposed to be widened 5.807±m to the outside for Phase 1 as shown on 95% Submittal "General Plan" drawing (dated August 29, 2008) prepared by Quincy Engineering, Incorporated (see attached Drawing 2). The ultimate bridge widening

(Phase 2) will include an additional widening of 5.1 m (left) and 8.4 m (right). The new widened superstructure for each bridge will consist of four spans (42.164±m—41.758±m—41.758±m—42.164±m, matching the length of the existing spans) of composite welded steel girders with reinforced concrete deck.

Deck grade for each bridge is shown on a negative vertical curve passing through elev. 507.94/508.14 at Abutment-1 (Left/Right) and elev. 504.20/504.21 at Abutment-5 (Left/Right) along centerline "US50" Station Line. The left structure is shown between "US50" Sta. 155+30.87 (Begin Bridge) and Sta. 156+98.71 (End Bridge); right structure is shown between "US50" Sta. 155+26.29 (Begin Bridge) and Sta. 156+94.14 (End Bridge).

Abutments for each structure will be open-style seat abutments, supported on spread footings established in embankment fill (similar to existing). Base of spread footings are anticipated to be established at/below existing.

For left and right structures, Piers 2, 3, and 4 are each indicated to be supported by a single 2.15 m by 4.35 m column above ground widened to 2.30 m by 4.50 m where extended underground into rock. Axial service loads (dead plus live loading) for columns range from 13,700 kN to 20,950 kN and are detailed in Table 14. No tension demand has been indicated. Maximum lateral loads at the top of columns are summarized in the table below. It is also planned to retrofit existing Pier-4 (L/R) foundations by constructing a footing around existing columns in combination with high strength rock anchors.

All pier foundations are expected to be mined shafts (similar to existing pier foundations).

Table 1

Summary of Maximum Lateral Loads

Support Location and Load Orientation	Maximum Lateral Load (kN)
Pier 2 Transverse	6,770
Pier 2 Longitudinal	3,470
Pier 3 Transverse	3,660
Pier 3 Longitudinal	1,860
Pier 4 Transverse	4,320
Pier 4 Longitudinal	2,190
Pier 4 Retrofit Transverse	2,450
Pier 4 Retrofit Longitudinal	1,680

At the south approach (Abutment-1), a standard Caltrans Type-1 cantilever retaining wall (Retaining Wall No. 3) is to be constructed along the east side of US50 to limit encroachment of new (widened) embankment fill. The retaining wall will be established below the old US50 grade and is anticipated to vary in height from 2.0 to 9.1 m. The wall is shown to be about 45.6 m long, with most of the wall located approximately 36 m right of "US50" 155+00 to 155+40. Minor cut/fill on order of 1.5 to 2.0 m in height/depth is anticipated along the west (left) side of US50 at Abutment-1.

At the north approach (Abutment-5, Left/Right), three standard Caltrans Type-1 cantilever retaining walls (Retaining Walls Nos. 4, A5L, and A5R) will be constructed to limit encroachment of new (widened) embankment fill. The retaining wall for the left (west) bridge abutment (Retaining Wall A5L) will be established within the existing embankment and is estimated to be about 100±m long located 24±m left of "US50" Sta. 157+00 to 158+00. The design height of the left abutment wall will vary from 6.1 to 7.3 meters.

The Abutment-5 right (east) structure has two tiered retaining walls, one of which attaches to the right bridge abutment and the other located 6±m below and at a lateral distance of approximately 4.5 m east. The lower right retaining wall (Retaining Wall No. 4) will be established below the old US 50 grade and is shown to be about 160±m long located about 31±m right of "US50" Sta. 156+81 to 158+40. Design wall heights have been indicated to vary from 3.0 to 8.5 m for the right lower wall (Retaining Wall No. 4). A descending slope of 1(v):1.5(h) is shown between Retaining Wall Nos. A5R and 4.

The upper right retaining wall (Retaining Wall No. A5R), which will attach to the bridge abutment, will be established within new embankment fill above the existing steel crib wall that is to be buried by the new fill. The new upper right wall is shown to be approximately 52±m long located 26±m right of "US50" Sta. 156+95 to 157+47. Wall height for this wall is to vary from 1.8 to 4.8 meters.

All substructure support for current and future widening is to be completed during Phase 1 construction. Future Phase 2 construction will consist of a further 5.1 m (left) and 8.4 m (right) widening of the superstructure and deck to the outside of each bridge.

Pertinent Structure/Site Information

Review of available structure/site information published by the former State of California Bridge Department (now Caltrans) pertinent to this project included the following:

- Foundation Investigation Report – Weber Creek Bridge (Br. No. 25-05 R&L), dated January 25, 1961
- "Log of Test Borings" (Drawing No. PR-7159-6) – Weber Creek Bridge (Br. No. 25-05), dated January 1961
- As-Built "Foundation Plan", Weber Creek Bridge (Br No. 25-05 R&L), dated August 30, 1963

The use of spread footings was specified at the abutments founded in approach embankments. Pier columns were specified to extend 6.1-7.3 m (20-24 ft) below ground surface and into bedrock (i.e., mined shaft foundations socketed into bedrock).

Design loads of 2 tsf (191.5 kN/m^2) bearing pressure and 15 tsf (1,436.4 kN/m^2) were indicated in the Foundation Investigation Report (1961) for the existing abutments and piers, respectively. The following table shows the support locations and recommended footing elevations for the left and right structures.

Table 2

Recommended Footing Elevations (1961)

Support	Left Structure	Right Structure
Abutment-1	1652.5 ft / 503.69 m	1653.0 ft / 503.84 m
Pier-2	1572.0 ft / 479.15 m	1575.0 ft / 480.07 m
Pier-3	1512.0 ft / 460.86 m	1512.0 ft / 460.86 m
Pier-4	1534.0 ft / 467.57 m	1538.0 ft / 468.79 m
Abutment-5	1640.5 ft / 500.03 m	1640.5 ft / 500.03 m

The As-Built "Foundation Plan" (1963) by the former State Bridge Department indicates the following:

- Abutment-1 and Abutment-5 (left & right); "As-built" base of footings are shown at indicated planned footing levels for each support,
- Pier-2 (Left & Right); "As-built" base of footing levels are shown at elev. 1569.0 ft (elev. 478.24 m),
- Pier-3 (Left & Right); "As-built" base of footing levels are shown at elev. 1508.0 ft (elev. 459.64 m),
- Pier-4 (Left); "As-built" base of footing level is shown at elev. 1530.0 ft (elev. 466.35 m), and
- Pier-4 (Right); "As-built" base of footing level is shown at elev. 1534.0 ft (elev. 467.57 m).

The 1961 "Log of Test Borings" drawing attached to this report as "Log of Test Borings 6 of 6" shows added "US50" Line stationing for the current project. The locations of these are also shown on the "Log of Test Borings 1 of 6" prepared for this project (2005 test borings).

Exploration and Testing

State Bridge Department Study

Bridge foundation exploration performed by the former State Bridge Department in 1960 consisted of one rotary test boring penetrating to elev. elev. 1610 ft (490.73 m) and two shorter 2¼-inch (57 mm) cone penetration borings driven to effective refusal using a small compressed-air sheet-pile hammer. The borings are indicated to have been supplemented by "numerous" 1-inch (25 mm) soil borings and test pits, but locations of these are not shown on the referenced "Log of Test Borings" drawing.

Taber Study

Exploration to investigate the nature and distribution of earth materials and conditions for the proposed bridge was conducted in May 2005 and included a total of nine drilled, sampled, and logged test borings to a maximum depth of 23.2±m (lowest elev. 450.6±m) supplemented by surface geologic reconnaissance and refraction seismic profiling of the immediate area. Locations and results of refraction seismic profiling are included in Appendix-E.

The borings were advanced by auger drilling, percussion air hammer, and diamond coring through surficial soil (including cobbles and boulders) and variably weathered (decomposed to very intensely weathered) rock. Diamond-coring was performed through underlying, less weathered rock to recover rock cores for logging.

Drive samples of unconsolidated soil and decomposed to very intensely weathered rock were recovered from the borings by means of a 2 3/8-inch (50 mm) OD "standard penetration" sampler advanced with standard striking force (140-pound / 63.5 kg weight and 30-inch / 760 mm drop per ASTM D1586) to provide a field estimate of soils consistency. Sampler penetration resistance was recorded and, to some extent, can be correlated to strength and bearing characteristics of the foundation materials.

Portions of earth materials recovered with the drive sampler were retained in moisture-proof containers for laboratory testing and reference. Bulk samples were also obtained from auger drill cuttings. Rock cores were retained in core boxes for laboratory testing and reference and these cores can be made available for inspection.

Borings were logged and earth materials field-classified by an engineer as to consistency, color, gradation and texture on the bases of sampler penetration resistance, and examination of samples, rock cores and drill cuttings. Where diamond coring was used to advance the borings, the recovered cores were logged as to percent recovery, Rock Quality Designation (RQD), degree of weathering, hardness, and fracture density (see Drawing-1, "Engineering Geology Field Descriptors"). Groundwater observations were made in the borings during drilling operations. Subsequent to field investigation, rock cores were reviewed in the office by Certified Engineering Geologists.

All borings were backfilled with cement-grout upon completion of drilling. Access for drill rigs to some support locations required pioneering roads. Restoration and clean-up of access trails to help minimize erosion was completed in early October 2005 pursuant to discussions with personnel with El Dorado County.

The boring locations were referenced to project stationing as shown on the above referenced plans; elevations were referenced to project datum provided by Topographic Surveys, Incorporated. Locations, elevations, details of borings and results of tests are shown on the attached "Log of Test Borings" drawings, Appendix-A and Appendix-B. Ron Loutzenhiser was field engineer for this study. Site reconnaissance and office review of rock cores was made by Martin McIlroy and Eric Nichols, both Certified Engineering Geologists.

Log of Test Boring sheets for borings performed near the Weber Creek Bridge as a part of the Geotechnical Design and Materials Report for the U.S. Route 50/Missouri Flat Road Interchange Project (prepared in conjunction with this study) are presented in Appendix-E for reference.

Laboratory tests were performed on samples of soil and decomposed rock materials to supplement field evaluation included moisture content-dry density tests. Laboratory testing on selected rock cores included moisture content-dry density, unconfined compressive strength and Point-Load Index tests (30 x 85 mm per ASTM D5731) (see Appendix-A). Petrographic examinations of two selected rock core samples were also made by personnel from Micro-Chem Laboratories (see Appendix-B).

Geologic Setting

The project site is located within the foothills of the Sierra Nevada geomorphic province of California. The Sierra Nevada has a general northwest trend and is on the order of 690 km long and 64-129 km wide. The mountain ranges of the Sierra Nevada were created roughly 120 to 130 million years ago when sediments as thick as 9,200 m along with volcanic rocks were buckled and warped resulting in a series of low mountain ranges. The roots of these mountain ranges were then intruded by granitic rock.

The Sierra Nevada ranges were subsequently tilted upward as a result of faulting along the east edge of the ranges. In the higher elevations of the Sierra Nevada, much of the sedimentary material has been eroded to extensively expose the granitic rock. Older rocks that remain have been metamorphosed and are exposed in the foothills of the Sierra Nevada.

Published geologic mapping (reference 4) shows surface materials within the project limits as Mesozoic granitic rock. Slate and metasedimentary rock of the Mariposa Formation and metavolcanic rock of the Logtown Ridge Formation are also shown nearby to the south and northeast of the project site.

Site reconnaissance made within project limits by our Certified Engineering Geologist indicates metamorphic rock exposed along the natural slopes and within the channel at Weber Creek. The rock is non-foliated with fine to medium grains contained within an aphanitic (i.e., grain size < 0.1 mm) matrix.

Based on the petrographic examination, the two rock samples from the Weber Creek site (see Appendix-B) are generally classified as Hornfels – a non-foliated metamorphic rock typically formed by contact metamorphism (i.e., with granitic pluton).

Surface exposures are mostly intensely to moderately weathered where exposed within the natural slopes and less weathered where exposed within the channel. In the vicinity of the bridge, joints/fractures within the rock were observed at approximate 0.15-0.7±m spacing. Prominent discontinuities (e.g., fracture, joint sets, etc.) were measured at various locations in the vicinity of the existing bridge and are as follows:

Table 3

Rock Discontinuity Measurements

Strike	Dip
Northwest	55°-86° Northeast
Northwest	40°-76° Southwest
Northeast	44° Northwest
Northeast	30°-40° Southeast

Review of existing approach embankments at Weber Creek indicate that the fills consist of a silty and sandy gravel/cobble mixture. However, boulders to 0.5-1.0±m dimension were commonly exposed on the fill face at each approach embankment.

The site is within an area of high seismicity, but no active faults are mapped within the immediate site vicinity and the site is not located within an Alquist Priolo "Earthquake Fault Zone" for fault rupture hazard. The nearest active fault is indicated to be the Big Bend-Wolf Creek-Maidu-Bear Mountain E (BWM) fault located approximately 9.1 km (5.65 mi) west of the project site. This fault is indicated (per Caltrans) to have a maximum credible earthquake magnitude of 6.5. The Forest Hill-Melones fault (FHM), located approximately 5.3 km east of the project, is no longer considered active by Caltrans, however the California Geologic Survey (reference 5) still considers the fault active. This fault is also indicated (per Caltrans) to have a maximum credible earthquake magnitude of 6.5.

The published mapping (references 3 and 4) shows an isolated band of near surface (or exposed) ultramafic rocks about 2.2±km east of the Weber Creek bridges. Such ultramafic rocks locally include serpentine (or serpentinite) and can, but do not always, contain naturally occurring asbestos. Ultramafic rock materials are not, however, mapped within the limits of this project, and none were observed during our site reconnaissance or drilling. The published mapping (reference 8) shows no asbestos within or near the project site. As such, naturally occurring asbestos testing was not included in our scope of services nor was it performed. We note that it is possible that naturally occurring asbestos may still be present in some fill materials, depending on their source. If desired, testing could be performed during construction activities to check for naturally occurring asbestos in existing soils or rock where excavated or disturbed.

No landslides are shown on the published mapping within the project interval, and none were observed at time of site reconnaissance. No evidence of other geologic hazards (such as settlement, very soft soils, severe erosion, etc) was observed as part of this study.

Earth Materials and Conditions

State Bridge Department Study

The 1961 foundation report indicates that the site "...is underlain by rhyolite porphyry bedrock of probable Jurassic age. The bedrock is well exposed on the south bank in the form of numerous outcroppings. In the southerly portion of the channel area, the bedrock is well exposed in the active channel. In the northerly bank, the bedrock is overlain by old placer mining tailings consisting of gravel, cobbles and boulders. The bedrock on the upper slope of the north bank is overlain by weathered in place bedrock and existing highway fill."

Taber Study

Earth materials encountered in the borings are divided into two units considered significant to the proposed project. A sample earth material profile with engineering properties is shown on Figure-2.

Unit 1 – Overburden: In all borings, overburden materials consisting of embankment/roadway fill associated with existing facilities, temporary fill associated with drill pad construction, alluvium and/or colluvium was encountered from ground surface to variable depth.

- Embankment/Roadway fill (penetrated below 130-180 mm of asphalt concrete) was encountered in Borings 05-18, 05-39, and 05-40 completed along US 50 and consists of medium dense and dense sandy gravel to clayey sand with gravel and gravelly sand with cobbles and boulders. These materials were encountered to depth 5.4±m (elev. 504.63±) in Boring 05-39. Borings 05-18 and 05-40 were terminated in "rock" materials (interpreted as boulders based on seismic refraction line S13-S14 interpretation) encountered from depth 6.4-9.4±m (elev. 497.75-494.75±) and 4.6-5.7±m (elev. 499.44-498.34±), respectively. The boulder in Boring 05-18 is at least 3 m (10-ft) in dimension; maximum size of this or other boulders is unknown. Outer portions of the embankment may be disturbed. In-place embankment materials are expected to be capable of supporting moderate intensity directly applied (footing) foundation loads similar to existing.
- Temporary fill associated with drill pad construction was encountered in Borings 05-10 and 05-11 (Pier 2 R/L) and consists of medium dense to dense silty sand with gravel and gravel/cobbles with varying amounts of silt and sand. These materials were encountered to depth 4.0±m (elev. 483.20±) in Boring 05-10 (Pier-2 R) and to depth 3.4±m (elev. 485.09±) in Boring 05-11 (Pier-2 L). Temporary fill overburden materials are considered unreliable for direct support of new structure loads.

- Alluvium/colluvium was encountered in borings completed at Pier-3 L/R and Pier-4 L/R as follows:

Table 4

Bottom of Alluvium/Colluvium

Boring	Support	Depth	Elevation
		m	m
05-08	Pier 3 L	1.95	465.97
05-09	Pier 3 R	1.52	466.49
05-07	Pier 4 L	3.20	470.94
05-06	Pier 4 R	2.70	472.85

These materials are described as loose to medium dense clayey/silty sand with gravel and cobbles. They are also considered unreliable for direct support of new structure loads.

Unit 2 – Weathered and Fractured Rock: This unit underlies Unit 1 soils and consists of metamorphic rock (Hornfels) consistent with outcrops at the project site.

The Unit 2 rock is divided into two sub-units, defined by an upper portion (Unit 2A) ranging from "decomposed" (i.e., effectively "soil-like") to "intensely/ moderately weathered" and a lower portion (Unit 2B) ranging in condition from "slightly weathered" to "fresh." In general, the rock unit appears to become fresher with depth and overall rock strength/quality improves from north to south. However, the transition between Unit 2A and Unit 2B rock was found to be both abrupt and gradational, and depth of Unit 2A rock may vary significantly between borings.

The depth/elevation interval of Unit 2A and Unit 2B rock encountered in each of the borings is shown in the following table.

Table 5

Rock Intervals

Boring	Support	UNIT 2A ROCK		UNIT 2B ROCK	
		Depth	Elevation	Depth	Elevation
		m	m	m	m
05-39	Abut-1	5.40 - 10.70	504.63 - 499.33	Not Encountered	
05-11	Pier 2 L	3.44 - 6.49	485.04 - 481.99	6.49 - 23.10	481.99 - 465.38
05-10	Pier 2 R	4.00 - 6.89	483.20 - 480.30	6.89 - 21.28	480.30 - 465.92
05-08	Pier 3 L	1.95 - 3.41	465.97 - 464.51	3.41 - 16.89	464.51 - 451.04
05-09	Pier 3 R	1.52 - 2.19	466.49 - 465.82	2.19 - 17.43	465.82 - 450.58
05-07	Pier 4 L	3.20 - 9.14	470.94 - 464.99	9.14 - 18.62	464.99 - 455.51
05-06	Pier 4 R	2.70 - 12.92	472.85 - 462.62	12.92 - 21.92	462.62 - 453.63
05-18	Abut-5	Not Encountered		Not Encountered	
05-40	Abut-5	Not Encountered		Not Encountered	

Unit 2A rock materials within the indicated intervals were locally augered with 100 mm solid-stem continuous flight auger and at least nominal penetration was achieved with the "Standard Penetration" sampler; core recovery within these materials varied significantly. Based on boring encounters, this subunit is indicated to have a Rock Mass Rating (RMR) value of 18 to 31 and to classify as "very poor" to "poor" rock (see Appendix-C). As indicated above, Unit 2A rock materials were not encountered in Boring 05-18 or 05-40 (both at Abutment-5).

Average core recovery and range/average Rock Quality Designation (RQD) for rock cores retrieved within Unit 2A is shown in the following table:

Table 6

RQD – Unit 2A Rock

Boring	Support	Average Recovery	RQD Range	RQD Average*
		%	%	%
05-11	Pier 2 L	82	0-36	11
05-10	Pier 2 R	79	0-36	19
05-08	Pier 3 L	100	-- +	0
05-09	Pier 3 R	100	-- +	18
05-07	Pier 4 L	95	0-92	24
05-06	Pier 4 R	83	0-100	43

** Weighted average value.*

+ Only one core run made in Unit 2A Rock materials.

Unit 2B rock materials are less weathered and required diamond coring for drill advancement and are described as moderately hard to hard-very hard, non-foliated metamorphic rock (Hornfels – see Appendix-B). The rock texture is typically composed of fine to medium grains within an aphanitic matrix. Degree of fracturing varies significantly from "very intensely" to "slightly." Based on boring encounters, this subunit is indicated to have a Rock Mass Rating (RMR) value of 51 to 62 and to classify as "fair" (mostly) to "good" rock (see Appendix-C). As indicated above, Unit 2B rock materials were not encountered in Boring 05-18, 05-39 or 05-40.

Average core recovery and range/average Rock Quality Designation (RQD) for rock cores retrieved within Unit 2B is shown in the following table:

Table 7

RQD – Unit 2B Rock

Boring	Support	Average Recovery	RQD	
			Range	Average*
		%	%	%
05-11	Pier 2 L	99	29-100	64
05-10	Pier 2 R	96	30-100	66
05-08	Pier 3 L	100	0-87	50
05-09	Pier 3 R	100	0-86	60
05-07	Pier 4 L	100	10-67	42
05-06	Pier 4 R	100	67-100	81

** Weighted average value.*

Rock Strength Test Results

Point Load Tests

Point load tests were performed on selected core samples from Boring 05-6 through Boring 05-11 in evaluation of rock compressive strength. For this project element, a total of forty-seven rock cores were broken using a basic diametral test procedure in which the core axis is oriented perpendicular to the applied load (ASTM D5731). Point load tensile-strength index values were used to estimate uniaxial compressive strength values based on correlations developed by Bieniawski (reference 1). Rock core samples tested yielded estimated ultimate compressive strength values as follows:

Table 8

Estimated Unconfined Compressive Strength

Rock Unit	(MPa)	(psi)
2A	24.3 - 116.6	3,523 - 16,908
2B	63.1 - 437.2	9,159 - 63,407

**Correlated from Point Load Index Test Results, using Bieniawski (reference 1)*

We note that there were two estimated unconfined compressive strengths not included in the above chart. The first is an anomalously high result in Unit 2A (325.5 MPa/47,203 psi) in Boring 05-09 Run A, interpreted as a stronger rock material in otherwise weaker rock matrix. The second is an anomalously low result in Unit 2B (20.4 MPa/2,959 psi) in Boring 05-08 Run L, caused by the rock sample splitting along a weathered fracture. This test result is not indicative of the strength of the rock mass.

Factors accounting for the variability in point load strength include rock composition, fracturing, grain size and weathering characteristics. Results of point-load tests are shown on the "Log of Test Borings" drawings and included with Appendix-A.

Unconfined Compressive Strength Tests

Laboratory unconfined compressive strength testing of selected rock core indicates compressive strengths as follows:

Table 9

Unconfined Compressive Strength

Rock Unit	(Mpa)	(psi)
2A	9.8*	1,422*
2B	64.3 - 180.1	9,300 -26,100[+]

**Only one sample tested within Unit 2A Rock.*

[+] Test results from 2 cores (Boring 05-10 Run F and Boring 05-8 Run G) not included. They appear to have fractured along pre-existing weakened planes and are not representative of the strength of native rock.

Factors accounting for the variability in unconfined compressive strength include rock composition, fracturing, grain size and weathering characteristics. Results of these tests are shown on the "Log of Test Borings" drawings and included with Appendix-A.

Groundwater

State Bridge Department Study

No free groundwater was encountered at time of December 1960 exploration made by the State and no notations regarding ground/surface water are included on the As-built Foundation Plan.

Taber Study

At time of May/June 2005 field study, free groundwater was measured in Boring 05-09 at 0.61±m depth (elev. 467.41±m), reflecting water level within Weber Creek at time of drilling. No seepage or groundwater was noted within the augered intervals (lowest elev. 466.03±m) of Borings 05-6, 05-7, 05-10, 05-11, 05-18, 05-39, and 05-40. Groundwater was not measured in those borings below the augered intervals or in Boring 05-8 due to caving conditions and/or presence of residual drill fluid.

The soil overburden materials and decomposed rock are expected to be seasonally saturated and are considered capable of transmitting seepage to open excavations; the decomposed to very intensely weathered rock somewhat less so than soil. Groundwater occurrences in the underlying less weathered/fractured rock are expected to be restricted to open fracture/joint planes and localized/limited in extent and quantity. Other occurrences of relatively shallow "perched" groundwater may be present, particularly during the wet season and/or wetter years.

Site Seismic Conditions

In accordance with current Caltrans Division of Structural Foundations site seismicity evaluation procedures (with reference to "Caltrans California Seismic Hazard Map 1996" and accompanying technical report), "Peak Bedrock Acceleration" (PBA) of 0.3 g can be assigned the site associated with a controlling event of 6.5 magnitude on the Big Bend-Wolf Creek-Maidu-Bear Mountain E (BWM) fault located approximately 9.1 km (5.65 mi) west. The fault type is unknown (see Appendix G).

This site may conservatively be assigned a soil profile "Type C" per Table B.1, Caltrans "Seismic Design Criteria" (SDC) version 1.4. However, where overburden materials are absent, use of a soil profile "Type B" for rock could be considered for use in design.

Caltrans structure design practice requires certain increases in SDC response curves due to fault type and/or fault proximity. At this site the proximity of the site to the seismic source will require a staged increase in spectral accelerations depending upon structure period. Per Caltrans procedures, sites within 15 km of an active fault should receive an increase in design spectral accelerations as follows:

Table 10

Caltrans Spectral Acceleration Increases

Structure Period (seconds)	Increase in Spectral Acceleration (%)
0-0.5	No Increase
0.5-1.0	0% to 20% Linear Increase
≥1.0	20% Increase

Based on the guidelines and published Caltrans criteria as discussed above, the following SDC seismic design parameters are recommended for this site.

- Big Bend-Wolf Creek-Maidu-Bear Mountain E (BWM) fault
- Magnitude 6.5±0.25
- Soil Profile Type C
- PBA = 0.3 g
- ARS curve from SDC Figure B.4 (modified to show increases in spectral accelerations)

The modified ARS curve is attached as Figure-3.

Seismic Effects

Other than possible distortion of loose overburden materials, no other significant site soils defects with respect to seismic loading (e.g., liquefaction, lateral spreading, ground lurching, etc.) were identified from the data obtained in this study. Should there be important structural and/or economic considerations associated with more closely defining these values or other site seismicity characteristics, further study would be required.

Corrosivity

Corrosivity testing (ph, minimum resistivity, chlorides and sulfates) was not performed as a part of this study. Corrosivity testing performed for the Missouri Flat Road Overcrossing GDMR report (which includes the Weber Creek project site) indicated a "non-corrosive" soils environment for both concrete and steel (per Caltrans "Corrosion Guidelines", v1.0 dated September 2003). Test results are summarized below, as requested by Caltrans. Rock materials are not anticipated to be corrosive to concrete and/or steel.

Table 11

Corrosivity Test Results

Boring / Sample	pH	Minimum Resistivity (ohm-cm x1000)	Chloride (ppm)	Sulfate (ppm)
2 / Bag C	7.17	1.50	45.2	115.5
4 / Bag E	6.82	2.36	19.4	25.5
5 / Bag F	6.93	4.56	14.9	21.5
13 / Bag H	6.30	4.02	8.0	9.4
16 / Bag N	7.24	3.22	21.3	25.8
24 / Bag F	7.40	2.65	5.9	29.0
25 / Bag R	7.49	2.17	6.0	48.9
28 / Bag T	6.31	5.09	14.4	1.2
29 / Bag U	6.44	2.63	11.4	35.0

Scour

Upper alluvial materials, including channel bedload, are considered to be susceptible to scour/erosion. Bedrock materials are considered "scour resistant." Due to the pier foundations being founded within these bedrock materials and abutments in fill founded well above anticipated water levels, scour is not considered to be a concern for foundation design.

Conclusions and Discussion

The site is considered stable with suitable support available for the proposed structure widenings. At the abutments, support is considered available by means of spread footing foundations bearing within a prism of engineered fill (constructed by subexcavating existing fill). At the piers, structure support is available by means of mined-shafts penetrating "intact" rock materials.

Factors to consider in design and construction of bridge widening foundations include the presence of coarse materials – including relatively large boulders – and/or concealed defects in existing approach fills and relation of existing slopes/walls to proposed abutment footings/wall footings.

For mined-shafts at piers, major site foundation characteristics/ constraints affecting details of support level, bearing, etc. include location of support-lines on irregular rock surfaces, excavation of hard rock to bearing levels, mechanical defects of the rock (fractures/joints) and local variation in rock depth/condition. Substantial bearing pressures for axial loads are available with very limited rock penetration. Depth of shafts will be controlled by lateral loading conditions.

Variation with respect to depth of overburden and underlying rock surface/ condition at actual support locations would not be unexpected. To confirm this interpretation and reduce uncertainties associated with rock level/characteristics at individual support locations, supplemental site exploration performed at the time of construction should be considered. Project design should consider the possibility of at least nominal departure from anticipated rock elevations.

Recommendations

Abutments (Left/Right)

Spread footings are shown to be at similar elevation to existing abutment footings. We recommended new abutment footings to be established within a prism of engineered fill to provide suitably firm, uniform support. Continuous footings at least 1 m wide established in engineered "Structure Backfill" (per Section 19 of Caltrans "Standard Specifications") compacted to at least 95% relative compaction (per CTM 216) may be assigned allowable (service load) bearing pressure of 192 kPa. Higher allowable bearing pressure (say, to 239 kPa or 287 kPa) may be considered with use of Class 2 Aggregate Base (per Section 26 of Caltrans "Standard Specifications") compacted to 95% relative compaction (per CTM 216) or concrete backfill, respectively.

The engineered fill prism should be at least 1.0 m thick and extend horizontally 1.0 m beyond toe of footing footprint (flush at heel). At Abutment-1 (Left), minor cut on order of 1.5±m into the hillside is indicated to establish new widened US50 grade. Based on surface geologic reconnaissance, decomposed metamorphic rock is anticipated to be at least locally present at shallow depth at this location. To minimize post-construction settlement of footings founded in fill (including differential settlement between rock and fill), all existing fill, native overburden, and decomposed rock materials should be excavated to at least 1.0 m below base of footing and replaced to footing grade with engineered fill (Structure Backfill, Class 2 Aggregate Base, or concrete backfill). Engineered fill should have a maximum differential thickness of 1 m (vertical) in 10 m (horizontal). Settlement of such footings is expected to be nominal (<13 mm).

Following is a Spread Footing Data Table. Footing elevations shown in the table below match existing.

Table 12

Spread Footing Data Table - Abutments

Support Location	Minimum Footing Width	Bottom of Footing Elevation	Recommended Bearing Limits	
			WSD[1]	LFD[2]
			Allowable Bearing Capacity (q_{all})	Nominal Bearing Resistance (q_n)
Abut-1 L	1.0 m	503.69	239 kPa	N/A
Abut-1 R	1.0 m	503.84	239 kPa	N/A
Abut-5 L	1.0 m	500.00	239 kPa	N/A
Abut-5 R	1.0 m	500.00	239 kPa	N/A

Notes: Values for Allowable Bearing Capacity assume use of Class 2 Aggregate Base for engineered fill below footings per above.

1) Working Stress Design, (WSD), the Maximum Contact Pressure, (q_{max}), is not to exceed the recommended Gross Allowable Bearing Capacity, (q_{all}).

2) Load Factor Design, (LFD), The Maximum Contact Pressure (q_{max}) divided by the Strength Reduction Factor (ϕ) is not to exceed the Nominal Bearing Resistance (q_n).

If one or more boulders are found to be present within an excavation at/along some part of the footing line, it may not be practical to remove/excavate them and our office and the bridge designer should be consulted. Conversely, removal of boulders within excavations may cause disruption at/below the footing level. In locations where boulders are removed, full depth replacement with compacted fill as above is expected to be appropriate. Due to potential for such concealed conditions, individual footing lines should be reviewed by our office at time of construction and may require modifications of recommended base of footing level and depth/extent of overexcavation.

Lateral load resistance of spread footings may be calculated as follows:

1. A base friction factor of 0.40 is recommended for engineered fill.

2. Soil resistance against the face of footings can be based on passive pressure of 64.0 $kN/m^2/m$ (based on formed footings with compacted Structure Backfill or Class 2 Aggregate Base).

3. Per Caltrans practice, the following guidelines should be used for the force/moment equilibrium analysis of the foundations:
   - Use 100% base friction and 0% passive resistance or
   - Use 0% base friction and 100% passive resistance.

Piers (Left/Right)

Due to difficult site access conditions on/along steep slopes and lane width/ barrier restrictions along US50, borings completed for this project are located outside the limits of proposed support locations. Based on nearby boring encounters, surface geologic reconnaissance, and review of project site topography, the following table presents the estimated lowest effective top of rock level anticipated at individual pier locations.

Table 13

Top of Rock Level - Piers

Support	Existing Ground Surface (m)	Estimated Lowest Effective Top of Rock (m)
Pier-2 Left	487.5 - 489.0	485.0
Pier-2 Right	487.0 - 489.0	481.0
Pier-3 Left	466.5 - 467.0	464.5
Pier-3 Right	467.5 - 468.5	465.5
Pier-4 Left	473.5 - 474.5	470.5
Pier-4 Right	481.0 - 485.0	471.0

Lateral loading conditions control specified bottom of mined-shaft levels at all pier locations. Soil parameters and rock p-y curves for use with the LPILE computer program to evaluate lateral capacity of mined shaft foundations are attached as Appendix-D. Bottom of individual mined-shafts are based on results of lateral support analysis by Quincy Engineering, Inc.

The following Mined-Shaft Data Table has been developed for this project:

Table 14

Mined-Shaft Data Table - Piers

Location	Dimension (m)	Design Loading (kN)	Nominal Resistance		Cut off Elevation (m)	Design Bottom of Shaft Elevation (m)	Specified Bottom of Shaft Elevation (m)
			Compression (kN)	Tension (kN)			
Pier-2 Left	2.30 x 4.50	N/A	13,700	0	487.5	482.0 (1), 477.7 (3)	477.7
Pier-2 Right	2.30 x 4.50	N/A	16,650	0	487.0	478.0 (1), 473.7 (3)	473.7
Pier-3 Left	2.30 x 4.50	N/A	19,700	0	466.5	461.5 (1), 457.2 (3)	457.2
Pier-3 Right	2.30 x 4.50	N/A	20,950	0	467.5	462.5 (1), 458.2 (3)	458.2
Pier-4 Left	2.30 x 4.50	N/A	17,100	0	473.5	467.5 (1), 462.6 (3)	462.6
Pier-4 Right	2.30 x 4.50	N/A	18,450	0	481.0	468.0 (1), 463.1 (3)	463.1

Design bottom of shaft elevations are controlled by the following demands:(1) Compression; (2) Tension; (3) Lateral loads

Rock Anchors

For retrofit of the existing Pier-4 (L/R) column, conditions are considered suitable for use of rock anchors. Base of footing is to be established at top of rock at each pier (estimated at elev. 470.8±m at Pier-4L and elev. 472.2±m at Pier-4R). Ultimate bond stresses of at least 689 kPa (100 psi) are considered available between grouted anchors (bond length) and intact (weathered) rock. Ultimate capacity on the order of 1334 kN – 2224 +kN (300-500+ kips) would be expected to be available for individual anchors of diameter 0.15 m (6 inches). Rock anchors should have a minimum free length of 3.0-4.5 m and extend below the bottom of existing footings. We recommend proof testing of at least 2 anchors per pier location (20% of installed anchors) to double the design load.

Retaining Walls

Footings for retaining walls are recommended to be established within a prism of engineered fill to provide suitably firm, uniform support. All soil should be excavated to at least 1.5 m below base of footing. Horizontal limits of excavation should be from heel line to 1.5 m beyond the toe of retaining wall footing. If, upon review and approval by the engineer, intact rock is identified as present at plan footing levels or within 1.5 m below footing the required depth of engineered fill prism may be reduced. Engineered fill should have a maximum differential thickness of 1 m (vertical) in 10 m (horizontal).

At Abutment-5 right, there is a tiered retaining wall system consisting of an upper wall (Abutment-5) and a lower retaining wall. The lower retaining wall will need to resist surcharge loading (from Abutment-5) of 24.7 kPa and 12.3 kPa for vertical and lateral pressures, respectively. Lateral surcharge pressure should extend 0.6 m vertically up wall stem. Modified over-excavation may be necessary for the lower retaining wall footing at this location due to clearance/right-of-way limitations. At this location, with our approval of subgrade conditions, footings may be over-excavated to 1.0 m depth at the heel and 1.5 m depth at the toe, stepping from one depth to the next mid-footing.

After approval by this office, the surface exposed by excavation (i.e., area to receive fill) for the retaining walls should be scarified to 150 mm depth, moisture conditioned as necessary to over-optimum moisture content and compacted to at least 95% relative compaction (per CTM 216). This requirement may be waived where the base of excavation is positively identified by our personnel to be uniformly established within intact rock materials. The excavated area should be filled to footing grade with "Structure Backfill" (per Caltrans "Standard Specifications") compacted to at least 95% relative compaction (per CTM 216).

Caltrans "Standard Plan" Type-1 retaining wall footings founded on compacted "Structure Backfill" per above and/or intact rock may be assigned allowable design bearing pressures up to 370 kPa, net at ground line. For "ultimate" bearing pressures for seismic loading, the dead plus live values can be increased by 1/3.

Wall drainage should be established per Caltrans "Standard Plan" details.

Lateral Soil Pressures

With use of Caltrans "Structure Backfill" or equivalent, active soil pressures of 5.6 $kN/m^2/m$ (36 pcf) and 8.5 $kN/m^2/m$ (54 pcf) are considered appropriate for use in abutment and retaining wall design with level backfill and 1v:2h slopes above wall, respectively. An active soil pressure of 9.4 $kN/m^2/m$ (60 pcf) can be used for 1(v):1.5(h) slopes provided that Caltrans Class 3 Aggregate Base or equivalent is used for slope construction. Back of wall drainage should be established per Caltrans Standard Plan B3-8 details.

Seismic loading will apply additional soil pressure to abutment/retaining walls. The resultant of incremental lateral soil pressure due to seismic loading will act at 0.6 times the wall height above the base of the wall and the magnitude of resultant may be calculated on the basis of an equivalent fluid pressure of 4.3 $kN/m^2/m$ (27 pcf).

For free standing walls, expected to be capable of significant "yield" and displacement under seismic loading, it is appropriate to reduce the incremental soil loading from seismic forces by as much as 50% for evaluating wall stability with respect to sliding and overturning.

For seismic loading into abutments, passive soil resistance of up to 239 kPa (2.5 tsf) is available (to be reduced for effective wall height less than 1.7 m in accordance with Caltrans SDC v.1.4).

Embankment

Embankment construction and any new fill placement should be in accordance with Caltrans "Standard Specifications," including at least 95% relative compaction on all fill within 50 m of bridge abutments and all fill placed below footings. Where new fill is to be placed onto existing embankment slopes, it should be fully-bonded into the existing fill by placing on discrete horizontal benches cut fully into the slope and below any loose/soft or otherwise unsuitable materials (per Section 19 of Caltrans "Standard

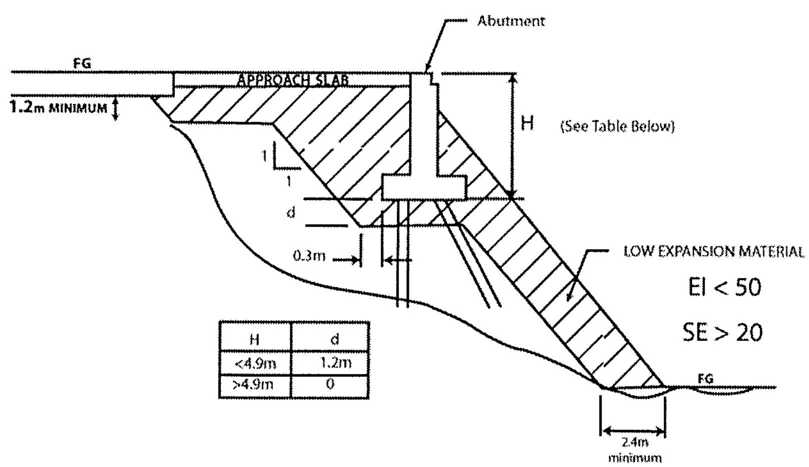
Specifications"). Benching is not required where fill is to be placed against the existing retaining wall at Abutment-5 Right.

A 1(v):2(h) slope is recommended for embankments; in locations where right of way is limited a 1(v):1.5(h) slope may be used as necessary with the understanding that Caltrans Class 3 Aggregate Subbase (or equivalent) should be used for slope construction. Increased erosion of surficial soils may result from steepened slopes. These areas in particular should have erosion protection measures implemented.

An expansive soil exclusion zone shall be used for bridge embankment construction as described in Caltrans "Guidelines for Structures Foundation Reports" Version 2.0 (March 2006) – provided below for reference:

> *Expansive soil materials shall not be placed as part of the embankment within the limits of a bridge abutment for the full width of the embankment. Expansive soil materials for this requirement are defined as having either an Expansion Index (EI) greater than 50 (EI to be determined in accordance with ASTM D 4829), or a Sand Equivalent (SE) less than 20 (SE to be determined in accordance with California Test 217). This requirement is exclusive of the structure backfill and pervious backfill material requirements as shown on the plans and set forth under Sections 19-3.06 and 19-3.065, respectively, in the Standard Specifications (Caltrans, 1999d). Refer to Section 5, Figure 5.4 (shown below) for the minimum limits for non-expansive soils within an embankment near a bridge.*

Typical Section: Expansive Soil Exclusion Zone in Bridge Embankment



H	d
<4.9m	1.2m
>4.9m	0

Source: California Department of Transportation (Caltrans), "Guidelines for Foundation Investigations and Reports", Version 2.0, March 2006.

Excavation Conditions

Groundwater is not anticipated during dry season construction. However, the presence of seepage from surface infiltration and/or through fractures within the rock unit cannot be precluded. Such seepage, if encountered, is expected to be of limited quantity and controllable by pumping from within embankments. At Pier-3 (L/R), adequate construction de-watering in foundation excavations is also expected to be achievable (at low channel flow) by means of diking/diversion of surface water and pumping.

Existing overburden materials (including embankment fill) and residual soils are expected to be readily excavated using typical earth moving equipment. Temporary (construction) backslope in existing fill embankment is expected to be appropriately stable at 1(v):1(h) or flatter. Some oversize material may be buried in existing fill (largest boring encounter on order of 3±m dimension). Consideration for shoring will be required for local areas of weak embankment and/or where existing supports/facilities may be undermined.

Mined-shafts at all pier locations will require excavation within "fresh to slightly" weathered rock. It is anticipated that blasting may be the most expedient and feasible means for such excavation. The use of air-tools to excavate rock at this site is expected to have limited effectiveness, limited to removing rock along existing fracture/joint planes within "intensely to moderately" weathered rock.

Particular care during blasting will be required to avoid disruption to the surrounding rock mass and bearing quality of foundation material. To reduce potential for overbreak and cracking of surrounding rock, controlled blasting techniques (e.g., line drilling, pre-splitting, cushion blasting) should be considered. Excavations should be thoroughly cleaned to remove and loose or deleterious materials. Any exposed open joints/fractures should be carefully evaluated by this office with respect to bearing considerations and cleaned/surfaced-grouted, if necessary.

Blasting should be performed in accordance with Caltrans "Standard Specifications" (including Section 7-1.10 and 19-2.03). The specifications and special provision developed for blasting should address safety issues and avoidance of damage to existing utilities, structures, and other natural and man-made features. Such procedures and specifications should be reviewed by this office.

Excavation and shoring should conform with CalOSHA requirements and the Caltrans "Trenching and Shoring Manual."

* * * * *

The conclusions presented in this report are based upon the indicated project criteria and the limited data as described. Variations in subsurface conditions may occur, and further, more detailed study could result in modification of conclusions and recommendations contained herein.

Should there be significant change in the project or should soils conditions different from those described in this report be encountered during construction, this office should be notified for evaluation and supplemental recommendations as necessary or appropriate. Early communication between the Resident Engineer, Contractor, and this office should be made as soon as differing conditions are recognized by any of the parties.

We appreciate the opportunity to provide service on this project.

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September 22, 2008

REL/FPT/MWM/CDT

GENERAL CONDITIONS

The conclusions and recommendations of this study are professional opinion based upon the indicated project criteria and the limited data described herein. It is recognized there is potential for variation in subsurface conditions and modification of conclusions and recommendations might emerge from further, more detailed study.

This report is intended only for the purpose, site location and project description indicated and assumes design and construction in accordance with Caltrans practice.

As changes in appropriate standards, site conditions and technical knowledge cannot be adequately predicted, review of recommendations by this office for use after a period of two years is a condition of this report.

A review by this office of any foundation and/or grading plans and specifications or other work product insofar as they rely upon or implement the content of this report, together with the opportunity to make supplemental recommendations as indicated therefrom is considered an integral part of this study and a condition of recommendations.

Subsequently defined construction observation procedures and/or agencies are an element of work, which may affect supplementary recommendations.

Should there be significant change in the project or should soils conditions different from those described in this report be encountered during construction, this office should be notified for evaluation and supplemental recommendations as necessary or appropriate.

Opinions and recommendations apply to current site conditions and those reasonably foreseeable for the described development--which includes appropriate operation and maintenance thereof. They cannot apply to site changes occurring, made, or induced, of which this office is not aware and has not had opportunity to evaluate.

The scope of this study specifically excluded sampling and/or testing for, or evaluation of the occurrence and distribution of, hazardous substances. No opinion is intended regarding the presence or distribution of any hazardous substances at this or nearby sites.

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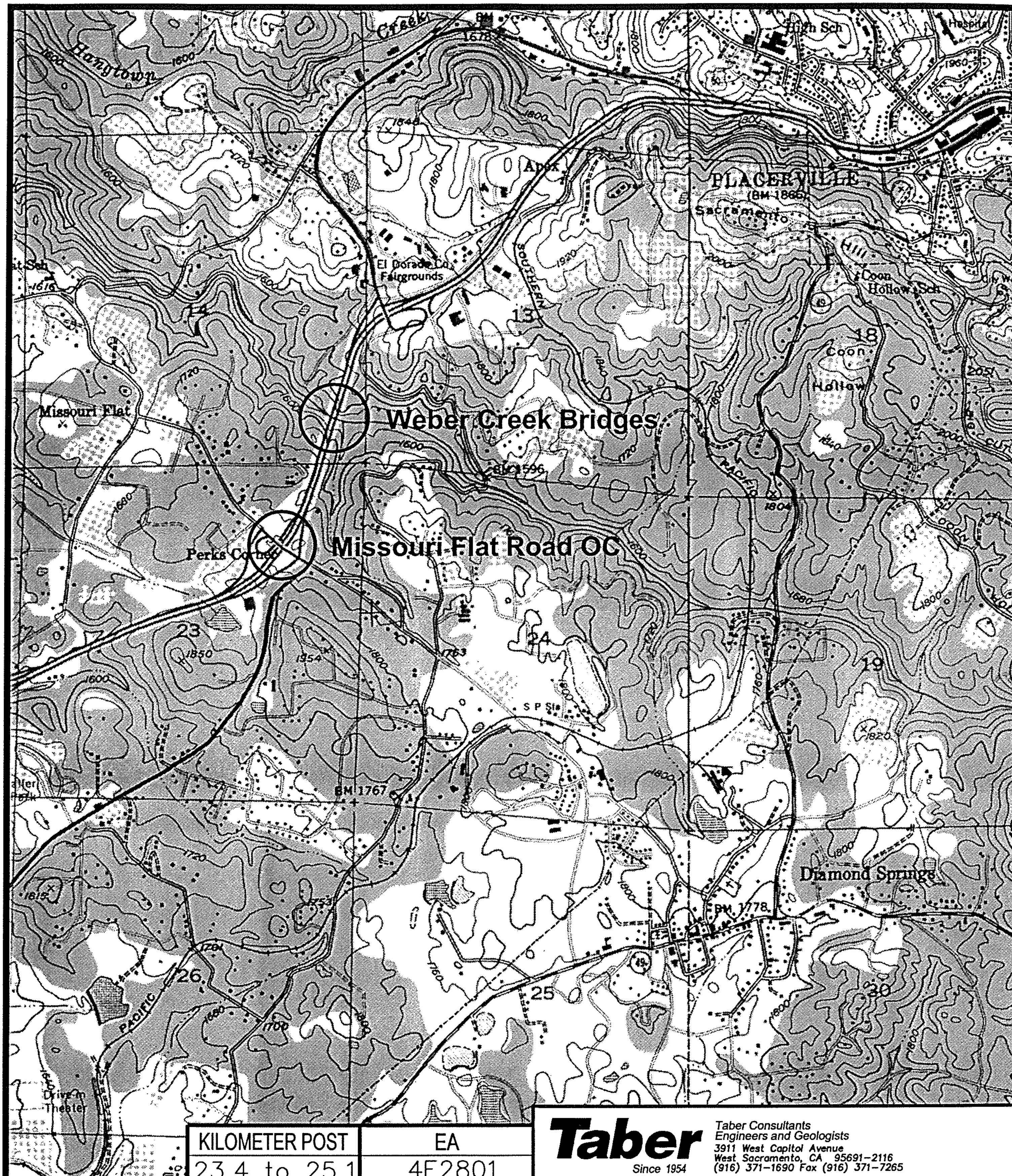

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USGS
"PLACERVILLE, CA"
QUADRANGLE 7.5 MINUTE SERIES (TOPOGRAPHIC), DATE 1949
PHOTOREVISED 1973

Quincy Engineering, Inc

Weber Creek Bridge (Widen)
El Dorado County, California

Vicinity Map

1P2/399/296-1.2W

Figure - 1

Generalized Earth Material Unit Profile with Engineering Properties

Weber Creek Bridge (Widen)
03-ED-50-23.2/25.4
Br. No. 25-05R/L
El Dorado County, California

Unit Designation	Generalized Earth Material Unit Description	Boring 05-39 (Abut-1)	05-11 (Pier-2L)	05-10 (Pier-2R)	05-08 (Pier-3L)	05-09 (Pier-3R)	05-07 (Pier-4L)	05-06 (Pier-4R)	05-18 (Abut-5)	05-40 (Abut-5)	Earth Material Parameters: Total Unit Weight	Buoyant Weight	Estimated Friction Angle ϕ	Estimated Cohesion c
											(kN/m³)	(kN/m³)	(degrees)	(kN/m²)
Existing ground at boring		510.03	488.49	487.20	467.93	468.02	474.14	475.55	504.15	504.04				
		Elevation at bottom of layer												
Unit 1 (Overburden)	(EMBANKMENT FILL) Medium dense - dense CLAYEY SAND with GRAVEL/COBBLES/BOULDERS	504.6	Not Encountered								19.0 - 19.4	9.2 - 9.6	30-34	0-25
	(TEMP FILL/ALLUVIUM/COLLUVIUM) Loose - medium dense (locally dense) SILTY/CLAYEY SAND with GRAVEL/COOBLES/BOULDERS	Not Encountered	485.04	483.84	465.97	466.49	470.87	472.22	Not Encountered		13.7 - 19.0	3.9 - 9.2	15 - 25	0 - 55
Unit 2A (Decomposed - Intensely Weathered Metamorphic Rock)	Hard SILTY CLAY/very dense SILTY SAND with GRAVEL/Very Intensely - intensely weathered/fractured, moderatley hard and hard METAMORPHIC ROCK		481.99	480.30	464.51	465.82	464.99	462.62	Not Encountered		20.0 - 20.7	10.2 - 10.9	15 - 25	100 - 200
Unit 2B (Less Weathered Metamorphic Rock)	Slightly weathered and fresh, hard - very hard, very intensely to moderately fractured METAMORPHIC ROCK	Not Encountered							Not Encountered		25 - 28 *	N/A	25 - 45	200 - 400
Bottom elevation of referenced test boring		499.43	465.38	465.92	451.04	450.58	455.51	453.63	494.75	498.44				
Groundwater Elevation		See Note 5												

* Based on typical rock properties for Metamorphic Rock; source: "Rock Slope Engineering" (3rd Edition), Hoek and Bray, 1981.

Notes:

1) For Unit 2B Metamorphic Rock, the unit weight of the material does not vary significantly between saturated and dry states.
2) For design use the following:
   Granular Layers: ϕ (varies as shown) and $S_u = 0$
   Cohesive Layers: S_u (varies as shown) and $\phi = 0$
3) Friction angle and cohesion of Unit 2A and Unit 2B rock estimated based on Rock Mass Rating (see Appendix-C).
4) Indicated depth to rock is based on boring encounters. Acutal depth to rock at/along individual pier supports is expected to vary due to sloping ground and/or irregular rock surface. Top of rock has been estimated at individual supports as discussed/outlined in the foundation report.
5) Based on visual logging of soil samples in borings completed in May/June 2005, free groundwater was measured in Boring 05-09 at 0.61m depth (elev. 467.41), reflecting water level within Weber Creek at time of drilling. No seepage or groundwater was noted within the augered intervals (lowest elev. 466.03) of Borings 05-6, 05-7, 05-10, 05-11, 05-18, 05-39 and 05-40. Groundwater was not measured in those borings below the augered intervals or in Boring 05-8 due to caving conditions and/or presence of residual drill fluid. Groundwater occurrences in the underlying less weathered/fractured rock are expected to be restricted to open fracture/joint planes and localized/limited in extent and quantity. Seasonal fluctuations of groundwater would not be unexpected. Occurrences of relatively shallow "perched" groundwater overlying the rock may be present, particularly during the wet season and/or wetter years.

Soil engineering properties and strength/bearing characteristics of foundation materials selected for use in this report have been derived/established from a combination of:

- visual logging of earth materials and drilling procedures by an engineer-geologist,
- laboratory testing of earth materials obtained during field exploration,
- correlation with "Standard Penetration Test" results, and
- professional engineering experience/judgement.

These parameters are for reference and guidance only; geotechnical criteria and constraints for any project element should be evaluated with respect to sensitivity of application, source data, etc. The need for additional study and/or revision should be considered in all cases.

Taber
Since 1954

Post km 23.4/25.1
EA 4E2801

Caltrans SDC: ARS Curve

1P2/399/296-1.2W

Weber Creek Bridge (Widen)
El Dorado County, California

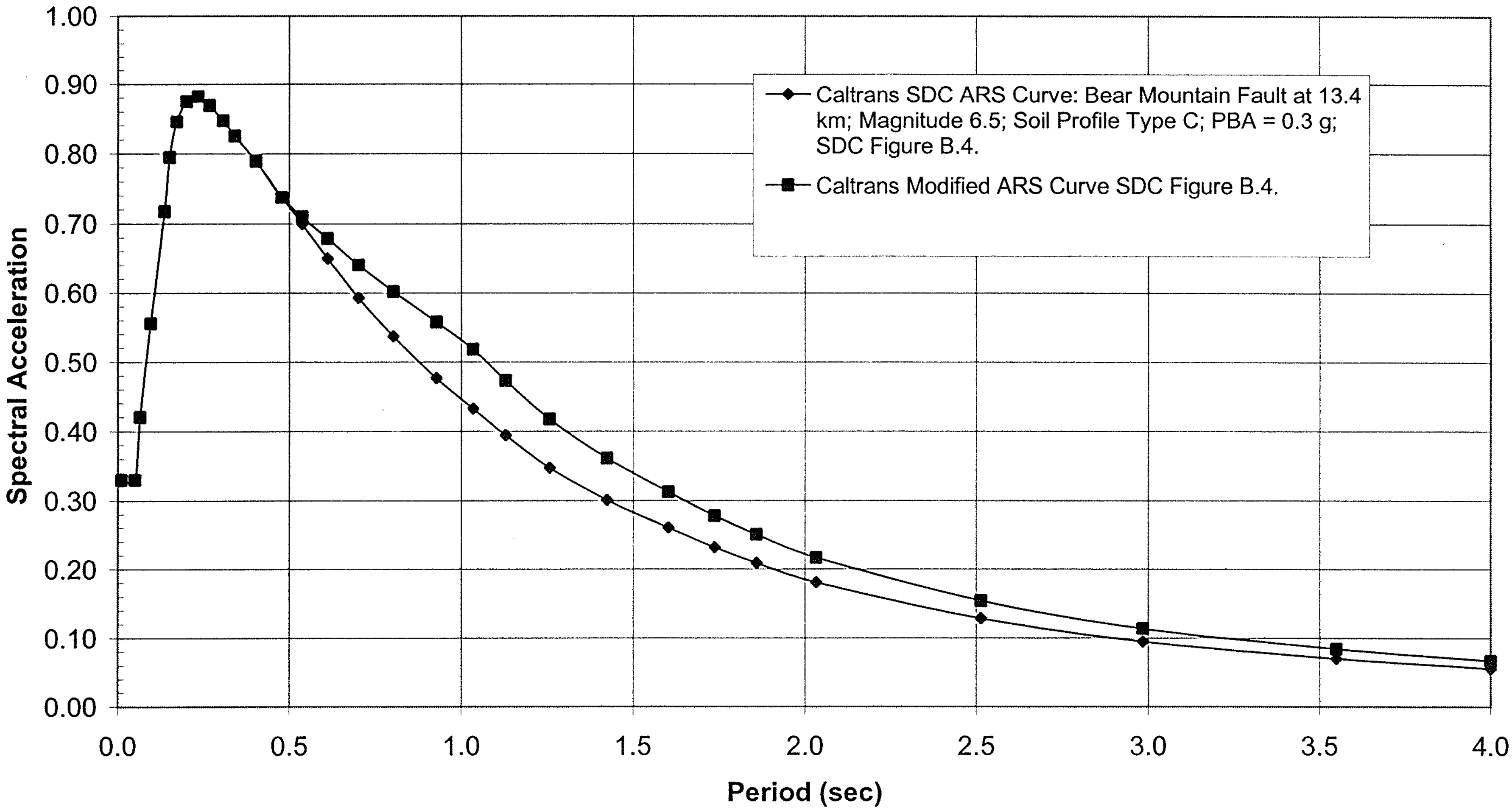


Figure-3

Taber
Since 1954

WEATHERING DESCRIPTORS

Modified from United States Bureau of Reclamation, Engineering Geology Field Manual.

Descriptors	Diagnostic features: Chemical weathering—Discoloration and/or oxidation		Mechanical weathering—Grain boundary conditions (disaggregation) primarily for granitics and some coarse-grained sediments	Texture and solutioning		General characteristic (strength, excavation, etc.)§
	Body of rock	Fracture surfaces†		Texture	Solutioning	
Fresh	No discoloration, not oxidized	No discoloration or oxidation	No separation, intact (tight)	No change	No solutioning	Hammer rings when crystalline rocks are struck. Almost always rock excavation except for naturally weak or weakly cemented rocks such as siltstones or shales.
Slightly weathered to fresh*						
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. With few exceptions, such as siltstones or shales, classified as rock excavation.
Moderately to slightly weathered*						
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. Depending on fracturing, usually is rock excavation except in naturally weak rocks such as siltstones or shales.
Intensely to moderately weathered*						
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. Usually common excavation.
Very intensely weathered*						
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. Always common excavation. Resistant minerals such as quartz may be present as "stringers" or "dikes".

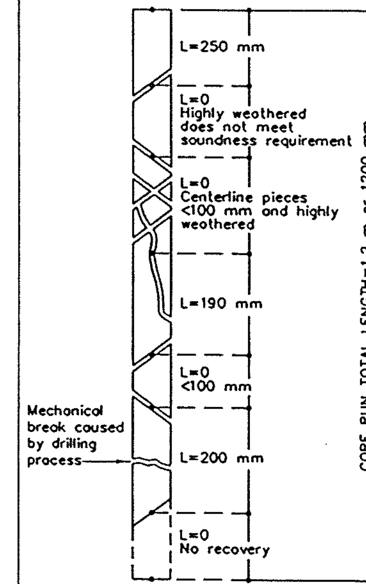
NOTE: This chart and its horizontal categories are more readily applied to rocks with feldspars and mafic minerals. Weathering in various sedimentary rocks, particularly limestones and poorly indurated sediments, will not always fit the categories established. This chart and weathering categories may have to be modified for particular site conditions or alterations such as hydrothermal effects; however, the basic framework and similar descriptors are to be used.

* Combination descriptors are permissible where equal distribution of both weathering characteristics are present over significant intervals or where characteristics present are "in between" the diagnostic feature. However, dual descriptors should not be used where significant, identifiable zones can be delineated. When given as a range, only two adjacent terms may be combined (i.e., decomposed to slightly weathered or moderately weathered to fresh) are not acceptable.

† Does not include directional weathering along shears or faults and their associated features. For example, a shear zone that carried weathering to great depths into a fresh rock mass would not require the rock mass to be classified as weathered.

§ These are generalizations and should not be used as diagnostic features for weathering or excavation classification. These characteristics vary to a large extent based on naturally weak materials or cementation and type of excavation.

RQD LOGGING



$$RQD = \frac{\sum \text{Length of sound core} > 100 \text{ mm pieces}}{\text{Total core run length}}$$

$$RQD = \frac{250+190+100}{1200} \times 100\%$$

RQD= 53% (fair)

RQD (ROCK QUALITY DESIGNATION)	DESCRIPTION OF ROCK QUALITY
0 – 25%	VERY POOR
25 – 50%	POOR
50 – 75%	FAIR
75 – 90%	GOOD
90 – 100%	EXCELLENT

After Deere & Deere, 1989

IGNEOUS AND METAMORPHIC ROCK GRAIN SIZE DESCRIPTORS

Descriptors	Average Crystal Diameter
Very coarse-grained or pegmatic	>10 mm (>3/8 in)
coarse-grained	5–10 mm (3/16–3/8 in)
medium-grained	1–5 mm (1/32–3/16 in)
fine-grained	0.1–1 mm (0.04–1/32 in)
Aphantic (cannot be seen with the unaided eye)	<0.1 mm (<0.04 in)

FRACTURE DENSITY

Modified from United States Bureau of Reclamation, Engineering Geology Field Manual.

FRACTURE DENSITY—Based on the spacing of all natural fractures in an exposure or core recovery lengths in boreholes; excludes mechanical breaks, shears, and shear zones; however, shear-distributed zones (fracturing outside the shear) are included. Descriptors for fracture density apply to all rock exposures such as tunnel walls, dozer trenches, outcrops, or foundation cut slopes and inverts, as well as boreholes. Descriptive criteria presented below are based on borehole cores where lengths are measured along the core axis, for other exposures the criteria is distance measured between fractures (size of blocks).

UNFRACTURED (FDØ): No fractures.

VERY SLIGHTLY FRACTURED (FD1): Core recovered mostly in lengths greater than 1 m.

SLIGHTLY TO VERY SLIGHTLY FRACTURED (FD2) *

SLIGHTLY FRACTURED (FD3): Core recovered mostly in lengths from 300 to 1000 mm, with few scattered lengths less than 300 mm or greater than 1000 mm.

MODERATELY TO SLIGHTLY FRACTURED (FD4) *

MODERATELY FRACTURED (FD5): Core recovered mostly in 100 to 300 mm lengths with most lengths about 200 mm.

INTENSELY TO MODERATELY FRACTURED (FD6) *

INTENSELY FRACTURED (FD7): Lengths average from 30 to 100 mm with scattered fragmented intervals. Core recovered mostly in lengths less than 100 mm.

VERY INTENSELY TO INTENSELY FRACTURED (FD8) *

VERY INTENSELY FRACTURED (FD9): Core recovered mostly as chips and fragments with a few scattered short core lengths.

* Combinations of fracture densities (e.g. very intensely to intensely fractured or moderately to slightly fractured) are used where equal distribution of both fracture density characteristics are present over a significant interval or exposure, or where characteristics are "in between" the descriptor definitions.

ROCK HARDNESS/STRENGTH DESCRIPTORS

Alphanumeric Descriptor	Descriptor	Criteria
H1	Extremely hard	Core, fragment, or exposure cannot be scratched with knife or sharp pick; can only be chipped with repeated heavy hammer blows.
H2	Very hard	Can be scratched with knife or sharp pick. Core or fragment breaks with repeated heavy hammer blows.
H3	Hard	Can be scratched with knife or sharp pick with difficulty (heavy pressure). Heavy hammer blow required to break specimen.
H4	Moderately hard	Can be scratched with knife or sharp pick with light or moderate pressure. Core or fragment breaks with moderate hammer blow.
H5	Moderately soft	Can be grooved 1/16 inch (2 mm) deep by knife or sharp pick with moderate or heavy pressure. Core or fragment breaks with light hammer blow or heavy manual pressure.
H6	Soft	Can be grooved or gouged easily by knife or sharp pick with light pressure, can be scratched with fingernail. Breaks with light to moderate manual pressure.
H7	Very soft	Can be readily indented, grooved or gouged with fingernail, or carved with a knife. Breaks with light manual pressure.

Any bedrock unit softer than H7, very soft, is to be described using soil consistency descriptors.

NOTE: Although "sharp pick" is included in these definitions, descriptions of ability to be scratched, grooved or gouged by a knife is the preferred criteria.
Modified from United States Bureau of Reclamation, Engineering Geology Field Manual.

BEDDING, FOLIATION, OR FLOW TEXTURE DESCRIPTORS

Descriptors	Thickness/spacing
Massive	Greater than 3 m
Very thickly (bedded, foliated, or banded)	1 to 3 m
Thickly	300 mm to 1 m
Moderately	100 to 300 mm
Thinly	30 to 100 mm
Very thinly	10 to 30 mm
Laminated (intensely foliated or banded)	Less than 10 mm

Modified from United States Bureau of Reclamation, Engineering Geology Field Manual.

DESIGN OVERSIGHT	DRAWN BY	M. D. Robertson	R. E. Loitzenhiser, FIELD INVESTIGATOR	PREPARED FOR THE County of El Dorado Department of Transportation
SIGN OFF DATE	CHECKED BY	W. E. Nichols	DATE April – June 2005	

PROJECT ENGINEER

BRIDGE NO.	25-05R/L
KP	25.2(R15.7)

Weber Creek Bridge (Widen)

ENGINEERING GEOLOGY FIELD DESCRIPTORS

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 20 40 60 80

CU 03198
EA 370000

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

DRAWING-1

10/10/07 1P2399296-1a.dwg

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
03	ED	50	23.4/25.1		

95% SUBMITTAL

REGISTERED CIVIL ENGINEER

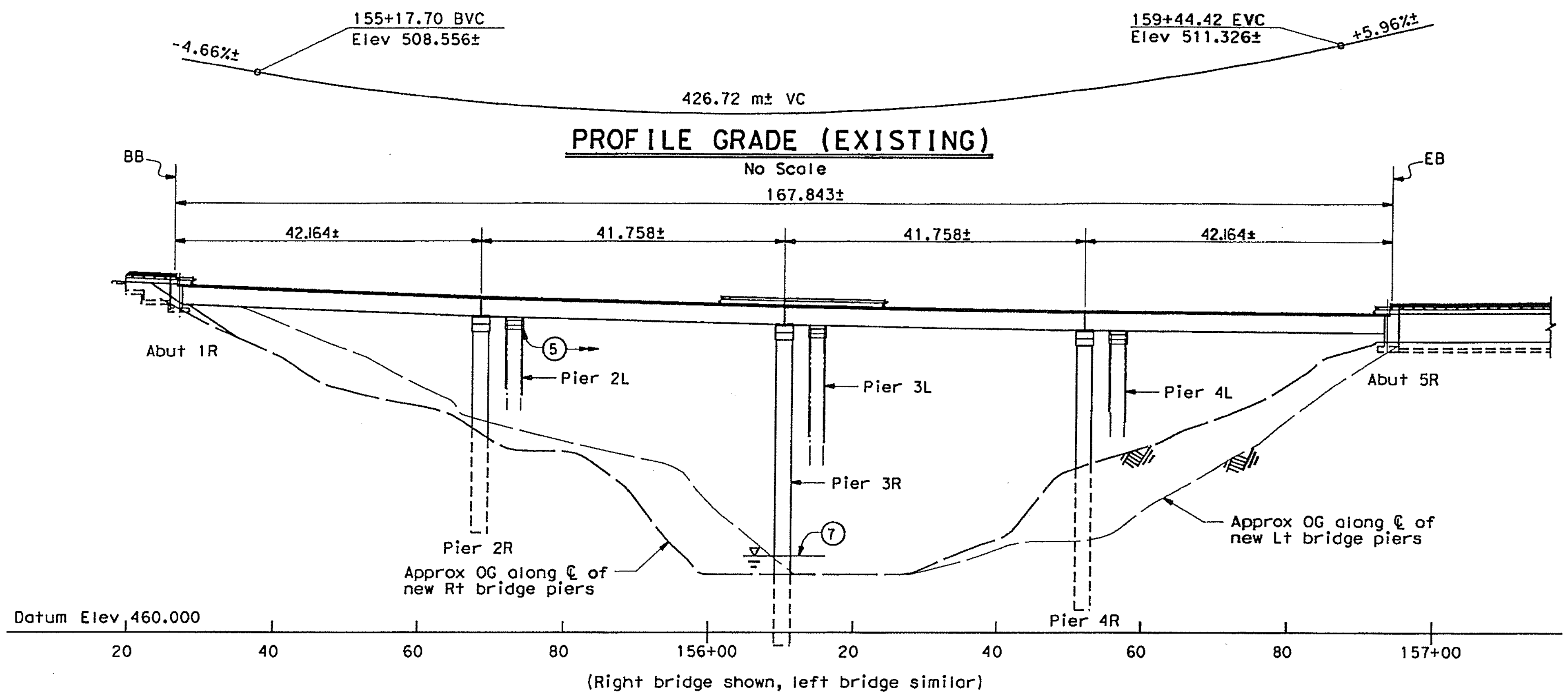
PLANS APPROVAL DATE

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

REGISTERED PROFESSIONAL ENGINEER Mario Quest No. C41055 Exp. 3-31-09 CIVIL STATE OF CALIFORNIA

Quincy Engineering, Inc.
3247 Ramos Circle
Sacramento, CA 95827

El Dorado County
2850 Fairlane Court
Placerville, CA 95667

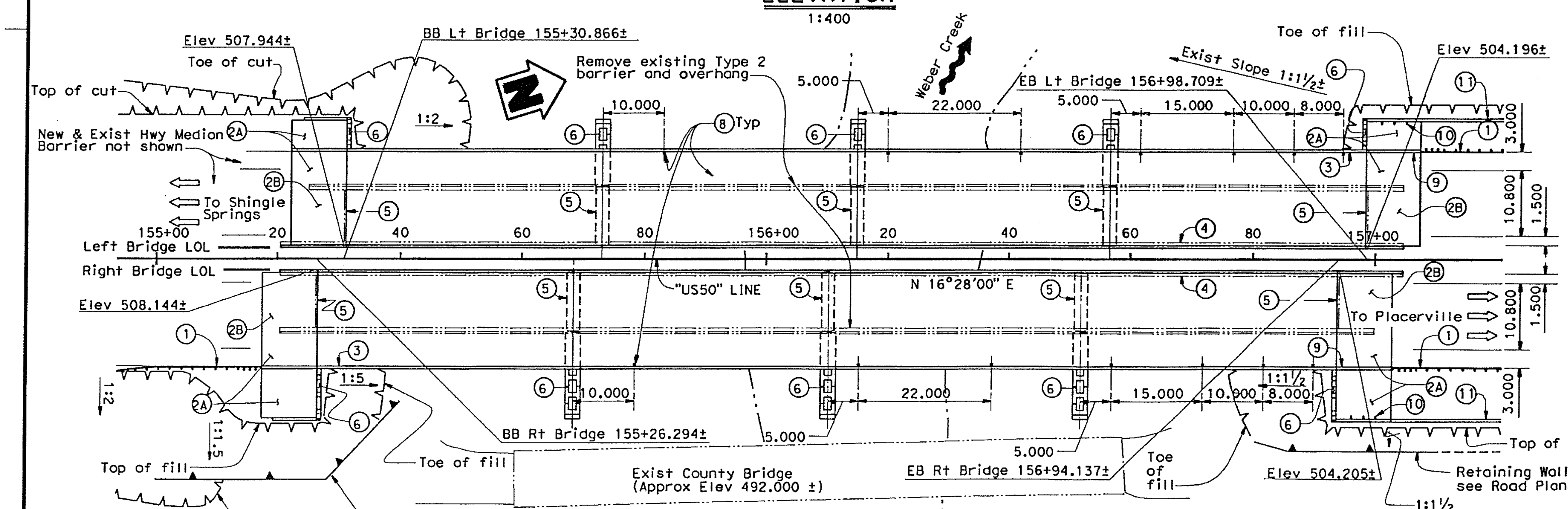


PROFILE GRADE (EXISTING)

No Scale

ELEVATION

1:400



Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

PLAN

1:400

Notes:

1. MBGR, see Road Plans.
2A. Structure Approach Type N(9S). Omit polyester concrete overlay on future widening portion of approach slab behind concrete railing.
2B. Structure Approach Type R(9S).
3. Paint Bridge Name and Number.
4. Replace existing Type 2 concrete barrier with Concrete Barrier Type 736R (Mod).
5. Seismic Retrofit: Existing bent caps, cross frames, Pier 4 foundations, and abutments.
6. Abutments and piers to be constructed for future ultimate width.
7. For Hydrologic Summary, see "General Plan No. 2" sheet.
8. Deck drains, see "Deck Drain Details" sheet.
9. Provide scuppers in Abutment 5 rails on approach slabs at 1.2 meters on center. See Scupper Detail on "Typical Section No. 2" sheet.
10. Provide Type A drains total of 3 in Abutment 5L & 5R approach slabs, low side. See "Structure Approach Drainage Details" sheet for details and spacing.
11. See abutment sheets for retaining wall details.

---- Indicates existing structure.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

DESIGN OVERSIGHT	DESIGN	BY M. Quest	CHECKED J. Foster	LOAD FACTOR DESIGN	LIVE LOADING: HS20-44 AND ALTERNATIVE AND PERMIT DESIGN LOAD	
	DETAILS	BY J. Blond	CHECKED J. Foster	LAYOUT	BY M. Quest	CHECKED L. Mason/J. Chou
SIGN OFF DATE	QUANTITIES	BY	CHECKED	SPECIFICATIONS	BY	PLANS AND SPECS COMPARED

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Mario Quest
PROJECT ENGINEER

BRIDGE NO. 25-05R/L

KILOMETER POST 25.2(R15.7)

WEBER CREEK BRIDGE (WIDEN)

GENERAL PLAN No. 1

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET No	TOTAL SHEETS
03	ED	50	23.4/25.1		

95% SUBMITTAL

REGISTERED CIVIL ENGINEER

PLANS APPROVAL DATE

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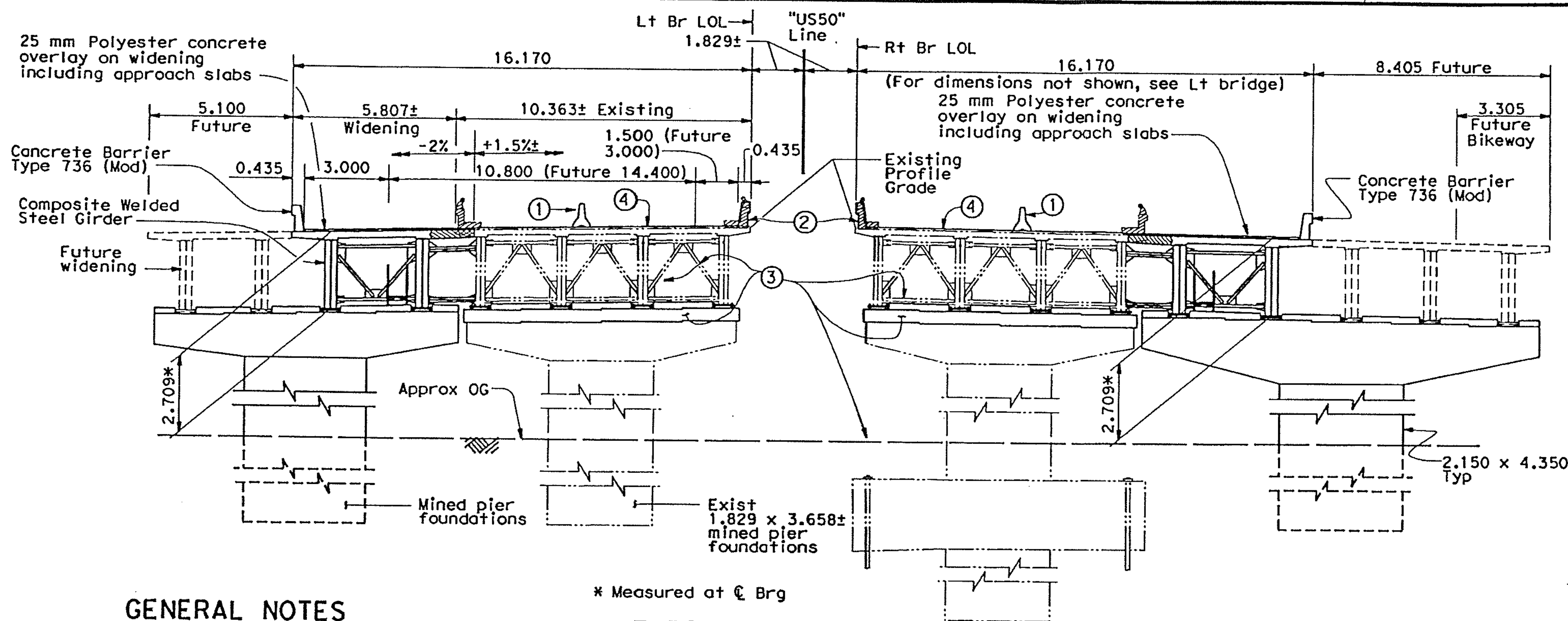
REGISTERED PROFESSIONAL ENGINEER, Mario Quest, No. C41055, Exp. 3-31-09, CIVIL, STATE OF CALIFORNIA

Quincy Engineering, Inc.
3247 Ramos Circle
Sacramento, CA 95827

El Dorado County
2850 Fairlane Court
Placerville, CA 95667



TYPICAL SECTION

1:100

Notes:

1. Temporary Railing Type K, see "Stage Construction" sheet.
2. Replace existing Type 2 Barrier with Concrete Barrier Type 736R (Mod).
3. Seismic Retrofit: Existing bent caps, end cross frames, Pier 4 foundations, and abutments.
4. Existing 3"AC overlay to be removed. Rehab existing deck and approach slabs with 25 mm polyester concrete overlay. Reconstruct existing deck joints. Place joint seals.

Legend:

- ---- Indicates existing structure
- Indicates Bridge Removal (Portion)
- Indicates Closure Pour

GENERAL NOTES LOAD FACTOR DESIGN

DESIGN: BRIDGE DESIGN SPECIFICATIONS - APRIL 2000 LFD (1996 AASHTO with Interims and Revisions by CALTRANS)

SEISMIC DESIGN: Caltran Seismic Design Criteria (SDC), Version 1.4 June 2006 with modifications

DEAD LOAD: 25mm polyester concrete wearing surface included. No additional future wearing surface included.

LIVE LOADING: HS20-44 and alternative and permit design load.

SEISMIC LOADING: SDC ARS curve profile for Soil Type C (M = 6.5± 0.25) Peak Rock Acceleration = 0.3 g, increased by up to 20% for proximity to fault.

REINFORCED CONCRETE:
f_y = 420 MPa
f'_c = 25 MPa
n = 9
Transverse Deck Slabs (Working Stress Design)
f_s = 138 MPa
f_c = 8.3 MPa
n = 10

STRUCTURAL STEEL: ASTM A709 Grade 345
f_y = 345 MPa

H.S. STEEL (RODS & ROCK ANCHORS): Bars - ASTM designation A722 Type II
f_{pu} = Ultimate stress of rod and rock anchor steel (1030 MPa)

H.S. BOLTS: ASTM A325 (non metric designation)

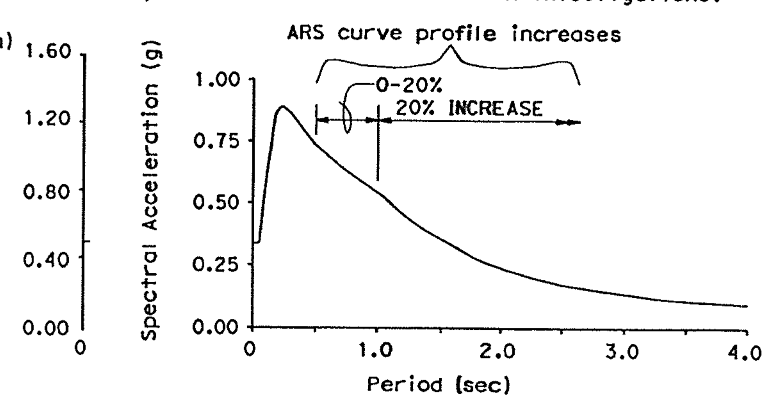
Note:
The Contractor shall verify all controlling field dimensions before ordering or fabricating any material.

HYDROLOGIC SUMMARY

Drainage area: 89.700 Square Kilometers

	Design Flood	Base Flood	
Frequency (years)	50	100	
Discharge (cubic meters per second)	176	209	
Water Surface Elevation at Bridge (m)	470.390	470.730	(Rt Bridge)
	470.090	470.440	(Lt Bridge)

Flood plain data based upon information available when the plans were prepared and are shown to meet Federal requirements. The accuracy of said information is not warranted by the County and interested or affected parties should make their own investigations.



ACCELERATION RESPONSE SPECTRA CURVE

No Scale

SPREAD FOOTING DATA TABLE

Support Location	Allowable Bearing Capacity (q_{all}) (1)	Normal Bearing Resistance (q_n)
Abut-1 L	192 kPa	N/A
Abut-1 R	192 kPa	N/A
Abut-5 L	192 kPa	N/A
Abut-5 R	192 kPa	N/A

Notes: (1) Allowable shown in Table is based on engineered fill prism under footings. Higher allowable bearing capacity of 237 kPa was used with Class 2 AB fill and 288 kPa with Class 4 Concrete Backfill prisms under footings. Allowables based on Working Stress Design (WSD).

PIER COLUMN DATA TABLE

Location	Dimension (m)	Design Loading	Nominal Resistance: Compression (kN)	Nominal Resistance: Tension (kN)	Cut-off Elevation	Design Pier Tip Elevation	Specified Pier Tip Elevation
Pier 2 Left	2.300 x 4.500	N/A	13,700	0	487.5	482.0 (1), 477.7 (3)	477.7
Pier 2 Right	2.300 x 4.500	N/A	16,650	0	486.5	478.0 (1), 473.7 (3)	473.7
Pier 3 Left	2.300 x 4.500	N/A	19,700	0	466.5	461.5 (1), 457.2 (3)	457.2
Pier 3 Right	2.300 x 4.500	N/A	20,950	0	466.5	462.5 (1), 458.2 (3)	458.2
Pier 4 Left	2.300 x 4.500	N/A	17,100	0	473.5	467.5 (1), 462.6 (3)	462.6
Pier 4 Right	2.300 x 4.500	N/A	18,450	0	482.5	468.0 (1), 463.1 (3)	463.1

Design bottom of shaft elevations are controlled by the following demands: (1) Compression; (2) Tension; (3) Lateral loads.

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

DESIGN OVERSIGHT	DESIGN	BY M. Quest	CHECKED J. Foster	LOAD FACTOR DESIGN	LIVE LOADING: HS20-44 AND ALTERNATIVE AND PERMIT DESIGN LOAD
SIGN OFF DATE	DETAILS	BY J. Blond	CHECKED J. Foster	LAYOUT	BY M. Quest; CHECKED L. Mason/J. Chou
	QUANTITIES	BY	CHECKED	SPECIFICATIONS	BY; PLANS AND SPECS COMPARED

DESIGN GENERAL PLAN SHEET (METRIC) (REV. 3/1/99)

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

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Mario Quest
PROJECT ENGINEER

BRIDGE NO. 25-05R/L
KILOMETER POST 25.2(R15.7)

CU 03198
EA 4E2801

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 2 OF 54

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WEBER CREEK BRIDGE (WIDEN)

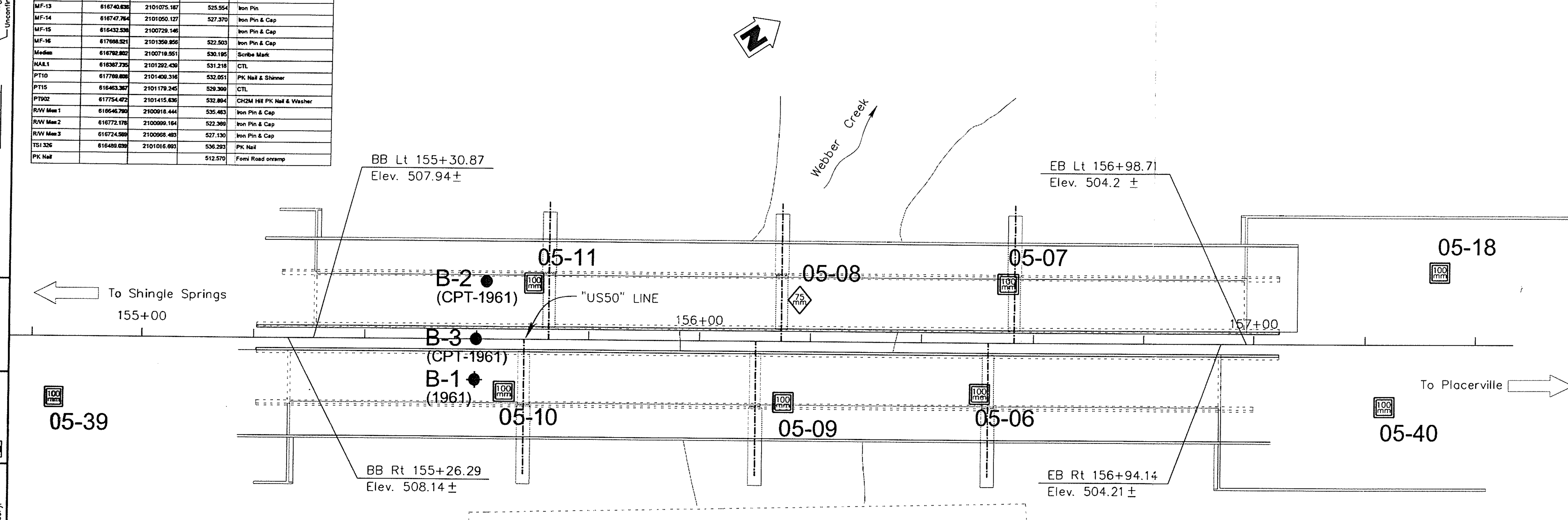
GENERAL PLAN No. 2

BENCH MARKS

Boring Locations and elevations established by Topographic Surveys, Inc. using NGVD 1929 – Metric for the vertical datum

MISSOURI FLAT ROAD PROJECT BENCHMARKS

POINT	NORTH (m)	EAST (m)	ELEV (m)	DESCRIPTION
#2	616695.714	2100613.970	536.669	PK Nail
25-197	616585.485	2100977.820	540.100	Brass Disc
25-198	616639.420	2100904.612	540.124	Brass Disc
Bridge	616606.833	2100945.621	540.934	Nail
HPGN 03 DM	616442.252	2100946.148	541.464	Brass Disc in Monument Well
HV-13	616658.923	2100645.380	538.644	Nail
HV-18	616538.925	2101066.291	530.367	Nail
MF-1	616356.911	2101344.400	532.678	PK Nail
MF-2	616478.420	2101134.789	533.053	PK Nail & Shinner
MF-3	616581.296	2100960.675	539.487	PK Nail & Shinner
MF-4	616646.412	2100892.927	540.124	PK Nail & Shinner
MF-5	616782.292	2100742.683	530.972	PK Nail & Shinner
MF-6	616863.842	2100676.680	526.770	PK Nail & Shinner
MF-7	616965.131	2100625.885	525.381	PK Nail & Shinner
MF-8	616763.836	2100979.824	526.612	Iron Pin & Cap
MF-9	616812.587	2100680.801	528.981	40d Nail
MF-10	616760.388	2100949.239	527.460	PK Nail
MF-11	616482.168	2101077.545	535.079	40d Nail
MF-12	616590.886	2101046.565	533.314	PK Nail & Shinner
MF-13	616740.638	2101075.187	525.554	Iron Pin
MF-14	616747.764	2101050.127	527.370	Iron Pin & Cap
MF-15	616432.538	2100729.146		Iron Pin & Cap
MF-16	617668.521	2101359.956	522.503	Iron Pin & Cap
Median	616792.882	2100719.551	530.195	Scribe Mark
NAIL1	616387.735	2101292.439	531.218	CTL
PT10	617769.838	2101409.316	532.051	PK Nail & Shinner
PT15	616463.367	2101179.245	529.399	CTL
PT902	617754.472	2101415.636	532.894	CH2M Hill PK Nail & Washer
R/W Mon 1	616646.790	2100918.444	535.483	Iron Pin & Cap
R/W Mon 2	616772.178	2100999.164	522.369	Iron Pin & Cap
R/W Mon 3	616724.569	2100968.493	527.130	Iron Pin & Cap
TSI 326	616489.639	2101016.693	536.293	PK Nail
PK Nail			512.570	Forni Road onramp



PLAN
1:400

LEGEND OF BORING OPERATIONS

95-1 — Year boring drilled, Boring number; Size of Samper (mm); Description of material — Total unit weight (kN/m³), % moisture; Sieve Analysis; Date measured; Conformable material change; Estimated material change; Unconformable material change; Point Load Test — Point Load Index (mPa), Failure Load (Kn); Unconfined Compression Test — Water content (%), Unit dry weight g/cm³, Unconfined Compressive Strength (kN/m³); Top Hole El; Casing driven; Sample No.; Unconfined compressive strength (kN/m²); Number of blows to produce 305 mm of penetration after the initial 152 mm of seating using a 63.5 kg hammer with a 760 mm drop, or as specified; Number of blows required to produce the indicated penetration after initial 152 mm seating; *50 blows produced the indicated penetration during the initial 152 mm interval; REC=70%, RQD=24%; Core run; Boring Date

ROTARY SAMPLE BORING (WET)

95-1 — Top Hole El; No count recorded; Pushed; Driving rate in blows per 305 mm using a 63.5 kg hammer with 760 mm drop or as noted; OHS ▽ Elev. Date measured; Boring Date

65 mm CONE PENETRATION BORING

IN-SITU, LAB & FIELD TEST DESIGNATIONS

(AL) Atterberg Limits; (CA) Chemical Analysis; (CN) Consolidation; (CU) Consolidated Undrained Triaxial; (DS) Direct Shear; (MD) Max. Dry Density; (PP) Pocket Penetrometer; (SA) Sieve Analysis; (TV) Torvane; (UC) Unconfined Compression; (UU) Unconsolidated Undrained Triaxial; (VS) Vane Shear

TYPES OF BORINGS

65 mm CONE PENETRATION; ROTARY SAMPLE BORING (WET); ELECTRONIC CONE PENETROMETER; AUGER BORING (DRY); TEST PIT; DIAMOND CORE BORING; AIR ROTARY BORING (DRY); HOLLOW STEM AUGER BORING; WIRELINE BORING

LEGEND OF MATERIALS (USCS) BASED ON ASTM D2487, D2488

FILL MATERIAL; CLAY (CL or CH); SILT (ML or MH); PEAT and/or ORGANIC MATTER; WELL-GRADED GRAVEL (GW); POORLY-GRADED GRAVEL (GP); SILTY GRAVEL (GM); CLAYEY GRAVEL (GC); POORLY-GRADED SAND (SP); WELL-GRADED SAND (SW); SILTY SAND (SM) or SANDY SILT; CLAYEY SAND (SC) or SANDY CLAY; COBBLES/BOULDERS; IGNEOUS ROCK; SEDIMENTARY ROCK; METAMORPHIC ROCK

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test (ASTM D-1586)

SPT N-Value (Blows/305mm)	Granular	SPT N-Value (Blows/305mm)	Cohesive
0–4	Very Loose	<2	Very Soft
5–10	Loose	2–4	Soft
11–30	Medium Dense	5–8	Firm
31–50	Dense	9–15	Stiff
>50	Very Dense	16–30	Very Stiff
		>30	Hard

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

DIST.	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
03	ED	50	23.4 to 25.1		

Caltrans Metric

9-22-2008
CERTIFIED ENGINEERING GEOLOGIST — DATE

REGISTERED GEOLOGIST MARTIN W. McILROY No. 2322 EXP. 03-31-09 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

PLANS APPROVAL DATE

TABER CONSULTANTS
3911 West Capitol Avenue
West Sacramento, CA 95691-2116
JOB No. 1P2/399/296-1 LOCATION: 38120-F7: 334N:244W

Quincy Engineering, Inc.
3247 Ramos Circle
Sacramento, CA 95827-2512

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.

DESIGN OVERSIGHT
SIGN OFF DATE
DESIGN By M. D. Robertson
CHECKED By R. E. Loutzenhiser
FIELD INVESTIGATION BY: M. W. McIlroy and R. E. Loutzenhiser May 2005

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Mario Quest
PROJECT ENGINEER

BRIDGE NO. 25-05R/L
KILOMETER POST 23.4 to 25.1

WEBER CREEK BRIDGE (WIDEN)

LOG OF TEST BORINGS 1 OF 6

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

CU 03198
EA 4E2801

DISREGARD PRINTS BEARING EARLIER REVISION DATES — 09/05/08
REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 49 OF 54

9/19/08 1P2399296-1.2Wo.dwg

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test (ASTM D-1586)

SPT N-Value (Blows/305mm)	Granular	SPT N-Value (Blows/305mm)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very Stiff
		>30	Hard

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

LEGEND OF MATERIALS (USCS) BASED ON ASTM D2487, D2488

- FILL MATERIAL
- POORLY-GRADED SAND (SP)
- CLAY (CL or CH)
- WELL-GRADED SAND (SW)
- SILT (ML or MH)
- SILTY SAND (SM) or SANDY SILT
- PEAT and/or ORGANIC MATTER
- CLAYEY SAND (SC) or SANDY CLAY
- WELL-GRADED GRAVEL (GW)
- COBBLES/ BOULDERS
- POORLY-GRADED GRAVEL (GP)
- IGNEOUS ROCK
- SILTY GRAVEL (GW)
- SEDIMENTARY ROCK
- CLAYEY GRAVEL (GC)
- METAMORPHIC ROCK

TYPES OF BORINGS

- 65 mm CONE PENETRATION
- ROTARY SAMPLE BORING (WET)
- ELECTRONIC CONE PENETROMETER
- AUGER BORING (DRY)
- TEST PIT
- DIAMOND CORE BORING
- AIR ROTARY BORING (DRY)
- HOLLOW STEM AUGER BORING
- WIRELINE BORING

IN-SITU, LAB & FIELD TEST DESIGNATIONS

- (AL) Atterberg Limits
- (CA) Chemical Analysis
- (CN) Consolidation
- (CU) Consolidated Undrained Triaxial
- (DS) Direct Shear
- (MD) Max. Dry Density
- (PP) Pocket Penetrometer
- (SA) Sieve Analysis
- (TV) Torvane
- (UC) Unconfined Compression
- (UU) Unconsolidated Undrained Triaxial
- (VS) Vane Shear

LEGEND OF BORING OPERATIONS

Casing driven; Sample No.; Size of Samper (mm); Unconfined compressive strength (kN/m²); Number of blows to produce 305 mm of penetration after the initial 152 mm of seating using a 63.5 kg hammer with a 760 mm drop, or as specified.; Number of blows required to produce the indicated penetration after an initial 152 mm seating.; *50 blows produced the indicated penetration during the initial 152 mm interval.; Core run; Boring Date

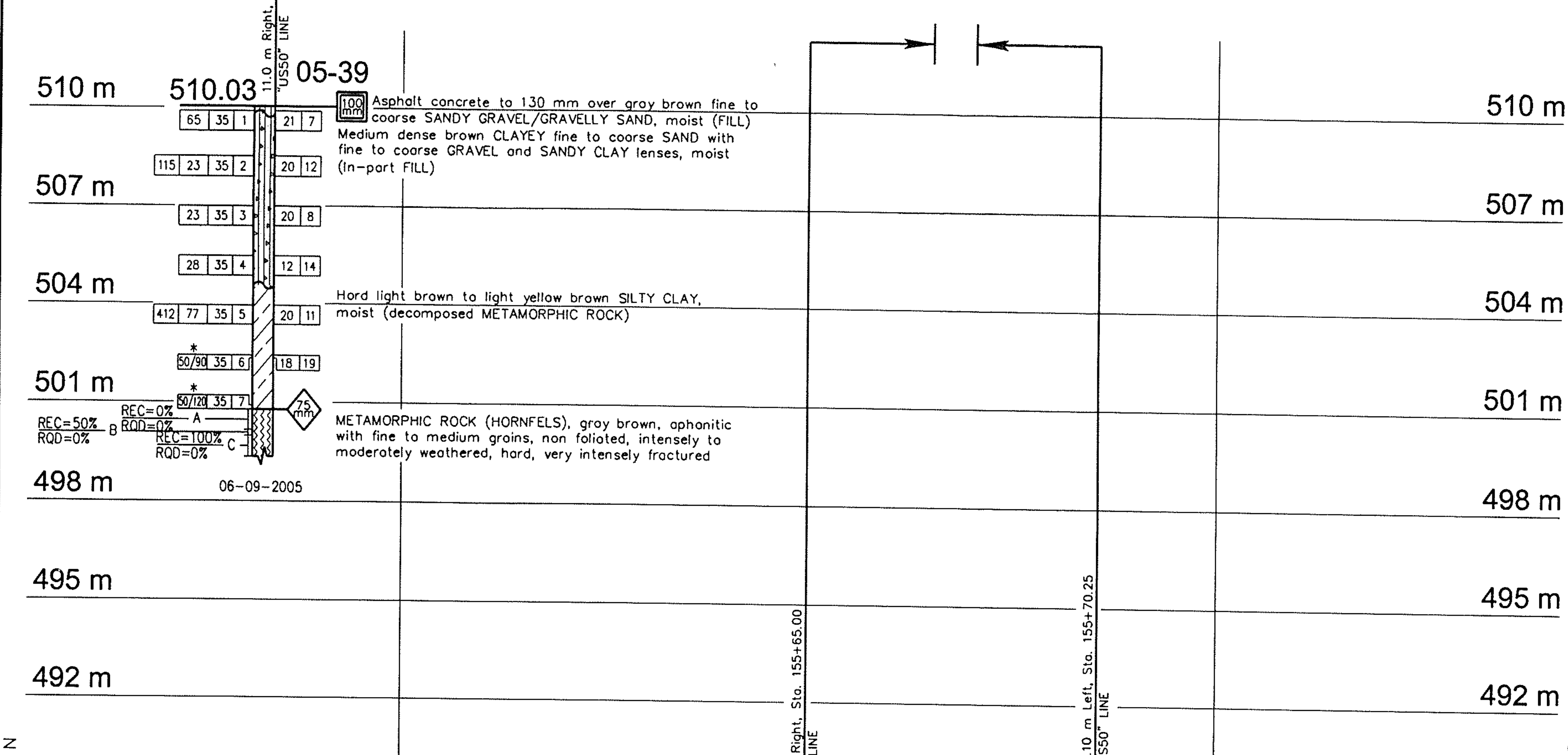
Top Hole El.; 95-1 — Year boring drilled, Boring number; Description of material; Total unit weight (kN/m³); % moisture; Sieve Analysis; GWS ▽ Elev. Date measured; Conformable material change; Estimated material change; Unconformable material change; Point Load Test; Point Load Index (mPa); Failure Load (Kn); Unconfined Compression Test; Water content (%); Unit dry weight (kN/m³); Unconfined Compressive Strength (kN/m²)

ROTARY SAMPLE BORING (WET)

95-1; Top Hole El.; No count recorded; Pushed; GWS ▽ Elev. Date measured; Driving rate in blows per 305 mm using using a 63.5 kg hammer with 760 mm drop or as noted.; Boring Date; 50 100 150

65 mm CONE PENETRATION BORING

FOR PLAN VIEW AND BENCH MARK DATA, SEE LOG OF TEST BORINGS 1 of 6



PROFILE

HOR. 1:400
VER. 1:100

Notes:

1. Field classification of soils was in accordance with ASTM D 2488-00 "Description and Identification of Soils (Visual-Manual Procedure)."
2. Rock classification according to Caltrans "Soil & Rock Logging Classification Manual (Field Guide)", August 1996, and Bureau of Reclamation U.S. Department of the Interior, USBR-5000, "Procedure for Determining Unified Soil Classifiaction", Earth Manual, Part II, Third Edition, 1990.
3. Standard Penetration tests were performed in accordance with ASTM D 1586-99 using a 63.5 kg safety hammer operated with an automated drop system with 760 mm drop, estimated to deliver 80% of theoretical striking energy to drill rod. Drill rods were 41 mm diameter "A"-rods; sampler was driven with brass liners. Sampler was "35 mm split-spoon sampler": Standard Penetration Test Sampler, ID=35 mm, OD=50 mm.
4. Where indicated by an asterisk (*) the number of blows shown is for only that fraction of the initial 0.15 m "seating drive" interval penetrated.
5. The length of each sampled interval is shown graphically on the boring log. Whole number blow counts ("N") represent the "standard penetration resistance" interval in accordance with ASTM D1586-99. Where less than 0.45 m of penetration is achieved, the blow count shown is for that fraction of the "standard penetration resistance" interval actually penetrated (interval expressed in mm).
6. Consistency of soils shown in ( ) where estimated.
7. Rock Quality Designation (RQD), Weathering, Rock Hardness/Strength, Bedding, and Fracture Density, as shown on this sheet, were used to describe all rock core from borings drilled in 2005. Descriptors were determined in the field and modified in the office by a certified engineering geologist.
8. REC = Percent Core Recovery.
9. RQD = Percent Rock Quality Designation.
10. Unconfined Compressive Strength (UC) Tests were run in the laboratory and test results were recorded in English units and converted to metric units as follows: UC Strength (kPa = kN/m2) = UC Strength (tsf) X 95.77 and Density (kN/m3) = Density (pcf) X 0.15715.
11. Point Load (PL) Index Tests were run in the laboratory using a "Soiltest" Point Load Tester (Model RM-735). The failure load P (kN) was recorded and the Point Load Index (MPa) determined.
12. All borings for this project were logged in English units, and were subsequently converted to metric units.
13. Groundwater surface elevations in the borings indicated on the Log of Test Boring Sheets reflect the fluid level in the borings on the specified date.
14. Groundwater levels are subject to seasonal fluctuations and may occur at higher or lower elevations depending on the conditions at any particular time.
15. This "Log of Test Borings" drawing is appended to bridge plans in accordance with Caltrans "Standard Specifications" Section 2-1.03.
16. Elevations for borings were surveyed and provided by Topographic Surveys, Inc.

Caltrans Metric

DIST.	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
03	ED	50	23.4 to 25.1		

CERTIFIED ENGINEERING GEOLOGIST 9-22-2008 DATE

REGISTERED GEOLOGIST MARTIN W. McILROY No. 2322 EXP. 03-31-09 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

PLANS APPROVAL DATE

TABER CONSULTANTS
3911 West Capitol Avenue
West Sacramento, CA 95691-2116
JOB No. 1P2/399/296-1 LOCATION: 38120-F7:334N:244W

Quincy Engineering, Inc.
3247 Ramos Circle
Sacramento, CA 95827-2512

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.

DESIGN OVERSIGHT
SIGN OFF DATE
DESIGN By M. D. Robertson
CHECKED By R. E. Loutzenhiser
FIELD INVESTIGATION BY: M. W. McIlroy and R. E. Loutzenhiser May 2005
PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
Mario Quest PROJECT ENGINEER
BRIDGE NO. 25-05R/L
KILOMETER POST 23.4 to 25.1

WEBER CREEK BRIDGE (WIDEN)
LOG OF TEST BORINGS 2 OF 6

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100
CU 03198
EA 4E2801
DISREGARD PRINTS BEARING EARLIER REVISION DATES 09/05/08
REVISION DATES (PRELIMINARY STAGE ONLY)
SHEET 50 OF 54

09/18/08 1P2399296-1.2Wb.dwg

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test (ASTM D-1586)

SPT N-Value (Blows/305mm)	Granular	SPT N-Value (Blows/305mm)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very Stiff
		>30	Hard

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

LEGEND OF MATERIALS (USCS) BASED ON ASTM D2487, D2488

- FILL MATERIAL
- CLAY (CL or CH)
- SILT (ML or MH)
- PEAT and/or ORGANIC MATTER
- WELL-GRADED GRAVEL (GW)
- POORLY-GRADED GRAVEL (GP)
- SILTY GRAVEL (GM)
- CLAYEY GRAVEL (GC)
- POORLY-GRADED SAND (SP)
- WELL-GRADED SAND (SW)
- SILTY SAND (SM) or SANDY SILT
- CLAYEY SAND (SC) or SANDY CLAY
- COBBLES/BOULDERS
- IGNEOUS ROCK
- SEDIMENTARY ROCK
- METAMORPHIC ROCK

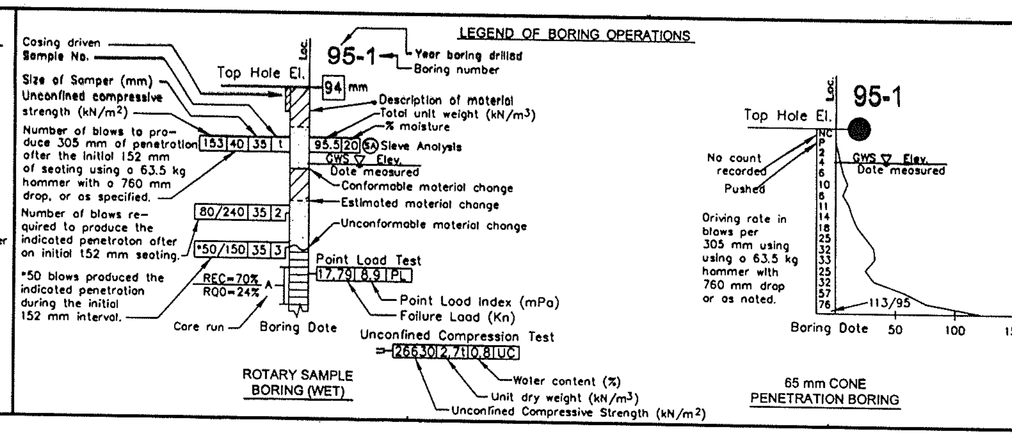
TYPES OF BORINGS

- 65 mm CONE PENETRATION
- ROTARY SAMPLE BORING (WET)
- ELECTRONIC CONE PENETROMETER
- AUGER BORING (DRY)
- TEST PIT
- DIAMOND CORE BORING
- AIR ROTARY BORING (DRY)
- HOLLOW STEM AUGER BORING
- WIRELINE BORING

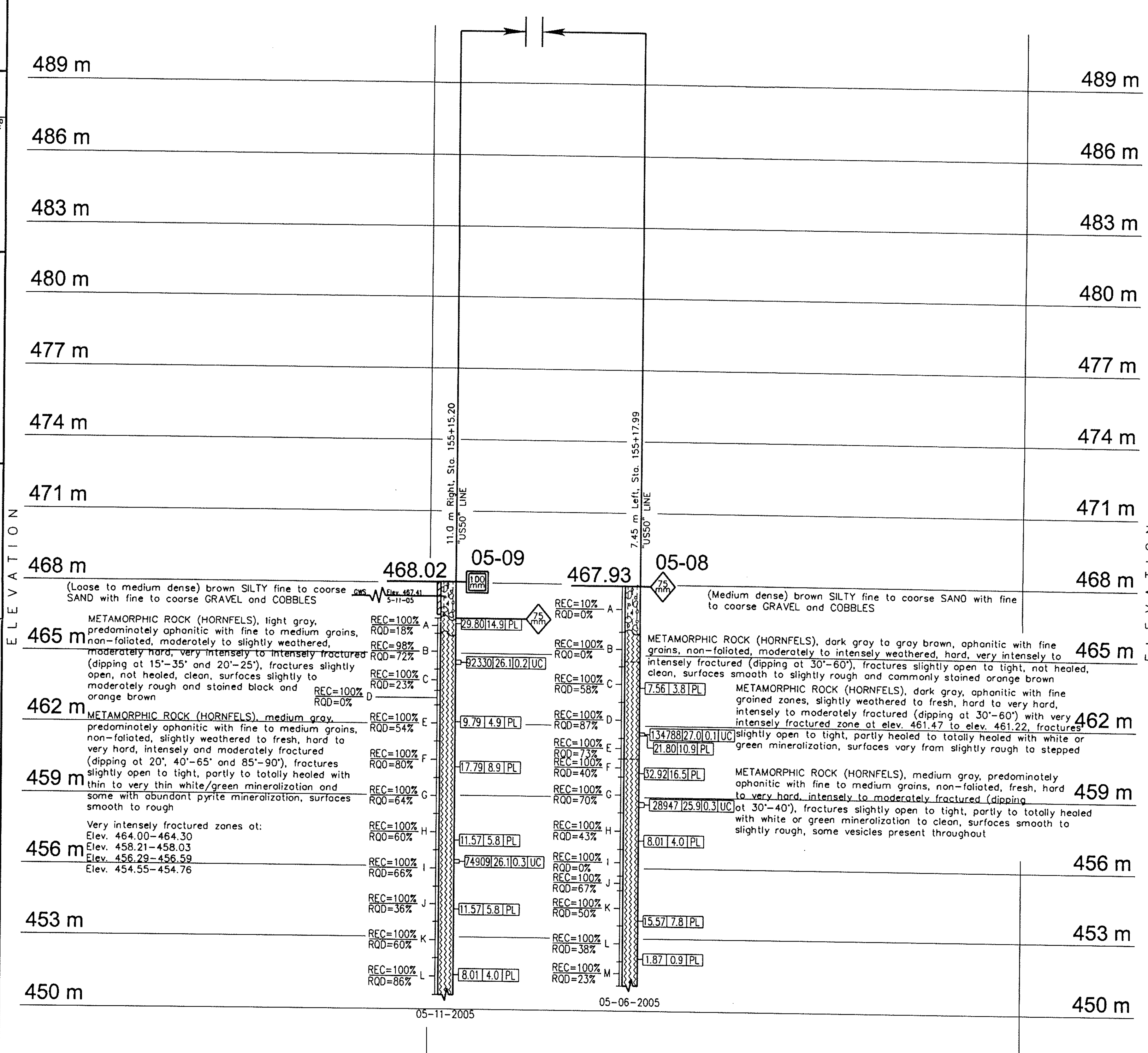
IN-SITU, LAB & FIELD TEST DESIGNATIONS

- Atterberg Limits
- Chemical Analysis
- Consolidation
- Consolidated Undrained Triaxial
- Direct Shear
- Max. Dry Density
- Pocket Penetrometer
- Sieve Analysis
- Torvane
- Unconfined Compression
- Unconsolidated Undrained Triaxial
- Vane Shear

LEGEND OF BORING OPERATIONS



FOR PLAN VIEW AND BENCH MARK DATA, SEE LOG OF TEST BORINGS 1 of 6



PROFILE
HOR. 1:400
VER. 1:100

Notes:
1. Field classification of soils was in accordance with ASTM D 2488-00 "Description and Identification of Soils (Visual-Manual Procedure)."
2. Rock classification according to Caltrans "Soil & Rock Logging Classification Manual (Field Guide)", August 1996, and Bureau of Reclamation U.S. Department of the Interior, USBR-5000, "Procedure for Determining Unified Soil Classifiaction", Earth Manual, Part II, Third Edition, 1990.
3. Standard Penetration tests were performed in accordance with ASTM D 1586-99 using a 63.5 kg safety hammer operated with an automated drop system with 760 mm drop, estimated to deliver 80% of theoretical striking energy to drill rod. Drill rods were 41 mm diameter "A"-rods; sampler was driven with brass liners. Sampler was "35 mm split-spoon sampler": Standard Penetration Test Sampler, ID=35 mm, OD=50 mm.
4. Where indicated by an asterisk (*) the number of blows shown is for only that fraction of the initial 0.15 m "seating drive" interval penetrated.
5. The length of each sampled interval is shown graphically on the boring log. Whole number blow counts ("N") represent the "standard penetration resistance" interval in accordance with ASTM D1586-99. Where less than 0.45 m of penetration is achieved, the blow count shown is for that fraction of the "standard penetration resistance" interval actually penetrated (interval expressed in mm).
6. Consistency of soils shown in ( ) where estimated.
7. Rock Quality Designation (RQD), Weathering, Rock Hardness/Strength, Bedding, and Fracture Density, as shown on this sheet, were used to describe all rock core from borings drilled in 2005. Descriptors were determined in the field and modified in the office by a certified engineering geologist.
8. REC = Percent Core Recovery.
9. RQD = Percent Rock Quality Designation.
10. Unconfined Compressive Strength (UC) Tests were run in the laboratory and test results were recorded in English units and converted to metric units as follows: UC Strength (kPa = kN/m2) = UC Strength (tsf) X 95.77 and Density (kN/m3) = Density (pcf) X 0.15715.
11. Point Load (PL) Index Tests were run in the laboratory using a "Soiltest" Point Load Tester (Model RM-735). The failure load P (kN) was recorded and the Point Load Index (MPa) determined.
12. All borings for this project were logged in English units, and were subsequently converted to metric units.
13. Groundwater surface elevations in the borings indicated on the Log of Test Boring Sheets reflect the fluid level in the borings on the specified date.
14. Groundwater levels are subject to seasonal fluctuations and may occur at higher or lower elevations depending on the conditions at any particular time.
15. This "Log of Test Borings" drawing is appended to bridge plans in accordance with Caltrans "Standard Specifications" Section 2-1.03.
16. Elevations for borings were surveyed and provided by Topographic Surveys, Inc.

DIST.	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
03	ED	50	23.4 to 25.1		

Caltrans Metric

CERTIFIED ENGINEERING GEOLOGIST — DATE 9-22-2008

REGISTERED GEOLOGIST MARTIN W. McILROY No. 2322 EXP. 03-31-09 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

PLANS APPROVAL DATE

TABER CONSULTANTS
3911 West Capitol Avenue
West Sacramento, CA 95691-2116
JOB No. 1P2/399/296-1 LOCATION: 38120-F7:334N:244W

Quincy Engineering, Inc.
3247 Ramos Circle
Sacramento, CA 95827-2512

DESIGN OVERSIGHT
SIGN OFF DATE
DESIGN By M. D. Robertson
CHECKED By R. E. Loutzenhiser
FIELD INVESTIGATION BY: M. W. McIlroy and R. E. Loutzenhiser May 2005
PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
Mario Quest
PROJECT ENGINEER
BRIDGE NO. 25-05R/L
KILOMETER POST 23.4 to 25.1

WEBER CREEK BRIDGE (WIDEN)
LOG OF TEST BORINGS 3 OF 6

09/18/08 1P2399296-1.2Wc.dwg
ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100
CU 03198
EA 4E2801
DISREGARD PRINTS BEARING EARLIER REVISION DATES 09/05/08
REVISION DATES (PRELIMINARY STAGE ONLY)
SHEET 51 OF 54

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test (ASTM D-1586)

SPT N-Value (Blows/305mm)	Granular	SPT N-Value (Blows/305mm)	Cohesive
0-4	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Firm
31-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very Stiff
		>30	Hard

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

LEGEND OF MATERIALS (USCS) BASED ON ASTM D2487, D2488

FILL MATERIAL; POORLY-GRADED SAND (SP); CLAY (CL or CH); WELL-GRADED SAND (SW); SILT (ML or MH); SILTY SAND (SM) or SANDY SILT; PEAT and/or ORGANIC MATTER; CLAYEY SAND (SC) or SANDY CLAY; WELL-GRADED GRAVEL (GW); COBBLES/BOULDERS; POORLY-GRADED GRAVEL (GP); IGNEOUS ROCK; SILTY GRAVEL (GW); SEDIMENTARY ROCK; CLAYEY GRAVEL (GC); METAMORPHIC ROCK

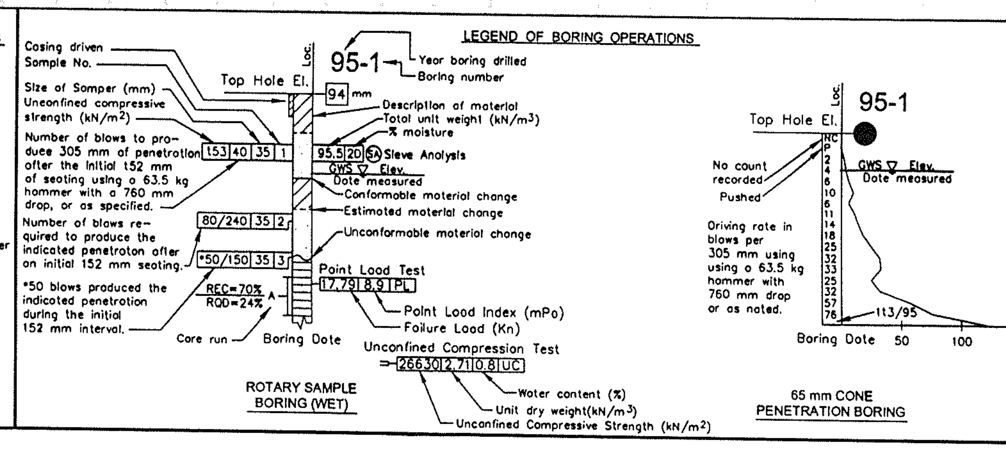
TYPES OF BORINGS

65 mm CONE PENETRATION; ROTARY SAMPLE BORING (WET); ELECTRONIC CONE PENETROMETER; AUGER BORING (DRY); TEST PIT; DIAMOND CORE BORING; AIR ROTARY BORING (DRY); HOLLOW STEM AUGER BORING; WIRELINE BORING

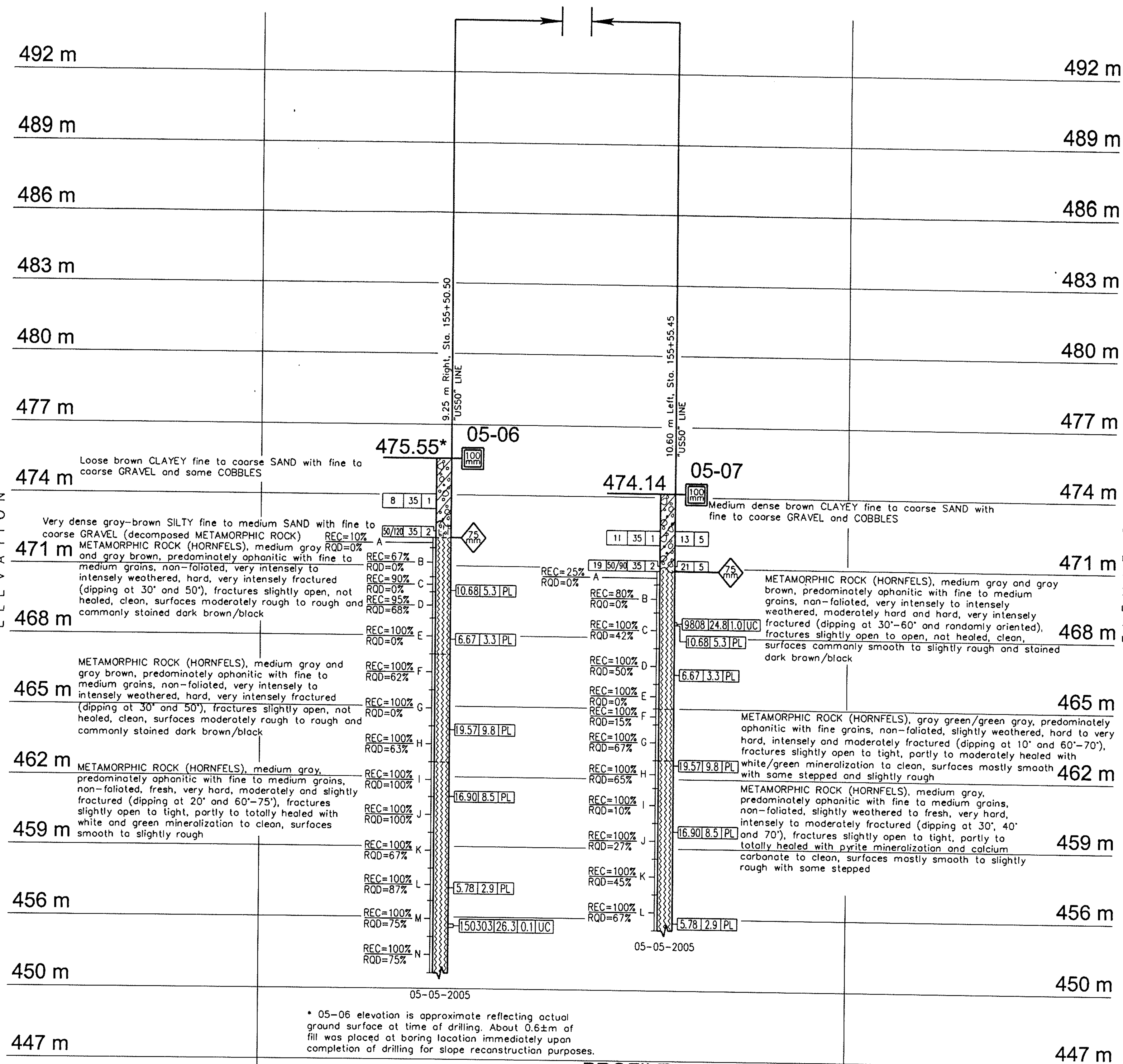
IN-SITU, LAB & FIELD TEST DESIGNATIONS

(AL) Atterberg Limits; (CA) Chemical Analysis; (CN) Consolidation; (CU) Consolidated Undrained Triaxial; (DS) Direct Shear; (MD) Max. Dry Density; (PP) Pocket Penetrometer; (SA) Sieve Analysis; (TV) Torvane; (UC) Unconfined Compression; (UU) Unconsolidated Undrained Triaxial; (VS) Vane Shear

LEGEND OF BORING OPERATIONS



FOR PLAN VIEW AND BENCH MARK DATA, SEE LOG OF TEST BORINGS 1 of 6



PROFILE
HOR. 1:400
VER. 1:100

Notes:

1. Field classification of soils was in accordance with ASTM D 2488-00 "Description and Identification of Soils (Visual-Manual Procedure)."
2. Rock classification according to Caltrans "Soil & Rock Logging Classification Manual (Field Guide)", August 1996, and Bureau of Reclamation U.S. Department of the Interior, USBR-5000, "Procedure for Determining Unified Soil Classifiaction", Earth Manual, Part II, Third Edition, 1990.
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4. Where indicated by an asterisk (*) the number of blows shown is for only that fraction of the initial 0.15 m "seating drive" interval penetrated.
5. The length of each sampled interval is shown graphically on the boring log. Whole number blow counts ("N") represent the "standard penetration resistance" interval in accordance with ASTM D1586-99. Where less than 0.45 m of penetration is achieved, the blow count shown is for that fraction of the "standard penetration resistance" interval actually penetrated (interval expressed in mm).
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16. Elevations for borings were surveyed and provided by Topographic Surveys, Inc.

DIST.	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
03	ED	50	23.4 to 25.1		

Caltrans Metric

CERTIFIED ENGINEERING GEOLOGIST — DATE 9-22-2008

REGISTERED GEOLOGIST MARTIN W. McILROY No. 2322 EXP. 03-31-09 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

PLANS APPROVAL DATE

TABER CONSULTANTS
3911 West Capitol Avenue
West Sacramento, CA 95691-2116
JOB No. 1P2/399/296-1 LOCATION: 38120-F7:334N:244W

Quincy Engineering, Inc.
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DESIGN OVERSIGHT
SIGN OFF DATE
DESIGN By M. D. Robertson
CHECKED By R. E. Loutzenhiser
FIELD INVESTIGATION BY: M. W. McIlroy and R. E. Loutzenhiser May 2005
PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION
Mario Quest PROJECT ENGINEER
BRIDGE NO. 25-05R/L
KILOMETER POST 23.4 to 25.1

WEBER CREEK BRIDGE (WIDEN)
LOG OF TEST BORINGS 4 OF 6

ORIGINAL SCALE IN MILLIMETERS FOR REDUCED PLANS 0 10 20 30 40 50 60 70 80 90 100
CU 03198
EA 4E2801
DISREGARD PRINTS BEARING EARLIER REVISION DATES — 09/03/08
REVISION DATES (PRELIMINARY STAGE ONLY)
SHEET 52 OF 54

09/18/08 1P2399296-1.2Wd.dwg

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test (ASTM D-1586)

SPT N-Value (Blows/305mm)	Granular	SPT N-Value (Blows/305mm)	Cohesive
0-4	Very Loose	<2	Very Soft
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		>30	Hard

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

LEGEND OF MATERIALS (USCS) BASED ON ASTM D2487, D2488

FILL MATERIAL; POORLY-GRADED SAND (SP); CLAY (CL or CH); WELL-GRADED SAND (SW); SILT (ML or MH); SILTY SAND (SM) or SANDY SILT; PEAT and/or ORGANIC MATTER; CLAYEY SAND (SC) or SANDY CLAY; WELL-GRADED GRAVEL (GW); COBBLES/BOULDERS; POORLY-GRADED GRAVEL (GP); IGNEOUS ROCK; SILTY GRAVEL (GM); SEDIMENTARY ROCK; CLAYEY GRAVEL (GC); METAMORPHIC ROCK

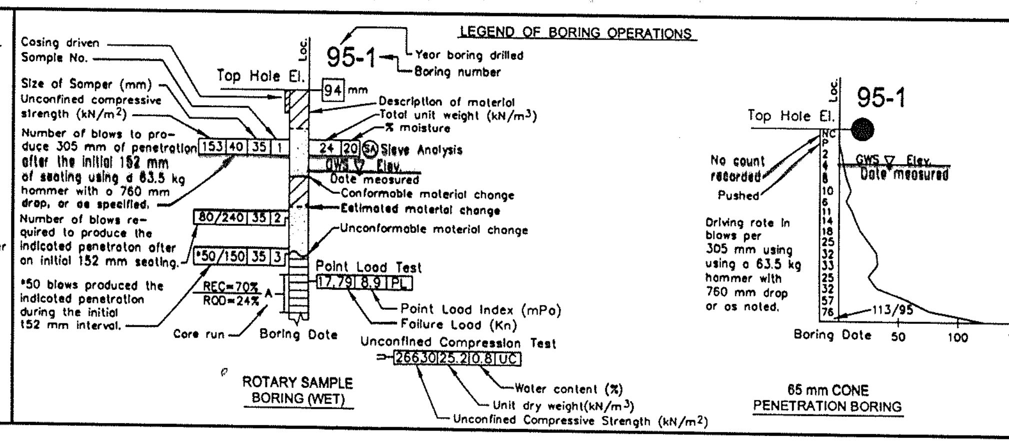
TYPES OF BORINGS

65 mm CONE PENETRATION; ROTARY SAMPLE BORING (WET); ELECTRONIC CONE PENETROMETER; AUGER BORING (DRY); TEST PIT; DIAMOND CORE BORING; AIR ROTARY BORING (DRY); HOLLOW STEM AUGER BORING; WIRELINE BORING

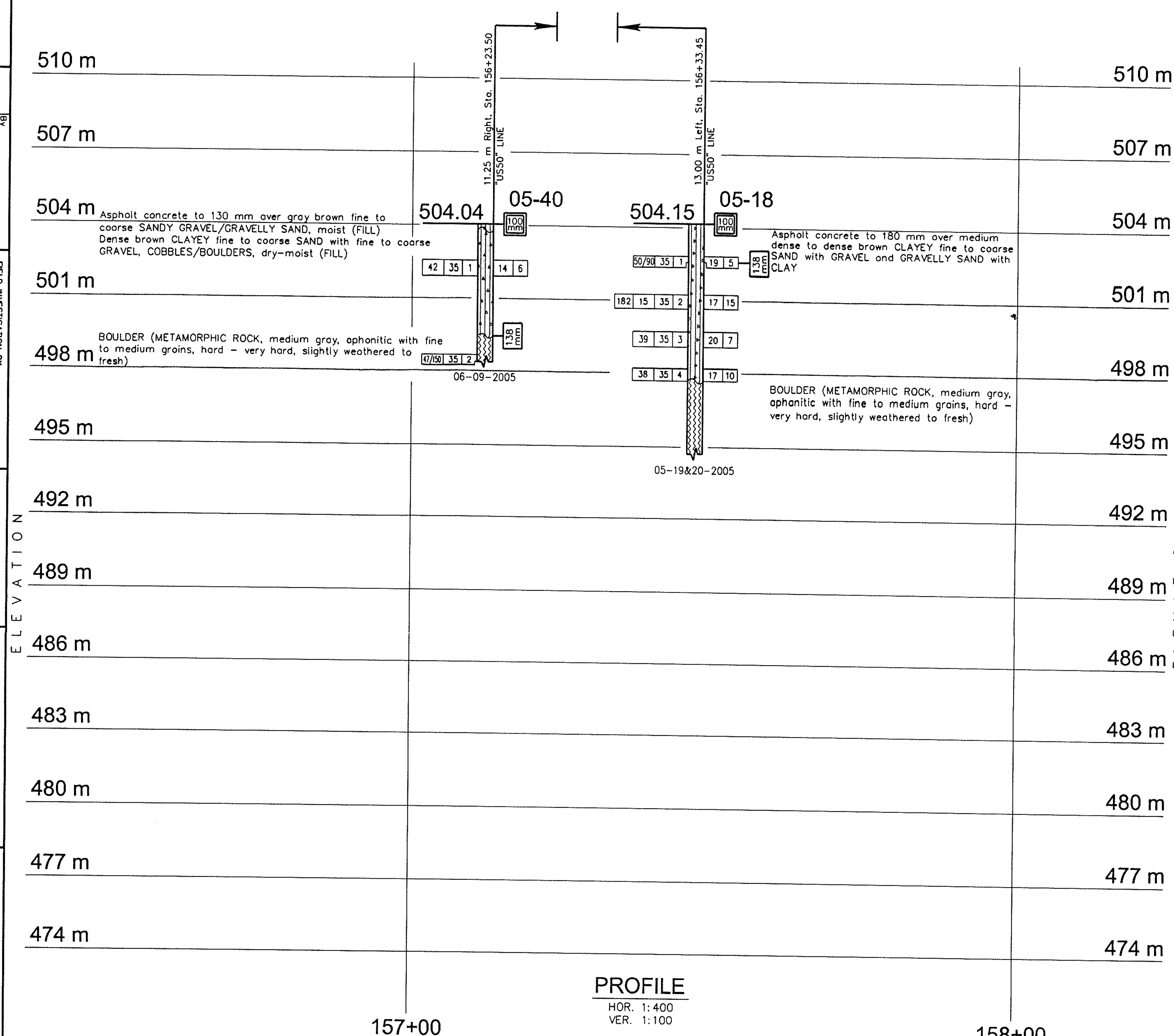
IN-SITU, LAB & FIELD TEST DESIGNATIONS

(AL) Atterberg Limits; (CA) Chemical Analysis; (CN) Consolidation; (CU) Consolidated Undrained Triaxial; (DS) Direct Shear; (MD) Max. Dry Density; (PP) Pocket Penetrometer; (SA) Sieve Analysis; (TV) Torvane; (UC) Unconfined Compression; (UU) Unconsolidated Undrained Triaxial; (VS) Vane Shear

LEGEND OF BORING OPERATIONS



FOR PLAN VIEW AND BENCH MARK DATA, SEE LOG OF TEST BORINGS 1 of 6



PROFILE
HOR. 1:400
VER. 1:100

Notes:
1. Field classification of soils was in accordance with ASTM D 2488-00 "Description and Identification of Soils (Visual-Manual Procedure)."
2. Rock classification according to Caltrans "Soil & Rock Logging Classification Manual (Field Guide)", August 1996, and Bureau of Reclamation U.S. Department of the Interior, USBR-5000, "Procedure for Determining Unified Soil Classifiaction", Earth Manual, Part II, Third Edition, 1990.
3. Standard Penetration tests were performed in accordance with ASTM D 1586-99 using a 63.5 kg safety hammer operated with an automated drop system with 760 mm drop, estimated to deliver 80% of theoretical striking energy to drill rod. Drill rods were 41 mm diameter "A"-rods; sampler was driven with brass liners. Sampler was "35 mm split-spoon sampler": Standard Penetration Test Sampler, ID=35 mm, OD=50 mm.
4. Where indicated by an asterisk (*) the number of blows shown is for only that fraction of the initial 0.15 m "seating drive" interval penetrated.
5. The length of each sampled interval is shown graphically on the boring log. Whole number blow counts ("N") represent the "standard penetration resistance" interval in accordance with ASTM D1586-99. Where less than 0.45 m of penetration is achieved, the blow count shown is for that fraction of the "standard penetration resistance" interval actually penetrated (interval expressed in mm).
6. Consistency of soils shown in ( ) where estimated.
7. Rock Quality Designation (RQD), Weathering, Rock Hardness/Strength, Bedding, and Fracture Density, as shown on this sheet, were used to describe all rock core from borings drilled in 2005. Descriptors were determined in the field and modified in the office by a certified engineering geologist.
8. REC = Percent Core Recovery.
9. RQD = Percent Rock Quality Designation.
10. Unconfined Compressive Strength (UC) Tests were run in the laboratory and test results were recorded in English units and converted to metric units as follows: UC Strength (kPa = kN/m2) = UC Strength (tsf) X 95.77 and Density (kN/m3) = Density (pcf) X 0.15715.
11. Point Load (PL) Index Tests were run in the laboratory using a "Soiltest" Point Load Tester (Model RM-735). The failure load P (kN) was recorded and the Point Load Index (MPa) determined.
12. All borings for this project were logged in English units, and were subsequently converted to metric units.
13. Groundwater surface elevations in the borings indicated on the Log of Test Boring Sheets reflect the fluid level in the borings on the specified date.
14. Groundwater levels are subject to seasonal fluctuations and may occur at higher or lower elevations depending on the conditions at any particular time.
15. This "Log of Test Borings" drawing is appended to bridge plans in accordance with Caltrans "Standard Specifications" Section 2-1.03.
16. Elevations for borings were surveyed and provided by Topographic Surveys, Inc.

DIST.	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
03	ED	50	23.4 to 25.1		

CERTIFIED ENGINEERING GEOLOGIST — DATE 9-22-2008

REGISTERED GEOLOGIST MARTIN W. McILROY No. 2322 EXP. 03-31-09 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

PLANS APPROVAL DATE

TABER CONSULTANTS
3911 West Capitol Avenue
West Sacramento, CA 95691-2116
JOB No. 1P2/399/296-1 LOCATION: 38120-F7:334N:244W

Quincy Engineering, Inc.
3247 Ramos Circle
Sacramento, CA 95827-2512

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.

DESIGN OVERSIGHT
SIGN OFF DATE
DESIGN By M. D. Robertson
CHECKED By R. E. Loutzenhiser
FIELD INVESTIGATION BY: M. W. McIlroy and R. E. Loutzenhiser May 2005

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Mario Quest
PROJECT ENGINEER

BRIDGE NO. 25-05R/L
KILOMETER POST 23.4 to 25.1

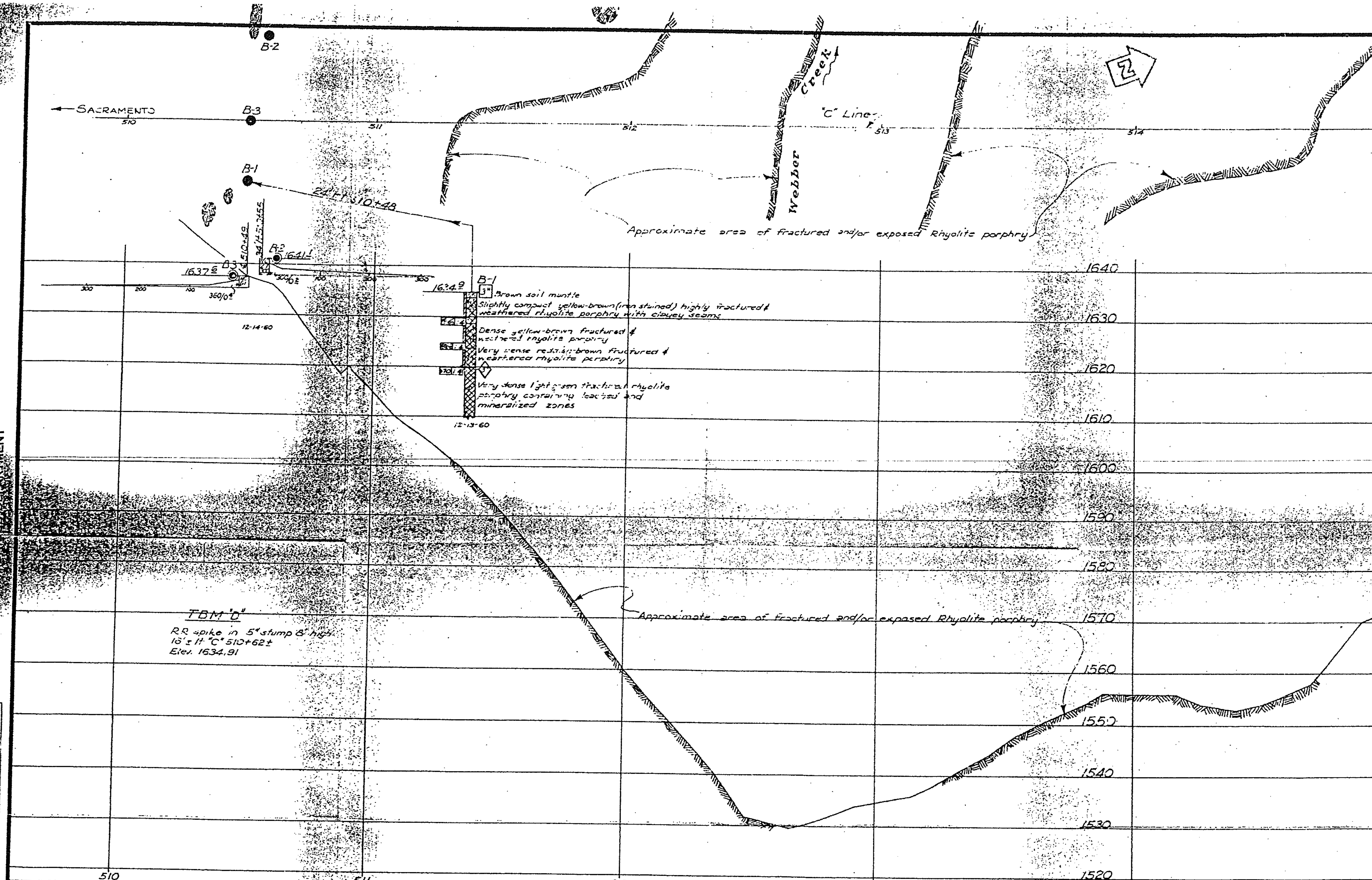
WEBER CREEK BRIDGE (WIDEN)
LOG OF TEST BORINGS 5 OF 6

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

CU 03198
EA 4E2801

DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES (PRELIMINARY STAGE ONLY) 09/05/08
SHEET 53 OF 54

09/18/08 1P2399296-1.2We.dwg



DIST.	COUNTY	ROUTE	KILOMETER POST - TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
7	CAL.				

OFFICE OF STRUCTURE FOUNDATIONS - ENGINEERING SERVICE CENTER

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. It does not attest to the accuracy or validity of the information contained in the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

DIST.	COUNTY	ROUTE	KILOMETER POST - TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
03	ED	50	28.4/25.1		

CERTIFIED ENGINEERING GEOLOGIST

PHASE 1

Weber Creek Bridge (Widen)

LOG OF TEST BORINGS 6 OF 6

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

CU: 03198
EA: 4E2801

BRIDGE NO. 25-05R/L

SHEET 54 OF 54

Revisions made to this Log of Test Borings from the original dated January 1961 consist of the following:

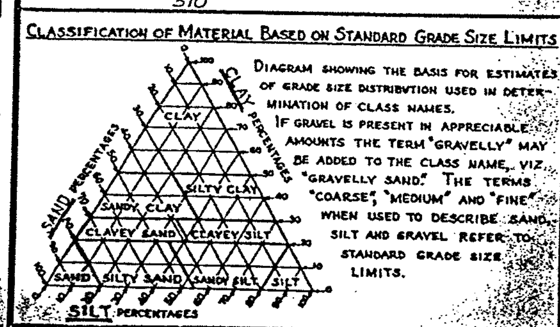
1. "C" Line = "US50" Line.
2. Metric to English station equation: "US50" Sta. 155+75.47 (Metric) = Sta. 511+00 (English).
3. The data presented in the table below was produced based upon a conversion of the original "C" Line English stations and offsets converted to Metric stations and offsets referenced to "US50" Line.
4. The 1960 boring locations, referenced to "US50" Line are as follows:

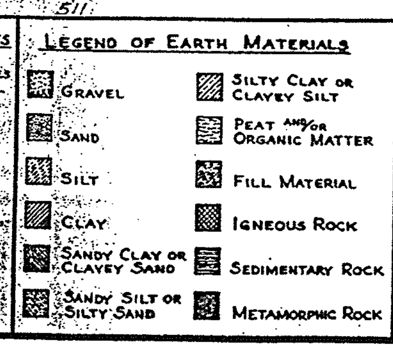
Boring	Station (Metric)	Station (English)	Offset from "MFRD" Line (Metric)	Offset from "MFRD" Line (English)
B-1	155+59.62	510+48	7.32 m Rt	24 ft Rt
B-2	155+61.75	510+55	10.36 m Lt	34 ft Lt
B-3	155+59.92	510+59	Centerline	Centerline

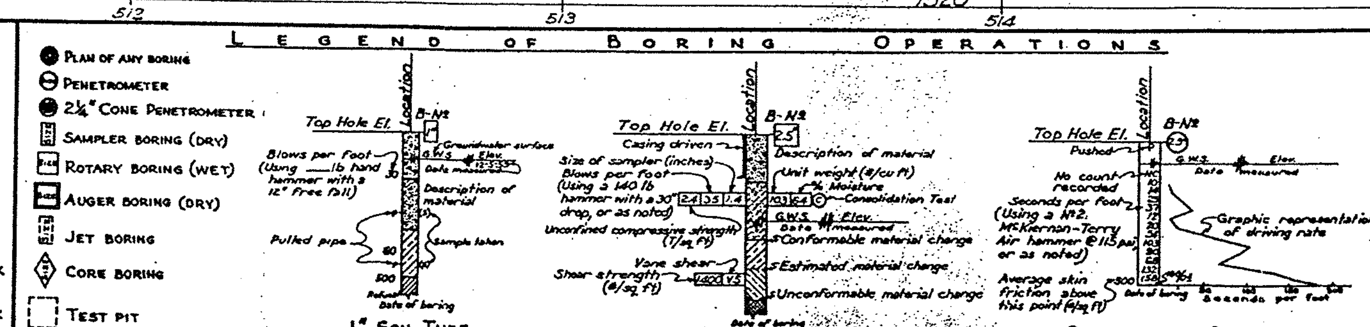
4. Multiply English boring elevation by 0.3048 to convert to metric elevation.

REGISTERED GEOLOGIST MARTIN W. McILROY No. 2322 EXP. 03-31-09 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

ENGR. GEOLOGY SECTION







NOTE

Classification of earth material as shown on this sheet is based upon field inspection and is not to be construed to imply mechanical analysis.

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

WEBBER CREEK

LOG OF TEST BORINGS

SCALE Horiz: 1"=20' Vert: 1"=10'
BRIDGE 25-05

PR-7155-6

APPENDIX – A

LABORATORY TEST RESULTS

POINT LOAD TEST RESULTS

Job # 1P2/399/296-1.2

Weber Creek Bridge

Boring	Core Run	Depth (feet)	Elevation (feet)	Core Diameter (inches)	Failure Load (lbf)	Point Load Index (psi)	Point Load Index (MPa)	Uniaxial Compressive Strength (psi)	Uniaxial Compressive Strength (MPa)
6	D	19.2	1541.0	1.76	500	161	1.1	3523	24.3
6	F	31.5	1528.7	1.76	1300	420	2.9	9159	63.1
6	H	40.9	1519.3	1.76	2200	710	4.9	15499	106.9
6	J	48.6	1511.6	1.76	5550	1792	12.4	39101	269.6
6	N	70.9	1489.3	1.76	2100	678	4.7	14795	102.0
7	C	18.4	1537.2	1.76	2400	775	5.3	16908	116.6
7	D	25.3	1530.3	1.76	1500	484	3.3	10568	72.9
7	H	37.9	1517.7	1.76	4400	1420	9.8	30999	213.7
7	J	47.3	1508.3	1.76	3800	1227	8.5	26772	184.6
7	L	60.1	1495.5	1.76	1300	420	2.9	9159	63.1
8	C	14.2	1521.0	1.76	1700	549	3.8	11977	82.6
8	D	20.8	1514.4	1.76	4900	1582	10.9	34521	238.0
8	F	26.0	1509.2	1.76	7400	2389	16.5	52134	359.5
8	H	35.3	1499.9	1.76	1800	581	4.0	12681	87.4
8	K	46.5	1488.7	1.76	3500	1130	7.8	24658	170.0
8	L	51.8	1483.4	1.76	420	136	0.9	2959	20.4
9	A	5.8	1529.7	1.76	6700	2163	14.9	47203	325.5
9	E	19.5	1516.0	1.76	2200	710	4.9	15499	106.9
9	F	25.7	1509.8	1.76	4000	1291	8.9	28181	194.3
9	H	35.8	1499.7	1.76	2600	839	5.8	18318	126.3
9	J	45.4	1490.1	1.76	2600	839	5.8	18318	126.3
9	L	54.5	1481.0	1.76	1800	581	4.0	12681	87.4
10	A	14.0	1584.4	1.76	2400	775	5.3	16908	116.6
10	D	21.2	1577.2	1.76	2300	743	5.1	16204	111.7
10	E	26.7	1571.7	1.76	4900	1582	10.9	34521	238.0
10	I	45.6	1552.8	1.76	4600	1485	10.2	32408	223.4
10	K	53.0	1545.4	1.76	5300	1711	11.8	37340	257.4
10	L	61.2	1537.2	1.76	9000	2905	20.0	63407	437.2
10	N	69.2	1529.2	1.76	5800	1872	12.9	40862	281.7

Uniaxial compressive strength values based on point load test data and correlations derived from Bieniawski (1975); "Rock Mechanics for Underground Mining", Brady & Brown, 1985 (page 98-99).

POINT LOAD TEST RESULTS

Job # 1P2/399/296-1.2

Weber Creek Bridge

Boring	Core Run	Depth (feet)	Elevation (feet)	Core Diameter (inches)	Failure Load (lbf)	Point Load Index (psi)	Point Load Index (Mpa)	Uniaxial Compressive Strength (psi)	Uniaxial Compressive Strength (Mpa)
11	D	18.7	1583.9	1.76	900	291	2.0	6341	43.7
11	G	30.5	1572.1	1.76	3500	1130	7.8	24658	170.0
11	I	40.1	1562.5	1.76	5600	1808	12.5	39453	272.0
11	M	57.0	1545.6	1.76	4900	1582	10.9	34521	238.0
11	M	58.6	1544.0	1.76	4100	1324	9.1	28885	199.2
11	O	66.5	1536.1	1.76	4800	1550	10.7	33817	233.2
11	P	72.8	1529.8	1.76	4000	1291	8.9	28181	194.3

Uniaxial compressive strength values based on point load test data and correlations derived from Bieniawski (1975); "Rock Mechanics for Underground Mining", Brady & Brown, 1985 (page 98-99).

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

June 28, 2005

Taber Consultants
Attn: Ralph Fisher
3911 West Capitol Avenue
West Sacramento CA 95691-2116

STL Project No: **05-273**
Subject: **IP2/399/296-1.2**
Project No:
Invoice No: **2948**

LABORATORY TEST RESULTS

Dear Mr. Fisher:

As requested, Sierra Testing Laboratories, Inc. performed laboratory testing on **eleven samples** of material from the subject site. The samples were identified as: **Boring 6, Run M, 65.1-65.6; Boring 7, run C, 17.9-18.4; Boring 7, Run G, 32.9-33.5; Boring 8, Run D, 20.4-20.8; Boring 8, Run G, 20-30.7; Boring 9, Run B, 10.9-11.5; Boring 9, Run I, 38.5-39; Boring 10, Run F, 29.2-29.6; Boring 10, Run N, 64.4-64.8; Boring 11, Run K, 50-50.4; and Boring 11, Run O, 67.8-68.3**. Our laboratory received the samples on **June 22, 2005**. The test performed on the submitted samples was as follows:

1. **Unconfined Compression of Intact Rock Core (ASTM D2938, RTH 111)**

The results of the above referenced testing are presented on attached figures.

We appreciate the opportunity to be of service to you on this project and look forward to providing additional service, as needed, in the future.

Should you have any questions or require additional information, please contact our office at your convenience.

Very truly yours,

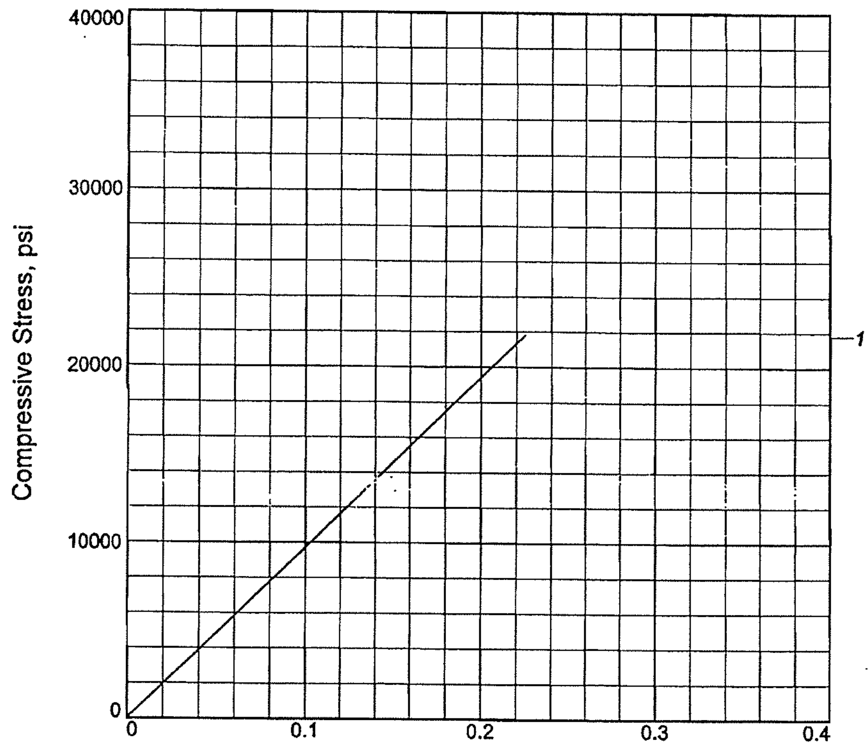
Chad M. Walker
Project Manager

Enclosures
ks

JUN 29 2005

5040 Robert J. Mathews, Suite 1, El Dorado Hills, CA 95762 (916) 939-3460 Fax (916) 939-3507
www.sierratestinglaboratories.com

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psi	21799.46			
Undrained shear strength, psi	10899.73			
Failure strain,	0.2			
Strain rate, in./min.	0.30			
Water content, %	0.1			
Wet density, pcf	167.7			
Dry density, pcf	167.5			
Saturation, %	4.9			
Void ratio	0.0770			
Specimen diameter, in.	1.77			
Specimen height, in.	4.45			
Height/diameter ratio	2.51			

Description:

LL = | **PL =** | **PI =** | **Assumed GS=** 2.89 | **Type:** Cast Cylinder

Project No.: 05-273
Date: Received 6/22/05
Remarks:

Figure ________

Client: Taber Consultants

Project: 1P2/399/296-1.2

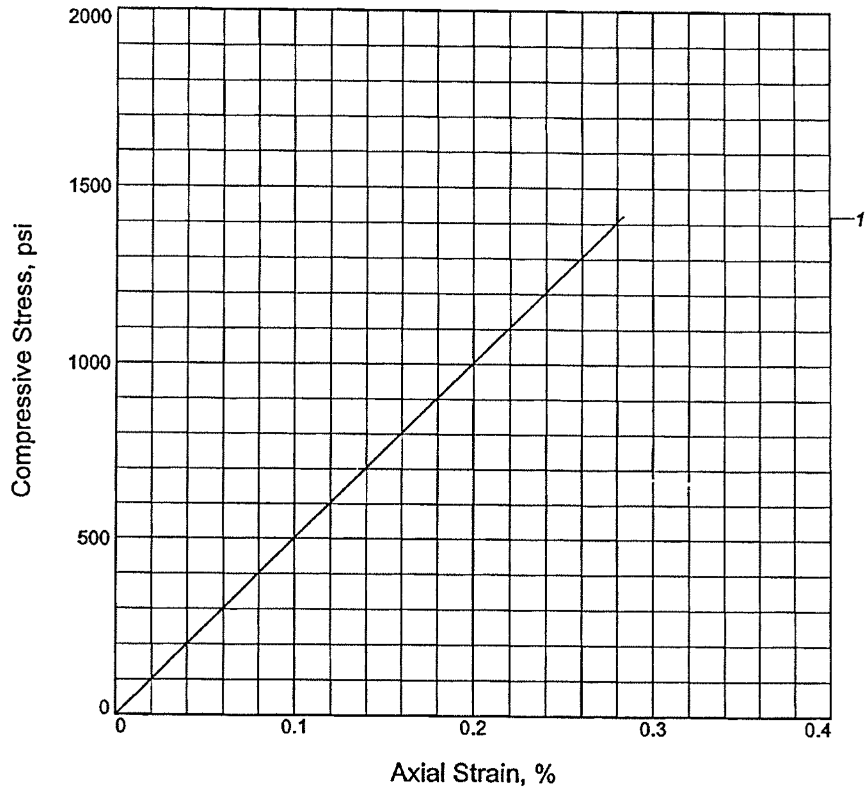
Source of Sample: Boring 6 **Depth:** 65.1-65.6
Sample Number: Run M

UNCONFINED COMPRESSION TEST

SIERRA TESTING LABS, INC.

Tested By: MW **Checked By:** CMW

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psi	1422.46			
Undrained shear strength, psi	711.23			
Failure strain,	0.3			
Strain rate, in./min.	0.30			
Water content, %	1.0			
Wet density, pcf	159.2			
Dry density, pcf	157.6			
Saturation, %	20.7			
Void ratio	0.1449			
Specimen diameter, in.	1.77			
Specimen height, in.	3.53			
Height/diameter ratio	1.99			

Description:

LL = | **PL =** | **PI =** | **Assumed GS=** 2.89 | **Type:** Cast Cylinder

Project No.: 05-273
Date: Received 6/22/05
Remarks:

Client: Taber Consultants

Project: 1P2/399/296-1.2

Source of Sample: Boring 7 **Depth:** 17.9-18.4
Sample Number: Run C

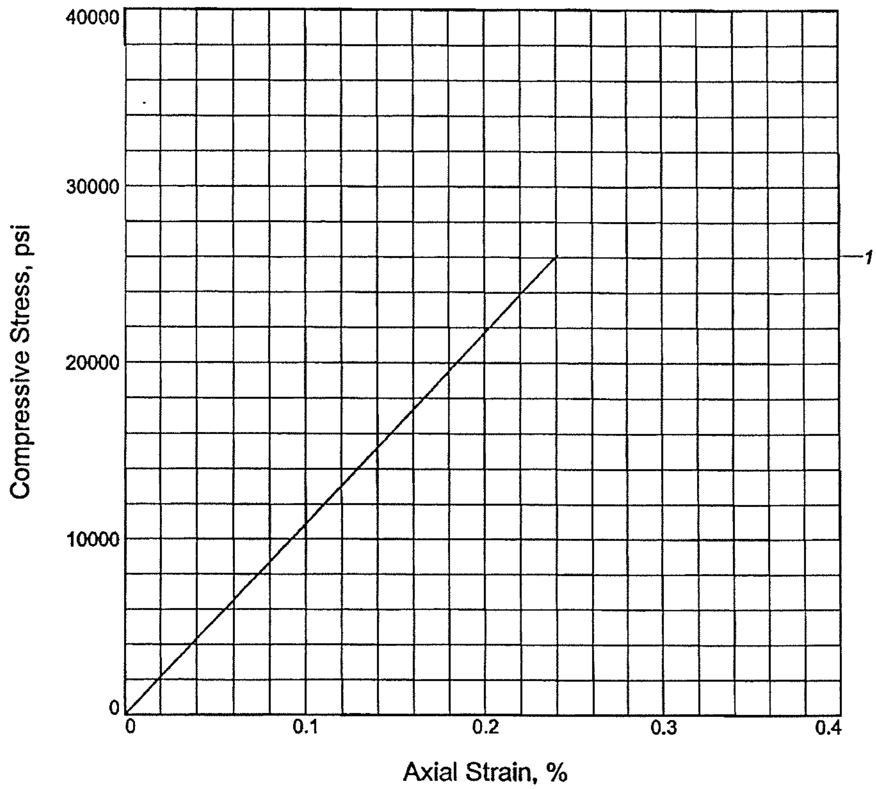
Figure ________

UNCONFINED COMPRESSION TEST

SIERRA TESTING LABS, INC.

Tested By: MW **Checked By:** CMW

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psi	26113.74			
Undrained shear strength, psi	13056.87			
Failure strain,	0.2			
Strain rate, in./min.	0.30			
Water content, %	0.3			
Wet density, pcf	169.3			
Dry density, pcf	168.8			
Saturation, %	11.6			
Void ratio	0.0686			
Specimen diameter, in.	1.77			
Specimen height, in.	4.15			
Height/diameter ratio	2.34			

Description:

LL =	PL =	PI =	Assumed GS= 2.89	Type: Cast Cylinder

Project No.: 05-273
Date: Received 6/22/05
Remarks:

Figure ________

Client: Taber Consultants

Project: 1P2/399/296-1.2

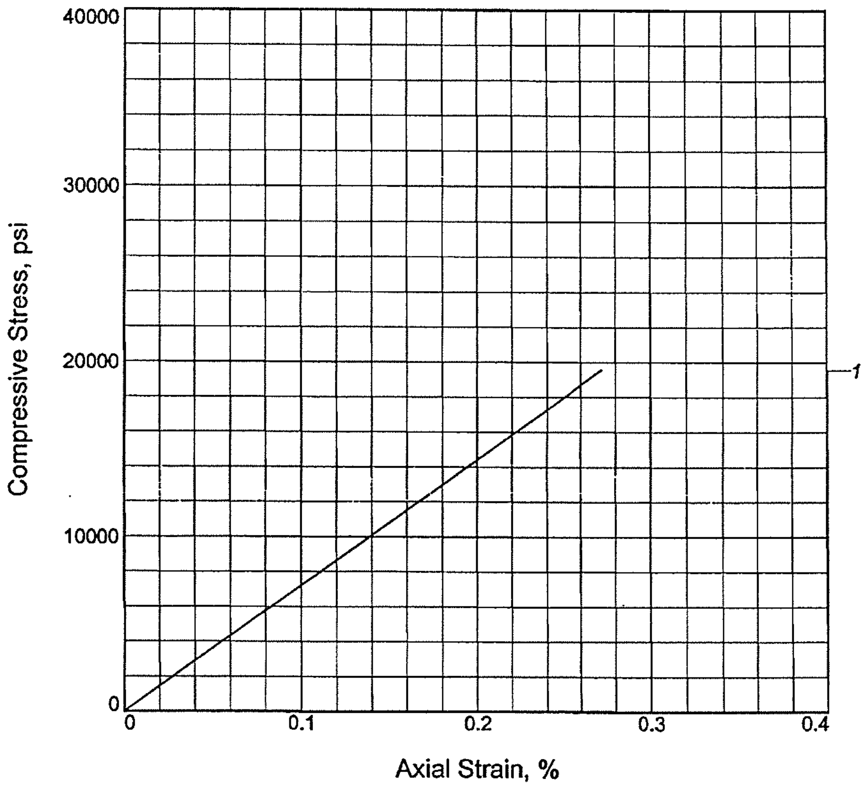
Source of Sample: Boring 7 **Depth:** 32.9-33.5
Sample Number: Run G

UNCONFINED COMPRESSION TEST

SIERRA TESTING LABS, INC.

Tested By: MW **Checked By:** CMW

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psi	19549.26			
Undrained shear strength, psi	9774.63			
Failure strain,	0.3			
Strain rate, in./min.	0.30			
Water content, %	0.1			
Wet density, pcf	172.2			
Dry density, pcf	172.0			
Saturation, %	7.5			
Void ratio	0.0490			
Specimen diameter, in.	1.76			
Specimen height, in.	3.68			
Height/diameter ratio	2.09			

Description:

LL =	**PL =**	**PI =**	**Assumed GS=** 2.89	**Type:** Cast Cylinder

Project No.: 05-273
Date: Received 6/22/05
Remarks:

Figure ________

Client: Taber Consultants

Project: 1P2/399/296-1.2

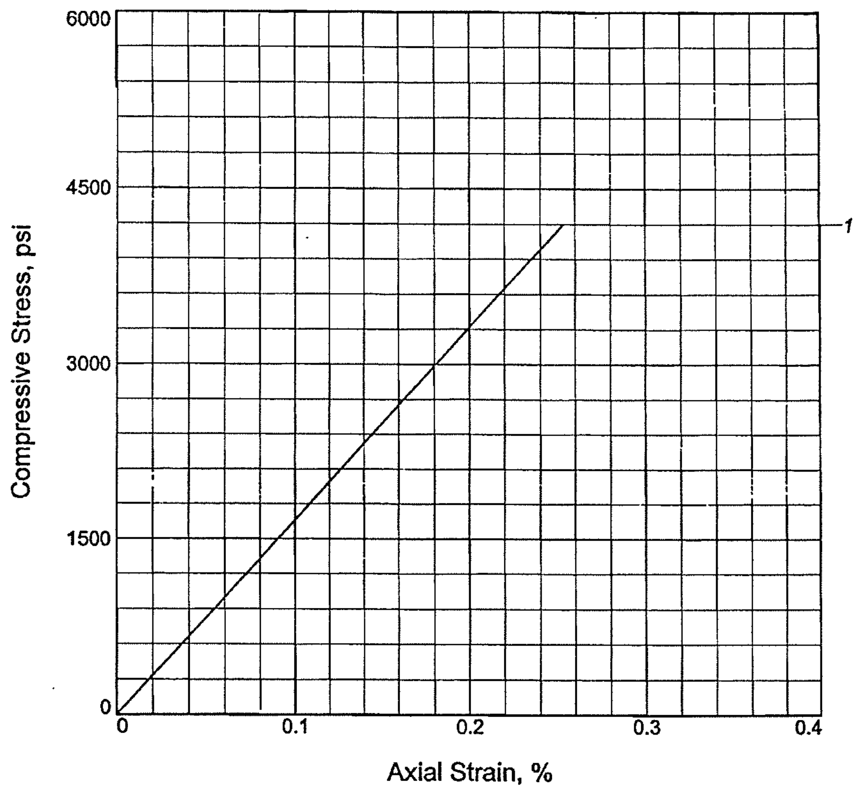
Source of Sample: Boring 8 **Depth:** 20.4-20.8
Sample Number: Run D

UNCONFINED COMPRESSION TEST

SIERRA TESTING LABS, INC.

Tested By: MPW **Checked By:** CMW

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psi	4198.40			
Undrained shear strength, psi	2099.20			
Failure strain,	0.3			
Strain rate, in./min.	0.30			
Water content, %	0.3			
Wet density, pcf	165.4			
Dry density, pcf	164.9			
Saturation, %	8.5			
Void ratio	0.0939			
Specimen diameter, in.	1.76			
Specimen height, in.	3.95			
Height/diameter ratio	2.24			

Description:

LL =	PL =	PI =	Assumed GS= 2.89	Type: Cast Cylinder

Project No.: 05-273
Date: Received 6/22/05
Remarks:

Figure _______

Client: Taber Consultants

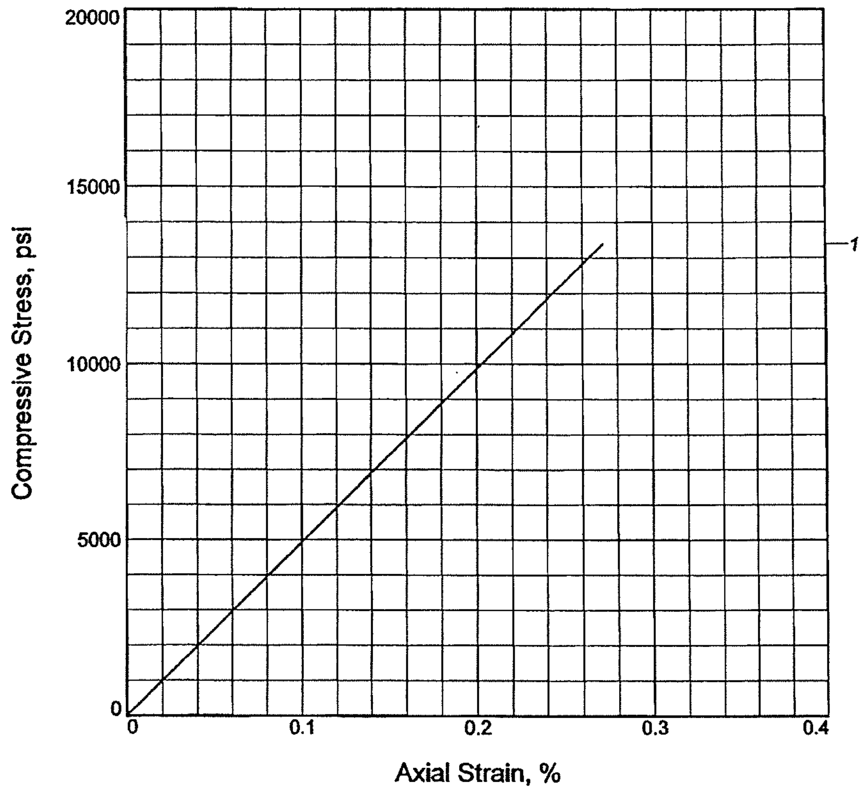
Project: 1P2/399/296-1.2

Source of Sample: Boring 8 **Depth:** 30.0-30.7
Sample Number: Run G

UNCONFINED COMPRESSION TEST
SIERRA TESTING LABS, INC.

Tested By: MPW **Checked By:** CMW

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psi	13391.27			
Undrained shear strength, psi	6695.64			
Failure strain,	0.3			
Strain rate, in./min.	0.30			
Water content, %	0.2			
Wet density, pcf	166.5			
Dry density, pcf	166.1			
Saturation, %	7.6			
Void ratio	0.0862			
Specimen diameter, in.	1.77			
Specimen height, in.	3.68			
Height/diameter ratio	2.08			

Description:

LL = **PL =** **PI =** **Assumed GS=** 2.89 **Type:** Cast Cylinder

Project No.: 05-273
Date: Received 6/22/05
Remarks:

Client: Taber Consultants

Project: 1P2/399/296-1.2

Source of Sample: Boring 9 **Depth:** 10.9-11.5
Sample Number: Run B

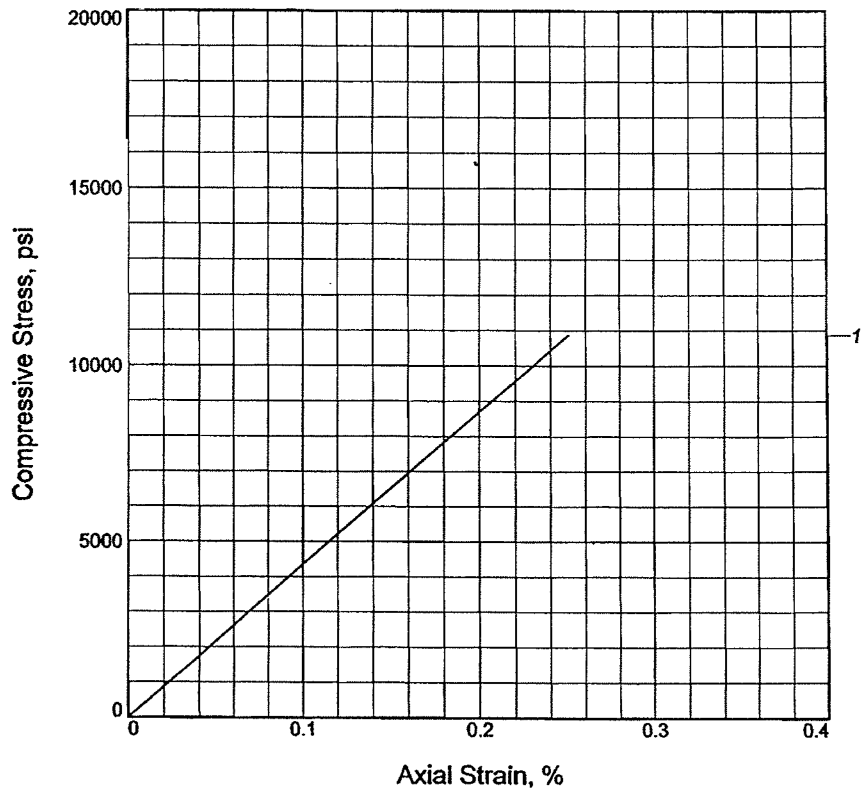
UNCONFINED COMPRESSION TEST

SIERRA TESTING LABS, INC.

Figure ________

Tested By: MPW **Checked By:** CMW

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psi	10864.54			
Undrained shear strength, psi	5432.27			
Failure strain,	0.3			
Strain rate, in./min.	0.30			
Water content, %	0.3			
Wet density, pcf	166.9			
Dry density, pcf	166.4			
Saturation, %	10.3			
Void ratio	0.0840			
Specimen diameter, in.	1.77			
Specimen height, in.	4.00			
Height/diameter ratio	2.26			

Description:

LL =	PL =	PI =	Assumed GS= 2.89	Type: Cast Cylinder

Project No.: 05-273
Date: Received 6/22/05
Remarks:

Client: Taber Consultants

Project: 1P2/399/296-1.2

Source of Sample: Boring 9 **Depth:** 38.5-39.0
Sample Number: Run I

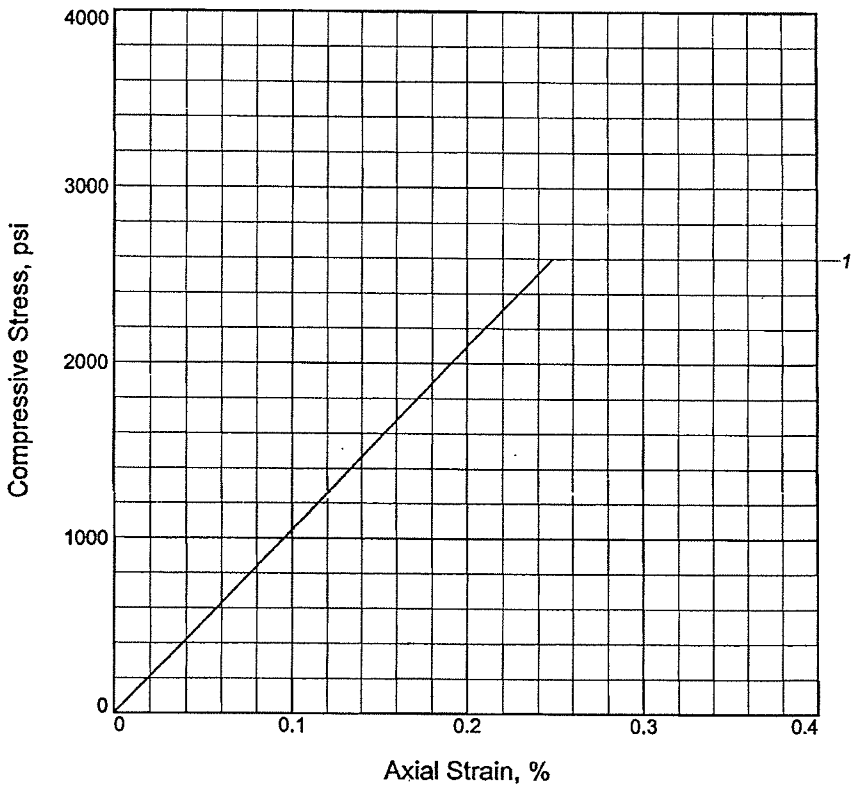
UNCONFINED COMPRESSION TEST

SIERRA TESTING LABS, INC.

Figure ________

Tested By: MPW **Checked By:** CMW

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psi	2598.62			
Undrained shear strength, psi	1299.31			
Failure strain,	0.2			
Strain rate, in./min.	0.30			
Water content, %	0.2			
Wet density, pcf	170.4			
Dry density, pcf	170.1			
Saturation, %	9.8			
Void ratio	0.0608			
Specimen diameter, in.	1.77			
Specimen height, in.	4.03			
Height/diameter ratio	2.28			

Description:

LL = | **PL =** | **PI =** | **Assumed GS=** 2.89 | **Type:** Cast Cylinder

Project No.: 05-273
Date: Received 6/22/05
Remarks:

Figure ________

Client: Taber Consultants

Project: 1P2/399/296-1.2

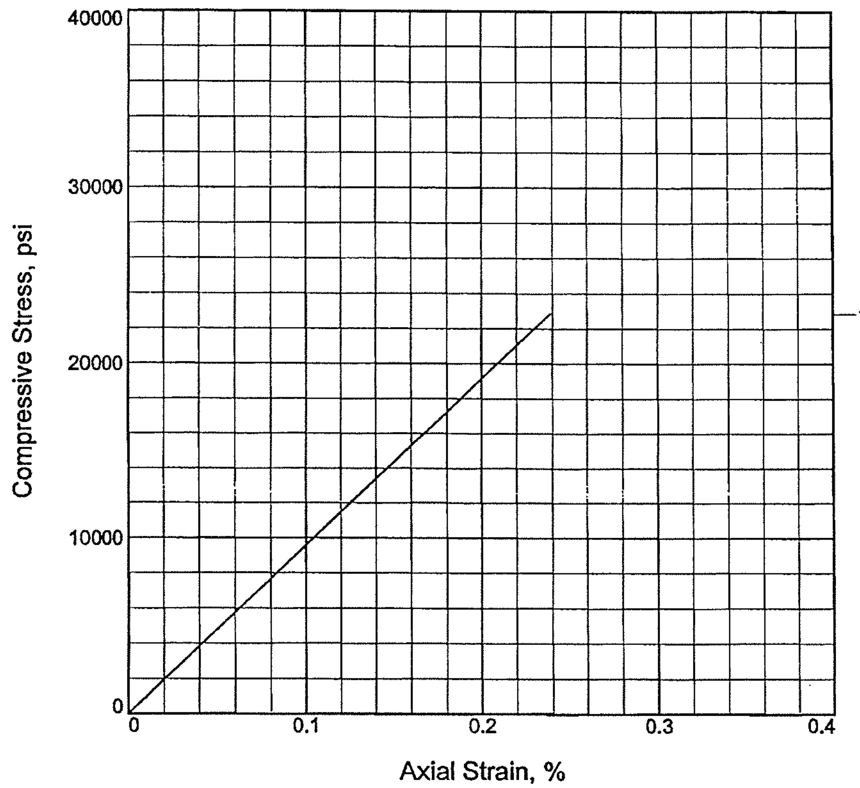
Source of Sample: Boring 10 **Depth:** 29.2-29.6
Sample Number: Run F

UNCONFINED COMPRESSION TEST

SIERRA TESTING LABS, INC.

Tested By: MPW **Checked By:** CMW

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psi	22826.23			
Undrained shear strength, psi	11413.12			
Failure strain,	0.2			
Strain rate, in./min.	0.30			
Water content, %	0.1			
Wet density, pcf	173.8			
Dry density, pcf	173.5			
Saturation, %	9.8			
Void ratio	0.0396			
Specimen diameter, in.	1.77			
Specimen height, in.	4.19			
Height/diameter ratio	2.37			

Description:

LL =	**PL =**	**PI =**	**Assumed GS=** 2.89	**Type:** Cast Cylinder

Project No.: 05-273
Date: Received 6/22/05
Remarks:

Figure ______

Client: Taber Consultants

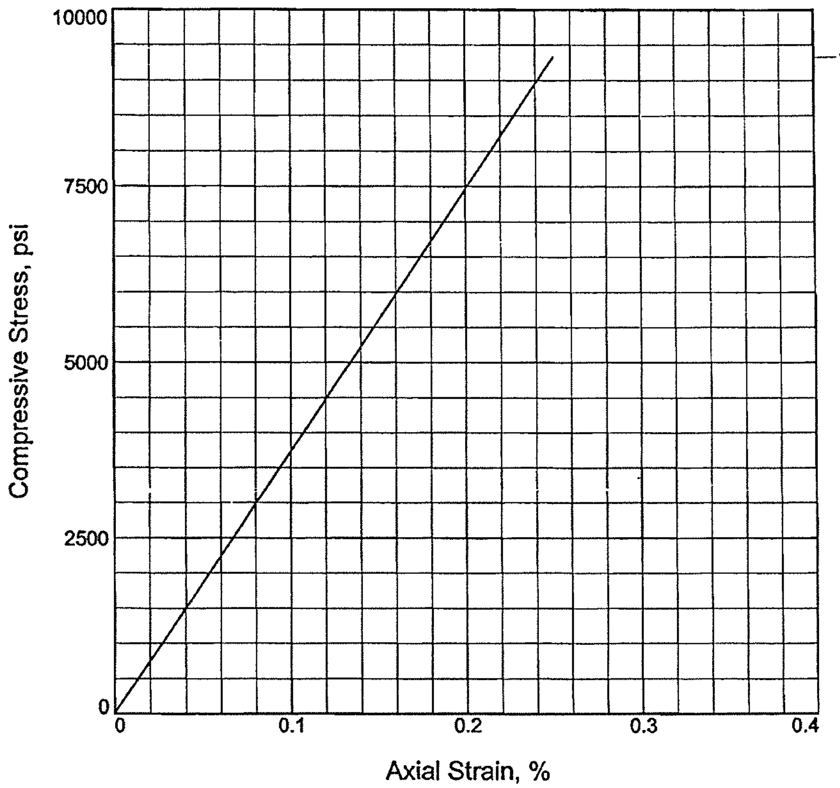
Project: 1P2/399/296-1.2

Source of Sample: Boring 10 **Depth:** 64.4-64.8
Sample Number: Run N

UNCONFINED COMPRESSION TEST
SIERRA TESTING LABS, INC.

Tested By: MPW **Checked By:** CMW

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psi	9328.10			
Undrained shear strength, psi	4664.05			
Failure strain,	0.3			
Strain rate, in./min.	0.30			
Water content, %	0.4			
Wet density, pcf	167.5			
Dry density, pcf	166.9			
Saturation, %	13.5			
Void ratio	0.0811			
Specimen diameter, in.	1.77			
Specimen height, in.	4.00			
Height/diameter ratio	2.26			

Description:

LL =	**PL =**	**PI =**	**Assumed GS=** 2.89	**Type:** Cast Cylinder

Project No.: 05-273
Date: Received 6/22/05
Remarks:

Figure _______

Client: Taber Consultants

Project: 1P2/399/296-1.2

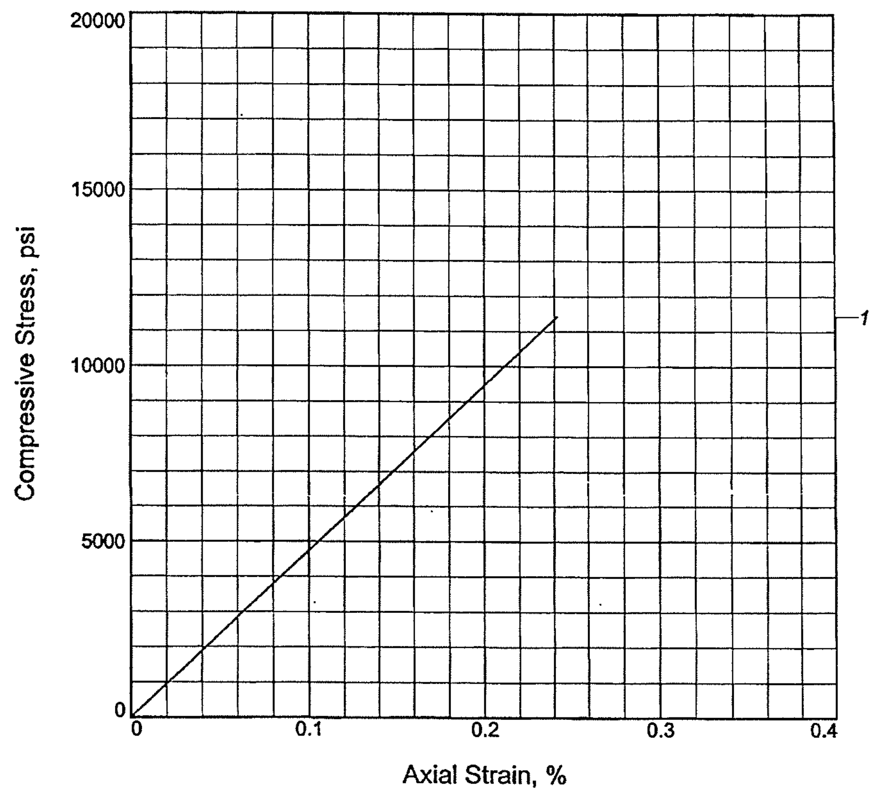
Source of Sample: Boring 11 **Depth:** 50.0-50.4
Sample Number: Run K

UNCONFINED COMPRESSION TEST

SIERRA TESTING LABS, INC.

Tested By: MPW **Checked By:** CMW

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psi	11429.00			
Undrained shear strength, psi	5714.50			
Failure strain,	0.2			
Strain rate, in./min.	0.30			
Water content, %	0.2			
Wet density, pcf	165.3			
Dry density, pcf	165.0			
Saturation, %	5.0			
Void ratio	0.0932			
Specimen diameter, in.	1.77			
Specimen height, in.	4.14			
Height/diameter ratio	2.34			

Description:

LL =	PL =	PI =	Assumed GS= 2.89	Type: Cast Cylinder

Project No.: 05-273
Date: Received 6/22/05
Remarks:

Figure ________

Client: Taber Consultants

Project: 1P2/399/296-1.2

Source of Sample: Boring 11 **Depth:** 67.8-68.3
Sample Number: Run O

UNCONFINED COMPRESSION TEST
SIERRA TESTING LABS, INC.

Tested By: MPW **Checked By:** CMW

APPENDIX – B

PETROGRAPHIC EXAMINATION OF ROCK SPECIMENS
(WEBER CREEK BRIDGES – WIDEN)

PETROGRAPHIC EXAMINATION OF ROCK SPECIMENS

PROJECT: Missouri Flat Road IC
(Weber Creek Bridge)
El Dorado County, CA
Job No. 1P2/399/296-1, 2

JOB NO. C-4571-05

JULY 29, 2005

MICRO-CHEM LABORATORIES
635 Bret Harte Drive
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MC LABS
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July 29, 2005

Taber Consultants Engineers & Geologists
3911 W. Capitol Avenue
West Sacramento, CA 95691-2116

Job No. C-4571-05

Attn: Mr. Martin McIlroy

Re: Petrographic Examination of Rock Specimens
Project: Missouri Flat Road IC
(Weber Creek Bridge)
El Dorado County, CA
Job No. 1P2/399/296-1,2

In response to your request, two rock specimens were received for petrographic examination. The samples were reportedly obtained from the above referenced project. The objectives of the testing were to determine the mineralogy of the rock samples by petrographic examination.

Test Methods

Sections of rock were saw cut, lapped, and examined with stereomicroscope. Thin sections were prepared from selected areas from Samples B-7 and B-10 and examined with a petrographic microscope. The samples were examined according to ASTM C295-03, "Standard Guide for Petrographic Examination of Aggregates for Concrete."

Sample Descriptions

The following rock specimens were received.

Sample ID.	Diameter, in.	Length, in.	Description	Date
B-7	1.8	8.5	Run G, 33.7'-34.4'	6/27/05
B-10	1.8	7.8	Run N, 66.0'-66.9'	6/27/05

Petrographic Examination

1. Samples B-7 and B-10 were hard and dense metamorphic rocks. Sample B-10 contained very few voids in the rock.

2. Sample B-7 is classified as a chlorite hornfels. The high quartz/feldspars content in this rock produced a very hard material.

3. Sample B-10 is classified as an epidote hornfels. Although the feldspars have mostly been altered, the rock is hard and dense (harder than stainless steel).

4. The details of the petrographic examination of Samples B-7 and B-10 are presented in Tables I and II.

Should any questions arise concerning the findings of this report, please contact the undersigned.

Respectfully submitted,
MICRO-CHEM LABORATORIES

William R. Nickison

William R. Nickison
Assistant Petrographer

WRN/jamc
C457105
Attachments

Sample Disposition: The samples will be stored for a period of one month and thereafter discarded. Charges for additional sample storage time and/or shipping of the samples will be billed to the client.

TABLE I

JOB NO. C-4571-05

SAMPLE ID. B-7

PETROGRAPHIC EXAMINATION OF ROCK
ASTM C295-03

Minerals	Estimated %, by volume	Approximate Size
Quartz/Feldspars[1]	80-90	<2.4 μm to 500 μm
Chlorite	10-15	10 μm to 900 μm
Cassiterite[2]	3-6	5 μm to 1 mm
Epidote	Trace	10 μm to 100 μm
Pyrite	<1	50 μm to 4 mm
Mica	Trace	10 μm to 450 μm

The sample is fine grained, very hard and dense, green gray colored, with white veins of calcite and mica. The rock is classified as a chlorite hornfels.

[1] An intimate mixture of quartz and feldspars (labradorite) in a felsitic matrix. Percentages of each constituent could not be reliably estimated from thin section analysis.
[2] Very high relief and birefringent subhedral and anhedral mineral that appears to be cassiterite.

TABLE II

JOB NO. C-4571-05

SAMPLE ID. B-10

PETROGRAPHIC EXAMINATION OF ROCK
ASTM C295-03

Minerals	Estimated %, by volume	Approximate Size
Quartz	40-50	<2.4 µm to 450 µm
Altered Feldspars	40-50	200 µm to 4 mm
Epidote	2-4	50 µm to 400 µm
Calcite	2-4	24 µm to 250 µm
Chlorite	2-4	24 µm to 700 µm

The rock is medium to fine grained, hard to very hard and dense with few voids, green-gray colored. The rock is classified as an epidote hornfels.

PHOTOGRAPHS OF AS-RECEIVED SAMPLES
SAMPLE B-7 (scale in cm)

PHOTO NO. 1

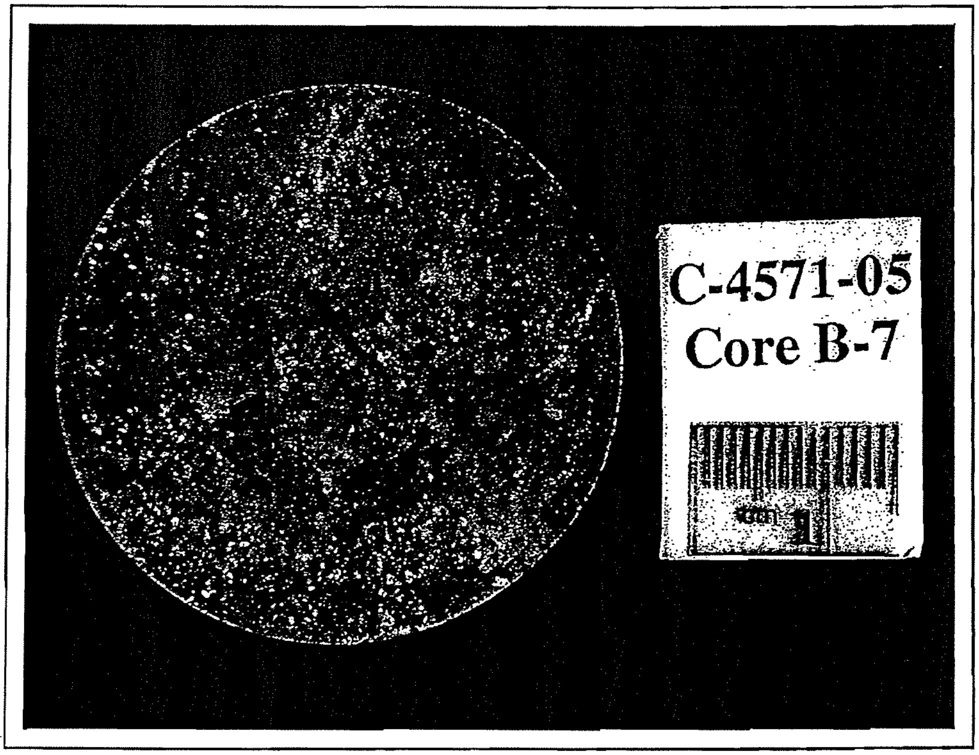
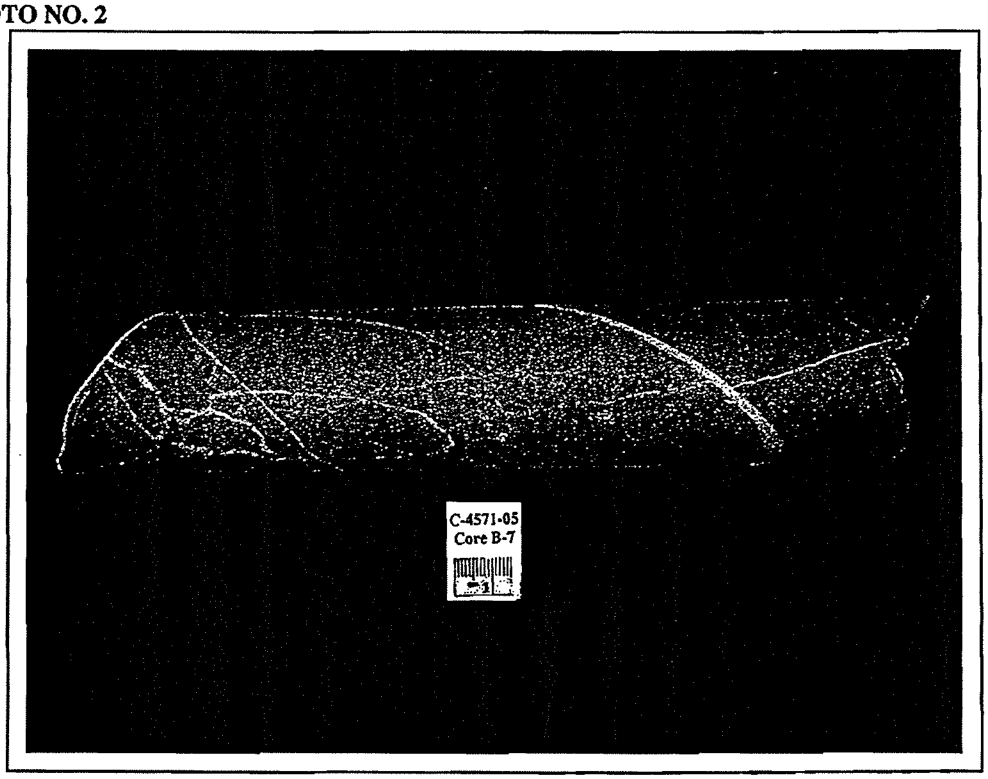


PHOTO NO. 2



PHOTOGRAPHS OF AS-RECEIVED SAMPLES
SAMPLE B-10 (scale in cm)

PHOTO NO. 3

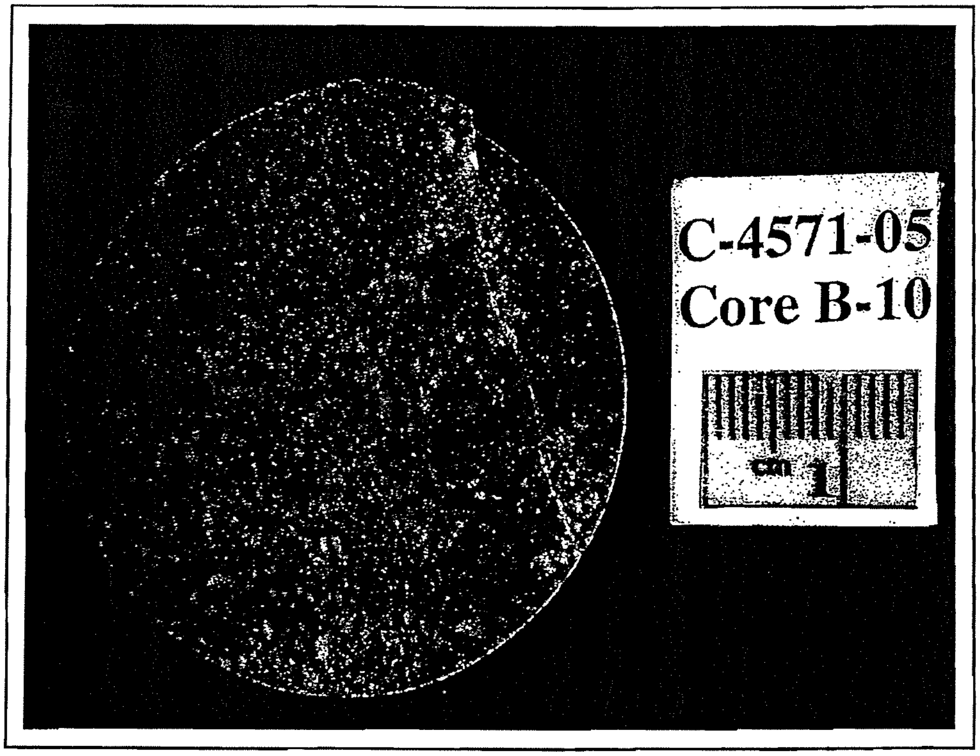
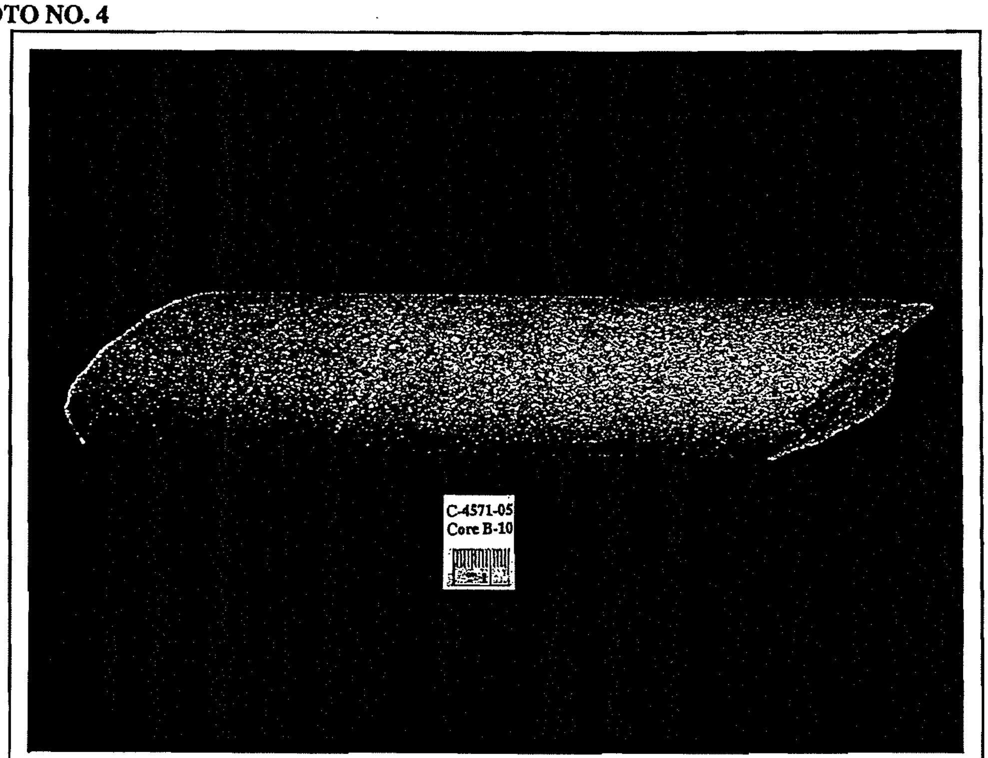


PHOTO NO. 4



PHOTOGRAPHS OF LAP SECTIONS
(scale in cm)

PHOTO NO. 5 – Sample B-7

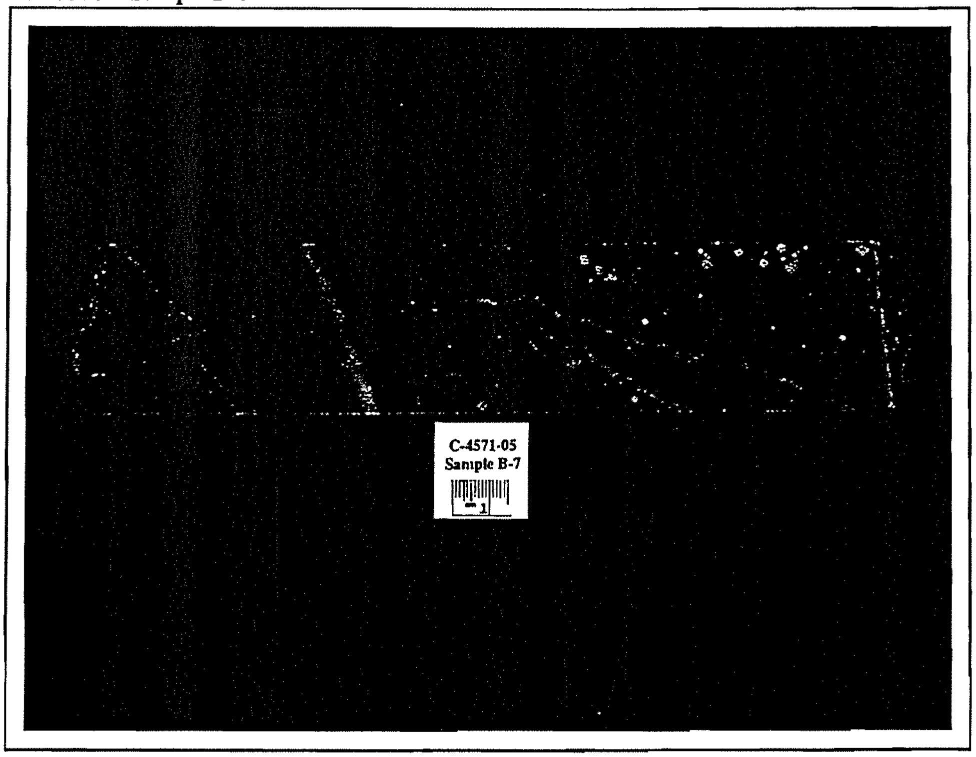
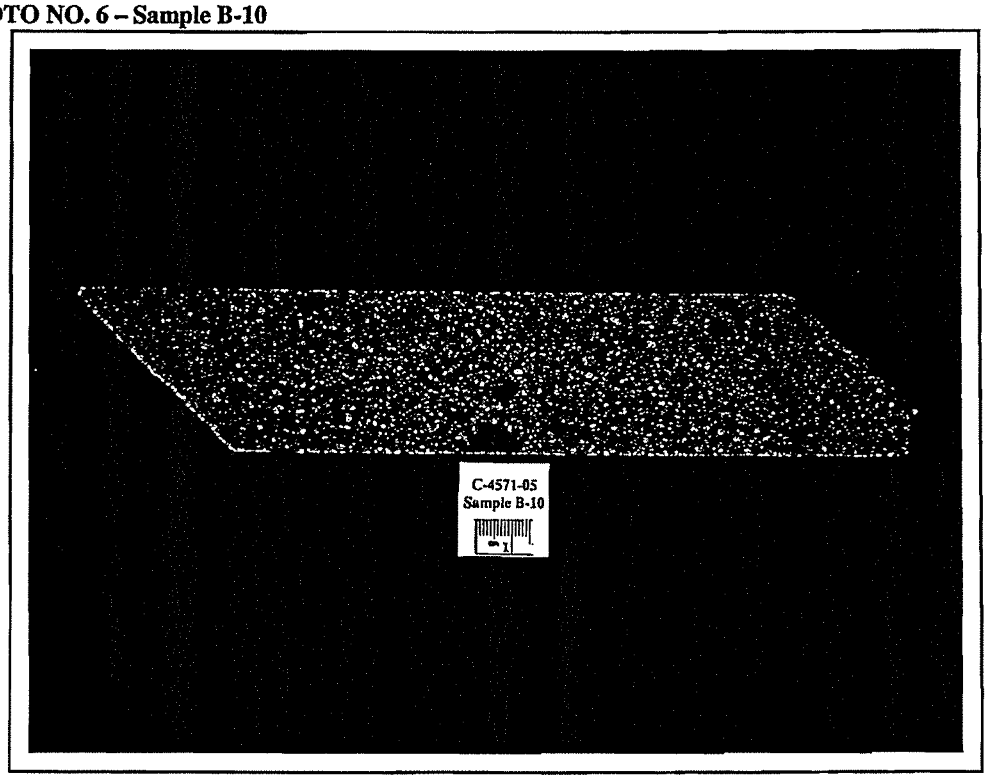
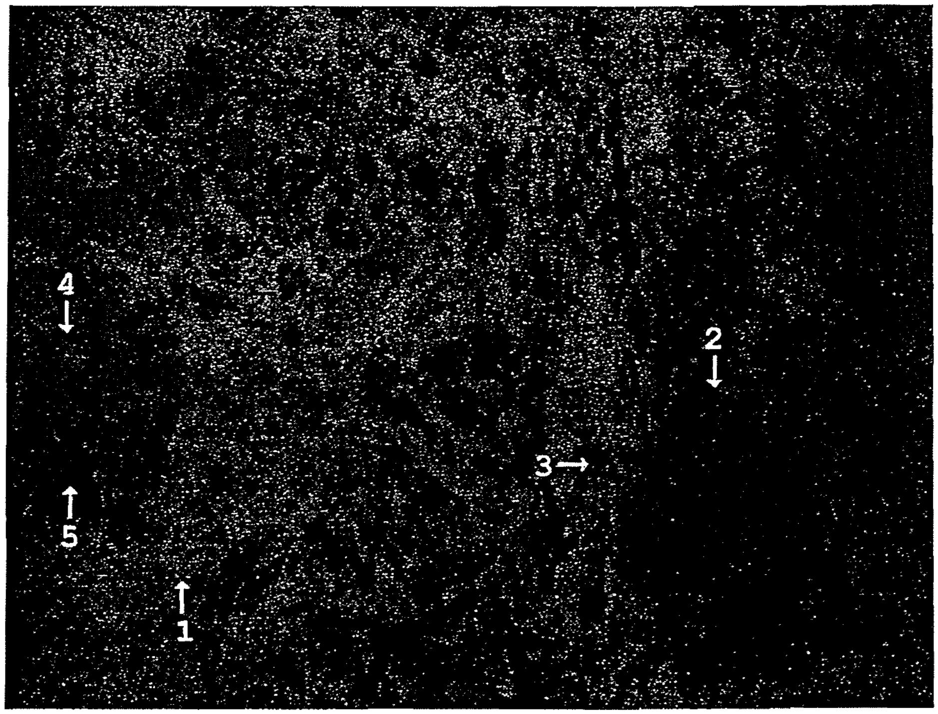


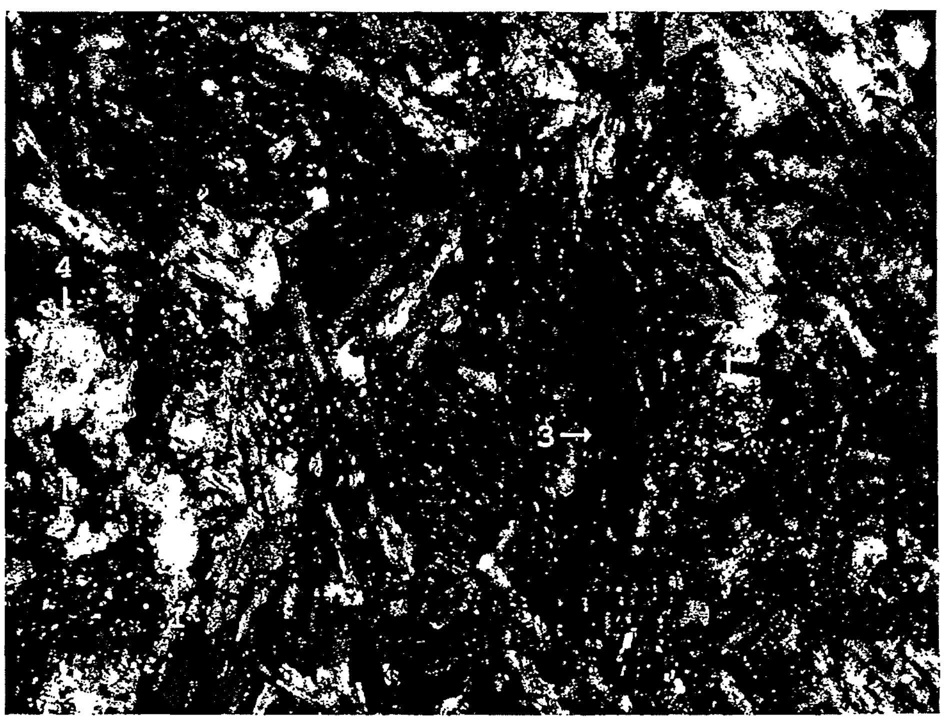
PHOTO NO. 6 – Sample B-10



PHOTOMICROGRAPHS OF THIN SECTIONS
(Magnification = 200X, Field Length = 0.6 mm)

Sample B-7. Top photo -plane polarized light, bottom photo same field of view with crossed polars.

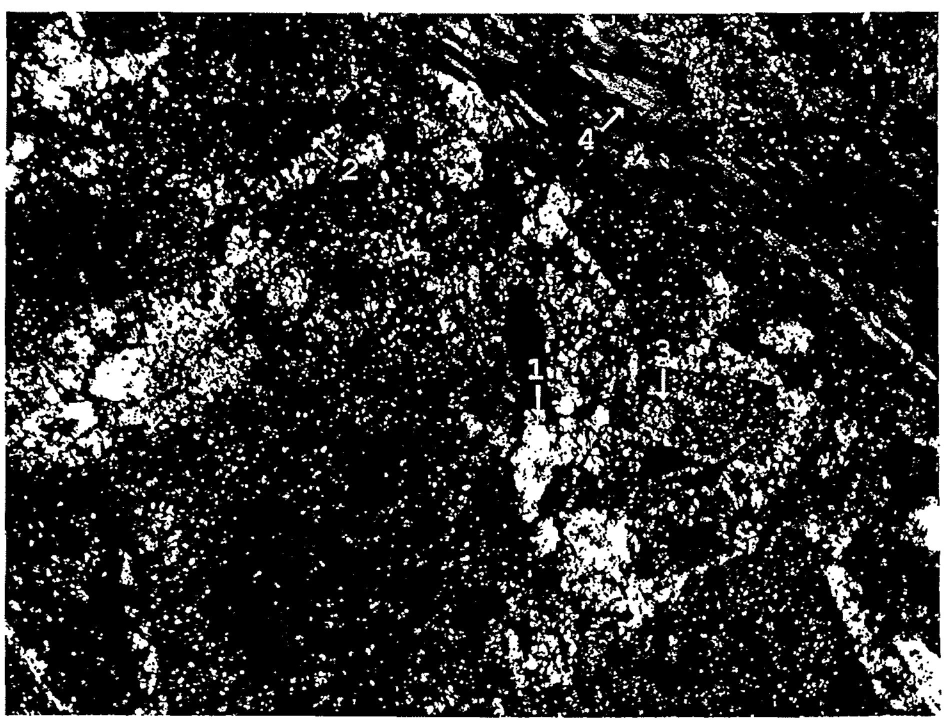




1) Quartz, 2) Epidote, 3) Chlorite, 4) Calcite, and 5) Pyrite.

PHOTOMICROGRAPHS OF THIN SECTIONS
(Magnification = 80X, Field Length = 1.7 mm)

Sample B-10. Top photo -plane polarized light, bottom photo same field of view with crossed polars.



1) Quartz, 2) Altered Feldspar, 3) Epidote, and 4) Chlorite.

APPENDIX – C

ROCK MASS RATING

BORING DATA

Project: Weber Creek Bridge (Widen)
Job #: 1P2/399/296-1.2W
Support: Pier-2/Left
Boring: 05-11

Top Hole	(ft)	(m)
Elevation:	1602.64	488.49

	(ft)	(m)
Proposed Footing Elevation:		
Existing Footing Elevation:	1569.00	478.24

Date: 10/6/2005

Diameter of Core: 1.75 (inches)

Layer	Run	Run Interval (ft)		Run Length	Recovery	RQD	Discontinuity Spacing	Point Load Index		UCS	
		Top	Bottom								
		(ft)	(ft)	(ft)	(%)		(inches)	(psi)	(MPa)	(psi)	(Mpa)
1	C	11.3	16.3	5.0	98	36	2				
1	D	16.3	21.3	5.0	76	0	2	291	2.0		
2	E	21.3	24.6	3.3	61	0	12				
2	F	24.6	26.8	2.2	91	0	12				
2	G	26.8	31.5	4.7	100	53	12	1130	7.8		
2	H	31.5	36.5	5.0	100	47	12				
2	I	36.5	41.5	5.0	100	40	12	1808	12.5		
2	J	41.5	46.5	5.0	100	37	12				
2	K	46.5	51.5	5.0	100	83	12	1582	10.9	9328	64.3
2	L	51.5	56.1	4.6	100	29	6				
2	M	56.1	61.1	5.0	100	60	28	1324	9.1		
2	N	61.1	66.1	5.0	100	100	28				
2	O	66.1	70.8	4.7	100	96	28	1550	10.7	11429	78.8
2	P	70.8	75.8	5.0	90	94	28	1291	8.9		
							AVERAGE:	1282	8.8	10379	71.6

Average Value for Tests Completed in Individual Layers

Layer	Point Load Index		UCS*		UCS	
	(psi)	(MPa)	(psi)	(MPa)	(psi)	(MPa)
1	291	2.0	6338	43.7		
2	1448	10.0	31525	217.4	10379	71.6
3						
4						
5						
6						
7						
8						

Average Value for All Point Load Tests

UCS*	
(psi)	(MPa)
27927	192.5

*Uniaxial compressive strength values based on point load test data and correlations derived from Bieniawski (1975); "Rock Mechanics for Underground Mining", Brady & Brown, 1985 (page 98-99).

ROCK MASS RATING (RMR) SYSTEM

Project: Weber Creek Bridge (Widen)
Job #: 1P2/399/296-1.2W
Support: Pier-2/Left
Boring: 05-11
Top Hole Elevation: 1602.64

Date: 10/6/05

Depth Interval (ft)		Elevation Interval (ft)	
Top Layer	Bottom Layer	Top Layer	Bottom Layer
11.3	21.3	1591.3	1581.3

Point Load Index: 2.0 MPa
UCS: MPa
RQD: 18 %
Spacing of Discont: 51 mm

If you would like to use the "Average" Unlaxial Compressive Strength from all Point Load Index Tests completed for this boring, enter value (otherwise leave blank): psi

Dscrptn: Decomposed and very intensely weathered/fractured ROCK

A. Classification Parameters and their Ratings

	Parameter		Range of Values							Rating
A1	Strength of Intact Rock Material	Point-Load Strength Index	>10 MPa	4 -10 MPa	2 - 4 MPa	1 - 2 MPa	For this low range -- uniaxial compressive test is preferred			4
		Unlaxial Compressive Strength	>250 MPa	100 - 250 MPa	50 - 100 MPa	25 - 50 MPa	5-25 MPa	1-5 MPa	<1 MPa	0
	Rating		*15*	*12*	*7*	*4*	*2*	*1*	*0*	
A2	Drill Core Quality RQD		90% - 100%	75% - 90%	50% - 75%	25% - 50%	<25%			3
	Rating		*20*	*17*	*13*	*8*	*3*			
A3	Spacing of Discontinuities		>2000 mm	600 - 2000 mm	200 - 600 mm	60 - 200 mm	<60 mm			5
	Rating		*20*	*15*	*10*	*8*	*5*			
A4	Condition of Discontinuities		Very rough surfaces Not continuous No Separation Unweathered wall	Slightly rough surfaces Separation <1 mm Slightly weathered	Slightly rough surfaces Separation <1 mm Highly weathered	Slickensided Surfaces or Gouge < 5 mm thick or Separation 1-5 mm Continuous	Soft gouge >5 mm thick or Separation >5 mm Continuous			0
	Rating		*30*	*25*	*20*	*10*	*0*			
A5	Groundwater (General Conditions)		Completely Dry	Damp	Wet	Dripping	Flowing			15
	Rating		*15*	*10*	*7*	*4*	*0*			

B. Rating Adjustment for Discontinuity Orientations

	Strike and Dip Orientations		Very Favorable	Favorable	Fair	Unfavorable	Very Unfavorable	
B	Ratings	Tunnels	0	-2	-5	-10	-12	-7
		Foundations	0	-2	-7	-15	-25	
		Slopes	0	-5	-25	-50	-60	

ROCK MASS				
Rating	**Class Number**	**Description**	**Cohesion (kPa)**	**Friction Angle (deg)**
20	V	Very Poor Rock	< 100	< 15

< 14.5 psi

ROCK MASS RATING (RMR) SYSTEM

Date: 10/6/05

Project: Weber Creek Bridge (Widen)
Support: Pier-2/Left
Boring: 05-11
Top Hole
Elevation: 1602.64

Depth Interval (ft)		Elevation Interval (ft)	
Top Layer	Bottom Layer	Top Layer	Bottom Layer
21.3	75.8	1581.3	1526.8

Estimated Uniaxial Compressive Strength: ______ psi

Point Load Index:		MPa
UCS:	71.6	MPa
RQD:	58	%
Spacing of Discont:	428	mm

Dscrptn: Slightly weathered to fresh, moderately fractured ROCK

* Enter value for Point Load Index or UCS

A. Classification Parameters and their Ratings

Parameter			Range of Values							Rating
A1	Strength of Intact Rock Material	Point-Load Strength Index	>10 MPa	4 -10 MPa	2 - 4 MPa	1 - 2 MPa	For this low range -- uniaxial compressive test is preferred			0
		Uniaxial Compressive Strength	>250 MPa	100 - 250 MPa	50 - 100 MPa	25 - 50 MPa	5-25 MPa	1-5 MPa	<1 MPa	7
	Rating		*15*	*12*	*7*	*4*	*2*	*1*	*0*	
A2	Drill Core Quality RQD		90% - 100%	75% - 90%	50% - 75%	25% - 50%	<25%			13
	Rating		*20*	*17*	*13*	*8*	*3*			
A3	Spacing of Discontinuities		>2000 mm	600 - 2000 mm	200 - 600 mm	60 - 200 mm	<60 mm			10
	Rating		*20*	*15*	*10*	*8*	*5*			
A4	Condition of Discontinuities		Very rough surfaces Not continuous No Separation Unweathered wall	Slightly rough surfaces Separation <1 mm Slightly weathered	Slightly rough surfaces Separation <1 mm Highly weathered	Slickensided Surfaces or Gouge < 5 mm thick or Separation 1-5 mm Continuous	Soft gouge >5 mm thick or Separation >5 mm Continuous			20
	Rating		*30*	*25*	*20*	*10*	*0*			
A5	Groundwater (General Conditions)		Completely Dry	Damp	Wet	Dripping	Flowing			10
	Rating		*15*	*10*	*7*	*4*	*0*			

B. Rating Adjustment for Discontinuity Orientations

B	Strike and Dip Orientations		Very Favorable	Favorable	Fair	Unfavorable	Very Unfavorable	
	Ratings	Tunnels	0	-2	-5	-10	-12	-7
		Foundations	0	-2	-7	-15	-25	
		Slopes	0	-5	-25	-50	-60	

ROCK MASS				
Rating	**Class Number**	**Description**	**Cohesion (kPa)**	**Friction Angle (deg)**
53	III	Fair Rock	200 - 300	25 - 35

29.0 - 43.5 psi

Rock Mass Rating (RMR) Summary

Project: Weber Creek Bridge (Widen)
Job Number: 1P2/399/296-1.2W
Support Location: Pier-2/Left
Boring: 05-11

	(ft)	(m)
Top Hole Elevation:	1602.64	488.49

	(ft)	(m)
Proposed Footing Elevation:		
Existing Footing Elevation:	1569.0	478.24

Date: 10/06/05

Layer	Depth Interval		Elevation Interval		Rock Description	RQD**	Point Load Index		Uniaxial Comp. Strength		Estimated Rock Mass Properties					
											Rating	Class Number	Description	Cohesion		Friction Angle
	(ft)	(m)	(ft)	(m)			(psi)	(Mpa)	(psi)	(Mpa)				(psi)	(kPa)	(degrees)
1	11.3 - 21.3	3.44 - 6.49	1591.3 - 1581.3	485.04 - 481.99	Decomposed and very intensely weathered/fractured ROCK	18	291	2.0	--	--	20	V	Very Poor Rock	< 14.5	< 100	< 15
2	21.3 - 75.8	6.49 - 23.10	1581.3 - 1526.8	481.99 - 465.38	Slightly weathered to fresh, moderately fractured ROCK	58	1448	10.0	--	70.0	53	III	Fair Rock	29.0 - 43.5	200 - 300	25 - 35

* Unconfined Compressive Strength (UCS) value selected based on correlations with published data, otherwise values shown for Point Load Index and UCS were determined from laboratory testing.
** Weighted Average RQD Value (%).

BORING DATA

Project: Weber Creek Bridge (Widen)
Job #: 1P2/399/296-1.2W
Support: Pier-2/Right
Boring: 05-10

Top Hole	(ft)	(m)
Elevation:	1598.4	487.20

	(ft)	(m)
Proposed Footing Elevation:		
Existing Footing Elevation:	1569.00	478.24

Date: 10/6/2005

Diameter of Core: 1.75 (inches)

Layer	Run	Run Interval (ft)		Run Length	Recovery	RQD	Discontinuity Spacing	Point Load Index		UCS	
		Top	Bottom								
		(ft)	(ft)	(ft)	(%)		(inches)	(psi)	(MPa)	(psi)	(Mpa)
1	A	11.0	14.8	3.8	50	0	2	775	5.3		
1	B	14.8	17.6	2.8	57	36	2				
1	C	17.6	20.0	2.4	100	0	2				
1	D	20.0	22.6	2.6	50	31	2	743	5.1		
2	E	22.6	27.3	4.7	100	81	12	1582	10.9		
2	F	27.3	32.3	5.0	100	66	12			2599	17.9
2	G	32.3	37.5	5.2	94	64	12				
2	H	37.5	42.4	4.9	100	55	12	1485	10.2		
2	I	42.4	47.4	5.0	100	88	12				
2	J	47.4	51.0	3.6	100	56	12				
2	K	51.0	56.2	5.2	96	31	12	1711	11.8		
2	L	56.2	61.2	5.0	70	30	3	2905	20.0		
2	M	61.2	64.8	3.6	100	100	3				
2	N	64.8	69.8	5.0	100	72	28	1872	12.9	22826	157.4
							AVERAGE:	1582	10.9	12713	87.7

Average Value for Tests Completed in Individual Layers

Layer	Point Load Index		UCS*		UCS	
	(psi)	(MPa)	(psi)	(MPa)	(psi)	(MPa)
1	759	5.2	16530	114.0		
2	1911	13.2	41619	287.0	12713	87.7
3						
4						
5						
6						
7						
8						

Average Value for All Point Load Tests

UCS*	
(psi)	(MPa)
34451	237.5

*Uniaxial compressive strength values based on point load test data and correlations derived from Bieniawski (1975); "Rock Mechanics for Underground Mining", Brady & Brown, 1985 (page 98-99).

ROCK MASS RATING (RMR) SYSTEM

Date: 10/6/05

Project: Weber Creek Bridge (Widen)
Job #: 1P2/399/296-1.2W
Support: Pier-2/Right
Boring: 05-10
Top Hole Elevation: 1598.4

Depth Interval (ft)		Elevation Interval (ft)	
Top Layer	Bottom Layer	Top Layer	Bottom Layer
11.0	22.6	1587.4	1575.8

Point Load Index:	2.0	MPa
UCS:		MPa
RQD:	16	%
Spacing of Discont:	51	mm

If you would like to use the "Average" Uniaxial Compressive Strength from all Point Load Index Tests completed for this boring, enter value (otherwise leave blank): ______ psi

Dscrptn: Intensely and moderately weathered, intensely fractured ROCK

A. Classification Parameters and their Ratings

Parameter			Range of Values							Rating
A1	Strength of Intact Rock Material	Point-Load Strength Index	>10 MPa	4 -10 MPa	2 - 4 MPa	1 - 2 MPa	For this low range -- uniaxial compressive test is preferred			*4*
		Uniaxial Compressive Strength	>250 MPa	100 - 250 MPa	50 - 100 MPa	25 - 50 MPa	5-25 MPa	1-5 MPa	<1 MPa	*0*
	Rating		*15*	*12*	*7*	*4*	*2*	*1*	*0*	
A2	Drill Core Quality RQD		90% - 100%	75% - 90%	50% - 75%	25% - 50%	<25%			*3*
	Rating		*20*	*17*	*13*	*8*	*3*			
A3	Spacing of Discontinuities		>2000 mm	600 - 2000 mm	200 - 600 mm	60 - 200 mm	<60 mm			*5*
	Rating		*20*	*15*	*10*	*8*	*5*			
A4	Condition of Discontinuities		Very rough surfaces Not continuous No Separation Unweathered wall	Slightly rough surfaces Separation <1 mm Slightly weathered	Slightly rough surfaces Separation <1 mm Highly weathered	Slickensided Surfaces or Gouge < 5 mm thick or Separation 1-5 mm Continuous	Soft gouge >5 mm thick or Separation >5 mm Continuous			*0*
	Rating		*30*	*25*	*20*	*10*	*0*			
A5	Groundwater (General Conditions)		Completely Dry	Damp	Wet	Dripping	Flowing			*15*
	Rating		*15*	*10*	*7*	*4*	*0*			

B. Rating Adjustment for Discontinuity Orientations

B	Strike and Dip Orientations		Very Favorable	Favorable	Fair	Unfavorable	Very Unfavorable	Rating
	Ratings	Tunnels	0	-2	-5	-10	-12	*-7*
		Foundations	0	-2	-7	-15	-25	
		Slopes	0	-5	-25	-50	-60	

ROCK MASS

Rating	Class Number	Description	Cohesion (kPa)	Friction Angle (deg)
20	V	Very Poor Rock	< 100	< 15

< 14.5 psi

ROCK MASS RATING (RMR) SYSTEM

Date: 10/6/05

Project: Weber Creek Bridge (Widen)
Support: Pier-2/Right
Boring: 05-10
Top Hole
Elevation: 1598.4

Depth Interval (ft)		Elevation Interval (ft)	
Top Layer	Bottom Layer	Top Layer	Bottom Layer
22.6	69.8	1575.8	1528.6

Estimated Uniaxial Compressive Strength: [ ] psi

Point Load Index:		MPa
UCS:	87.7	MPa
RQD:	63	%
Spacing of Discont:	300	mm

* Enter value for Point Load Index or UCS

Dscrptn: Slightly weathered to fresh, intensely to moderately fractured ROCK

A. Classification Parameters and their Ratings

Parameter			Range of Values							Rating
A1	Strength of Intact Rock Material	Point-Load Strength Index	>10 MPa	4 -10 MPa	2 - 4 MPa	1 - 2 MPa	For this low range -- uniaxial compressive test is preferred			*0*
		Uniaxial Compressive Strength	>250 MPa	100 - 250 MPa	50 - 100 MPa	25 - 50 MPa	5-25 MPa	1-5 MPa	<1 MPa	*7*
	Rating		*15*	*12*	*7*	*4*	*2*	*1*	*0*	
A2	Drill Core Quality RQD		90% - 100%	75% - 90%	50% - 75%	25% - 50%	<25%			*13*
	Rating		*20*	*17*	*13*	*8*	*3*			
A3	Spacing of Discontinuities		>2000 mm	600 - 2000 mm	200 - 600 mm	60 - 200 mm	<60 mm			*10*
	Rating		*20*	*15*	*10*	*8*	*5*			
A4	Condition of Discontinuities		Very rough surfaces Not continuous No Separation Unweathered wall	Slightly rough surfaces Separation <1 mm Slightly weathered	Slightly rough surfaces Separation <1 mm Highly weathered	Slickensided Surfaces or Gouge < 5 mm thick or Separation 1-5 mm Continuous	Soft gouge >5 mm thick or Separation >5 mm Continuous			*20*
	Rating		*30*	*25*	*20*	*10*	*0*			
A5	Groundwater (General Conditions)		Completely Dry	Damp	Wet	Dripping	Flowing			*10*
	Rating		*15*	*10*	*7*	*4*	*0*			

B. Rating Adjustment for Discontinuity Orientations

B	Strike and Dip Orientations		Very Favorable	Favorable	Fair	Unfavorable	Very Unfavorable	
	Ratings	Tunnels	0	-2	-5	-10	-12	*-7*
		Foundations	0	-2	-7	-15	-25	
		Slopes	0	-5	-25	-50	-60	

ROCK MASS				
Rating	**Class Number**	**Description**	**Cohesion (kPa)**	**Friction Angle (deg)**
53	III	Fair Rock	200 - 300	25 - 35

29.0 - 43.5 psi

Rock Mass Rating (RMR) Summary

Project: Weber Creek Bridge (Widen)
Job Number: 1P2/399/296-1.2W
Support Location: Pier-2/Right
Boring: 05-10

	(ft)	(m)
Top Hole Elevation:	1598.4	487.20

	(ft)	(m)
Proposed Footing Elevation:		
Existing Footing Elevation:	1569.0	478.24

Date: 10/06/05

Layer	Depth Interval		Elevation Interval		Rock Description	RQD**	Point Load Index		Unlaxial Comp. Strength		Estimated Rock Mass Properties					
											Rating	Class Number	Description	Cohesion		Friction Angle
	(ft)	(m)	(ft)	(m)			(psi)	(Mpa)	(psi)	(Mpa)				(psi)	(kPa)	(degrees)
1	11.0 - 22.6	3.35 - 6.89	1587.4 - 1575.8	483.84 - 480.30	Intensely and moderately weathered, intensely fractured ROCK	16	759	5.2	--	--	20	V	Very Poor Rock	< 14.5	< 100	< 15
2	22.6 - 69.8	6.89 - 21.28	1575.8 - 1528.6	480.30 - 465.92	Slightly weathered to fresh, intensely to moderately fractured ROCK	63	1911	13.2	--	80.0	53	III	Fair Rock	29.0 - 43.5	200 - 300	25 - 35

* Unconfined Compressive Strength (UCS) value selected based on correlations with published data, otherwise values shown for Point Load Index and UCS were determined from laboratory testing.
** Weighted Average RQD Value (%).

BORING DATA

Project: Weber Creek Bridge (Widen)
Job #: 1P2/399/296-1.2W
Support: Pier-3/Left
Boring: 05-8

	(ft)	(m)
Top Hole Elevation:	1535.18	467.93

	(ft)	(m)
Proposed Footing Elevation:		
Existing Footing Elevation:	1508.00	459.64

Date: 10/6/2005

Diameter of Core: 1.75 (inches)

Layer	Run	Run Interval (ft) Top	Run Interval (ft) Bottom	Run Length	Recovery	RQD	Discontinuity Spacing	Point Load Index		UCS	
		(ft)	(ft)	(ft)	(%)		(inches)	(psi)	(MPa)	(psi)	(Mpa)
1	B	6.4	11.2	4.8	100	0	2				
2	C	11.2	16.2	5.0	100	58	3	549	3.8		
2	D	16.2	21.2	5.0	100	87	10	1582	10.9	19549	134.8
2	E	21.2	24.0	2.8	100	73	10				
2	F	24.0	26.5	2.5	100	40	3	2389	16.5		
2	G	26.5	31.5	5.0	100	70	3			4198	28.9
2	H	31.5	36.5	5.0	100	93	3	581	4.0		
2	I	36.5	40.2	3.7	100	0	2				
2	J	40.2	42.2	2.0	100	67	12				
2	K	42.2	47.2	5.0	100	50	12	1130	7.8		
2	L	47.2	52.2	5.0	100	38	12	136	0.9		
2	M	52.2	55.4	3.2	100	23	6				
							AVERAGE:	1061	7.3	11874	81.9

Average Value for Tests Completed in Individual Layers

Layer	Point Load Index		UCS*		UCS	
	(psi)	(MPa)	(psi)	(MPa)	(psi)	(MPa)
1						
2	1061	7.3	23111	159.3	11874	81.9
3						
4						
5						
6						
7						
8						

Average Value for All Point Load Tests

UCS*	
(psi)	(MPa)
23111	159.3

*Uniaxial compressive strength values based on point load test data and correlations derived from Bieniawski (1975); "Rock Mechanics for Underground Mining", Brady & Brown, 1985 (page 98-99).

ROCK MASS RATING (RMR) SYSTEM

Date: 10/6/05

Project: Weber Creek Bridge (Widen)
Job #: 1P2/399/296-1.2W
Support: Pier-3/Left
Boring: 05-8
Top Hole Elevation: 1535.18

Depth Interval (ft)		Elevation Interval (ft)	
Top Layer	Bottom Layer	Top Layer	Bottom Layer
6.4	11.2	1528.8	1524.0

Point Load Index:	2.0	MPa
UCS:		MPa
RQD:	0	%
Spacing of Discont:	51	mm

If you would like to use the "Average" Uniaxial Compressive Strength from all Point Load Index Tests completed for this boring, enter value (otherwise leave blank): ______ psi

Dscrptn: Intensely and moderately weathered, very intensely to intensely fractured ROCK

A. Classification Parameters and their Ratings

	Parameter		Range of Values							Rating
A1	Strength of Intact Rock Material	Point-Load Strength Index	>10 MPa	4 -10 MPa	2 - 4 MPa	1 - 2 MPa	For this low range -- uniaxial compressive test is preferred			*4*
		Uniaxial Compressive Strength	>250 MPa	100 - 250 MPa	50 - 100 MPa	25 - 50 MPa	5-25 MPa	1-5 MPa	<1 MPa	*0*
	Rating		*15*	*12*	*7*	*4*	*2*	*1*	*0*	
A2	Drill Core Quality RQD		90% - 100%	75% - 90%	50% - 75%	25% - 50%	<25%			*3*
	Rating		*20*	*17*	*13*	*8*	*3*			
A3	Spacing of Discontinuities		>2000 mm	600 - 2000 mm	200 - 600 mm	60 - 200 mm	<60 mm			*5*
	Rating		*20*	*15*	*10*	*8*	*5*			
A4	Condition of Discontinuities		Very rough surfaces Not continuous No Separation Unweathered wall	Slightly rough surfaces Separation <1 mm Slightly weathered	Slightly rough surfaces Separation <1 mm Highly weathered	Slickensided Surfaces or Gouge < 5 mm thick or Separation 1-5 mm Continuous	Soft gouge >5 mm thick or Separation >5 mm Continuous			*0*
	Rating		*30*	*25*	*20*	*10*	*0*			
A5	Groundwater (General Conditions)		Completely Dry	Damp	Wet	Dripping	Flowing			*15*
	Rating		*15*	*10*	*7*	*4*	*0*			

B. Rating Adjustment for Discontinuity Orientations

	Strike and Dip Orientations		Very Favorable	Favorable	Fair	Unfavorable	Very Unfavorable	
B	Ratings	Tunnels	0	-2	-5	-10	-12	*-7*
		Foundations	0	-2	-7	-15	-25	
		Slopes	0	-5	-25	-50	-60	

ROCK MASS

Rating	Class Number	Description	Cohesion (kPa)	Friction Angle (deg)
20	V	Very Poor Rock	< 100	< 15
			< 14.5 psi	

ROCK MASS RATING (RMR) SYSTEM

Date: 10/6/05

Project: Weber Creek Bridge (Widen)
Support: Pier-3/Left
Boring: 05-8
Top Hole
Elevation: 1535.18

Depth Interval (ft)		Elevation Interval (ft)	
Top Layer	Bottom Layer	Top Layer	Bottom Layer
11.2	55.4	1524.0	1479.8

Estimated Uniaxial Compressive Strength: ______ psi

Point Load Index:		MPa
UCS:	81.9	MPa
RQD:	56	%
Spacing of Discont:	175	mm

* Enter value for Point Load Index or UCS

Dscrptn: Slightly weathered to fresh, intensely to moderately fractured ROCK

A. Classification Parameters and their Ratings

Parameter			Range of Values							Rating
A1	Strength of Intact Rock Material	Point-Load Strength Index	>10 MPa	4 -10 MPa	2 - 4 MPa	1 - 2 MPa	For this low range -- uniaxial compressive test is preferred			0
		Uniaxial Compressive Strength	>250 MPa	100 - 250 MPa	50 - 100 MPa	25 - 50 MPa	5-25 MPa	1-5 MPa	<1 MPa	7
	Rating		15	12	7	4	2	1	0	
A2	Drill Core Quality RQD		90% - 100%	75% - 90%	50% - 75%	25% - 50%	<25%			13
	Rating		20	17	13	8	3			
A3	Spacing of Discontinuities		>2000 mm	600 - 2000 mm	200 - 600 mm	60 - 200 mm	<60 mm			8
	Rating		20	15	10	8	5			
A4	Condition of Discontinuities		Very rough surfaces Not continuous No Separation Unweathered wall	Slightly rough surfaces Separation <1 mm Slightly weathered	Slightly rough surfaces Separation <1 mm Highly weathered	Slickensided Surfaces or Gouge < 5 mm thick or Separation 1-5 mm Continuous	Soft gouge >5 mm thick or Separation >5 mm Continuous			20
	Rating		30	25	20	10	0			
A5	Groundwater (General Conditions)		Completely Dry	Damp	Wet	Dripping	Flowing			10
	Rating		15	10	7	4	0			

B. Rating Adjustment for Discontinuity Orientations

	Strike and Dip Orientations		Very Favorable	Favorable	Fair	Unfavorable	Very Unfavorable	
B	Ratings	Tunnels	0	-2	-5	-10	-12	-7
		Foundations	0	-2	-7	-15	-25	
		Slopes	0	-5	-25	-50	-60	

ROCK MASS				
Rating	**Class Number**	**Description**	**Cohesion (kPa)**	**Friction Angle (deg)**
51	III	Fair Rock	200 - 300	25 - 35

29.0 - 43.5 psi

Rock Mass Rating (RMR) Summary

Project: Weber Creek Bridge (Widen)
Job Number: 1P2/399/296-1.2W
Support Location: Pier-3/Left
Boring: 05-8

	(ft)	(m)
Top Hole Elevation:	1535.18	467.93

	(ft)	(m)
Proposed Footing Elevation:		
Existing Footing Elevation:	1508.0	459.64

Date: 10/06/05

Layer	Depth Interval		Elevation Interval		Rock Description	RQD**	Point Load Index		Unlaxial Comp. Strength		Estimated Rock Mass Properties					
											Rating	Class Number	Description	Cohesion		Friction Angle
	(ft)	(m)	(ft)	(m)			(psi)	(Mpa)	(psi)	(Mpa)				(psi)	(kPa)	(degrees)
1	6.4 - 11.2	1.95 - 3.41	1528.8 - 1524.0	465.97 - 464.51	Intensely and moderately weathered, very intensely to intensely fractured ROCK	0			--	--	20	V	Very Poor Rock	< 14.5	< 100	< 15
2	11.2 - 55.4	3.41 - 16.89	1524.0 - 1479.8	464.51 - 451.04	Slightly weathered to fresh, intensely to moderately fractured ROCK	56	1061	7.3	--	80.0	51	III	Fair Rock	29.0 - 43.5	200 - 300	25 - 35

* Unconfined Compressive Strength (UCS) value selected based on correlations with published data, otherwise values shown for Point Load Index and UCS were determined from laboratory testing.
** Weighted Average RQD Value (%).

BORING DATA

Project: Weber Creek Bridge (Widen)
Job #: 1P2/399/296-1.2W
Support: Pier-3/Right
Boring: 05-9

Date: 10/6/2005

Top Hole	(ft)	(m)
Elevation:	1535.48	468.02

	(ft)	(m)
Proposed Footing Elevation:		
Existing Footing Elevation:	1508.00	459.64

Diameter of Core: 1.75 (inches)

Layer	Run	Run Interval (ft) Top	Run Interval (ft) Bottom	Run Length	Recovery	RQD	Discontinuity Spacing	Point Load Index		UCS	
		(ft)	(ft)	(ft)	(%)		(inches)	(psi)	(MPa)	(psi)	(Mpa)
1	A	5.0	7.2	2.2	100	18	2	2163	14.9		
2	B	7.2	12.2	5.0	98	72	12			13391	92.3
2	C	12.2	15.2	3.0	100	23	6				
2	D	15.2	17.2	2.0	100	0	6				
2	E	17.2	22.2	5.0	100	54	12	710	4.9		
2	F	22.2	27.2	5.0	100	80	12	1291	8.9		
2	G	27.2	32.2	5.0	100	64	12				
2	H	32.2	37.2	5.0	100	60	12	839	5.8		
2	I	37.2	42.2	5.0	100	66	12			10864	74.9
2	J	42.2	47.2	5.0	100	36	12	839	5.8		
2	K	47.2	52.2	5.0	100	60	12				
2	L	52.2	57.2	5.0	100	86	12	581	4.0		
							AVERAGE:	1071	7.4	12128	83.6

Average Value for Tests Completed in Individual Layers

Layer	Point Load Index		UCS*		UCS	
	(psi)	(MPa)	(psi)	(MPa)	(psi)	(MPa)
1	2163	14.9	47107	324.8		
2	852	5.9	18555	127.9	12128	83.6
3						
4						
5						
6						
7						
8						

Average Value for All Point Load Tests

UCS*	
(psi)	(MPa)
23314	160.7

*Uniaxial compressive strength values based on point load test data and correlations derived from Bieniawski (1975); "Rock Mechanics for Underground Mining", Brady & Brown, 1985 (page 98-99).

ROCK MASS RATING (RMR) SYSTEM

Project: Weber Creek Bridge (Widen)
Job #: 1P2/399/296-1.2W
Support: Pier-3/Right
Boring: 05-9
Top Hole
Elevation: 1535.48

Date: 10/6/05

Depth Interval (ft)		Elevation Interval (ft)	
Top Layer	Bottom Layer	Top Layer	Bottom Layer
5.0	7.2	1530.5	1528.3

Point Load Index:	2.5	MPa
UCS:		MPa
RQD:	18	%
Spacing of Discont:	51	mm

If you would like to use the "Average" Uniaxial Compressive Strength from all Point Load Index Tests completed for this boring, enter value (otherwise leave blank): ______ psi

Dscrptn: Moderately weathered, very intensely to intensely fractured ROCK

A. Classification Parameters and their Ratings

	Parameter		Range of Values							Rating
A1	Strength of Intact Rock Material	Point-Load Strength Index	>10 MPa	4 -10 MPa	2 - 4 MPa	1 - 2 MPa	For this low range -- uniaxial compressive test is preferred			*7*
		Uniaxial Compressive Strength	>250 MPa	100 - 250 MPa	50 - 100 MPa	25 - 50 MPa	5-25 MPa	1-5 MPa	<1 MPa	*0*
	Rating		*15*	*12*	*7*	*4*	*2*	*1*	*0*	
A2	Drill Core Quality RQD		90% - 100%	75% - 90%	50% - 75%	25% - 50%	<25%			*3*
	Rating		*20*	*17*	*13*	*8*	*3*			
A3	Spacing of Discontinuities		>2000 mm	600 - 2000 mm	200 - 600 mm	60 - 200 mm	<60 mm			*5*
	Rating		*20*	*15*	*10*	*8*	*5*			
A4	Condition of Discontinuities		Very rough surfaces Not continuous No Separation Unweathered wall	Slightly rough surfaces Separation <1 mm Slightly weathered	Slightly rough surfaces Separation <1 mm Highly weathered	Slickensided Surfaces or Gouge < 5 mm thick or Separation 1-5 mm Continuous	Soft gouge >5 mm thick or Separation >5 mm Continuous			*0*
	Rating		*30*	*25*	*20*	*10*	*0*			
A5	Groundwater (General Conditions)		Completely Dry	Damp	Wet	Dripping	Flowing			*10*
	Rating		*15*	*10*	*7*	*4*	*0*			

B. Rating Adjustment for Discontinuity Orientations

	Strike and Dip Orientations		Very Favorable	Favorable	Fair	Unfavorable	Very Unfavorable	
B	Ratings	Tunnels	0	-2	-5	-10	-12	*-7*
		Foundations	0	-2	-7	-15	-25	
		Slopes	0	-5	-25	-50	-60	

ROCK MASS

Rating	Class Number	Description	Cohesion (kPa)	Friction Angle (deg)
18	V	Very Poor Rock	< 100	< 15

< 14.5 psi

ROCK MASS RATING (RMR) SYSTEM

Project: Weber Creek Bridge (Widen)
Support: Pier-3/Right
Boring: 05-9
Top Hole Elevation: 1535.48

Date: 10/6/05

Depth Interval (ft)		Elevation Interval (ft)	
Top Layer	Bottom Layer	Top Layer	Bottom Layer
7.2	57.2	1528.3	1478.3

Estimated Uniaxial Compressive Strength: ______ psi

Point Load Index:		MPa
UCS:	83.6	MPa
RQD:	59	%
Spacing of Discont:	277	mm

* Enter value for Point Load Index or UCS

Dscrptn: Slightly weathered to fresh, Intensely and moderately fractured ROCK

A. Classification Parameters and their Ratings

	Parameter		Range of Values							Rating
A1	Strength of Intact Rock Material	Point-Load Strength Index	>10 MPa	4 -10 MPa	2 - 4 MPa	1 - 2 MPa	For this low range -- uniaxial compressive test is preferred			0
		Uniaxial Compressive Strength	>250 MPa	100 - 250 MPa	50 - 100 MPa	25 - 50 MPa	5-25 MPa	1-5 MPa	<1 MPa	7
	Rating		*15*	*12*	*7*	*4*	*2*	*1*	*0*	
A2	Drill Core Quality RQD		90% - 100%	75% - 90%	50% - 75%	25% - 50%	<25%			*13*
	Rating		*20*	*17*	*13*	*8*	*3*			
A3	Spacing of Discontinuities		>2000 mm	600 - 2000 mm	200 - 600 mm	60 - 200 mm	<60 mm			*10*
	Rating		*20*	*15*	*10*	*8*	*5*			
A4	Condition of Discontinuities		Very rough surfaces Not continuous No Separation Unweathered wall	Slightly rough surfaces Separation <1 mm Slightly weathered	Slightly rough surfaces Separation <1 mm Highly weathered	Slickensided Surfaces or Gouge < 5 mm thick or Separation 1-5 mm Continuous	Soft gouge >5 mm thick or Separation >5 mm Continuous			*20*
	Rating		*30*	*25*	*20*	*10*	*0*			
A5	Groundwater (General Conditions)		Completely Dry	Damp	Wet	Dripping	Flowing			*10*
	Rating		*15*	*10*	*7*	*4*	*0*			

B. Rating Adjustment for Discontinuity Orientations

	Strike and Dip Orientations		Very Favorable	Favorable	Fair	Unfavorable	Very Unfavorable	
B	Ratings	Tunnels	0	-2	-5	-10	-12	*-7*
		Foundations	0	-2	-7	-15	-25	
		Slopes	0	-5	-25	-50	-60	

ROCK MASS

Rating	Class Number	Description	Cohesion (kPa)	Friction Angle (deg)
53	III	Fair Rock	200 - 300	25 - 35

29.0 - 43.5 psi

Rock Mass Rating (RMR) Summary

Project: Weber Creek Bridge (Widen)
Job Number: 1P2/399/296-1.2W
Support Location: Pier-3/Right
Boring: 05-9

	(ft)	(m)
Top Hole Elevation:	1535.48	468.02

	(ft)	(m)
Proposed Footing Elevation:		
Existing Footing Elevation:	1508.0	459.64

Date: 10/06/05

Layer	Depth Interval		Elevation Interval		Rock Description	RQD**	Point Load Index		Unlaxial Comp. Strength		Estimated Rock Mass Properties					
											Rating	Class Number	Description	Cohesion		Friction Angle
	(ft)	(m)	(ft)	(m)			(psi)	(Mpa)	(psi)	(Mpa)				(psi)	(kPa)	(degrees)
1	5.0 - 7.2	1.52 - 2.19	1530.5 - 1528.3	466.49 - 465.82	Moderately weathered, very intensely to intensely fractured ROCK	18	2163	14.9	--	--	18	V	Very Poor Rock	< 14.5	< 100	< 15
2	7.2 - 57.2	2.19 - 17.43	1528.3 - 1478.3	465.82 - 450.58	Slightly weathered to fresh, intensely and moderately fractured ROCK	59	852	5.9	--	80.0	53	III	Fair Rock	29.0 - 43.5	200 - 300	25 - 35

* Unconfined Compressive Strength (UCS) value selected based on correlations with published data, otherwise values shown for Point Load Index and UCS were determined from laboratory testing.
** Weighted Average RQD Value (%).

BORING DATA

Project: Weber Creek Bridge (Widen)
Job #: 1P2/399/296-1.2W
Support: Pier-4/Left
Boring: 05-7

Top Hole	(ft)	(m)
Elevation:	1555.56	474.14

	(ft)	(m)
Proposed Footing Elevation:		
Existing Footing Elevation:	1530.00	466.35

Date: 10/6/2005

Diameter of Core: 1.75 (inches)

Layer	Run	Run Interval (ft) Top	Run Interval (ft) Bottom	Run Length	Recovery	RQD	Discontinuity Spacing	Point Load Index		UCS	
		(ft)	(ft)	(ft)	(%)		(inches)	(psi)	(MPa)	(psi)	(Mpa)
1	A	10.7	12.6	1.9	25	0	2				
1	B	12.6	16.6	4.0	80	0	2				
1	C	16.6	21.6	5.0	100	92	6	775	5.3	1422	9.8
1	D	21.6	26.6	5.0	100	50	6	484	3.3		
1	E	26.6	30.0	3.4	100	0	2				
2	F	30.0	32.2	2.2	100	15	2				
2	G	32.2	37.2	5.0	100	67	6			26114	180.1
2	H	37.2	41.1	3.9	100	65	6	1420	9.8		
2	I	41.1	46.1	5.0	100	10	6				
2	J	46.1	51.1	5.0	100	27	6	1227	8.5		
2	K	51.1	56.1	5.0	100	45	6				
2	L	56.1	61.1	5.0	100	67	6	420	2.9		
							AVERAGE:	865	6.0	13768	94.9

Average Value for Tests Completed in Individual Layers

Layer	Point Load Index		UCS*		UCS	
	(psi)	(MPa)	(psi)	(MPa)	(psi)	(MPa)
1	630	4.3	13710	94.5	1422	9.8
2	1022	7.0	22265	153.5	26114	180.1
3						
4						
5						
6						
7						
8						

Average Value for All Point Load Tests

UCS*	
(psi)	(MPa)
18843	129.9

*Uniaxial compressive strength values based on point load test data and correlations derived from Bieniawski (1975); "Rock Mechanics for Underground Mining", Brady & Brown, 1985 (page 98-99).

ROCK MASS RATING (RMR) SYSTEM

Date: 10/6/05

Project: Weber Creek Bridge (Widen)
Job #: 1P2/399/296-1.2W
Support: Pier-4/Left
Boring: 05-7
Top Hole Elevation: 1555.56

Depth Interval (ft)		Elevation Interval (ft)	
Top Layer	Bottom Layer	Top Layer	Bottom Layer
10.7	30.0	1544.9	1525.6

Point Load Index:		MPa
UCS:	9.8	MPa
RQD:	37	%
Spacing of Discont:	91	mm

If you would like to use the "Average" Uniaxial Compressive Strength from all Point Load Index Tests completed for this boring, enter value (otherwise leave blank): ______ psi

Dscrptn: Very intensely to intensely weathered, very intensely fractured ROCK

A. Classification Parameters and their Ratings

Parameter			Range of Values							Rating
A1	Strength of Intact Rock Material	Point-Load Strength Index	>10 MPa	4 -10 MPa	2 - 4 MPa	1 - 2 MPa	For this low range -- uniaxial compressive test is preferred			0
		Uniaxial Compressive Strength	>250 MPa	100 - 250 MPa	50 - 100 MPa	25 - 50 MPa	5-25 MPa	1-5 MPa	<1 MPa	2
	Rating		*15*	*12*	*7*	*4*	*2*	*1*	*0*	
A2	Drill Core Quality RQD		90% - 100%	75% - 90%	50% - 75%	25% - 50%	<25%			8
	Rating		*20*	*17*	*13*	*8*	*3*			
A3	Spacing of Discontinuities		>2000 mm	600 - 2000 mm	200 - 600 mm	60 - 200 mm	<60 mm			8
	Rating		*20*	*15*	*10*	*8*	*5*			
A4	Condition of Discontinuities		Very rough surfaces Not continuous No Separation Unweathered wall	Slightly rough surfaces Separation <1 mm Slightly weathered	Slightly rough surfaces Separation <1 mm Highly weathered	Slickensided Surfaces or Gouge < 5 mm thick or Separation 1-5 mm Continuous	Soft gouge >5 mm thick or Separation >5 mm Continuous			10
	Rating		*30*	*25*	*20*	*10*	*0*			
A5	Groundwater (General Conditions)		Completely Dry	Damp	Wet	Dripping	Flowing			10
	Rating		*15*	*10*	*7*	*4*	*0*			

B. Rating Adjustment for Discontinuity Orientations

B	Strike and Dip Orientations		Very Favorable	Favorable	Fair	Unfavorable	Very Unfavorable	-7
	Ratings	Tunnels	0	-2	-5	-10	-12	
		Foundations	0	-2	-7	-15	-25	
		Slopes	0	-5	-25	-50	-60	

ROCK MASS				
Rating	**Class Number**	**Description**	**Cohesion (kPa)**	**Friction Angle (deg)**
31	IV	Poor Rock	100 - 200	15 - 25

14.5 - 29.0 psi

ROCK MASS RATING (RMR) SYSTEM

Date: 10/6/05

Project: Weber Creek Bridge (Widen)
Support: Pier-4/Left
Boring: 05-7
Top Hole
Elevation: 1555.56

Depth Interval (ft)		Elevation Interval (ft)	
Top Layer	Bottom Layer	Top Layer	Bottom Layer
30.0	61.1	1525.6	1494.5

Estimated Uniaxial Compressive Strength: [ ] psi

Point Load Index:		MPa
UCS:	180.1	MPa
RQD:	44	%
Spacing of Discont:	138	mm

Dscrptn: Slightly weathered to fresh, intensely and moderately fractured ROCK

* Enter value for Point Load Index or UCS

A. Classification Parameters and their Ratings

Parameter			Range of Values							Rating
A1	Strength of Intact Rock Material	Point-Load Strength Index	>10 MPa	4 -10 MPa	2 - 4 MPa	1 - 2 MPa	For this low range -- uniaxial compressive test is preferred			0
		Uniaxial Compressive Strength	>250 MPa	100 - 250 MPa	50 - 100 MPa	25 - 50 MPa	5-25 MPa	1-5 MPa	<1 MPa	12
	Rating		15	12	7	4	2	1	0	
A2	Drill Core Quality RQD		90% - 100%	75% - 90%	50% - 75%	25% - 50%	<25%			8
	Rating		20	17	13	8	3			
A3	Spacing of Discontinuities		>2000 mm	600 - 2000 mm	200 - 600 mm	60 - 200 mm	<60 mm			8
	Rating		20	15	10	8	5			
A4	Condition of Discontinuities		Very rough surfaces Not continuous No Separation Unweathered wall	Slightly rough surfaces Separation <1 mm Slightly weathered	Slightly rough surfaces Separation <1 mm Highly weathered	Slickensided Surfaces or Gouge < 5 mm thick or Separation 1-5 mm Continuous	Soft gouge >5 mm thick or Separation >5 mm Continuous			20
	Rating		30	25	20	10	0			
A5	Groundwater (General Conditions)		Completely Dry	Damp	Wet	Dripping	Flowing			10
	Rating		15	10	7	4	0			

B. Rating Adjustment for Discontinuity Orientations

B	Strike and Dip Orientations		Very Favorable	Favorable	Fair	Unfavorable	Very Unfavorable	-7
	Ratings	Tunnels	0	-2	-5	-10	-12	
		Foundations	0	-2	-7	-15	-25	
		Slopes	0	-5	-25	-50	-60	

ROCK MASS

Rating	Class Number	Description	Cohesion (kPa)	Friction Angle (deg)
51	III	Fair Rock	200 - 300	25 - 35

29.0 - 43.5 psi

Rock Mass Rating (RMR) Summary

Project: Weber Creek Bridge (Widen)
Job Number: 1P2/399/296-1.2W
Support Location: Pier-4/Left
Boring: 05-7

	(ft)	(m)
Top Hole Elevation:	1555.56	474.14

	(ft)	(m)
Proposed Footing Elevation:		
Existing Footing Elevation:	1530.0	466.35

Date: 10/06/05

Layer	Depth Interval		Elevation Interval		Rock Description	RQD**	Point Load Index		Uniaxial Comp. Strength		Estimated Rock Mass Properties					
											Rating	Class Number	Description	Cohesion		Friction Angle
	(ft)	(m)	(ft)	(m)			(psi)	(Mpa)	(psi)	(Mpa)				(psi)	(kPa)	(degrees)
1	10.7 - 30.0	3.26 - 9.14	1544.9 - 1525.6	470.87 - 464.99	Very intensely to intensely weathered, very intensely fractured ROCK	37	630	4.3	--	--	31	IV	Poor Rock	14.5 - 29.0	100 - 200	15 - 25
2	30.0 - 61.1	9.14 - 18.62	1525.6 - 1494.5	464.99 - 455.51	Slightly weathered to fresh, intensely and moderately fractured ROCK	44	1022	7.0	--	80.0	51	III	Fair Rock	29.0 - 43.5	200 - 300	25 - 35

* Unconfined Compressive Strength (UCS) value selected based on correlations with published data, otherwise values shown for Point Load Index and UCS were determined from laboratory testing.
** Weighted Average RQD Value (%).

BORING DATA

Project: Weber Creek Bridge (Widen)
Job #: 1P2/399/296-1.2W
Support: Pier-4/Right
Boring: 05-6

	(ft)	(m)
Proposed Footing Elevation:		
Existing Footing Elevation:	1534.00	467.57

Date: 10/6/2005

Top Hole	(ft)	(m)
Elevation:	1560.18	475.55

Diameter of Core: 1.75 (inches)

Layer	Run	Run Interval (ft) Top	Run Interval (ft) Bottom	Run Length	Recovery	RQD	Discontinuity Spacing	Point Load Index		UCS	
		(ft)	(ft)	(ft)	(%)		(inches)	(psi)	(MPa)	(psi)	(Mpa)
1	A	10.9	12.4	1.5	10	0	2				
1	B	12.4	16.5	4.1	67	0	2				
1	C	16.5	18.6	2.1	90	0	2				
1	D	18.6	22.4	3.8	95	68	6	161	1.1		
1	E	22.4	27.4	5.0	100	0	2				
1	F	27.4	32.4	5.0	100	67	12	420	2.9		
1	G	32.4	37.4	5.0	100	0	2				
1	H	37.4	42.4	5.0	100	63	12	710	4.9		
2	I	42.4	47.4	5.0	100	100	12				
2	J	47.4	52.4	5.0	100	100	12	1792	12.4		
2	K	52.4	57.4	5.0	100	67	12				
2	L	57.4	61.9	4.5	100	87	12				
2	M	61.9	66.9	5.0	100	75	12			21799	150.3
2	N	66.9	71.9	5.0	100	75	12	678	4.7		
							AVERAGE:	752	5.2	21799	150.3

Average Value for Tests Completed in Individual Layers

Layer	Point Load Index		UCS*		UCS	
	(psi)	(MPa)	(psi)	(MPa)	(psi)	(MPa)
1	430	3.0	9372	64.6		
2	1235	8.5	26897	185.4	21799	150.3
3						
4						
5						
6						
7						
8						

Average Value for All Point Load Tests

UCS*	
(psi)	(MPa)
16382	113.0

*Uniaxial compressive strength values based on point load test data and correlations derived from Bieniawski (1975); "Rock Mechanics for Underground Mining", Brady & Brown, 1985 (page 98-99).

ROCK MASS RATING (RMR) SYSTEM

Date: 10/6/05

Project: Weber Creek Bridge (Widen)
Job #: 1P2/399/296-1.2W
Support: Pier-4/Right
Boring: 05-6
Top Hole Elevation: 1560.18

Depth Interval (ft)		Elevation Interval (ft)	
Top Layer	Bottom Layer	Top Layer	Bottom Layer
10.9	42.4	1549.3	1517.8

Point Load Index:	1.5	MPa
UCS:		MPa
RQD:	29	%
Spacing of Discont:	127	mm

If you would like to use the "Average" Uniaxial Compressive Strength from all Point Load Index Tests completed for this boring, enter value (otherwise leave blank): ______ psi

Dscrptn: Very intensely to intensely weathered, very intensely fractured ROCK

A. Classification Parameters and their Ratings

Parameter			Range of Values							Rating
A1	Strength of Intact Rock Material	Point-Load Strength Index	>10 MPa	4 -10 MPa	2 - 4 MPa	1 - 2 MPa	For this low range -- uniaxial compressive test is preferred			*4*
		Uniaxial Compressive Strength	>250 MPa	100 - 250 MPa	50 - 100 MPa	25 - 50 MPa	5-25 MPa	1-5 MPa	<1 MPa	*0*
	Rating		*15*	*12*	*7*	*4*	*2*	*1*	*0*	
A2	Drill Core Quality RQD		90% - 100%	75% - 90%	50% - 75%	25% - 50%	<25%			*8*
	Rating		*20*	*17*	*13*	*8*	*3*			
A3	Spacing of Discontinuities		>2000 mm	600 - 2000 mm	200 - 600 mm	60 - 200 mm	<60 mm			*8*
	Rating		*20*	*15*	*10*	*8*	*5*			
A4	Condition of Discontinuities		Very rough surfaces Not continuous No Separation Unweathered wall	Slightly rough surfaces Separation <1 mm Slightly weathered	Slightly rough surfaces Separation <1 mm Highly weathered	Slickensided Surfaces or Gouge < 5 mm thick or Separation 1-5 mm Continuous	Soft gouge >5 mm thick or Separation >5 mm Continuous			*10*
	Rating		*30*	*25*	*20*	*10*	*0*			
A5	Groundwater (General Conditions)		Completely Dry	Damp	Wet	Dripping	Flowing			*10*
	Rating		*15*	*10*	*7*	*4*	*0*			

B. Rating Adjustment for Discontinuity Orientations

	Strike and Dip Orientations		Very Favorable	Favorable	Fair	Unfavorable	Very Unfavorable	
B	Ratings	Tunnels	0	-2	-5	-10	-12	*-7*
		Foundations	0	-2	-7	-15	-25	
		Slopes	0	-5	-25	-50	-60	

ROCK MASS

Rating	Class Number	Description	Cohesion (kPa)	Friction Angle (deg)
33	IV	Poor Rock	100 - 200	15 - 25

14.5 - 29.0 psi

ROCK MASS RATING (RMR) SYSTEM

Date: 10/6/05

Project: Weber Creek Bridge (Widen)
Support: Pier-4/Right
Boring: 05-6
Top Hole
Elevation: 1560.18

Depth Interval (ft)		Elevation Interval (ft)	
Top Layer	Bottom Layer	Top Layer	Bottom Layer
42.4	71.9	1517.8	1488.3

Estimated Uniaxial Compressive Strength: [ ] psi

Point Load Index: [ ] MPa
UCS: 150.3 MPa
RQD: 84 %
Spacing of Discont: 305 mm

Dscrptn: Fresh, moderately and slightly fractured ROCK

* Enter value for Point Load Index or UCS

A. Classification Parameters and their Ratings

	Parameter		Range of Values							Rating
A1	Strength of Intact Rock Material	Point-Load Strength Index	>10 MPa	4 -10 MPa	2 - 4 MPa	1 - 2 MPa	For this low range -- uniaxial compressive test is preferred			0
		Uniaxial Compressive Strength	>250 MPa	100 - 250 MPa	50 - 100 MPa	25 - 50 MPa	5-25 MPa	1-5 MPa	<1 MPa	12
	Rating		*15*	*12*	*7*	*4*	*2*	*1*	*0*	
A2	Drill Core Quality RQD		90% - 100%	75% - 90%	50% - 75%	25% - 50%	<25%			17
	Rating		*20*	*17*	*13*	*8*	*3*			
A3	Spacing of Discontinuities		>2000 mm	600 - 2000 mm	200 - 600 mm	60 - 200 mm	<60 mm			10
	Rating		*20*	*15*	*10*	*8*	*5*			
A4	Condition of Discontinuities		Very rough surfaces Not continuous No Separation Unweathered wall	Slightly rough surfaces Separation <1 mm Slightly weathered	Slightly rough surfaces Separation <1 mm Highly weathered	Slickensided Surfaces or Gouge < 5 mm thick or Separation 1-5 mm Continuous	Soft gouge >5 mm thick or Separation >5 mm Continuous			20
	Rating		*30*	*25*	*20*	*10*	*0*			
A5	Groundwater (General Conditions)		Completely Dry	Damp	Wet	Dripping	Flowing			10
	Rating		*15*	*10*	*7*	*4*	*0*			

B. Rating Adjustment for Discontinuity Orientations

	Strike and Dip Orientations		Very Favorable	Favorable	Fair	Unfavorable	Very Unfavorable	
B	Ratings	Tunnels	0	-2	-5	-10	-12	-7
		Foundations	0	-2	-7	-15	-25	
		Slopes	0	-5	-25	-50	-60	

ROCK MASS				
Rating	**Class Number**	**Description**	**Cohesion (kPa)**	**Friction Angle (deg)**
62	II	Good Rock	> 400	35 - 45

> 58.0 psi

Rock Mass Rating (RMR) Summary

Project: Weber Creek Bridge (Widen)
Job Number: 1P2/399/296-1.2W
Support Location: Pier-4/Right
Boring: 05-6

	(ft)	(m)
Top Hole Elevation:	1560.18	475.55

	(ft)	(m)
Proposed Footing Elevation:		
Existing Footing Elevation:	1534.0	467.57

Date: 10/06/05

Layer	Depth Interval		Elevation Interval		Rock Description	RQD**	Point Load Index		Unlaxial Comp. Strength		Estimated Rock Mass Properties					
											Rating	Class Number	Description	Cohesion		Friction Angle
	(ft)	(m)	(ft)	(m)			(psi)	(Mpa)	(psi)	(Mpa)				(psi)	(kPa)	(degrees)
1	10.9 - 42.4	3.32 - 12.92	1549.3 - 1517.8	472.22 - 462.62	Very intensely to intensely weathered, very intensely fractured ROCK	29	430	3.0	--	--	33	IV	Poor Rock	14.5 - 29.0	100 - 200	15 - 25
2	42.4 - 71.9	12.92 - 21.92	1517.8 - 1488.3	462.62 - 453.63	Fresh, moderately and slightly fractured ROCK	84	1235	8.5	21800	150.0	62	II	Good Rock	> 58.0	> 400	35 - 45

* Unconfined Compressive Strength (UCS) value selected based on correlations with published data, otherwise values shown for Point Load Index and UCS were determined from laboratory testing.
** Weighted Average RQD Value (%).

APPENDIX – D

ROCK P-Y CURVES
(WEBER CREEK)

The A, B & C points of p-y curves and lateral springs are based on "Analysis of Laterally Loaded Piles in Weak Rock" by Lymon C. Reese in the November 1997 issue of the Journal of Geotechnical and Geoenvironmental Engineering (ASCE). The strength and modulus of intact rock were estimated from Point Load Index tests and adjusted for RQD (mostly less than 65). The D and E points on p-y curves and springs are based on a "residual" resistance (i.e. to capture hypothetical brittle behavior after "ultimate" lateral resistance of rock is exceeded) based on "standard" dense sand p-y curves.

The p-y curves were calculated at 24-inch depth intervals relative to effective top of rock elevations as noted. Different curves are calculated for each bent owing to apparent differences in rock strength from location to location. Separate curves are shown at each bent for 72-inch width (traverse loading) and 144-inch width (longitudinal loading). The "spring" for each 2-ft interval is calculated by multiplying the p-y curve by 24-inches and is expressed in units of force (kips) versus units of length or deflection (inches).

As always, these curves are approximate and estimations. Details of rock behavior are best evaluated on the basis of full scale load tests. Nonetheless, we believe that the curves represent a rational basis for estimating the behavior of existing shafts. These curves can also be used for initial design of new shafts for bridge widening, with the understanding that various modification would result from different shaft width and depth.

Technical Note – p-y curves in rock at Weber Creek Bridge

The lateral springs developed for existing pier shafts in rock are based on method outlined by Reese in 1997 – based on two field tests of large diameter cast in drilled hole piles in "soft" rock. The Weber Creek bridge project differs in the fact that existing shafts are rectangular and that rock strengths involved are considerably greater. To my knowledge, there are no field tests of comparable shafts/conditions in the literature.

Reese is somewhat unclear on how to select rock strengths to be used in these formulas, saying, that compressive strength may be obtained from tests of intact core or as a "lower bound function of depth." The rock strength data Reese used for his San Francisco case history came from pressure meter testing and for his Florida case history from a combination of unconfined compression tests and grout-plug pullout testing.

Also, where pressuremeter testing is not performed, he suggests that the elastic modulus of the rock mass be derived from typical published correlations of modulus with rock strength and modified for RQD. It is common for such modifications (based on RQD) to also be applied to the results of strength testing to derive an overall strength for the rock mass.

For lateral spring calculations for this project, we have derived the compressive strength values for use in the Reese p-y formulas by averaging the results of Point Load testing for rock from the two borings made at each bent and then multiplying this average by a factor of 0.15 – consistent with RQD less than 65%. This correction was also applied to obtain the elastic modulus of the rock mass.

I think that the approach that I chose here is reasonable, and reasonably conservative. While much higher rock strengths might be rationalized, we also have to consider the limited number of data points that we are working with from field/lab testing, in terms of both the number of test borings and number of tests. These considerations include the very minimal number of published records of field testing of lateral response of large shafts in rock.

I also note that the existing shafts have very short rock embedment lengths relative to their plan dimensions of 6'x12' – 15-ft @ Bent-2, 19-ft @ Bent-3 and 9-13 ft @ Bent-4, corresponding to an effective L/B in the range of 1-2. Since the Bent-4 shafts combine the shortest relative length (L/B in rock of about 1) with the lowest rock strength, it should not be surprising that these are the shafts with marginal lateral stability.

-FPT

Weber Creek Bridge
Existing Bent
Lateral Spring Summary
September 18, 2007
1P2/399/296-1.2W

Support: Bent-2L/R | Effective Top Elev. 1584 | Tip Elev.: 1569 | Length: 15 | Direction: Transverse/72-inch width

			p-y curve at center of interval (lb/in)					Lateral Spring for 2-ft Interval (kips)				
	Point (p):		A	B	C	D	E	A	B	C	D	E
Depth Interval (ft)		Center Depth (in)										
1	3	24	0	79885	274982	2342	2342	0	1917	6600	56	56
3	5	48	0	105584	362477	5423	5423	0	2534	8699	130	130
5	7	72	0	131284	449971	8857	8857	0	3151	10799	213	213
7	9	96	0	156986	537466	12371	12371	0	3768	12899	297	297
9	11	120	0	182688	624960	15805	15805	0	4385	14999	379	379
11	13	144	0	208390	712454	19050	19050	0	5001	17099	457	457
13	15	168	0	234093	799949	22009	22009	0	5618	19199	528	528
Deflection (y--inches):			0	0.00041027	0.0576	0.1152	2	0	0.0004103	0.0576	0.1152	2

Support: Bent-2L/R | Effective Top Elev. 1584 | Tip Elev.: 1569 | Length: 15 | Direction: Longitudinal/144-inch width

			p-y curve at center of interval (lb/in)					Lateral Spring for 2-ft Interval (kips)				
	Point (p):		A	B	C	D	E	A	B	C	D	E
Depth Interval (ft)		Center Depth (in)										
1	3	24	0	134068	462470	4220	4220	0	3218	11099	101	101
3	5	48	0	159763	549965	9368	9368	0	3834	13199	225	225
5	7	72	0	185460	637459	15271	15271	0	4451	15299	366	366
7	9	96	0	211159	724954	21692	21692	0	5068	17399	521	521
9	11	120	0	236858	812448	28473	28473	0	5685	19499	683	683
11	13	144	0	262557	899942	35429	35429	0	6301	21599	850	850
13	15	168	0	288258	987437	42519	42519	0	6918	23698	1020	1020
Deflection (y--inches):			0	0.00081362	0.1152	0.2304	2	0	0.0008136	0.1152	0.2304	2

Weber Creek Bridge
Existing Bent
Lateral Spring Summary
September 18, 2007
1P2/399/296-1.2

Support: Bent-3L/R   Effective Top Elev. 1527   Tip Elev.: 1508   Length: 19   Direction: Transverse/72-inch width

Depth Interval (ft)		Center Depth (in)	p-y curve at center of interval (lb/in) A	B	C	D	E	Lateral Spring for 2-ft Interval (kips) A	B	C	D	E
	Point (p):		A	B	C	D	E	A	B	C	D	E
1	3	24	0	59301	204019	2342	2342	0	1423	4896	56	56
3	5	48	0	78378	268934	5423	5423	0	1881	6454	130	130
5	7	72	0	97457	333850	8857	8857	0	2339	8012	213	213
7	9	96	0	116536	398765	12371	12371	0	2797	9570	297	297
9	11	120	0	135616	463680	15805	15805	0	3255	11128	379	379
11	13	144	0	154695	528595	19050	19050	0	3713	12686	457	457
13	15	168	0	173775	593510	22009	22009	0	4171	14244	528	528
15	17	192	0	192855	658426	24806	24806	0	4629	15802	595	595
17	19	216	0	211936	723341	27583	27583	0	5086	17360	662	662
Deflection (y--inches):			0	0.00041828	0.0576	0.1152	2	0	0.0004183	0.0576	0.1152	2

Support: Bent-3L/R   Effective Top Elev. 1527   Tip Elev.: 1508   Length: 19   Direction: Longitudinal/144-inch width

Depth Interval (ft)		Center Depth (in)	p-y curve at center of interval (lb/in) A	B	C	D	E	Lateral Spring for 2-ft Interval (kips) A	B	C	D	E
	Point (p):		A	B	C	D	E	A	B	C	D	E
1	3	24	0	99524	343123	4220	4220	0	2389	8235	101	101
3	5	48	0	118598	408038	9368	9368	0	2846	9793	225	225
5	7	72	0	137673	472954	15271	15271	0	3304	11351	366	366
7	9	96	0	156750	537869	21692	21692	0	3762	12909	521	521
9	11	120	0	175828	602784	28473	28473	0	4220	14467	683	683
11	13	144	0	194905	667699	35429	35429	0	4678	16025	850	850
13	15	168	0	213984	732614	42519	42519	0	5136	17583	1020	1020
15	17	192	0	233062	797530	49482	49482	0	5593	19141	1188	1188
17	19	216	0	252141	862445	56146	56146	0	6051	20699	1348	1348
Deflection (y--inches):			0	0.00083642	0.1152	0.2304	2	0	0.0008364	0.1152	0.2304	2

Support: Bent-4R — Effective Top Elev. 1543 — Tip Elev.: 1534 — Length: 9 — Direction: Transverse/72-inch width

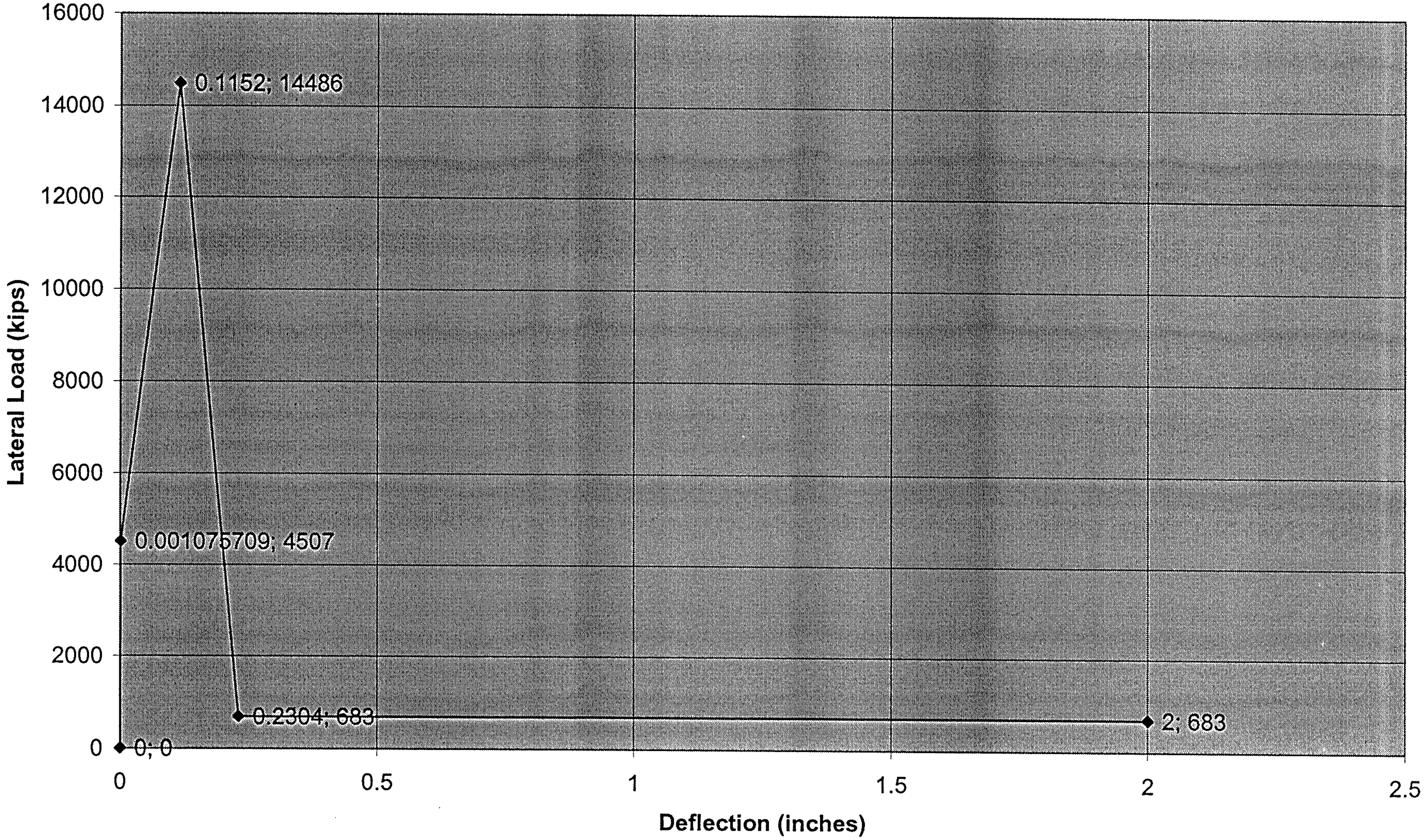
			p-y curve at center of interval (lb/in)					Lateral Spring for 2-ft Interval (kips)				
	Point (p):		A	B	C	D	E	A	B	C	D	E
Depth Interval (ft)		Center Depth (in)										
1	3	24	0	63337	204283	2342	2342	0	1520	4903	56	56
3	5	48	0	83712	269282	5423	5423	0	2009	6463	130	130
5	7	72	0	104089	334282	8857	8857	0	2498	8023	213	213
7	9	96	0	124466	399281	12371	12371	0	2987	9583	297	297
9	11	120	0	144844	464280	15805	15805	0	3476	11143	379	379
11	13	144	0	165222	529279	19050	19050	0	3965	12703	457	457
13	15	168	0	185600	594278	22009	22009	0	4454	14263	528	528
Deflection (y--inches):			0	0.00054148	0.0576	0.1152	2	0	0.0005415	0.0576	0.1152	2

Support: Bent-4L — Effective Top Elev. 1543 — Tip Elev.: 1530 — Length: 13

Support: Bent-4R — Effective Top Elev. 1543 — Tip Elev.: 1534 — Length: 9 — Direction: Longitudinal/144-inch width

			p-y curve at center of interval (lb/in)					Lateral Spring for 2-ft Interval (kips)				
	Point (p):		A	B	C	D	E	A	B	C	D	E
Depth Interval (ft)		Center Depth (in)										
1	3	24	0	106296	343567	4220	4220	0	2551	8246	101	101
3	5	48	0	126668	408566	9368	9368	0	3040	9806	225	225
5	7	72	0	147042	473566	15271	15271	0	3529	11366	366	366
7	9	96	0	167417	538565	21692	21692	0	4018	12926	521	521
9	11	120	0	187792	603564	28473	28473	0	4507	14486	683	683
11	13	144	0	208168	668563	35429	35429	0	4996	16046	850	850
13	15	168	0	228545	733562	42519	42519	0	5485	17605	1020	1020
Deflection (y--inches):			0	0.00107571	0.1152	0.2304	2	0	0.0010757	0.1152	0.2304	2

Sample Lateral Spring for 2-ft Interval



Skin Friction Load:Displacement

	Rock Mass							
Support	Compressive Strength	Elastic Modulus	Effective Top of Shaft Elev.	Bottom of Shaft Elev.	"Ultimate" skin friction	"Ultimate" Load for 2-ft Interval	Estimated Displacement at "Ultimate"	"Residual" Load for 2-ft Interval
	(psi)	(psi)			(ksf)	(kips)	(inches)	(kips)
Bent-2L/R	4650	1,350,000	1584	1569	24.5	1764	0.03	60
Bent-3L/R	3450	1,000,000	1527	1508	21.6	1555	0.03	60
Bent-4L/R	2650	825,000	1543	1530 & 1534	18.7	1346	0.03	60

Displacement	Bent-2	Bent-3	Bent-4
(inches)	(kips)	(kips)	(kips)
0	0	0	0
0.03	1764	1555	1346
0.06	60	60	60
0.5	60	60	60

Existing Concrete	
Compressive Strength	Elastic Modulus
(psi)	(psi)
5000	4,000,000

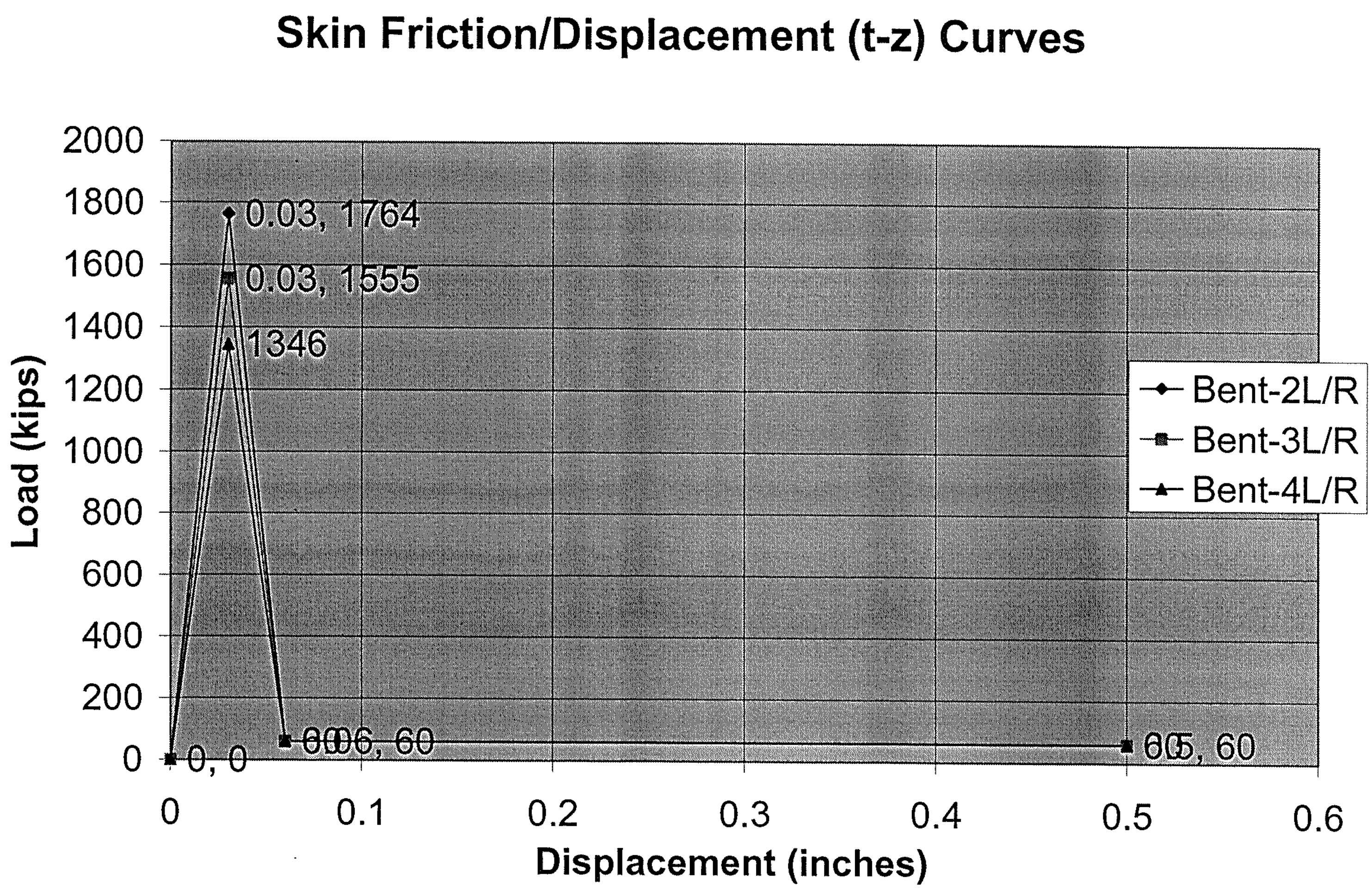
"Ultimate" skin friction is based on Caltrans BDS equations 4.6.5.3.1-1 & -2 and Figure 4.6.5.3.1A using rock mass strength and elastic modulus estimated from Point Load Index testing and RQD and existing concrete compressive strength and elastic modulus provided by Quincy Engineering. The peak load for a 2-ft vertical interval is calculated as the product of the shaft surface area for that interval times the "ultimate" skin friction.

Vertical displacement of about 0.03-inches at maximum or ultimate skin friction is derived from BDS equation 4.6.5.2-1 for settlement of the butt of a rock socketed pile under compression loading, but omitting the term for elastic shortening of the concrete shaft. Perhaps not coincidentally, this value corresponds to shear strain in the rock mass at maximum skin friction estimated using an assumed radial distance of about 6-ft to derive vertical displacement from shear strain.

The residual skin resistance part of the load-displacement curve is based on a friction angle of 30 degrees at concrete:rock interface for displacements greater than or equal to 2 times 0.03". Maximum displacement at residual load can be arbitrarily large.

Construction conditions and details could substantially alter skin friction stiffness relative to the very small deflection indicated. We have assumed that the shaft walls are effectively "smooth" or, more specifically, that no particular effort was made to roughen or groove the sides of the shaft. Further, any loosening of rock in shaft walls, the presence of dirt/debris on shaft walls or local rock condition could significantly decrease or increase resulting stiffness.

As is often the case, the structural solutions based on these foundation springs should be evaluated for sensitivity to the substantial variables present. If any particular value of foundation spring is considered critical, then large scale load testing should be considered.


Skin Friction/Displacement (t-z) Curves
Load (kips)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0.03, 1764
0.03, 1555
1346
0, 0
0.06, 60
0.5, 60
0
0.1
0.2
0.3
0.4
0.5
0.6
Displacement (inches)
Bent-2L/R
Bent-3L/R
Bent-4L/R

Vertical Spring at Bottom of 6-ft x 12-ft Shaft Foundation

		Existing Support:	Bent-2L	Bent-2R		Bent-3L	Bent-3R		Bent-4L	Bent-4R
Top of Test Boring Elevation		(ft)	1602	1598		1533	1535		1556	1562
Effective Top of Shaft Elevation		(ft)	1584	1584		1527	1527		1543	1543
Bottom of Shaft Elevation		(ft)	1569	1569		1508	1508		1530	1534
Rock Descriptors 10-ft below bottom of shaft	Rock Mass Rating (RMR)		50	73		55	70		35	46
	Core Recovery	(%)	100	96		100	100		100	100
	Rock Quality Designation (RQD)	(%)	60	65		55	62		35	30
Average Unconfined Compressive Strength of Rock (Point Load Test)		(psi)	31250			23250			17650	
Elastic Modulus of Rock Mass (adjusted for RQD)		(psi)	1350000			1000000			825000	
"Ultimate" Bearing Capacity		(ksf)	364			270			180	
Elastic Settlement in Rock at "Ultimate" Bearing Capacity		(inches)	0.11			0.11			0.09	
Vertical "Spring" at Bottom of Shaft (6'x12')		(kips/inch)	238000			177000			144000	

Reference Caltrans "Bridge Design Specifications" (BDS).

The rock is considered "competent" with tight and unweathered fractures. "Ultimate Bearing Capacity" is from either BDS Figure 4.4.8.1.1A for Bent-4 (with Factor of Safety 3.0 assumed to derive "ultimate" capacity from "allowable") or from equation 4.4.8.1.2-1. Rock is identified as "Type E" per BDS Table 4.4.8.1.2B with strength modification factor (Nms) from Table 4.4.8.1.2A for indicated RMR.

Estimated elastic settlement in rock below base of shaft was estimated using BDS equation 4.4.8.2.2-2 with Elastic Modulus of Rock Mass estimated from compressive strength (after Figure 4.4.8.2.2A) and reduced for RQD per BDS equations 4.4.8.2.2-3 and 4.4.8.2.2-4. The method of calculating ultimate bearing capacity was chosen to correspond to estimated settlement of about 0.1-inch at "ultimate" loading.

Weber Creek Bridge
New Bent-2L/R
Lateral Springs in Rock

Support: New Bent-2L/R | Effective Top Elev. (see report) | Tip Elev.: | Length: | Direction: Transverse/84-inch width

			p-y curve at center of interval (lb/in)					Lateral Spring for 2-ft Interval (kips)				
	Point (p):		A	B	C	D	E	A	B	C	D	E
Depth Interval (ft)		Center Depth (in)										
1	3	24	0	88916	306230	2732	2732	0	2134	7350	66	66
3	5	48	0	114614	393725	6327	6327	0	2751	9449	152	152
5	7	72	0	140313	481219	10334	10334	0	3368	11549	248	248
7	9	96	0	166014	568714	14432	14432	0	3984	13649	346	346
9	11	120	0	191716	656208	18439	18439	0	4601	15749	443	443
11	13	144	0	217418	743702	22225	22225	0	5218	17849	533	533
13	15	168	0	243120	831197	25677	25677	0	5835	19949	616	616
15	17	192	0	268822	918691	28940	28940	0	6452	22049	695	695
17	19	216	0	294525	1006186	32181	32181	0	7069	24148	772	772
19	21	240	0	320228	1093680	36878	36878	0	7685	26248	885	885
Deflection (y--inches):			0	0.00048	0.0672	0.1344	2	0	0.00048	0.0672	0.1344	2

Support: Bent-2L/R | Effective Top Elev. (see report) | Tip Elev.: | Length: | Direction: Longitudinal/184-inch width

			p-y curve at center of interval (lb/in)					Lateral Spring for 2-ft Interval (kips)				
	Point (p):		A	B	C	D	E	A	B	C	D	E
Depth Interval (ft)		Center Depth (in)										
1	3	24	0	164170	566630	5040	5040	0	3940	13599	121	121
3	5	48	0	189864	654125	11189	11189	0	4557	15699	269	269
5	7	72	0	215559	741619	18240	18240	0	5173	17799	438	438
7	9	96	0	241256	829114	25910	25910	0	5790	19899	622	622
9	11	120	0	266954	916608	34010	34010	0	6407	21999	816	816
11	13	144	0	292653	1004102	42318	42318	0	7024	24098	1016	1016
13	15	168	0	318352	1091597	50786	50786	0	7640	26198	1219	1219
15	17	192	0	344052	1179091	59104	59104	0	8257	28298	1418	1418
17	19	216	0	369751	1266586	67063	67063	0	8874	30398	1610	1610
19	21	240	0	395452	1354080	75514	75514	0	9491	32498	1812	1812
21	23	264	0	421152	1441574	82672	82672	0	10108	34598	1984	1984
23	25	288	0	446853	1529069	90628	90628	0	10724	36698	2175	2175
25	27	312	0	472553	1616563	98583	98583	0	11341	38798	2366	2366
27	29	336	0	498254	1704058	106538	106538	0	11958	40897	2557	2557
29	31	360	0	523955	1791552	114494	114494	0	12575	42997	2748	2748
31	33	384	0	549656	1879046	122449	122449	0	13192	45097	2939	2939
33	35	408	0	575357	1966541	130405	130405	0	13809	47197	3130	3130
35	37	432	0	601059	2054035	138360	138360	0	14425	49297	3321	3321
37	39	456	0	626760	2141530	146315	146315	0	15042	51397	3512	3512
39	41	480	0	652461	2229024	154271	154271	0	15659	53497	3702	3702
41	43	504	0	678163	2316518	162226	162226	0	16276	55596	3893	3893
43	45	528	0	703864	2404013	170182	170182	0	16893	57696	4084	4084
45	47	552	0	729566	2491507	178137	178137	0	17510	59796	4275	4275
Deflection (y--inches):			0.0000	0.0011	0.1472	0.2944	2.000	0	0.0011	0.1472	0.2944	2

Weber Creek Bridge
New Bent-3L/R
Lateral Springs in Rock

Support: New Bent-3L/R | Effective Top Elev. (see report) | Tip Elev.: | Length: | Direction: Transverse/84-inch width

			p-y curve at center of interval (lb/in)					Lateral Spring for 2-ft Interval (kips)				
	Point (p):		A	B	C	D	E	A	B	C	D	E
Depth Interval (ft)		Center Depth (in)										
1	3	24	0	65975	227223	2732	2732	0	1583	5453	66	66
3	5	48	0	85043	292144	6327	6327	0	2041	7011	152	152
5	7	72	0	104113	357065	10334	10334	0	2499	8570	248	248
7	9	96	0	123183	421985	14432	14432	0	2956	10128	346	346
9	11	120	0	142253	486906	18439	18439	0	3414	11686	443	443
11	13	144	0	161324	551827	22225	22225	0	3872	13244	533	533
13	15	168	0	180395	616748	25677	25677	0	4329	14802	616	616
15	17	192	0	199466	681669	28940	28940	0	4787	16360	695	695
17	19	216	0	218537	746590	32181	32181	0	5245	17918	772	772
19	21	240	0	237609	811511	36878	36878	0	5703	19476	885	885
Deflection (y--inches):			0	0.00048	0.0672	0.1344	2	0	0.00048	0.0672	0.1344	2

Support: New Bent-3L/R | Effective Top Elev. (see report) | Tip Elev.: | Length: | Direction: Longitudinal/184-inch width

			p-y curve at center of interval (lb/in)					Lateral Spring for 2-ft Interval (kips)				
	Point (p):		A	B	C	D	E	A	B	C	D	E
Depth Interval (ft)		Center Depth (in)										
1	3	24	0	121814	420440	5040	5040	0	2924	10091	121	121
3	5	48	0	140879	485361	11189	11189	0	3381	11649	269	269
5	7	72	0	159945	550281	18240	18240	0	3839	13207	438	438
7	9	96	0	179012	615202	25910	25910	0	4296	14765	622	622
9	11	120	0	198080	680123	34010	34010	0	4754	16323	816	816
11	13	144	0	217148	745044	42318	42318	0	5212	17881	1016	1016
13	15	168	0	236217	809965	50786	50786	0	5669	19439	1219	1219
15	17	192	0	255286	874886	59104	59104	0	6127	20997	1418	1418
17	19	216	0	274356	939807	67063	67063	0	6585	22555	1610	1610
19	21	240	0	293425	1004727	75514	75514	0	7042	24113	1812	1812
21	23	264	0	312495	1069648	82672	82672	0	7500	25672	1984	1984
23	25	288	0	331565	1134569	90628	90628	0	7958	27230	2175	2175
25	27	312	0	350635	1199490	98583	98583	0	8415	28788	2366	2366
27	29	336	0	369705	1264411	106538	106538	0	8873	30346	2557	2557
29	31	360	0	388775	1329332	114494	114494	0	9331	31904	2748	2748
31	33	384	0	407845	1394252	122449	122449	0	9788	33462	2939	2939
33	35	408	0	426915	1459173	130405	130405	0	10246	35020	3130	3130
35	37	432	0	445986	1524094	138360	138360	0	10704	36578	3321	3321
37	39	456	0	465056	1589015	146315	146315	0	11161	38136	3512	3512
39	41	480	0	484126	1653936	154271	154271	0	11619	39694	3702	3702
41	43	504	0	503197	1718857	162226	162226	0	12077	41253	3893	3893
43	45	528	0	522267	1783777	170182	170182	0	12534	42811	4084	4084
45	47	552	0	541338	1848698	178137	178137	0	12992	44369	4275	4275
Deflection (y--inches):			0.0000	0.0011	0.1472	0.2944	2.000	0	0.0010708	0.1472	0.2944	2

Weber Creek Bridge
New Bent-4L/R
Lateral Springs in Rock

Support: New Bent-4L/R | Effective Top Elev. (see report) | Tip Elev.: | Length: | Direction: Transverse/84-inch width

			p-y curve at center of interval (lb/in)					Lateral Spring for 2-ft Interval (kips)				
	Point (p):		A	B	C	D	E	A	B	C	D	E
Depth Interval (ft)		Center Depth (in)										
1	3	24	0	49526	174551	2732	2732	0	1189	4189	66	66
3	5	48	0	63840	224423	6327	6327	0	1532	5386	152	152
5	7	72	0	78155	274295	10334	10334	0	1876	6583	248	248
7	9	96	0	92470	324167	14432	14432	0	2219	7780	346	346
9	11	120	0	106786	374039	18439	18439	0	2563	8977	443	443
11	13	144	0	121102	423910	22225	22225	0	2906	10174	533	533
13	15	168	0	135418	473782	25677	25677	0	3250	11371	616	616
15	17	192	0	149734	523654	28940	28940	0	3594	12568	695	695
17	19	216	0	164050	573526	32181	32181	0	3937	13765	772	772
19	21	240	0	178367	623398	36878	36878	0	4281	14962	885	885
Deflection (y--inches):			0	0.0004776	0.0672	0.1344	2	0	0.0004776	0.0672	0.1344	2

Support: New Bent-4L/R | Effective Top Elev. (see report) | Tip Elev.: | Length: | Direction: Longitudinal/184-inch width

			p-y curve at center of interval (lb/in)					Lateral Spring for 2-ft Interval (kips)				
	Point (p):		A	B	C	D	E	A	B	C	D	E
Depth Interval (ft)		Center Depth (in)										
1	3	24	0	91443	322979	5040	5040	0	2195	7752	121	121
3	5	48	0	105754	372851	11189	11189	0	2538	8948	269	269
5	7	72	0	120067	422723	18240	18240	0	2882	10145	438	438
7	9	96	0	134380	472595	25910	25910	0	3225	11342	622	622
9	11	120	0	148693	522467	34010	34010	0	3569	12539	816	816
11	13	144	0	163008	572338	42318	42318	0	3912	13736	1016	1016
13	15	168	0	177322	622210	50786	50786	0	4256	14933	1219	1219
15	17	192	0	191637	672082	59104	59104	0	4599	16130	1418	1418
17	19	216	0	205952	721954	67063	67063	0	4943	17327	1610	1610
19	21	240	0	220267	771826	75514	75514	0	5286	18524	1812	1812
21	23	264	0	234582	821697	82672	82672	0	5630	19721	1984	1984
23	25	288	0	248897	871569	90628	90628	0	5974	20918	2175	2175
25	27	312	0	263212	921441	98583	98583	0	6317	22115	2366	2366
27	29	336	0	277528	971313	106538	106538	0	6661	23312	2557	2557
29	31	360	0	291843	1021185	114494	114494	0	7004	24508	2748	2748
31	33	384	0	306159	1071056	122449	122449	0	7348	25705	2939	2939
33	35	408	0	320474	1120928	130405	130405	0	7691	26902	3130	3130
35	37	432	0	334790	1170800	138360	138360	0	8035	28099	3321	3321
37	39	456	0	349105	1220672	146315	146315	0	8379	29296	3512	3512
39	41	480	0	363421	1270544	154271	154271	0	8722	30493	3702	3702
41	43	504	0	377737	1320415	162226	162226	0	9066	31690	3893	3893
43	45	528	0	392052	1370287	170182	170182	0	9409	32887	4084	4084
45	47	552	0	406368	1420159	178137	178137	0	9753	34084	4275	4275
Deflection (y--inches):			0.0000	0.0010	0.1472	0.2944	2.000	0	0.0010	0.1472	0.2944	2

APPENDIX – E

"LOG OF TEST BORINGS" DRAWINGS (HALF-SIZE, 4 SHEETS) AND REFRACTION SEISMIC PROFILING DATA FROM "U.S. ROUTE 50/MISSOURI FLAT ROAD INTERCHANGE PROJECT" REPORT DATED JULY 2006

DIST.	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
03	ED	50	23.1/25.4		

Caltrans Metric

REGISTERED CIVIL ENGINEER 7/21/06 DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RONALD E. LOUTZENHISER No. 64089 EXP. 9-30-06 CIVIL STATE OF CALIFORNIA

TABER CONSULTANTS
3911 West Capitol Avenue
West Sacramento, CA 95691-2116

JOB No. 1P2/399/296-1 LOCATION: 38120-F7:334N:244W

Quincy Engineering, Inc.
3247 Ramos Circle
Sacramento, CA 95827-2512

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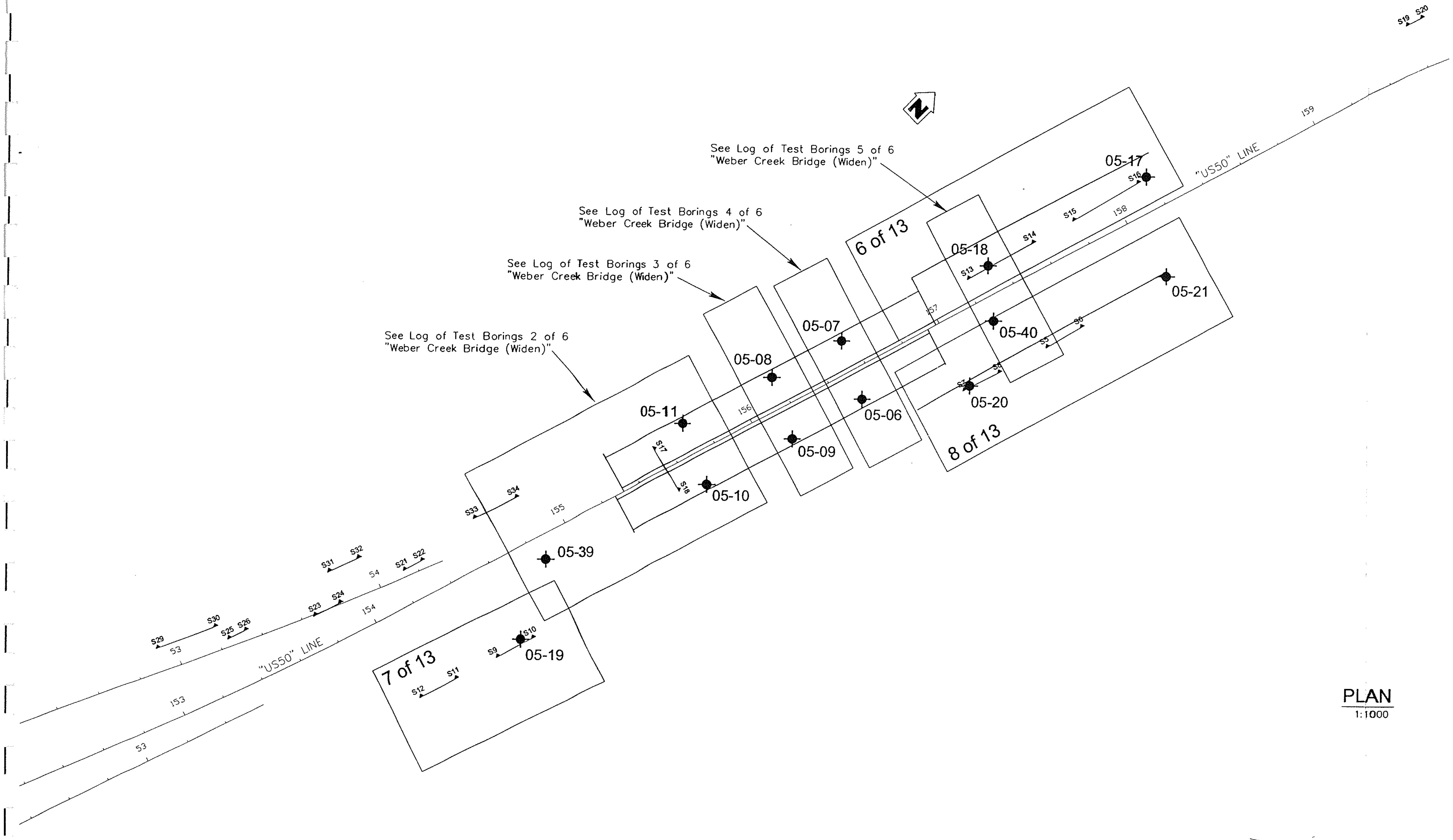

PLAN
1:1000

DESIGN OVERSIGHT	DESIGN	By M. D. Robertson	FIELD INVESTIGATION BY: M. W. McIlroy and R. E. Loutzenhiser May 2005	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Mario Quest PROJECT ENGINEER	BRIDGE NO.	MISSOURI FLAT ROAD INTERCHANGE IMPROVEMENTS
SIGN OFF DATE	CHECKED	By R. E. Loutzenhiser				KILOMETER POST 23.1/25.4	LOG OF TEST BORINGS 3 OF 13

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

CU 03198
EA 370004

DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES (PRELIMINARY STAGE ONLY) SHEET OF

07/20/06 1P2399296-1.2R.dwg

DIST.	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
03	ED	50	23.1/25.4		

REGISTERED CIVIL ENGINEER — DATE 7/21/06

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — RONALD E. LOUTZENHISER — No. 64089 — EXP. 9-30-06 — CIVIL — STATE OF CALIFORNIA

TABER CONSULTANTS
3911 West Capitol Avenue
West Sacramento, CA 95691-2116

JOB No. 1P2/399/296-1 LOCATION: 38120-F7:334N:244W

Quincy Engineering, Inc.
3247 Ramos Circle
Sacramento, CA 95827-2512

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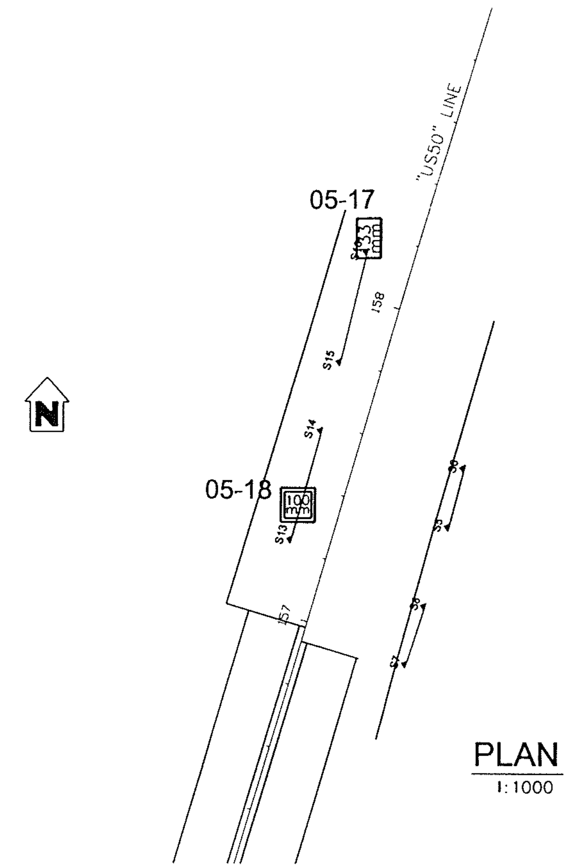
BENCH MARKS

Boring Locations and elevations established by Topographic Surveys, Inc. using NGVD 1929 – Metric for the vertical datum

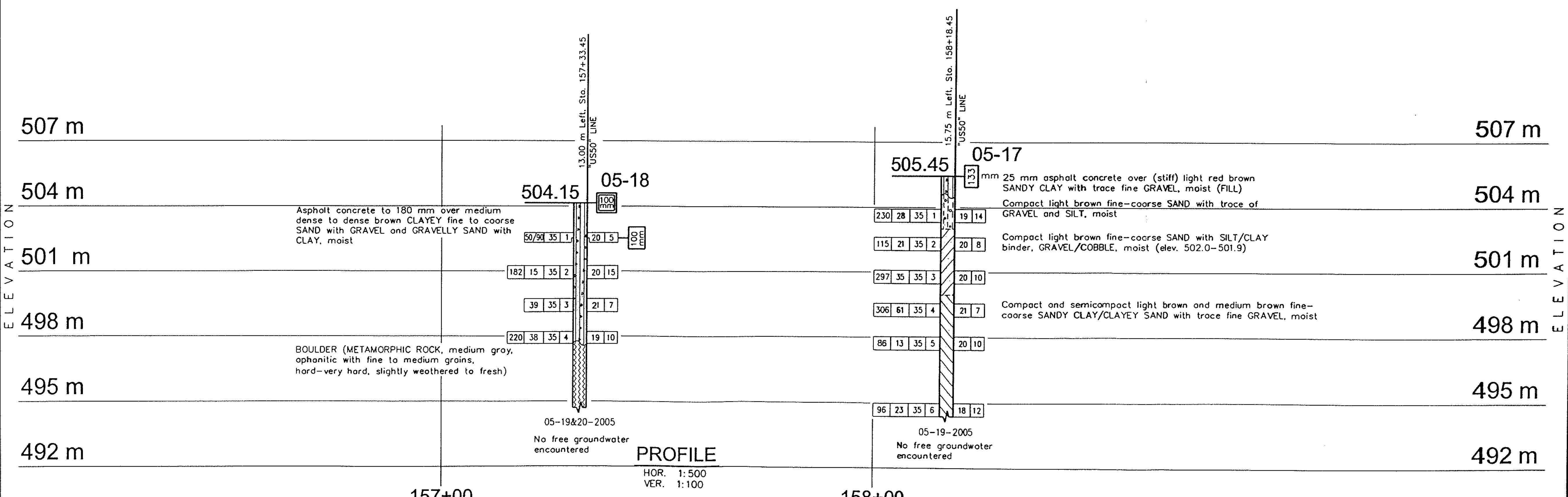
MISSOURI FLAT ROAD PROJECT BENCHMARKS

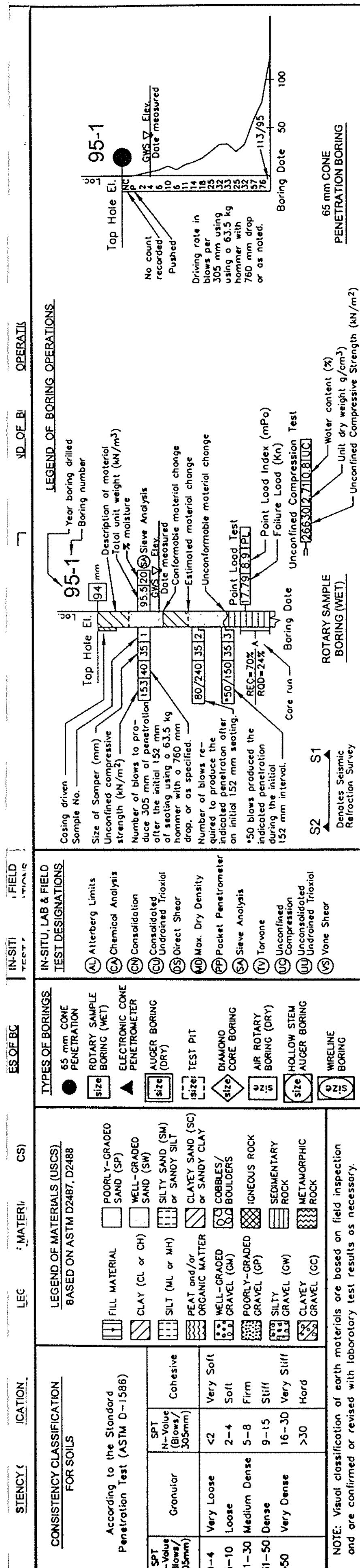
POINT	NORTH (m)	EAST (m)	ELEV (m)	DESCRIPTION
#2	616695.714	2100813.970	536.669	PK Nail
25-197	616585.495	2100977.820	540.100	Brass Disc
25-198	616639.420	2100904.612	540.124	Brass Disc
Bridge	616606.833	2100945.621	540.934	Nail
HPGN 03 DM	616442.252	2100948.148	541.484	Brass Disc in Monument Well
HV-13	616658.923	2100845.380	536.644	Nail
HV-18	616536.925	2101086.291	530.367	Nail
MF-1	616356.911	2101344.400	532.678	PK Nail
MF-2	616478.420	2101134.789	533.053	PK Nail & Shinner
MF-3	616581.296	2100980.675	539.487	PK Nail & Shinner
MF-4	616646.412	2100892.927	540.124	PK Nail & Shinner
MF-5	616782.292	2100742.683	530.972	PK Nail & Shinner
MF-6	616863.842	2100676.680	526.770	PK Nail & Shinner
MF-7	616965.131	2100625.885	525.381	PK Nail & Shinner
MF-8	616763.938	2100979.824	526.612	Iron Pin & Cap
MF-9	616812.507	2100680.801	528.981	40d Nail
MF-10	616760.368	2100949.239	527.460	PK Nail
MF-11	616482.168	2101077.545	535.079	40d Nail
MF-12	616590.096	2101046.565	533.314	PK Nail & Shinner
MF-13	616740.638	2101075.187	525.554	Iron Pin
MF-14	616747.764	2101050.127	527.370	Iron Pin & Cap
MF-15	616432.538	2100729.146		Iron Pin & Cap
MF-16	617688.521	2101359.956	522.503	Iron Pin & Cap
Median	616792.902	2100719.551	530.195	Scribe Mark
NAIL1	616387.735	2101292.439	531.218	CTL
PT10	617769.606	2101409.316	532.051	PK Nail & Shinner
PT15	616463.367	2101179.245	529.399	CTL
PT902	617754.472	2101415.636	532.894	CH2M Hill PK Nail & Washer
R/W Mon 1	616646.790	2100918.444	535.483	Iron Pin & Cap
R/W Mon 2	616772.178	2100999.164	522.369	Iron Pin & Cap
R/W Mon 3	616724.569	2100968.493	527.130	Iron Pin & Cap
TSI 326	616489.039	2101016.693	536.293	PK Nail
PK Nail			512.570	Forni Road onramp



Notes:

1. Field classification of soils was in accordance with ASTM D 2488-00 "Description and Identification of Soils (Visual-Manual Procedure)."
2. Standard Penetration tests were performed in accordance with ASTM D 1586-99 using hammer operated with an automated drop system, estimated to deliver 80% of theoretical striking energy to drill rod. Drill rods were 41 mm diameter "A"-rods; sampler was driven with brass liners.
3. The length of each sampled interval is shown graphically on the boring log. Whole number blow counts ("N") represent the "standard penetration resistance" interval in accordance with ASTM D1586-84. Where less than 0.457 mm of penetration is achieved, the blow count shown is for that fraction of the "standard penetration resistance" interval actually penetrated.
4. Where indicated by an asterisk (*) the number of blows shown is for only that fraction of the initial 152 mm "seating drive" interval penetrated.
5. Consistency of soils shown in ( ) where estimated.
6. All borings for this project were logged in English units, and were subsequently converted to metric units.
7. Groundwater surface elevations in the borings indicated on the Log of Test Boring Sheets reflect the fluid level in the borings on the specified date.
8. Groundwater levels are subject to seasonal fluctuations and may occur at higher or lower elevations depending on the conditions at any particular time.
9. This "Log of Test Borings" drawing is appended to bridge plans in accordance with Caltrans "Standard Specifications" Section 2-1.03.





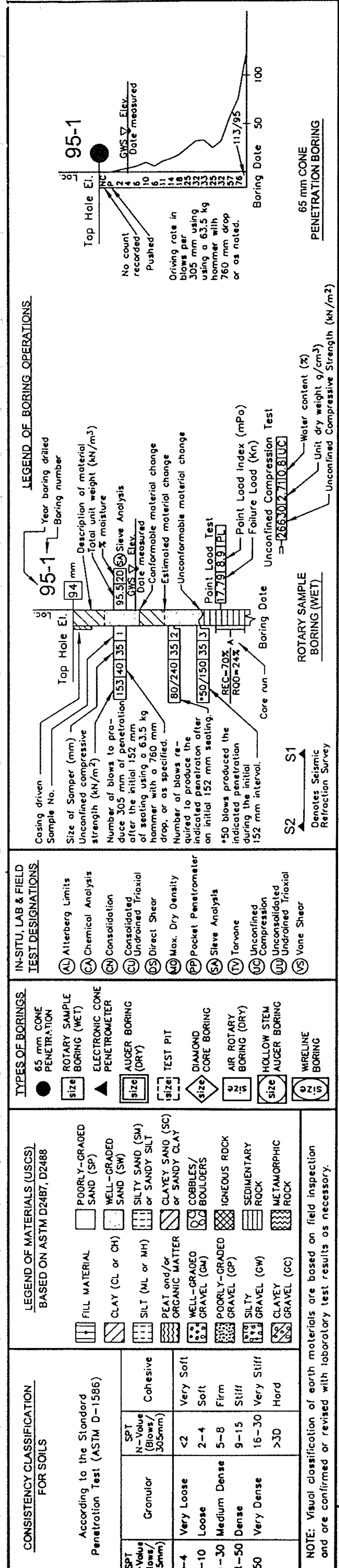
DESIGN OVERSIGHT	DESIGN	By M. D. Robertson	FIELD INVESTIGATION BY: M. W. McIlroy and R. E. Loutzenhiser May 2005	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Mario Quest PROJECT ENGINEER	BRIDGE NO.	MISSOURI FLAT ROAD INTERCHANGE IMPROVEMENTS
SIGN OFF DATE	CHECKED	By R. E. Loutzenhiser				KILOMETER POST 23.1/25.4	LOG OF TEST BORINGS 6 OF 13

07/20/06 1P2399296-1.2R.dwg

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

CU 03198
EA 370004

DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES (PRELIMINARY STAGE ONLY) — SHEET OF

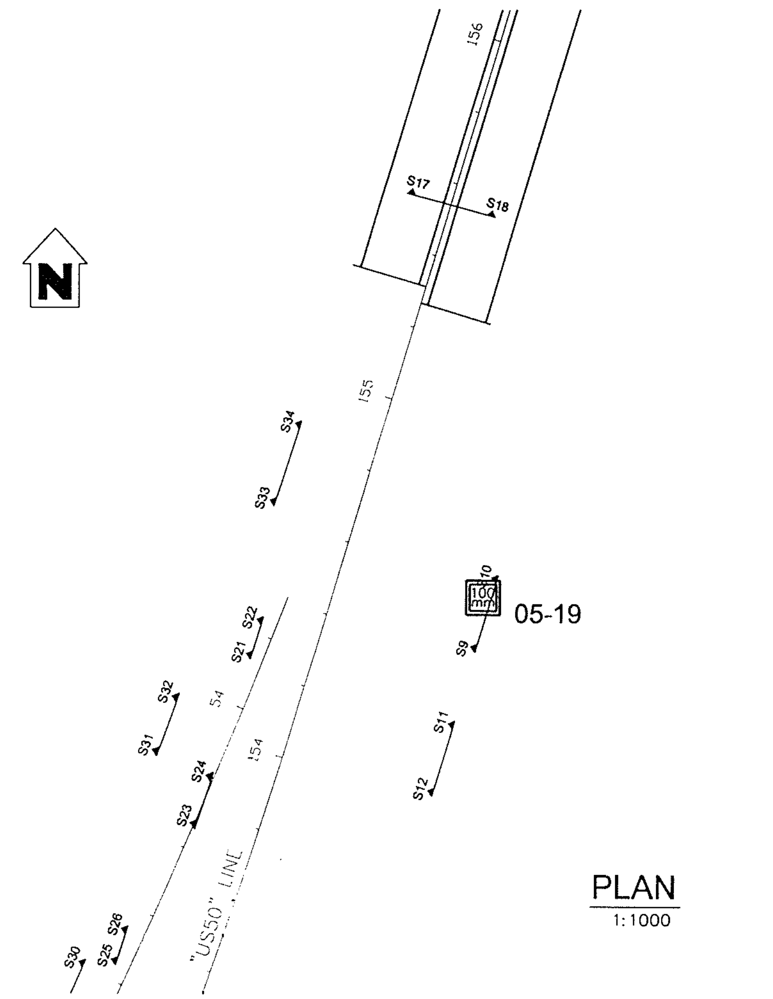


BENCH MARKS

Boring Locations and elevations established by Topographic Surveys, Inc. using NGVD 1929 – Metric for the vertical datum

MISSOURI FLAT ROAD PROJECT BENCHMARKS

POINT	NORTH (m)	EAST (m)	ELEV (m)	DESCRIPTION
#2	616695.714	2100813.970	536.889	PK Nail
25-197	616585.495	2100977.820	540.100	Brass Disc
25-198	616639.420	2100904.612	540.124	Brass Disc
Bridge	616608.833	2100845.621	540.934	Nail
HPGN 03 DM	616442.252	2100848.146	541.464	Brass Disc in Monument Well
HV-13	616658.923	2100845.360	536.644	Nail
HV-16	616538.925	2101086.291	530.367	Nail
MF-1	616356.911	2101344.400	532.678	PK Nail
MF-2	616478.420	2101134.789	533.053	PK Nail & Shinner
MF-3	616581.298	2100980.675	536.467	PK Nail & Shinner
MF-4	616646.412	2100892.927	540.124	PK Nail & Shinner
MF-5	616782.292	2100742.663	530.972	PK Nail & Shinner
MF-6	616863.842	2100876.680	526.770	PK Nail & Shinner
MF-7	616965.131	2100825.865	525.381	PK Nail & Shinner
MF-8	616763.938	2100979.824	526.612	Iron Pin & Cap
MF-9	616812.507	2100880.801	528.981	40d Nail
MF-10	616760.386	2100949.239	527.460	PK Nail
MF-11	616462.168	2101077.545	536.079	40d Nail
MF-12	616590.096	2101046.565	533.314	PK Nail & Shinner
MF-13	616740.838	2101075.187	525.554	Iron Pin
MF-14	616747.764	2101050.127	527.370	Iron Pin & Cap
MF-15	616432.538	2100729.146		Iron Pin & Cap
MF-16	617688.521	2101359.956	522.503	Iron Pin & Cap
Median	616792.902	2100719.551	530.195	Scribe Mark
NAIL1	616387.735	2101292.439	531.218	CTL
PT10	617769.608	2101409.316	532.051	PK Nail & Shinner
PT15	616463.367	2101179.245	529.399	CTL
PT902	617754.472	2101415.636	532.884	CH2M Hill PK Nail & Washer
R/W Mon 1	616648.790	2100898.444	535.483	Iron Pin & Cap
R/W Mon 2	616772.178	2100889.164	522.369	Iron Pin & Cap
R/W Mon 3	616724.569	2100868.493	527.130	Iron Pin & Cap
TSI 326	616489.039	2101016.693	536.293	PK Nail
PK Nail			512.570	Forni Road onramp



PLAN
1:1000

DIST.	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
03	ED	50	23.1/25.4		

REGISTERED CIVIL ENGINEER DATE 7/21/06

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER RONALD E. LOUTZENHISER No. 64089 EXP. 9-30-06 CIVIL STATE OF CALIFORNIA

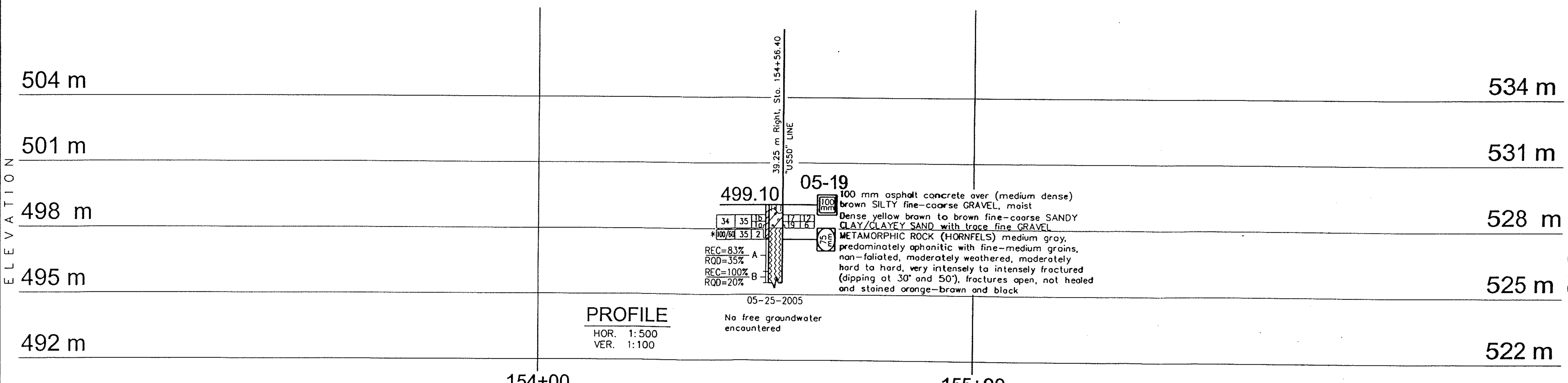
TABER CONSULTANTS
3911 West Capitol Avenue
West Sacramento, CA 95691-2116

JOB No. 1P2/399/296-1 LOCATION: 38120-F7: 334N: 244W

Quincy Engineering, Inc.
3247 Ramos Circle
Sacramento, CA 95827-2512

NOTES:

1. Field classification of soils was in accordance with ASTM D 2488-00 "Description and Identification of Soils (Visual-Manual Procedure)."
2. Rock classification according to Caltrans "Soil & Rock Logging Classification Manual (Field Guide)", August 1996.
3. Standard Penetration tests were performed in accordance with ASTM D 1586-99 using a safety hammer operated with cat-head, rope and pully. Drill rods were 41 mm diameter "A"-rods; sampler was driven with brass liners.
4. The length of each sampled interval is shown graphically on the boring log. Whole number blow counts ("N") represent the "standard penetration resistance" interval in accordance with ASTM D1586-84. Where less than 457 mm of penetration is achieved, the blow count shown is for that fraction of the "standard penetration resistance" interval actually penetrated.
4. Where indicated by an asterisk (*) the number of blows shown is for only that fraction of the initial 152 mm "seating drive" interval penetrated.
6. Consistency of soils shown in ( ) where estimated.
7. Rock Quality Designation (RQD), Weathering, Rock Hardness and Fracture Density, as shown on this sheet, were used to describe all rock core from borings drilled in 2005. Descriptors were determined in the field.
8. REC = Percent Core Recovery.
9. RQD = Percent Rock Quality Designation.
10. All borings for this project were logged in English units, and were subsequently converted to metric units.
11. Groundwater levels are subject to seasonal fluctuations and may occur at higher or lower elevations depending on the conditions at any particular time.
12. This "Log of Test Borings" drawing is included with bridge plans in accordance with Caltrans "Standard Specifications" Section 2-1.03.



PROFILE
HOR. 1:500
VER. 1:100

DESIGN OVERSIGHT	DESIGN	By M. D. Robertson	FIELD INVESTIGATION BY: M. W. McIlroy and R. E. Loutzenhiser May 2005	
SIGN OFF DATE	CHECKED	By R. E. Loutzenhiser		

PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

Mario Quest
PROJECT ENGINEER

BRIDGE NO.
KILOMETER POST 23.1/25.4

MISSOURI FLAT ROAD INTERCHANGE IMPROVEMENTS

LOG OF TEST BORINGS 7 OF 13

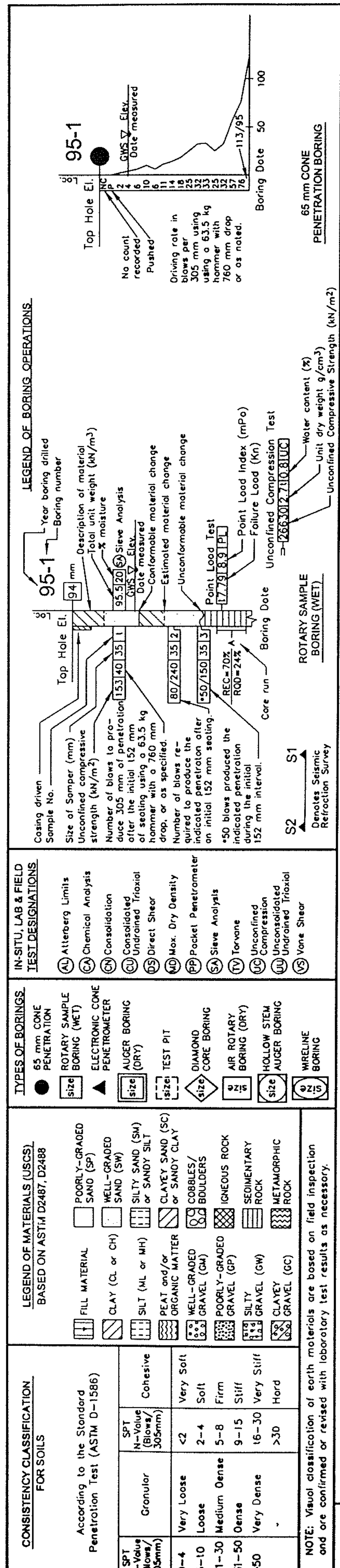
07/20/06 1P2399296-1.2R.dwg

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

CU 03198
EA 370004

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) SHEET OF



BENCH MARKS

Boring Locations and elevations established by Topographic Surveys, Inc. using NGVD 1929 – Metric for the vertical datum

MISSOURI FLAT ROAD PROJECT BENCHMARKS

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
#2	816895.714	2100813.970	538.669	PK Nail
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PK Nail			512.570	Forni Road onramp

DIST.	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
03	ED	50	23.1/25.4		

REGISTERED CIVIL ENGINEER — DATE 7/21/06

(Seal: REGISTERED PROFESSIONAL ENGINEER, RONALD E. LOUTZENHISER, No. 64089, EXP. 9-30-06, CIVIL, STATE OF CALIFORNIA)

PLANS APPROVAL DATE

TABER CONSULTANTS
3911 West Capitol Avenue
West Sacramento, CA 95691-2116

JOB No. 1P2/399/296-1 — LOCATION: 38120-F7:334N:244W

Quincy Engineering, Inc.
3247 Ramos Circle
Sacramento, CA 95827-2512

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NOTES:

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5. Where indicated by an asterisk (*) the number of blows shown is for only that fraction of the initial 152 mm "seating drive" interval penetrated.
6. Consistency of soils shown in ( ) where estimated.
7. Rock Quality Designation (RQD), Weathering, Rock Hardness and Fracture Density, as shown on this sheet, were used to describe all rock core from borings drilled in 2005. Descriptors were determined in the field.
8. REC = Percent Core Recovery.
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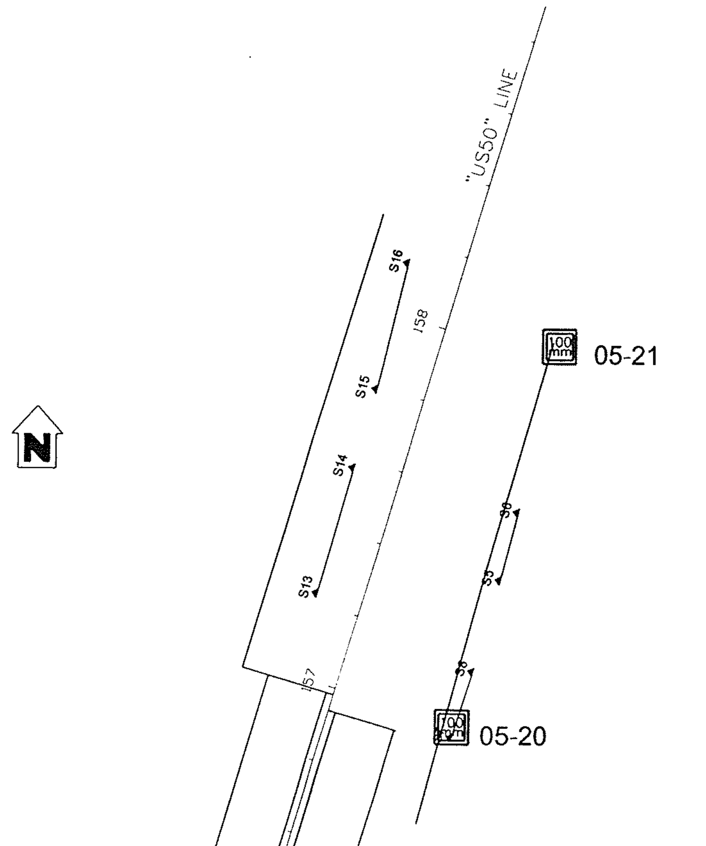

PLAN
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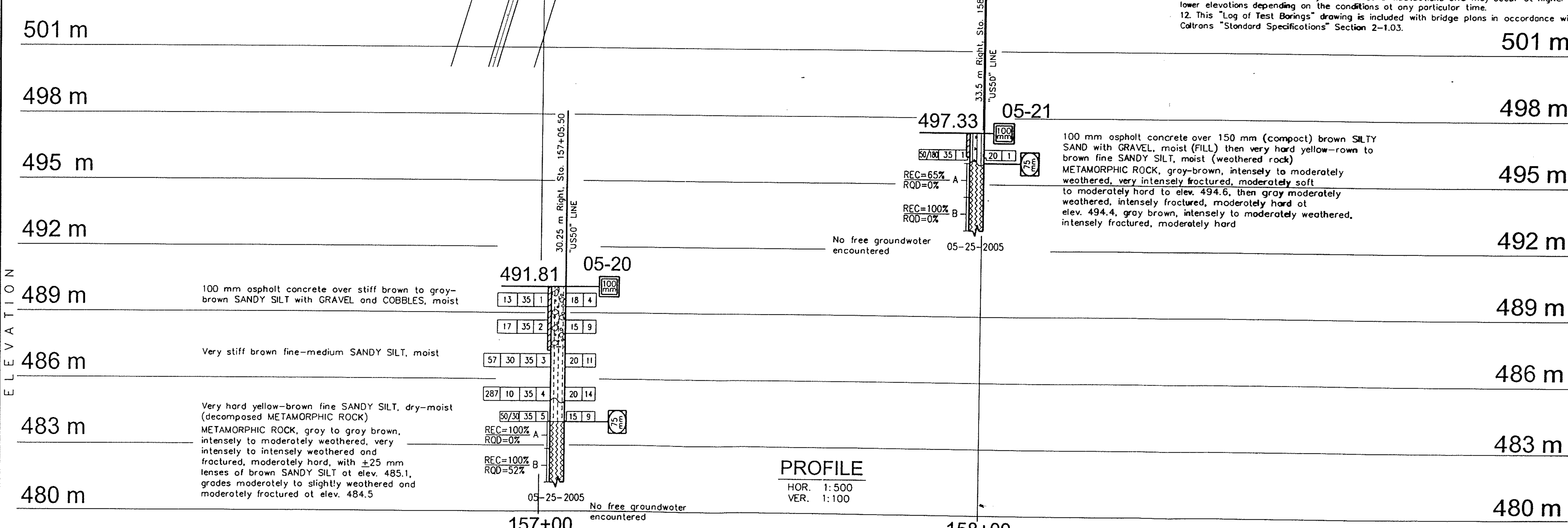


PROFILE
HOR. 1:500
VER. 1:100

DESIGN OVERSIGHT	DESIGN	By M. D. Robertson	FIELD INVESTIGATION BY: M. W. McIlroy and R. E. Loutzenhiser May 2005	PREPARED FOR THE STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	Mario Quest PROJECT ENGINEER	BRIDGE NO.	MISSOURI FLAT ROAD INTERCHANGE IMPROVEMENTS
SIGN OFF DATE	CHECKED	By R. E. Loutzenhiser				KILOMETER POST 23.1/25.4	LOG OF TEST BORINGS 8 OF 13

07/21/06 1P2399296-1.2R.dwg

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

CU 03198
EA 370004

DISREGARD PRINTS BEARING EARLIER REVISION DATES — REVISION DATES (PRELIMINARY STAGE ONLY) — SHEET — OF

WEBER CREEK BRIDGE SOUTH APPROACH (SE Retaining Wall)

Seismic Line	Bottom of Layer Depth (m)	Layer Velocity (m/s)	Materials Description
S9-S10	1.1-1.5	460-490	Residual soil/decomposed-very intensely weathered rock
	--	1,830-3,050	Slightly weathered to fresh rock
S11-S12	0.6-0.8	340-430	Residual soil/decomposed-very intensely weathered rock
	--	1,830-4,570	Slightly weathered to fresh rock
S17-S18	2.7-3.7	400	Residual soil/decomposed-very intensely weathered rock
	--	1,680-1,830	Slightly weathered rock

WEBER CREEK BRIDGE NORTH APPROACH (NW Retaining Wall)

Seismic Line	Bottom of Layer Depth (m)	Layer Velocity (m/s)	Materials Description
S13-S14	1.5-2.0	340-400	Embankment Fill
	--	610	Embankment Fill
S15-S16	1.5-4.3	300	Embankment Fill
	--	550-1,070	Embankment Fill

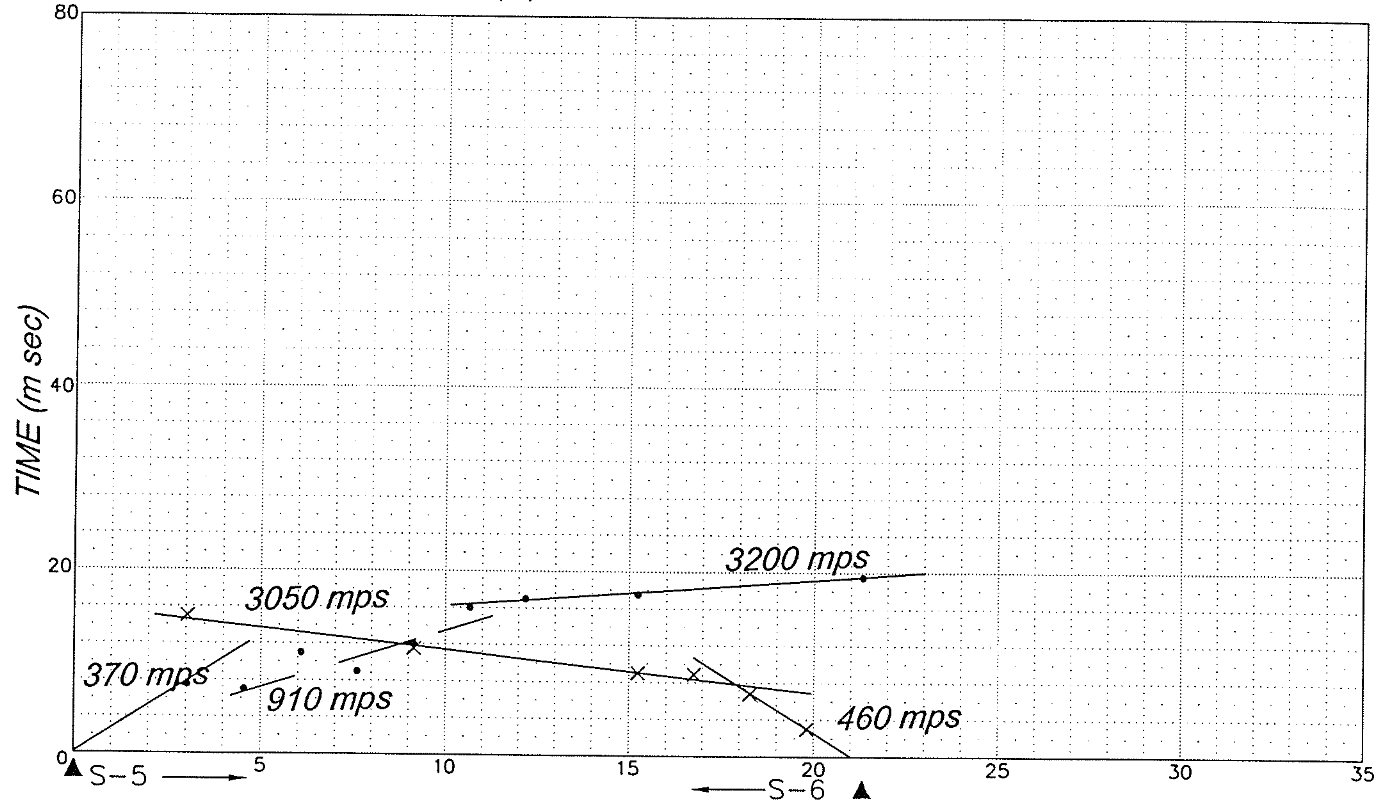
WEBER CREEK BRIDGE NORTH APPROACH (NE Retaining Wall)

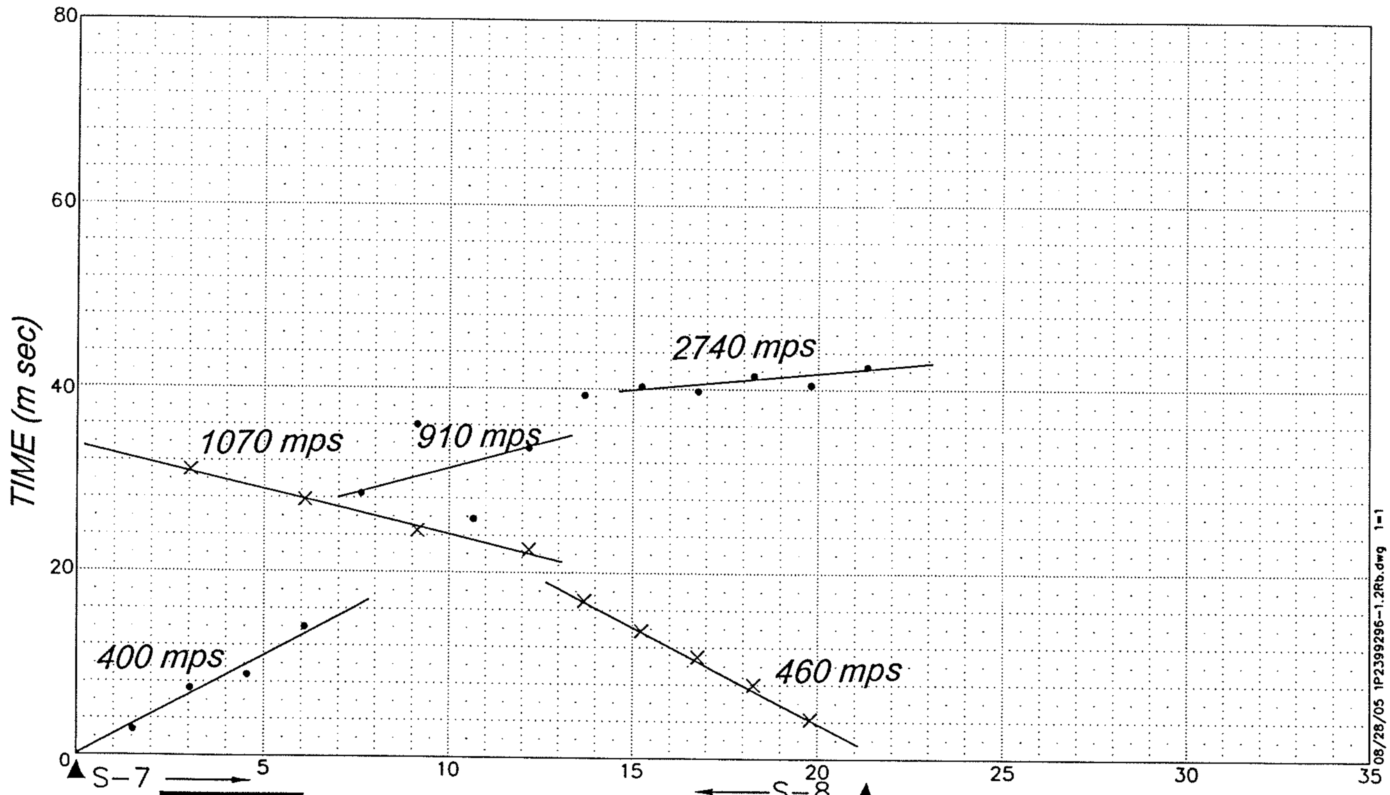
Seismic Line	Bottom of Layer Depth (m)	Layer Velocity (m/s)	Materials Description
S5-S6	1.0-2.0	370-460	Fill/residual soil/decomposed rock
	4.6	910	Intensely to moderately weathered rock
	--	3,050-3,200	Fresh rock
S7-S8	2.7	400-460	Fill/residual soil/decomposed rock
	5.2	910-1,070	Intensely to moderately weathered rock
	--	2,740	Slightly weathered to fresh rock

WEBER CREEK BRIDGE NORTH APPROACH

Seismic Line	Bottom of Layer Depth (m)	Layer Velocity (m/s)	Materials Description
S19-S20	2.0	300-330	Fill
	--	1,500	Moderately weathered rock

Taber
Since 1954
Taber Consultants
Engineers and Geologists
536 Galveston Street
West Sacramento, CA 95691
(916) 371-1690 Fax (916) 371-7265





DISTANCE (m)

Taber Metric

REFRACTION SEISMIC RECORD

Figure - 2

Taber
Since 1954
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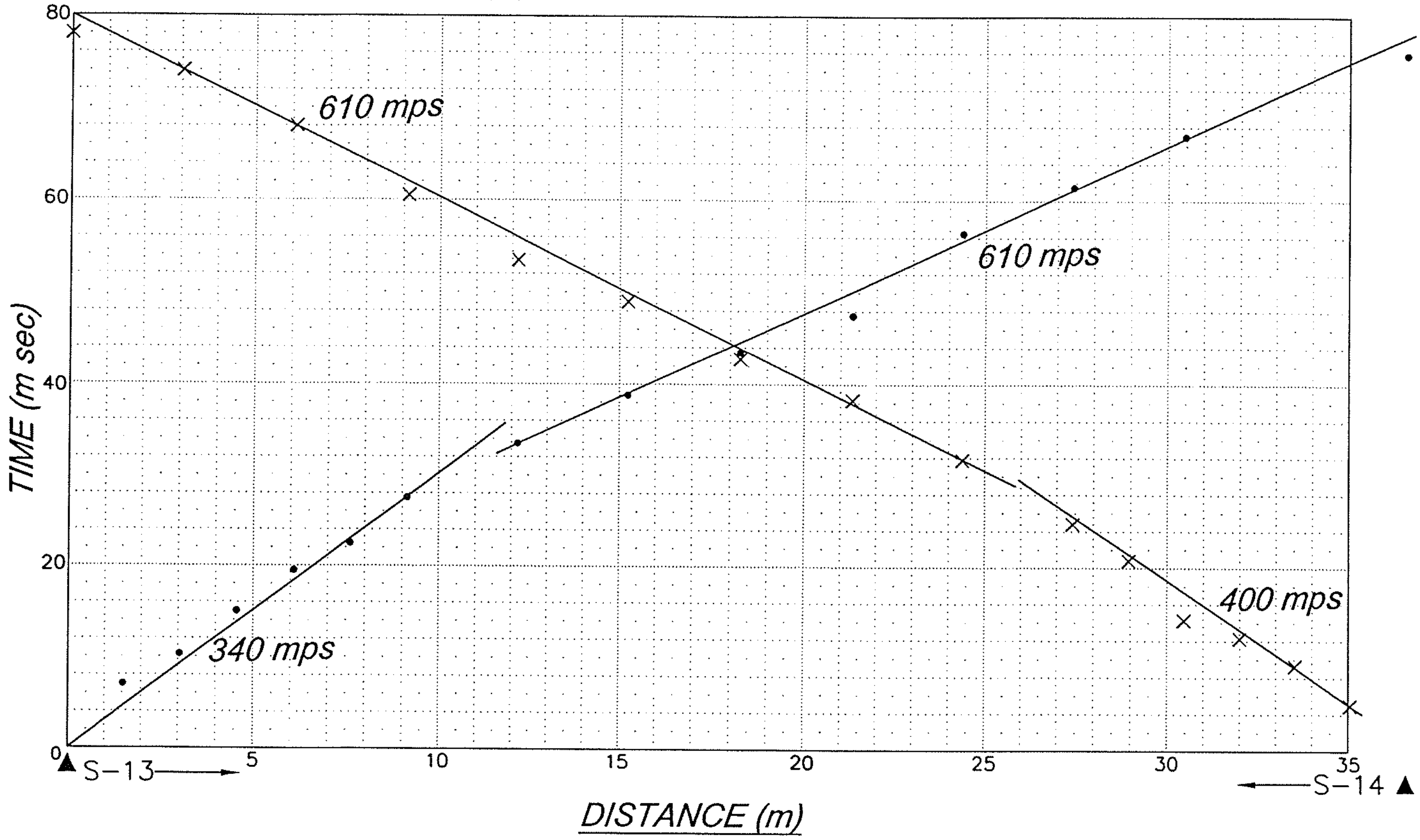
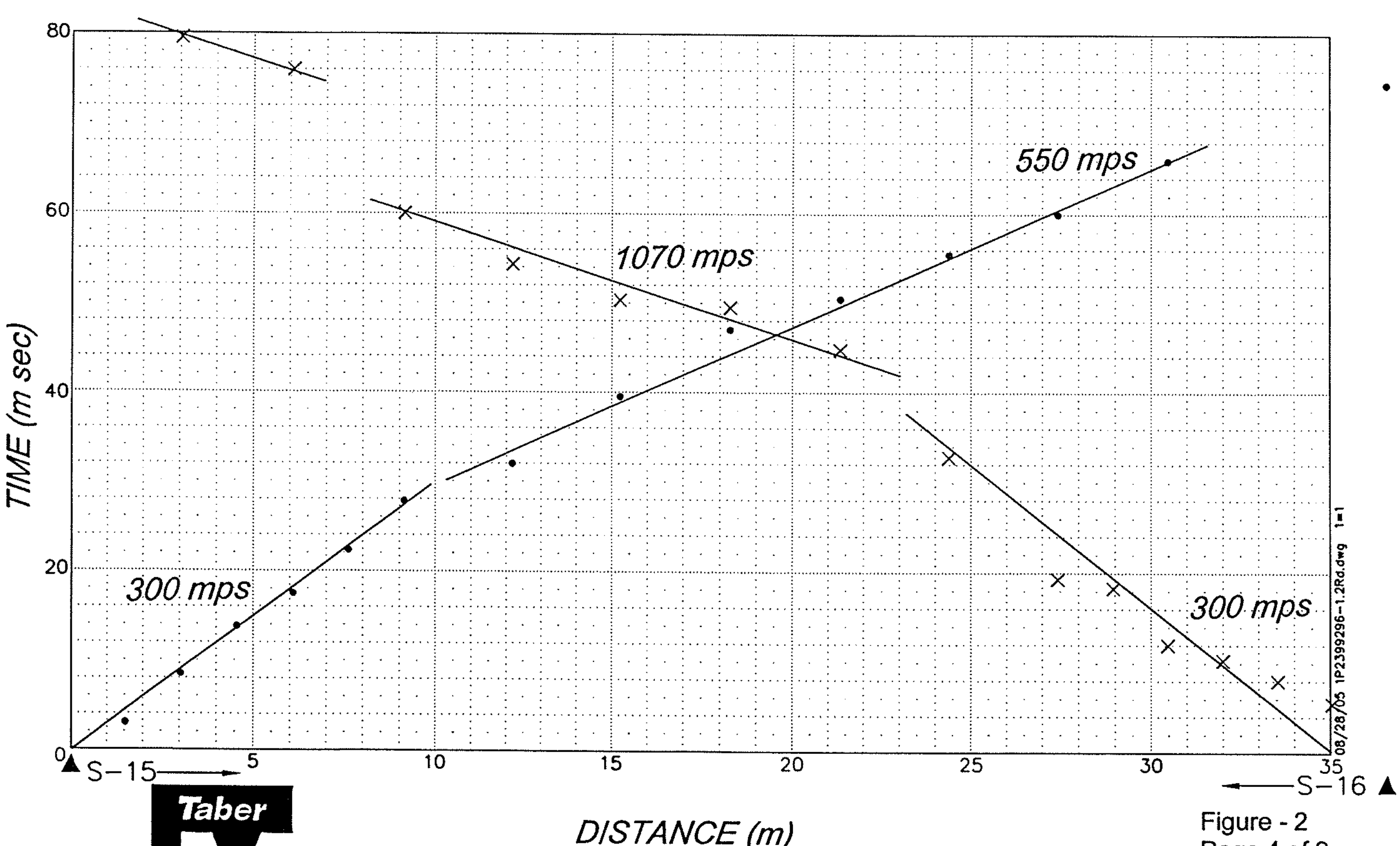
Engineers and Geologists
536 Galveston Street
West Sacramento, CA 95691
(916) 371-1690 Fax (916) 371-7265

1P2/399/296-1.2R





Taber Metric

Figure - 2

REFRACTION SEISMIC RECORD

Taber
Since 1954
Taber Consultants
Engineers and Geologists
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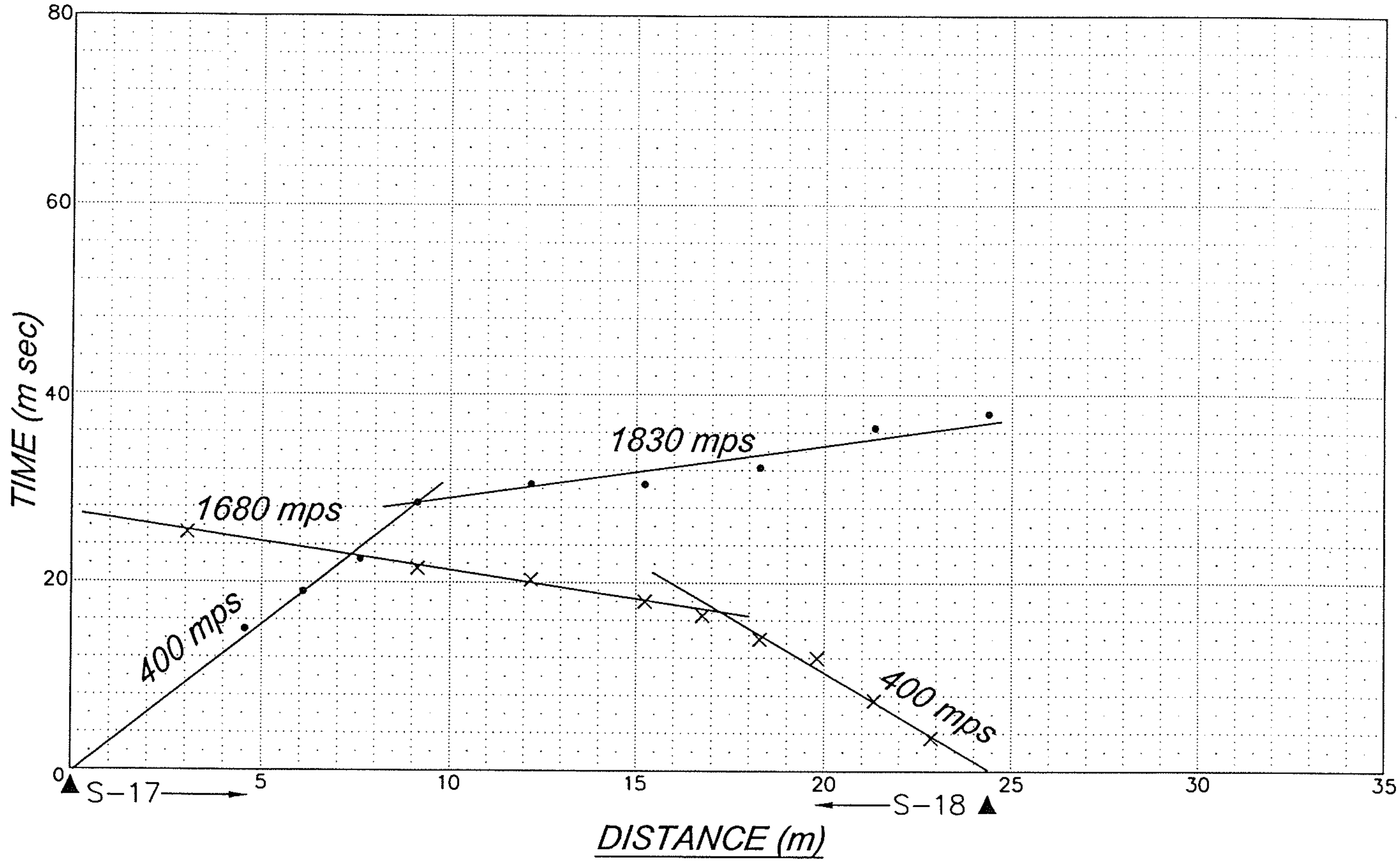
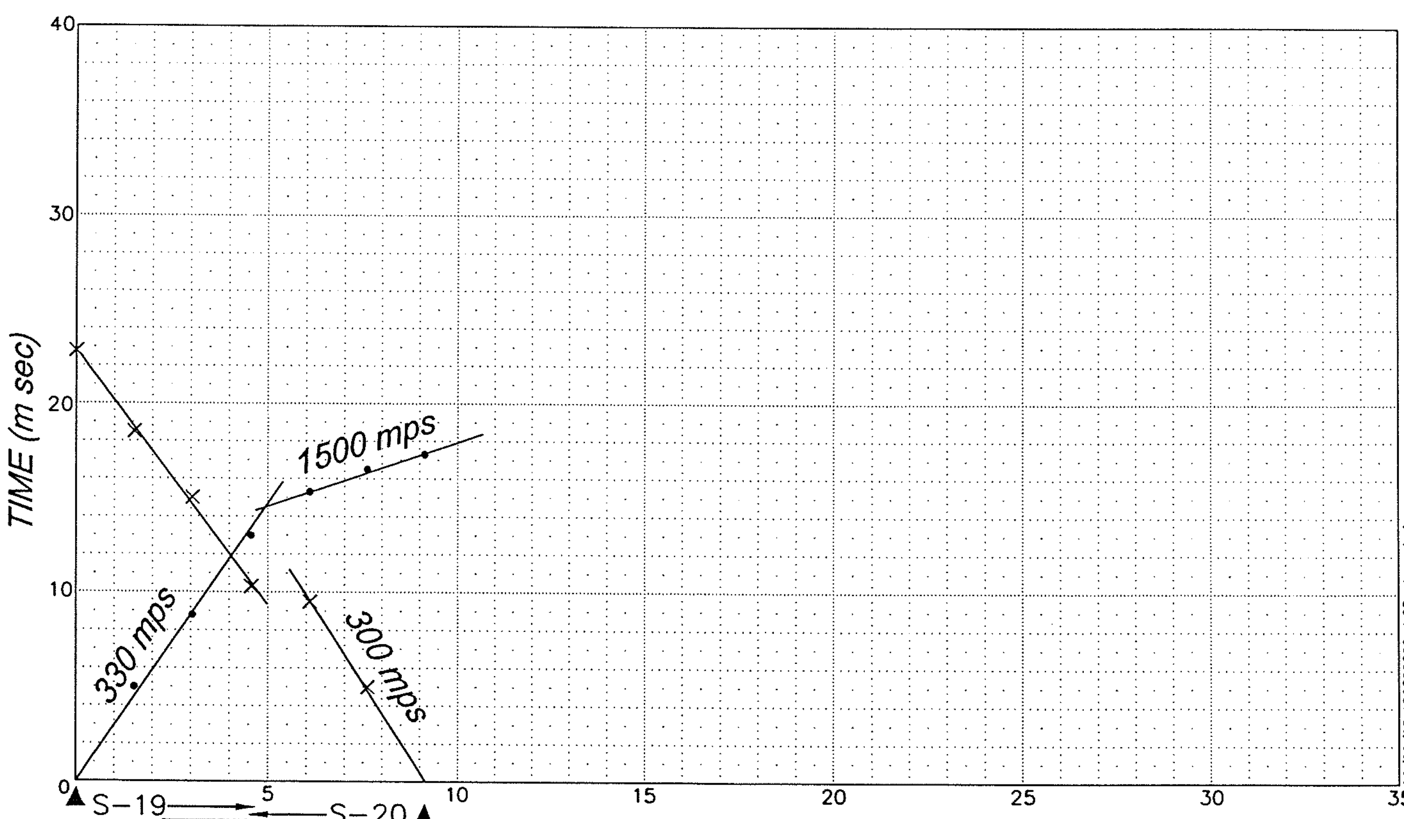
West Sacramento, CA 95691
(916) 371-1690 Fax (916) 371-7265





08/28/05 1P2399296-1.2Re.dwg 1=1

Taber Metric

REFRACTION SEISMIC RECORD

Figure - 2

DIST.	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
03	ED	50	23.1/25.4		

Caltrans Metric

[signature] 7/21/06
REGISTERED CIVIL ENGINEER DATE

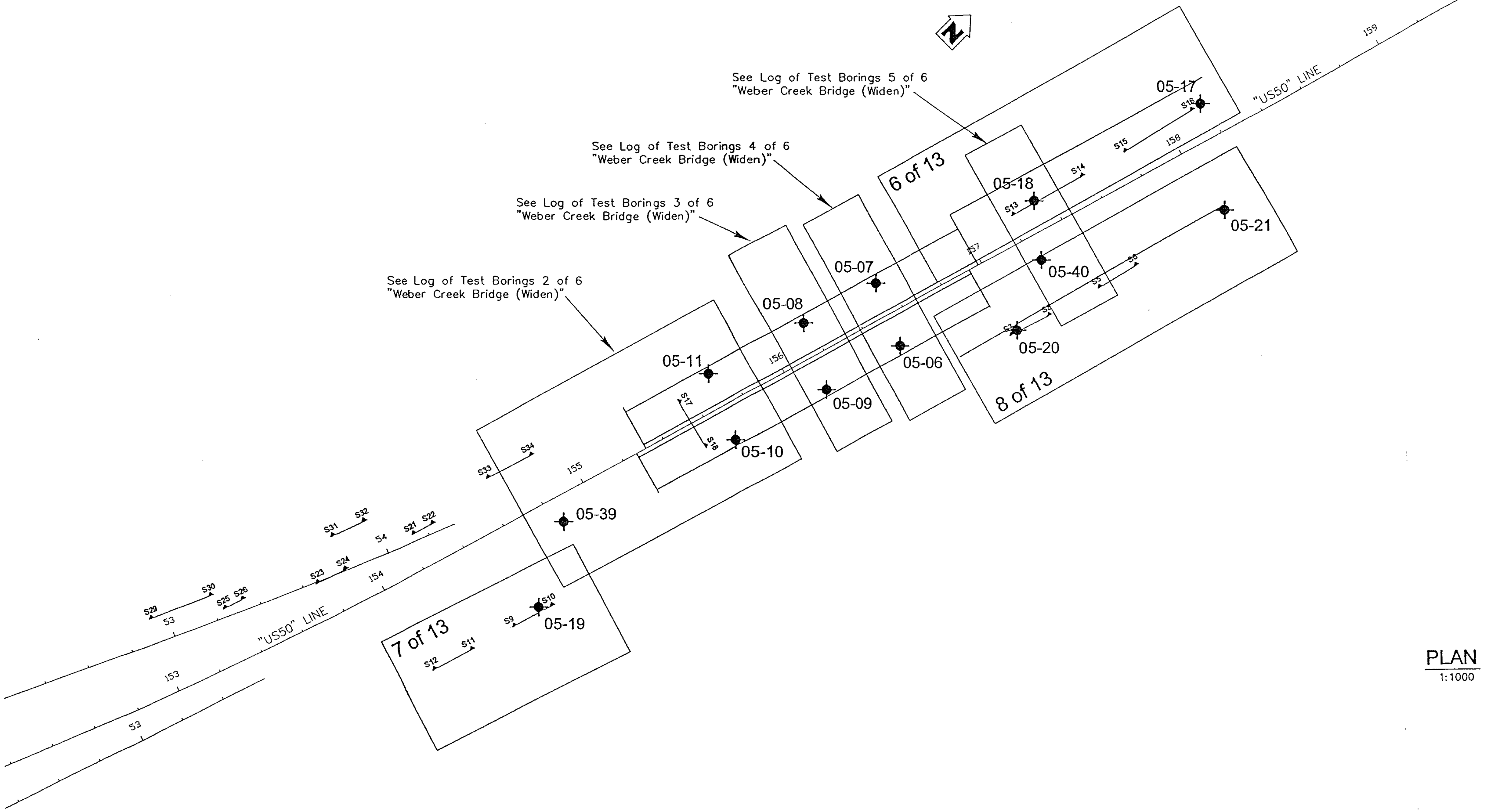
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
RONALD E. LOUTZENHISER
No. 64089
EXP. 9-30-06
CIVIL
STATE OF CALIFORNIA

TABER CONSULTANTS
3911 West Capitol Avenue
West Sacramento, CA 95691-2116
JOB No. 1P2/399/296-1 LOCATION: 38120-F7:334N:244W

Quincy Engineering, Inc.
3247 Ramos Circle
Sacramento, CA 95827-2512

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.



PLAN
1:1000

DESIGN OVERSIGHT	DESIGN	By M. D. Robertson	FIELD INVESTIGATION BY: M. W. McIlroy and R. E. Loutzenhiser May 2005
SIGN OFF DATE	CHECKED	By R. E. Loutzenhiser	

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

Mario Quest
PROJECT ENGINEER

BRIDGE NO.
KILOMETER POST 23.1/25.4

MISSOURI FLAT ROAD INTERCHANGE IMPROVEMENTS

LOG OF TEST BORINGS 3 OF 13

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

CU 03198
EA 370004

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) SHEET OF

11/29/05 1P2399296-1.2R.dwg

APPENDIX – F

SAMPLE FOUNDATION DESIGN CALCULATIONS

Allowable Bearing Capacity for abutment foundations is based on "Ultimate Bearing Capacity of Shallow Footings with Concentric Loads" in Chapter 4 of the Naval Facilities Engineering Command (NAVFAC) "Foundations & Earth Structures" Design Manual 7.02. An internal friction angle (phi) of 35 degrees is conservatively estimated for the existing gravelly sands in Boring 05-18, representing the "worst case" soil condition at an abutment location as Borings 05-39 and 05-40 contain more dense/hard soils/weathered rock from bottom of footing levels to fresh rock. Bottom of footing is approximately 4 m (13 ft) below existing ground surface at this location.

Spread Footing Settlement for abutment foundations is based on "Settlement of Footings over Granular Soils" in Chapter 5 of the Naval Facilities Engineering Command (NAVFAC) "Soil Mechanics" Design Manual 7.01. Settlement is estimated to be less than 2.5 mm (0.1 inch) in existing soils; settlement in underlying rock is expected to be negligible. Again, Boring 05-18 is used as a "worst case" example. A slightly conservative value of 0.3 was used for I_z.

Ultimate Bearing Capacity of mined shaft foundations is calculated to be a minimum of 8,618 kPa (180 ksf) as shown on the attached "Vertical Spring at Bottom of 6-ft x 12-ft Shaft Foundation" sheet. An "ultimate" foundation capacity of greater than 57,000 kN per shaft is calculated based on minimum 6.7 square meter ("6-ft x 12-ft," or 72 square foot) bearing area with a settlement of less than 2.5 mm (0.1 inch). Planned footing size is larger, approximately 10.2 square meters (110 square feet). Mined shaft axial capacity is conservatively designed using end-bearing only.

Calculations regarding lateral capacity are included in the bridge design calculations according to Quincy Engineering, Inc.

Equivalent Fluid Pressures are based on a total unit weight of 120 pcf and effective phi of 33 degrees for "Structure Backfill" for level backfill as well as 1(v):2(h) slopes. A higher effective phi of 36 degrees was used for Class 3 Aggregate Subbase for slopes of steeper than 1(v):2(h).

Weber Creek Bridge
1P2/399/296-1.2W
REL
19-Sep-08

General Bearing Capacity

Soil	
gamma, γ	127
phi, ϕ	35
cohesion, c	0

Footing	
Ultimate load, Q	2,346,000
Length, L	69
Width, B	8.5
Depth to bottom, D	13

From Figure 1 (NAVFAC 7.2-131)	
Nc	50.0
Nq	35.0
$N\gamma$	40.0

Desired Factor of Safety	
FS	3

	q_{ult}, psf	q_{net}, psf	q_{all}, psf
Continuous footing	79,375	77,724	25,908
Square/Rectangular footing	75,057	73,406	24,469
Circular footing	70,739	69,088	23,029
"q" based on q=Q/(L*B)			***4,000***

Notes:

From NAVFAC 7.02
All units in feet, pounds, and degrees.
For rough (cast-in-place) footings.
Concentric footing loads (no eccentric loading).
Depth of footing less than the footing width.
No groundwater within zone below bottom of footing equal to footing width (B).
No "L" term required for Continuous or Circular footings.
R=B/2 for Circular footings.
Suggested FS = 3 for DL+LL, 2 for EQ/Wind/Snow.
For local shear analysis, replace c and phi with: c'=2/3c
tan (phi')=2/3 tan (phi)

Weber Creek Bridge
1P2/399/296-1.2W
REL
19-Sep-08

Settlement of Footings Over Granular Soils

From NAVFAC DM 7.1-220

Footing Width, ft	8.5	=B	c1 =	0.652542	
Depth of Embedment, ft	13	=D	c2 =	2.06	
Contact Pressure, psf	4000	=P			
po (overburden at foundation level), tsf	0.82		2 * B =	17	ft
dp (net foundation pressure increase), tsf	1.18		2 * B + D =	30	ft
Time, years	20		B / 2 =	4.25	ft
			B / 2 + D =	17.25	ft

Boring	Layer Top, ft	Layer Bottom, ft	dz, inches	N	Es / N	Es (tsf)	zc, in	Iz	(Iz*dz)/Es	**Settlement, in**
B-5	0	3	36	39	10	390	18	0.3	0.027692	**0.04**

Vertical Spring at Bottom of 6-ft x 12-ft Shaft Foundation										
Existing Support:			Bent-2L	Bent-2R		Bent-3L	Bent-3R		Bent-4L	Bent-4R
Top of Test Boring Elevation		(ft)	1602	1598		1533	1535		1556	1562
Effective Top of Shaft Elevation		(ft)	1584	1584		1527	1527		1543	1543
Bottom of Shaft Elevation		(ft)	1569	1569		1508	1508		1530	1534
Rock Descriptors 10-ft below bottom of shaft	Rock Mass Rating (RMR)		50	73		55	70		35	46
	Core Recovery	(%)	100	96		100	100		100	100
	Rock Quality Designation (RQD)	(%)	60	65		55	62		35	30
Average Unconfined Compressive Strength of Rock (Point Load Test)		(psi)	31250			23250			17650	
Elastic Modulus of Rock Mass (adjusted for RQD)		(psi)	1350000			1000000			825000	
"Ultimate" Bearing Capacity		(ksf)	364			270			180	
Elastic Settlement in Rock at "Ultimate" Bearing Capacity		(inches)	0.11			0.11			0.09	
Vertical "Spring" at Bottom of Shaft (6'x12')		(kips/inch)	238000			177000			144000	

Reference Caltrans "Bridge Design Specifications" (BDS).

The rock is considered "competent" with tight and unweathered fractures. "Ultimate Bearing Capacity" is from either BDS Figure 4.4.8.1.1A for Bent-4 (with Factor of Safety 3.0 assumed to derive "ultimate" capacity from "allowable") or from equation 4.4.8.1.2-1. Rock is identified as "Type E" per BDS Table 4.4.8.1.2B with strength modification factor (Nms) from Table 4.4.8.1.2A for indicated RMR.

Estimated elastic settlement in rock below base of shaft was estimated using BDS equation 4.4.8.2.2-2 with Elastic Modulus of Rock Mass estimated from compressive strength (after Figure 4.4.8.2.2A) and reduced for RQD per BDS equations 4.4.8.2.2-3 and 4.4.8.2.2-4. The method of calculating ultimate bearing capacity was chosen to correspond to estimated settlement of about 0.1-inch at "ultimate" loading.

Equivalent Fluid Pressure (EFP) Worksheet
Level Ground Condition (Structure Backfill)

Date: 9/19/2008
Job No: 1P2/399/296-1.2W
Project: Weber Creek Bridge

				Buoyant	
Total Unit Weight of Soil (γ):	120	pcf		57.6	pcf
Angle of Internal Friction (ϕ):	33	degrees			
Site Horiz. Ground Accel. (k_h):	0.3	g			

			Buoyant	
Active (EFP):	35.4 psf/f	5.56 kN/m^2/m	17.0	psf/f
Passive (EFP):	407.1 psf/f	63.94 kN/m^2/m	195.4	psf/f
"At Rest" (EFP):	54.6 psf/f	8.58 kN/m^2/m	26.2	psf/f
Incremental Seismic (ΔEFP):	27.0 psf/f	4.24 kN/m^2/m		

Equations:

Active Earth Pressure = $P_a = K_a \times \gamma \times z$

$K_a = \tan^2[45-(\phi/2)]$
γ = total unit weight of soil
z = depth

Passive Earth Pressure = $P_p = K_p \times \gamma \times z$

$K_p = \tan^2[45+(\phi/2)] = 1/K_a$
γ = total unit weight of soil
z = depth

"At Rest" Earth Pressure = $P_o = K_o \times \gamma \times z$

$K_o = 1 - \sin\phi$
γ = total unit weight of soil
z = depth

Incremental Seismic (Δ *EFP*) = $0.75 \times \gamma \times k_h$

γ = total unit weight of soil
k_h = horizontal ground acceleration

Reference: Naval Facilities Engineering Command Design Manual 7.02, 1986

Note: For compacted "Structure Backfill" use 120 pcf and 33 degrees

Equivalent Fluid Pressure (EFP)
Sloping Ground Condition (Structure Backfill)

Date: 9/19/2008
Job No: 1P2/399/296-1.2W
Project: Weber Creek Bridge

Slope Angle (β): 27 degrees
Unit Weight of Soil (γ): 120 pcf
Angle of Internal Friction (ϕ): 33 degrees

sin ϕ	cos ϕ	tan β	sin β
0.5446	0.8387	0.5095	0.4540

Slope	Degree
1.5h:1v	34
2h:1v	27
2.5h:1v	22
3h:1v	18.4
5h:1v	11.3
10h:1v	5.7
20h:1v	2.9

Active (EFP): 53.8 psf/f 8.45 $kN/m^2/m$

Equations:

Active Earth Pressure $= P_a = K_a \times \gamma \times z$

$$K_a = [\cos \Phi/(1+(\sin \Phi(\sin \Phi - \cos\Phi \tan\beta)^{1/2})]$$

Reference: Naval Facilities Engineering Command Design Manual 7.02, 1986

Note: For compacted "Structure Backfill" use 120 pcf and 33 degrees

Equivalent Fluid Pressure (EFP) Worksheet
Level Ground Condition (Caltrans Class 3 Subbase)

Date: 9/19/2008
Job No: 1P2/399/296-1.2W
Project: Weber Creek Bridge

Total Unit Weight of Soil (γ):	120	pcf	**Buoyant** 57.6	pcf
Angle of Internal Friction (ϕ):	36	degrees		
Site Horiz. Ground Accel. (k_h):	0.3	g		

			Buoyant	
Active (EFP):	31.2 psf/f	4.89 $kN/m^2/m$	15.0	psf/f
Passive (EFP):	462.2 psf/f	72.61 $kN/m^2/m$	221.9	psf/f
"At Rest" (EFP):	49.5 psf/f	7.77 $kN/m^2/m$	23.7	psf/f
Incremental Seismic (ΔEFP):	27.0 psf/f	4.24 $kN/m^2/m$		

Equations:

Active Earth Pressure $= P_a = K_a \times \gamma \times z$

$K_a = \tan^2[45-(\phi/2)]$
γ = total unit weight of soil
z = depth

Passive Earth Pressure $= P_p = K_p \times \gamma \times z$

$K_p = \tan^2[45+(\phi/2)] = 1/K_a$
γ = total unit weight of soil
z = depth

"At Rest" Earth Pressure $= P_o = K_o \times \gamma \times z$

$K_o = 1 - \sin\phi$
γ = total unit weight of soil
z = depth

Incremental Seismic $(\Delta EFP) = 0.75 \times \gamma \times k_h$

γ = total unit weight of soil
k_h = horizontal ground acceleration

Reference: Naval Facilities Engineering Command Design Manual 7.02, 1986

Note: For compacted "Structure Backfill" use 120 pcf and 33 degrees

Equivalent Fluid Pressure (EFP)

Sloping Ground Condition (Caltrans Class 3 Subbase)

Date: 9/19/2008

Job No: 1P2/399/296-1.2W

Project: Weber Creek Bridge

Slope Angle (β): 34 degrees

Unit Weight of Soil (γ): 120 pcf

Angle of Internal Friction (ϕ): 36 degrees

sin ϕ	cos ϕ	tan β	sin β
0.5878	0.8090	0.6745	0.5592

Slope	Degree
1.5h:1v	34
2h:1v	27
2.5h:1v	22
3h:1v	18.4
5h:1v	11.3
10h:1v	5.7
20h:1v	2.9

Active (EFP): 58.6 psf/f 9.21 $kN/m^2/m$

Equations:

Active Earth Pressure $= P_a = K_a \times \gamma \times z$

$$K_a = [\cos\Phi/(1+(\sin\Phi(\sin\Phi - \cos\Phi\tan\beta)^{1/2})]$$

Reference: Naval Facilities Engineering Command Design Manual 7.02, 1986

Note: For compacted "Structure Backfill" use 120 pcf and 33 degrees

APPENDIX – G

CALTRANS COMMENTS AND RESPONSES

Taber
Since 1954

This document lists our responses to the Caltrans comments dated February 11, 2008 and February 28, 2008, of our report "Draft Foundation Investigation, Weber Creek Bridge (Widen), Bridge No. 25-05R/L, Phase 1 – US Route 50/Missour Flat Road Interchange Project, El Dorado County, California" dated January 2008. Copies of the Caltrans comments are appended for reference.

Caltrans comments dated February 11, 2008 - Response to Comments:

Page 2

- We received the updated General Plan from Quincy Engineering and have updated the project description.

Page 3

- We updated loading conditions.

Page 4

- We updated widening details.

Page 5

- Per pages 1 and 2 of "Webber Creek Bridge, III-ED-11-C, Bridge #25-05 R&L" letter stamped January 25, 1961, piers "may be designed for loads up to and including" 15 tsf at all pier support locations for "pier columns extending into bedrock."
- Bullet items have been edited.

Page 14

- The phrase "and included with Appendix A" refers to the "results of point load tests," not the location of the Log of Test Boring sheets. No changes were made.

Page 15, 16

- Please see comment 3 of the Caltrans comments dated February 28, 2008. References to the draft mapping have been removed.

Page 21

- We changed the units to kN.

Page Figure 3

- Please see comment 3 of the Caltrans comments dated February 28, 2008.

General Plan

- We received the updated General Plan and Foundation Plan sheets from Quincy Engineering.

Log of Test Boring sheets

- The Engineering Geology Field Descriptors sheet is not to be included with contract plans; it is for use in the "Foundation Investigation" report only.

Caltrans comments dated February 28, 2008 - Response to Comments:

1. The EA number, Bridge Number, and Post Kilometer were already present in the title page. We edited the title page to clarify the Post Kilometer. We added the Bridge Number and EA to page headers.
2. We added Post Kilometer and EA number.
3. The section has been updated.
4. The test results have been added to the report text.
5. The units have been changed.
6. We added benchmark information and stream flow direction arrow.
7. We made the changes to the Logs of Test Borings.
8. The Engineering Geology Field Descriptors sheet is not to be included with contract plans; it is for use in the "Foundation Investigation" report only.
9. The calculations have been added in Appendix F. Calculations regarding lateral capacity are included in the bridge design calculations according to Quincy Engineering, Inc.
10. Reference to the appendix has been added in the "Exploration and Testing" section of the report.

MISSOURI FLAT I/C – PHASE 1B
DRAFT FOUNDATION INVESTIGATION
REVIEW COMMENTS
WEBER CREEK BRIDGE (WIDEN & RETROFIT)
BR. NO. 25-0005 L/R

03-2E1701
03-ED-50

2-11-08

To: Mario Quest – Quincy Engineering, Inc., Sacramento
From: Eric Fredrickson – Special Funded Projects, Structures 916-227-8916

ADDITIONAL COMMENTS TO OFFICE OF GEOTECHNICAL SERVICES' COMMENTS, DATED 2-28-08
PLEASE FORWARD COPY TO TABER CONSULTANTS.

PAGE 2
- Project Description – Get updated General Plan (and Foundation Plan) for this report. Label drawings appropriately. Please note that the left and right pier column locations are different distances from the existing structure (ultimate right widen is greater than left widen).

PAGE 3
- 4th and 5th paragraphs – Update sections to reflect actual lateral and retrofit loading conditions from designer.

PAGE 4
- 4th paragraph – Phase 2 widening will be "5.1 m (left) and 8.4 m (right)".

PAGE 5
- 1st paragraph – Please confirm if the as-built pier design loads were 15.0 tsf or 5.0 tsf.
- Bullets 3, 4, 5 – Include "ft" for the base elevations noted for the piers.

PAGE 14
- Verify location of Log of Test Borings sheets. Are they in Appendix A (noted in 2 locations)?

PAGE 15, 16
- Verify site seismic design parameters. How did the PBA change from 0.5g to 0.3g? I do not believe that the Draft Hazard Mapping is applicable at this time.

PAGE 21
- Table 2 – Verify if "kPa" or "kN" should be used.

Figure 3
- Verify ARS curve (0.5g vs. 0.3g).

General Plan
- Get current GP and Foundation Plan sheets.

Log of Test Boring sheets
- Is the Engineering Geology Field Descriptors sheet part of the Log of Test Boring sheets that need to be included in the contract plans?

FOUNDATION REVIEW

DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL SERVICES

TO: MR. ERIC FREDRICKSON
Office of Special Funded Projects (OSFP)
Division of Engineering Services

DATE: February 28, 2008

FILE: 03 (District) ED (County) 50 (Route) 14.4-15.8 (Post Mile)

FDN REPORT BY: Taber Consultants DATED: 01/31/08 Weber Creek Bridge (Widen) (Structure Name)

GENERAL PLAN DATED: 01/31/08 FDN PLAN DATED: 01/31/08 03-2E1701 (EA Number) 25-005L/R (Bridge Number)

Submittal (*Check One*): [X] 1st [ ] 2nd [ ] 3rd [ ] 4th [ ] Other: Type: FR

The Office of Geotechnical Design – North has completed its review of the following documents:

(a) The Draft Foundation Investigations for the Weber Creek Bridge (Bridge No. 25-005L/R). The left and right bridges will be widened 19.05 feet to the outside. This report, dated January 31, 2008, was prepared by Taber Consultants for Quincy Engineering, Inc.

(b) Bridge Plan Sheets consisting of General Plan Num. 1 and 2, Foundation Plan, Abutment and Pier Layout and Detail Plans, dated January 31,2008. Log of Test Borings for Weber Creek Bridge, undated.

1. Please include EA number, Bridge Number and Post Mile in title page and Bridge Number and EA in heading for each page of the report.

2. Please include Post Mile and EA number in title blocks of figures 1 and 3.

3. We concur with the Controlling Fault, named in this report as Bear Mountain Fault Zone. Based on the Caltrans California Seismic Hazard Map, 1996, our Office recommends using the complete name of the fault as Big Bend-Wolf Creek-Maidu-Bear Mountain/E (BWM). Please write down the fault codes. This fault is located 5.65 miles west of the bridge project location. Please correct the distance to the fault. We also concur with the Maximum Credible Moment of Magnitude of 6.5, the Peak Bedrock Acceleration of 0.3g, and the Type of soil profile as Type C. The fault type is currently not known.

4. Please include corrosion testing results performed at Missouri Flat Road Overcrossing in either one of the appendices or a table right below the Corrosivity Section.

5. Please correct the units used under Nominal Resistance for Compression and Tension in Table 2. The correct unit used for Nominal Resistance for Compression and Tension is kN.

6. Please add the benchmark information used for determining the top of boring elevations in the Plan View Plan, Log of Test Borings 1 of 6. Benchmark information should include descriptions, locations, and elevations and should be placed at the top left side of the Plan View. Also, in the same plan, please show the direction of the stream flow.

FOUNDATION REVIEW

DIVISION OF ENGINEERING SERVICES
OFFICE OF GEOTECHNICAL SERVICES

TO: MR. ERIC FREDRICKSON
Office of Special Funded Projects (OSFP)
Division of Engineering Services

DATE: February 28, 2008

FILE: 03 (District) ED (County) 50 (Route) 14.4-15.8 (Post Mile)

FDN REPORT BY: Taber Consultants DATED: 01/31/08 Weber Creek Bridge (Widen) (Structure Name)

GENERAL PLAN DATED: 01/31/08 FDN PLAN DATED: 01/31/08 03-2E1701 (EA Number) 25-005L/R (Bridge Number)

7. In the Notes of Log of Test Borings 2 through 6 please include in note 3 hammer type and weight, lift and drop method and drop weight. Additionally, please describe types of samplers used for field exploration along with in and outside diameters of the sampler. And, the size of the font for the Notes seems to be too small, please increase the font size of this section. Generally, the font size for a 24 by 36-inch sheet is not less than 34 mm; and a reproduction copy of 11 by 17-inch sheet, like the one presented in this report, is half of the 24 by 36-inch sheet.

8. Please present the Engineering Geology Field Descriptors as part of the numbering for the Log of Test Borings sheets.

9. Please show in one of the appendices your foundation design calculations including Allowable Bearing Capacity, Spread Footing Settlement for the bridge abutments, and the Mine Shaft Axial Capacity, Lateral Capacity, and Settlement for the bridge bents. Additionally, in the same appendix, please show Lateral Earth Pressures calculations for the retaining walls.

10. Appendix E, Log of Test Borings for Missouri Flat Road Interchange Improvements, is not referenced in the text of the report. Please, either reference it in the text or remove it.

Please do not hesitate to call Luis Paredes-Mejia at (916) 227-5505 for further clarification of these or other issues.

Approval: C3 - Revise + Resubmit ~~(C6) Type Selection Meeting - OSFP~~

Office of Special Funded Projects (OSFP)

Luis M. Paredes-Mejia. ~~7/16/07~~
Geotechnical Design Branch – North

cc: OGS (Sacramento) DES Specifications and Estimates Branch (All Reviews) OSC R.E Pending File