ATTACHMENT H

GEOTECHNICAL REPORT

LOWER SACRAMENTO ROAD/UPRR UNDERPASS

& BEAR CREEK BRIDGE REPLACEMENT

Stockton, California

Prepared by:

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May 7, 2010

Prepared for:

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Geotechnical • Construction Services • Forensics

File No. 879.5
May 7, 2010

Mr. Matt Satow
Mark Thomas & Co., Inc.
7300 Folsom Boulevard, Suite 203
Sacramento, CA 95826

Subject: **GEOTECHNICAL REPORT**
Lower Sacramento Road/UPRR Underpass
and Bear Creek Bridge Replacement
Stockton, California

Dear Mr. Satow,

Blackburn Consulting (BCI) is pleased to submit this Geotechnical Report for the Lower Sacramento Road/UPRR Underpass and Bear Creek Bridge Replacement Project. BCI prepared this report in accordance with our December 10, 2007 Subconsultant Amendment 1 to our original May 2, 2006 agreement.

This report defines the geotechnical conditions as evaluated from field and laboratory test data and provides geotechnical recommendations for project design and construction. BCI prepared separate Foundation Reports for design and construction of the bridge structures.

Please call if you have questions or require additional information.

Sincerely;

BLACKBURN CONSULTING

Reviewed By:

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GEOTECHNICAL REPORT
Lower Sacramento Road/UPRR Underpass
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Stockton, California

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1 INTRODUCTION

1.1 Purpose

BCI prepared this Geotechnical Report for the proposed roadway improvements, retaining walls, and pump station that are part of the Lower Sacramento Road/UPRR Underpass and Bear Creek Bridge Replacement Project in Stockton, California. BCI prepared separate Foundation Reports for design and construction of the bridge structures.

This report documents subsurface geotechnical conditions, provides analyses of anticipated site conditions as they pertain to the project described herein, and recommends design and construction criteria for the roadway portion of the project. This report also provides geotechnical criteria for use in assessing the existence and scope of changed site conditions.

1.2 Scope of Services

To prepare this report, BCI:

- Discussed the proposed improvements with Matt Satow and Derek Minnema with Mark Thomas and Company, Inc. (MTCo).
- Reviewed preliminary plans for Lower Sacramento Road/UPRR Underpass and Lower Sacramento Road/Bear Creek Bridge Replacement project provided by MTCo.
- Reviewed BCI's January 31, 2007 Preliminary Foundation Report titled 'North Stockton Railroad Grade Separations and Bridge Replacements'.
- Reviewed BCI's May 5, 2008 Preliminary Geotechnical Memorandum for the North Stockton Grade Separations Project.
- Observed the subsurface conditions in twelve exploratory borings between September 8, 2006 and May 5, 2008.
- Performed laboratory tests on soil samples obtained from the exploratory borings.
- Performed engineering analysis and calculations to develop our conclusions and recommendations.

1.3 Project Description

The project corridor extends approximately 4,500 feet from Royal Oaks Drive on the south to about 1,200 feet north of the Union Pacific Railroad (UPRR) tracks on the north. The project includes replacement of the Bear Creek Bridge (at approximate "LSR" Sta. 28+50), a new underpass at the UPRR tracks (at approximate "LSR" Sta. 43+57), six retaining walls, a sound wall, and a pump station.

Roadway improvements include:

- Between the beginning of the project to about LSR Sta. 20+02, the new total roadway section will vary from about 86 feet to 115 feet wide, including an 8.5-foot wide sidewalk on the east side. Within this interval, the new roadway will be established about 1 to 3 feet above existing grade.
- Between LSR Sta. 20+02 to Sta. 35+50, the new roadway section will vary from about 107 feet to 125 feet wide including an 8 to 14 foot wide raised median and 8.5 foot wide sidewalks on each side. Within this interval, the new roadway will be established as much as 10 feet above existing grade.
- Between LSR Sta. 35+50 to Sta. 53+75, the new roadway will be a depressed section as much as 24 feet below the top of railroad tracks with lowest roadway grade at about elev.-0.7. The new roadway will be about 109 to 127 feet wide with variable center raised median and sidewalks on each side.
- Between about LSR Sta. 53+75 to Sta. 56+00, the new roadway width will taper to conform with the existing 24 foot wide roadway to the end of the project. Within this interval the new roadway will be at/near existing grade.
- A 12 foot-high by 710±foot-long Sound Wall (Caltrans, Masonry Block on Pile Cap) located on the west side of Lower Sacramento Road between "SW" Sta. 02+1.08 (Armor Drive) and "SW" Sta. 9+10.85.
- Extend Whistler Way about 1,225 feet west to connect to Lower Sacramento Road. The new roadway will be a 32-40 foot wide two lane section established at about 1 foot above/below existing ground surface.
- Where the new roadway is established on fill, permanent 2H:1V side slopes are planned.

A total of six Retaining Walls (Caltrans Type 1, 5 and 7) are planned for this project as follows:

Retaining Wall Number	Approximate "RW" Station Interval (feet)	Height (feet)	Approximate Bottom Footing Elevation (feet)	Backslope Condition
RW1	37+22.23 to 43+46.23	6 and 8	2.8 to 9.7	Case II
RW2	39+61.00 to 47+53.00	6, 8, and 10	-4.8 to 1.7	Case I
RW3	44+19.61 to 49+47.61	6 and 8	2.8 to 8.2	Case II
RW4	39+81.00 to 47+49.00	4, 6, 8, and 10	-4.8 to 1.7	Case I
RW5	43+68.74 to 49+44.74	6 and 8	2.8 to 7.7	Case II
RW6	37+39.13 to 42+91.13	12, 14, and 16	2.7 to 9.2	Case I

The proposed pump station is located about 80 feet right of LSR Sta. 42+45. The pump station will be a 12 foot diameter reinforced concrete structure with top at approximate elev. 20.85 and wet well invert at elev.-14.0, about 32 feet below existing ground surface.

BCI includes a Vicinity Map as Figure 1 in Appendix A. Refer to Log of Test Boring (LOTB) Sheets 1 and 2 in Appendix A for project stationing and limits.

1.4 Site Description

Lower Sacramento Road is a 24 foot wide, two-lane roadway and currently crosses the UPRR tracks at-grade at the top of a 3 to 5 foot high railroad embankment. Elsewhere within the project corridor alignment, Lower Sacramento Road grade is at/slightly above natural ground surface.

Within the project interval, the United States Geological Survey (USGS) 7.5 minute topographic series "Lodi South Quadrangle" (1968; photo-revised 1975) shows natural ground surface sloping very gently to the southeast from about elev. 21 feet to elev. 17 feet (NGVD 1929 datum). Surface drainage is presently provided by unlined ditches along each side of the road.

Bear Creek is an unlined man-made channel section that crosses the Lower Sacramento Road alignment about 1,500 feet south of the railroad tracks.

Private residences occupy land south of Bear Creek and east of Lower Sacramento Road. Undeveloped land with a few commercial properties occupies the area north of Bear Creek, east of Lower Sacramento Road. West of Lower Sacramento Road, agriculture fields are present with some commercial properties.

2 SITE GEOLOGY

2.1 Regional Geology

The site is located in the San Joaquin Valley within the southern portion of the Great Valley Geomorphic Province. This province encompasses the San Joaquin Valley in the south and the Sacramento Valley in the north. The province is bound by the Sierra Nevada Mountains to the east, the Coast Ranges to the west, the Mojave Desert and Transverse Ranges to the south, and the Klamath Mountains to the north.

The Great Valley is a broad, elongated, northwest trending, structural trough that has been filled with a thick sequence of sediments. The eastern margin of the valley is formed by the west sloping Sierran bedrock surface that extends westward beneath the alluvium and older sedimentary bedrock within the valley. The western border is underlain by east dipping rock of the Coast Ranges that form a deeply buried trough.

During the late Mesozoic and through most of Tertiary time (approximately 100 million to 20 million years before present), deposition of thousands of feet of marine sediments occurred within the Great Valley. Continental deposits (generally alluvium) of late Tertiary and Quaternary age (approximately 20 million years ago to the present) overlie these marine deposits. Both the continental deposits and the underlying marine sediments form a wedge of sediments that generally thickens from east to west.

2.2 Local Geology

The California Geologic Survey (CGS)[1] maps surface materials within the project limits as upper and lower members of the Pleistocene Modesto Formation. Both upper and lower members of this formation consist of unconsolidated gravel, sand, silt, and clay. The upper member is mapped east of the UPRR tracks; the lower member is mapped west of the UPRR tracks.

3 SUBSURFACE CONDITIONS

For the preliminary phase, BCI retained V&W Drilling to drill and sample one exploratory boring (B2-06) near the UPRR tracks on September 8, 2006 to a depth of 81.5 feet. For the design phase, BCI retained V&W Drilling and Precision Drilling to drill eleven additional borings (B1-08 through B11-08) between March 19, 2008 to May 5, 2008 to depths of 3 feet to 101.5 feet to further characterize the subsurface conditions and obtain additional samples for laboratory testing. The drillers used 6-inch and 8-inch diameter hollow stem auger and mud rotary drilling methods to advance the borings.

BCI obtained relatively undisturbed soil samples at various intervals using either a Standard Penetration Test (SPT) Sampler or 3-inch O.D. Modified California Sampler (equipped with 2.5-inch O.D. brass liners). These samplers were driven into the ground by the force of a 140-pound auto-trip hammer falling approximately 30 inches. We sealed the sample liners with plastic caps and placed disturbed samples from the SPT sampler in sealed plastic bags. We also obtained bulk soil samples from the auger cuttings.

BCI installed a piezometer casing in Boring B7-08 (located near the UPRR tracks). We installed the screened interval in the lowermost 20 feet of the boring between 36.5 feet and 56.5 feet below ground surface (between elev.-18.5 and elev.-38.5).

3.1 Soil Conditions

In general, soils consist of stiff-very stiff to hard sandy silt, clay with sand, and sandy clay interlayered with layers of medium dense to very dense (locally loose) clayey/silty sand, sand, and sand with gravel and sand to the maximum depth explored (101.5 feet, elev.-82.9).

Refer to the LOTB drawings in Appendix A for soil descriptions, exploration details and sampling methods. Appendix B contains the LOTB drawings for the Lower Sacramento Road Underpass and Bear Creek Bridge.

[1] "Geologic Map of the Sacramento Quadrangle, California"; Regional Geologic Map Series; Map No. 1A; California Division of Mines and Geology; D.L. Wagner, C.W. Jennings, T. L. Bedrossian, and E. J. Bortugno; 1991

3.2 Water

3.2.1 Surface Water

At the time of our April 2008 field exploration at Bear Creek, we observed water flowing in the creek.

Seasonal ponding of surface water is common in the project area in the winter and spring months due to the relatively flat terrain and low infiltration rate of the near-surface clayey soil.

3.2.2 Ground Water

BCI measured ground water in the following borings:

Table 1: Ground Water

Boring	Date	Ground Water (feet)	
		(depth)	(elevation)
B2-06	09/08/2008	52.0	-33.0
B1-08	03/19/2008	49.0	-26.0
B7-08	03/24/2008	44.0	-30.4
B9-08	04/04/2008	50.0	-26.2
B10-08	04/04/2008	50.0	-27.9

BCI did not encounter ground water in Borings B2-08 through B6-08 and B8-08, drilled to depths ranging from 11.5 feet to 36.5 feet below grade between March 20-25, 2008. We did not measure ground water in Boring B11-08 due to the presence of residual drill fluid.

BCI reviewed ground water well data at the California Department of Water Resources website for three nearby wells. This data indicates that the groundwater level in project area has been about 30 feet below existing grade during the last 15 years.

Ground water and perched water levels can fluctuate due to changes in precipitation, canal or creek levels, irrigation, pumping of wells, and other factors.

4 LABORATORY TESTS

We performed the following laboratory tests on representative soil samples from the exploratory borings:

- Sieve analysis
- Plasticity index
- Triaxial shear strength
- Moisture content and dry density
- Resistance value (R-value)
- pH, resistivity, sulfate content, chloride content.

We attach our laboratory test results in Appendix C.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Project Site Seismicity

5.1.1 Ground Motions

Based on the Caltrans "California Seismic Hazard Map 1996", the peak horizontal rock acceleration for the site is approximately 0.14g. The controlling seismic source is the Coast Ranges-Sierran Block Boundary Zone (CSB), located about 22 miles west of the site, with an estimated maximum moment Magnitude of 7.0. Using Table B.1 of Caltrans "Seismic Design Criteria (SDC), Version 1.4 (June 2006), we classify the site soil profile as Type D.

5.1.2 Ground Rupture

Our review of published geologic mapping and preliminary site review did not reveal the presence of Late Quaternary (displacement within the last 700,000 years) or younger faults within the project site. Therefore, the potential for ground rupture at the site is very low to nonexistent.

5.1.3 Liquefaction and Seismic Settlement

Liquefaction can occur when loose to medium dense, granular, saturated soils (generally within 50 ft of the surface) are subjected to ground shaking. We consider the potential for detrimental liquefaction to be very low to nonexistent given the medium dense to dense nature of the sand at the site, the relatively low peak ground acceleration, and the ground water depth.

During a seismic event, ground shaking can cause seismic settlement of relatively loose granular soil above the water table, which can result in settlement of the ground surface.

We consider the potential for detrimental seismic settlement to be very low to nonexistent given the medium dense to dense nature of the sand at the site, and the relatively low peak ground acceleration.

5.2 Grading Recommendations

We understand that the project will be constructed using the City of Stockton Standard Specifications (November 2003) and the latest amendments to these specifications. BCI provides the following additional recommendations that should be incorporated as special provisions for the project. If a conflict exists between the City of Stockton Standard Specifications and our recommendations in Sections 5.2.1 through 5.2.6, our recommendations will govern.

5.2.1 Earthwork

Section 19-5.03 of the Caltrans Standard Specifications (May 2006) should be included in the project special provisions in its entirety.

5.2.2 Acceptable Fill and Borrow Material

Embankments will be constructed using imported borrow material, supplemented with material excavated from shallow on-site cuts and existing embankment fill. Since the project borrow source(s) has not been determined, additional sample collection, laboratory testing, and engineering analysis will be required to evaluate proposed borrow materials for use on this project.

On-site soil is suitable for use as fill for the project provided it is free of organics, debris, or deleterious material. However, on-site soil will not meet material requirements for "structure backfill" per Section 19-3.06 of the Caltrans Standard Specifications (May 2006).

The existing asphalt concrete pavement may be pulverized and/or broken up to particles not exceeding 6 inches in maximum dimension and incorporated into fills for the project. Avoid nesting of asphalt concrete fragments during fill compaction.

<u>Import Select Borrow</u>

Import borrow material used as fill within the upper 4.5 feet of finish grade shall meet the following requirements for Import Select Borrow Material:

- No concentrations of organics, debris, and other deleterious materials
- Resistance value not less than 20 (California Test Method 301)
- Expansion Index less than 30, per ASTM D4829
- At least 15 percent passing the No. 200 Sieve
- At least 75 percent passing the No. 4 Sieve
- Maximum particle size of 3 inches

Import General Borrow

Import General Borrow Material may be used as fill at depths greater than 4.5 feet below finish grade provided it meets the following requirements:

- No concentrations of organics, debris, and other deleterious materials
- Expansion Index less than 70, per ASTM D4829
- At least 15 percent passing the No. 200 Sieve
- At least 75 percent passing the No. 4 Sieve
- Maximum particle size of 3 inches

Structure Backfill

Imported fill used as retaining wall backfill shall meet "Structure Backfill" requirements per Section 19-3.06 of the Caltrans Standard Specifications (May 2006).

5.2.3 Cuts and Excavations

Shallow cut slopes (less than 15 feet in height) should be stable at an inclination of 2:1 or flatter provided that proper erosion control is implemented and surface water is directed away from the slope face. Slope and shore temporary excavations in accordance with current Cal OSHA requirements.

To avoid conflict with proposed project excavations, the type, location and elevation of any existing underground utility should be established/confirmed prior to the start of construction. The contractor is responsible for protecting underground utilities from construction damage.

5.2.4 Embankment Stability and Settlement

New embankment fills for the project will be up to 10 ft. high. Embankments sloped at 2:1 (horizontal to vertical) or flatter should be stable provided they are constructed in accordance with recommendations in Section 5.2.1. To mitigate potential erosion and subsequent surficial slumping, vegetate slopes as soon as possible after construction, and direct surface drainage away from the top of slopes.

Based on the subsurface conditions, we anticipate about 1 to 3 inches of settlement for 10 foot high embankments, mostly occurring during construction. We do not anticipate significant long-term settlement and a settlement waiting period is not required.

5.2.5 Utility Trenches

For the most part, trenches should be stable within the upper 4 feet. The contractor is responsible for the safety of all temporary excavations and should provide excavation sloping and shoring in accordance with current Cal OSHA requirements.

Seepage may be encountered at contacts between relatively permeable soil and less permeable clay and cemented soil, particularly in relatively low-lying areas during and shortly following the rainy season. Based on our experience, sump pumps should be adequate to remove moderately accumulated seepage water.

5.2.6 Perched Ground Water and Over-Optimum Soil Moisture

During the rainy season, infiltrating rain water can pond upon less permeable underlying soil creating a perched water condition. This perched water condition may extend into the late spring or early summer season. If perched ground water or surface water is encountered, sump pumps may be required to facilitate construction.

Excessively over-optimum (wet) soil conditions can make proper compaction difficult or impossible. Wet soil is commonly encountered during the winter and spring months, or in excavations where ground water or perched ground water is encountered.

In general, wet soil can be mitigated by:

- Discing the soil during prolonged periods of warm, dry weather (late spring to early all months)
- Overexcavating and replacement with drier material
- Lime treatment or stabilization using aggregate and or stabilization fabric

We anticipate that over-optimum wet soil conditions, and resulting unstable soil, will exist at the site from late October through late April during normal years. To avoid delays and additional costs to dry and/or stabilize subgrade and fill, we recommend scheduling grading during the drier late spring to early fall months.

If wet, unstable soil is encountered, BCI can observe the conditions and provide more specific mitigation recommendations.

5.3 Soil Corrosivity

Based on the Caltrans Corrosion Guidelines (Version 1.0, September 2003), a corrosive soil for reinforced concrete has more than 500 ppm chlorides or more than 2000 ppm sulfates. We performed corrosion testing on samples obtained from the borings, including a shallow soil sample obtained from a boring conducted for the bridge structure. The results indicate that the subsurface soil has less than less than 60 ppm chlorides and sulfates. The pH ranged from 7.02 to 8.24 with resistivity values between 1,020 and 4,560 ohm-cm. Given the corrosion test results, special corrosion protection is not necessary for the planned reinforced concrete retaining walls.

Our pH and resistivity tests generally indicate that the near-surface onsite soil is moderately to severely corrosive to metal pipes. A corrosion consultant should provide specific corrosion protection recommendations for any planned metal underground utility pipes or conduits at the site.

5.4 Culverts

5.4.1 Support

Native soil, existing embankment and new embankment fill are suitable for support of proposed pipe culverts. For culvert extensions, loose native soil or accumulated loose sediment should be overexcavated and backfilled with Structure Backfill per City of Stockton Standard Specifications (November 2003) and the latest amendments to these specifications. We anticipate the overexcavation depths will be less than 1 ft.

5.4.2 Materials

Based on the pH, sulfate and chloride testing, and Table 854.1A of the California Highway Design Manual (CHDM), there are no restrictions on cementitious materials with respect to soil corrosivity.

Table 2 presents our recommended metal corrugated pipe material and minimum unprotected thicknesses for a 50-year maintenance free service life with respect to soil corrosivity. The recommendations are based on the pH and resistivity testing, and Table 854.3B of the CHDM.

Table 2: Recommended Metal Corrugated Pipe Material

Recommended Metal Corrugated Pipe Material	Minimum 50-year Design Thickness
Galvanized Steel-Metal	12 gage

Aluminum or aluminized steel pipe should not be used on this project based on our analysis. Alternative plastic pipe and concrete pipe can be used for culverts. The above minimum thickness and alternative pipe recommendations do not take pipe abrasion resistance and overfill height into consideration.

5.4.3 Backfill

Backfill culverts in accordance with City of Stockton Standard Specifications (November 2003) and the latest amendments to these specifications.

5.5 Sound Wall

Based on our boring data, the Caltrans Standard Plan Sheets B15-3, B15-4 and B15-5 for “Sound Wall – Masonry Block on Pile Cap” can be used for foundation design for the sound wall. We recommend using a design soil friction angle of 30 degrees for foundation design.

Sound Wall 1 should be designed using either Case 1 (level ground) or Case 2 (sloping ground) from the above Standard Plan Sheets, depending on adjacent finish grades. Use Figure 1 from Caltrans August 2004 Memo to Designers 22-1 (Sound Wall Criteria) to determine the criteria for Case 1 level ground conditions. Per Memo to Designers 22-1, seismic dead load can be calculated by multiplying 0.57 by the sound wall dead load.

Although we did not observe ground water in any of our borings completed for the roadway project elements, the potential exists that perched water could be encountered during the winter and spring months. If perched water is encountered during foundation drilling, sump pumps should be adequate to remove the water prior to pouring concrete.

5.6 Retaining Walls

Based on our review of preliminary plans provided by MTCo, Caltrans Type 1, Type 5, and Type 7 (modified) Retaining Walls will be founded 6 to 21 feet below existing grade within intact native soil. Caltrans Standard Plans B3-1, B3-7, and B3-8 can be used to design the Type 1 and Type 5 retaining walls on spread footings. Use Caltrans Standard Drawing XS14-010 Sheet for Type 7 retaining walls on spread footings.

Use Case II loading for 2:1 (horizontal:vertical) unlimited slope backfill conditions for Retaining Walls 1, 3 and 6. Use Case I loading for level backfill and surcharge loading for Retaining Walls 2, 4, and 5. Design wall drainage consistent with Caltrans Standard Plan details (B3-8).

If loose, disturbed, or unstable materials are present at plan footing grade, remove to full depth and replace with “Structure Backfill” (per Caltrans Standard Specifications) compacted to 95% (per CTM 216) at 1 to 2 percent over optimum moisture content.

We estimate settlement of retaining wall footings to be about 0.5-inches, or less.

5.7 Pump Station

Intact native soils are capable of providing firm subgrade support for the base of the pump station established at/below elev.-14.0. Use an allowable soil bearing pressure of 2,000 psf for the base of slab founded on intact native soil.

For static conditions, use an “at-rest” equivalent fluid pressure of 60 pcf for design of the pump station walls. For earthquake loading, use a dynamic “at-rest” equivalent fluid pressure of 75 pcf and apply the resultant of the seismic active and at-rest pressures at a depth of 0.5H from the base of the wall, where H equals the wall height in feet.

The “at-rest” values provided above assume level backfill conditions using native soils or “Structure Backfill” (per Caltrans) with an estimated soil unit weight of 130 pcf and angle of internal friction of 33º under drained conditions.

For surcharge loads, apply an additional uniform lateral load behind the wall equivalent to 0.3-times the surcharge pressure.

5.8 Pavement Design

Based on our R-value test results, we recommend a design R-value of 15 for the project. MTCo requested pavement sections for traffic indexes between 6 and 12. Using Caltrans Flexible Pavement Design Methods, we recommend the pavement sections in Table 3 below.

Table 3: Recommended Pavement Sections

Traffic Index	6.0	7.0	8.0	9.0	10.0	11.0	12.0
Asphalt Concrete (in.)	3.5	4.0	4.5	5.5	6.0	7.0	7.5
Aggregate Base (in.)	11.0	13.0	16.0	17.0	20.0	22.0	24.0

Pavement material quality and construction should conform to the City of Stockton Standard Specifications (November 2003) and the latest amendments to these specifications.

No subdrainage of the structural section is required since all portions of the roadway and structural section are at least 12 feet above anticipated ground water level.

Premature failure of flexible pavement is often caused by water migrating into the aggregate base and subgrade. To help prevent premature failure, construct cut-off curbs where landscaping abuts the new pavement. Provide a minimum cut-off curb width of 4 inches, and extend curbs a minimum of 4 inches into the soil underlying the aggregate base.

6 RISK MANAGEMENT

Our experience and that of our profession clearly indicates that the risks of costly design, construction, and maintenance problems can be significantly lowered by retaining the geotechnical engineer of record to provide additional services during design and construction. For this project, BCI should be retained to:

- Review and provide comments on the civil plans and specifications prior to construction.
- Monitor construction to check and document our report assumptions. At a minimum, BCI should review foundation excavations for sound walls and retaining walls, monitor grading, trench backfill, culvert backfill, pavement subgrade and aggregate base compaction.
- Update this report if design changes occur, 2 years or more lapse between this report and construction, and/or site conditions have changed.

If we are not retained to perform the above applicable services, we are not responsible for any other party's interpretation of our report, and subsequent addendums, letters, and discussions.

7 LIMITATIONS

This report should only be used for design and construction of the Lower Sacramento Road/UPRR Underpass and Bear Creek Bridge Replacement Project in Stockton, as described herein.

BCI based this report on the current site conditions. We assumed the soil and ground water conditions encountered in our borings are representative of the subsurface conditions across the site. Actual conditions between borings could be different. If differing site conditions are encountered, please contact BCI immediately to provide additional recommendations.

BCI performed services in accordance with generally accepted geotechnical engineering principles and practices currently used in this area. Where referenced, we used ASTM or Caltrans standards as a general (not strict) guideline only. We do not warranty our services.

Our scope for this report did not include evaluation of on-site hazardous material, flood potential, aerial photograph review, off-site slope stability evaluation, or biological pollutants. Please contact BCI if you would like an evaluation of one or more of these potentially damaging issues.

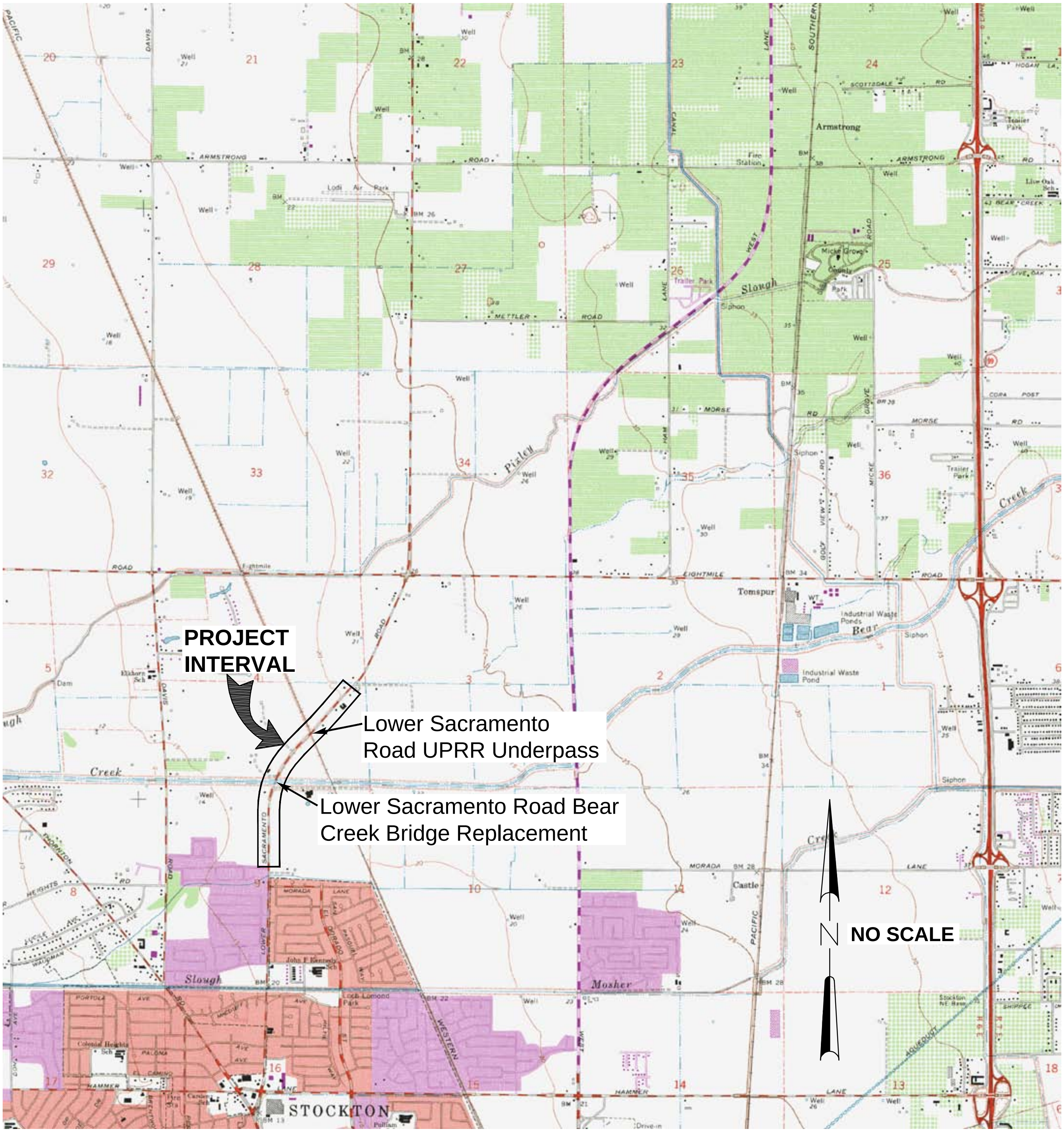
Logs of Test Borings are presented in Appendix A and Appendix B. The lines designating the interface between soil types are approximate. The transition between material types may be abrupt or gradual. Our recommendations are based on the final logs, which represent our interpretation of the field logs and general knowledge of the site and geological conditions.

Modern design and construction is complex, with many regulatory sources/restrictions, involved parties, construction alternatives, etc. It is common to experience changes and delays. The owner should set aside a reasonable contingency fund based on complexities and cost estimates to cover changes and delays.

APPENDIX A

Figure 1: Vicinity Map

Log of Test Borings Sheets (3 Sheets)



Source: MAPTECH Terrain Navigator Pro, v. 7.01, USGS topographic map, 7.5 minute quadrangle, 1:24000, Lodi South 1968, photorevised 1976.

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VICINITY MAP

Lower Sacramento Road UPRR Underpass and Bear Creek Bridge Replacement
Stockton, California

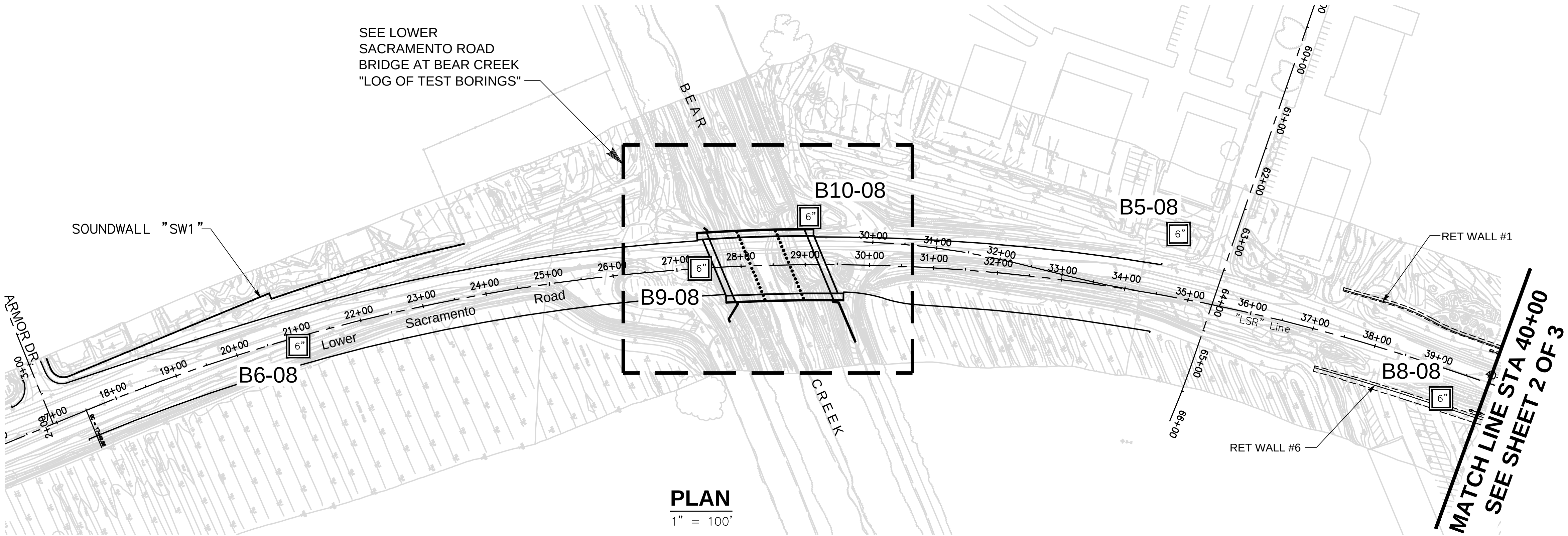
File No. 879.5

May 2010

Figure 1

5/11/2010 879.5 Lower Sacramento Road Geotech Report Figure 1.dwg

ATTACHMENT H



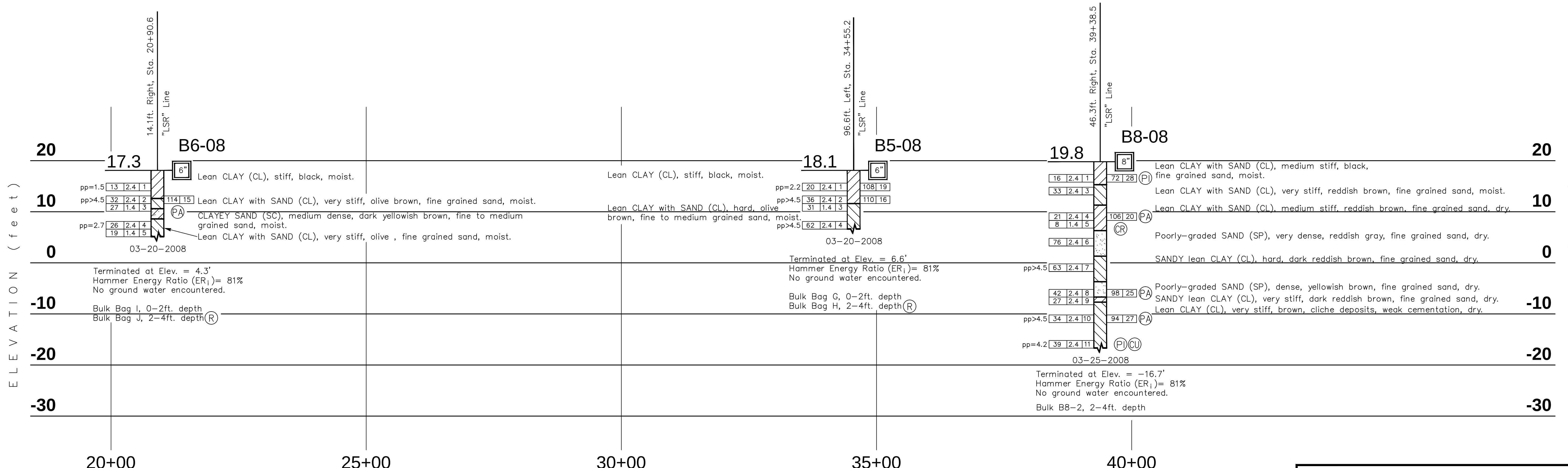
PLAN
1" = 100'

NOTES:

1. Field classification of soils was in accordance with ASTM D 2488-00 "Description and Identification of Soils (Visual-Manual Procedure)".
2. Standard Penetration tests were performed in accordance with ASTM D 1586-99 using a hammer operated with an automated drop system. Drill rods were 1 5/8-inch diameter "A"-rods; sampler was driven without brass liners.
3. "2.5 inch sampler": ID=2.5 inch, OD=2.9 inch. Driven in same manner as SPT ("1.4 inch") sampler.
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 D1586-99. Where less than 1 foot of penetration is achieved, the blow count shown is for that fraction of the "standard penetration resistance" interval actually penetrated.
5. Consistency of soils shown in ( ) where estimated.
6. Ground water surface elevations in the borings indicated on the Log of Test Boring Sheets reflect the fluid level in the borings on the specified date.
7. Ground water surface elevations are subject to seasonal fluctuations and may occur at higher or lower elevations depending on the conditions at any particular time.
8. Electronic media for plan view provided by Mark Thomas & Company, December 2008.
9. The "Log of Test Borings" drawing is included with plans in accordance with Section 2-1.03 of Caltrans "Standard Specifications".

BENCHMARK

City of Stockton BM #4 Monument #IN-10, a Brass Disk in monument well located at the intersection of Davis Road and Eight Mile Road. Elevation 17.49 feet (NGVD 29 Datum).



PROFILE
VERT. 1" = 10'
HOR. 1" = 100'

ORIGINAL SCALE IN INCHES FOR REDUCED PLAN
0 1 2 3

blackburn consulting

BLACKBURN CONSULTING
2491 BOATMAN AVENUE
WEST SACRAMENTO, CALIFORNIA 95691
(916) 375-8706 FAX: (916) 375-8709

BCI JOB NUMBER: 879.5

REGISTERED PROFESSIONAL GEOLOGIST — WILLIAM E. NICHOLS, No. CEG 2229, Exp. 01/31/12, ENGINEERING GEOLOGIST, STATE OF CALIFORNIA

Revision No.	Description	Date	By	Apprvd. By

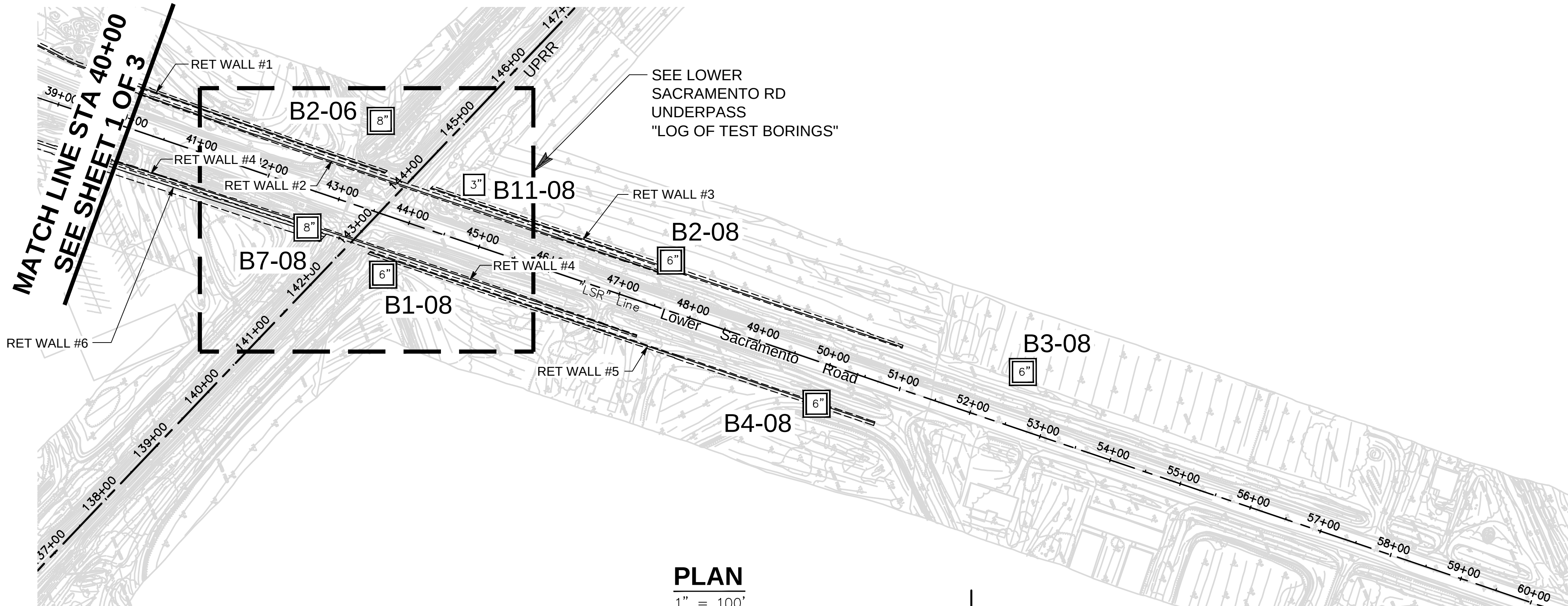
LOWER SACRAMENTO ROAD

LOG OF TEST BORINGS 1 OF 3

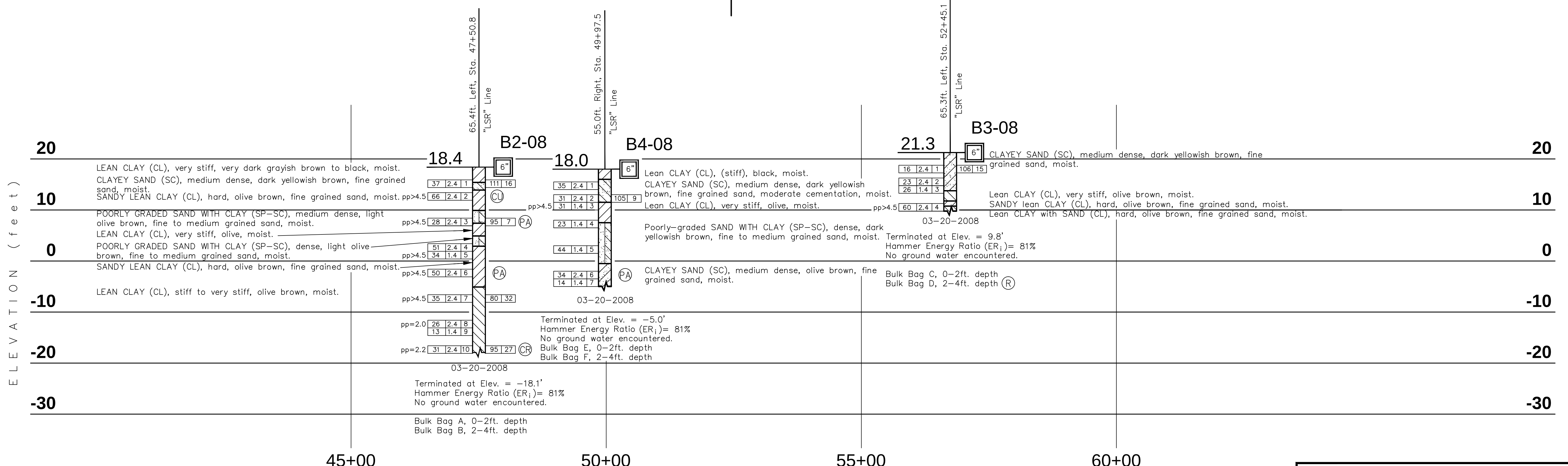
CITY OF STOCKTON
PUBLIC WORKS DEPARTMENT

BRIDGE NO.: 29C0443	APPROVED BY: ______ DATE	SHEET NO.
DESIGNED BY: WEN		
DRAWN BY: MDR		
CHECKED BY: WEN	CITY ENGINEER STOCKTON, CALIFORNIA	PROJECT NO. 05-17
RECORD DWG:		

PLOT DATE: May 10, 2010-04:19:06pm
FILE NAME: 03 NSGS_LS ROAD LOTB
PATH: Z:\Active Projects\879.X - Stockton Bridges\879.5 - Lower Sacramento Road_UPRR\CAD Drawings\



PLAN
1" = 100'



PROFILE
VERT. 1" = 10'
HOR. 1" = 100'

ATTACHMENT H

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 a hammer operated with an automated drop system. Drill rods were 1 5/8-inch diameter "A"-rods; sampler was driven without brass liners.
3. "2.5 inch sampler": ID=2.5 inch, OD=2.9 inch. Driven in same manner as SPT ("1.4 inch") sampler.
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8. Electronic media for plan view provided by Mark Thomas & Company, December 2008.
9. The "Log of Test Borings" drawing is included with plans in accordance with Section 2-1.03 of Caltrans "Standard Specifications".

BENCHMARK

City of Stockton BM #4 Monument #IN-10, a Brass Disk in monument well located at the intersection of Davis Road and Eight Mile Road. Elevation 17.49 feet (NGVD 29 Datum).

ORIGINAL SCALE IN INCHES FOR REDUCED PLAN
0 1 2 3

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BCI JOB NUMBER: 879.5

REGISTERED PROFESSIONAL GEOLOGIST — WILLIAM E. NICHOLS No. CEG 2229 Exp. 01/31/12 ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

Revision No.	Description	Date	By	Aprvd. By

LOWER SACRAMENTO ROAD

LOG OF TEST BORINGS 2 OF 3

CITY OF STOCKTON
PUBLIC WORKS DEPARTMENT

BRIDGE NO.: 29C0443	APPROVED BY:	SHEET NO.
DESIGNED BY: WEN	DATE	
DRAWN BY: MDR		
CHECKED BY: WEN	CITY ENGINEER STOCKTON, CALIFORNIA	PROJECT NO. 05-17
RECORD DWG:		

ATTACHMENT H

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

GROUP SYMBOLS AND NAMES

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

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

FIELD AND LABORATORY TESTING

C	Consolidation (ASTM D 2435–04)
CL	Collapse Potential (ASTM D 5333–03)
CP	Compaction Curve (CTM 216–06)
CR	Corrosivity Testing (CTM 643, CTM 422, CTM 417)
CU	Consolidated Undrained Triaxial (ASTM D 4767–04)
DS	Direct Shear (ASTM D 3080–04)
EI	Expansion Index (ASTM D 4829–03)
M	Moisture Content (ASTM D 2216–05)
OC	Organic Content–% (ASTM D 2974–07)
P	Permeability (CTM 220–05)
PA	Particle Size Analysis (ASTM D 422–63) (2002)
PI	Plasticity Index (AASHTO T 90–00) Liquid Limit (AASHTO T 89–02)
PL	Point Load Index (ASTM D 5731–05)
PM	Pressure Meter
PP	Pocket Penetrometer
R	R–Value (CTM 301–00)
SE	Sand Equivalent (CTM 217–99)
SG	Specific Gravity (AASHTO T 100–06)
SL	Shrinkage Limit (ASTM D 427–04)
SW	Swell Potential (ASTM D 4546–03)
TV	Pocket Torvane
UC	Unconfined Compression–Soil (ASTM D 2166–06) Unconfined Compression–Rock (ASTM D 2938–95) (2002)
UU	Unconsolidated Undrained Triaxial (ASTM D 2850–03)
UW	Unit Weight (ASTM D 2937–04)
VS	Vane Shear (AASHTO T 223–96) (2004)
LT	Unconfined Compressive Strength of Lime Treated Soil/Aggregates (CTM 373–00)

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} –Value (Blows / 12 in.)
Very Loose	0 – 4
Loose	5 – 10
Medium Dense	11 – 30
Dense	31 – 50
Very Dense	> 50

MOISTURE

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

PERCENT OR PROPORTION OF SOILS

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

PARTICLE SIZE

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

CEMENTATION

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

CONSISTENCY OF COHESIVE SOILS

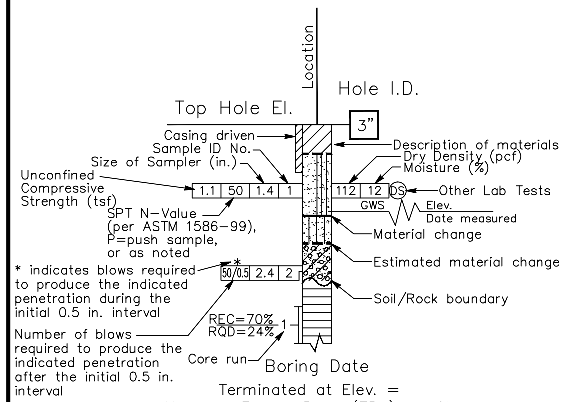
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	<0.25	<0.25	<0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff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

PLASTICITY OF FINE-GRAINED SOILS

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

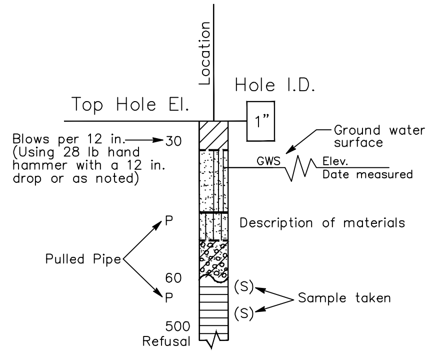
BOREHOLE IDENTIFICATION

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

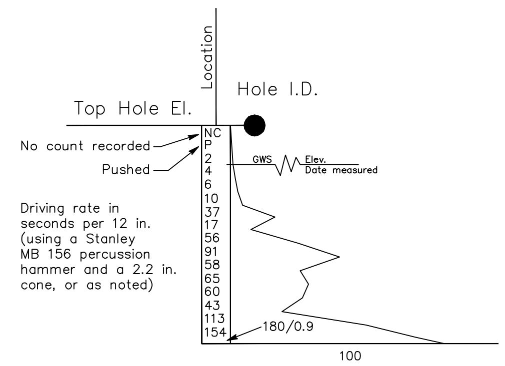


ROTARY BORING

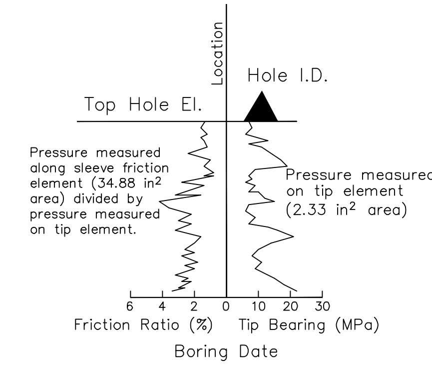
pp=4.5 Pocket Penetrometer (tsf)



HAND BORING



DYNAMIC CONE PENETRATON BORING



CONE PENETRATON TEST (CPT) SOUNDING

ORIGINAL SCALE IN INCHES FOR REDUCED PLAN

0 1 2 3

BLACKBURN CONSULTING
2491 BOATMAN AVENUE
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BCI JOB NUMBER: 879.5

PROFESSIONAL GEOLOGIST — REGISTERED — WILLIAM E. NICHOLS — No. CEG 2229 — Exp. 01/31/12 — ENGINEERING GEOLOGIST — STATE OF CALIFORNIA

Revision No.	Description	Date	By	Aprvd. By

SOIL LEGEND

LOWER SACRAMENTO ROAD

LOG OF TEST BORINGS 3 OF 3

CITY OF STOCKTON
PUBLIC WORKS DEPARTMENT

BRIDGE NO.: 29C0443
DESIGNED BY: WEN
DRAWN BY: MDR
CHECKED BY: WEN
RECORD DWG:

APPROVED BY: ______ DATE

CITY ENGINEER
STOCKTON, CALIFORNIA

SHEET NO.

PROJECT NO. 05-17

APPENDIX B

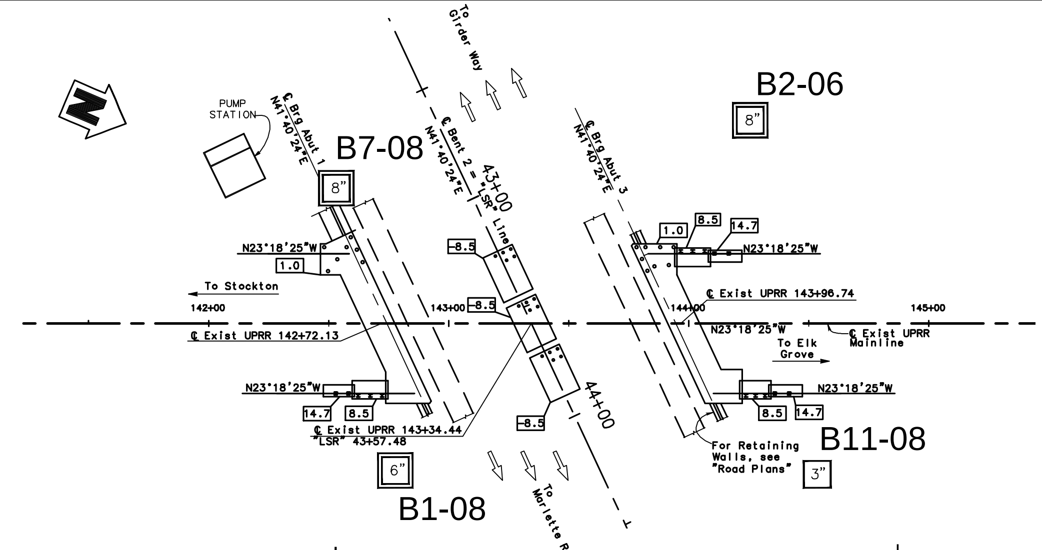
Lower Sacramento Road Underpass (3 sheets)

Lower Sacramento Road at Bear Creek (3 sheets)

ATTACHMENT H

BENCHMARK

City of Stockton BM #4
Monument #IN-10, a Brass Disk in monument well located at the intersection of Davis Road and Eight Mile Road. Elevation 17.53 feet (NGVD 29 Datum).
Note: Project elevation does not match published value for this point.



PLAN
1" = 40'

LEGEND:

▭ Indicates Bottom of Footing Elevation (feet)
o Indicates Driven Pile (all piles not shown)
I Indicates Driven HP Pile (all piles not shown)

NOTES:
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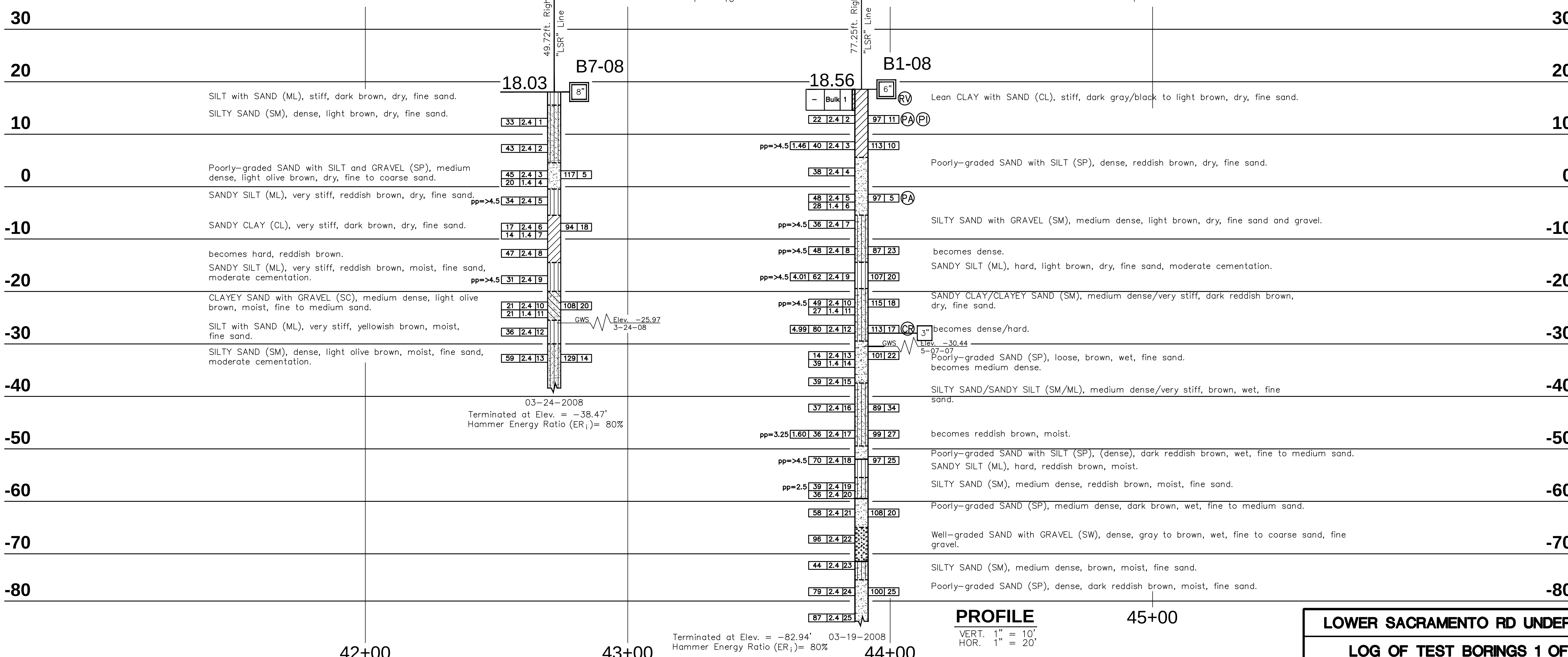

PROFILE
VERT. 1" = 10'
HOR. 1" = 20'

PROJECT: LOWER SACRAMENTO RD	
MILEPOST: 100.44	
SUBDIVISION: SACRAMENTO	
CITY: STOCKTON	
COUNTY: SAN JOAQUIN	
STATE: CA	DOT NO.: 924 457X

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ORIGINAL SCALE IN INCHES FOR REDUCED PLAN
0 1 2 3

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WEST SACRAMENTO, CALIFORNIA 95691
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01/19/09 | 08/31/09 | 05/07/10 | BCI JOB NUMBER: 879.5

REGISTERED PROFESSIONAL GEOLOGIST
WILLIAM E. NICHOLS
No. CEG 2229
Exp. 01/31/12
ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Revision No.	Description	Date	By	Aprvd. By

LOWER SACRAMENTO RD UNDERPASS

LOG OF TEST BORINGS 1 OF 3

CITY OF STOCKTON
PUBLIC WORKS DEPARTMENT

BRIDGE NO.: 29C0446
DESIGNED BY: WEN
DRAWN BY: MDR
CHECKED BY: WEN
RECORD DWG:

APPROVED BY:
DATE
CITY ENGINEER
STOCKTON, CALIFORNIA

SHEET NO. 181
S36 of S38
OF 183 SHEETS
PROJECT NO. 05-17

ATTACHMENT H

BENCHMARK

City of Stockton BM #4
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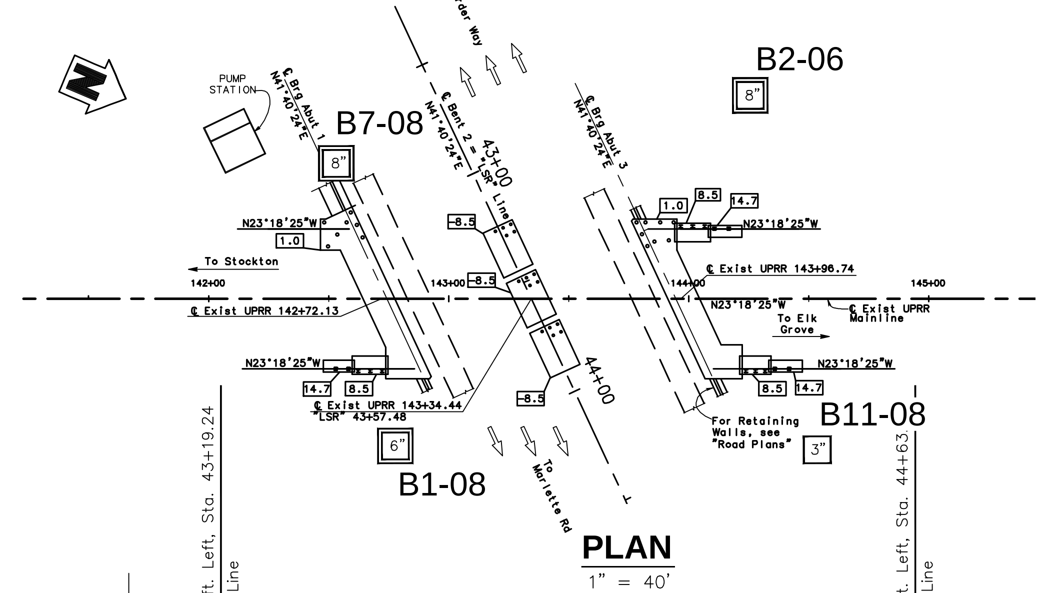

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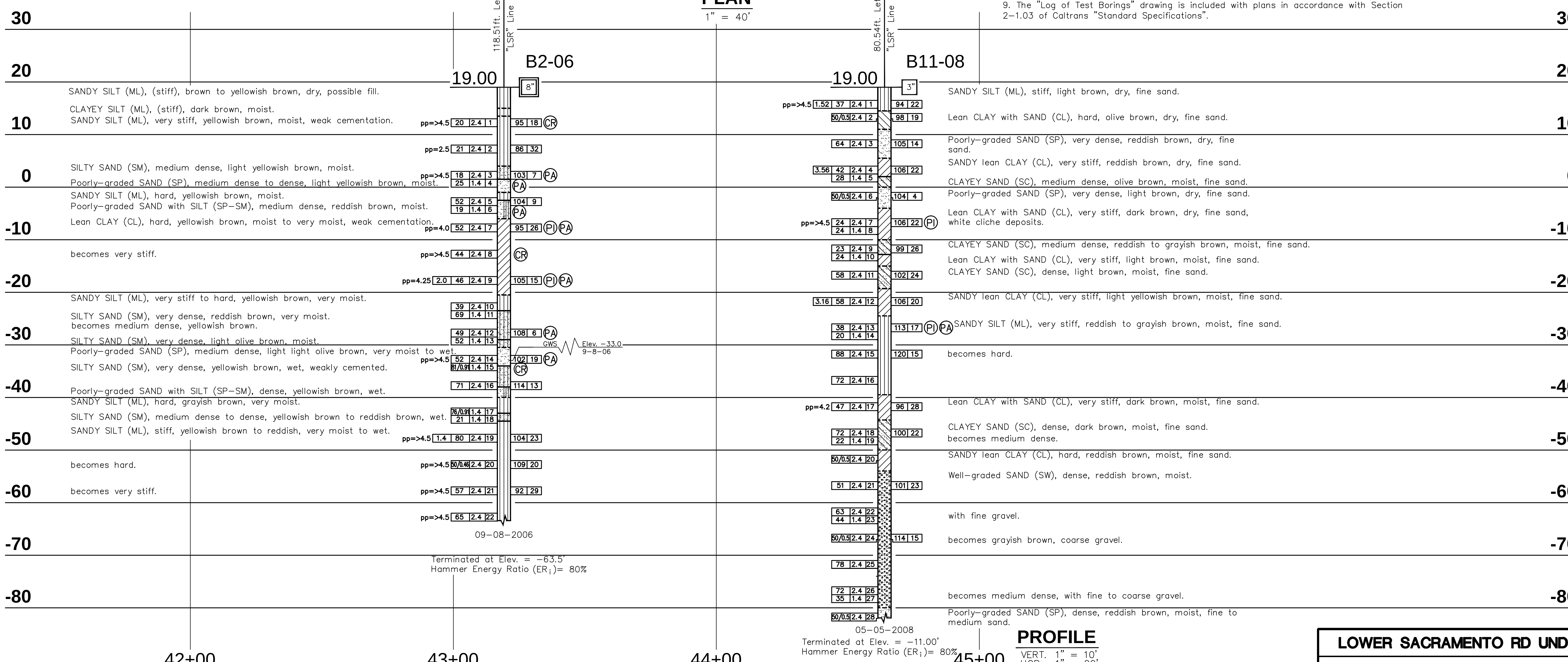

LOWER SACRAMENTO RD UNDERPASS

LOG OF TEST BORINGS 2 OF 3

CITY OF STOCKTON
PUBLIC WORKS DEPARTMENT

BRIDGE NO.: 29C0446	APPROVED BY:
DESIGNED BY: WEN	DATE
DRAWN BY: MDR	
CHECKED BY: WEN	CITY ENGINEER STOCKTON, CALIFORNIA
RECORD DWG:	

SHEET NO. 182
S37 of S38
OF 183 SHEETS
PROJECT NO. 05-17

Revision No.	Description	Date	By	Aprvd. By

BLACKBURN CONSULTING
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REGISTERED PROFESSIONAL GEOLOGIST — WILLIAM E. NICHOLS, No. CEG 2229, Exp. 01/31/12, ENGINEERING GEOLOGIST, STATE OF CALIFORNIA

ORIGINAL SCALE IN INCHES FOR REDUCED PLAN
0 1 2 3

PROJECT: LOWER SACRAMENTO RD	
MILEPOST: 100.44	
SUBDIVISION: SACRAMENTO	
CITY: STOCKTON	
COUNTY: SAN JOAQUIN	
STATE: CA	DOT NO.: 924 457X

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PATH: Z:\Active Projects\879.X - Stockton Bridges\879.5 - Lower Sacramento Road_UPRR\CAD Drawings\ FILE NAME: 03 NSGS_LSUP LOTB PLOT DATE: May 07, 2010-03:15:53pm CAD USER: Mike's CAD

CAD USER: Mike's CAD

PLOT DATE: May 07, 2010-03:15:57pm

FILE NAME: 03 NSGS_LSUP LOTB

PATH: Z:\Active Projects\879.X - Stockton Bridges\879.5 - Lower Sacramento Road_UPRR\CAD Drawings\

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	COBBLES COBBLES and BOULDERS BOULDERS

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

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435-04)
- (CL) Collapse Potential (ASTM D 5333-03)
- (CP) Compaction Curve (CTM 216-06)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767-04)
- (DS) Direct Shear (ASTM D 3080-04)
- (EI) Expansion Index (ASTM D 4829-03)
- (M) Moisture Content (ASTM D 2216-05)
- (OC) Organic Content-% (ASTM D 2974-07)
- (P) Permeability (CTM 220-05)
- (PA) Particle Size Analysis (ASTM D 422-63) (2002)
- (PI) Plasticity Index (AASHTO T 90-00) Liquid Limit (AASHTO T 89-02)
- (PL) Point Load Index (ASTM D 5731-05)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R-Value (CTM 301-00)
- (SE) Sand Equivalent (CTM 217-99)
- (SG) Specific Gravity (AASHTO T 100-06)
- (SL) Shrinkage Limit (ASTM D 427-04)
- (SW) Swell Potential (ASTM D 4546-03)
- (TV) Pocket Torvane
- (UC) Unconfined Compression-Soil (ASTM D 2166-06) Unconfined Compression-Rock (ASTM D 2938-95) (2002)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850-03)
- (UW) Unit Weight (ASTM D 2937-04)
- (VS) Vane Shear (AASHTO T 223-96) (2004)
- (LT) Unconfined Compressive Strength of Lime Treated Soil/Aggregates (CTM 373-00)

APPARENT DENSITY OF COHESIONLESS SOILS

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

MOISTURE

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

PERCENT OR PROPORTION OF SOILS

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

PARTICLE SIZE

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

CEMENTATION

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

CONSISTENCY OF COHESIVE SOILS

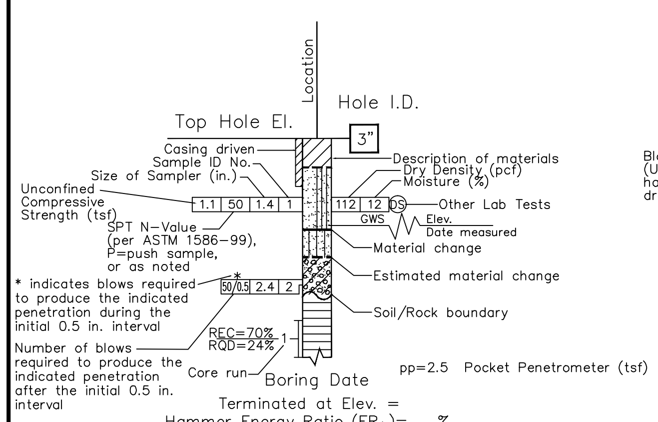
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	<0.25	<0.25	<0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff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

PLASTICITY OF FINE-GRAINED SOILS

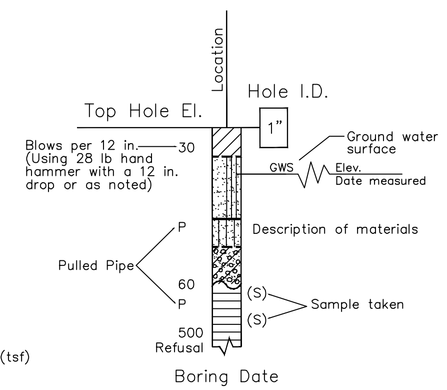
Description	Criteria
Nonplastic	A 1/8-in. thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be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

BOREHOLE IDENTIFICATION

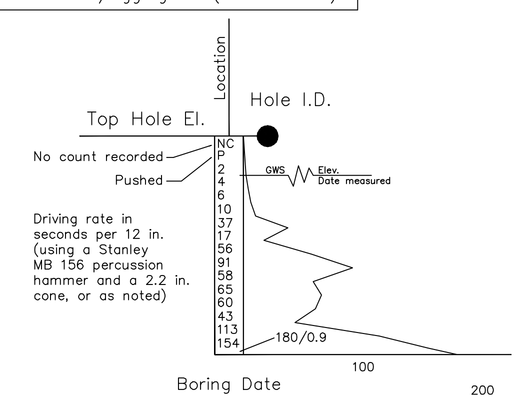
Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
Size	T	Backhoe Test Pit



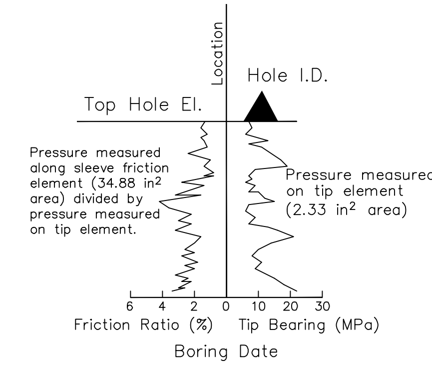
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATON BORING



CONE PENETRATON TEST (CPT) SOUNDING

ORIGINAL SCALE IN INCHES FOR REDUCED PLAN

0 1 2 3

PROJECT: LOWER SACRAMENTO RD	
MILEPOST: 100.44	
SUBDIVISION: SACRAMENTO	
CITY: STOCKTON	
COUNTY: SAN JOAQUIN	
STATE: CA	DOT NO.: 924 457X

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BLACKBURN CONSULTING
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01/19/09 | 08/31/09 | 05/07/10 | BCI JOB NUMBER: 879.5

REGISTERED PROFESSIONAL GEOLOGIST
WILLIAM E. NICHOLS
No. CEG 2229
Exp. 01/31/12
ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Revision No.	Description	Date	By	Aprvd. By

SOIL LEGEND

LOWER SACRAMENTO RD UNDERPASS

LOG OF TEST BORINGS 3 OF 3

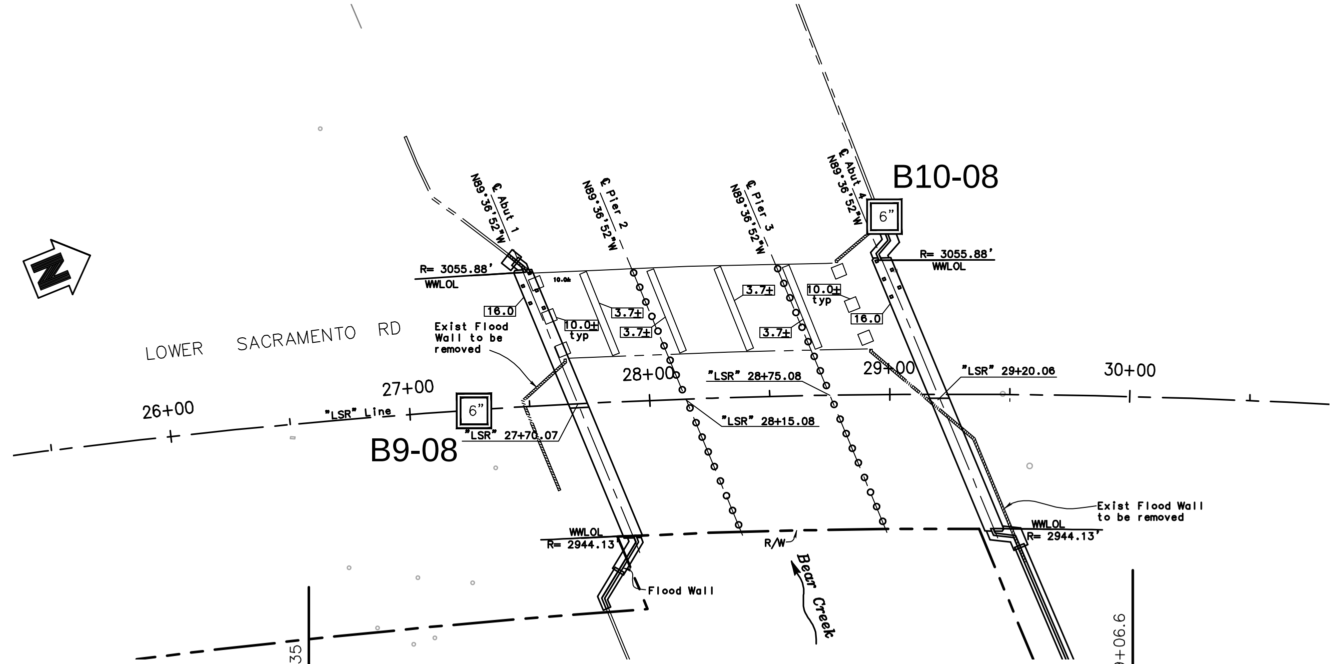
CITY OF STOCKTON
PUBLIC WORKS DEPARTMENT

BRIDGE NO.: 29C0446	APPROVED BY:	SHEET NO. 183
DESIGNED BY: WEN	DATE	S38 of S38
DRAWN BY: MDR		OF 183 SHEETS
CHECKED BY: WEN	CITY ENGINEER STOCKTON, CALIFORNIA	PROJECT NO. 05-17
RECORD DWG:		

ATTACHMENT H

BENCHMARK

City of Stockton BM #4 Monument #IN-10, a Brass Disk in monument well located at the intersection of Davis Road and Eight Mile Road. Elevation 17.53 feet (NGVD 29 Datum)



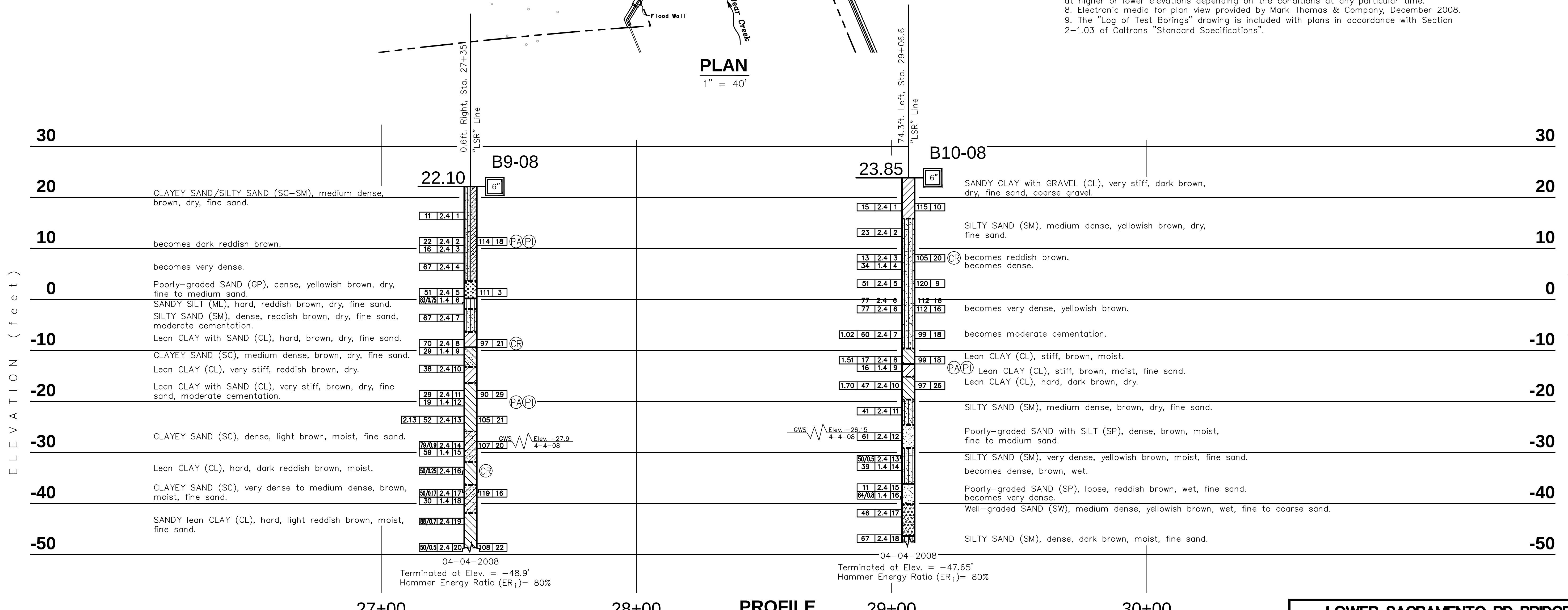
PLAN
1" = 40'

LEGEND

▭	Indicates Bottom of Footing Elevation
▫	Indicates Precast Prestressed Concrete Pile (All Piles Not Shown)
○	Indicates CIDH Pile
— - - —	Indicates Existing Structure

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 a hammer operated with an automated drop system. Drill rods were 1 5/8–inch diameter "A"–rods; sampler was driven without brass liners.
3. "2.5 inch sampler": ID=2.5 inch, OD=2.9 inch. Driven in same manner as SPT ("1.4 inch") sampler.
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 D1586–99. Where less than 1 foot of penetration is achieved, the blow count shown is for that fraction of the "standard penetration resistance" interval actually penetrated.
5. Consistency of soils shown in ( ) where estimated.
6. Ground water surface elevations in the borings indicated on the Log of Test Boring Sheets reflect the fluid level in the borings on the specified date.
7. Ground water surface elevations are subject to seasonal fluctuations and may occur at higher or lower elevations depending on the conditions at any particular time.
8. Electronic media for plan view provided by Mark Thomas & Company, December 2008.
9. The "Log of Test Borings" drawing is included with plans in accordance with Section 2–1.03 of Caltrans "Standard Specifications".



PROFILE
VERT. 1" = 10'
HOR. 1" = 20'

ORIGINAL SCALE IN INCHES FOR REDUCED PLAN
0 1 2 3

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blackburn consulting

REGISTERED PROFESSIONAL GEOLOGIST
WILLIAM E. NICHOLS
No. CEG 2229
Exp. 01/31/12
ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

01/13/09 | 08/31/09 | 05/07/10 | BCI JOB NUMBER: 879.5

Revision No.	Description	Date	By	Aprvd. By

LOWER SACRAMENTO RD BRIDGE AT BEAR CREEK (REPLACE)

LOG OF TEST BORINGS 1 OF 3

CITY OF STOCKTON
PUBLIC WORKS DEPARTMENT

BRIDGE NO.: 29C0443	APPROVED BY:	SHEET NO.123
DESIGNED BY: WEN	DATE	S24 of S26
DRAWN BY: MDR		OF 125 SHEETS
CHECKED BY: WEN	CITY ENGINEER STOCKTON, CALIFORNIA	PROJECT NO. 05-17
RECORD DWG:		

PLOT DATE: May 07, 2010–03:25:33pm
FILE NAME: 03 NSGS_LSBC LOTB
PATH: Z:\Active Projects\879.X – Stockton Bridges\879.5 – Lower Sacramento Road_UPRR\CAD Drawings\

ATTACHMENT H

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

GROUP SYMBOLS AND NAMES

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

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

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435-04)
- (CL) Collapse Potential (ASTM D 5333-03)
- (CP) Compaction Curve (CTM 216-06)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767-04)
- (DS) Direct Shear (ASTM D 3080-04)
- (EI) Expansion Index (ASTM D 4829-03)
- (M) Moisture Content (ASTM D 2216-05)
- (OC) Organic Content-% (ASTM D 2974-07)
- (P) Permeability (CTM 220-05)
- (PA) Particle Size Analysis (ASTM D 422-63) (2002)
- (PI) Plasticity Index (AASHTO T 90-00) Liquid Limit (AASHTO T 89-02)
- (PL) Point Load Index (ASTM D 5731-05)
- (PM) Pressure Meter
- (PP) Pocket Penetrometer
- (R) R-Value (CTM 301-00)
- (SE) Sand Equivalent (CTM 217-99)
- (SG) Specific Gravity (AASHTO T 100-06)
- (SL) Shrinkage Limit (ASTM D 427-04)
- (SW) Swell Potential (ASTM D 4546-03)
- (TV) Pocket Torvane
- (UC) Unconfined Compression-Soil (ASTM D 2166-06) Unconfined Compression-Rock (ASTM D 2938-95) (2002)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850-03)
- (UW) Unit Weight (ASTM D 2937-04)
- (VS) Vane Shear (AASHTO T 223-96) (2004)
- (LT) Unconfined Compressive Strength of Lime Treated Soil/Aggregates (CTM 373-00)

APPARENT DENSITY OF COHESIONLESS SOILS

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

MOISTURE

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

PERCENT OR PROPORTION OF SOILS

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

PARTICLE SIZE

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

CEMENTATION

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

CONSISTENCY OF COHESIVE SOILS

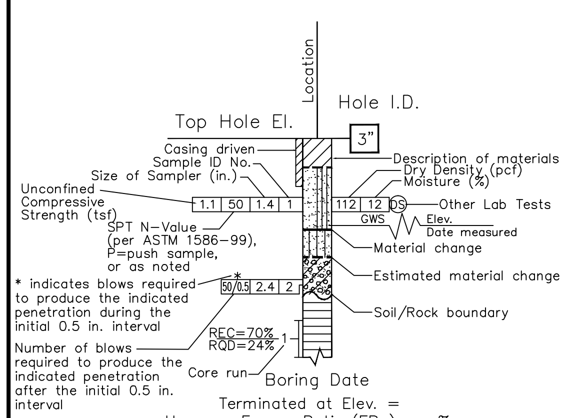
Description	Unconfined Compressive Strength (tsf)	Pocket Penetrometer Measurement (tsf)	Torvane Measurement (tsf)	Field Approximation
Very Soft	<0.25	<0.25	<0.12	Easily penetrated several inches by fist
Soft	0.25 to 0.50	0.25 to 0.50	0.12 to 0.25	Easily penetrated several inches by thumb
Medium Stiff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

PLASTICITY OF FINE-GRAINED SOILS

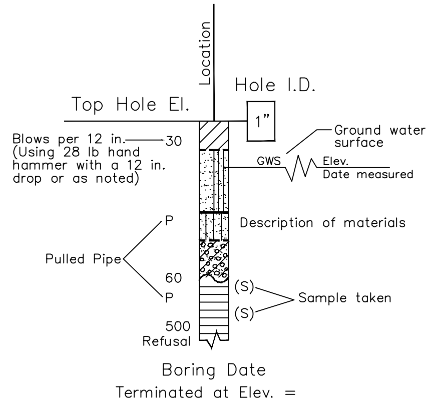
Description	Criteria
Nonplastic	A 1/8-in. thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be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

BOREHOLE IDENTIFICATION

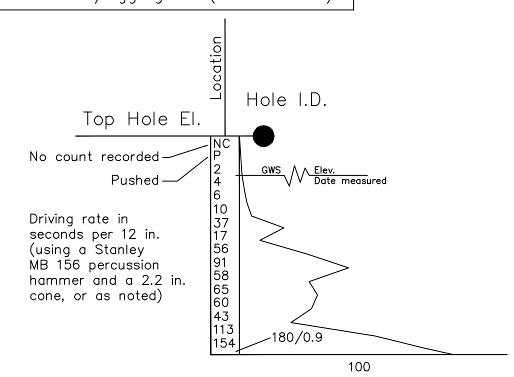
Symbol	Hole Type	Description
Size	A	Auger Boring
Size	R P	Rotary drilled boring Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
●	D	Dynamic Cone Penetration Boring
▲	CPT	Cone Penetration Test (ASTM D 5778-95)
Size	T	Backhoe Test Pit



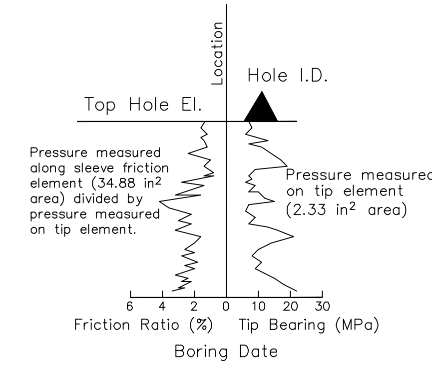
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATON BORING



CONE PENETRATON TEST (CPT) SOUNDING

ORIGINAL SCALE IN INCHES FOR REDUCED PLAN
0 1 2 3

SOIL LEGEND

LOWER SACRAMENTO RD BRIDGE AT BEAR CREEK (REPLACE)

LOG OF TEST BORINGS 2 OF 3

BLACKBURN CONSULTING
2491 BOATMAN AVENUE
WEST SACRAMENTO, CALIFORNIA 95691
(916) 375-8706 FAX: (916) 375-8709

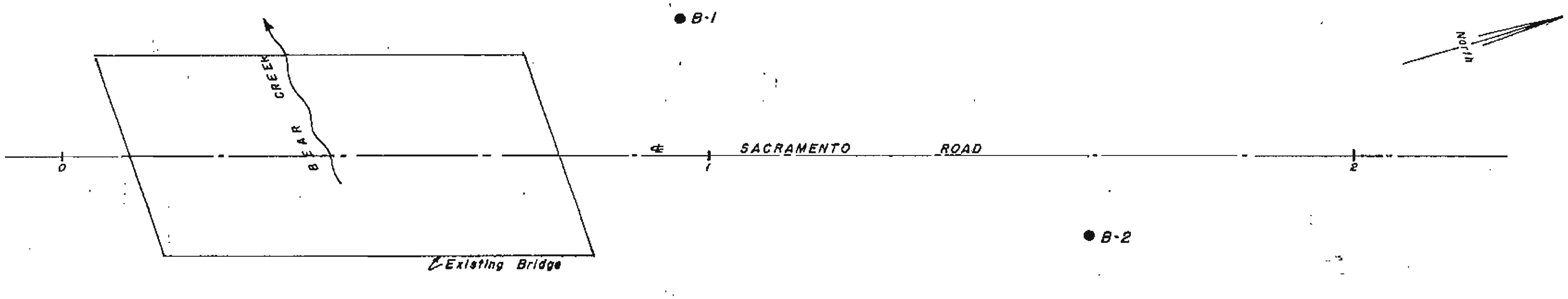
REGISTERED PROFESSIONAL GEOLOGIST — WILLIAM E. NICHOLS, No. CEG 2229, Exp. 01/31/12, ENGINEERING GEOLOGIST, STATE OF CALIFORNIA

01/13/09	08/31/09	05/07/10	BCI JOB NUMBER: 879.5

Revision No.	Description	Date	By	Aprvd. By

CITY OF STOCKTON
PUBLIC WORKS DEPARTMENT

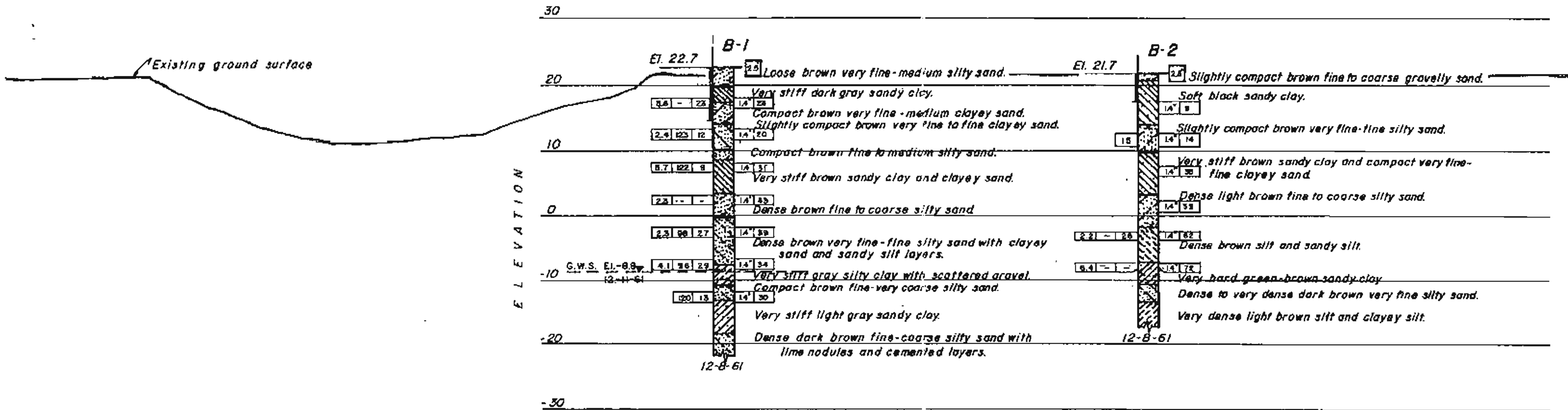
BRIDGE NO.: 29C0443	APPROVED BY:	SHEET NO. 124
DESIGNED BY: WEN	DATE	S25 of S26
DRAWN BY: MDR		OF 125 SHEETS
CHECKED BY: WEN	CITY ENGINEER STOCKTON, CALIFORNIA	PROJECT NO. 05-17
RECORD DWG:		



—PLAN—

NOTE

BM. North end of bridge at ℄ of road. El. 22.7



—PROFILE—

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	MILEPOST–PROJECT	SHEET NO.	TOTAL SHEETS
10	SJ	C.R.	101.32		

REGISTERED ENGINEERING GEOLOGIST DATE

LOWER SACRAMENTO RD BRIDGE AT BEAR CREEK (REPLACE)

LOG OF TEST BORINGS 3 OF 3

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

CU:
EA:

BRIDGE NO. 29C0443
SHEET NO. 125
S26 of S26
OF 125 SHEETS
PROJECT NO. 05-17

PROFESSIONAL GEOLOGIST William E. Nichols No. 2229 Exp. 1-31-12 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

a/s.

LEGEND OF EARTH MATERIALS

SIZE CLASSIFICATION

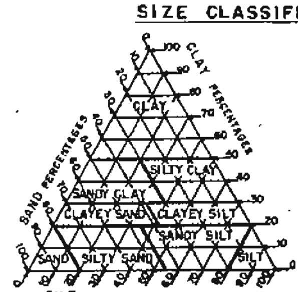


Diagram showing the basis of grain size distribution used in nomenclature of stem names. Size classification is based on the Wentworth grade scale in field classification or the A.S.T.M. grade scale in the laboratory sieve analysis. Classification of earth material shown on this sheet is based on field inspection and should not be construed to imply mechanical analysis unless so stated.

MATERIAL SYMBOLS

Gravel, Sand, Silt, Clay, Sandy clay or clayey sand, Sandy silt or silty sand, Silty clay or clayey silt, Peat or organic matter, Fill material, Shale, Sandstone, Limestone, Metamorphic rock, Igneous rock

CONSISTENCY CLASSIFICATION

According to the Standard Penetration Test.

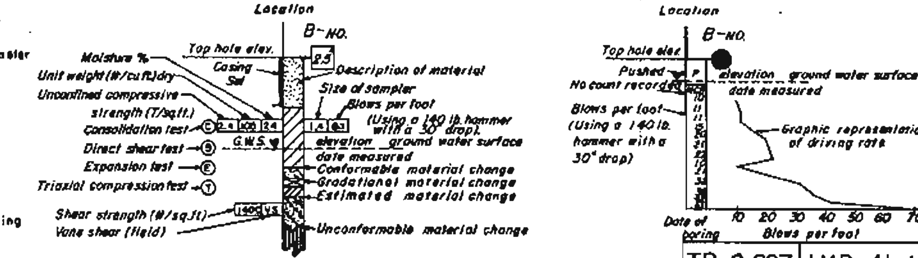
No. of blows	Granular	Cohesive
0-5	very loose	very soft
6-10	loose	soft
11-20	slightly compact	stiff
21-35	compact	very stiff
36-70	dense	hard
70+	very dense	very hard

LEGEND OF BORING OPERATIONS

Plan of any boring
Flush penetrometer
2.5" Cone penetrometer
Rotary boring
Auger boring
Sample boring
Jet boring
Diamond core boring
Test pit

ROTARY BORING

PENETRATION TEST



TR. 2-897 MAP: 41-12

MOORE and TABER
Engineers — Geologists

Job No. 3164F-3 APPROVED H.E. Taber 12-26-61 LICENSED CIVIL ENGINEER No. 9165

THE RECLAMATION BOARD
STATE OF CALIFORNIA

BEAR CREEK BRIDGE AT SACRAMENTO ROAD

LOG OF TEST BORINGS

Scale 1" = 10' | Date Dec. 20, 1961 | File | Drawing 9 of 24

APPENDIX C

Laboratory Test Results

Project Name: Lower Sac at UPRR (Geotechnical Report)

BCI File No: 879.5
Date: 4/24/2008
Technician: RT

blackburn consulting

MOISTURE-DENSITY TESTS

Sample No.	B2-08-1c	B2-08-3b	B2-08-7c	B2-08-10c	B3-08-1c	B4-08-2c	B5-08-1c
Depth (ft.)	3.5-4.0'	10.5-11.0'	26.0-26.5'	36.0-36.5'	3.5-4.0'	6.0-6.5'	3.5-4.0'
Sample Length (in.)	6.000	5.375	5.750	5.250	5.500	6.000	4.750
Diameter (in.)	2.438	2.438	2.438	2.438	2.438	2.438	2.438
Sample Volume (ft^3)	0.01621	0.01452	0.01553	0.01418	0.01486	0.01621	0.01283
Tare No.	J	P	E	M	C	F	O
Tare (g)	187.7	189.7	195.2	188.4	188.8	192.8	189.9
Wet Soil + Tare (g)	1134.1	857.7	936.4	960.8	1014.2	1027.8	938.8
Dry Soil + Tare (g)	1004.5	815.6	756.3	799.0	905.7	961.7	821.1
Dry Soil Weight (g)	816.8	625.9	561.1	610.6	716.9	768.9	631.2
Water (g)	129.6	42.1	180.1	161.8	108.5	66.1	117.7
Moisture (%)	**15.9**	**6.7**	**32.1**	**26.5**	**15.1**	**8.6**	**18.6**
Dry Density (pcf)	**111.1**	**95.0**	**79.6**	**94.9**	**106.4**	**104.6**	**108.4**

Sample: B2-1c — Description:
Moisture (Appearance): Moist — Consistency/Cementation:

Sample: B2-3b — Description:
Moisture (Appearance): — Consistency/Cementation:

Sample: B2-7c — Description:
Moisture (Appearance): Moist — Consistency/Cementation:

Sample: B2-10c — Description:
Moisture (Appearance): Moist — Consistency/Cementation:

Sample: B3-1c — Description:
Moisture (Appearance): — Consistency/Cementation:

Sample: B4-2c — Description:
Moisture (Appearance): Moist — Consistency/Cementation:

Sample: B5-1c — Description:
Moisture (Appearance): Moist — Consistency/Cementation:

Diameter = 1.44" for 1.5-inch Tubes
Diameter = 1.938" for 2-inch Tubes
Diameter = 2.438" for 2.5-inch Tubes
Diameter= 2.850" for 3.0-inch Shelby Tubes

Project Name: Lower Sac at UPRR (Geotechnical Report)

BCI File No: 879.5
Date: 4/24/2008
Technician: RT

blackburn consulting

MOISTURE-DENSITY TESTS

Sample No.	B5-08-2c	B6-08-2c	B8-08-4-II	B8-08-8-II	B8-08-10-II	B8-08-1-II	
Depth (ft.)	6.0-6.5'	6.0-6.5'	10.5-11.0'	25.5-26.0'	30.5-31.0'	3.0-3.5'	
Sample Length (in.)	6.000	6.000	5.000	5.125	5.125	4.750	
Diameter (in.)	2.438	2.438	2.438	2.438	2.438	2.438	
Sample Volume (ft^3)	0.01621	0.01621	0.01351	0.01385	0.01385	0.01283	
Tare No.	D	G	M	N	J	G	
Tare (g)	189.3	192.9	188.0	189.1	187.8	193.0	
Wet Soil + Tare (g)	1125.5	1155.6	970.3	957.3	939.5	728.6	
Dry Soil + Tare (g)	996.3	1028.8	838.2	806.3	777.6	611.7	
Dry Soil Weight (g)	807.0	835.9	650.2	617.2	589.8	418.7	
Water (g)	129.2	126.8	132.1	151.0	161.9	116.9	
Moisture (%)	**16.0**	**15.2**	**20.3**	**24.5**	**27.4**	**27.9**	
Dry Density (pcf)	**109.8**	**113.7**	**106.1**	**98.3**	**93.9**	**71.9**	

Sample: B5-2c — Description:

Moisture (Appearance): Moist — Consistency/Cementation:

Sample: B6-2c — Description:

Moisture (Appearance): Moist — Consistency/Cementation:

Sample: B8-4-II — Description:

Moisture (Appearance): Moist — Consistency/Cementation:

Sample: B8-8-II — Description:

Moisture (Appearance): Moist — Consistency/Cementation:

Sample: B8-10-II — Description:

Moisture (Appearance): Moist — Consistency/Cementation:

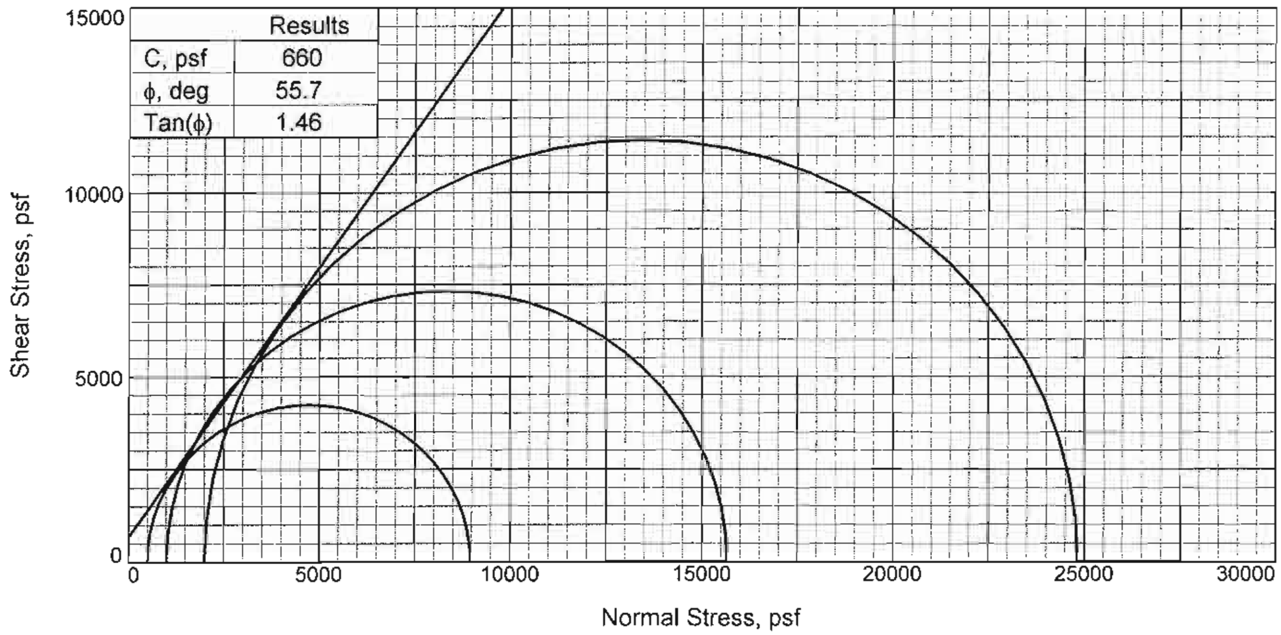
Sample: — Description:

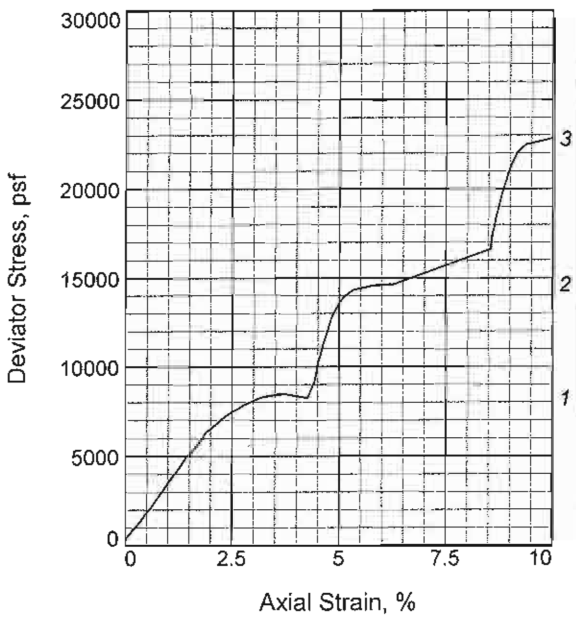
Moisture (Appearance): — Consistency/Cementation:

Sample: — Description:

Moisture (Appearance): — Consistency/Cementation:

Diameter = 1.44" for 1.5-inch Tubes
Diameter = 1.938" for 2-inch Tubes
Diameter = 2.438" for 2.5-inch Tubes
Diameter= 2.850" for 3.0-inch Shelby Tubes





Specimen No.		1	2	3
Initial	Water Content, %	22.3	22.3	22.3
	Dry Density, pcf	104.6	104.6	104.6
	Saturation, %	98.6	98.6	98.6
	Void Ratio	0.6110	0.6110	0.6110
	Diameter, in.	2.410	2.410	2.410
	Height, in.	5.860	5.860	5.860
At Test	Water Content, %	22.3	22.3	22.3
	Dry Density, pcf	104.6	104.6	104.6
	Saturation, %	98.6	98.6	98.6
	Void Ratio	0.6110	0.6110	0.6110
	Diameter, in.	2.410	2.463	2.407
	Height, in.	5.860	5.610	5.873
Strain rate, %/min.		0.30	0.30	0.30
Back Pressure, psf		0	0	0
Cell Pressure, psf		500	1000	2000
Fail. Stress, psf		8467	14657	22829
Strain, %		3.7	6.3	10.0
Ult. Stress, psf				
Strain, %				
σ_1 Failure, psf		8967	15657	24829
σ_3 Failure, psf		500	1000	2000

Type of Test: Consolidated Undrained

Sample Type: Undisturbed

Description: Dark Olive Brown SILT With SAND

Assumed Specific Gravity= 2.7

Remarks: Each stage taken to 5% strain increments unless failure observed

Figure ________

Client: Mark Thomas & Company

Project: Lower Sacramento Road at UPRR

Source of Sample: Boring B2 **Depth:** 6.0-6.5'

Sample Number: B2-08-2c

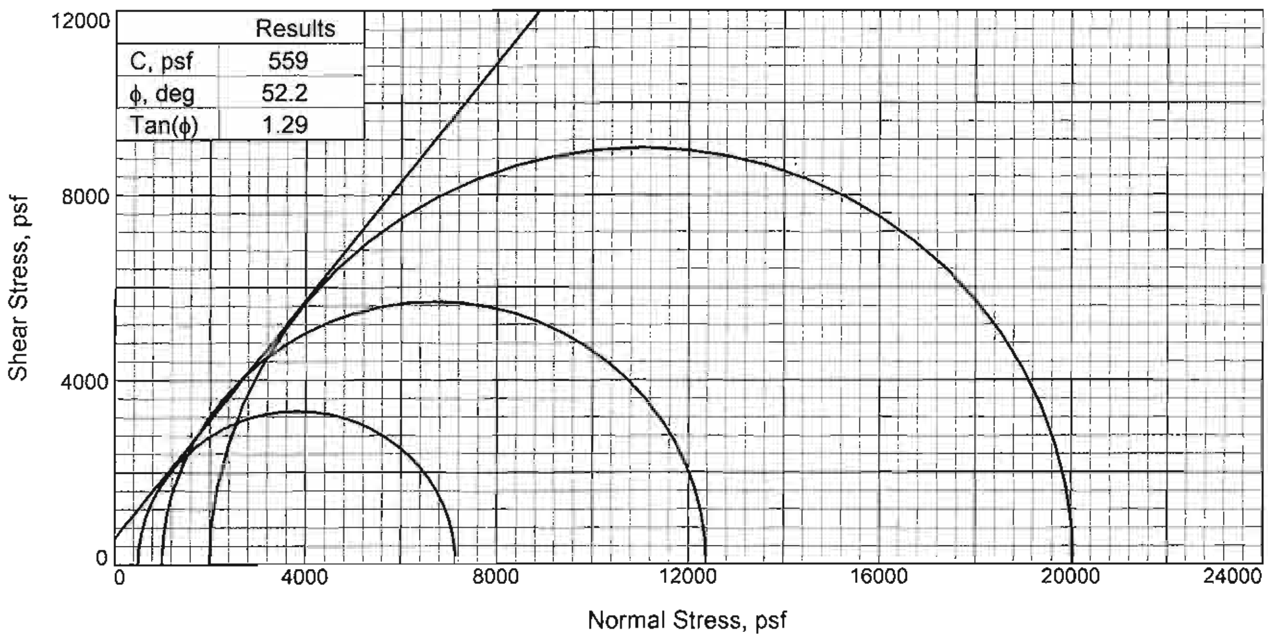
Proj. No.: 879.5 **Date Sampled:**

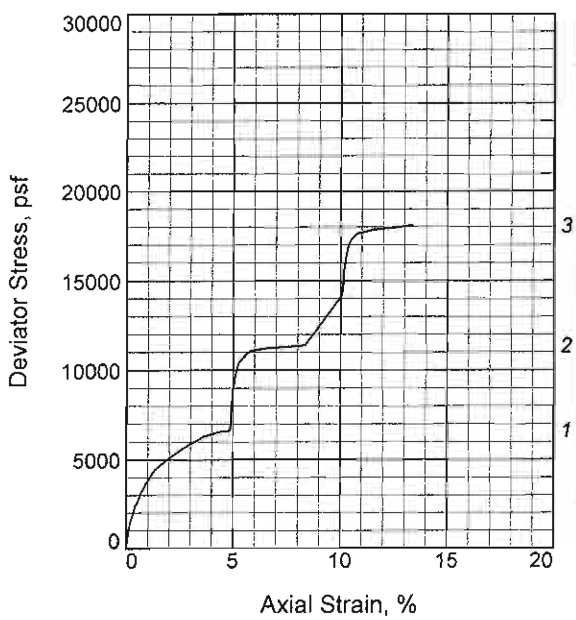
TRIAXIAL SHEAR TEST REPORT

Blackburn Consulting

Tested By: JRM

Results	
C, psf	559
ϕ, deg	52.2
Tan(ϕ)	1.29





	Specimen No.	1	2	3
Initial	Water Content, %	24.3	24.3	24.3
	Dry Density, pcf	101.0	101.0	101.0
	Saturation, %	98.0	98.0	98.0
	Void Ratio	0.6687	0.6687	0.6687
	Diameter, in.	2.420	2.420	2.420
	Height, in.	5.810	5.810	5.810
At Test	Water Content, %	0.0	0.0	0.0
	Dry Density, pcf	0.0	0.0	0.0
	Saturation, %	0.0	0.0	0.0
	Void Ratio	N/A	N/A	N/A
	Diameter, in.	2.422	2.483	2.420
	Height, in.	5.800	5.518	5.810
	Strain rate, %/min.	0.30	0.30	0.30
	Back Pressure, psf	0	0	0
	Cell Pressure, psf	500	1000	2000
	Fail. Stress, psf	6651	11378	18048
	Strain, %	4.9	9.9	15.1
	Ult. Stress, psf			
	Strain, %			
	σ_1 Failure, psf	7151	12378	20048
	σ_3 Failure, psf	500	1000	2000

Type of Test:
Consolidated Undrained

Sample Type: Undisturbed

Description: Dark Brown Lean CLAY

Assumed Specific Gravity= 2.7

Remarks: Each stage taken to 5% strain increments unless failure observed

Figure ________

Client: Mark Thomas & Company

Project: Lower Sacramento Road at UPRR

Source of Sample: Boring B8 **Depth:** 36.0-36.5'

Sample Number: B8-08-11c

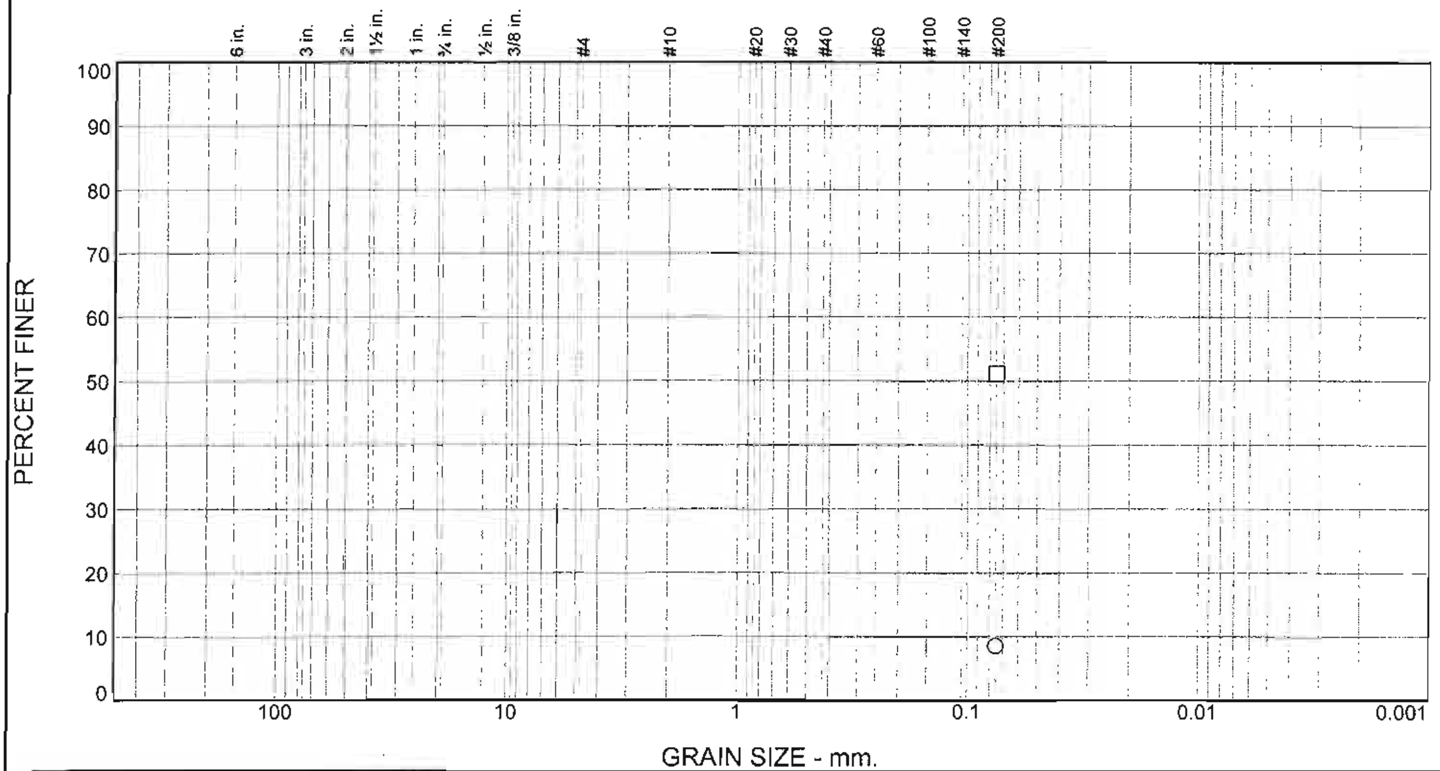
Proj. No.: 879.5 **Date Sampled:**

TRIAXIAL SHEAR TEST REPORT

Blackburn Consulting

Tested By: JRM

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							8.5	
□							51.0	

☒	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										
□										

Material Description	USCS	AASHTO
○ Light Olive Brown Poorly-graded SAND with CLAY	SP-SC	
□ Olive Brown SANDY lean CLAY	CL	

Project No. 879.5 **Client:** Mark Thomas & Company, Inc.

Project: Lower Sacramento Road and UPRR Undercrossing

○ **Sample Source:** Boring 2 **Depth:** 10.5'-11.0' **Sample No.:** B2-08-3b

□ **Source of Sample:** Boring 2 **Depth:** 21.0'-21.5 **Sample Number:** B2-08-6c

Remarks:

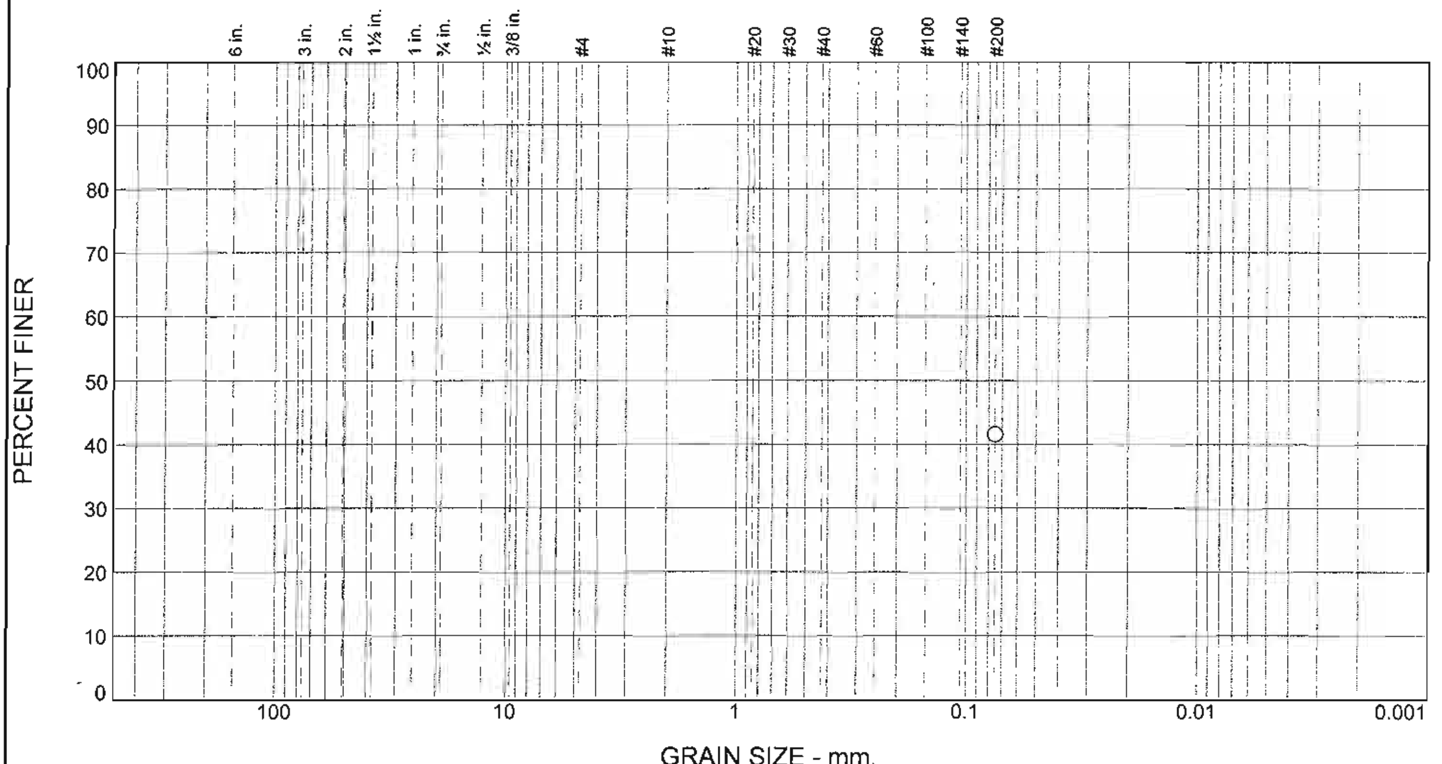
Blackburn Consulting

W. Sacramento, CA

Figure

Tested By: RT **Checked By:** DPC

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
o							41.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o										

Material Description	USCS	AASHTO
o Olive Brown CLAYEY SAND	SC	

Project No. 879.5 **Client:** Mark Thomas & Company, Inc.

Project: Lower Sacramento Road and UPRR Undercrossing

o **Source of Sample:** Boring 4 **Depth:** 21.0'-21.5' **Sample Number:** B4-08-6c

Remarks:

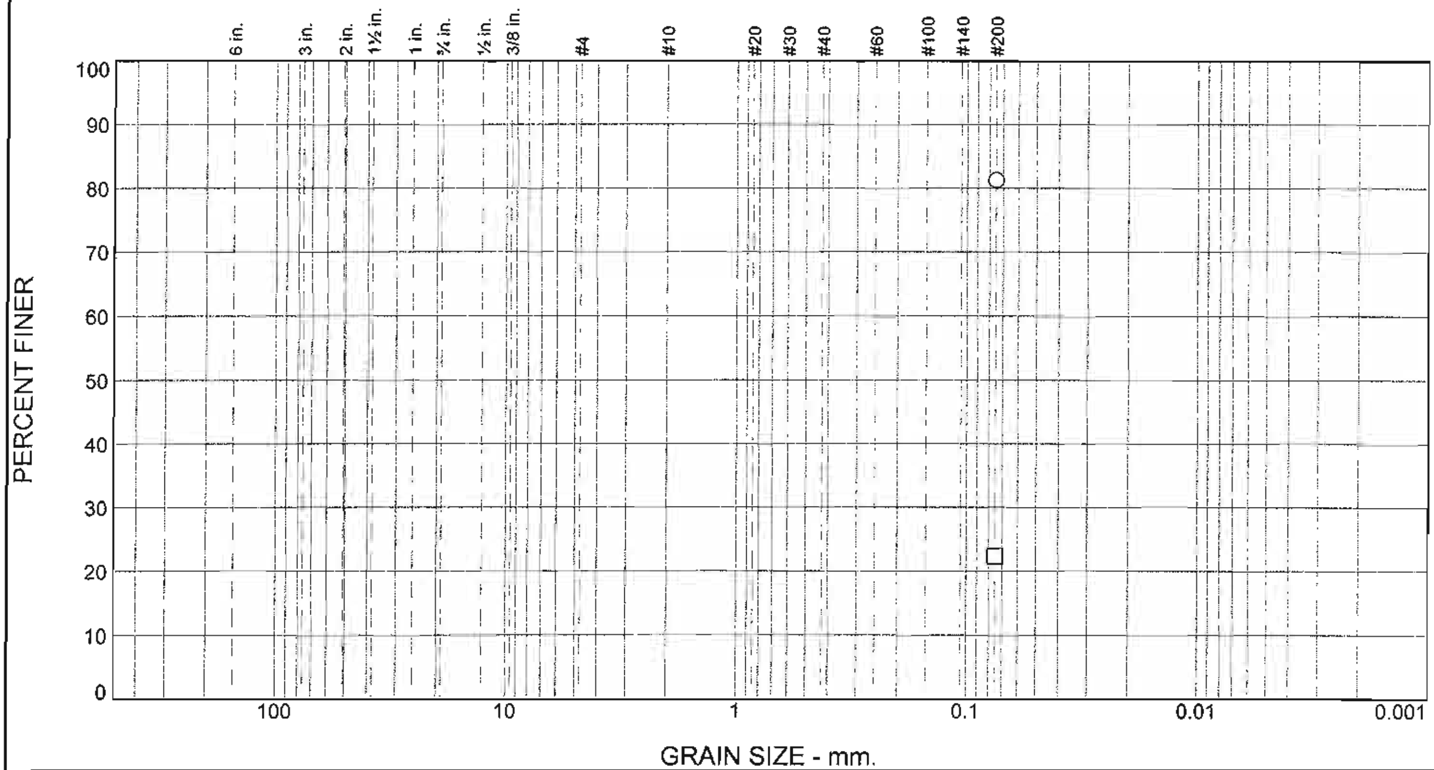
Blackburn Consulting

W. Sacramento, CA

Figure

Tested By: RT **Checked By:** DPC

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							81.3	
□							22.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										
□										

Material Description	USCS	AASHTO
○ Olive Brown Lean CLAY with SAND	CL	
□ Dark Yellowish Brown CLAYEY SAND	SC	

Project No. 879.5 **Client:** Mark Thomas & Company, Inc.

Project: Lower Sacramento Road and UPRR Undercrossing

○ **Source of Sample:** Boring 6 **Depth:** 6.5'-7.0' **Sample Number:** B6-08-3a

□ **Source of Sample:** Boring 6 **Depth:** 7.5'-8.0' **Sample Number:** B6-08-3b

Remarks:

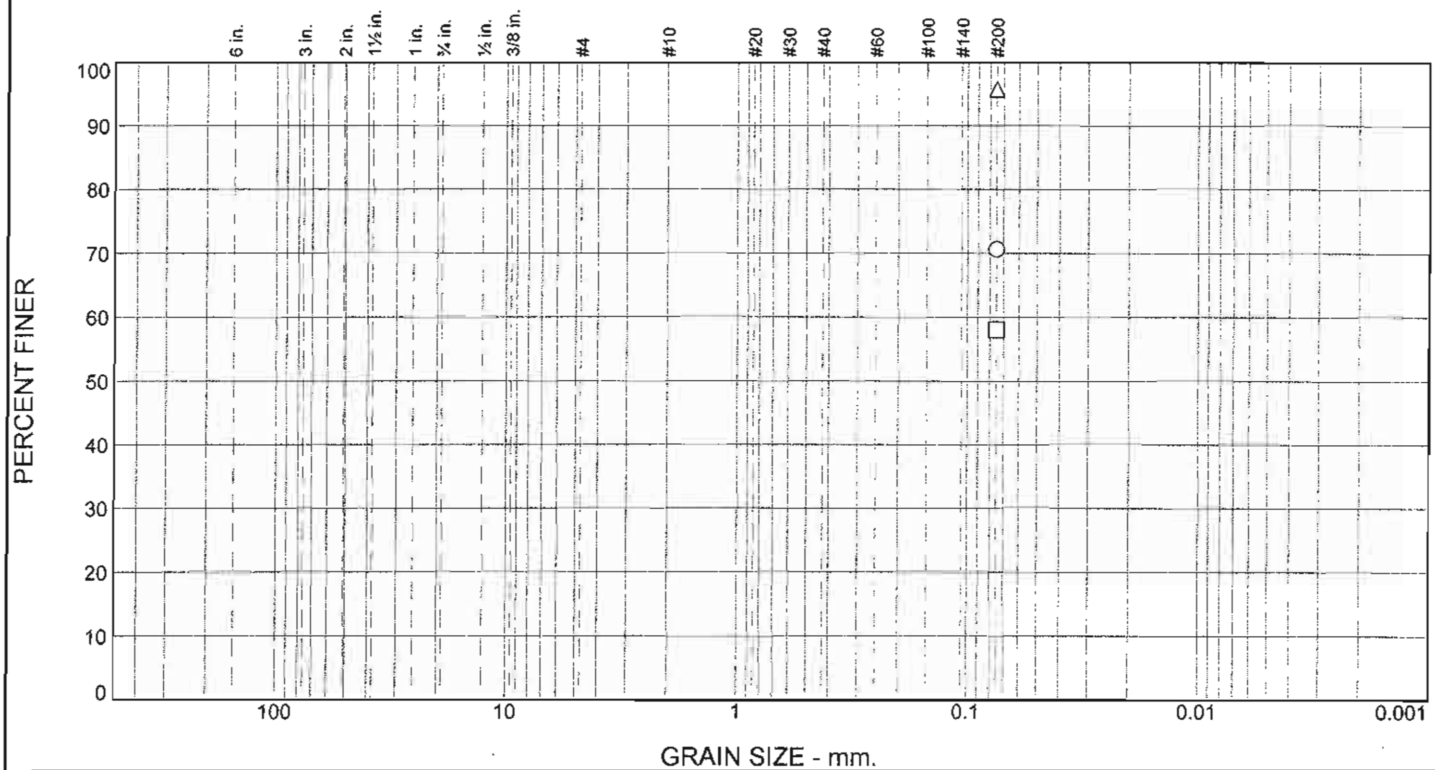
Blackburn Consulting

W. Sacramento, CA

Figure

Tested By: RT **Checked By:** DPC

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							70.6	
□							58.0	
△							95.7	

☒	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										
□										
△										

Material Description	USCS	AASHTO
○ Reddish Brown Lean CLAY with SAND	CL	
□ Dark Reddish Brown SANDY lean CLAY	CL	
△ Reddish Brown Lean CLAY	CL	

Project No. 879.5 **Client:** Mark Thomas & Company, Inc.

Project: Lower Sacramento Road and UPRR Undercrossing

○ **Sample Source:** Boring 8 **Depth:** 10.5'-11.0' **Sample No.:** B8-08-4b

□ **Sample Source:** Boring 8 **Depth:** 25.5'-26.0' **Sample No.:** B8-08-8b

△ **Sample Source:** Boring 8 **Depth:** 30.5'-31.0' **Sample No.:** B8-08-10b

Remarks:

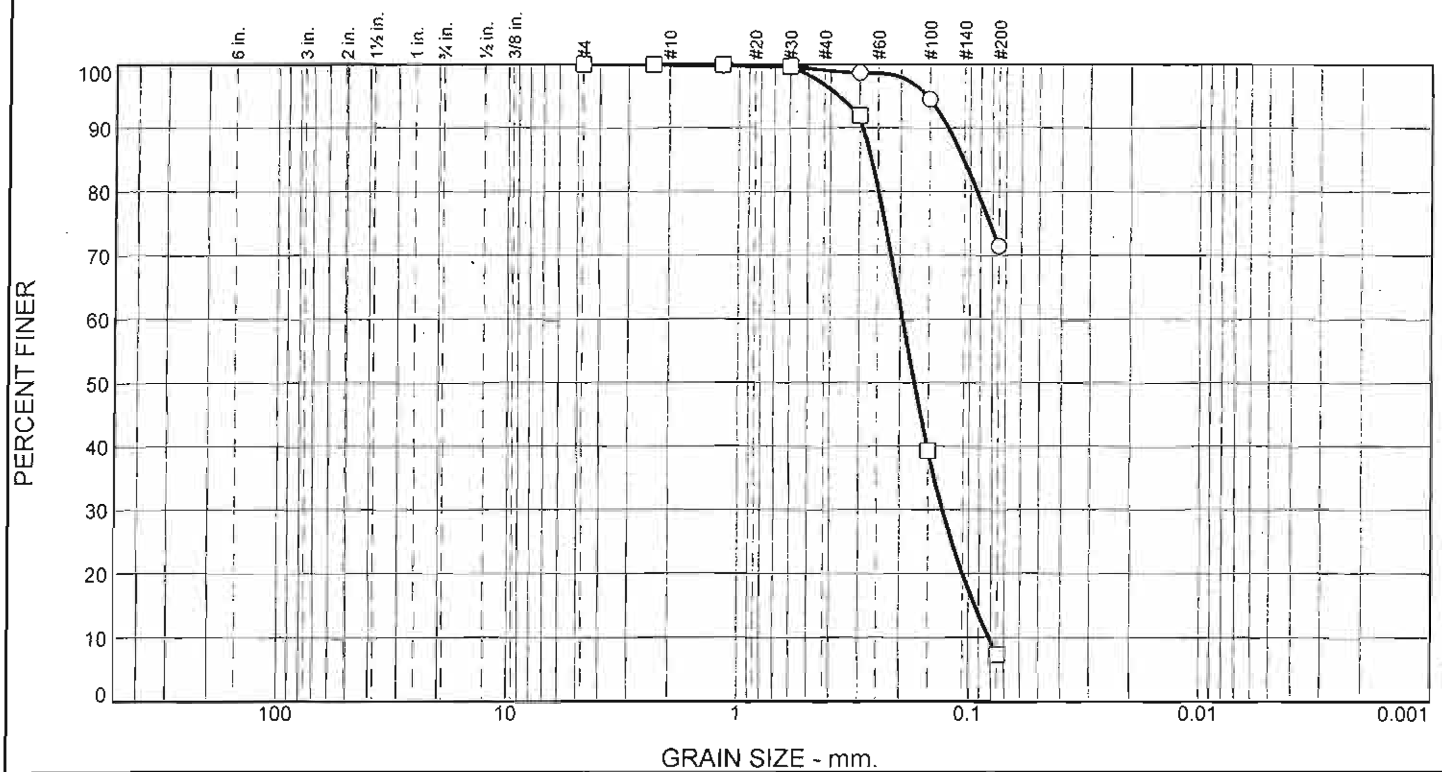
Blackburn Consulting

W. Sacramento, CA

Figure

Tested By: RT **Checked By:** DPC

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	0.8	27.7	71.4	
□	0.0	0.0	0.0	0.0	3.2	89.5	7.3	

☒	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	27	19	0.1067							
□			0.2661	0.1941	0.1723	0.1297	0.0935	0.0812	1.07	2.39

Material Description	USCS	AASHTO
○ Brown Lean CLAY with SAND	CL	A-4(4)
□ Olive yellow Poorly-graded SAND with SILT	SP-SM	

Project No. 879.5 **Client:** Mark Thomas & Company

Project: Lower Sacramento Road at UPRR

○ **Source of Sample:** Boring B1 **Depth:** 6.0-6.5' **Sample Number:** B1-08-2c

□ **Sample Source:** Boring B1 **Depth:** 21.0-21.5' **Sample No.:** B1-08-5c

Remarks:

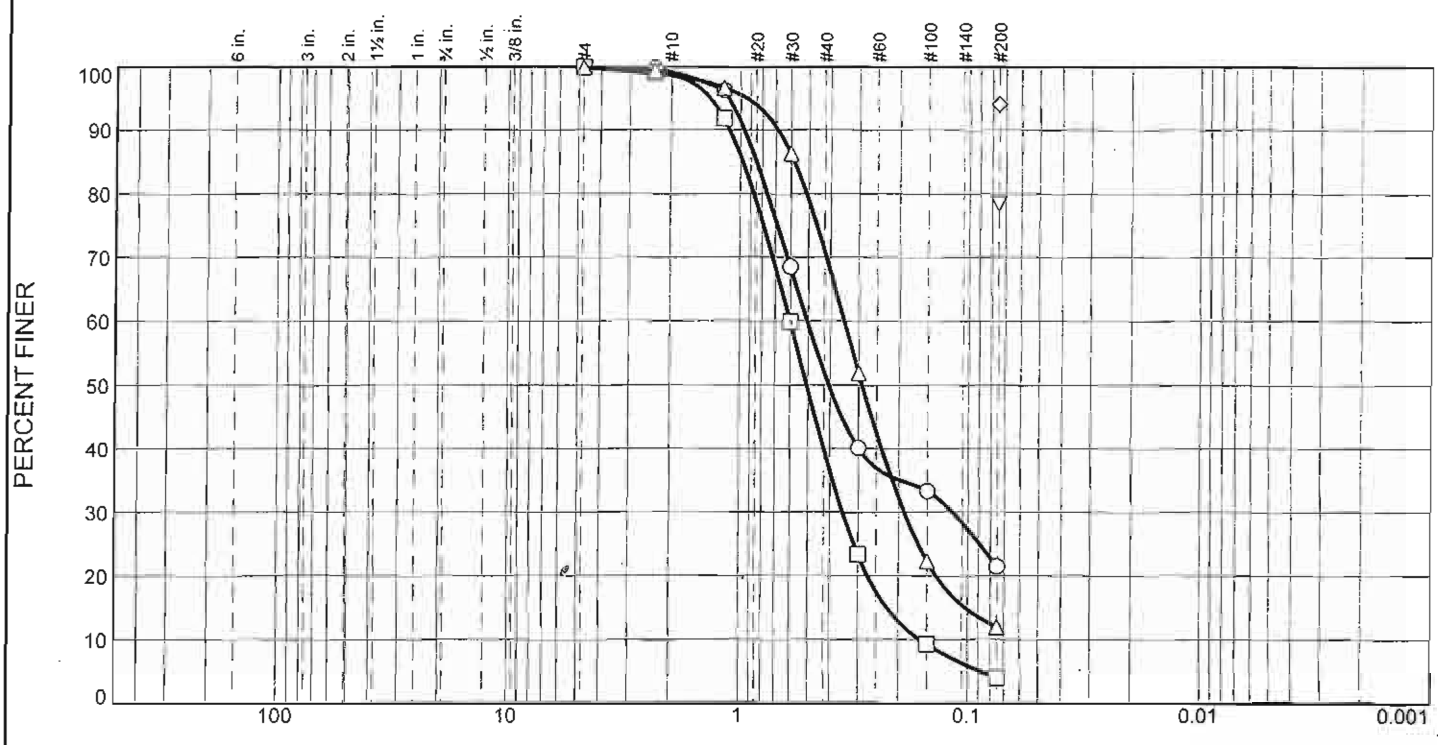
Blackburn Consulting

W. Sacramento, CA

Figure

Tested By: ____________________ **Checked By:** ____________________

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.8	47.2	30.5	21.5	
□	0.0	0.0	0.0	1.3	58.8	35.9	4.0	
△				0.9	28.1	59.0	11.9	
◇							94.1	
▽							78.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.8477	0.5054	0.4050	0.1160				
□			0.9725	0.6009	0.5069	0.3507	0.2242	0.1603	1.28	3.75
△			0.5784	0.3476	0.2895	0.1889	0.1024			
◇	42	25								
▽	34	17								

Material Description	USCS	AASHTO
○ Light olive brown SILTY SAND	SM	
□ Light olive brown Poorly-graded SAND	SP	
△ Dark yellowish brown Poorly-graded SAND with SILT	SP-SM	
◇ Brown Lean CLAY	CL	
▽ Grayish brown Lean CLAY with SAND	CL	

Project No. 879.1 **Client:** MTCO

Project: N. Stockton RR & Bridge Structures

○ **Sample Source:** Boring B2-06 **Depth:** 16.5-17.0' **Sample No.:** B2-06-3b

□ **Sample Source:** Boring B2-06 **Depth:** 17.5-18.0' **Sample No.:** B2-06-4

△ **Sample Source:** Boring B2-06 **Depth:** 22.5-23.0' **Sample No.:** B2-06-6

◇ **Sample Source:** Boring B2-06 **Depth:** 26.5-27.0' **Sample No.:** B2-06-7b

▽ **Sample Source:** Boring B2-06 **Depth:** 36.5-37.0' **Sample No.:** B2-06-9b

Remarks:

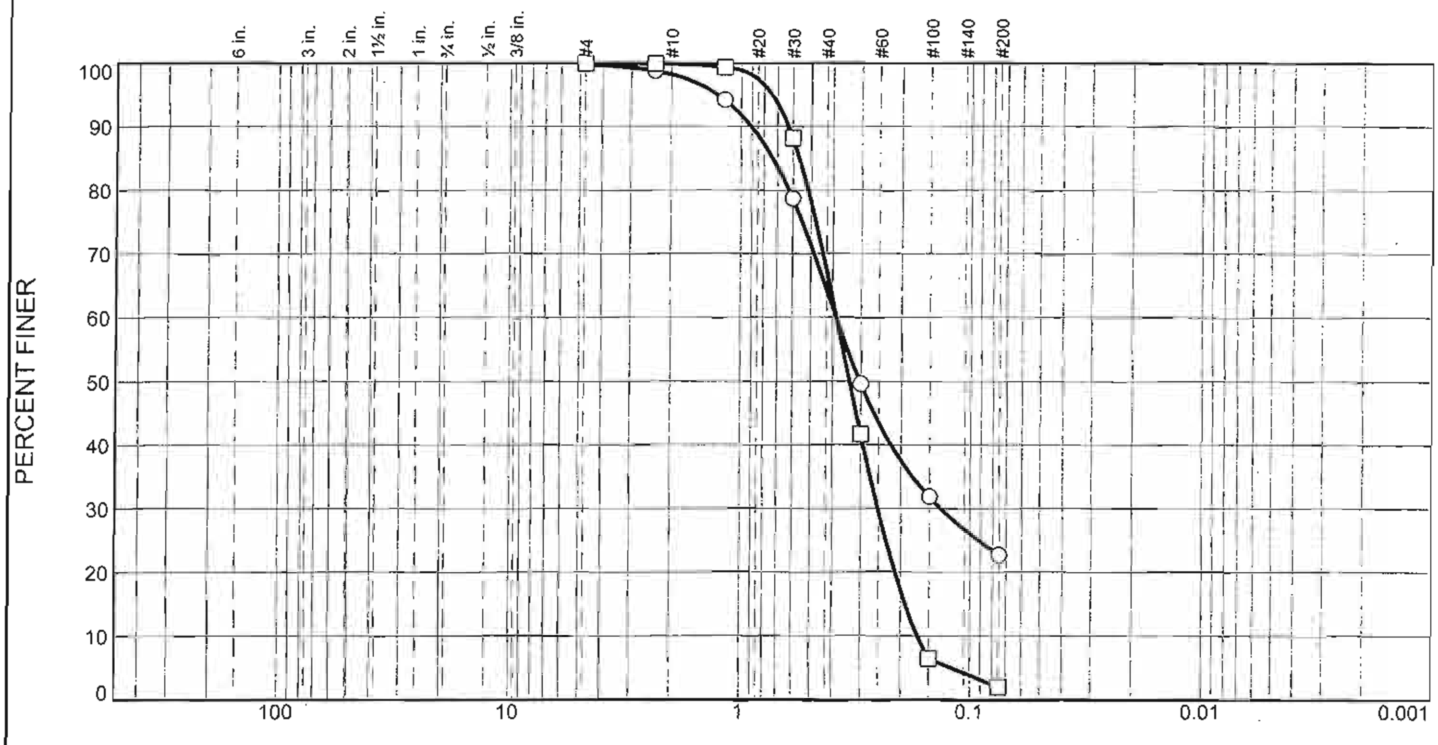
Blackburn Consulting

W. Sacramento, CA

Figure

Tested By: ______________ **Checked By:** ______________

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○				1.7	33.8	41.7	22.7	
□	0.0	0.0	0.0	0.1	32.5	65.4	2.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.7315	0.3852	0.3031	0.1335				
□			0.5613	0.3842	0.3362	0.2517	0.1906	0.1683	0.98	2.28

Material Description	USCS	AASHTO
○ Light olive brown SILTY SAND	SM	
□ Olive brown Poorly-graded SAND	SP	

Project No. 879.1 **Client:** MTCO

Project: N. Stockton RR & Bridge Structures

○ **Sample Source:** Boring B2-06 **Depth:** 46.5-47.0' **Sample No.:** B2-06-12b

□ **Sample Source:** Boring B2-06 **Depth:** 51.5-52.0' **Sample No.:** B2-06-14b

Remarks:

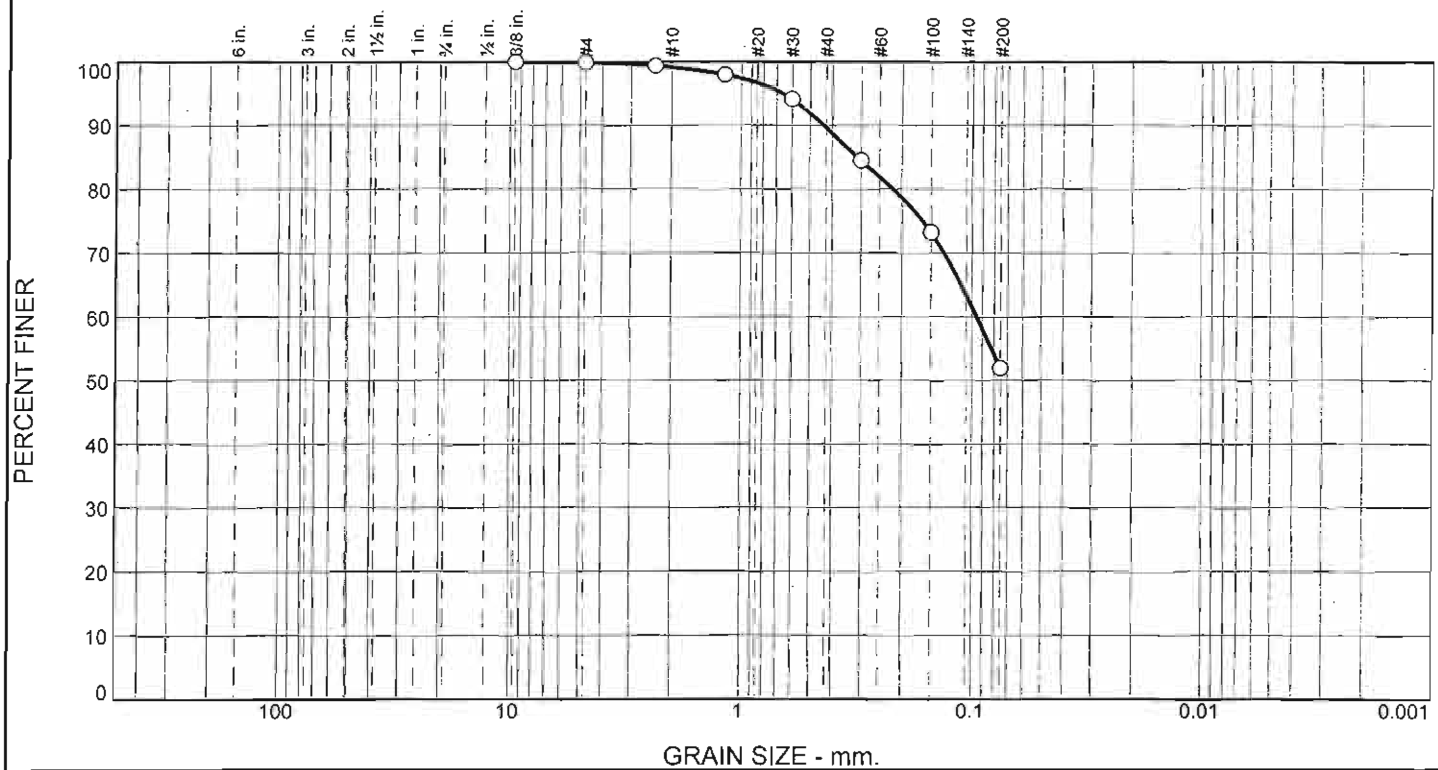
Blackburn Consulting

W. Sacramento, CA

Figure

Tested By: ____________________ **Checked By:** ____________________

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.1	0.7	9.5	37.8	51.9	

☒	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	23	21	0.3111	0.0951						

Material Description	USCS	AASHTO
○ Olive brown SANDY SILT	ML	A-4(0)

Project No. 879.5 **Client:** Mark Thomas & Company, Inc.

Project: Lower Sacramento Road at UPRR Foundation Report

○ **Sample Source:** Boring B11 **Depth:** 45.5-46.0 **Sample No.:** B11-08-13b

Remarks:

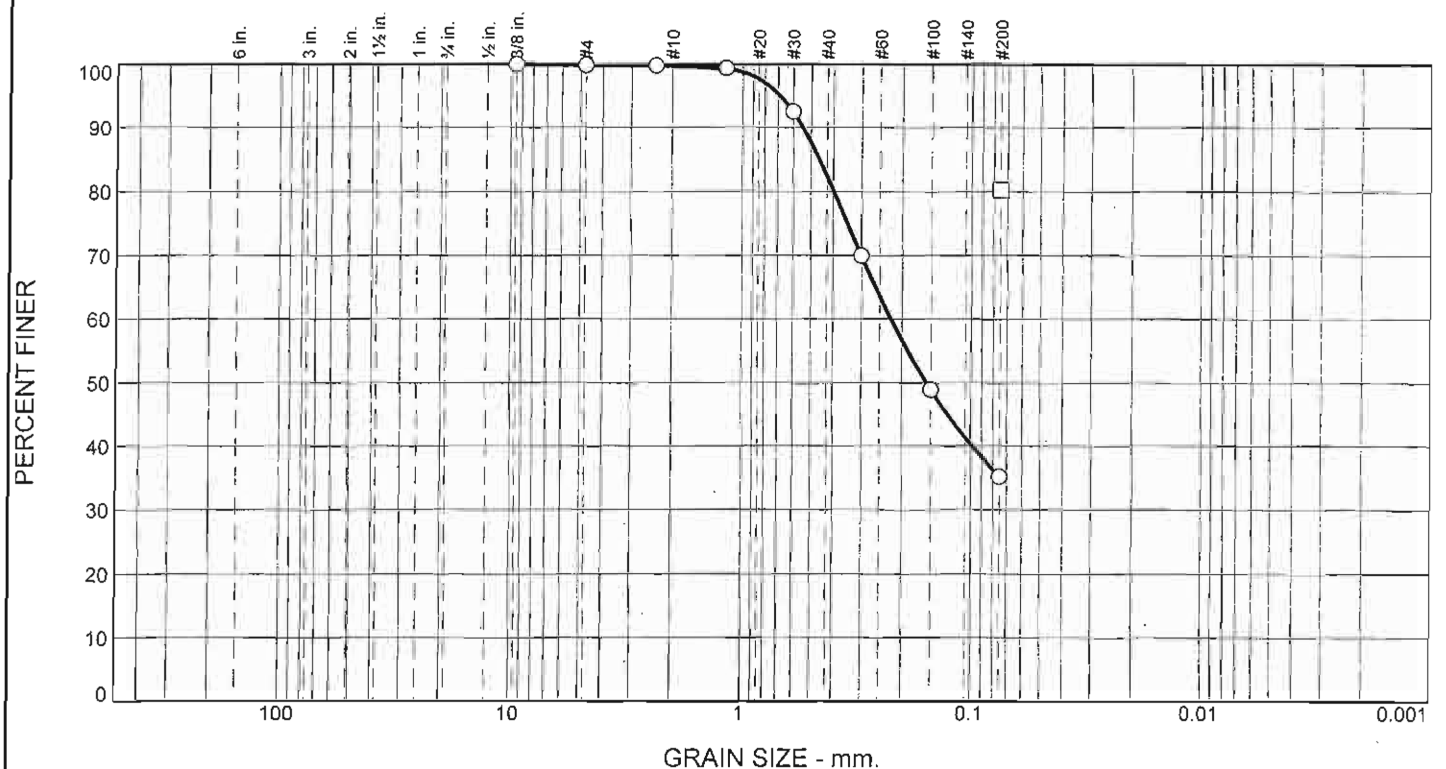
Blackburn Consulting

W. Sacramento, CA

Figure

Tested By: ____________ **Checked By:** ____________

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.1	0.2	17.3	47.2	35.2	
□							80.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	22	15	0.4588	0.2225	0.1565					
□	49	23								

Material Description	USCS	AASHTO
○ Brown SILTY, CLAYEY SAND	SC-SM	A-2-4(0)
□ Brown Lean CLAY with SAND	CL	

Project No. 879.5 **Client:** Mark Thomas & Company, Inc.

Project: Bear Creek Bridge

○ **Sample Source:** Boring B9 **Depth:** 11.0-11.5' **Sample No.:** B9-08-2c

□ **Sample Source:** Boring B9 **Depth:** 41.5-41.0' **Sample No.:** B9-08-12

Remarks:

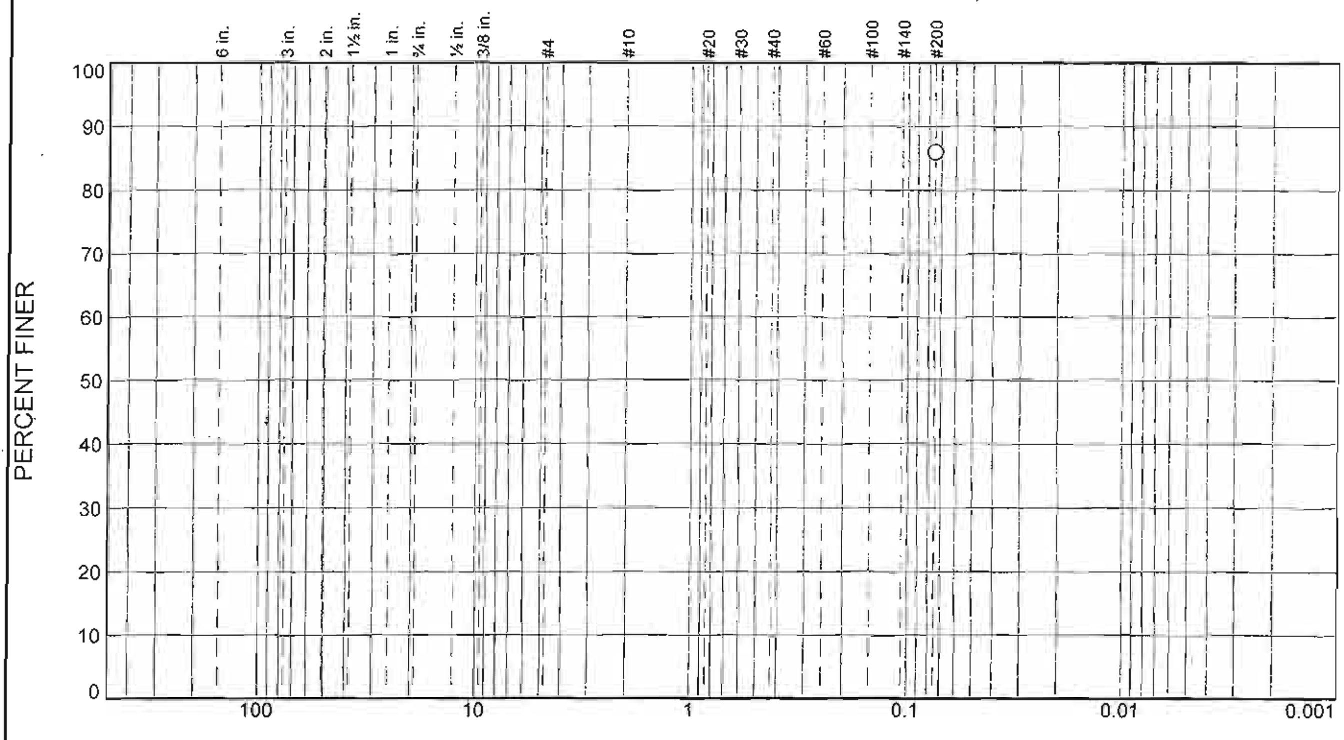
Blackburn Consulting

W. Sacramento, CA

Figure

Tested By: ______________________ **Checked By:** ______________________

Particle Size Distribution Report



	% +3"	% Gravel Coarse	% Gravel Fine	% Sand Coarse	% Sand Medium	% Sand Fine	% Fines Silt	% Fines Clay
○							86.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	44	25								

Material Description	USCS	AASHTO
○ Brown Lean CLAY	CL	

Project No. 879.5 **Client:** Mark Thomas & Company, Inc.

Project: Bear Creek Bridge

○ **Sample Source:** Boring B10 **Depth:** 36.5-38.0 **Sample No.:** B10-08-9

Remarks:

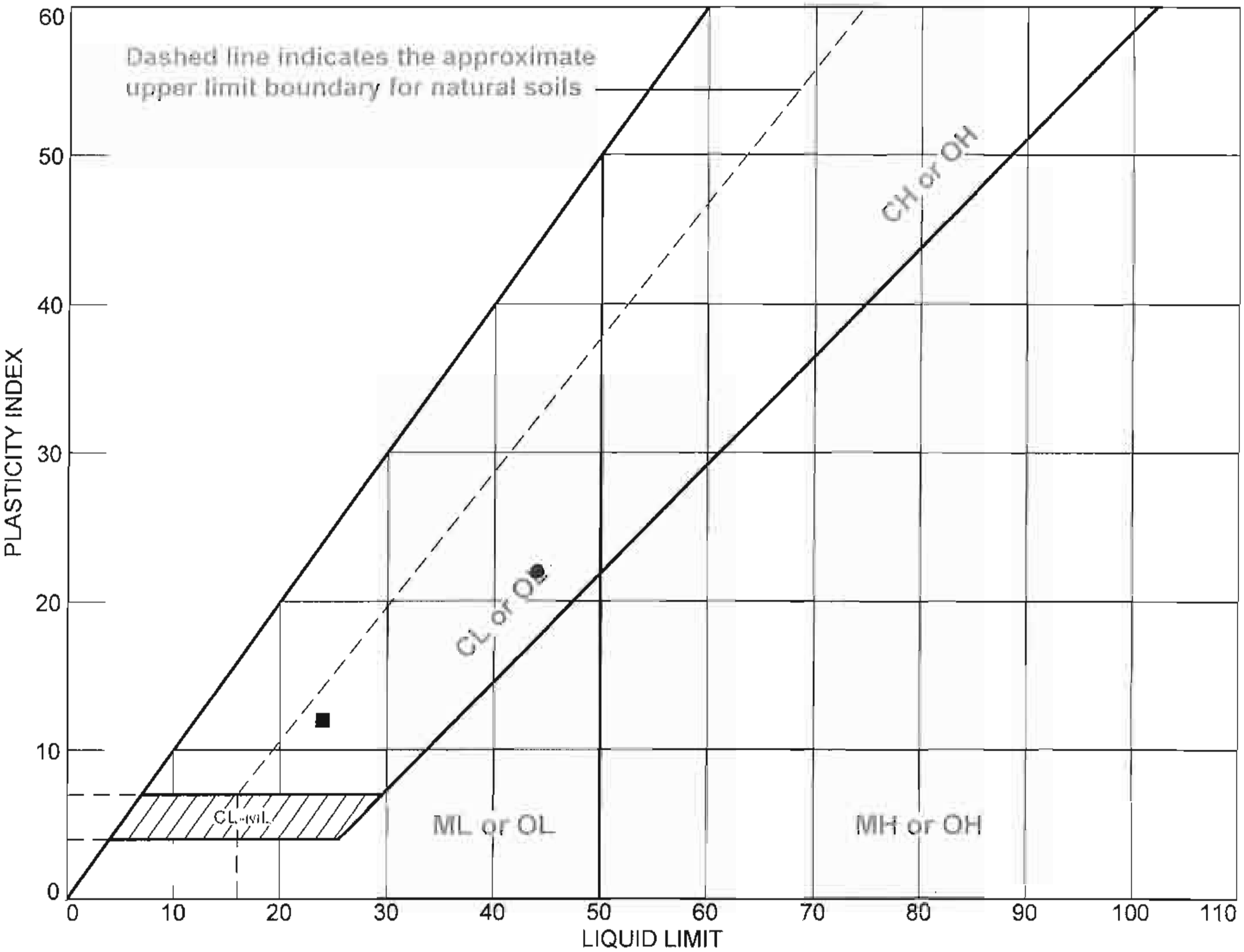
Blackburn Consulting

W. Sacramento, CA

Figure

Tested By: ____________ **Checked By:** ____________

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Boring 8	B8-08-1	2.5'-4.0'		22	44	22	CL
■	Boring 8	B8-08-11	35.0'-36.5'		12	24	12	CL

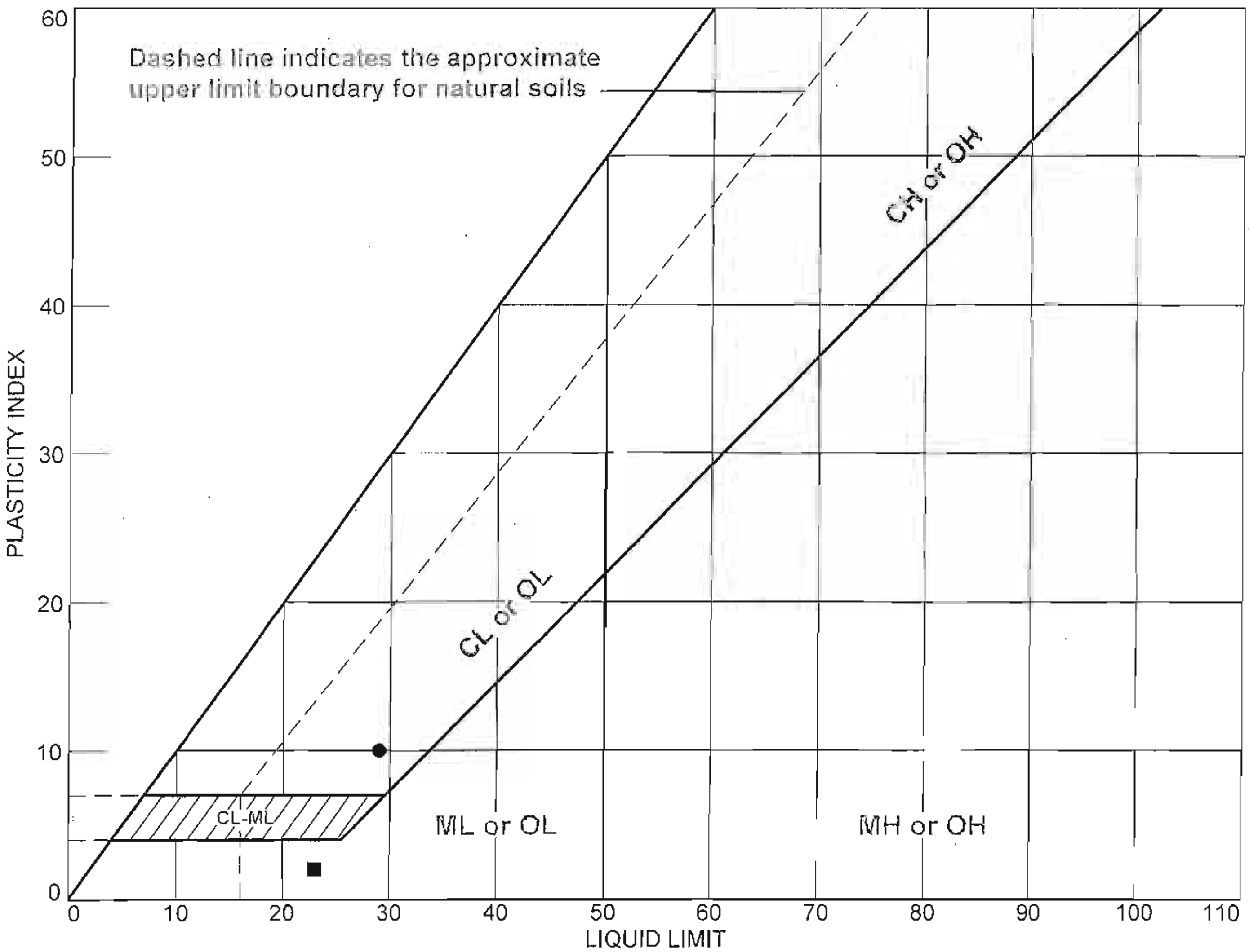
Blackburn Consulting

W. Sacramento, CA

Client: Mark Thomas & Company, Inc.
Project: Lower Sacramento Road and UPRR Undercrossing
Project No.: 879.5 **Figure**

Tested By: RT **Checked By:** DPC

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

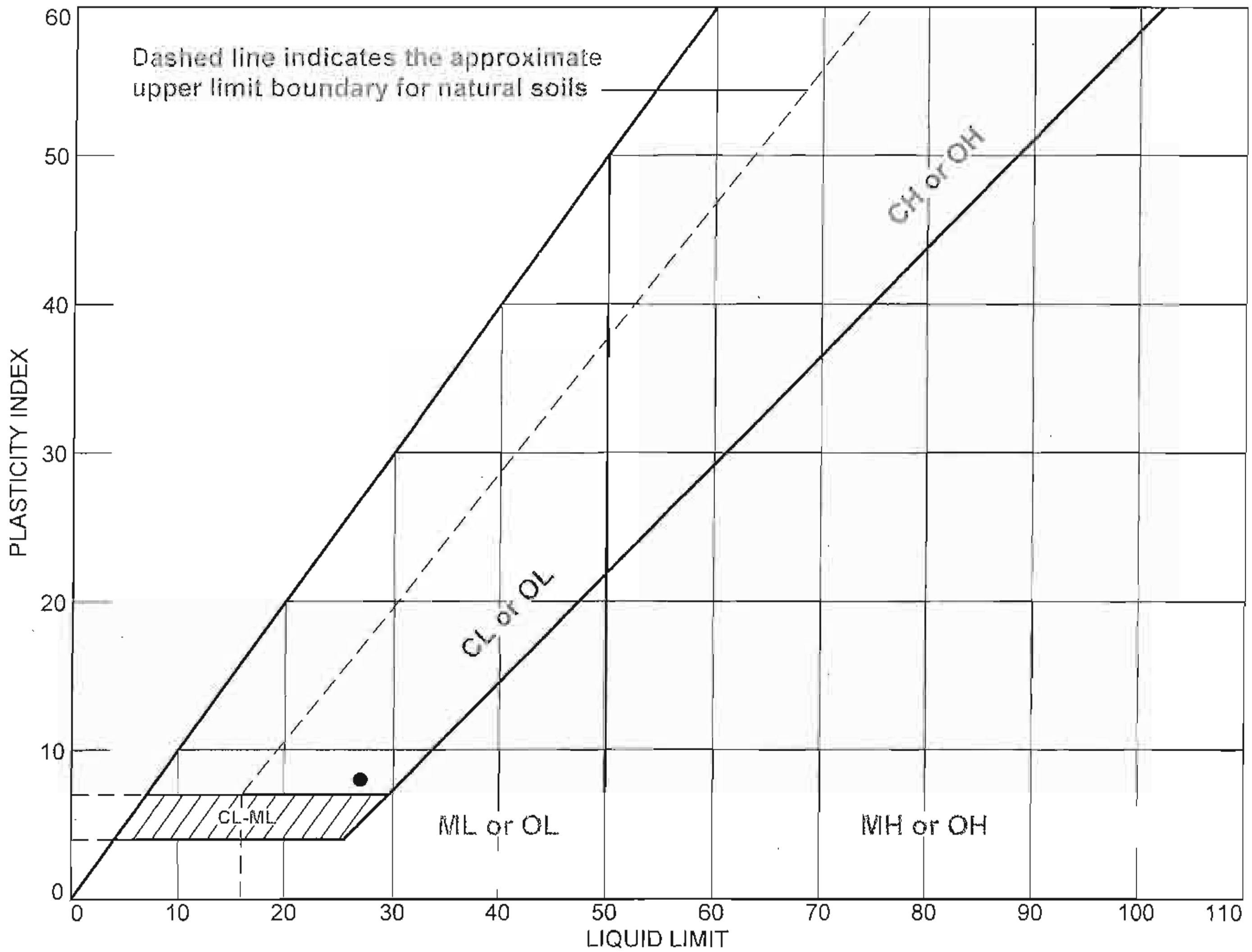
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Boring B11	B11-08-7b	25.5-26.0'		19	29	10	CL
■	Boring B11	B11-08-13b	45.5-46.0	20.7	21	23	2	ML

Blackburn Consulting **W. Sacramento, CA**	**Client:** Mark Thomas & Company, Inc. **Project:** Lower Sacramento Road at UPRR Foundation Report **Project No.:** 879.5 **Figure**

Tested By: ____________________ **Checked By:** ____________________

ATTACHMENT H

LIQUID AND PLASTIC LIMITS TEST REPORT

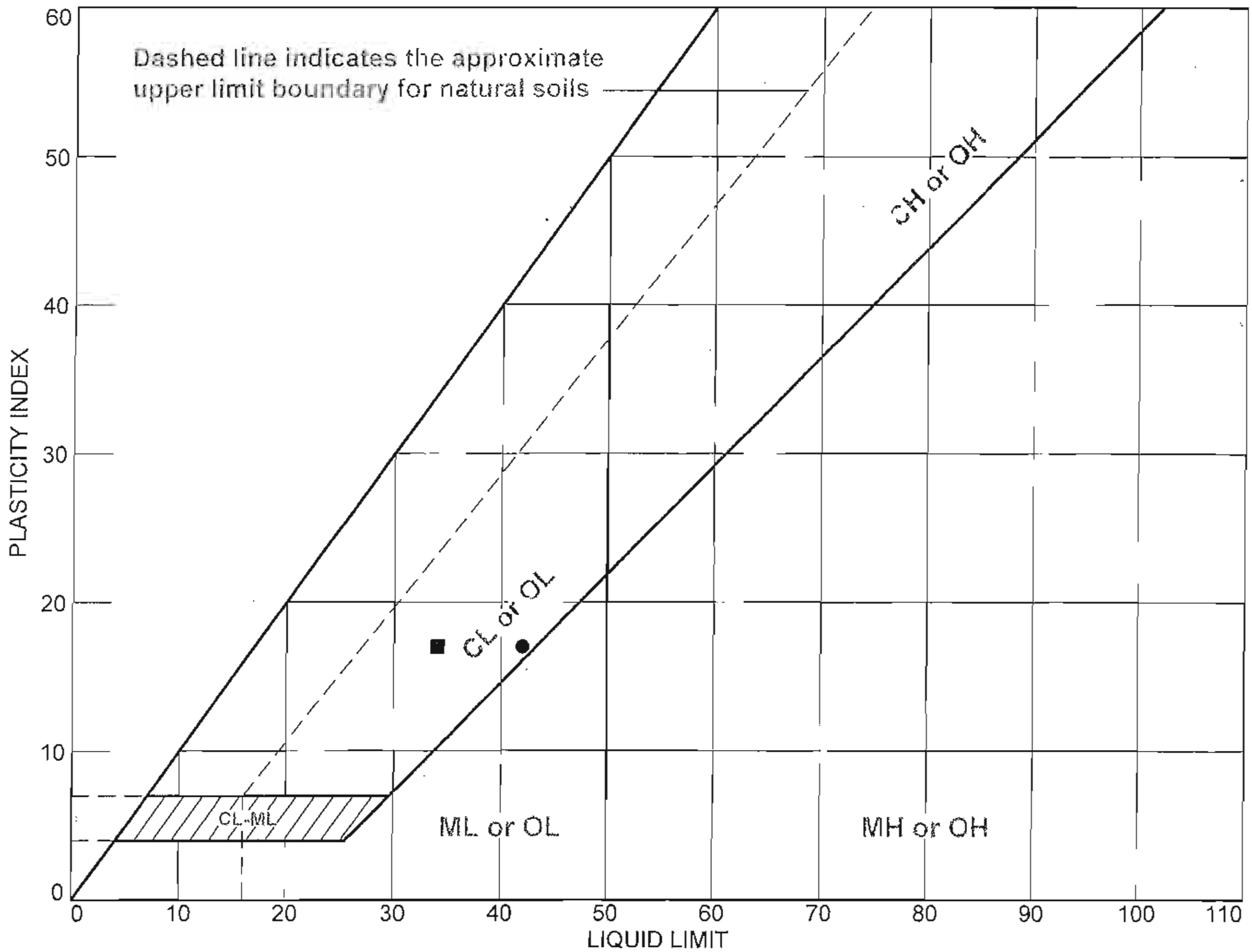


SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Boring B1	B1-08-2c	6.0-6.5'		19	27	8	CL

Blackburn Consulting **W. Sacramento, CA**	**Client:** Mark Thomas & Company **Project:** Lower Sacramento Road at UPRR **Project No.:** 879.5 **Figure**

Tested By: ______________ **Checked By:** ______________

LIQUID AND PLASTIC LIMITS TEST REPORT



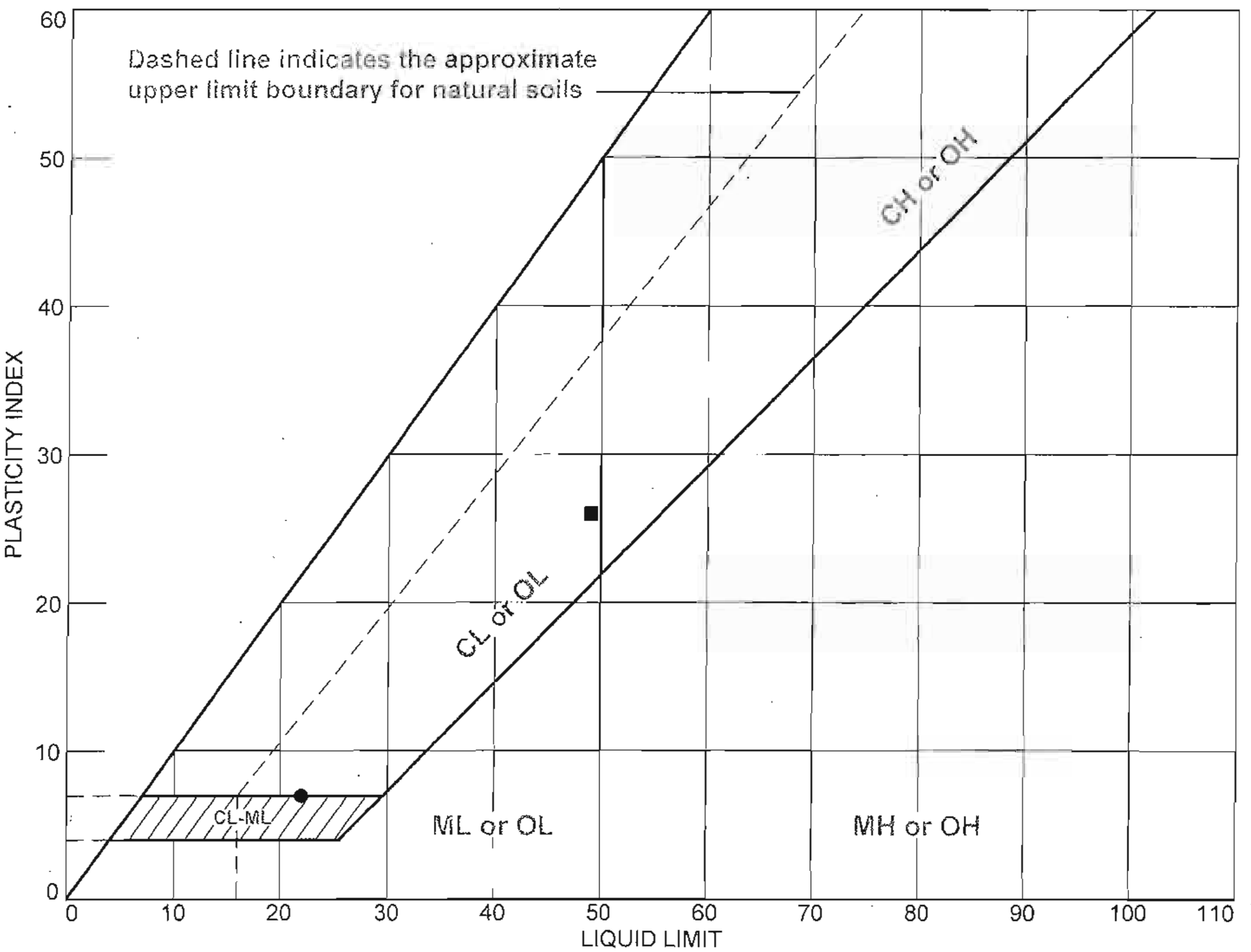
SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Boring B2-06	B2-06-7b	26.5-27.0'		25	42	17	CL
■	Boring B2-06	B2-06-9b	36.5-37.0'		17	34	17	CL

Blackburn Consulting **W. Sacramento, CA**	**Client:** MTCO **Project:** N. Stockton RR & Bridge Structures **Project No.:** 879.1 **Figure**

Tested By: ____________________ **Checked By:** ____________________

LIQUID AND PLASTIC LIMITS TEST REPORT

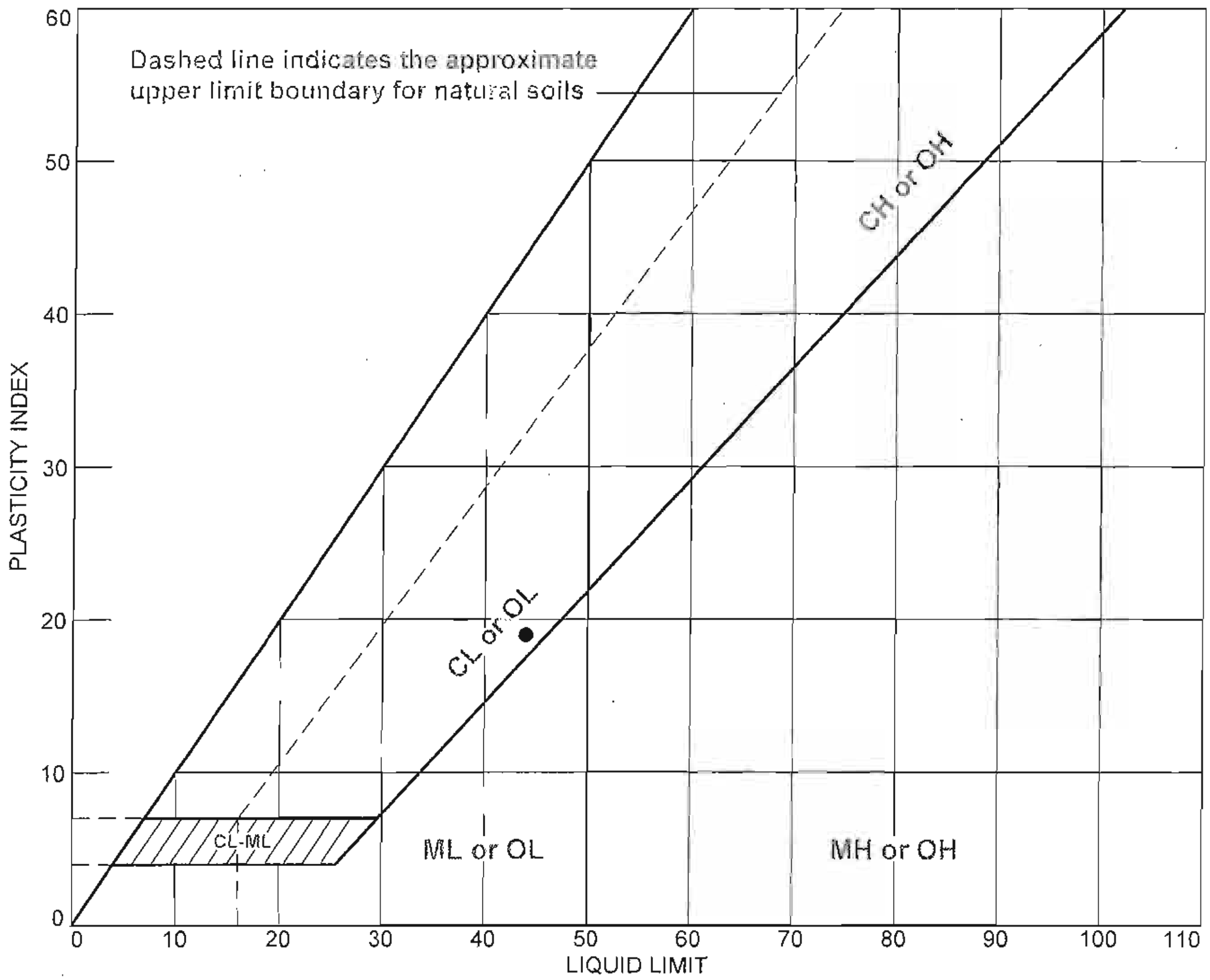


SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Boring B9	B9-08-2c	11.0-11.5'		15	22	7	SC-SM
■	Boring B9	B9-08-12	41.5-41.0'		23	49	26	CL

Blackburn Consulting **W. Sacramento, CA**	**Client:** Mark Thomas & Company, Inc. **Project:** Bear Creek Bridge **Project No.:** 879.5 **Figure**

Tested By: ____________________ **Checked By:** ____________________

LIQUID AND PLASTIC LIMITS TEST REPORT

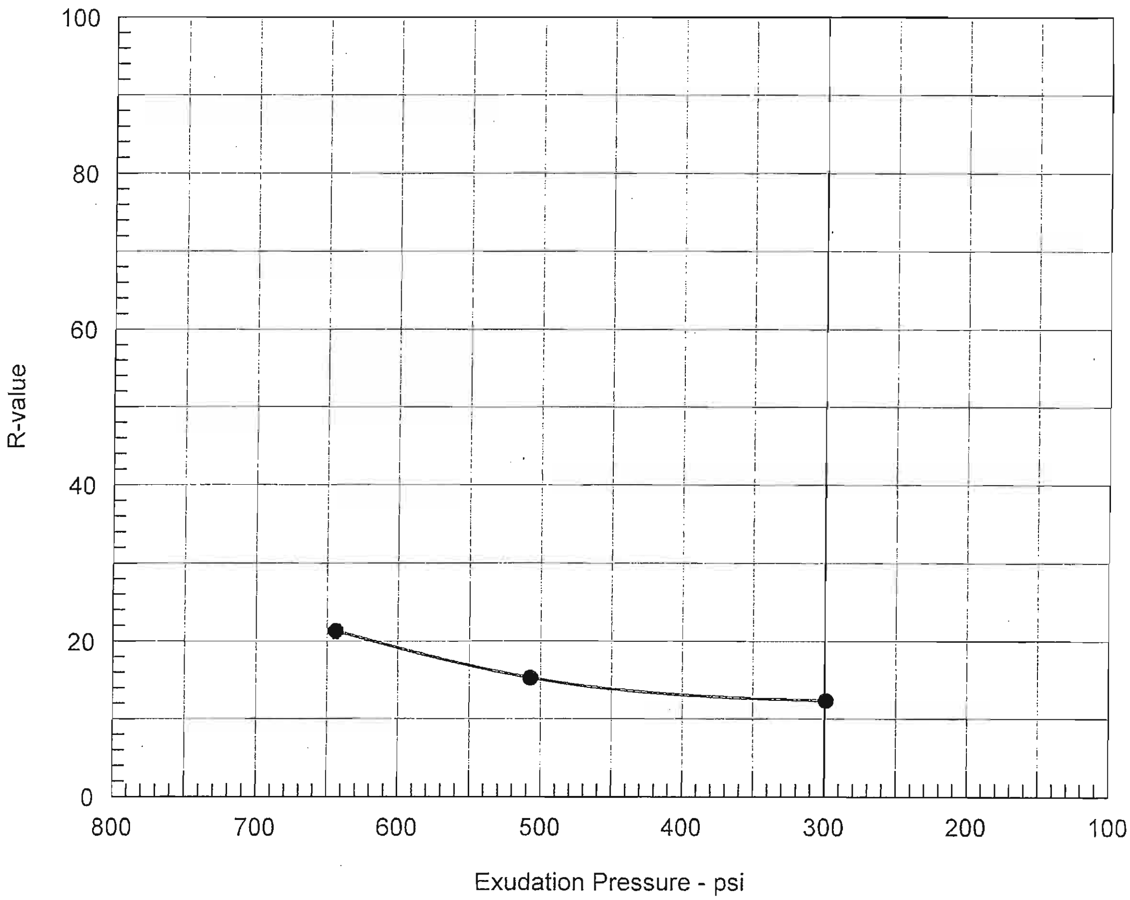


SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	Boring B10	B10-08-9	36.5-38.0		25	44	19	CL

Blackburn Consulting **W. Sacramento, CA**	**Client:** Mark Thomas & Company, Inc. **Project:** Bear Creek Bridge **Project No.:** 879.5 **Figure**

Tested By: __________ **Checked By:** ___

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psf	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	87	109.1	18.0	44	103	2.46	644	21	21
2	43	105.3	19.7	31	116	2.36	507	17	15
3	22	100.7	21.9	17	122	2.36	299	14	12

Test Results	Material Description
R-value at 300 psi exudation pressure = 12	Very dark gray/black Lean CLAY with SAND (CL)

Project No.: 879.5

Project: Lower Sacramento Road at UPRR

Source of Sample: Boring B1 **Depth:** 2.0-4.0 ft.

Sample Number: B1-08-1 (Bulk)

Date: 5/7/2010

Tested by: MDR

Checked by: RBL

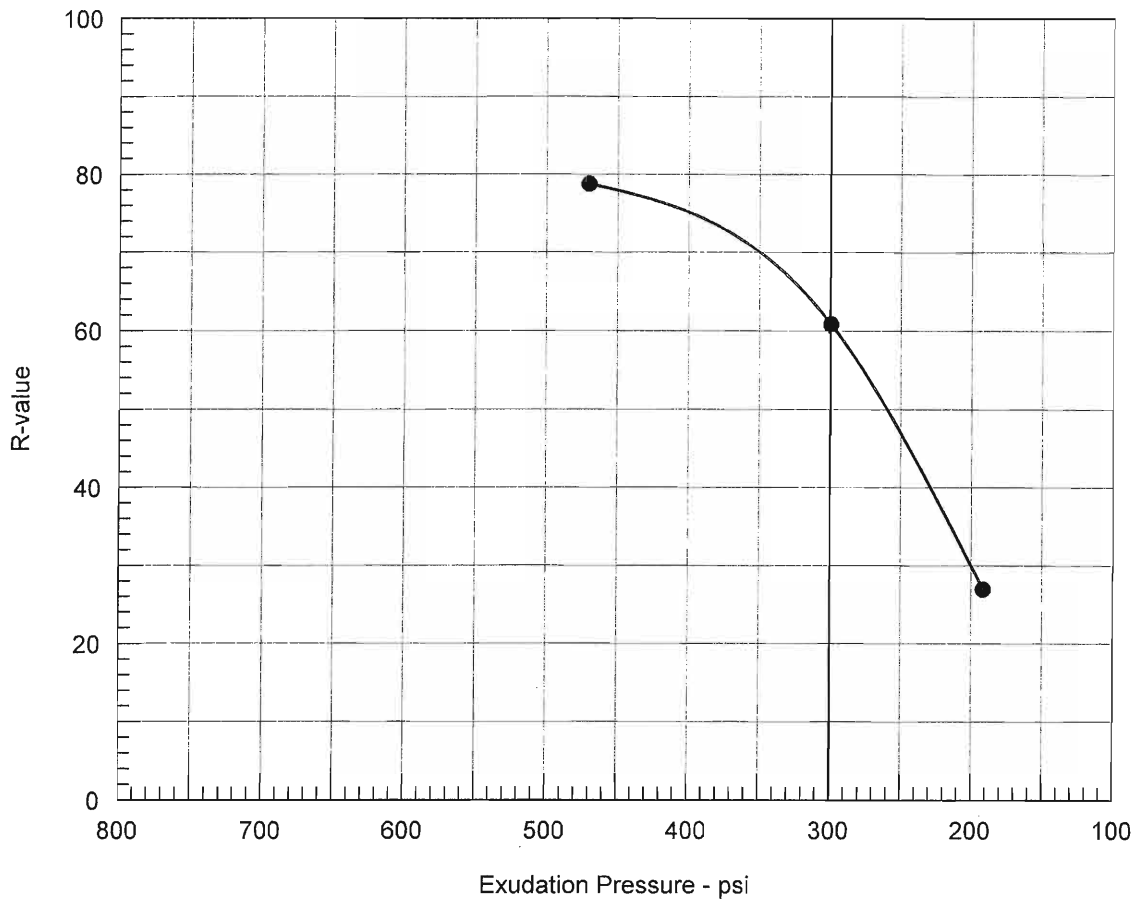
Remarks:
Depending on Traffic Index, "R"-Value by expansion could be lower than "R"-Value by Stabilometer.

R-VALUE TEST REPORT

Blackburn Consulting

Figure ______

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psf	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	350	119.8	11.5	74	24	2.49	470	79	79
2	350	118.9	12.5	0	46	2.56	300	59	61
3	350	118.7	13.4	0	95	2.47	192	27	27

Test Results	Material Description
R-value at 300 psi exudation pressure = 61	Dark yellowish brown SILTY SAND (SM)

Project No.: 879.5

Project: Lower Sacramento Road at UPRR

Source of Sample: Boring B3 **Depth:** 2.0-4.0 ft.

Sample Number: B3-08, Bag D

Date: 5/5/2010

Tested by: KAO

Checked by: RBL

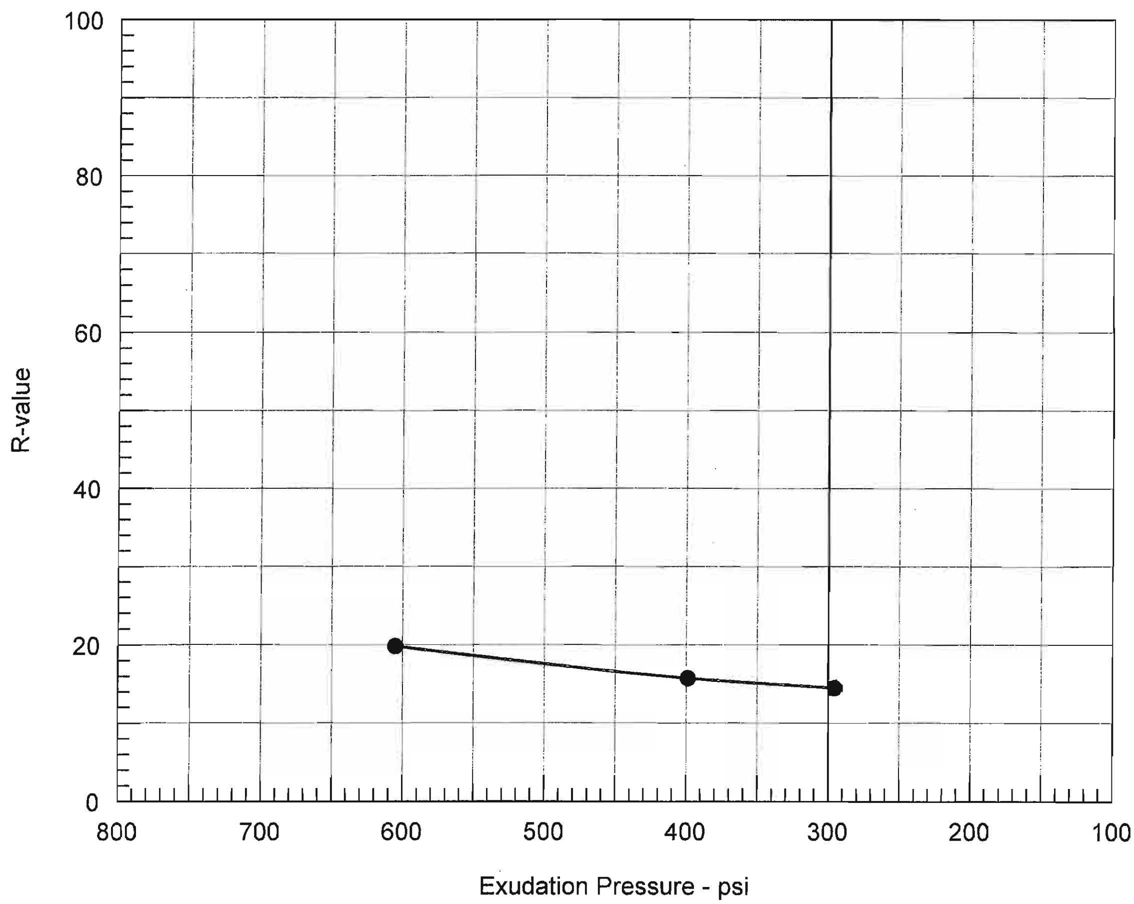
Remarks:
* Depending on Traffic Index, "R"-Value by expansion could be lower than "R"-Value by Stabilometer

R-VALUE TEST REPORT

Blackburn Consulting

Figure ______

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psf	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	87	112.1	16.9	31	114	2.51	605	20	20
2	54	108.4	18.7	0	121	2.51	399	16	16
3	43	105.7	20.4	0	124	2.59	296	14	15

Test Results	Material Description
R-value at 300 psi exudation pressure = 15	Very dark gray Lean CLAY with SAND (CL)

Project No.: 879.5

Project: Lower Sacramento Road at UPRR

Source of Sample: Boring B5 **Depth:** 2.0-4.0 ft.

Sample Number: B5-08, Bag H

Date: 5/5/2010

R-VALUE TEST REPORT

Blackburn Consulting

Tested by: KAO

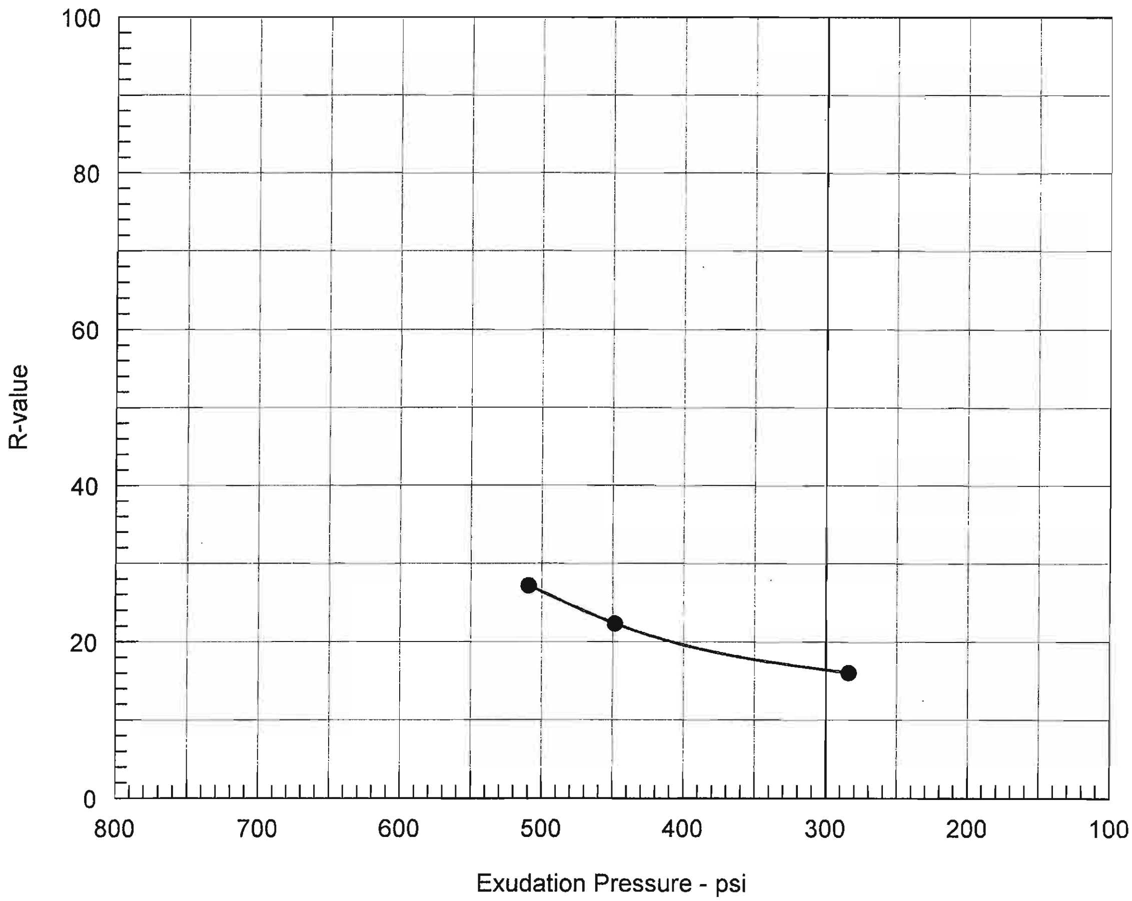
Checked by: RBL

Remarks:

* Depending on Traffic Index, "R"-Value by expansion could be lower than "R"-Value by Stabilometer

Figure ______

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psf	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	109	109.7	17.7	13	107	2.48	509	27	27
2	87	106.9	19.6	4	112	2.59	448	21	22
3	65	102.7	21.5	0	117	2.48	284	16	16

Test Results	Material Description
R-value at 300 psi exudation pressure = 16	Very dark grayish brown Lean CLAY with SAND (CL)

Project No.: 879.5

Project: Lower Sacramento Road at UPRR

Source of Sample: Boring B6 **Depth:** 2.0-4.0 ft.

Sample Number: B6-08, Bag J

Date: 5/5/2010

Tested by: KAO

Checked by: RBL

Remarks:
* Depending on Traffic Index, "R"-Value by expansion could be lower than "R"-Value by Stabilometer

R-VALUE TEST REPORT

Blackburn Consulting

Figure ______

ATTACHMENT H

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 10/06/2006
Date Submitted 10/02/2006

To: Kristy Chapman
Blackburn Consulting
2437 Front Street
West Sacramento, CA 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : N.STOCKTON-RR/BRIDGE Site ID : B2-1B.
Your purchase order number is 879.1.
Thank you for your business.

* For future reference to this analysis please use SUN # 48999-97622.

EVALUATION FOR SOIL CORROSION

Soil pH	8.24		
Minimum Resistivity	4.56	ohm-cm (x1000)	
Chloride	27.4 ppm	00.00274	%
Sulfate	18.3 ppm	00.00183	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

ATTACHMENT H

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 10/06/2006
Date Submitted 10/02/2006

To: Kristy Chapman
Blackburn Consulting
2437 Front Street
West Sacramento, CA 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : N.STOCKTON-RR/BRIDGE Site ID : B2-8B. (2006)
Your purchase order number is 879.1.
Thank you for your business.

* For future reference to this analysis please use SUN # 48999-97623.

EVALUATION FOR SOIL CORROSION

Soil pH	8.03	
Minimum Resistivity	1.26 ohm-cm (x1000)	
Chloride	16.4 ppm	00.00164 %
Sulfate	3.9 ppm	00.00039 %

METHODS
pH and Min.Resistivity CA DOT Test #643 Mod.(Sm.Cell)
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

ATTACHMENT H

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 10/06/2006
Date Submitted 10/02/2006

To: Kristy Chapman
Blackburn Consulting
2437 Front Street
West Sacramento, CA 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : N.STOCKTON-RR/BRIDGE Site ID : B2-15. (2006)
Your purchase order number is 879.1.
Thank you for your business.

* For future reference to this analysis please use SUN # 48999-97624.

EVALUATION FOR SOIL CORROSION

Soil pH	7.90		
Minimum Resistivity	2.57	ohm-cm (x1000)	
Chloride	15.1 ppm	00.00151	%
Sulfate	14.5 ppm	00.00145	%

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

ATTACHMENT H

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 05/09/2008
Date Submitted 05/06/2008

To: John Massetti
Blackburn Consulting
2437 Front Street
W. Sacramento, CA 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : LWR SAC.RD@UPRR TRKS Site ID : B1-12B.
Your purchase order number is 879.5.
Thank you for your business.

* For future reference to this analysis please use SUN # 53179-106449.

EVALUATION FOR SOIL CORROSION

Soil pH	7.02	
Minimum Resistivity	1.31 ohm-cm (x1000)	
Chloride	19.6 ppm	00.00196 %
Sulfate	12.9 ppm	00.00129 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

ATTACHMENT H

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 04/09/2008
Date Submitted 04/02/2008

To: John Massetti
Blackburn Consulting
2437 Front Street
W. Sacramento, CA 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : LWR SAC.RD@UPPR TRKS Site ID : B2-10B.
Your purchase order number is 879.5.
Thank you for your business.

* For future reference to this analysis please use SUN # 52890-105811.

EVALUATION FOR SOIL CORROSION

Soil pH	7.74	
Minimum Resistivity	1.02 ohm-cm (x1000)	
Chloride	8.8 ppm	00.00088 %
Sulfate	16.6 ppm	00.00166 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Sunland Analytical
11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 04/09/2008
Date Submitted 04/02/2008

To: John Massetti
Blackburn Consulting
2437 Front Street
W. Sacramento, CA 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : LWR SAC.RD@UPPR TRKS Site ID : B8-5.
Your purchase order number is 879.5.
Thank you for your business.

* For future reference to this analysis please use SUN # 52890-105812.

EVALUATION FOR SOIL CORROSION

Soil pH	7.46	
Minimum Resistivity	2.65 ohm-cm (x1000)	
Chloride	11.4 ppm	00.00114 %
Sulfate	12.3 ppm	00.00123 %

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422