FOR CONTRACT NO.: **03-3E4404**
PROJECT ID: 0300020000

INFORMATION HANDOUT

FOUNDATION REPORT
(DATED AUGUST 18, 2010)

LOCATION: 03-GLE-5734

M e m o r a n d u m

Flex your power!
Be energy efficient!

To: MR. SEAN SAMUEL
Branch Chief, Structure Design Section 2
Office of Transportation Architecture
Structure Design Services &
Earthquake Engineering
Division of Engineering Services

Date: August 18, 2010

File: 03-GLE-5734
(11M5734)
03-3E4401
New Crew
Building
(939 N. Humboldt
Avenue)

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES – MS 5

Subject: **Foundation Report**

INTRODUCTION

As requested, the Office of Geotechnical Design North (OGDN) has prepared this Foundation Report (FR) for the proposed Maintenance Station Crew building to be located at the existing Caltrans Maintenance facility at 939 North Humboldt Avenue, in Willows, Glenn County (see Plate No. 1).

Scope of work

The scope of our work included performing a literature and historical review in an effort to obtain geological and geotechnical data pertaining to the subject site that could provide insight into the design and construction of the proposed facilities. A field exploration program was implemented which included the drilling of exploratory borings in an effort to characterize the subsurface conditions and collect samples. Upon completion of the field exploration program, laboratory testing of selected samples was performed. Subsequently we have performed our engineering analysis and prepared this report summarizing our findings, conclusions and recommendations.

The purpose of this report is to document subsurface geotechnical conditions, provide analyses of anticipated site conditions as they pertain to the project described herein, and to recommend design and construction criteria for the project. This report also

establishes a geotechnical baseline to be used in assessing the existence and scope of changed site conditions.

Proposed Structure

The proposed crew building is to be composed of offices, a crew/locker room, a storage radio room, an electrical HVAC room, and restrooms. The building is to be constructed in the center area of the existing Willows Caltrans Maintenance Station, where a concrete loading dock exists and is proposed for removal. The crew building will consist of a single-story, 42 feet by 30 feet rectangular-shaped, roughly 42,000 ft^2 building with metal stud walls, and Portland cement concrete (PCC) slab-on-grade interior floors. Plywood sheathing and metal roofing supported by pre-engineered roof truss are also proposed. A column-supported canopy is proposed on the front of the building. Maximum dead plus live loads (DL+LL) for the proposed crew building are anticipated to be on the order of 3.2 kips for point (column) loads, and 1 kips/ft for running (wall) loads. Isolated spread footings are only proposed on the exterior of the building to support the canopy. The Finish Floor (FF) elevation for the new building is proposed at approximately142.7 feet. Based on a provided topography plan (see Plate No. 2) it appears that the proposed depth of fill to bring the building pad to subgrade will be roughly 12 inches and less. A Portland cement concrete (PCC) walkway is proposed on the entire exterior perimeter of the building and is proposed to be abutting flush with the encompassing asphalt concrete pavement. No landscaping areas are proposed adjacent to or near the crew building. Our understanding of the project is based upon plans and information provided by the Caltrans Division of Engineering Services, Office of Transportation Architecture and North Region Project Development, Office of Design East, Design Branch M2. Specifically, the "Willows MS Office" draft foundation plans and details (Reference No. 12) where reviewed.

Field Study Program and Laboratory Testing

The subsurface exploration program for the proposed crew building was performed on May 17 and 18, 2010. Two borings was accomplished with a Mobile B47 trailer-mounted drill rig utilizing hollow-stem augering methods. Approximate boring locations are shown on the attached Site Plan, Plate No. 2. An engineer maintained a log of the borings and visually classified encountered soils in accordance with the Caltrans "Soil and Rock Logging. Classification, and Presentation Manual" (2010 Edition). "Relatively undisturbed" samples were collected at various depths from borings by advancing a "Standard Penetration Test" (SPT) sampler (2.0 inch O.D.) or a "California Modified" (2.5 inch O.D.) sampler with a "safety driver" that utilizes a standard striking force with a weight of 140 lb dropped 30 inches. Based on the Caltrans 2005 hammer efficiency report (Reference No. 4) the equipment utilized was measured to have an average

hammer efficiency (ER_i) of 68%. The depth to the groundwater surface was measured in the boring during drilling and in the open hole upon completion of drilling and extraction of the augers. The open borehole was then backfilled with site soils and bentonite chips.

Selected samples were returned to the Transportation Laboratory for reference and testing. Laboratory testing was performed to assist in soil classification and determining the engineering characteristics of site materials. Laboratory testing included particle size analysis (ASTM D 422), Atterberg Limits (AASHTO T 89 and T 90), moisture (ASTM D 2216), unit weight (ASTM D 4767), Expansion Index (ASTM D 4829), and pH and resistivity (CTM 643). Although sulfate content (CTM 471) and chloride content (CTM 422) testing was requested, per the 2003 Caltrans Corrosion Guidelines (Reference No. 3) they were not performed because: "…soil and water are not tested for chlorides and sulfates if the minimum resistivity is greater than 1,000 ohm-cm because a minimum resistivity greater than 1,000 ohm-cm indicates that the chloride and sulfate contents are low (i.e., low corrosion potential)." The results of laboratory testing are provided in the attached appendix.

FINDINGS

Site Description

The site of the proposed crew building consists of a roughly 3 acre, rectangular shaped Caltrans Maintenance Station facility located at 939 North Humboldt Avenue, in the city of Willows. The facility's latitude and longitude coordinates are 39.531055^o North and 122.212944^o West (these coordinates are the basis for obtaining data in this report available through GIS related information sources). The facility is bounded on the south and west by US Forest Service office facilities. North Humboldt Avenue bounds the site to the east and separates the property from residential land to the east. A Southern Pacific Railroad line bounds the property to the north and separate the site from farmland to the north. The ground surface of the Maintenance Facility is relatively flat with elevations ranging between roughly 140 and 143 feet (see Plate No. 2). The facility is primarily comprised of asphalt concrete pavement throughout, with the exception of a landscape buffer zone on the east edge. A shop building, wash rack, storage bunkers, carport and other associated structures are located near the north, south, and east perimeters of the facility. An approximately 3 feet high concrete loading dock exists in the center area of the site. During our field reconnaissance, no significant distress was noted on the existing building and interior floors.

The above site description is based upon a review of available project documents, air photos, and information provided by Caltrans support personnel, and on data collected during the various site visits in May of 2010.

Subsurface Conditions

Geologic Setting

The project site lies on the northwest margin of the Great Valley Geomorphic Province in Northern California. In general, the geology in the vicinity of the site can be characterized by younger (Holocene) alluvial sediments deposited under present day stream and river systems that drain the Coast Ranges to the west. Locally, older (Pleistocene) alluvial fans and terraces are presently being dissected by the Holocene stream channels.

Site Geology

Based on review of published geologic mapping of the region (USGS, 1985, Reference No. 1), the immediate site is underlain by Holocene Basin Deposits (Qb) described as dark gray to black, fine-grained silt and clay, and is indicated to be the distal facies of Holocene alluvium (Qa) derived from present-day stream and river systems.

Subsurface Materials Encountered

The following description is based subsurface exploration in the proposed crew building location and the results of laboratory testing,

Near surface site conditions consist of a pavement structural section at the ground surface composed of 4 to 5 inches of asphalt concrete overlying roughly 12 to 18 inches of pavement base course gravel. Native materials underlying the pavement section are composed of 1.5 to 2 feet of grayish brown, stiff, lean clay with sand, overlying brown to light brown, stiff to hard, lean clay extending to a maximum depth explored of 41.5 feet below the ground surface (BGS).

The near surface lean clay materials immediately underlying the pavement base coarse tested to an Expansion Index (EI) of 45, indicating the material to "be considered expansive" in accordance with 2007 CBC section 1802.3.2. ASTM 4829-08a indicates the material to have a 'low' classification of expansion potential. A more detailed presentation of the subsurface conditions encountered during site subsurface exploration is presented on the attached Boring Records (see Appendix).

Groundwater

During site subsurface exploration on May 17 and 18, 2010, on the completion of drilling, a free groundwater surface was measured in the open borehole of Boring A-10-001 at an approximate depth of 17.5 feet below the ground surface, which would correspond to an elevation of 125.8 feet. Based on review of the latest available (2008) Department of Water Resources Sacramento Valley groundwater water contour maps (see Reference No. 8), groundwater elevations beneath the site ranged between a high of approximately 132 feet for spring of 2008 and a low of approximately 122 feet for the summer of 2008.

Faults

The Caltrans ARS Online web tool (http://10.160.173.178/shake2/shake_index2.php) indicates that the closets late Quaternary (active in the past 700,000 years) fault to the site is the Holocene Great Valley Fault. The web tool indicates the closest surface trace of this fault to be a distance of approximately 4.4 miles west of the project site, and that this fault is a "normal" fault type capable of generating a Maximum Movement Magnitude (Mmax) of 6.7. The site is not within an Alquist-Priolo Earthquake Fault Zone. No faults are known to cut Quaternary valley alluvium at or near the project site.

Seismicity

Based on shear wave velocity correlations presented in the "Geotechnical Services Design Manual" (Reference No. 11), the average small strain shear wave velocity for the upper 30 meters (Vs_{30}) of materials at the project site is estimated to be approximately 1,000 ft./sec. The Caltrans ARS Online web tool indicates the depth to rock-like (Vs = 3,200 ft./sec) materials is roughly 1,000 feet. Table No. 1 presents the peak ground acceleration (PGA) for the site for various probabilities (based on the 2008 USGS National Seismic Hazard Maps).

Table 1. Probabilistic Peak Ground Acceleration (PGA)

PGA (%g) for Vs_{30} = 2,500 feet/sec (CBC Site Class B/C boundary) [1]	**PGA (%g) for Vs_{30} = 750 feet/sec (CBC Site Class D) based on soil amplification factor** [2]	**Probability of Exceedance in 50 years**	**Return Period**
29.8	36.0	2 %	2,475 years
20.2	24.4	5 %	975 years
15.4	18.6	10 %	476 years

Notes:

[1] PGA for Vs_{30}=2,500 ft./sec obtained from the 2008 USGS National Seismic Hazard Maps (at http://gldims.cr.usgs.gov/nshmp2008/viewer.htm) and the Caltrans ARS Online Probabilistic Response Spectrum Spread Sheet.

[2] Soil amplification factor of 1.208 (at a period, T=0 seconds) obtained from the Caltrans ARS Online Probabilistic Response Spectrum Spread Sheet.

Geotechnical Hazards

Liquefaction and Seismically Induced Settlement

Stiff to very stiff clays materials were encountered beneath the site. The guidelines presented by the Southern California Earthquake Center (SCEC, see Reference No. 2) indicate these materials to be considered "non-liquefiable" and not susceptible to severe strength loss due to earthquake induce ground shaking. Hence, the potential for liquefaction at the site due to seismically induced ground shaking is considered to be very low. Based on the SCEC guidelines, significant ground settlement associated with seismically induced ground shaking is not expected to occur.

CONCLUSIONS AND RECOMMENDATIONS

General

Based on the results of our findings, OGDN concludes that the site appears capable to receive the proposed maintenance station facility improvements provided the recommendations presented in this report are incorporated into the design and construction of the project.

Expansive Materials

It is acceptable to place the proposed crew building on the 'low" potentially expansive materials encountered beneath the pavement structural section on the site provided the recommendations contained in this report incorporated in to the project construction. It should be noted that the crew building will is proposed to not have landscaping adjacent to or near the building and canopy foundations, which in effect can lower the potential for post-construction related building distress related to expansive soils.

Earthquake and Seismic Design

Based on the subsurface conditions encountered at the site, and the calculated Vs_{30} (see "Seismicity" section), a Site Class "D" is recommended in accordance with Section 1613 of the 2007 CBC. Table No. 2 provides the 2007 CBC site coefficients and mapped spectral accelerations recommended for the project site. Recommendations for foundation design for lateral and vertical seismic loading are provided in the "Foundation Design" section below.

Table No. 2. Recommended Seismic Ground Motion Values [1]
for Section 1613.5 of the 2007 CBC.

Period (seconds)	Mapped Spectral Response Acceleration Parameter (as a fraction of g) [2]	Site Coefficient for Site Class "D"[3]
0.2	$S_s = 0.722$	$F_a = 1.223$
1.0	$S_1 = 0.284$	$F_v = 1.833$

Notes:

[1] Values derived by the USGS "Ground Motion Parameter Calculator" (available at http://earthquake.usgs.gov/research/hazmaps/design/) for the NEHRP 2003 Seismic Design Provisions. It is the understanding of OGDN that these provisions are the basis for the values presented on Tables 1613.5.3(1) and (2), and Figures 1613.5(3) and (4) of the 2007 CBC.

[2] Parameters based on Site Class "B" and a 2% probability of exceedance in 50 years

[3] Site Coefficients based on linear interpolation of intermediate values of 2007 CBC Tables 1613.5.3(1) and (2).

Site Preparation

Following the demolition and clearing operations, all depressions extending below final grade resulting from the removal of deleterious materials or soft/loose soils, root systems, and above and below ground facilities should be processed properly and backfilled in accordance with Caltrans Standard Specifications.

Fill Materials

Based on the proposed building development, fill material is anticipated to be imported to the site relatively limited in extent. In an effort to provide continuity between the existing near-surface pavement base course materials, fill material should consist of Caltrans Class 2 Aggregate Base and compacted in accordance with Caltrans Standard Specifications.

Excavations

Instability and caving of excavation sidewalls could be expected to occur in the existing near-surface pavement base coarse materials on the site when trenching for footings and underground utility construction. At no time should someone be allowed to enter excavations unless the excavations are properly shored or sidewalls sloped in accordance with OSHA requirements. Excavations and trenches (either open or backfilled) that parallel structures should be planned so they do not extend below a plane having a downward slope of 1:2 (V:H) from a line 9 inches above the bottom edge of footings, and should be no closer than 18 inches from the closest edge of a footing. All trench backfill

extending into the proposed crew building area should meet the requirements of "Fill Material" above.

Foundations

Corrosion Potential of Foundation Elements

In accordance with 2003 Caltrans Corrosion Guidelines (Reference No. 3), the Department considers a site to be corrosive to foundation elements if one or more of the following conditions exist for the representative soil and/or water samples taken at the site:

1) Chloride concentration is greater than or equal to 500 ppm,
2) sulfate concentration is greater than or equal to 2000 ppm,
3) or the pH is 5.5 or less.

Two soil samples were obtained for corrosion analyses at the following locations and were combined in the lab:

Boring ID. A-10-001;2.0 to3.5 feet BGS (Bulk A), and
Boring ID: A-10-002;1.5 to 3.5 feet BGS (Bulk E).

Sulfate content (CTM 471) and chloride content (CTM 422) testing was not performed per the 2003 Caltrans Corrosion Guidelines which states "…soil and water are not tested for chlorides and sulfates if the minimum resistivity is greater than 1,000 ohm-cm because a minimum resistivity greater than 1,000 ohm-cm indicates that the chloride and sulfate contents are low (i.e., low corrosion potential)." Based on the results of the corrosion testing (see Plate A-3, attached appendix), the site is considered "non-corrosive" per the 2003 Caltrans Corrosion Guidelines.

Spread Footing Design

A continuous, reinforced foundation should be utilized for the building perimeter to act as a "cut-off" to help minimize moisture infiltration and variations beneath the interior slab-on-grade. The proposed one story crew building may be supported upon continuous spread foundations that extend at least 18 inches below the lowest adjacent compacted soil grade. If required, isolated spread footings within the interior of the proposed building should extend at least 12 inches below lowest adjacent compacted soil grade. The draft foundation plans and details provided for the project (Reference No. 12) indicate that the top of the perimeter concrete apron will match the interior finish floor; Therefore, the lowest adjacent compacted soil grade for the perimeter footing would be the surface on which the capillary break material layer (see "Slab-on-grade" section) is

placed. Isolated spread footings proposed to support the exterior canopy should extend a minimum of 18 inches below lowest adjacent soil grade. Continuous foundations should be at least 12 inches wide; isolated spread foundations should be at least 18 inches wide.

Foundations may be sized for maximum allowable soil pressures of 2,250 pounds per square foot (psf) for dead plus live load, with an allowable one-third increase for total load to evaluate the short-term effects of seismic or wind forces. The weight of the foundation concrete extending below lowest adjacent soil grade may be disregarded in sizing computations. The draft foundation plans and details provided for the project (Reference No. 12) indicate the building foundations will be reinforced with a minimum of four No. 5 rebar, placed two near the top and two near the bottom of the footing section. This minimum reinforcement is adequate for minimizing the effects of expansive soils, and providing structural continuity and permit spanning of local subgrade irregularities.

Estimated Settlement

It is estimated that post-construction total and differential settlement of spread footings design in accordance with the recommendations of this memo will not exceed about ¾ inch and ½ inch, respectively.

Foundation Resistance to Lateral Loads

Resistance to lateral displacement of foundations may be computed using an allowable friction factor of 0.25 multiplied by the effective vertical load on each foundation. Additional lateral resistance can be achieved by considering passive soil resistance against the vertical projection of the foundation equal to an equivalent fluid pressure of 250 psf per foot of depth. These two modes of resistance (friction and passive pressure) should not be added unless the frictional component is reduced by 50 percent due to the mobilizations of the resistive force occurring at different degrees of horizontal movement.

Slab-on-Grade

The draft foundation plans and details provided for the project (Reference No. 12) indicate the interior floor slab will be reinforced with a minimum of No. 3 rebar placed at 18 inches on center spacing, each way, throughout the slab. Based on the proposed finish floor elevation of 142.7 feet, the depth to potentially expansive materials below the base of the interior floor slab concrete will be at least 30 inches. Hence, the proposed reinforcement should be adequate in minimizing the potential for expansive soil related cracking of the slab-on-grade floor. During construction, accurate and consistent location of the reinforcement at the middle third of the slab section (preferably with plastic rebar chairs with a large round base support, see below) is essential to its performance, and the risk of uncontrolled drying shrinkage slab cracking is increased if the reinforcement is not properly located within the slab.

Moisture Penetration Resistance

To reduce the potential for water and water vapor transmission upward through concrete slab-on-grade, the concrete slab should be constructed on a minimum 4-inch thick layer of capillary break material covered with a vapor retarder. The capillary break material should be a free-draining material complying with Class 1, Type B Permeable Material of the Caltrans Standard Specifications (Section 68).

The vapor retarder should be at least 10-mil in thickness and should meet the material requirements in ASTM Standard Specification E-1745. The design and selection of the vapor retarder Class (per ASTM E-1745) should be based on the standard practices presented in ASTM E 1643. These standard practices include the ability to withstand tear and puncture damage based the anticipated construction operations (such as vehicle traffic), and on the properties of the material directly beneath the vapor retarder. If angular crushed stone is used for the capillary material and/or heavy construction vehicle traffic is expected directly on the vapor retarder, it is recommended that the vapor retarder should be at least 15 mil thickness and have a minimum puncture resistance meeting or exceeding that of the ASTM E 1745 “A” Performance Class.

Installation of the vapor retarder should also meet the standard practices of ASTM E 1643, in addition to the manufacturer’s specifications. The ASTM E 1643 standard practices for installation include overlapping seams by at least 6 inches, taping seams, and sealing penetrations in the vapor retarder. These standard practices also include protection measures during construction, such as utilizing rebar supports with base sections that minimize the potential for puncture of the vapor retarder (such as plastic rebar chairs with a large round base support).

The American Concrete Institute (ACI) Committee document ACI 302.2R-06 (Reference No. 6) provides guidelines for reducing moisture migration through slabs-on-grade. This document recommends that concrete slabs be cast directly on the vapor retarder (ACI 302.2R-06, Section 9.3) and provides guidelines for selecting vapor permeance, tensile strength and puncture resistance. When casting the slab directly on the vapor retarder, a reduced joint spacing, low shrinkage mix design (including water-reducing admixtures), and/or other appropriate measures should be used to control slab curl, shrinkage cracking, and the potential for concrete blistering and delaminating associated with performing finishing operations prior to the extended period of bleed-water rise. As an option, a "blotter" layer consisting of 2 inches of sand could be placed on top of the vapor retarder membrane to aid in proper curing of the slab concrete. However, the potential exists for trapping of moisture in the sand layer above the vapor retarder membrane from water sources such as rainfall, saw cutting operations, and excessive concrete bleed-water. The benefits of proper concrete curing would have to be weighed against efforts to reduce slab moisture vapor transmission.

The ACI guide also notes that a maximum water-cement ratio of 0.5 has yielded satisfactory performance on many slab-on-grade projects. However, the water-cement ratio is recommended to be lowered, if appropriate, to meet the manufacture's specifications for proposed floor covering. After proper curing, the slabs should be allowed to dry and then should be tested to check that the moisture rate is appropriate for the intended floor covering.

If relatively higher loading on the floor slab is anticipated (exceeding 250 psf), the capillary break material should be replaced with compacted Caltrans Class 2 aggregate base. The Class 2 aggregate base will not serve as an effective capillary break; hence, a moisture-protection specialist should approve this slab support prior to final design. The use of blotter sand beneath relatively higher loaded slabs is not recommended as a considerable reduction in the effective subgrade support can occur.

The recommendations contained in this report concerning foundation and floor slab design are presented as minimum requirements, in respect to geotechnical engineering only. Use of the capillary break material and vapor retarder is not considered to "moisture proof" the slab, nor does it assure that slab moisture transmission levels will prevent damage to floor coverings or other building components. It is emphasized that OGDN does not provide slab moisture proofing or moisture protection expertise. If increase concrete moisture proofing protection is desired, a concrete moisture protection specialist should be consulted.

If you have any questions or comments, please call Mark Hagy at (916) 227-1077 or Douglas Brittsan at (916) 227-1079.

MARK HAGY, P.E., G.E.
Transportation Engineer
Office of Geotechnical Design North, Branch C

Attachments
References
Plate No. 1. Vicinity Map
Plate No. 2: Site Plan
Appendix
Boring Record (A-10-001); 2 Sheets
Boring Record (A-10-002); 1 Sheet
Boring Record Legend; 3 Sheets
Table No. A-1: Summary of Laboratory Test Results
Plate No. A-1: Atterberg Limits Test
Plate No. A-2: Expansion Index Testing Results
Plate No. A-3: Corrosion Testing Results

ecopy: M. Gibb, DPE
N. Dakak, PM
M. Willian, GS Corporate
SC RE Pending File
DES OE
J. Peterson, DME
D. Brittsan, OGDN
OGDN File

REFERENCES

1. USGS (1985) "Geologic Map of Late Cenozoic Deposits of the Sacramento Valley and Northern Sierran Foothills, California", By Edward J. Helley and David S. Harwood, U.S. Geological Survey Miscellaneous Field Studies Map MF-1790, Scale: 1:62,500.

2. SCEC (1999) "Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California", Southern California Earthquake Center, University of Southern California, Los Angeles, March 1999.

3. Caltrans (2003) "Corrosion Guidelines", Corrosion Technology Branch, Materials Engineering and Testing Services, Caltrans, Version 1.0, September 2003.

4. Caltrans (2005) "Standard Penetration Test Energy Testing and Hammer Efficiency Measurements", Foundation Testing Branch, Caltrans Geotechnical Services, dated December 7, 2005.

5. Caltrans (2006) "Caltrans Seismic Design Criteria", version 1.4, California Department of Transportation, dated June 2006.

6. ACI (2006) "Guide for Concrete Slabs that Receive Moisture Sensitive Flooring Materials", reported by the ACI Committee 302, ACI 302.2R-06, effective August 15, 2006.

7. ASTM (2008) "Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring", ASTM Designation F 710-08, approved January 1, 2008.

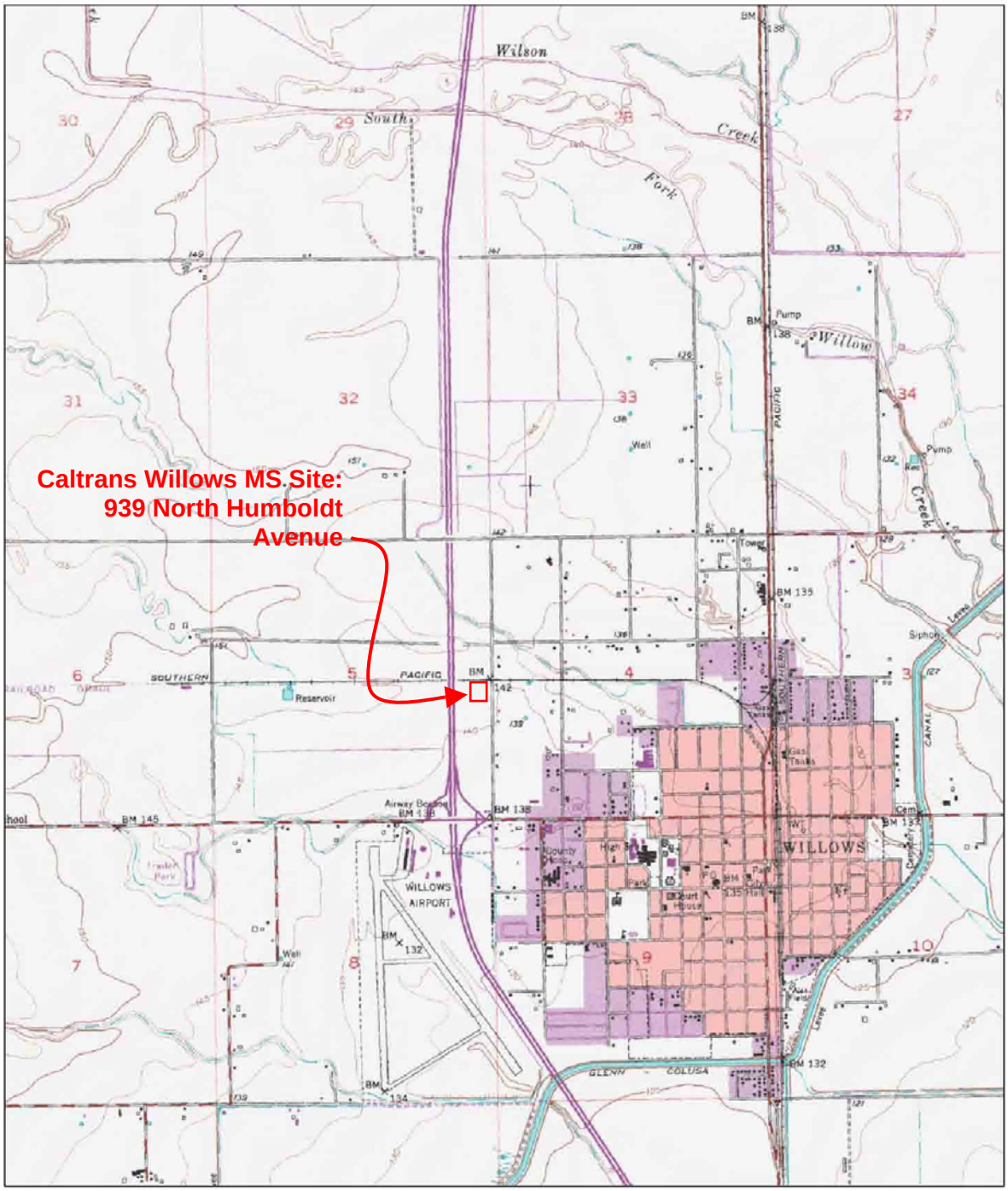
8. DWR (2008) Sacramento Valley Groundwater Elevation Map (for Spring, Summer and Fall 2008), California Department of Water Resources, Northern District, obtained at: http://www.nd.water.ca.gov/PPAs/GroundwaterBasins/GroundwaterLevel/index.cfm

9. ASTM (2009) "Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs", ASTM Designation E 1643-09, approved February 15, 2009.

10. ASTM (2009) "Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs", ASTM Designation E 1745-09, approved February 15, 2009.

11. Caltrans (2009) "Geotechnical Services Design Manual", Version 1.0, Division of Engineering Services, Geotechnical Services, Caltrans, August 2009.

12. Caltrans (2010) "Willows MS Office" draft foundation plans and details (Sheets ST1-1, ST-3 and ST-4, provided by the Division of Engineering Services, Architectural and Structural Design, revision date 6-28-10)



CALTRANS
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - North

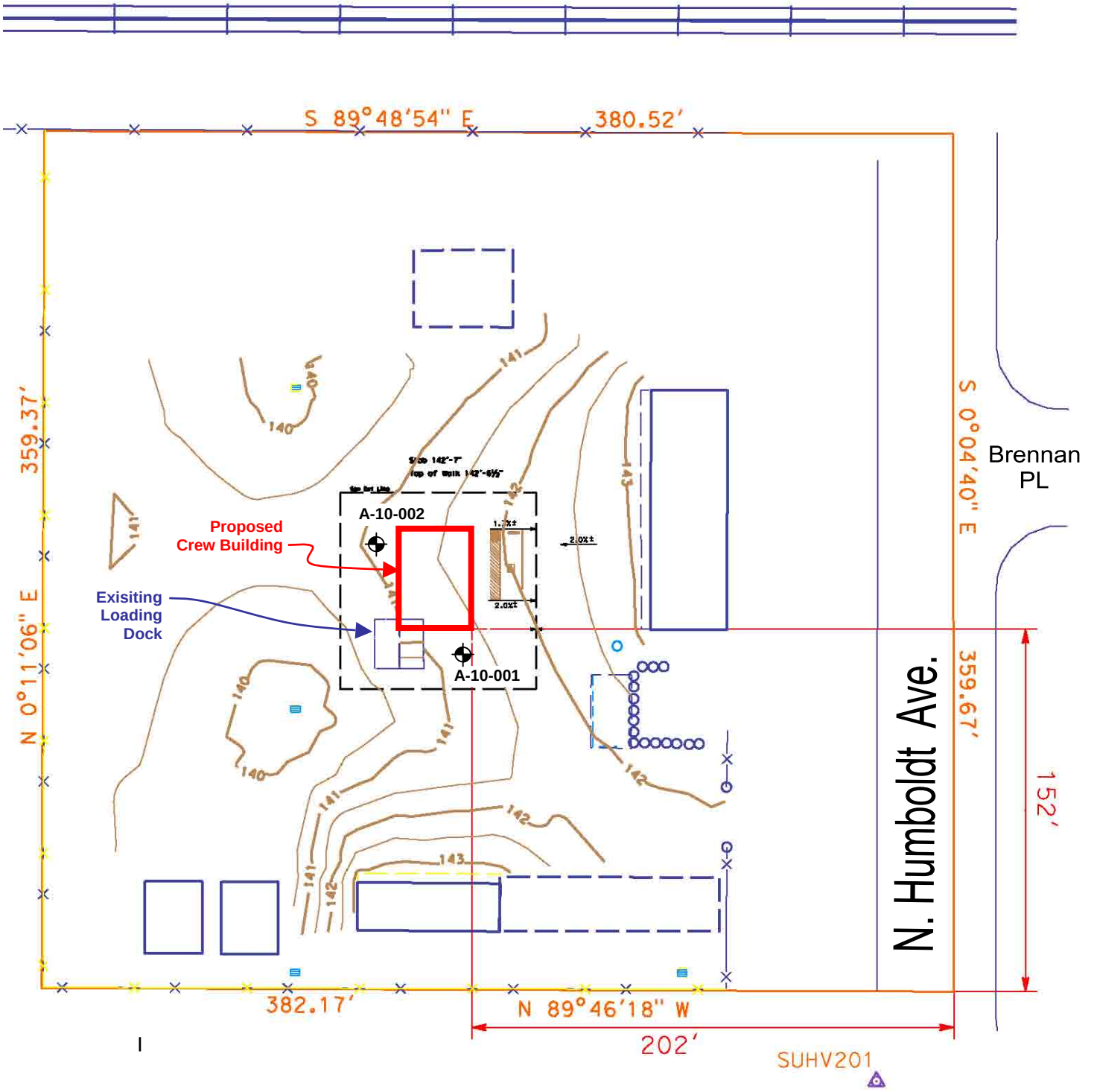
EA: 03-3E4401

Date: August 2010

VICINITY MAP

03-GLE-5734
WILLOWS MS CREW BUILDING
FOUNDATION REPORT

Plate No. 1



APPROXIMATE SCALE: 1 inch = 60 feet

0 25 50 75 100 feet

LEGEND

A-10-001 — **Approximate Location of Boring No. A-10-001, typical.**

Base Plan Reference: Base plan from Microstation file 3e440base.dgn; emailed on 8/13/10 by Caltrans North Region Project Development, Office of Design East, Design Branch M2 (elevations in feet).

CALTRANS Division of Engineering Services Geotechnical Services Office of Geotechnical Design - North	EA: 03-3E4401 Date: August 2010	**SITE PLAN**
	03-GLE-5734 **WILLOWS MS CREW BUILDING** **FOUNDATION REPORT**	PLATE No. 2

03-GLE-5734
11M5734
WILLOW MS
CREW BUILDING
FOUNDATION REPORT

APPENDIX

Boring Record (A-10-001); 2 Sheets
Boring Record (A-10-002); 1 Sheet
Boring Record Legend; 3 Sheets
Table No. A-1: Summary of Laboratory Test Results
Plate No. A-1: Atterberg Limits Test
Plate No. A-2: Expansion Index Testing Results
Plate No. A-3: Corrosion Testing Results

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
M. Hagy	5-17-10	5-18-10		A-10-001
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION ~141.3 ft
DRILLING METHOD Hollow-Stem Auger			DRILL RIG Mobile B47	BOREHOLE DIAMETER 6 in
SAMPLER TYPE(S) AND SIZE(S) (ID) SPT (1.4"), Mod. Cal (2.0")			SPT HAMMER TYPE safety hammer	HAMMER EFFICIENCY, ERi 68%
BOREHOLE BACKFILL AND COMPLETION betonite chips; AC cap			GROUNDWATER READINGS DURING DRILLING 18.5 ft	AFTER DRILLING (DATE) 17.5 ft on 5-18-10
				TOTAL DEPTH OF BORING 41.5 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT.												
	1		Poorly graded GRAVEL with SILT and SAND (GP-GM); medium dense; brown; moist; fine GRAVEL; about 30 to 40% coarse to fine SAND [(Base Course, Fill)].		1-1	14 9 12	21			4					
139.30	2		Lean CLAY with SAND (CL); stiff; grayish brown; moist; little coarse to fine SAND.												Bulk Sample "A"; 2.0' to 3.5 feet depth PI
	3				1-2	12 12 11	23					PP = 1.5			
			Dark brown; trace fine GRAVEL.												
137.30	4		Well-graded SAND (SW); gray; moist.							21	100				
			Lean CLAY (CL); stiff; brown; moist.												
	5				1-3	5 7 9	16					PP = 3.0			
135.30	6		Very stiff.							20	96				Bulk Sample "B"; 6.0' to 9.0 feet depth
	7														
133.30	8									21					PI
	9														
131.30	10				1-4	8 14 20	34					PP = 4.0			
	11		Hard.												
129.30	12														
	13														
127.30	14														
	15		Light brown.		1-5	8 15 20	35					PP = 4.5			
125.30	16														
	17														
123.30	18		Wet.												Bulk Sample "C"; 18.0' to 20.0 feet depth
	19									23					PI
121.30	20				1-6	7 11 13	24			25		PP = 3.75			
	21		Very stiff.												
119.30	22														
	23														
117.30	24														
	25														

(continued)

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - North

REPORT TITLE BORING RECORD				HOLE ID A-10-001
DIST. 03	COUNTY GLE	ROUTE 5	POSTMILE 9.9	EA 03-3E4401
PROJECT OR BRIDGE NAME WILLOWS MS NEW CREW BUILDING				
BRIDGE NUMBER 11M5734	PREPARED BY M. Hagy		DATE 8-16-10	SHEET 1 of 2

5 BR - STANDARD GLE5MS5734PM9.87.GPJ CALTRANS_LIBRARY_DEC09.GLB 8/16/10

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	25		Grayish brown; trace fine SAND; black and rust mottling.		1-7	6 9 15	24					PP = 3.5			
115.30	26		Lean CLAY (CL) *(continued)*.												
	27														Bulk Sample "D"; 27.0' to 30.0 feet depth
113.30	28														
	29														
111.30	30		Hard.		1-8	9 18 25	43					PP = >4.5			
	31														
109.30	32														
	33														
107.30	34														
	35		Stiff.		1-9	6 8 8	16					PP = 1.75			
105.30	36														
	37														
103.30	38														
	39														
101.30	40		Lean to fat CLAY (CL/CH); hard; reddish brown; moist; white mottling.		1-10	9 17 24	41					PP = 4.5			
	41														
99.30	42		Bottom of borehole at 41.5 ft bgs												
	43														
97.30	44														
	45														
95.30	46														
	47														
93.30	48														
	49														
91.30	50														
	51														
89.30	52														
	53														
87.30	54														
	55														

5 BR - STANDARD GLE5MS5734PM9.87.GPJ CALTRANS_LIBRARY_DEC09.GLB 8/16/10

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - North

REPORT TITLE: **BORING RECORD**				HOLE ID: **A-10-001**
DIST.: **03**	COUNTY: **GLE**	ROUTE: **5**	POSTMILE: **9.9**	EA: **03-3E4401**
PROJECT OR BRIDGE NAME: **WILLOWS MS NEW CREW BUILDING**				
BRIDGE NUMBER: **11M5734**	PREPARED BY: **M. Hagy**		DATE: **8-16-10**	SHEET: **2 of 2**

LOGGED BY	BEGIN DATE	COMPLETION DATE	BOREHOLE LOCATION (Lat/Long or North/East and Datum)	HOLE ID
M. Hagy	5-18-10	5-18-10		A-10-002
DRILLING CONTRACTOR			BOREHOLE LOCATION (Offset, Station, Line)	SURFACE ELEVATION ~141.1 ft
DRILLING METHOD Hollow-Stem Auger			DRILL RIG Mobile B47	BOREHOLE DIAMETER 6 in
SAMPLER TYPE(S) AND SIZE(S) (ID) SPT (1.4"), Mod. Cal (2.0")			SPT HAMMER TYPE safety hammer	HAMMER EFFICIENCY, ERi 68%
BOREHOLE BACKFILL AND COMPLETION betonite chips; AC cap			GROUNDWATER READINGS DURING DRILLING not encountered AFTER DRILLING (DATE)	TOTAL DEPTH OF BORING 15.0 ft

ELEVATION (ft)	DEPTH (ft)	Material Graphics	DESCRIPTION	Sample Location	Sample Number	Blows per 6 in.	Blows per foot	Recovery (%)	RQD (%)	Moisture Content (%)	Dry Unit Weight (pcf)	Shear Strength (tsf)	Drilling Method	Casing Depth	Remarks
	0		ASPHALT.												
	1		Poorly graded GRAVEL with SILT and SAND (GP-GM); medium dense; brown; moist; fine GRAVEL; about 30 to 40% coarse to fine SAND [(Base Course, Fill)].		2-1	13 13 12	25			20	93				Bulk Sample "E"; 1.5' to 3.5 feet depth PI
139.10	2		Lean CLAY with SAND (CL); stiff; grayish brown; moist; little coarse to fine SAND.												
	3		Trace fine GRAVEL.		2-2	9 14 20	34			20	101	PP = 2.25			
137.10	4		Lean CLAY (CL); very stiff; brown; moist.												
	5				2-3	5 4 6	10			20	98	PP = 4.0			
135.10	6		Trace fine SAND. Hard.												
	7														
133.10	8														
	9														
131.10	10				2-4	8 13 16	29			17		PP = 4.5			
	11														
129.10	12														
	13														
127.10	14				2-5	7 12 18	30								Drill rig hydraulic line break at 13.5 feet depth (can not auger); Drive sample and terminated.
	15		Bottom of borehole at 15.0 ft bgs												
125.10	16														
	17														
123.10	18														
	19														
121.10	20														
	21														
119.10	22														
	23														
117.10	24														
	25														

5 BR - STANDARD GLE5MS5734PM9.87.GPJ CALTRANS_LIBRARY_DEC09.GLB 8/16/10

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - North

REPORT TITLE BORING RECORD				HOLE ID A-10-002
DIST. 03	COUNTY GLE	ROUTE 5	POSTMILE 9.9	EA 03-3E4401
PROJECT OR BRIDGE NAME WILLOWS MS NEW CREW BUILDING				
BRIDGE NUMBER 11M5734	PREPARED BY M. Hagy		DATE 8-16-10	SHEET 1 of 1

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 elastic ELASTIC SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND

FIELD AND LABORATORY TESTS

C	Consolidation (ASTM D 2435-04)
CL	Collapse Potential (ASTM D 5333-03)
CP	Compaction Curve (CTM 216 - 06)
CR	Corrosion, Sulfates, Chlorides (CTM 643 - 99; CTM 417 - 06; CTM 422 - 06)
CU	Consolidated Undrained Triaxial (ASTM D 4767-02)
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	Liquid Limit, Plastic Limit, Plasticity Index (AASHTO T 89-02, AASHTO T 90-00)
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)
UU	Unconsolidated Undrained Triaxial (ASTM D 2850-03)
UW	Unit Weight (ASTM D 4767-04)
VS	Vane Shear (AASHTO T 223-96 [2004])

SAMPLER GRAPHIC SYMBOLS

- Standard Penetration Test (SPT)
- Standard California Sampler
- Modified California Sampler
- Shelby Tube
- Piston Sampler
- NX Rock Core
- HQ Rock Core
- Bulk Sample
- Other (see remarks)

DRILLING METHOD SYMBOLS

- Auger Drilling
- Rotary Drilling
- Dynamic Cone or Hand Driven
- Diamond Core

WATER LEVEL SYMBOLS

- First Water Level Reading (during drilling)
- Static Water Level Reading (short-term)
- Static Water Level Reading (long-term)

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - North

REPORT TITLE
BORING RECORD LEGEND

DIST.	COUNTY	ROUTE	POSTMILE	EA
03	Glenn	5	9.9	03-3E4401

PROJECT OR BRIDGE NAME
WILLOWS MS NEW CREW BUILDING

BRIDGE NUMBER	PREPARED BY	DATE	SHEET
11M5734			1 of 3

CONSISTENCY OF COHESIVE SOILS

Descriptor	Unconfined Compressive Strength (tsf)	Pocket Penetrometer (tsf)	Torvane (tsf)	Field Approximation
Very Soft	< 0.25	< 0.25	< 0.12	Easily penetrated several inches by fist
Soft	0.25 - 0.50	0.25 - 0.50	0.12 - 0.25	Easily penetrated several inches by thumb
Medium Stiff	0.50 - 1.0	0.50 - 1.0	0.25 - 0.50	Can be penetrated several inches by thumb with moderate effort
Stiff	1.0 - 2.0	1.0 - 2.0	0.50 - 1.0	Readily indented by thumb but penetrated only with great effort
Very Stiff	2.0 - 4.0	2.0 - 4.0	1.0 - 2.0	Readily indented by thumbnail
Hard	> 4.0	> 4.0	> 2.0	Indented by thumbnail with difficulty

APPARENT DENSITY OF COHESIONLESS SOILS

Descriptor	SPT N_{60} - Value (blows / foot)
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

MOISTURE

Descriptor	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

Descriptor	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%

SOIL PARTICLE SIZE

Descriptor		Size
Boulder		> 12 inches
Cobble		3 to 12 inches
Gravel	Coarse	3/4 inch to 3 inches
	Fine	No. 4 Sieve to 3/4 inch
Sand	Coarse	No. 10 Sieve to No. 4 Sieve
	Medium	No. 40 Sieve to No. 10 Sieve
	Fine	No. 200 Sieve to No. 40 Sieve
Silt and Clay		Passing No. 200 Sieve

PLASTICITY OF FINE-GRAINED SOILS

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

CEMENTATION

Descriptor	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.

NOTE: This legend sheet provides descriptors and associated criteria for required soil description components only. Refer to Caltrans Soil and Rock Logging, Classification, and Presentation Manual (July 2007), Section 2, for tables of additional soil description components and discussion of soil description and identification.

ROCK GRAPHIC SYMBOLS

IGNEOUS ROCK

SEDIMENTARY ROCK

METAMORPHIC ROCK

BEDDING SPACING

Descriptor	Thickness or Spacing
Massive	> 10 ft
Very thickly bedded	3 to 10 ft
Thickly bedded	1 to 3 ft
Moderately bedded	3-5/8 inches to 1 ft
Thinly bedded	1-1/4 to 3-5/8 inches
Very thinly bedded	3/8 inch to 1-1/4 inches
Laminated	< 3/8 inch

WEATHERING DESCRIPTORS FOR INTACT ROCK

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

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

RELATIVE STRENGTH OF INTACT ROCK

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

ROCK HARDNESS

Descriptor	Criteria
Extremely Hard	Specimen cannot be scratched with pocket knife or sharp pick; can only be chipped with repeated heavy hammer blows
Very hard	Specimen cannot be scratched with pocket knife or sharp pick; breaks with repeated heavy hammer blows
Hard	Specimen can be scratched with pocket knife or sharp pick with heavy pressure; heavy hammer blows required to break specimen
Moderately Hard	Specimen can be scratched with pocket knife or sharp pick with light or moderate pressure; breaks with moderate hammer blows
Moderately Soft	Specimen can be grooved 1/6 in. with pocket knife or sharp pick with moderate or heavy pressure; breaks with light hammer blow or heavy hand pressure
Soft	Specimen can be grooved or gouged with pocket knife or sharp pick with light pressure, breaks with light to moderate hand pressure
Very Soft	Specimen can be readily indented, grooved, or gouged with fingernail, or carved with pocket knife; breaks with light hand pressure

CORE RECOVERY CALCULATION (%)

$$\frac{\Sigma \text{ Length of the recovered core pieces (in.)}}{\text{Total length of core run (in.)}} \times 100$$

RQD CALCULATION (%)

$$\frac{\Sigma \text{ Length of intact core pieces} > 4 \text{ in.}}{\text{Total length of core run (in.)}} \times 100$$

FRACTURE DENSITY

Descriptor	Criteria
Unfractured	No fractures
Very Slightly Fractured	Lengths greater 3 ft
Slightly Fractured	Lengths from 1 to 3 ft, few lengths outside that range
Moderately Fractured	Lengths mostly in range of 4 in. to 1 ft, with most lengths about 8 in.
Intensely Fractured	Lengths average from 1 in. to 4 in. with scattered fragmented intervals with lengths less than 4 in.
Very Intensely Fractured	Mostly chips and fragments with few scattered short core lengths

Department of Transportation
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - North

REPORT TITLE
BORING RECORD LEGEND

DIST.	COUNTY	ROUTE	POSTMILE	EA
03	Glenn	5	9.9	03-3E4401

PROJECT OR BRIDGE NAME
WILLOWS MS NEW CREW BUILDING

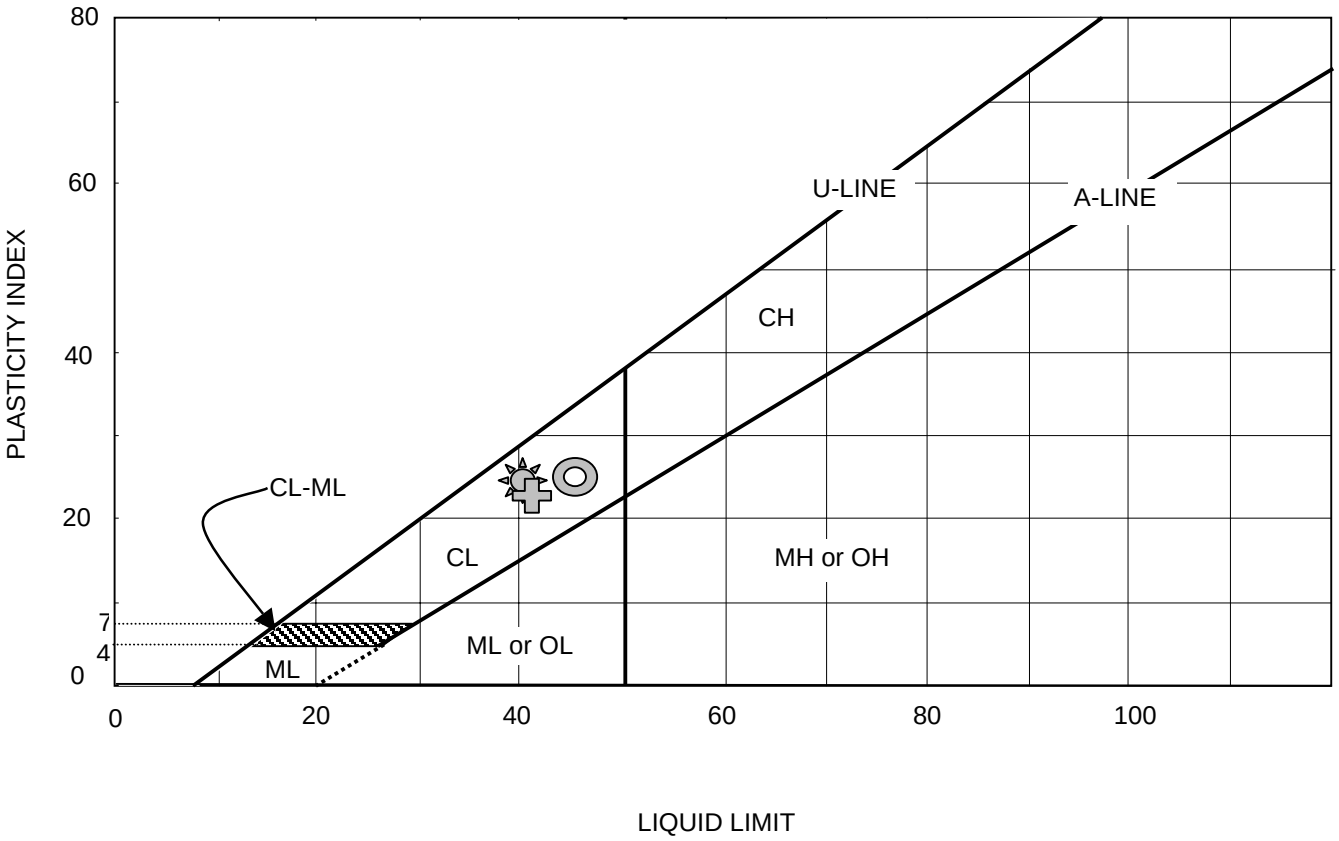
BRIDGE NUMBER	PREPARED BY	DATE	SHEET
11M5734			3 of 3

TABLE NO. A-1.SUMMARY OF LABORATORY TEST RESULTS

Sample Location				In-Situ		Atterb. Limits		EI	Percentage Passing Through Sieve No. or Particle Size Finer Than													Strength Tests (Triaxial UU, CU) or Direct Shear	Corrosion		Max. Lab Density	
Boring	I.D.	Depth (feet)		Dry Density	Moisture																					
No.	No.	start	end	γ_d (pcf)	(%)	LL	PI		1 ½	1	3/4	1/2	3/8	4	8	16	30	50	100	200	5μ	1μ	C (psf), ϕ			γ_d (pcf)	%m
A-10-001	1iii	1.0	1.5		4.2																					
A-10-001	2i	4.0	4.5	99.6	21.0																					
A-10-001	3i	6.0	6.5	95.8	20.4																					
A-10-001	6	20.0	21.5		25.0																					
A-10-002	1i	1.5	2.0	92.9	19.9																					
A-10-002	2ii	3.0	3.5	101.4	19.9																					
A-10-002	3i	6.0	6.5	97.8	19.5																					
A-10-002	4	10.0	11.5		17.1																					
A-10-001	A	2.0	3.5			41	23	45																pH	6.55		
																								Resistivity (Ohm-cm)	1518		
A-10-002	E	1.5	3.5																					Chlorides (ppm)	N/A		
																								Sulfates (ppm)	N/A		
A-10-001	B	6.0	9.0		21.1	45	25																			
A-10-001	C	18	20.0		22.8	40	24																			

*NOTE: Corrosion testing in accordance with CTM 417, 422, 532 and 643; A more detailed presentation of some laboratory test results are attached in this appendix.

ATTERBERG LIMITS TEST (AASHTO T 89 & T 90)



SYMBOL	SAMPLE LOCATION	LIQUID LIMIT (%)	PLASTICITY INDEX	CLASSIFICATION
✚	Boring No. A-10-001: 2.0'-3.5' (Bulk A) Boring No. A-10-002: 1.5'-3.5' (Bulk E)	41	23	CL
◎	Boring No. A-10-001: 6.0'-9.5' (Bulk B)	45	25	CL
✹	Boring No. A-10-001: 18'-20' (Bulk C)	40	24	CL

CALTRANS
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design - North

Project Name:	WILLOWS MAINT. STATION CREW BUILDING
EA:	03-3E4401
D-Co-Rt-PM:	03-GLE-5734
Date:	August-10

Plate No. A-1

Division of Engineering Services
Geotechnical Laboratory

Expansion Index

ASTM D 4829

Dist-EA: 03-3E4401
Dist-Co-Rte-PM: GLE-5-5734/
Sample ID: 1-2_Bulk A-Bulk E

GI Tracking No.: 10-048
Approved : June 29, 2010

Volume of Mold: 12.6 in^3 Specific Gravity: 2.7

Prior to Test							Test Data		After Test
Soil + Mold (g)	Mold (g)	Specimen (g)	Moisture Content (%)	Dry Unit Weight Yd (pcf)	Saturation %	Initial Sample Height (in)	Initial Reading (in)	Final Reading (in)	Moisture Content (%)
745.5	365.7	379.8	13.0	101.4	53.0	1.0	1.2431	1.2858	24.4

Measured Expansion Index EI_{meas} = 43

Expansion Index at S=50%, EI_{50} = 45

Expansion Index	Potential Expansion
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
>130	Very High

REMARKS:

Division ngineering Services
Materials Engineering and Testing Services
Corrosion Technology Branch
Report Date: 6/10/2010
Reported By: Lopez, Rudy

CORROSION TEST SUMMARY REPORT - Soil/Water

Bridge Name:
Bridge Number:
EA No.: **03-3E4401**
Dist/Co/Rte/PM or KP: **03 / GLE / 5 /**

SIC Number (TL101)	Sample Location	Sample Type	Sample Depth	Minimum Resistivity[1] (ohm-cm)	pH[2]	Chloride Content[3] (ppm)	Sulfate Content[4] (ppm)
C709276	BULK A & E	SOIL	2-3.5/1.5-3.5 FT/BORING 1 & 2	1518	6.55		

This site is not corrosive to foundation elements (see note below for MSE wall backfill).

Note: For MSE wall structure backfill material, minimum resisitivity must be 2000 ohm-cm or greater, pH must be between 5.5 and 10.0, chloride content must not be greater than 250 ppm, and sulfate content must not be greater than 500 ppm.

[1,2]CTM 643, [3]CTM 422, [4]CTM 417