FOR CONTRACT NO.: 12-0G9904

INFORMATION HANDOUT

WATER QUALITY

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

PERMITS

UNITED STATES ARMY CORPS OF ENGINEERS

ENCROACHMENT PERMITS

ORANGE COUNTY FLOOD CONTROL DISTRICT
PERMIT NO. 2009-00470

MATERIALS INFORMATION

FOUNDATION REPORT
FINAL HYDRAULIC REPORT
MATERIALS REPORT

ROUTE: 12-Ora-5-27.6/28.2

DEPARTMENT OF THE ARMY
LOS ANGELES DISTRICT CORPS OF ENGINEERS
P.O. BOX 532711
LOS ANGELES, CALIFORNIA 90053-2325

November 23, 2009

REPLY TO
ATTENTION OF:

Office of the Chief
Regulatory Division

DEPARTMENT OF THE ARMY NATIONWIDE PERMIT AUTHORIZATION

Matthew Cugini, Senior Engineer
Attention: Maggi Elgeziry
California Department of Transportation, District 12
3337 Michelson Drive, Suite 380
Irvine, California 92612

Dear Mr. Cugini:

This is in reply to your correspondence (File No. SPL-2009-00401-SCH) dated November 18, 2009, for a Department of the Army Permit to temporarily discharge 0.006 acres of fill onto non-wetland waters of the U.S., in association with the El Modena-Irvine Channel Bridge Widening Project. The project will widen the westerly side of the existing El Modena-Irvine Channel Bridge 14 feet. The bridge widening work involves constructing a temporary dirt ramp to access the channel bottom from the levee, excavating both channel walls to drive concrete pre-cast piles as abutment foundation, erecting falsework at the channel bottom and on both levees; and placing reinforced steel and pouring concrete at the bridge abutments and the bridge deck. (see attached figures). The receiving water impacted in association with this project is the El Moderna-Irvine Channel, which drains into San Diego Creek. The proposed work will take place along the south bound Interstate-5 (I-5) at the El Modena-Irvine Channel Bridge within the City of Irvine, Orange County, California.

Based on the information you have provided, the Corps of Engineers has determined that your proposed activity complies with the enclosed terms and conditions of Nationwide Permit No. 33 Temporary Construction, Access, and Dewatering, as described in enclosure 1.

Furthermore, you must comply with the following non-discretionary Special Conditions:

1. The permittee shall abide by the terms and conditions of the Clean Water Act Section 401 Certification (30-2009-40) dated November 16, 2009

2. Staging, storage, fueling, and maintenance of equipment and materials shall be located outside of waters of the U.S.

3. The permittee shall provide notification, either written or verbal, to the Corps of Engineers at least one week prior to the start of work as to the begin and end dates of construction.

4. A copy of the permit shall be on the job site at all times during construction. The permittee shall provide a copy of this permit to all contractors, subcontractors, and forepersons. The permittee shall require that all contractors and forepersons read this authorization in its entirety and acknowledge they understand its contents and their responsibility to ensure compliance with all general and special conditions contained herein. The permittee shall hold a pre-construction meeting with the contractor(s), the Corps of Engineers, and other appropriate resource agencies to discuss the special conditions of this authorization, as well as other relevant approvals.

5. Diversion or blocking of tidal influence and/or dewatering of the construction site are not authorized by this verification.

6. All temporarily disturbed areas shall be returned to pre-project conditions.

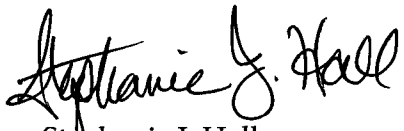
This letter of verification is valid through 12/23/2011. All nationwide permits expire on March 18, 2012. It is incumbent upon you to remain informed of changes to the nationwide permits. If the Corps of Engineers modifies, reissues, or revokes any nationwide permit at an earlier date, we will issue a public notice announcing the changes.

A nationwide permit does not grant any property rights or exclusive privileges. Also, it does not authorize any injury to the property or rights of others or authorize interference with any existing or proposed Federal project. Furthermore, it does not obviate the need to obtain other Federal, state, or local authorizations required by law.

Thank you for participating in our regulatory program. If you have any questions, please contact Sophia Huynh of my staff at 213.452.3357 or via e-mail at Sophia.C.Huynh@usace.army.mil.

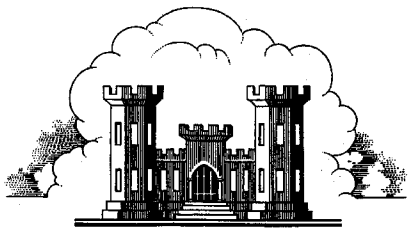
Please be advised that you can now comment on your experience with Regulatory Division by accessing the Corps web-based customer survey form at: http://per2.nwp.usace.army.mil/survey.html.

Sincerely,



Stephanie J. Hall
Senior Project Manager
Regulatory Division

Enclosure



LOS ANGELES DISTRICT
U.S. ARMY CORPS OF ENGINEERS

CERTIFICATION OF COMPLIANCE WITH
DEPARTMENT OF THE ARMY NATIONWIDE PERMIT

Permit Number: *SPL-2009-00401-SCH*

Name of Permittee: *California Department of Transportation, Matthew Cugini,*

Date of Issuance: *November 23, 2009*

Upon completion of the activity authorized by this permit and any mitigation required by the permit, sign this certification and return it to the following address:

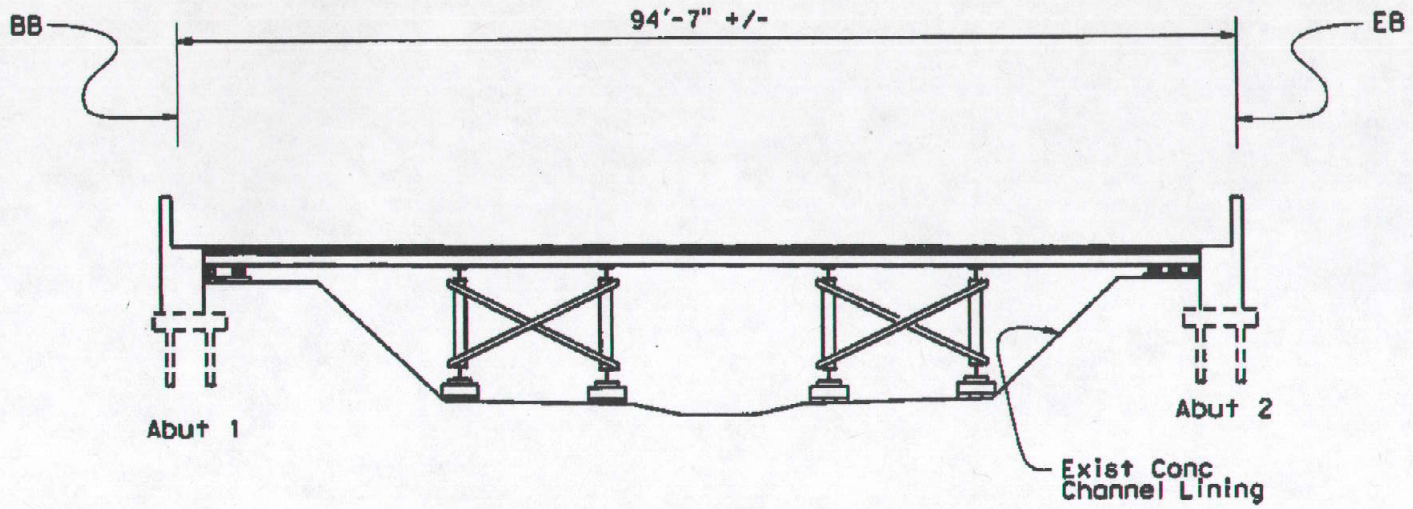
U.S Army Corps of Engineers
Regulatory Division
ATTN: CESPL-RG-SPL-2009-00401-SCH

Please note that your permitted activity is subject to a compliance inspection by an Army Corps of Engineers representative. If you fail to comply with this nationwide permit you may be subject to permit suspension, modification, or revocation procedures as contained in 33 CFR 330.5 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5.

I hereby certify that the work authorized by the above referenced permit has been completed in accordance with the terms and conditions of the said permit, and required mitigation was completed in accordance with the permit condition(s).

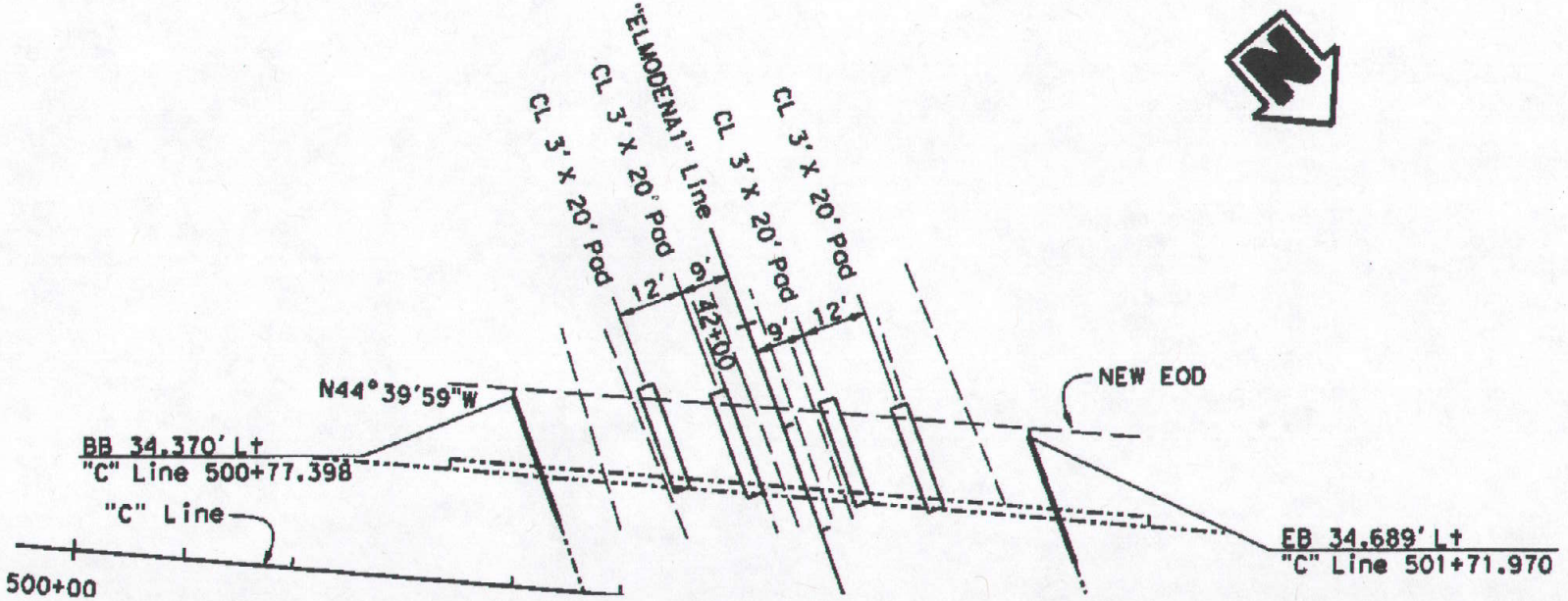
_____ _____

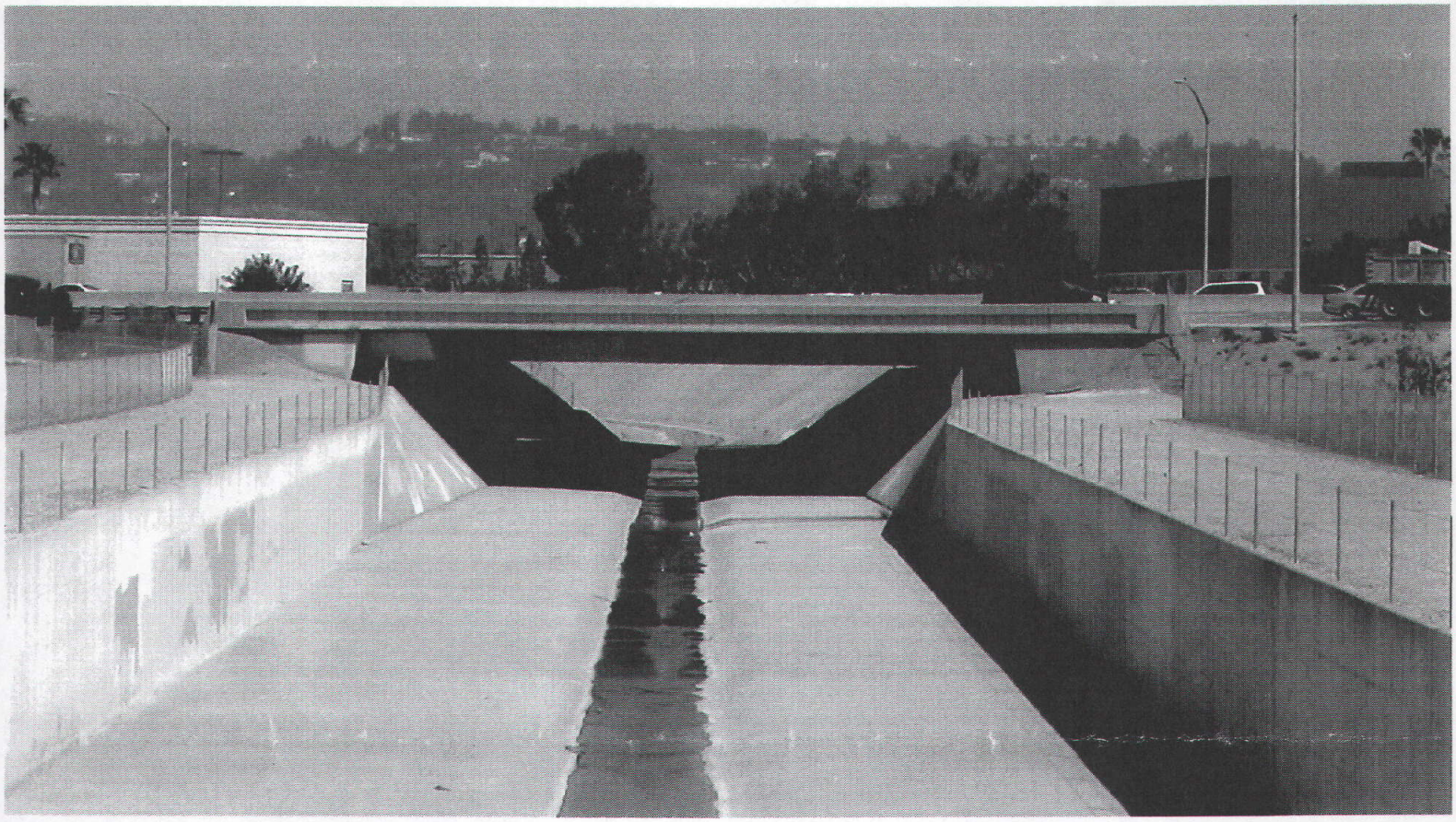
Signature of Permittee Date



MIRRORED ELEVATION

NO SCALE





California Regional Water Quality Control Board
Santa Ana Region

Linda S. Adams
Secretary for
Environmental Protection

3737 Main Street, Suite 500, Riverside, California 92501-3348
Phone (951) 782-4130 • FAX (951) 781-6288 • TDD (951) 782-3221
www.waterboards.ca.gov/santaana

Arnold Schwarzenegger
Governor

November 16, 2009

Matthew Cugini
Senior Engineer
California Dept. of Transportation (District 12)
3337 Michelson Drive, Suite 380
Irvine, CA 92612

CLEAN WATER ACT SECTION 401 WATER QUALITY STANDARDS CERTIFICATION FOR THE EL MODENA-IRVINE CHANNELBRIDGE WIDENING PROJECT TO ADD AN AUXILLARY S/B LANE FROM TUSTIN RANCH ROAD TO JAMBOREE ROAD AND WIDEN JAMBOREE ROAD OFF RAMP, CALIFORNIA DEPARTMENT OF TRANSPORATION, DISTRICT 12 (ACOE REFERENCE NO. NOT AVAILABLE)(RWQCB REF. NO. 302009-40)

Dear Mr. Cugini:

On September 16, 2009, we received an application for Clean Water Act Section 401 Water Quality Standards Certification (Certification) for the proposed bridge widening and improvements to a section of Interstate 5 between Tustin Ranch Road and Jamboree Road in the City of Tustin, Orange County. On October 13, 2009, this office notified your office that the application for certification was incomplete, due to the lack of California Environmental Quality Act (CEQA) documents and because the required fee had not been submitted. On the same date, this office received the required supplemental information necessary to complete the application.

This letter responds to your request for certification that the proposed project, described in your application and summarized below, will comply with State water quality standards outlined in the Water Quality Control Plan for the Santa Ana River Basin (1995) (Basin Plan) and subsequent Basin Plan amendments:

Project Description: The westerly side of the existing one-span El Modena-Irvine Channel Bridge will be widened 14 feet, and an 1500-foot second auxiliary southbound lane on Interstate-5 from Tustin Ranch Road to Jamboree Road will be added. The project will involve: 1) constructing a temporary dirt ramp to access the channel bottom from the levee; 2) excavating both channel walls to drive concrete precast piles as abutment

	foundation; 3) erecting falsework at the channel bottom and on both levees; and 4) placing reinforced steel and pouring concrete at the bridge abutments and the bridge deck. The project will not require the diversion of stream flow within the work area. The project is located within Section 64 of Township 5 South, Range 9 West, of the U.S. Geological Survey *Tustin, California*, 7.5-minute topographic quadrangle map (33°43'16.98" N/-117°47'53.95" W).
Receiving water:	El Modena-Irvine Channel, which drains into San Diego Creek.
Fill area:	Area of temporary access ramp and falsework pads
Dredge/Fill volume:	240 cu. ft.
Federal permit:	U.S. Army Corps of Engineers Nationwide Permit No. 33.

You have proposed to mitigate water quality impacts as described in your Certification application and subsequent application submittals. The proposed mitigation is summarized below:

Onsite Water Quality Standards Mitigation Proposed:

- The project will occur outside of the rainy season.
- Pre-construction ground elevations will be restored upon completion of work.
- Areas where riparian vegetation is removed will be re-vegetated with native riparian plants.
- The work area will be delineated with fencing or other appropriate means to the minimal area necessary.
- Construction-phase best management practices (BMPs), such as silt fencing, gravel bags, and vehicle fueling and maintenance activity restrictions, will be employed to reduce the discharge of pollutants in storm water runoff from the site.

Offsite Water Quality Standards Mitigation Proposed:

Should the proposed project impact state- or federally-listed endangered species or their habitat, implementation of measures identified in consultation with U.S. Fish and Wildlife Service and the California Department of Fish and Game will ensure those

impacts are mitigated to an acceptable level. Appropriate Best Management Practices will be implemented to reduce construction-related impacts to Waters of the State according to the requirements of Order No. 99-06-DWQ, commonly known as the CalTrans Storm Water Permit.

Construction de-watering discharges may be regulated under Regional Board Order No. R8-2009-0003, General Waste Discharge Requirements for Discharges to Surface Waters that Pose an Insignificant (De Minimus) Threat to Water Quality. For more information, please review Order No. R8-2009-0003 at: www.waterboards.ca.gov/santaana.

You have applied for a Nationwide Permit from the U.S. Army Corps of Engineers in compliance with Section 404 of the Clean Water Act. Pursuant to the California Environmental Quality Act (CEQA), the Regional Board has determined that the proposed project is categorically exempt from provisions of CEQA under Guidelines Section 15301 for the minor alteration of existing structures or facilities where existing uses are not expanded.

This 401 Certification is contingent upon the execution of the following conditions:

1. The discharger must maintain a copy of this Certification at the project site during construction.
2. The discharger must implement an effective combination of best management practices to maintain or restore the physical integrity of the affected waters of the State for the purpose of protecting its beneficial uses. The discharger must implement a corresponding post-construction monitoring program to assure that the proposed project does not result in permanent impacts to the water's physical integrity.

Under California Water Code, Section 1058, and Pursuant to 23 CCR §3860, the following shall be included as conditions of all water quality certification actions:

(a) Every certification action is subject to modification or revocation upon administrative or judicial review, including review and amendment pursuant to Section §13330 of the Water Code and Article 6 (commencing with Section 3867) of this Chapter.

(b) Certification is not intended and shall not be construed to apply to any activity involving a hydroelectric facility and requiring a FERC license or an amendment to a FERC license unless the pertinent certification application

was filed pursuant to Subsection §3855(b) of this Chapter and that application specifically identified that a FERC license or amendment to a FERC license for a hydroelectric facility was being sought.

(c) Certification is conditioned upon total payment of any fee required under this Chapter and owed by the applicant.

Although we anticipate no further regulatory involvement, if the above stated conditions are changed, any of the criteria or conditions as previously described are not met, or new information becomes available that indicates a water quality problem, we may formulate Waste Discharge Requirements.

In the event of any violation or threatened violation of the conditions of this certification, the violation or threatened violation shall be subject to any remedies, penalties, process or sanctions as provided for under state law. For purposes of section 401(d) of the Clean Water Act, the applicability of any state law authorizing remedies, penalties, process or sanctions for the violation or threatened violation constitutes a limitation necessary to assure compliance with the water quality standards and other pertinent requirements incorporated into this certification.

In response to a suspected violation of any condition of this certification, the Santa Ana Regional Water Quality Control Board (Regional Board) may require the holder of any permit or license subject to this certification to furnish, under penalty of perjury, any technical or monitoring reports the Regional Board deems appropriate. The burden, including costs, of the reports shall be reasonable in relation to the need for the reports and the benefits to be obtained from the reports.

In response to any violation of the conditions of this certification, the Regional Board may add to or modify the conditions of this certification as appropriate to ensure compliance. Pursuant to California Code of Regulations Section 3857, we will take no further action on your application. Please notify our office five (5) days before construction begins on this project.

This letter constitutes a Water Quality Standards Certification issued pursuant to Clean Water Act Section 401. I hereby issue an order certifying that any discharge from the referenced project will comply with the applicable provisions of Sections 301 (Effluent Limitations), 302 (Water Quality Related Effluent Limitations), 303 (Water Quality Standards and Implementation Plans), 306 (National Standards of Performance), and 307 (Toxic and Pretreatment Effluent Standards) of the Clean Water Act, and with other applicable requirements of State law. This discharge is also regulated under State Water Resources Control Board Order No. 2003-0017-DWQ (Order No. 2003-0017-DWQ), "General Waste Discharge Requirements for Dredge and Fill Discharges That Have Received Water Quality Certification" which requires compliance with all conditions of this Water Quality Standards Certification. Order No. 200-0017-DWQ is available at www.swrcb.ca.gov/resdec/wqorders/2003/wqo/wqo2003-0017.pdf.

Should there be any questions, please contact Marc Brown at (951) 321-4584, or Mark Adelson at (951) 782-3234.

Sincerely,

GERARD J. THIBEAULT
Executive Officer

cc (via electronic mail):
U. S. Army Corps of Engineers, Los Angeles Office – Jason Lambert
State Water Resources Control Board, OCC – Erik Spiess
State Water Resources Control Board, DWQ-Water Quality Certification Unit – Bill Orme
California Department of Fish and Game – Naeem Siddiqui
U.S. EPA, Supervisor of the Wetlands Regulatory Office WTR- 8 – Eric Raffini and Dave Smith

w:\afischer\401\certifications\el modena-irvine channel bridge wideningt 302009-40.doc

COUNTY PROPERTY PERMIT

4/22/2010

2009-00470
Verma, Amit 1:14:59 PM
INSPECTION PHONE
714-567-7804

Inspection office shall be notified at least TWO (2) WORK DAYS PRIOR to commencing permitted use. FAILURE TO OBTAIN INSPECTION SHALL VOID THIS PERMIT

ENCROACHMENT PERMIT

COUNTY OF ORANGE
OC Public Works
County Property Permits
Main Office: 300 North Flower Street,
Santa Ana, California 92703-5001
or P.O. Box 4048, Santa Ana, California 92702-4048
(714) 834-3474 or (714) 834-5529
Fax: (714) 835-7425

Permit No: **2009-00470**
Effective Date: 3/15/2010 12:00 AM
Expiration Date: 3/14/2011 12:00 AM

PERMITTEE

California Department of Transportation - District 12 (CalTrans)
3337 Michelson Drive, Suite 380

Irvine, CA 92612-8894
949-724-2020

Contact Person Roger Kao or Dinh Le
Telephone No. 949-724-2020

FACILITY

Type	Facility Name	Number
	EL MODENA-IRVINE CHANNEL	F07

PERMITTED USE: User of County property is hereby authorized as follows, subject to provisions attached hereto:

Temporary access to construct and maintain a 14-feet bridge extension for the Inter-State Route 5 (I-5) Widening Project within a portion of Orange County Flood Control District's El Modena-Irvine Channel (F07) right-of-way, per attached plans, provisions, and to the satisfaction of the assigned County inspection personnel.

PERMITTED USE NOT EFFECTIVE UNTIL APPROVED BY THE ASSIGNED COUNTY INSPECTOR.

NO WORK (INCLUDING MOBILIZATION) SHALL BEGIN UNTIL THE PROJECT STORM WATER POLLUTION PREVENTION PLAN (SWPPP) HAS BEEN REVIEWED AND ACCEPTED BY THE COUNTY OF ORANGE.

THIS PERMIT IS NOT VALID UNTIL THE PERMITTEE FIRST OBTAINS A RIDER TO THIS PERMIT TO ADD THE SELECTED CONTRACTOR AND SUBMIT THE CONTRACTOR'S VALID INSURANCE THAT MEETS COUNTY INSURANCE REQUIREMENTS TO COUNTY PROPERTY PERMITS.

THIS ENCROACHMENT PERMIT IS FOR ACCESS ONLY. IF THE PERMITTEE/CONTRACTOR INTENDS TO STAGE MATERIALS OR EQUIPMENT WITHIN THE COUNTY R/W, A SEPARATE ENCROACHMENT PERMIT MUST BE OBTAINED AND EXECUTED PRIOR TO START OF CONSTRUCTION.

CEQA Code 1 SWPPP: Yes

LOCATION OF WORK:

El Modena-Irvine Channel (F07) at I-5

Dimension/Type: 14-feet Bridge extension Thomas Brother: 830;E6 Area: Tustin

PERMITTEE'S ACCEPTANCE:

SIGNATURE ON FILE

COUNTY APPROVAL:

Uribe, Carolyn 3/15/2010

PERMIT AND APPROVED PLANS SHALL BE MAINTAINED ON JOB SITE. PERMITTEE SHALL COMPLY WITH REGULATIONS PRINTED ON REVERSE SIDE OF PERMIT AND ATTACHMENTS. ALL UNDERGROUND WORK REQUIRES PRIOR 'UNDERGROUND SERVICE ALERT' COMPLIANCE. THIS PERMIT IS NON-TRANSFERABLE.

Note: Surety will not be refunded until Final Inspection is performed and submitted to County Property Permits.

ENCROACHMENT PERMIT

CONSIDERATION:

Types	PWO#	Permit Fees	Surety	Penalty	Total	Total Fees: 0.00
FE	EF68120	0.00 (2071)	0.00 (2091)	0.00	0.00	

Surety Paid By: TUF Invoice Paid By:

Contractor: TBD

Engineer:

Inspection: Subdivision & Permits Inspection CC: Operations & Maintenance

PERMIT INSPECTORS REPORT:

DATE WORK COMPLETED:_____

The permitted work was completed in satisfactory manner per instructions and/or the as-built plans and inspectors report submitted herewith for county files

Remarks:

Inspector:

Date

Permit Superintendent:

Date

Refund Recommended By:

Date

Refund Approved By:

Date:

State of California — Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: TRACI MENARD
Senior Bridge Engineer
Design Branch 15

Attention: Gabriel Galo

Date: October 15, 2009
File: 12-ORA-005, PM 27.6
EA: 12-0G9901
El Modena-Irvine
Bridge Widening
Bridge No. 55-0655

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design South 1
Branch B

Subject: Third Revised Foundation Report For The I-5 El Modena-Irvine Channel Bridge Widening

Per your request dated May 7, 2009, Geotechnical Design South 1 – Branch B has prepared this revised Foundation Report (FR) for widening the southbound side of El Modena – Irvine Channel Bridge at I-5 PM 27.6. This revised report replaces the original FR for this project dated August 05, 2009. The recommendations provided below are based on the following:

- Review of a Foundation Study dated January 1954, a Foundation Recommendations Report dated July 07, 1987 and As-Built Log of Test Borings (LOTB) dated August 04, 1958 and August 15, 1991.
- A Geotechnical investigation, which included the drilling of two (2) soil boring and one (1) Cone Penetration Sounding (CPT) positioned within the immediate vicinity of the proposed bridge widening.
- Laboratory test results and engineering analysis for the project.

The initial Foundation Report for the project was submitted on August 05, 2009. A revised report containing additional recommendations for the two (2) bridge wing walls was submitted on August 19, 2009. This submittal includes amendments to Table 4, where minor changes to wing walls for Abutment 1 have been implemented. The design parameters to the revised re-design remain unchanged.

1.0 PROJECT DESCRIPTION

1.1 Existing Structures

El Modena – Irvine Channel crosses I-5 at a skew of approximately 20°. The channel flows in a southerly direction. The existing structure is a simply supported single-span; CIP/PS box (26) Girder Bridge with open-end Reinforced Concrete (RC) seated abutments, all on driven RC piles.

In July 1956 the existing two-lane bridge structure was removed to build a new bridge. This second bridge was removed and subsequently completed in 1991.

1.2 Proposed Structures

Based on the typical section of the planning study, the project proposes to widen the southbound (SB) side of the El Modena - Irvine Channel Bridge by a width of 13'-9".

The proposed foundation type for the abutment walls is driven piles. Existing as well as proposed plans are included in Appendix A

2.0 GEOTECHNICAL INVESTIGATION

The Geotechnical investigation consisted of reviewing available information pertaining to the site and the drilling of two borings (R-08-004 & 005) with a CME 75 drill rig, coordinated by OGDS-1. The depth of the boring exploration varied between 51.5 and 76.5 feet below the I-5 street level. An additional CPT (CPT-2) was also advanced to a depth of 76.5 feet below the surface. A summary of the exploration locations and depths is listed in Table 1.

Table No. 1 – Summary of Boring Locations

Boring	Location	Station	Offset, ft	Elevation, ft
R-08-004	I-5 SB shoulder	1503+99.07	-104.04 Lt	84.35
R-08-005	I-5 SB shoulder	1500+21.25	-130.29 Lt	86.08
CPT-2	I-5 SB shoulder	1502+47.55	-110.02 Lt	85.09

The borings were logged and sampled using Standard Penetration Test (SPT) and California Modified Samplers (CMS), obtained at 5-foot intervals. The samples were driven using a 140 lb hammer falling freely for 30-inches for a total penetration of 18 inches. In some instances and when possible, some of the CMS samples were obtained by pushing the sampler into native soil. Following drilling, sampling, and logging, boring R-08-004 was backfilled with Bentonite-Grout mix and patched with asphalt patch at the surface. Boring R-08-005 was subsequently converted into a temporary peizometer to monitor static ground water elevations at the site. The CPT sounding was advanced with a Vertek 20-ton CPT Rig to a depth of 76.5 feet below the I-5 street level. The site lithology will be presented on a Log of Test Borings (LOTB) sheet, which will be delivered at a later date. The exploratory location map is shown in Appendix B.

3.0 LABORATORY TESTING

Laboratory testing was performed on selected SPT and California Modified undisturbed samples from the borings. Laboratory testing included moisture density, Mechanical Analysis, Atterberg Limits, Unconfined Compression and corrosion. Samples submitted for testing were analyzed at a Department of Transportation laboratory. Testing was performed in accordance with California

Test Methods and/or ASTM procedures (see Table No.2). Laboratory test results are included as Appendix C.

Table No. 2 – Laboratory Test Methods

Test	Standard
Moisture	CTM 226
Unit weight	CTM 212
Mechanical Analysis of Soils	CTM 201, 202, 203
Atterberg Limits	CTM 204
Unconfined Compression	ASTM D2166
Corrosion – Resistivity, pH, Chloride & Sulfate Content.	CTM 417, CTM 422, CTM 643

Corrosion testing was performed on selected soil samples. Testing was performed in the Translab Soils Laboratory.

3.0 GEOLOGY

3.1 Regional Geology

The site is within the Los Angeles Basin of the Peninsular Ranges geomorphic province. The Peninsular Ranges province is composed of mountain ranges that are oriented roughly northwest-southeast, which roughly parallel the San Andreas fault. The Los Angeles Basin is an alluvium filled basin that is up to several miles thick at its deepest point. The bridge site is located in central Orange County.

3.2 Site Geology

The site is located in the Los Angeles Basin, and is underlain by alluvium derived from the surrounding mountains. The alluvium is composed of various amounts of clay, silt, and sand. The topography is relatively level.

4.0 SUBSURFACE CONDITIONS

Based on the geotechnical investigation, the underlying material is mostly sandy silts and clays to approximately elevation +25. There are discontinuous thin sandy beds between elevations +55 to +40. Below elevation +25 feet are dense sands and sand mixtures.

The encountered fine-grained soils with the upper 45 feet below the cut off elevation (clays/silts) are in a medium stiff to very stiff state, with SPT blow counts between 7 and 29. The thin interbeded sandy lenses with that zone are in a Medium Dense state with SPT blow counts

between 12 and 16. The soils below the upper zone consist of very dense sands and hard clays, with SPT blow counts between 70 and 90.

4.1 Ground Water

According to our latest groundwater-monitoring episode on 7/15/09, the static level was an elevation of 61.93 feet in boring R-08-005, (a depth of 24.15 feet below the I-5 freeway level). This is consistent with previous ground water measurements and Department of Water Resources records. This roughly coincides with the bottom of the channel, which is a likely maximum ground water elevation.

5.0 SEISMICITY

The San Joaquin Hills Blind Thrust Fault with an MCE = 7.0 is the controlling fault for this bridge. The closest site-to-fault rupture surface distance is about 4.6 km. Based on the attenuation relationship by Sadigh et al (1997), the median peak or design PBA for this bridge should be taken as 0.6g. The design PGA is estimated to be about 0.55g. The attached ARS was developed by modifying the standard SDC ARS for M=7.25+/-0.25, PBA=0.6g, Soil Profile Type D. The modifications were introduced due to near fault effects as per the SDC. The ARS curve and associated data is included in Appendix D.

5.1 Liquefaction Evaluation

Liquefaction is a phenomenon in which loose, saturated fine-grained, granular soils behave like a liquid while being subjected to high-intensity ground shaking. Liquefaction occurs when shallow ground water, low-density, fine, sandy soils and high-intensity ground motion exist in a site. Given the predominant fine-grained nature of the subsurface soil, and dense sands beneath the static groundwater level at the site, the potential for Liquefaction is considered to be low.

6.0 CORROSIVITY

Per section 4.1 of the Corrosion Technology Branch Guidelines a corrosive area is defined as an area where the soil and/or water contains more than 500 PPM of chlorides, more than 2000 PPM of sulfates, or has a pH of 5.5 or less.

Table No. 3- Corrosion Test Results

Boring	Sample Depth (ft.)	Minimum Resistivity * (ohm-cm)	pH	Chloride Content (PPM)	Sulfate Content (PPM)
R-08-004	25-26.5	950	7.95	27	198
R-08-005	5-6.5	740	7.92	10	1516

Note: For corrosion definitions refer to "Memo to Designers" 3-1.

- The Corrosion Technology Branch policy states that if the minimum resistivity is greater than 1000 ohm-cm the area is considered to be non-corrosive and sulfate and chloride contents are not tested (NT).

Based on existing laboratory test results shown above in Table 3, soils beneath the site are considered to be non-corrosive.

7.0 FOUNDATION RECOMMENDATIONS

7.1 Driven piles (Bridge Abutments)

Per the July 2008 Memo to Designers, The abutment foundations will be designed in accordance with the Working Stress Design methodology. Loads from the LRFD, Service-I Limit State shall be used as design loads for the WSD of the abutments. The axial demand for the proposed Abutment piles is 140 Kip Service, 280 Kip Nominal.

Class 200 precast pre-stressed concrete driven pile foundations "alternative X" (14"x14") are recommended for bridge support. The specified tip elevations are provided in the Table 4 below:

Table No. 4 – Pile Data Table

Abutment Foundations Design Recommendations

Support Location	Pile Type	Cut-off Elevation (ft)	LRFD Service-I Limit State Load (kips) per Support		LRFD Service-I Limit State Total Load (kips) per Pile (Compression)	Nominal Resistance (kips)	Design Tip Elevations (ft)	Specified Tip Elevation (ft)	Nominal Driving Resistance Required (kips)
			Total	Permanent					
Abut. 1	Class 200 Alt. X	74	456	N/A	140	280	24(a) 35(c) 61(d)	24	280
Abut. 2	Class 200 Alt. X	74	456	N/A	140	280	24(a) 35(c) 61(d)	24	280

Notes:

1) Design tip elevations are controlled by: (a) Compression, (c) Settlement, and (d) Lateral Load, respectively.
2) The specified tip elevation shall not be raised above the design tip elevations for Settlement and Lateral Load.
3) The nominal driving resistance required is equal to the nominal resistance needed to support the factored load plus driving resistance, which do not contribute to the design resistance.
4) Structural Design typically provides design tip elevation for Lateral Load.

We used Driven 1.2 (FHWA) software, A-Pile (plus 4.0 version by Ensoft) software and checked it against Navfac (Navy Manual, chapter 5) to calculate the axial demand. Pile bearing capacity is based on friction and end bearing. Results of A-Pile analysis indicated pile settlement less than 0.5 inches at the nominal load.

In calculating the design tip elevation controlled by settlement, change letter 3 dated July 2008 of the Memo to designers was followed. The procedure required a tip elevation to produce a settlement 1 or 2 inches under the service load.

We utilized (L-Pile plus 5.0) software by Ensoft for lateral deflection analysis. In calculating the design tip elevation controlled by the lateral load, section 4.5.6.5.1 of the BDS was followed. The conditions required a lateral shear force of 13 Kips under service load to produce a lateral deflection not to exceed ¼ inch. L-Pile parameters as well as P-Y curves are attached to this report as Appendix D.

7.2 **Spread footings (Wing Walls)** Type 1 Retaining Wall

Listed in Table 5, is a summary of the proposed wing walls. The proposed wall locations, foundation types, retaining wall heights, widths and elevations are obtained from layout sheets provided by Structure Design Branch 15. The required ultimate bearing capacities are obtained from the Standard Plans, Page 246 Standard Drawing B3-1.

Lateral active/passive earth pressures for the proposed retaining walls are provided in Section 7.2.2. Potential settlements for the wing walls is discussed in Sections 7.2.3.

7.2.1 Bearing Capacity

Based on laboratory test results and according to our calculations, the on-site soils do not meet the bearing capacity requirements as shown in the Standard Plans to support the proposed walls. These soils are predominantly fine-grained soils consisting of Clays & Silts with blow counts less than 10 with a medium-high degree of expansion potential. A typical shear angle of these soils is normally less than 30° degrees. Given the above data, this type of soil does not meet the minimum soil parameters outlined in Standard Plan B3-8. Remedial grading/inspection will be needed prior to and during construction. Please refer to section 8.2 "Spread footings"

Retaining wall spread footings should be founded on compacted import soils. Exposed soils at the bottom of the footing over excavation shall be competent, unyielding sub-grade approved by a Caltrans RE representative. Excavation and replacement of the sub-grade soil is required to upgrade the quality and condition of the soils supporting the walls.

7.2.2 Lateral Ac tive/Passive Earth Pressures

If retaining walls are free to move laterally at the top, an **active lateral** earth pressure of 43 pounds per square foot (PSF) per foot of depth is recommended. This active lateral earth pressure was calculated using an active earth pressure coefficient of Ka = 0.33 and a soil unit weight of γ =130 pounds per cubic foot (PCF). A traffic surcharge of 240 PSF should be added in the case of active pressures for the Retaining Walls.

Applied lateral loads may be resisted by passive earth pressures acting against the sides of the wall footings. The sliding resistance along the bottom of the retaining wall footings may be based on an allowable coefficient of friction of 0.4. The recommended allowable **passive resistance** coefficient value for footings on compacted imported fill and on level ground is Kp=3.4, with allowable resistance of 400 PSF per foot of depth for the upper three (3) feet of imported granular soil below

the bottom of the footings. Should the footing key extend into the native fine-grained soil, these parameters should be reduced to an allowable coefficient of friction of 0.27 and a Kp=2.4 with an allowable resistance of 300 PSF per foot of depth.

The above specified earth pressure parameters do not include surcharge or hydrostatic water pressures. These parameters should be used only when adequate drainage is provided in accordance with Caltrans Standard Plans.

7.2.3 Anticipated Settlement of Spread Footings

Total settlements were calculated for the proposed retaining wall footings. Settlement was based on proposed fill depths at the retaining walls. Settlement parameters were estimated from laboratory consolidation test results for the proposed retaining wall footings.

The total calculated settlement is approximately 1.1 inches. With the proposed subsurface soil improvements the differential settlement for the proposed wing wall spread footings is approximately one half (½) inch.

7.2.4 Slope stability

The wing walls are founded on level ground at the bottom of existing slope. Slope stability issues related to the Type 1 retaining walls and associated fill embankment were evaluated using the computer program SLOPE W for static and pseudo static conditions. Analysis of the proposed fill embankment indicate a safety factor greater than 1.5 and for static conditions, and greater than 1.1 for pseudo static conditions.

7.2.5 Shoring Parameters

For shoring parameters the following is recommended:

- If shoring is located on a 2:1 slope, assume an active earth pressure Ka =0.57 and a passive pressure kp =1.1. The above parameters assume a granular soil with an internal angle of friction of 28°. If the encountered soil is predominantly clayey, assume a cohesion of C = 750 PSF.

- If shoring is located on a flat surface, assume a Ka =0.36 and a passive pressure kp =2.77. The above parameters assume a granular soil with an internal angle of friction of 28°. If the encountered soils are clayey, assume a cohesion of C= 750 PSF.

Any live or dead loads within a 1:1 plane projected from the bottom of the shoring must be added to the given active earth pressure.

The contractor must design any temporary shoring systems in accordance to the above-recommended parameters, including recommendations outlined in section 7.2.2.

It should be noted that theoretical geotechnical literature suggests that clayey soil with a C = 750 PSF, has the temporary potential to withstand a vertical cut up to 8 feet in height. This parameter assumes a safety factor of 3. We however recommend that the contractor comply with OSHA requirements.

7.2.5 Summary of spread footing parameters for the wing walls

A summary of the spread footing foundations (Wing walls) is listed in Table 5. The presented parameters assume ground improvement as described in section 8.2

Table 5

Foundation Design Recommendations for Wing Wall (Abutments 1&2) Spread Footings[1,2]
(Assuming adequate ground improvement achieved)

Support Location	Footing Size (ft)		Bottom of Footing Elevation (ft)	Minimum Footing Embedment Depth (ft)	Total Permissible Support Settlement[3] (inches)	WSD (LRFD Service-I Limit State Load Combination)		LRFD		
								Service	Strength $\varphi_b = X$	Extreme Event $\varphi_b = 1.00$
Wing Walls @ Abut. 1 & 2	B	L				Permissible Gross Contact Stress (ksf)	Allowable Gross Bearing Capacity (ksf)	Permissible Net Contact Stress (ksf)	Factored Gross Nominal Bearing Resistance (ksf)	Factored Gross Nominal Bearing Resistance (ksf)
Abut 1	5.25	16	76.167	3	1	6.6	2.2	N/A	N/A	N/A
Abut 1	6.25	33	74.167	3	1	7.5	2.5	N/A	N/A	N/A
Abut 2	5.25	37.11	76.34	3	1	6.6	2.2	N/A	N/A	N/A

Notes:

1) *Recommendations are based on the foundation geometry and the load provided by Structure Design in the Foundation Design Data Sheet. The footing contact area is taken as equal to the effective footing area, where applicable.*
2) *See MTD 4-1 for definitions and applications of the recommended design parameters*
3) *Minimum foot Embedment is measured from the top of fill to the bottom of footing.*

8.0 CONSTRUCTION CONDITIONS

8.1 Pile Foundations

1. In order to reduce the impact of pile driving on the existing concrete lined channel, it is recommended that pre drilling take place to below the channel bottom. Drilling to assist driving should not exceed a maximum 10-inch allowable drill-hole diameter. Exceeding the recommended pre drilling hole diameter could impact lateral pile deflection. Pile heads must be protected from direct impact of the hammer by a cushion-driving block.

2. Contractor should expect hard driving conditions close to the tip elevation. Based on the Field investigation results (R-08-005), blow counts of 91 were encountered at an elevation of 26. Similar blow counts (greater than 50) continued to the bottom of the boring. CPT soundings as reported in CPT-2 indicated an increase in Tip and sleeve stress at similar elevations, but penetrated the dense strata to an elevation of 8.56, where refusal was encountered.

3. For pile driving acceptance criteria, please refer to section 49-1.08 in the Caltrans Standard Specification, May 2006 edition. "Ru" is the Nominal Resistance in kips (280 Kips/pile).

4. If the Nominal Resistance is not achieved at the specified tip, the contractor should allow the piles to set for a minimum period of 24 hours, then retap for bearing verification.

5. The settlement based on the proposed bridge widening as described within the body of this report, is estimated to be less than one half (0.5) inch.

8.2 Spread footings

In order to improve the subgrade bearing characteristics and reduce settlements, it is recommended that a minimum depth of three (3) feet be removed below the bottom of the footing elevation and replaced by predominantly granular material. The lateral extent of removal should extend a minimum distance of three (3) feet beyond the exterior parameter footprint along the toe portion and one (1) foot beyond the exterior parameter footprint along the heel portion of proposed footings.

For footings constructed on slopes, a minimum horizontal distance of 4 feet, measured at the top of footing, shall be provided between the near face of the footing and the face of the finished slope, per section 4.4.5.1 of the BDS.

Prior to placement of any fill, the bottom of the exposed sub grade should be firm and unyielding. This sub grade must be proof rolled with no visual evidence of pumping areas. The subgrade should then be moisture-conditioned and compacted to 95% relative compaction. It is imperative that a Caltrans Resident Engineer (RE) or his/her representative observe and approve this operation prior to placement of the imported granular fill. All grading operations must conform to Section 19 "Earthwork" of the Caltrans Standard Specifications dated May 2006.

The fill should be moisture conditioned, placed in thin lifts not exceeding 8 inches and compacted to 95 % relative compaction. The compaction results must be presented and approved by the RE.

The finish grade should be sloped away from the footings. All weep holes draining trapped water from behind the retaining walls, must divert all water away from the wall footings.

8.3 Structural Backfill Behind the Wing Walls

Structural backfill behind the walls should be implemented in accordance to general requirements outlined in section 19-3 of the Caltrans Standard Specifications, and more specifically sections19-3.06 and 19-3.065.

If the pervious backfill is selected, a filter fabric will need to be placed against the native soil prior to placement of the pervious fill, to reduce piping of the fine-grained Silts/Clays into the back fill. The backfill must be completely wrapped in a burrito wrap fashion. The fill must be kept low to allow the placement of the roadway structural section.

9.0 GENERAL NOTES

1. All Structures Work associated with piling installation shall be implemented in accordance to the recommendations outlined in Section 49 in the Caltrans Standard Specifications.

2. All Earth Work shall be implemented in accordance to the recommendations outlined in Section 19 in the Caltrans Standard Specifications.

3. Quality control must be practiced during pile installation to insure compliance with Caltrans construction procedures.

4. The Contractor must become familiarized with the site conditions. Due to the close proximity of the proposed driven piles to the existing Abutment and Concrete channel, care should be exercised during driving. The channel walls should be monitored during pile driving.

5. Prior to importing the granular fill material, the contractor must submit a soil sample to the RE for laboratory testing, to check the gradation and corrosion characteristics of the import.

6. Final Plans and specifications should be submitted to OGDS-1 for review and comment.

The recommendations contained in this report are based on specific project information provided to our office. If any conceptual changes are made during final project design, this office should review those changes to determine if the foundation recommendations are still applicable.

If you have any questions, please contact Nadeem Srour at (213) 620-2377 or Sam Sukiasian at (213) 620-2135.

Prepared by:

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10/15/09

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cc: (1)Traci Minard, Structural Design, Sacramento.
(1) Gabriel Galo, Structural Design, Sacramento.
(1)Jose Higareda, Structural Design, Sacramento.
(1) OGDS-1-Sacramento;
(1) GS File- Sacramento;
(1) OGDS-1- Los Angeles.

REFERENCES

1. Caltrans 1961, San Gabriel River Freeway, LA-170-A, Cecilia Street to Whittier Boulevard.Waddell street undecrossing, Bridge # 53-1666.

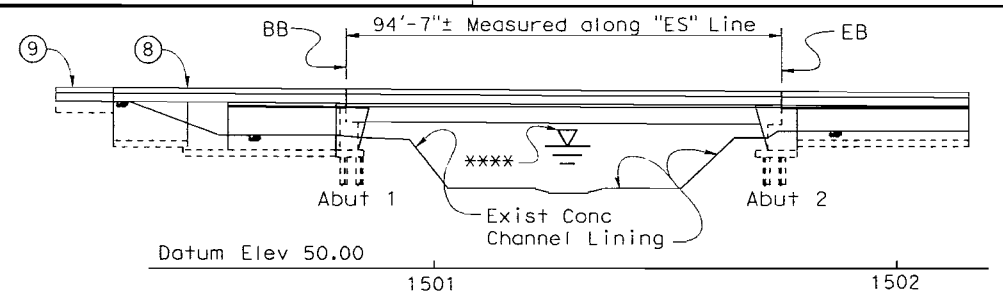
2. Mualchin, L., 1996, A Technical Report to accompany the Caltrans California Seismic Hazard Map 1996 (Based on Maximum Credible Earthquakes), Caltrans, 7/1996.

3. Sadigh, K, Chang, C.Y., Egan, J.A., Makdisi, F. and Youngs, R.R., 1997, Attenuation Relationships for Shallow Crustal Earthquake Based on California Strong Motion Data, Seismological Research Letters, Vol. 68, No.1.

4. State of California Division of Mines and Geology, "Seismic Hazard Zones, Tustin Quadrangle", 2001.

Appendix A

Existing and Proposed Type of Foundation



MIRRORED ELEVATION

1" = 20'

Legend:

*	Match existing grade and cross slope
**	Measured normal to ℄ "Route 5"
***	Measured normal to "ES" Line
****	See "HYDROLOGIC SUMMARY" Table on "FOUNDATION PLAN" sheet
-----	Indicates existing structure
	Indicates Bridge Removal (Portion)
———	Joint Seal (MR=1") Type B
	Indicates Remove existing Structure Approach

Notes:

1. Closure pour
2. Remove existing Concrete Barrier (Type 25)
3. Temporary Railing (Type K) see "Road Plans".
4. Structure Approach Type N(30S). Includes area shown by ▨
5. Limits of "Clean Expansion Joint"
6. Paint "EL MODENA-IRVINE CHANNEL"
7. Paint "55-0655"
8. Concrete Barrier Type 736A
9. Concrete Barrier Type 736B

For "General Notes", "Standard Plans" and Foundation Data Tables see "INDEX TO PLANS" sheet

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	ORA	05	27.6 / 28.2		

REGISTERED CIVIL ENGINEER X DATE

PLANS APPROVAL DATE

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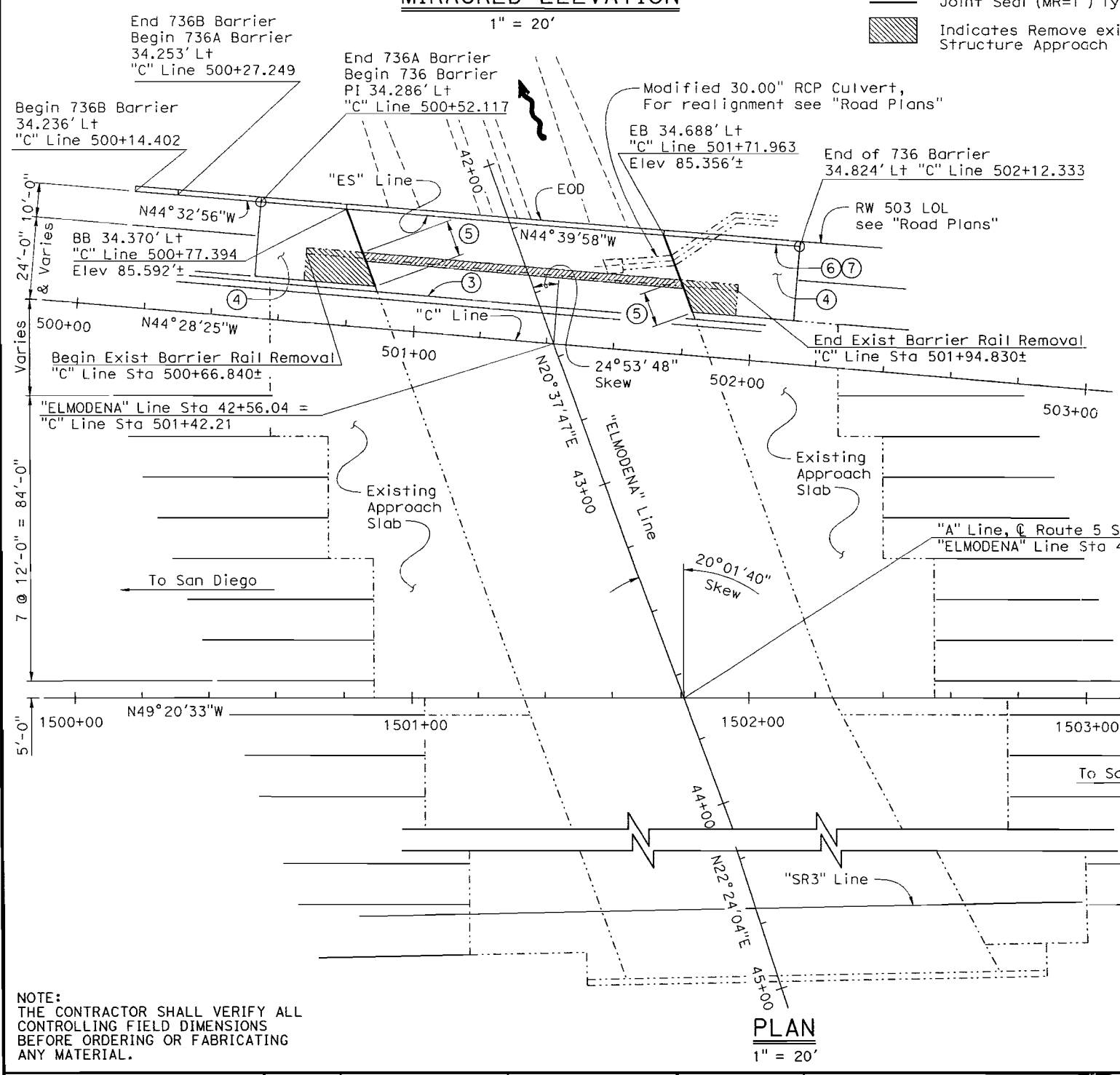
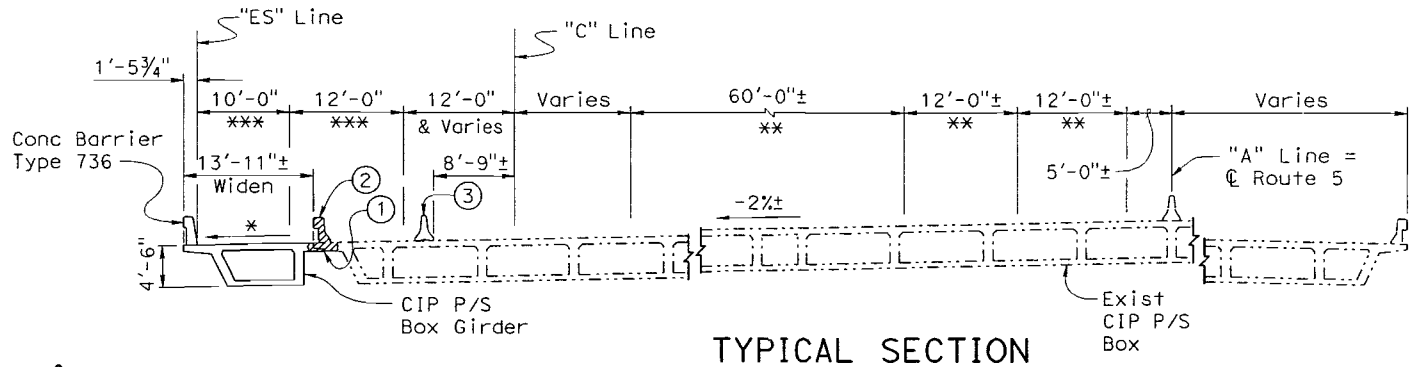


PLAN

1" = 20'



TYPICAL SECTION

1" = 10'

QUANTITIES

TRO (STRUCTURES)	LUMP	SUM
BRIDGE REMOVAL (PORTION)	LUMP	SUM
STRUCTURE EXCAVATION (BRIDGE)	52	CY
STRUCTURE EXCAVATION (RETAINING WALL)	195	CY
STRUCTURE BACKFILL (BRIDGE)	37	CY
STRUCTURE BACKFILL (RETAINING WALL)	204	CY
FURNISH PILE (CLASS 200)	400	LF
DRIVE PILING (CLASS 200)	8	EA
PRESTRESSING CAST-IN-PLACE CONCRETE	LUMP	SUM
STRUCTURAL CONCRETE, BRIDGE FOOTING	11	CY
STRUCTURAL CONCRETE, BRIDGE	125	CY
STRUCTURAL CONCRETE, RETAINING WALL	44	CY
STRUCTURAL CONCRETE, APPROACH SLAB (TYPE N)	57	CY
DRILL AND BOND DOWEL	40	LF
JOINT SEAL (MR 1")	49	LF
BAR REINFORCING STEEL (BRIDGE)	29,577	LB
BAR REINFORCING STEEL (RETAINING WALL)	2,839	LB
CONCRETE BARRIER (TYPE 736)	160	LF
CONCRETE BARRIER (TYPE 736A)	16	LF

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

X DESIGN ENGINEER	DESIGN	BY Christine Chan	CHECKED Jose Higareda	LOAD & RESISTANCE FACTOR DESIGN	LIVE LOADING: HL93 W/"LOW-BOY"; PERMIT DESIGN VEHICLE		
	DETAILS	BY Herman Mauroschadt	CHECKED Jose Higareda	LAYOUT	BY Gabriel Galo	CHECKED Jose Higareda	
	QUANTITIES	BY Suzan Moradi	CHECKED Tim Trefz	SPECIFICATIONS	BY Kevin Ellingson	PLANS AND SPECS COMPARED X	

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH 15

CU 12
EA 069901

BRIDGE NO. 55-0655
POST MILE 27.82

EL MODENA-IRVINE CHANNEL (Widen)

GENERAL PLAN

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES: 5-14-09 | 5-17-09 | 5-20-09 | 6-30-09 | 7-16-09 | 7-27-09 | 8-6-09 | 8-10-09 | 8-26-09

SHEET 1 OF 17

STRUCTURES DESIGN GENERAL PLAN SHEET (ENGLISH) (REV.07-24-06)

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USERNAME => pmquiroz DATE PLOTTED => 07-OCT-2009 TIME PLOTTED => 09:44

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	ORA	5			

REGISTERED CIVIL ENGINEER — X — DATE

Registered Professional Engineer — Gabriel Gato — No. 52288 — Exp. 12-31-10 — CIVIL — State of California

PLANS APPROVAL DATE

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HYDROLOGIC SUMMARY

DRAINAGE AREA: 12.8 SQUARE MILES

	DESIGN FLOOD	BASE FLOOD	OVERTOPPING FLOOD
FREQUENCY (YEARS)	N/A	100	N/A
DISCHARGE (CUBIC FEET PER SECOND)	N/A	8600	N/A
WATER SURFACE ELEV. AT BRIDGE (FEET)	N/A	73.8	N/A

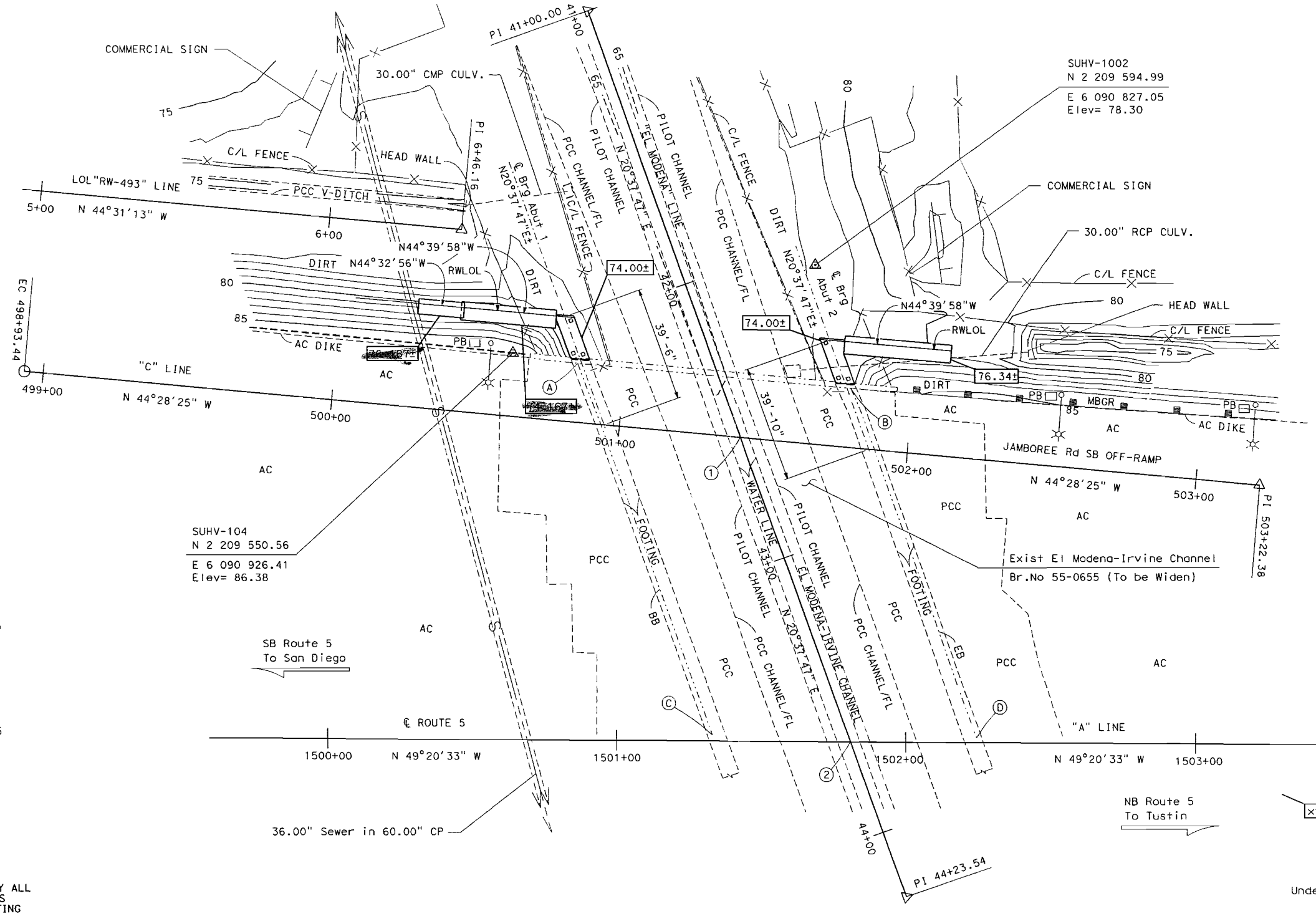
FLOOD PLAIN DATA ARE BASED UPON INFORMATION AVAILABLE WHEN THE PLANS WERE PREPARED AND ARE SHOWN TO MEET FEDERAL REQUIREMENTS. THE ACCURACY OF SAID INFORMATION IS NOT WARRANTED BY THE STATE AND INTERESTED OR AFFECTED PARTIES SHOULD MAKE THEIR OWN INVESTIGATIONS.

① Sta 42+56.04, "EL MODENA" LINE =
Sta 501+42.21, "C" LINE, JAMBOREE RD SB OFF-RAMP

② Sta 43+67.05, "EL MODENA" LINE =
Sta 1501+80.88, "A" LINE, ℄ ROUTE 5

BRIDGE LOCATION (55-0655)

Ⓐ 129.44 Ft Lt ℄ Rte 5, "A1" Line, Sta 1500+86.52, Elev= 85.85±
Ⓑ 121.38 Ft Lt ℄ Rte 5, "A1" Line, Sta 1501+80.92, Elev= 85.62±
Ⓒ 1.94 Ft Lt ℄ Rte 5, "A1" Line, Sta 1501+33.32, Elev= 88.20±
Ⓓ 1.69 Ft Lt ℄ Rte 5, "A1" Line, Sta 1502+24.56, Elev= 87.77±



SURVEY CONTROL

SUHV-104

Fnd Spk./Dirt
132.78 Ft Lt ℄ Route 5
Sta 1500+64.18
N 2 209 550.56
E 6 090 926.41
Elev= 86.38

SUHV-1002

Set Spk./Dirt
163.82 Ft Lt ℄ Route 5
Sta 1501+68.50
N 2 209 594.99
E 6 090 827.05
Elev= 78.30

Notes:

Underground Utilities As Shown Are Approximate

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

PRELIMINARY INVESTIGATION SECTION

SCALE 1"=20'	VERT.DATUM NAVD88	PHOTOGRAMMETRY AS OF: X			
	HORZ.DATUM NAD 83(1991.35)	SURVEYED	BY T.PHUNG 12/2008	CHECKED	BY C.STEWART 12/2008
	ALIGNMENT TIES DIST.TRAVERSE SHEETS	DRAFTED	BY V.PHAM 01/2009	CHECKED	BY S.ALIVIO 01/2009

	BY	CHECKED
DESIGN	Gabriel Gaio	Jose Higareda
DETAILS	Herman Mauroschadt	Jose Higareda
QUANTITIES	Suzan Moradi	Tim Trefz

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH 15

BRIDGE NO. 55-0655
POST MILE 27.82

EL MODENA-IRVINE CHANNEL (Widen)
FOUNDATION PLAN

STRUCTURES FOUNDATION PLAN SHEET (ENGLISH) (REV. 10/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12-222
EA 069901

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES: 01/16/09 | 09/10/09 | 10-6-09

SHEET 3 OF 17

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USERNAME => bmouroscac DATE PLOTTED => 07-Oct-2009 TIME PLOTTED => 09:45

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
12	ORA	05	27.6 / 28.2		

REGISTERED CIVIL ENGINEER — DATE X

PLANS APPROVAL DATE

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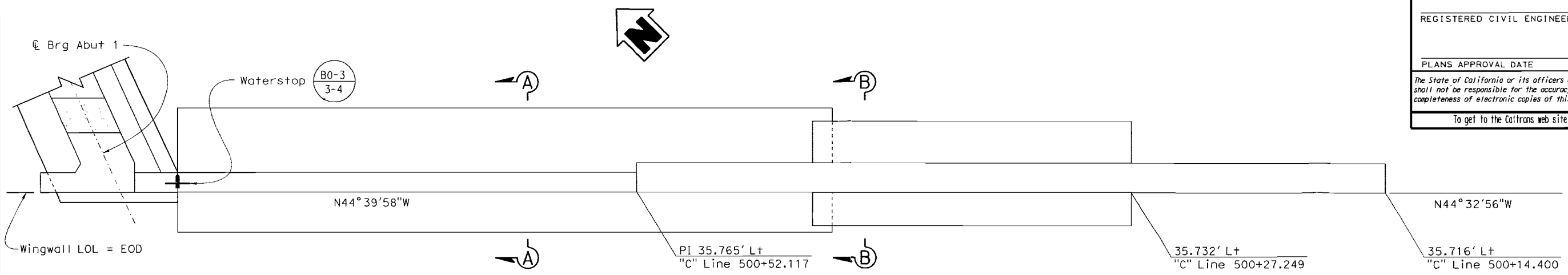
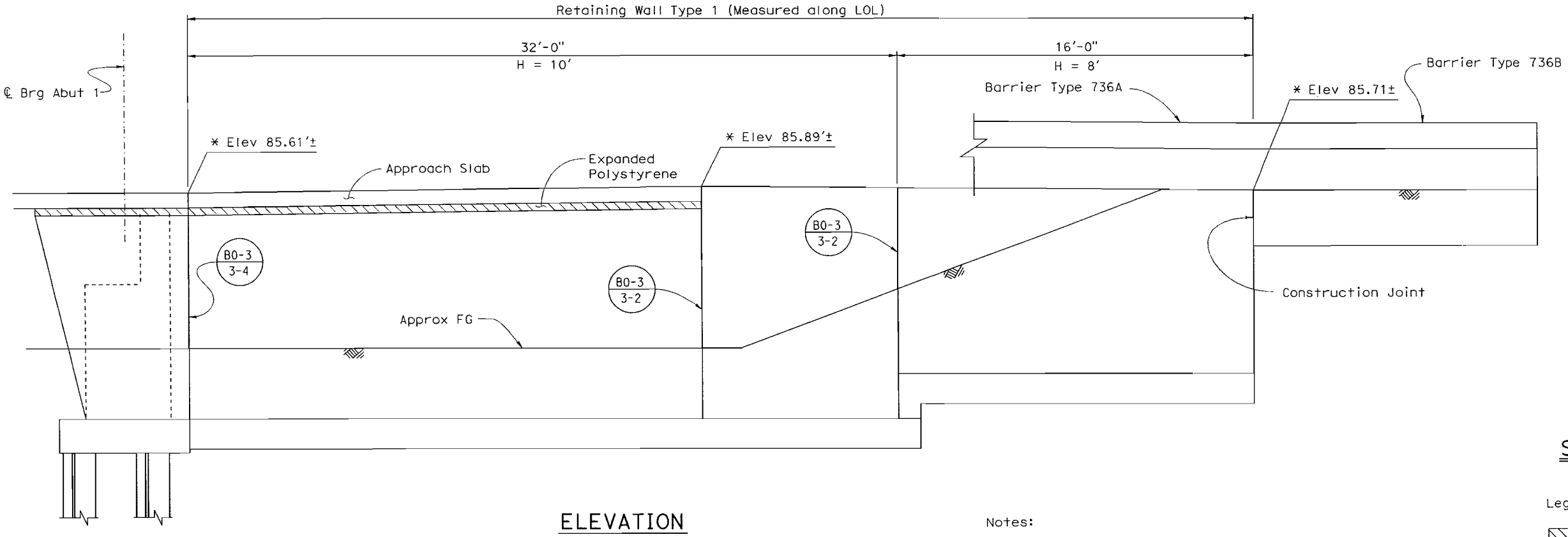


PLAN

Note:

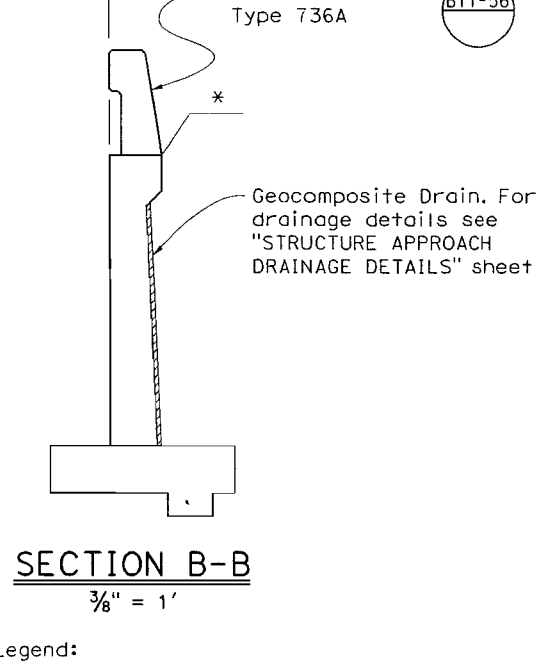
Longitudinal reinforcing steel continuous between Barrier Type 736A and Barrier Type 736B



ELEVATION
ABUTMENT 1 WINGWALL

3/8" = 1'

B3-1 B3-8 B0-3



SECTION B-B

3/8" = 1'

Notes:

For "SECTION A-A" see "ABUTMENT DETAILS NO. 6" sheet.

* Final elevations shown are approximate and dependent on existing roadway cross slope.

Legend:

Indicates Expanded Polystyrene

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

	BY	CHECKED
DESIGN	Gabriel Galo	Jose Higareda
DETAILS	Herman Mauroschadt	Jose Higareda
QUANTITIES	Anthony Logus	David Chung

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH 15

CU 12
EA 0G9901

BRIDGE NO. 55-0655
POST MILE 27.82

EL MODENA-IRVINE CHANNEL (Widen)

ABUTMENT DETAILS NO. 5

STRUCTURES DESIGN DETAIL SHEET (ENGLISH) (REV. 10/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES: 4-27-09 | 5-1-09 | 6-15-09 | 8-1-09 | 8-10-09 | 9-1-09 | 9-8-09 | 9-14-09 | 10-1-09

SHEET 10 OF 17

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12	ORA	05	27.6 / 28.2		

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Gabriel Galo
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STATE OF CALIFORNIA

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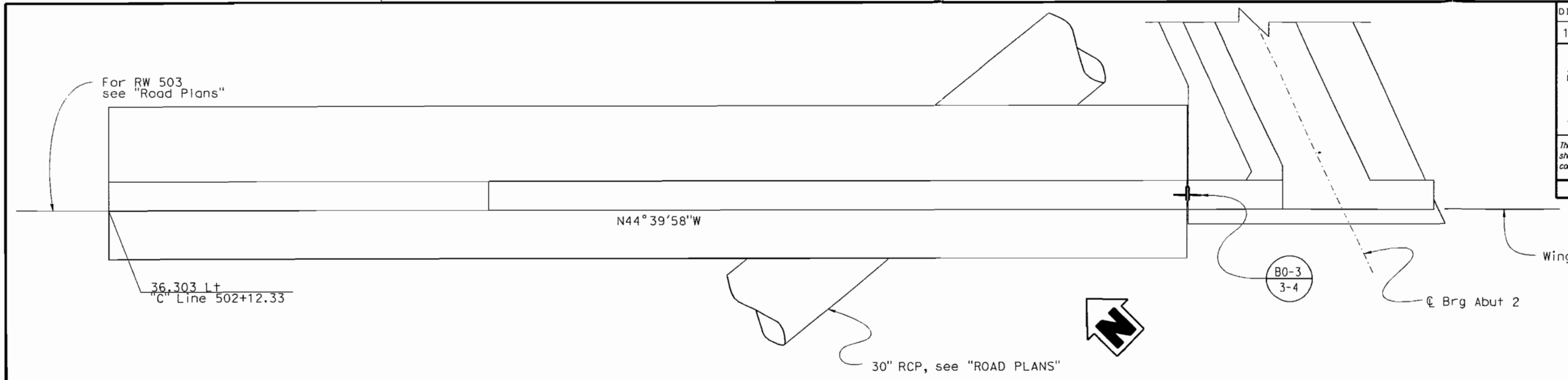
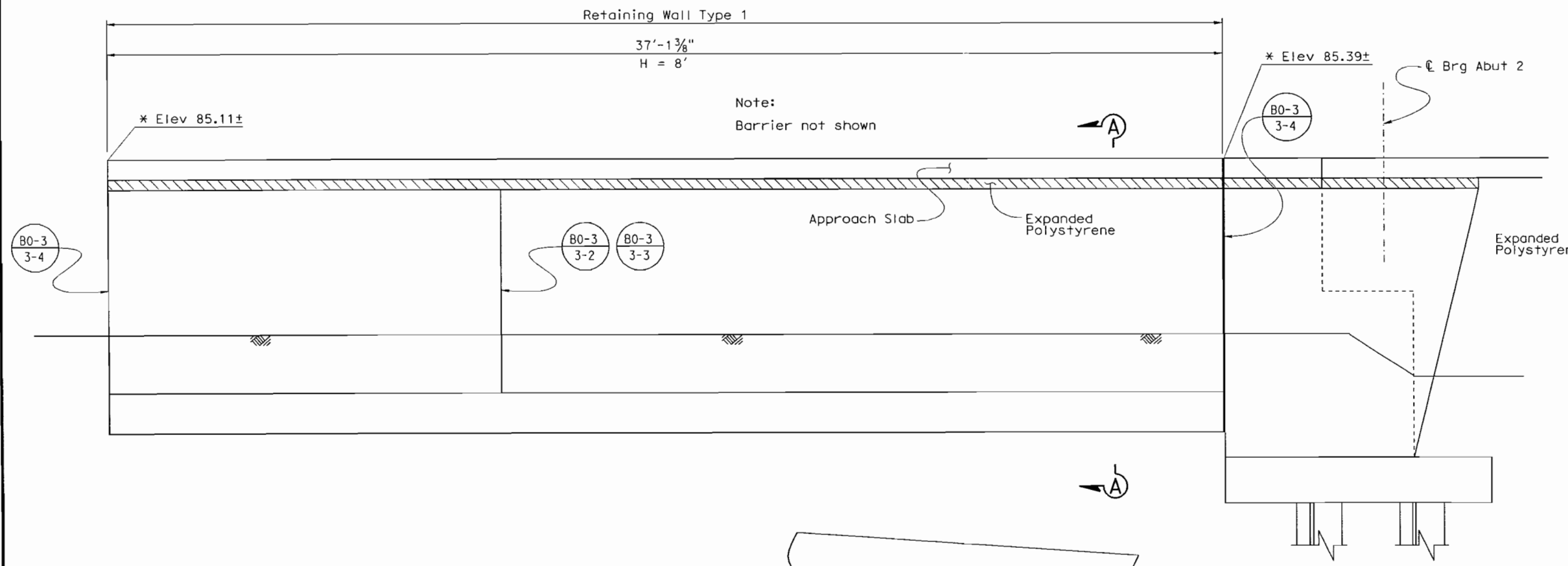
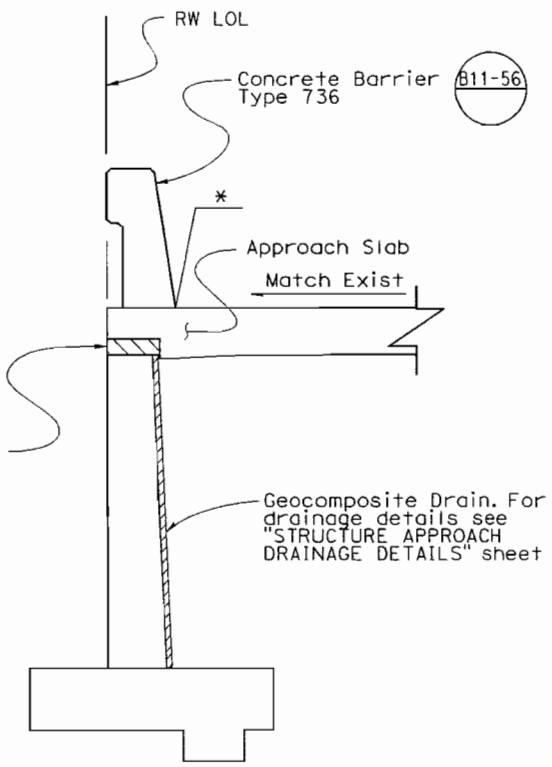


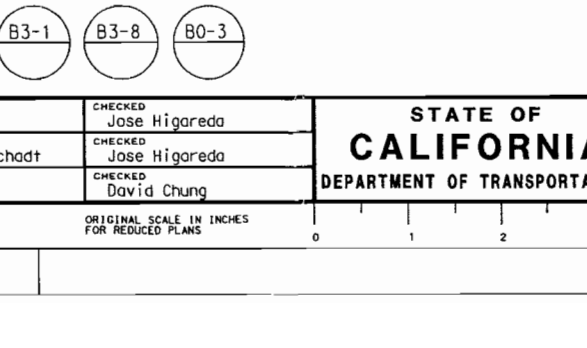
PLAN





SECTION A-A

½" = 1'



ELEVATION

ABUTMENT 2 WINGWALL

B3-1 B3-8 B0-3

½" = 1'

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

Legend:

▨ Indicates Expanded Polystyrene

* Final elevations dependent on existing roadway cross slope

	BY	CHECKED
DESIGN	Gabriel Galo	Jose Higareda
DETAILS	Herman Mauroschadt	Jose Higareda
QUANTITIES	Anthony Logus	David Chung

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH 15

BRIDGE NO.	EL MODENA-IRVINE CHANNEL (Widen)
55-0655	
POST MILE	ABUTMENT DETAILS NO. 6
27.82	

STRUCTURES DESIGN DETAIL SHEET (ENGLISH) (REV. 10/25/05)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12
EA 0G9901

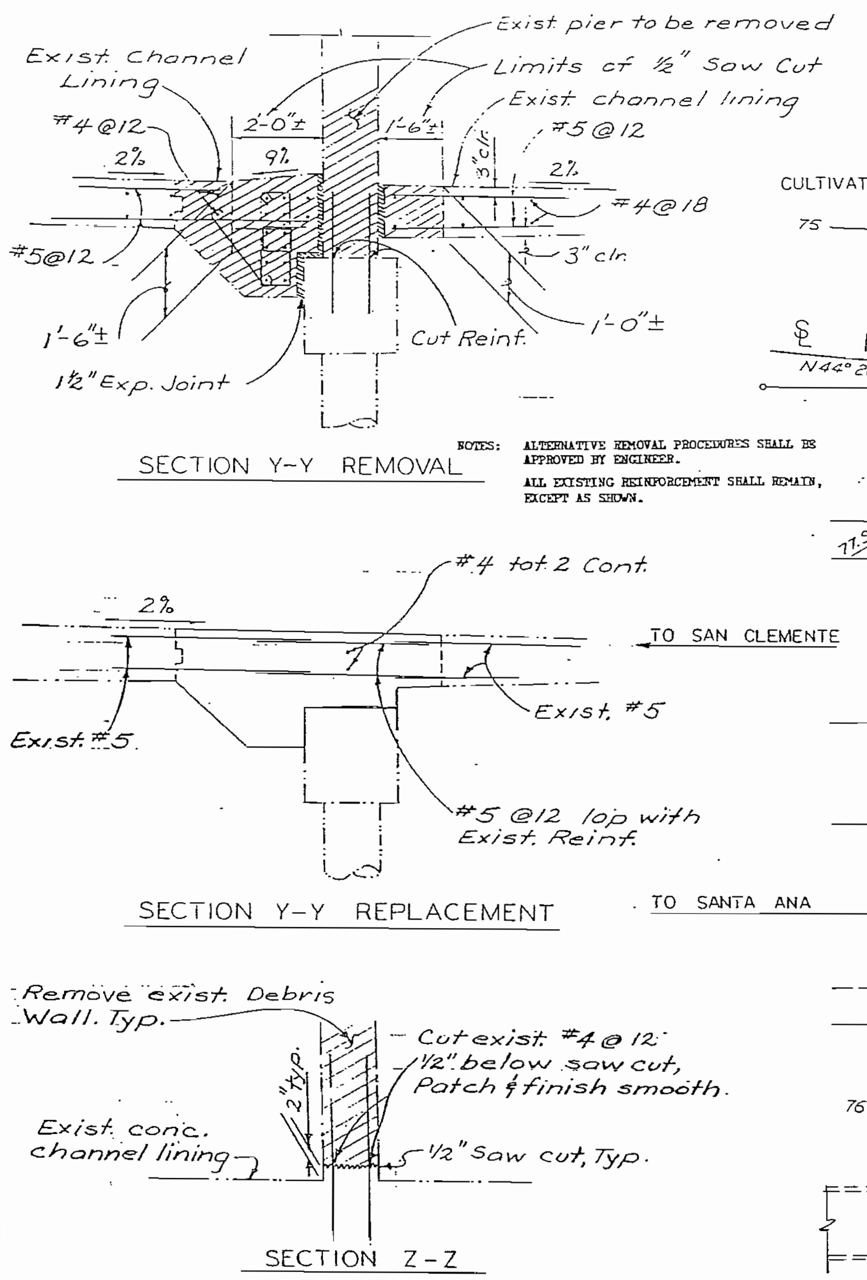
DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES: 5-1-09 | 5-8-09 | 7-28-09 | 8-4-09 | 8-18-09 | 9-1-09 | 9-9-09 | 9-14-09 | 10-5-09

SHEET 11 OF 17

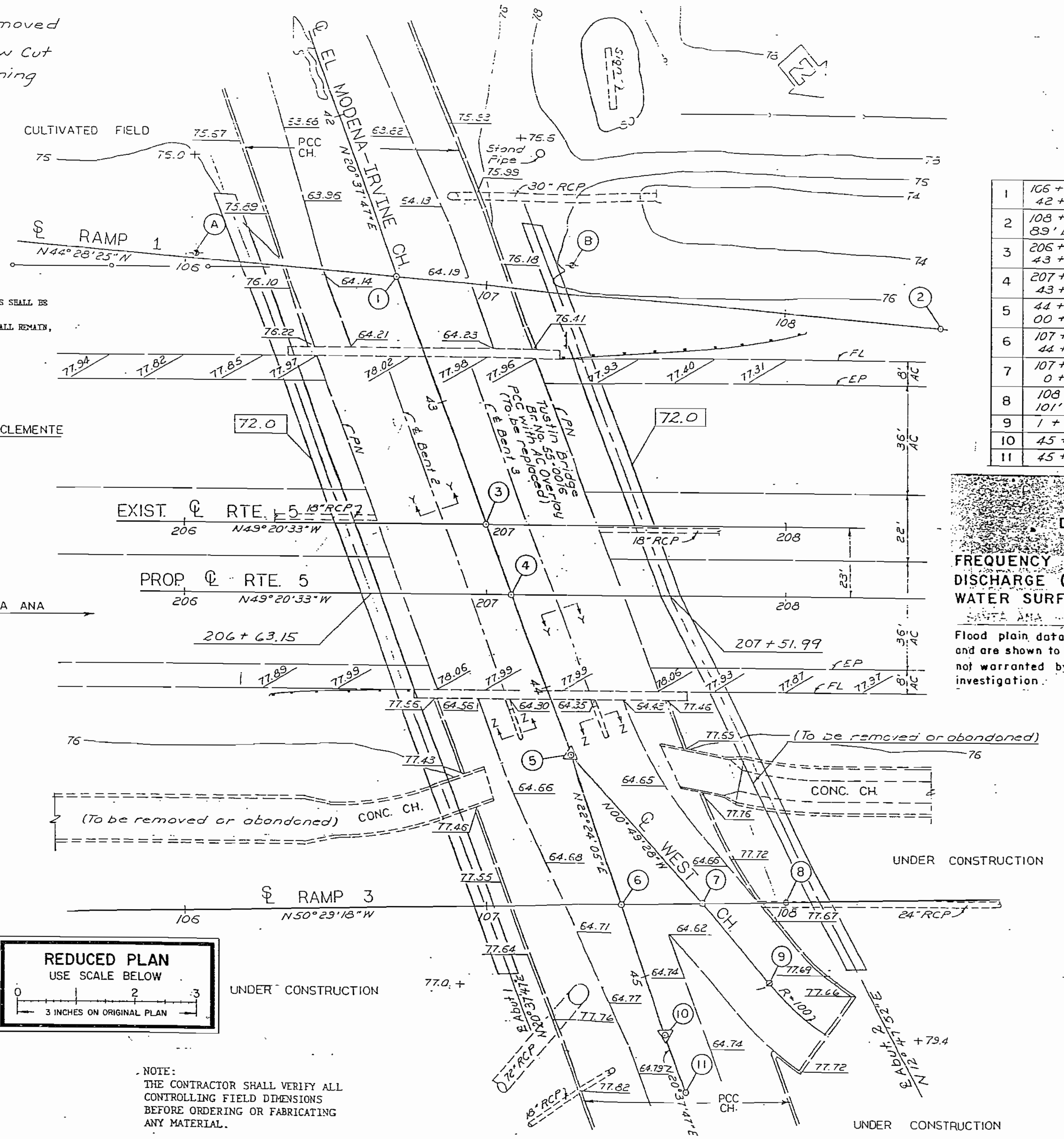
FILE => 55-0655-e-ad06.dgn

USERNAME => hmgurosc DATE PLOTTED => 07-OCT-2009 TIME PLOTTED => 09:45



EXISTING PIER WALL & DEBRIS WALL REMOVAL & REPLACEMENT DETAILS

No Scale



		NORTH	EAST
1	106 + 70.05 ℄ Ramp 1 42 + 56.04 ℄ Channel	565,177.255	529,479.302
2	108 + 50.26 ℄ Ramp 1 89' Lt. 208 + 50.26 Prop. ℄ Rte. 5	569,305.665	529,353.049
3	206 + 99.94 Exist. ℄ Rte. 5 43 + 42.57 ℄ Channel	569,258.28	529,509.79
4	207 + 08.32 Prop. ℄ Rte. 5 43 + 67.05 ℄ Channel	569,281.191	529,518.415
5	44 + 23.54 ∓ Pt ℄ Channel 00 + 00.00 Begin ℄ West Ch.	569,334.058	529,538.318
6	107 + 44.23 ℄ Ramp 3 44 + 75.18 ℄ Channel	569,381.798	529,557.996
7	107 + 70.94 ℄ Ramp 3 0 + 64.74 ℄ West Ch.	569,398.794	529,537.386
8	108 + 00.00 ℄ Ramp 3 101' Rt 208 + 00 Prop. ℄ Rte. 5	569,417.282	529,514.968
9	1 + 00.00 B.C. ℄ West Ch.	569,434.048	529,536.879
10	45 + 20.58 ∓ Pt. ℄ Channel	569,423.775	529,575.299
11	45 + 40.67 BC ℄ Channel	569,442.576	529,582.377

HYDROLOGIC SUMMARY

DRAINAGE AREA ___ square miles

	DESIGN FLOOD	BASE FLOOD
FREQUENCY (Years)	100	
DISCHARGE (Cubic feet per second)	7900	
WATER SURFACE (Elevation at bridge)	76.0	

SANTA ANA

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

BENCH MARKS

BM# 15-00103 Elev. 76.59'
Brass cap & nail approx. 0.5 mi NW of Myford Rd. set in top of NE side of concrete drainage ditch, about on ℄ prod. of 15 in. concrete pipe cross drain under Santa Ana Fwy., approx. 50ft. SW of EP of Northbound Santa Ana Fwy.

BM# 15-00110 Elev. 75.11'
Brass cap & nail in the NE retaining wall of a 10ft. concrete drainage ditch 40ft. NE of northbound EP Santa Ana Fwy.; of Bridge No. 55-15 at P.M. 27.63, approx. 3ft. NW of SE end of wall; 0.25 mi NW of Myford Rd.

℄ West Ch.
R = 100'
Δ = 14°19'26"
T = 12.57'
L = 25.00'
N569,432.609
E529,436.889

UTILITIES

(A) PP# 593713H
1 cable NW-SE at elev. 106'±

(B) PP# 593713H
1 cable NW-SE at elev. 106'±

NOTES

+ Denotes spot elevation.
Underground utilities as shown are approximate.
Datum: So-Cal Co-op Level Lines 400, 402.

[box] Denotes bottom of footing elevation.

REDUCED PLAN
USE SCALE BELOW
0 1 2 3
3 INCHES ON ORIGINAL PLAN

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL.

DIST.	COUNTY	ROUTE	POST MILES—TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	Ora	5	27.3/28.2	159	188

DESIGN ENGINEER: [signature] — REGISTERED CIVIL ENGINEER NUMBER
DATE APPROVED: 5-23-88

REGISTERED PROFESSIONAL ENGINEER — FLOYD L. MELLON — No. 12547 — Exp. 3-31-89 — CIVIL — STATE OF CALIFORNIA

PRELIMINARY INVESTIGATION SECTION

SCALE	DATUM	PHOTOGRAMMETRY AS OF:		DESIGN	By J. A. Kessler 6/87	Checked T. P. [illegible] 5-88
1" = 20'	SEE NOTES	SURVEYED By	DRAWN By S. Odo 1-14-87	DETAILS	By L. M. [illegible] 5/88	Checked C. R. [illegible] 5-88
ALIGNMENT TIES		FIELD CHKD By H. Joe 1-9-87	TRACED By / CHECKED By H. Joe 1-30-87	QUANTITIES	By T. [illegible] 7.88	Checked [illegible]

State of **CALIFORNIA**
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES 8
STRUCTURE DESIGN
[signature] C40902 — REGISTERED CIVIL ENGINEER NO.

BRIDGE NO. 55-655
POST MILE 27 82

EL MODENA-IRVINE CHANNEL
FOUNDATION PLAN

CU 07204

DS 0145 (Rev 6/85)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

Disregard prints bearing earlier revision dates

REVISION DATES (PRELIMINARY STAGE ONLY)

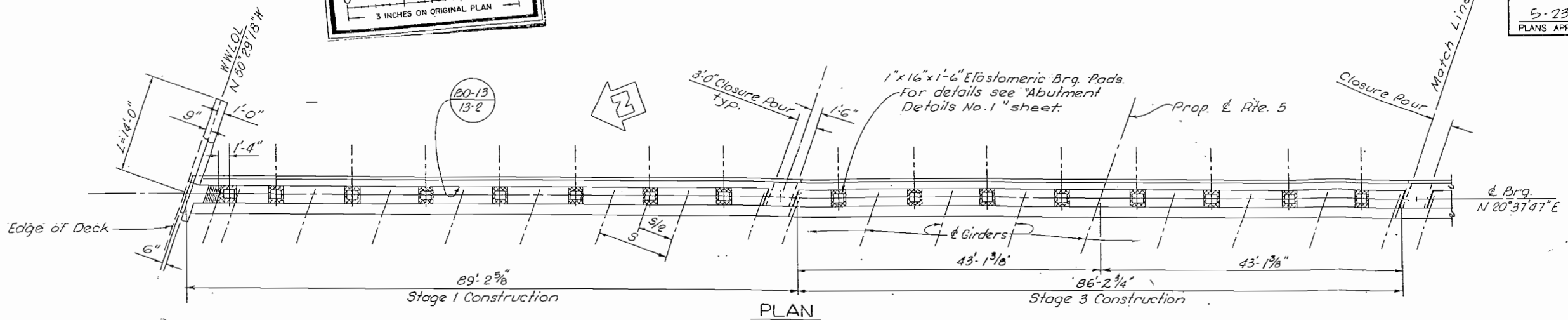
DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.
07	Ora	5	27.3/28.2	10

REGISTERED ENGINEER - CIVIL

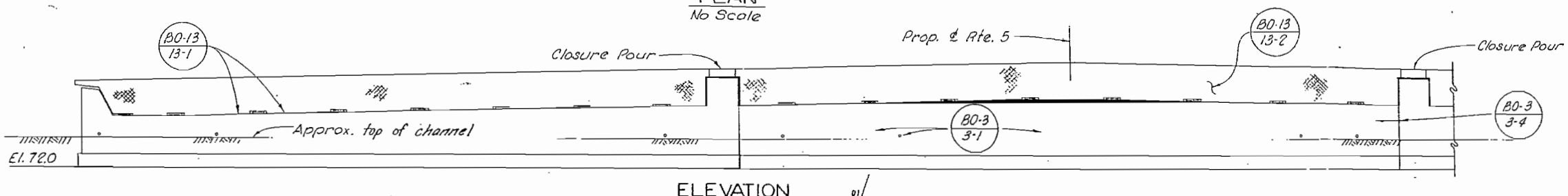
5-23-88
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — FLOYD L. MEL — No. 1254 — Exp. 3-31- — CIVIL — STATE OF CA

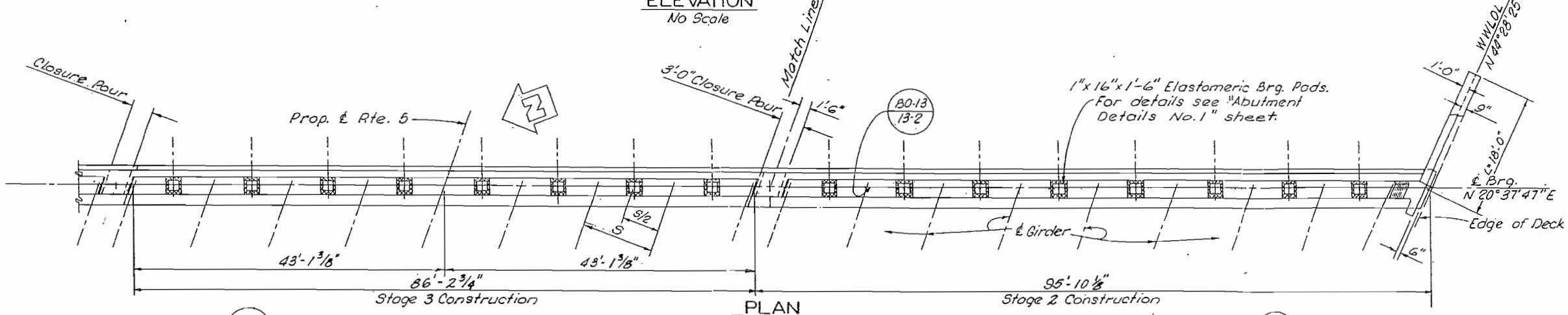
REDUCED PLAN
USE SCALE BELOW
0 1 2 3
3 INCHES ON ORIGINAL PLAN



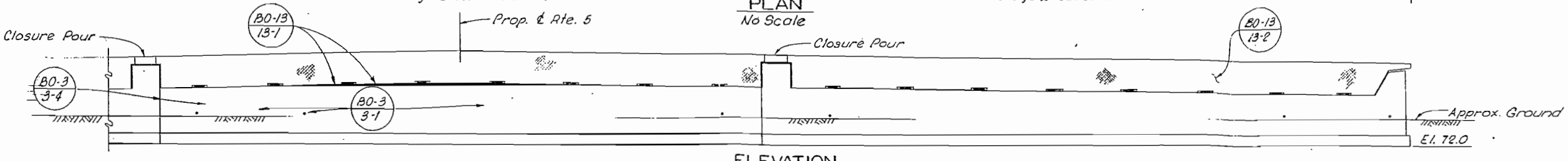
PLAN
No Scale



ELEVATION
No Scale



PLAN
No Scale



ELEVATION
No Scale

Note:
For details not shown see "Abutment Details No. 1 & No. 2" sheets.

DESIGN	By M Kelly 6/87	Checked [illegible]	5-88	State of CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF STRUCTURES 8 STRUCTURE DESIGN
DETAILS	By [illegible] 6/87	Checked [illegible]	5-88		majid madani 40902
QUANTITIES	By T. Cooper 5.88	Checked [illegible]	5-88		PROJECT ENGINEER REGISTERED CIVIL ENGINEER NO.

BRIDGE NO. 55-655
POST MILE 27.82

EL MODENA – IRVINE CHANNEL
ABUTMENT NO. 1 LAYOUT

DS 050 2139 (2/86)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 07209
EA 018811

Disregard prints bearing earlier revision dates →

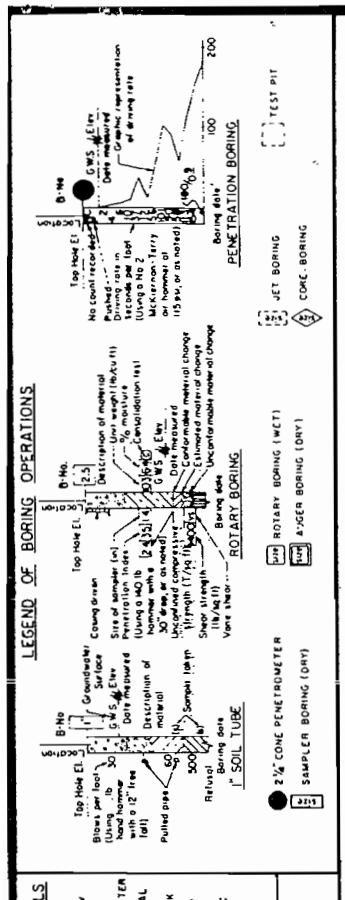
REVISION DATES (PRELIMINARY STAGE ONLY)

DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	Ora.	5	27.3/28.2	171	188

Garth T. Goldschmidt -27
REGISTERED - CERTIFIED ENGINEERING GEOLOGIST
5-23-88
PLANS APPROVAL DATE

REGISTERED GEOLOGIST · A.F. GOLDSCHMIDT · No. 598 · Exp. 6-30-88 · STATE OF CALIFORNIA

LEGEND OF BORING OPERATIONS



LEGEND OF EARTH MATERIALS

GRAVEL · SAND · SILT · CLAY · SILTY CLAY or CLAYEY SILT · SANDY CLAY or CLAYEY SAND · SANDY SILT or SILTY SAND · ORGANIC MATTER · FILL MATERIAL · IGNEOUS ROCK · SEDIMENTARY ROCK · METAMORPHIC ROCK

CONSISTENCY CLASSIFICATION FOR SOILS

According to the Standard Penetration Test

Penetration (Blows/Ft)	Granular	Cohesive
0-4	Very loose	Very soft
5-9	Loose	Soft
10-19	Slightly compact	Stiff
20-34	Compact	Very stiff
35-69	Dense	Hard
> 70	Very dense	Very hard

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

UNIFIED SOIL CLASSIFICATION SYSTEM

Group Symbols	Typical Names	Laboratory Classification Criteria	Field Identification Procedures (Excluding particles larger than 3 in. and basing fractions on estimated weights)
GW	Well graded gravels, gravel-sand mixtures, little or no fines	Cu greater than 4; Cc between 1 and 3	
GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting both criteria for GW	
GM	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	
GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7	
SW	Well graded sands, gravelly sands, little or no fines	Cu greater than 6; Cc between 1 and 3	
SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting both criteria for SW	
SM	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	
SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7	
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity		
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
OL	Organic silts and organic silty clays of low plasticity		
MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
CH	Inorganic clays of high plasticity, fat clays		
OH	Organic clays of medium to high plasticity, organic silts		
Pt	Peat and other highly organic soils		

Fine grained soils: Silts and Clays (Liquid limit less than 50) — Silts and Clays (Liquid limit greater than 50) — Highly Organic Soils

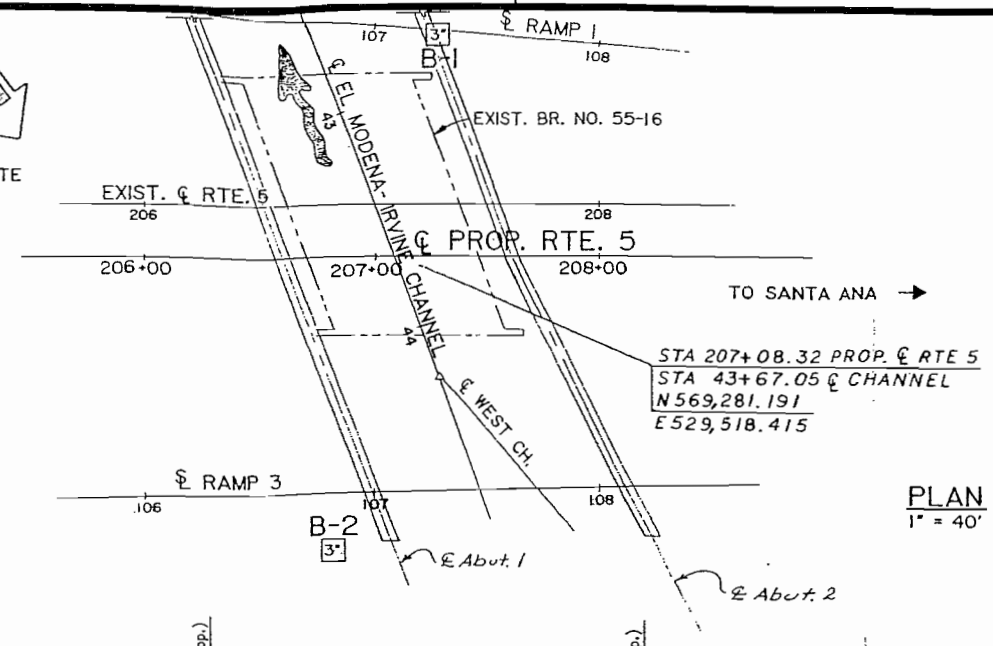
Coarse grained soils: Gravels — Sands

BENCH MARK

TBM STA 209 Elev. 76.78
Found flush nail 4' from EP on S/B 5 at Sta. 209 ℄ 5 set by Dist. 7 surveys.

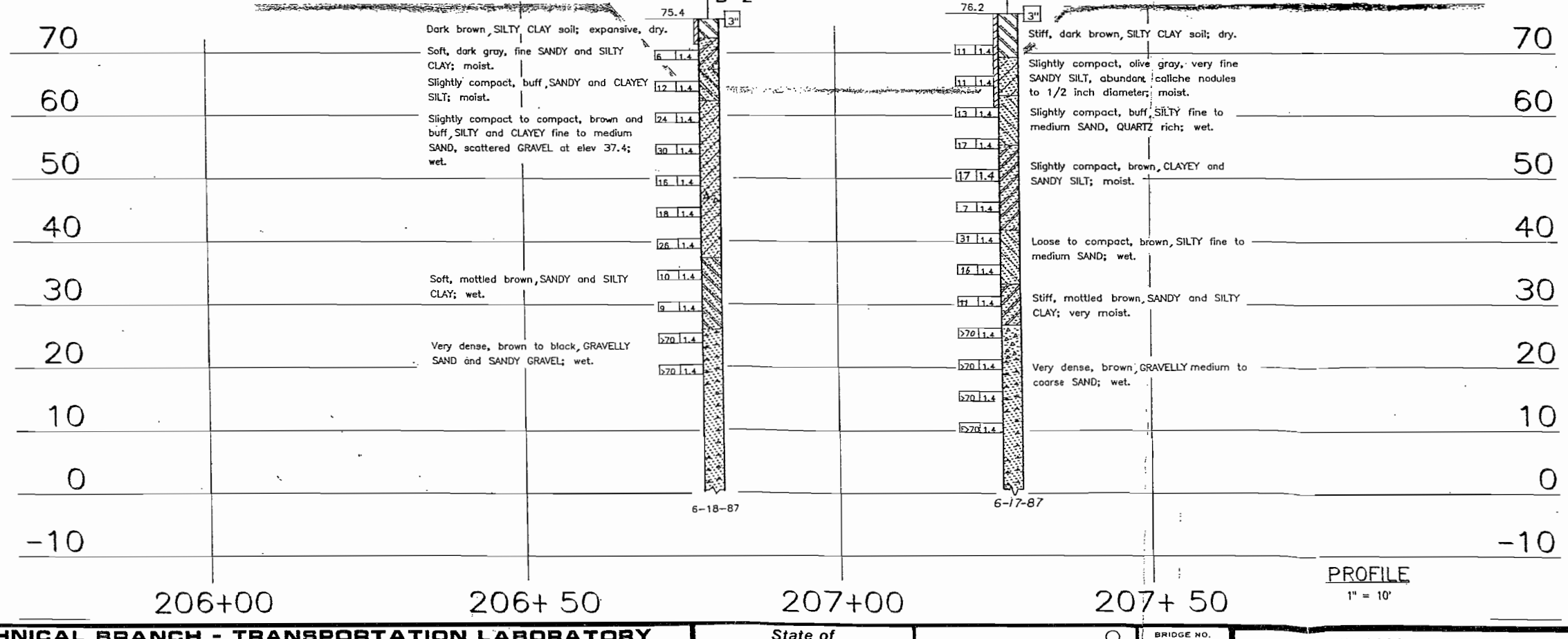
TBM STA. 221 Elev. 78.69
Found flush nail 4' from EP on N/B Rte. 5 at Sta. 215 ℄ 5 set by Dist. 7 surveys.

Note: Groundwater was not measured. Groundwater is estimated at elevation 63.



PLAN
1" = 40'

REDUCED PLAN
USE SCALE BELOW
0 1 2 3
3 INCHES ON ORIGINAL PLAN



PROFILE
1" = 10'

GEOTECHNICAL BRANCH - TRANSPORTATION LABORATORY							
DRAWN BY	I. Howell	8/87	Approved Recommended By:		CHARGE UNIT	EXPEND. AUTHOR	SPEC. DESIGN
CHECKED BY		8/87	PROJECT GEOLOGIST	C.E.G. NO.			
			ENGINEERING GEOLOGIST	C.E.G. NO. 751			

State of CALIFORNIA
DEPARTMENT OF TRANSPORTATION

STRUCTURES - DESIGN 8
PROJECT ENGINEER — REGISTERED CIVIL ENGINEER NO.

BRIDGE NO.
55-0655
POST MILE
27.82

EL MODENA-IRVINE CHANNEL
LOG OF TEST BORINGS 1 of 2

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 07209
EA 018811

Disregard prints bearing earlier revision dates →

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET	OF
15	16

85 0148

FED. ROAD DIST. No.	STATE	PROJ. No.	FISCAL YEAR	SHEET No.
2	CAL.	[illegible]		143

DIST.	COUNTY	ROUTE	POST MILES—TOTAL PROJECT	SHEET No.	TOTAL SHEETS
07	Ora	5	27.3/28.2	172	188

DIST.	COUNTY	ROUTE	SECTION	SHEET No.
VII	Ora	-2	C	-9

DATE APPROVED 5-23-88

JULY 2 1956

To San Diego — 205 — ℄ CONSTRUCTION — 206 — 207 — N 50°06'30" W 208 — To Tustin

Logged Pile #1 — Logged Pile #2

B-4 — B-2 — B-3

Abut #1 — Abut #2 — Abut #3 — Abut #4

REDUCED PLAN
USE SCALE BELOW
0 1 2 3
3 INCHES ON ORIGINAL PLAN

GEOTECHNICAL BRANCH - TRANSPORTATION LABORATORY

EL MODENA-IRVINE CHANNEL BR.

LOG OF TEST BORINGS 2 of 2

PROJECT ENGINEER	APPROVED RECOMMENDED BY ENGINEERING GEOLOGIST	CU: 07209 EA: 018811	BRIDGE No. 55-0655

REGISTERED GEOLOGIST — No. — Exp. — STATE OF CALIFORNIA

Abut #1 Logged Pile #1 — 24 Pc. Sta 206+76 ℄ Const. — 6 Pc. Sta 206+87 ℄ Const. — 7 Pc. Sta 207+23 ℄ Const. — 57 Pc. Sta 207+39 ℄ Const. — Abut #4 Logged Pile #2

Approx existing ground along ℄ Construction

El. 2[illegible] Ftg. Gr "As Built" — El. 76.12 — El. 78.08 — El. 77.72 — El. 78.53 — El. 76.11 Ftg. Gr "As Built"

B-1 — B-4 — B-2 — B-3

80 70 60 50 40 30 20 10 0 -10 -20

Loose, brown silty clay

Loose, light gray clayey silt

Loose, gray & light tan layered silty very fine sand

Loose dark gray organic silt lime concretions

Slightly compact silty sand

Slightly compact gray clayey, limey silty very fine sand

Slightly compact gray limey silty very fine sand, layered with 2-3 medium grain quartz sand

Slightly compact orange clayey fine oxidized sand

Slightly compact gravel

Slightly compact light buff-orange clayey silt with lime concretions clayey silt & fine sand layers. Some gravel streaks

Slightly compact buff clay with oxidized streaks of lime concretions

Slightly compact buff-orange silty very fine sand

Compact gray green gravel & sand, angular shale fragments

Compact brown medium grain sand

G.W.S. El 66.5 12-22-53

12-22-53

Min. Ave. Max. Per — Tons Bearing E.N.R.

Sec. Per Ft.

1-13-64 — 11-4-53 — 12-9-53

203 — 208

Hammer: No. 1 Vulcan (5000" lbs)
Design Pile Loading: 45 Tons
Type Pile: Raymond Step Taper
Diameter: Tip 8" Butt 15½"
Total No. Piles: 5#
Lineal Ft. Piles, "As Built": 2,232:8
Lineal Ft. Piles, Called for on Plan[illegible]
Remarks:

AS BUILT PLANS
Contract No. 57-7VC415
Date Completed
Document No. 70002055

Test Boring By Bridge Dept.

AS BUILT
CORRECTIONS BY.....
DATE 8-4-58

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

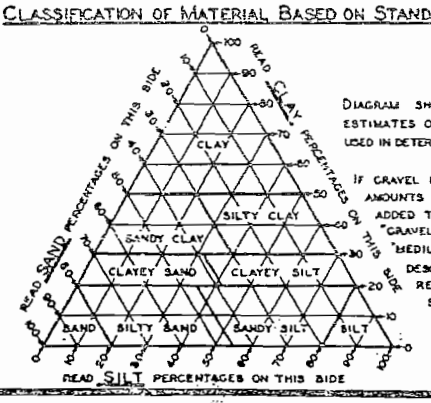


DIAGRAM SHOWING THE BASIS FOR ESTIMATES OF GRADE SIZE DISTRIBUTION USED IN DETERMINATION OF CLASS NAMES

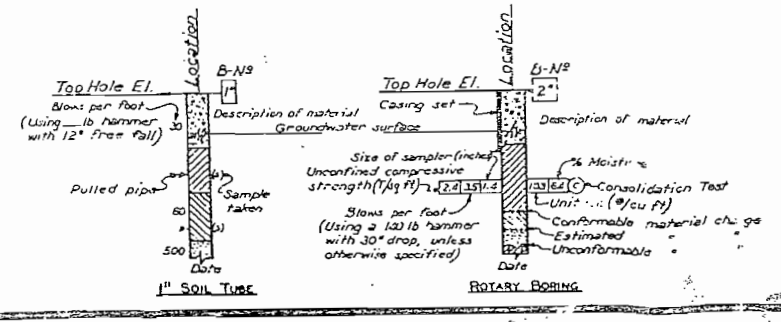
IF GRAVEL IS PRESENT IN APPRECIABLE AMOUNTS THE TERM "GRAVELLY" MAY BE ADDED TO THE CLASS NAME, VIZ. "GRAVELLY SAND". THE TERMS "COARSE", "MEDIUM" AND "FINE" WHEN USED TO DESCRIBE GRAVEL, SAND AND SILT REFER TO STANDARD GRADE SIZE LIMITS.

LEGEND OF EARTH MATERIALS

- Gravel
- Sand
- Silt
- Clay
- Sandy Clay or Clayey Sand
- Sandy Silt or Silty Sand
- Silty Clay or Clayey Silt
- Peat and/or Organic Clay
- Filled Material
- Igneous Rock
- Sedimentary Rock
- Metamorphic Rock

LEGEND OF BORING OPERATIONS

- Plan of any boring
- Penetrometer
- 2½" Cone penetrometer
- Sampler boring (dry)
- Rotary boring (wet)
- Auger boring (dry)
- Jet boring
- Core boring
- Test pit



NOTES

THE CONTRACTOR'S ATTENTION IS DIRECTED TO SECTION 2, ARTICLE (5) OF STANDARD SPECIFICATIONS AND TO THE SPECIAL PROVISIONS ACCOMPANYING THIS SET O
CLASSIFICATION OF EARTH MATERIAL AS SHOWN ON THIS SHEET IS BASED
FIELD INSPECTION AND IS NOT TO BE CONSTRUED TO IMPLY MECHANICAL ANALYSI
PENETROMETER BORINGS HAVING A RATE OF PENETRATION MEASURED IN
PER FOOT ARE DRIVEN WITH A No 2 WASHINGTON-TERZY AIR HAMMER AT 115

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

TUSTIN BRIDGE

LOG OF TEST BORINGS

SCALE: HORIZ. 1"=20' VERT. 1"=10'	BRIDGE 55-16	FILE	DRAWING C-1-14

PREL. DRAWING NO. P-146

Appendix B
Exploratory Location Map

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	5	27.6/28.2		

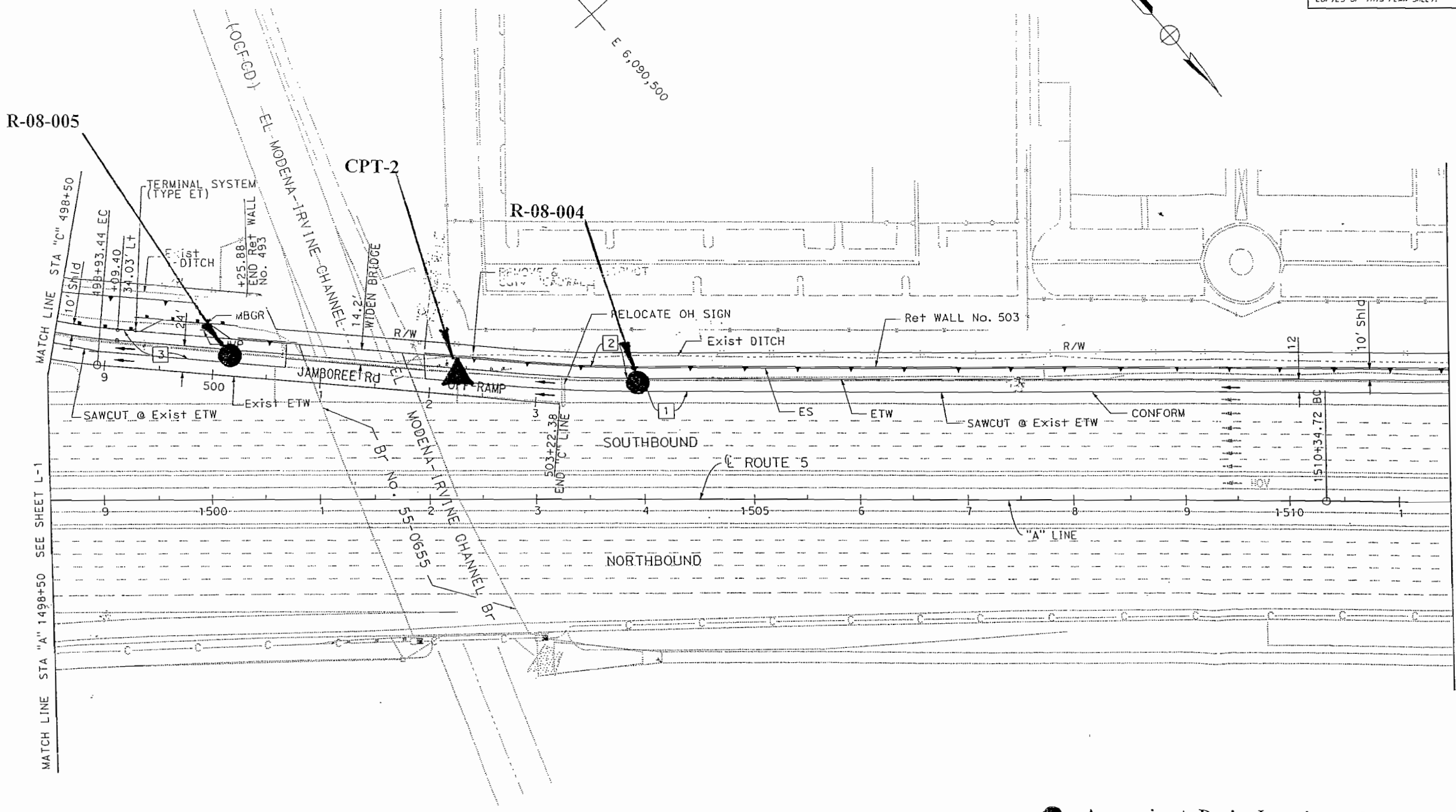
REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

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

NOTE:
FOR COMPLETE RIGHT OF WAY AND ACCURATE ACCESS DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.



● Approximate Boring Location and Number

▲ Approximate CPT sounding location

LAYOUT
SCALE : 1"=50'

L-2

REVISED BY | DATE REVISED
CALCULATED-DESIGNED BY | CHECKED BY
FUNCTIONAL SUPERVISOR: MATTHEW CUGINI
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION | DESIGN
Caltrans

LAST REVISION DATE PLOTTED => 13-JUN-2008
00-00-00 TIME PLOTTED => 09:25

BORDER LAST REVISED 3/1/2007

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

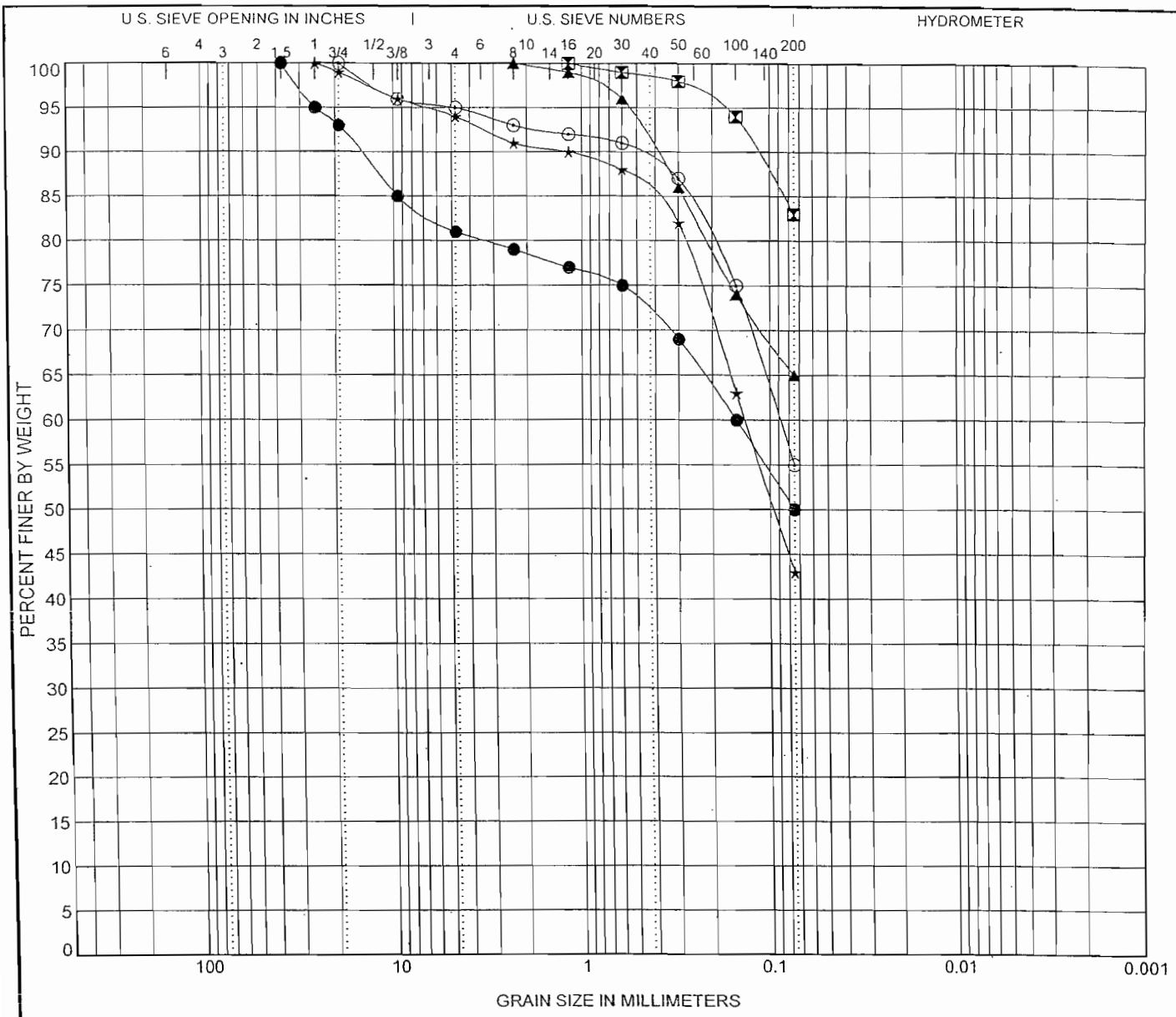
USERNAME => s111599
DGN FILE => c0g990e0002.dgn

CU 12222 | EA 0G9900

Appendix C
Laboratory Test Results

Summary of Laboratory Results

Boring #	Depth (ft.)	γ_d, lb/ft^3	Moisture %	PH/Min. Resistivity	% pass # 200	Atterburg LL/PL/PI	Direct Shear (Ø°,C psf)	Unconfined Compression (ksf)
R-08-004	5-6.5			8.42/1200	50	47/20/27		
	15-16.5				83	50/30/20		
	25-26.5			7.95/950	65	33/17/16		
	35-36.5			8.38/2000	43	23/22/1		
	40-41.5				55	24/23/1		
	50-51.5			8.14/1100	87	38/26/12		
R-08-005	5-6.5			7.92/740	68	43/22/21		
	15-16.5				71	49/23/26		
	25-26.5				56	34/20/14		
	35-36.5			8.35/1500	62	26/18/8		
	45-46.5				89	40/23/17		
	55-56.5			8.16/1900	48	22/20/2		
	60-61.5				13	53/27/26		
	65-76.5			8.68/5900	12			
R-08-004	10-11.5	75.54	40.15					2.2
	20-21.5	101.1	22.63					2.5
	30-31.5	114.2	16.76					8.7
R-08-005	10-11.5	85.56	36.45					1.6
	20-21.5	94.27	28.58					2.5
	30-31.5	111.8	17.28					4.7
	50-51.5	101.3	24.36					3.4



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	A-08-004	5.0	SANDY LEAN CLAY with GRAVEL(CL)	47	20	27		
⊠	A-08-004	15.0	ELASTIC SILT with SAND(MH)	50	30	20		
▲	A-08-004	25.0	SANDY LEAN CLAY(CL)	33	17	16		
★	A-08-004	35.0	SILTY SAND(SM)	23	22	1		
⊙	A-08-004	40.0	SANDY SILT(ML)	24	23	1		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	A-08-004	5.0	37.5	0.15			19.0	31.0	50.0	
⊠	A-08-004	15.0	1.18				0.0	17.0	83.0	
▲	A-08-004	25.0	2.36				0.0	35.0	65.0	
★	A-08-004	35.0	25	0.135			6.0	51.0	43.0	
⊙	A-08-004	40.0	19	0.089			5.0	40.0	55.0	

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

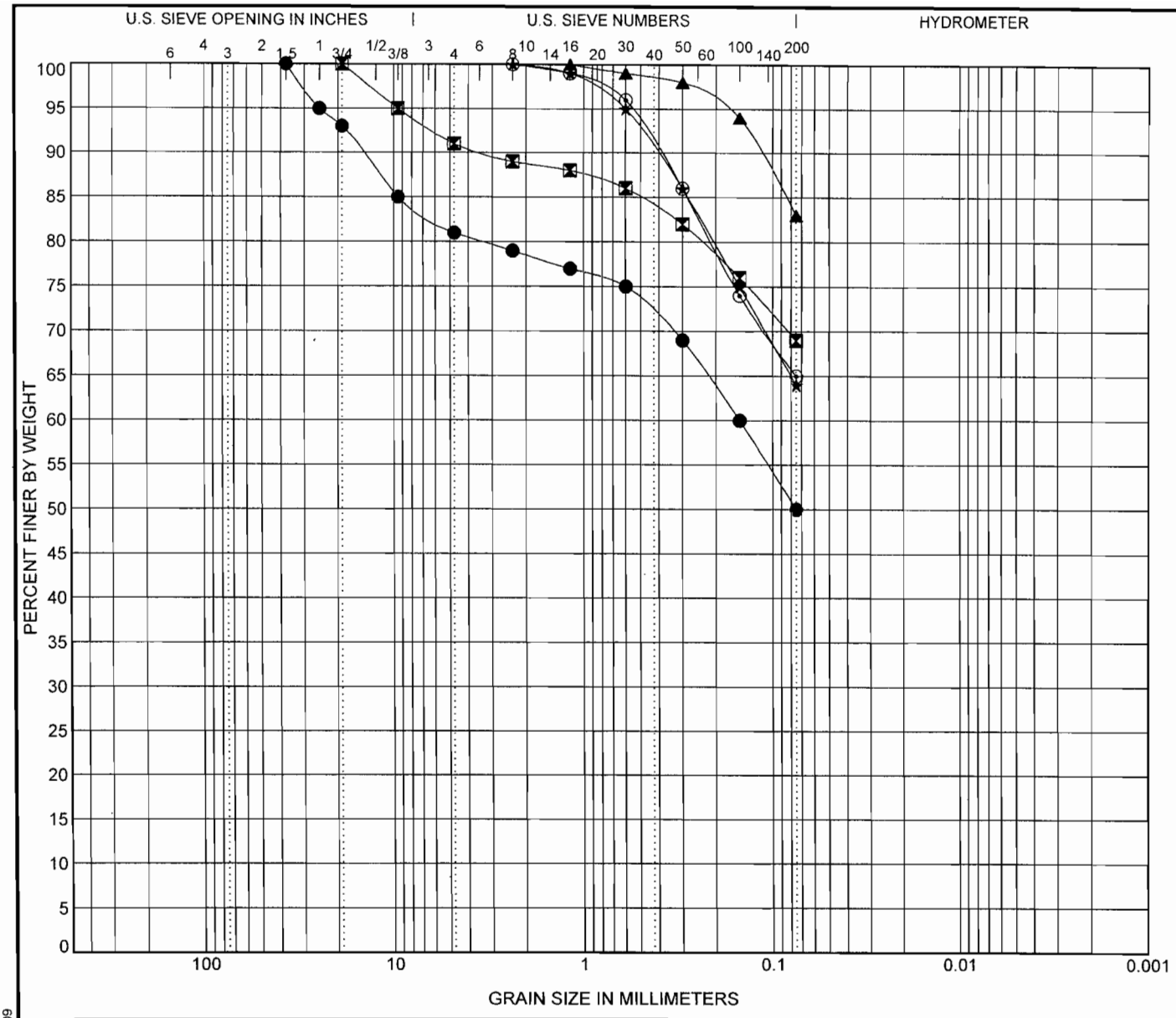
GRAIN SIZE DISTRIBUTION

DIST	COUNTY	ROUTE	POSTMILE	EA
12	Orange	I-5	D27.6/D	12-12-0G9901

PROJECT OR BRIDGE NAME: El-Modena-Irvine channel

BRIDGE NUMBER	PREPARED BY	DATE	SHEET
			1 of 3

CALTRANS GRAIN SIZE 12-0G9901 ELMODENA.GPJ CALTRANS LIBRARY 040808.GLB 8/5/09



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	A-08-004	5.0	SANDY LEAN CLAY with GRAVEL(CL)	47	20	27		
⊠	A-08-004	10.0	SANDY LEAN CLAY(CL)	47	23	24		
▲	A-08-004	15.0	ELASTIC SILT with SAND(MH)	50	30	20		
★	A-08-004	20.0	SANDY LEAN CLAY(CL)	45	14	31		
⊙	A-08-004	25.0	SANDY LEAN CLAY(CL)	33	17	16		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	A-08-004	5.0	37.5	0.15			19.0	31.0	50.0	
⊠	A-08-004	10.0	19				9.0	22.0	69.0	
▲	A-08-004	15.0	1.18				0.0	17.0	83.0	
★	A-08-004	20.0	2.36				0.0	36.0	64.0	
⊙	A-08-004	25.0	2.36				0.0	35.0	65.0	

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

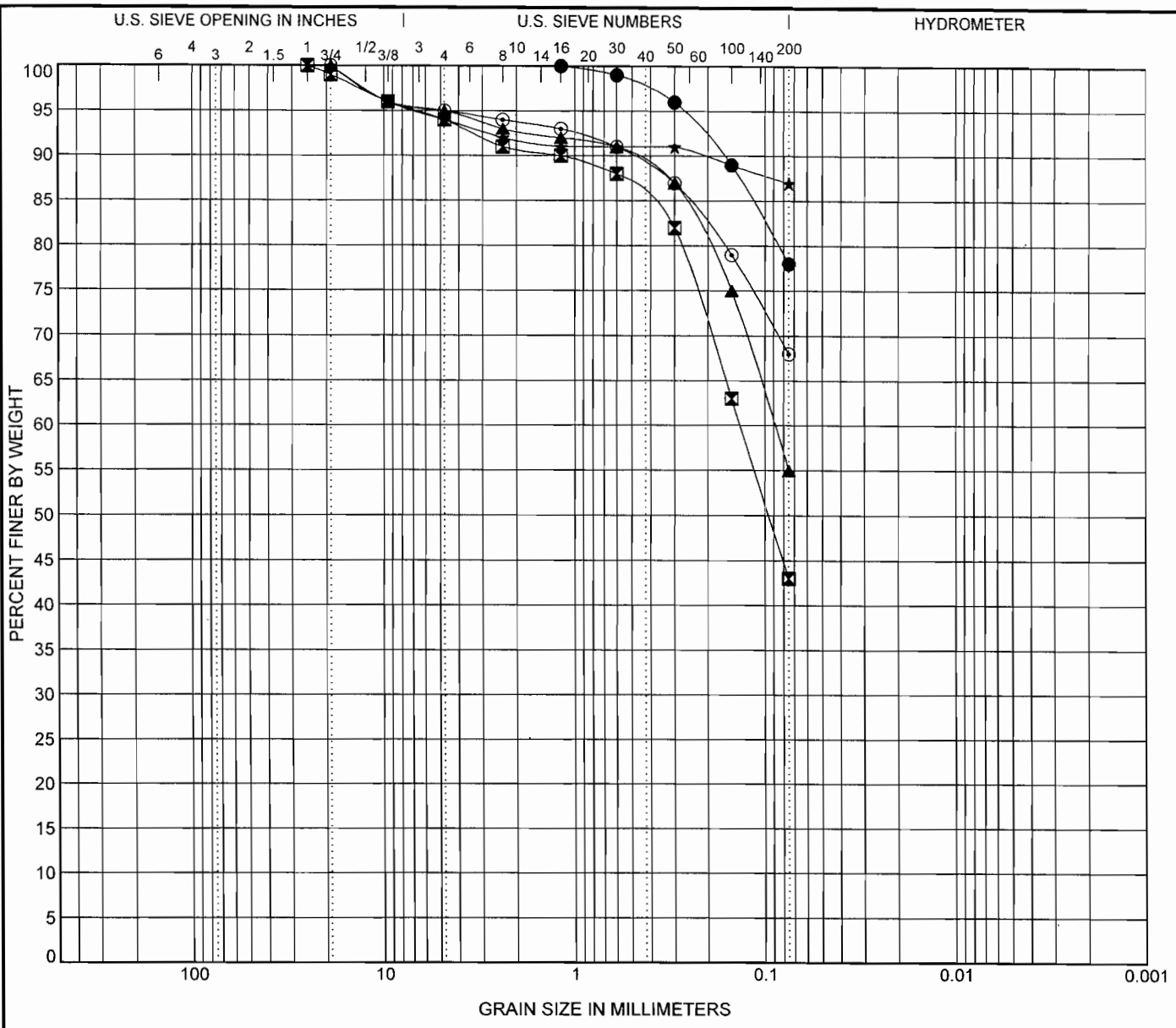
GRAIN SIZE DISTRIBUTION

DIST	COUNTY	ROUTE	POSTMILE	EA
12	Orange	I-5	D27.6/D	12-12-0G9901

PROJECT OR BRIDGE NAME: **El-Modena-Irvine channel**

BRIDGE NUMBER	PREPARED BY	DATE	SHEET
			1 of 5

CALTRANS GRAIN SIZE 12-0G9901 ELMODENA.GPJ CALTRANS LIBRARY 040808.GLB 10/15/09



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	A-08-004	30.0	LEAN CLAY with SAND(CL)	40	15	25		
⊠	A-08-004	35.0	SILTY SAND(SM)	23	22	1		
▲	A-08-004	40.0	SANDY SILT(ML)	24	23	1		
★	A-08-004	50.0	SILT(ML)	38	26	12		
⊙	A-08-005	5.0	SANDY LEAN CLAY(CL)	43	22	21		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	A-08-004	30.0	1.18				0.0	22.0	78.0	
⊠	A-08-004	35.0	25	0.135			6.0	51.0	43.0	
▲	A-08-004	40.0	19	0.089			5.0	40.0	55.0	
★	A-08-004	50.0	19				6.0	7.0	87.0	
⊙	A-08-005	5.0	19				5.0	27.0	68.0	

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

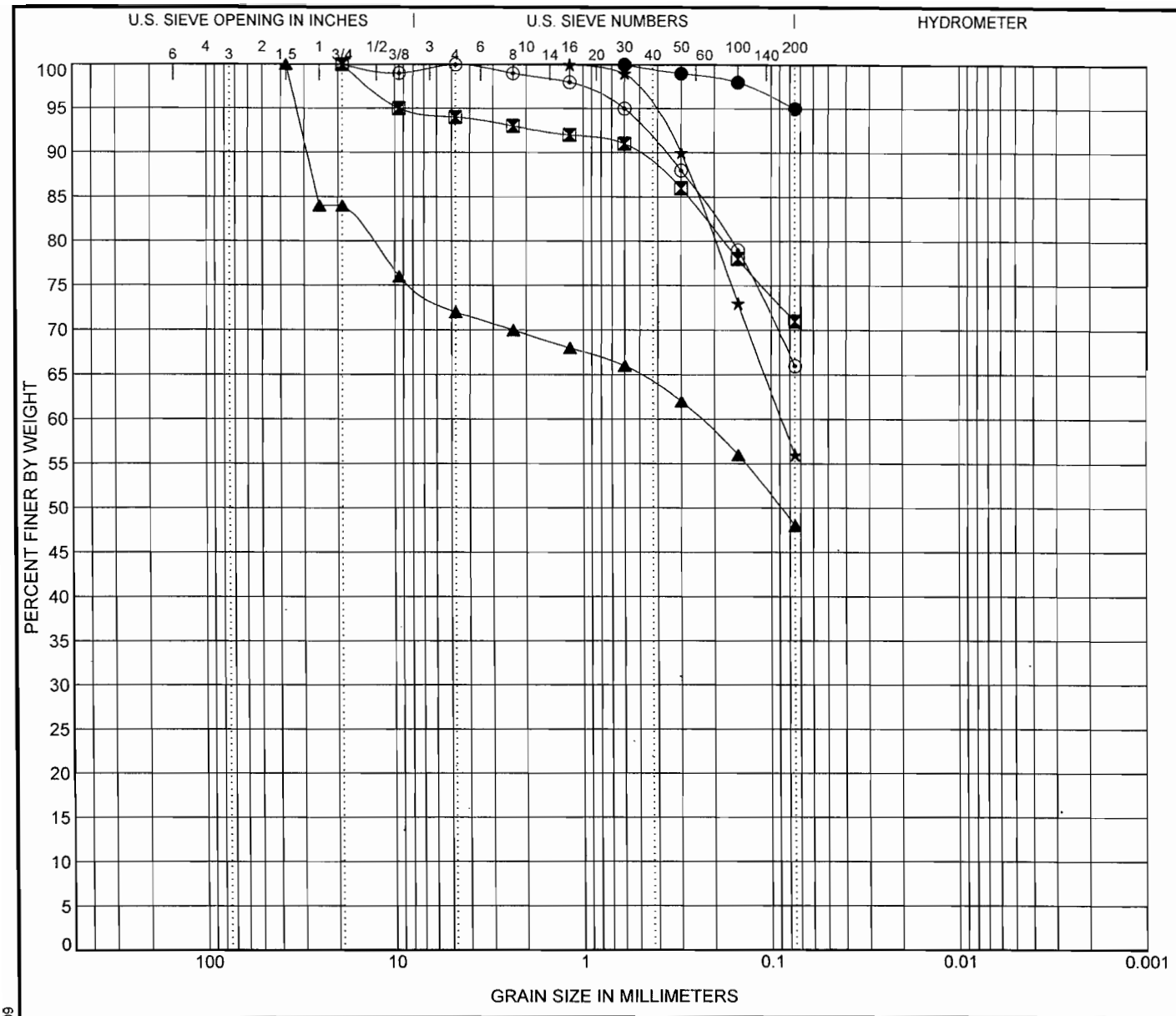
GRAIN SIZE DISTRIBUTION

DIST.	COUNTY	ROUTE	POSTMILE	EA
12	Orange	I-5	D27.6/D	12-12-0G9901

PROJECT OR BRIDGE NAME: El-Modena-Irvine channel

BRIDGE NUMBER	PREPARED BY	DATE	SHEET
			2 of 5

CALTRANS GRAIN SIZE 12-0G9901 ELMODENA.GPJ CALTRANS LIBRARY 040808.GLB 10/15/09



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	A-08-005	10.0						
⊠	A-08-005	15.0	LEAN CLAY with SAND(CL)	49	23	26		
▲	A-08-005	20.0	CLAYEY GRAVEL with SAND(GC)	45	19	26		
★	A-08-005	25.0	SANDY LEAN CLAY(CL)	34	20	14		
⊙	A-08-005	30.0	SANDY LEAN CLAY(CL)	39	16	23		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	A-08-005	10.0	0.6				0.0	5.0	95.0	
⊠	A-08-005	15.0	19				6.0	23.0	71.0	
▲	A-08-005	20.0	37.5	0.238			28.0	24.0	48.0	
★	A-08-005	25.0	1.18	0.088			0.0	44.0	56.0	
⊙	A-08-005	30.0	19				0.0	34.0	66.0	

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

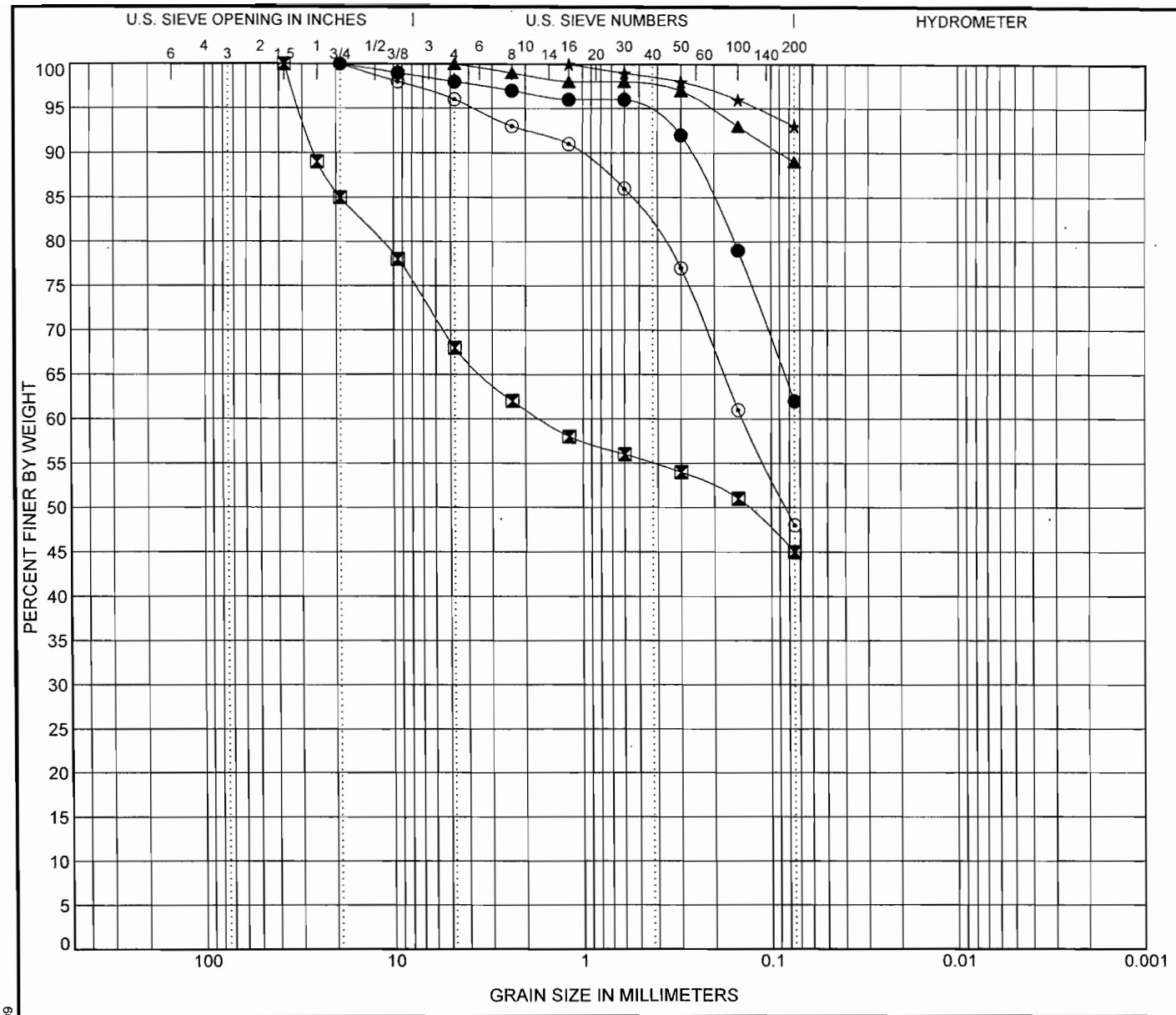
GRAIN SIZE DISTRIBUTION

DIST	COUNTY	ROUTE	POSTMILE	EA
12	Orange	I-5	D27.6/D	12-12-0G9901

PROJECT OR BRIDGE NAME: El-Modena-Irvine channel

BRIDGE NUMBER	PREPARED BY	DATE	SHEET
			3 of 5

CALTRANS GRAIN SIZE 12-0G9901 ELMODENA.GPJ CALTRANS LIBRARY 040808.GLB 10/15/09



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	A-08-005	35.0	SANDY LEAN CLAY(CL)	26	18	8		
⊠	A-08-005	40.0	SILTY, CLAYEY GRAVEL with SAND(GC-GM)	26	20	6		
▲	A-08-005	45.0	LEAN CLAY(CL)	40	23	17		
★	A-08-005	50.0	LEAN CLAY(CL)	39	20	19		
⊙	A-08-005	55.0	SILTY SAND(SM)	22	20	2		

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	A-08-005	35.0	19				2.0	36.0	62.0	
⊠	A-08-005	40.0	37.5	1.669			32.0	23.0	45.0	
▲	A-08-005	45.0	4.75				0.0	11.0	89.0	
★	A-08-005	50.0	1.18				0.0	7.0	93.0	
⊙	A-08-005	55.0	19	0.142			4.0	48.0	48.0	

Department of Transportation
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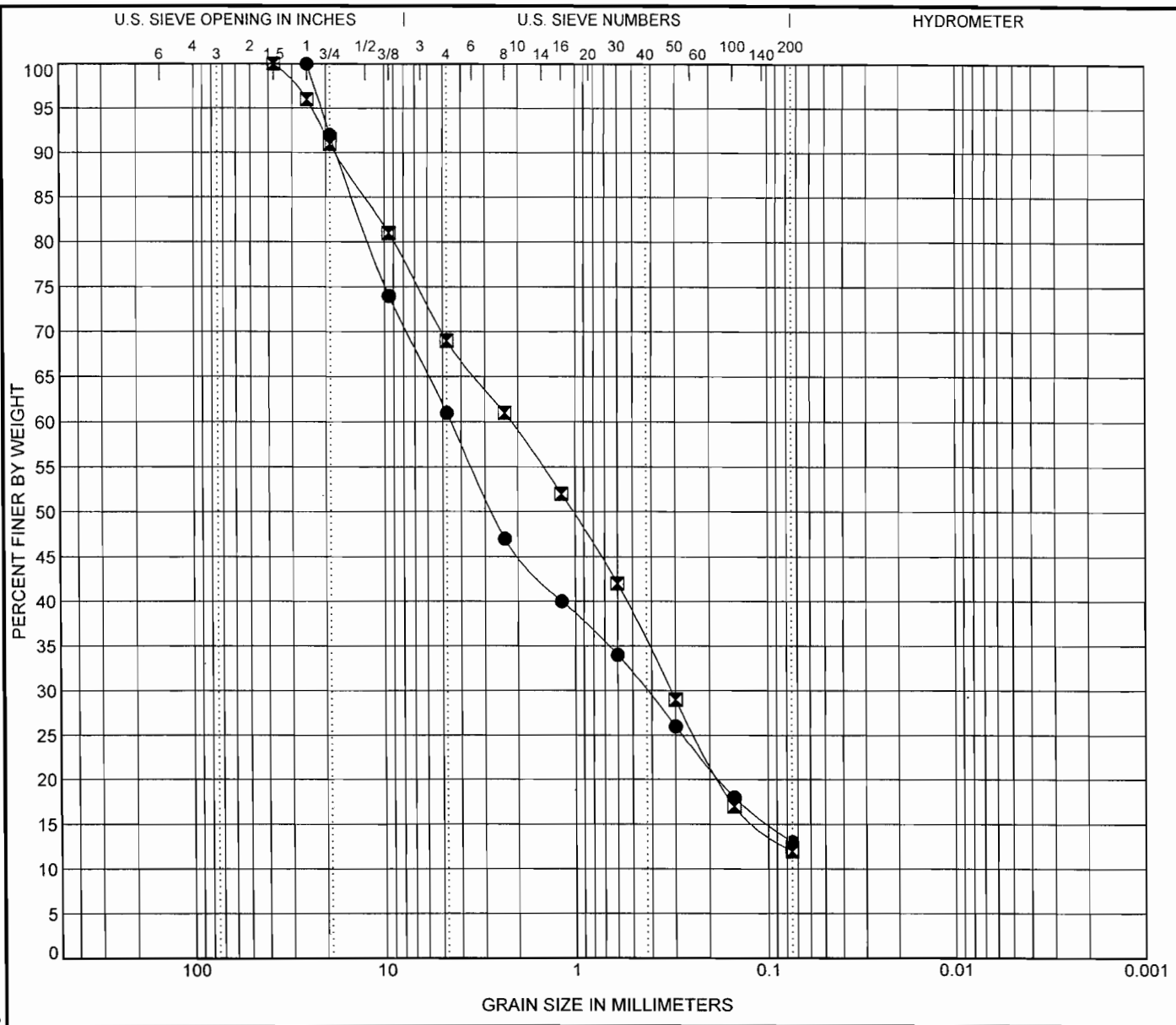
GRAIN SIZE DISTRIBUTION

DIST.	COUNTY	ROUTE	POSTMILE	EA
12	Orange	I-5	D27.6/D	12-12-0G9901

PROJECT OR BRIDGE NAME: El-Modena-Irvine channel

BRIDGE NUMBER	PREPARED BY	DATE	SHEET
			4 of 5

CALTRANS GRAIN SIZE 12-0G9901 ELMODENA.GPJ CALTRANS LIBRARY 040808.GLB 10/15/09



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	A-08-005	60.0	CLAYEY SAND with GRAVEL(SC)	53	27	26		
⊠	A-08-005	65.0					0.81	38.44

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	A-08-005	60.0	25	4.519	0.424		39.0	48.0	13.0	
⊠	A-08-005	65.0	37.5	2.185	0.316		31.0	57.0	12.0	

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GRAIN SIZE DISTRIBUTION

DIST.	COUNTY	ROUTE	POSTMILE	EA
12	Orange	I-5	D27.6/D	12-12-0G9901

PROJECT OR BRIDGE NAME: El-Modena-Irvine channel

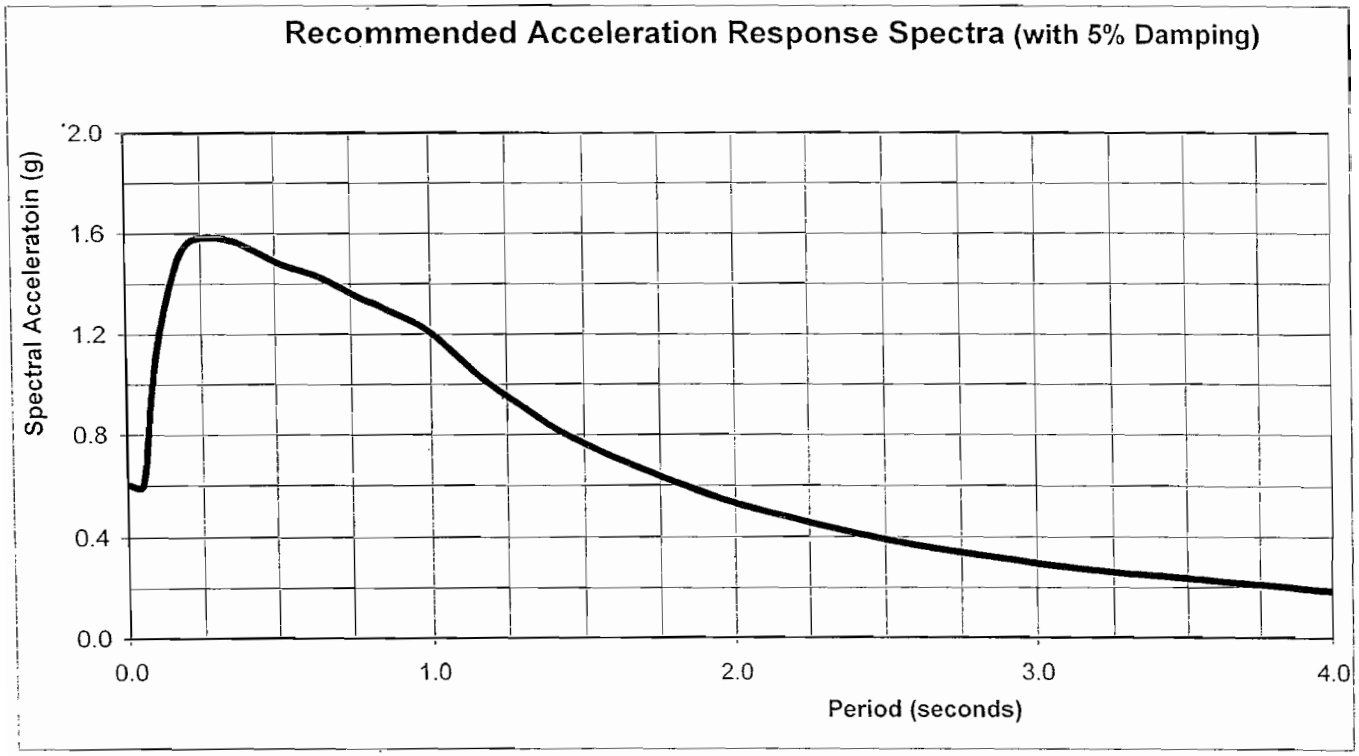
BRIDGE NUMBER	PREPARED BY	DATE	SHEET
			5 of 5

CALTRANS GRAIN SIZE 12-0G9901 ELMODENA.GPJ CALTRANS LIBRARY 040808.GLB 10/15/09

Appendix D
ARS data

Recommended Acceleration Spectra (with 5% Damping)

Period (Sec)	SA (g)	Period (Sec)	SA (g)
.01	0.60	0.48	1.50
.05	0.60	0.49	1.49
.08	0.94	0.50	1.48
0.10	1.13	1.00	1.21
0.12	1.28	1.16	1.03
0.15	1.42	1.31	0.91
0.18	1.51	1.41	0.82
0.21	1.56	1.57	0.72
0.24	1.58	1.82	0.61
0.27	1.58	2.07	0.51
0.31	1.58	2.54	0.38
0.35	1.57	2.95	0.30
0.39	1.56	3.20	0.27
0.44	1.52	3.46	0.24
0.45	1.52	4.00	0.19
0.46	1.51		



Appendix E

L-Pile, P-Y Curves & Pile Head Deflection Data

El Modena-Irvine Channel bridge widening (L-Pile input data)

Cut off elevation is @ 74 feet.

According to our calculations the length of pile to develop a Nominal Resistance of 280 Kips is 50 feet below the cut-off elevation. The proposed tip elevation is at an elevation of 24.

Between Elevation of 74 & 59.3 use the following:

Assume a stiff Clay : $\gamma = 0.07$ lb/in^3, $c = 7.01$ lb/in^2 , K=100 lb/in^3, $\varepsilon_{50} = 0.007$

Between Elevation of 59.3 & 55.7 use the following:

Assume a Sand : $\gamma = 0.07$ lb/in^3, $K = 60$ lb/in^3, $\theta = 34^\circ$.

Between Elevation of 55.7 & 51.5 use the following:

Assume a soft Clay: $\gamma = 0.063$ lb/in^3, $c = 4.16$ lb/in^2 , $\varepsilon_{50} = 0.002$

Between Elevation of 51.5 & 45.6 use the following:

Assume a Sand : $\gamma = 0.07$ lb/in^3,, $K = 60$ lb/in^3, $\theta = 34^\circ$.

Between Elevation of 45.6 & 23.3 use the following:

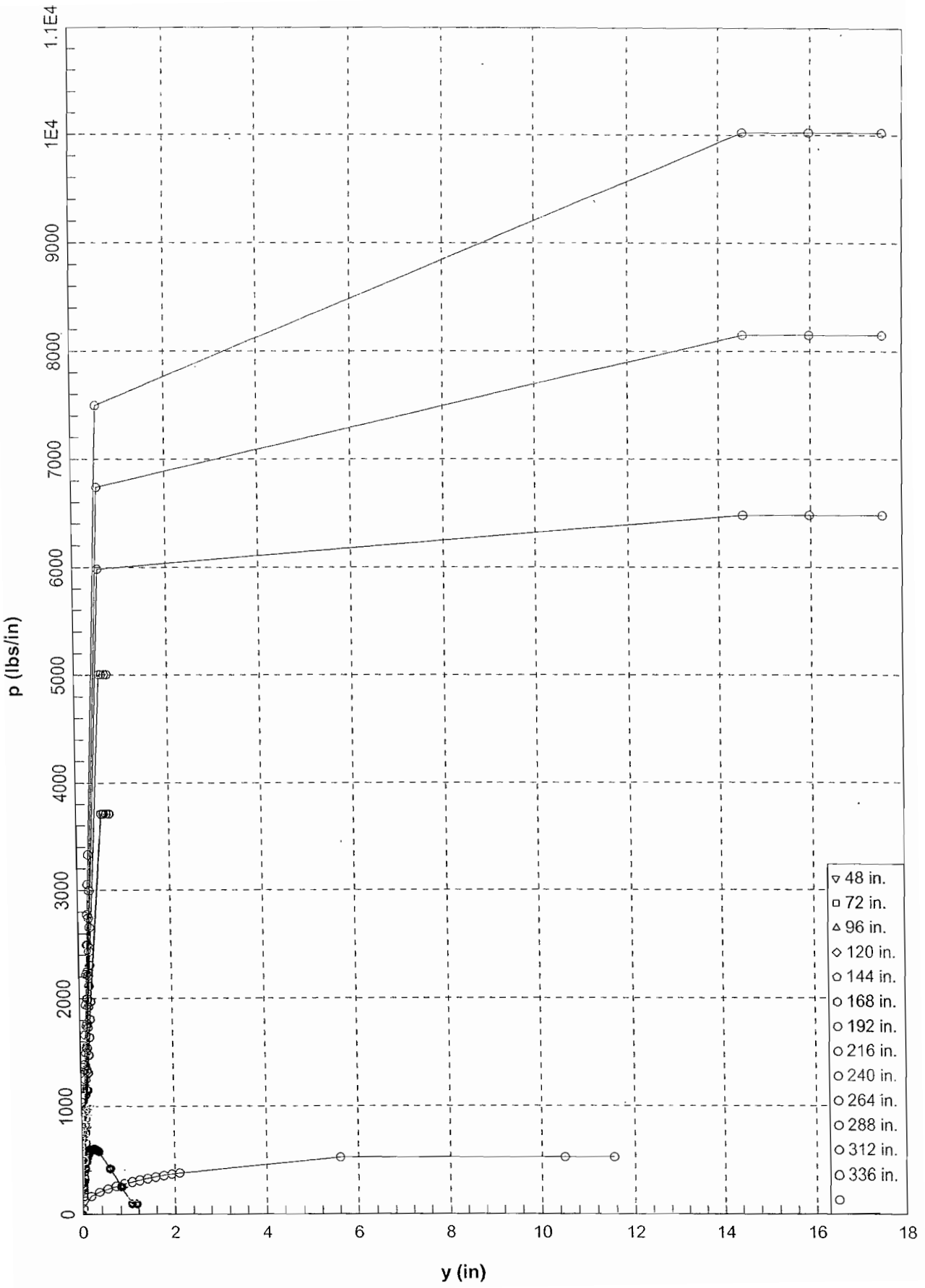
Assume a stiff Clay : $\gamma = 0.072$ lb/in^3, $c = 11.8$ lb/in^2, K= 400 lb/in^3, ε_{50}=0.007

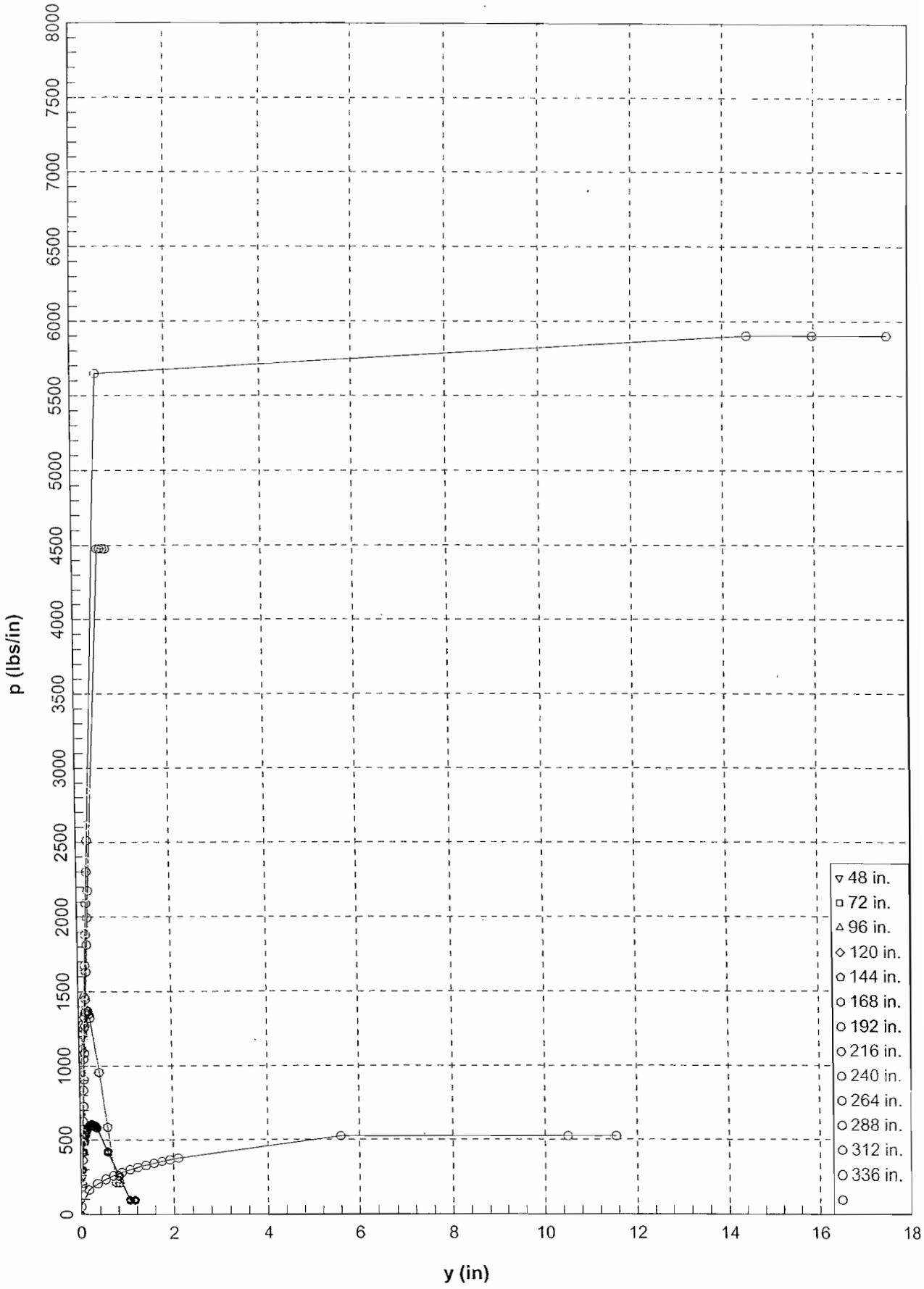
Between Elevation of 23.3 & 9.6 use the following:

Assume a Clay: $\gamma = 0.07$ lb/in^3, $c = 42$ lb/in^2 , K=1500 lb/in^3 , ε_{50}=0.004

Summary Of L-Pile Run

Bridge# 55-0655	Class 200 (Inch)	Pile length (feet)	Axiel Load (Kips) (Nominal)	Maximum shear Force (Lbs)	Pile-head deflection (Inch)	Maximum bending moment (Lbs-inch)	Depth of Maximum Bending Moment (inches)
55-0655	14	50	140	13000	0.093	266319	42


p (lbs/in)
y (in)
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
1E4
1.1E4
0
2
4
6
8
10
12
14
16
18
48 in.
72 in.
96 in.
120 in.
144 in.
168 in.
192 in.
216 in.
240 in.
264 in.
288 in.
312 in.
336 in.


p (lbs/in)
y (in)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
7000
7500
8000
0
2
4
6
8
10
12
14
16
18
48 in.
72 in.
96 in.
120 in.
144 in.
168 in.
192 in.
216 in.
240 in.
264 in.
288 in.
312 in.
336 in.

State of California - Department of Transportation
Division of Engineering Services
Structure Design Services & Earthquake Engineering

FINAL HYDRAULIC REPORT

El Modena-Irvine Channel Bridge

Br. No. 55-0655

12 - ORA - 5 - PM 27.6

Located in the City of Tustin, California

PROJECT DESCRIPTION:
Proposed Downstream Widening of Existing Structure (EA 12-0G9901)

Prepared by:

Jose J. Vargas, P.E.
Transportation Engineer (Civil)
Structure Hydraulics & Hydrology Branch
April 2, 2009

TABLE OF CONTENTS

General Notes:

1) *Elevations shown in this report are based on the North American Vertical Datum of 1988 (NAVD88), unless otherwise indicated. Field survey data (CAiCE file provided by District 12 for a field survey completed in December 2007) was based on NAVD88. A comparison of elevations along the concrete-lined channel at the bridge site between the 1991 "As-Built" Foundation Plan sheet and the 2007 survey data indicates a vertical datum difference. Therefore, elevations based on the 1991 "As-Built" vertical datum will require an adjustment (vertical transformation) to convert to NAVD88.*

2) *The hydraulic study and results contained in the report are only applicable to the proposed widening location on the downstream side of the existing bridge. Due to additional site-specific factors and assumptions, the hydraulic parameters provided in this report for the downstream (D/S) side are not directly applicable to the upstream side.*

GENERAL INFORMATION

It is proposed to widen the existing bridge structure, El Modena-Irvine Channel (Br. No. 55-0655), on the downstream side. The bridge site is located in the City of Tustin, California, along Interstate Route 5 (Santa Ana Freeway). The existing structure has a National Bridge Inspection Standards (NBIS) Item 113 Code rating of "8", which indicates, *"Bridge foundations determined to be stable for the assessed or calculated scour condition."* The Item 113 code rating also considers the channel is fully concrete-lined at this location. For this report, the existing bridge is also referred to as the "I-5 Bridge".

The existing bridge is a simply-supported single-span, cast-in-place/pre-stressed (CIP/PS) box (26 cell) girder bridge with open-end, reinforced concrete (RC) seated abutments, all on driven RC piles. The bridge spans over El Modena-Irvine Channel (Orange County Facility No. F07), which is a flood control channel owned by the Orange County Flood Control District (OCFCD). Along this reach, the channel is fully lined with PCC (Portland cement concrete), which includes the channel invert and side slopes. The existing bridge was built in 1992 to replace South Tustin Storm Drain (Br. No. 55-0016), a 3-span RC slab bridge. The existing structure has a length of 92.0 feet and a minimum width of 245.5 feet (width varies).

A Final Hydraulic Report (FHR) request letter dated 1/26/09 and a "Planning Study" plan sheet dated 2/1/01 for the proposed downstream-side widening were provided by Design Branch 15 and were used to estimate the bridge details and assumptions used for this study. Currently, the proposed widening to the existing bridge is roughly 14.2 feet in width and is a single-span, CIP/PS box girder bridge structure. The proposed structure depth for the widened section will match the existing structure depth of 4.5 feet. It is further assumed the proposed foundations/channel lining for the widening will match the existing details.

DESCRIPTION OF WATERSHED

El Modena-Irvine Channel is part of a complex flood control system located in an urban environment. Typical flows in the channel are due to seasonal precipitation and urban runoff. Many smaller tributary drainage systems drain into and contribute to the total flow conveyed along this channel system. One nearby significant tributary system along this section of channel is a large (double-box) culvert outfall that converges with the main channel just upstream of the I-5 Bridge.

Based on site photos and other information available, the channel geometry of the concrete-lined channel varies along this reach. From Browning Avenue downstream to the I-5 Bridge, the RC channel is trapezoidal with a 25-foot bottom width and 1.5H:1V side slopes. As the channel continues through the I-5 Bridge, it remains trapezoidal-shaped, but the bottom width changes to roughly 44.5 feet and has 1H:1V side slopes.

Just downstream of the I-5 Bridge, the channel begins to gradually transition into a square channel (approximately 54 feet wide with vertical walls) and then continues for roughly 680 feet until it reaches the Michelle Drive Bridge, at which point the RC channel then transitions back into a trapezoidal-shaped channel. Between I-5 and Michelle Drive, the channel is a straight section (no bends in the channel). In addition, there is a "low flow" channel located within the main channel section.

A hydrologic/hydraulic study for the channel completed in 1990 by a private consultant firm *(see below)* determined the drainage area above the bridge site to be 12.8 square miles (8,210 acres). The County of Orange Resources and Development Management Department (RDMD) operates and maintains multiple stream and tidal gages in Orange County. Station 216 is located on El Modena-Irvine Channel downstream of the I-5 Bridge, roughly 100 feet upstream of the Michelle Drive (local agency) bridge. For comparison purposes, the drainage area for Station 216 was estimated as 11.9 square miles. Although the two drainage area estimates are similar, the more conservative value of 12.8 sq. mi. was considered for this study.

PEAK DISCHARGES

Previous hydrologic/hydraulic studies related to El Modena-Irvine Channel were located. In 1989, "***San Diego Creek Flood Control Master Plan***" was completed by John M. Tettemer & Associates LTD and was prepared for the Orange County Environmental Management Agency (OCEMA). This study provided design discharge estimates for El Modena-Irvine Channel, a tributary of San Diego Creek. Under assumed ultimate channel conditions, the 1989 study determined a 100-year design discharge of 8,600 cubic feet per second (cfs) for the channel downstream of the I-5 Bridge. The 8,600 cfs flow was also used in a 1990 study, "***Basis of Design, El Modena-Irvine Channel, Orange County Facility F07, Michelle Drive to Santa Ana Freeway***", which was prepared for the City of Tustin by Robert Bein, William Frost & Associates.

According to the 1990 consultant report, the channel improvements upstream of the I-5 Bridge (from Browning Avenue downstream to the I-5 Bridge) were completed in 1987. These channel improvements, in addition to the channel improvements completed with the I-5 Bridge replacement (underneath the bridge) in 1991, had been designed (based on earlier assumptions) to convey the ultimate design discharge of 7,900 cfs. The 1991 "As-Built" Foundation Plan for the existing bridge shows an estimated 100-year frequency design flood of 7,900 cfs, which is assumed to have been based on the design flow reported in the 1990 study.

The 1990 report was prepared to provide the hydrologic/hydraulic basis for the design of the channel improvements for the reach between the I-5 Bridge to roughly 100 feet downstream of Michelle Drive. This subsequent section of channel improvements were intended to tie into the I-5 Bridge channel improvements completed in 1991 and complete the next phase of ultimate channel improvements along El Modena-Irvine Channel. For the hydraulic analysis of this channel reach, the 1990 study utilized the more conservative (100-year) design flow of 8,600 cfs - previously determined in the 1989 San Diego Creek study.

For comparison purposes, historical streamgage data from an Orange County streamgage (Station 216) located in the El Modena-Irvine Channel was analyzed to estimate 50-year and 100-year frequency discharges at the gage site location. Peak discharges were estimated by using available stream gage records (for a 37-year period between 1968-2005) and the Log Pearson III statistical analysis method. Based on the gage data analysis, the 50-year and 100-year frequency discharges at the gage location (downstream of the I-5 Bridge) were estimated as 6,100 cfs and 7,200 cfs, respectively.

Considering previous hydrologic/hydraulic studies and other information available for this channel and bridge site, the more conservative 100-year frequency design flow of 8,600 cfs (based on ultimate channel conditions) was used for the hydraulic analysis at the proposed downstream bridge widening.

WATER SURFACE ELEVATIONS

Based on plans and other available information, a longitudinal channel slope of 0.00328 and a Manning's roughness coefficient ("n") of 0.015 were assumed for the concrete-lined channel at the proposed widening location. Field survey data (dated December 2007) provided by District 12 (Preliminary Investigations - South) and based on the NAVD88 datum was used to obtain a cross-section along the downstream face of the existing I-5 Bridge. Based on the 100-year frequency design discharge of 8,600 cfs, a BrEase (Version 3.3) model calculated a local water surface elevation (WSEL) of 73.8 feet.

For comparison purposes, the most recent FEMA Flood Insurance Rate Map (FIRM) (last revised on February 18, 2004) for this area indicates a base flood elevation of 84 feet (NAVD88) on the upstream side of the existing bridge. Although the FEMA map indicates some potential flooding areas (overtopping of channel) on the upstream side of the existing I-5 Bridge, the map also indicates that the flows are contained within the channel (no overtopping) on the downstream side of I-5 (where the bridge widening is proposed). No reports of localized flooding or (bridge) overtopping were located in the Caltrans bridge (inspection) files for the existing bridge structure.

The "Hydrologic Summary" table that is shown on the 1991 "As-Built" Foundation Plan indicates a 100-year design flood of 7,900 cfs and a corresponding WSEL of 76.0 feet (1991 "As-Built" vertical datum). No documentation was located to determine the calculation method used to obtain the previously-reported WSEL. The previous WSEL may have been based on the conservative assumption that the channel flowed at full capacity (without overbanking) and represented the estimated top of PCC channel elevation for the general bridge site.

PEAK VELOCITY

Based on the 100-year design discharge and other site-specific assumptions, BrEase calculated a local peak (water) velocity of approximately 22 feet per second (fps) at the downstream side of the existing bridge. The hydraulic model indicates supercritical flow conditions along the reach between I-5 and Michelle Drive.

WATERWAY CAPACITY & MINIMUM SOFFIT ELEVATION

NOTE: Left and Right Bank are determined while looking in the downstream direction (i.e. Right Bank is Abutment 2/North side).

No changes are proposed to the existing concrete-lined channel in conjunction with the proposed bridge widening project. The hydraulic analysis indicates the waterway capacity of the existing concrete-lined channel (at the proposed downstream widening location) is adequate to convey the 100-year frequency design discharge of 8,600 cfs without overtopping the local banks. For information purposes, the available minimum "channel" freeboard (distance from the 100-year WSEL to the top of the concrete-lined channel bank) is estimated as 3.8 feet at the Left Bank (the lower of both banks). *(Note: Left and Right Bank elevations obtained from the field survey data along the D/S face of the existing bridge were 77.6 feet and 77.9 feet, respectively.)*

Based on December 2007 field survey data provided by (Caltrans) District 12 and several field measurements provided by Design Branch 15, the (lowest) bridge soffit elevation along the downstream face of the existing structure was estimated as 80.9 feet at the Right Bank. Considering a 2% cross-slope for the proposed 14.2-foot widening, the new (lowest) bridge soffit elevation would be lowered to roughly 80.6 feet. Based on the calculated 100-year WSEL of 73.8 feet, the (minimum) total available "bridge" freeboard above the 100-year WSEL in the channel (to the proposed bridge soffit) is estimated as 6.8 feet. For information purposes only, the estimated vertical clearance (freeboard) available above the top of the PCC

channel banks to the proposed (lowest) bridge soffit elevation are estimated as 3.0 feet and 2.7 feet on the Left and Right Banks, respectively.

It should be noted that in addition to any specific (various) freeboard requirements, flood control districts (or other agencies) may have other horizontal/vertical minimum clearances or other requirements for this site or flood control waterway; therefore, coordination with the OCFCD and all other relevant agencies will be necessary by (Caltrans) District 12 to determine any other potential restrictions or factors which may impact the proposed widening design details (i.e. proposed structure depth). Due to other potential restrictions/requirements for the flood control channel, a recommendation for a minimum soffit elevation is not provided in this report.

DRIFT POTENTIAL

The existing bridge is a single-span structure (no piers in the waterway) and the channel is fully concrete-lined. The proposed downstream bridge widening will be single-span and will not modify the existing channel; therefore, drift accumulation potential was considered negligible for the purpose of this study.

LOCAL PIER SCOUR & LONG-TERM CHANNELBED TRENDS

The proposed 14.2-foot downstream widening will match the existing, single-span bridge structure details (foundations, concrete-lining, etc.) and will not have any piers located in the waterway. In addition, the existing channel is fully concrete-lined (channel invert and side slopes) at this location; therefore, local pier scour (or abutment scour) was not analyzed in this study. Provided the concrete channel lining remains in good condition and/or is repaired or maintained as necessary, no local pier/abutment scour or long-term channelbed degradation is anticipated at this bridge site.

OTHER CONSIDERATIONS

As mentioned previously, Caltrans (District 12) will need to coordinate with OCFCD and other relevant local or government agencies (FEMA, U.S. Army Corps of Engineers, Department of Fish & Game, etc.) in order to determine any potential issues and restrictions/requirements related to the proposed bridge widening project and the flood control channel. Further coordination between Caltrans and the relevant agencies is anticipated as the project proceeds.

No changes are proposed to the existing concrete-lined channel in conjunction with the proposed bridge widening project. The hydraulic conditions and the existing channel itself are expected to remain unchanged prior to and after the proposed project is completed. The main hydraulic-related impact of the proposed bridge widening project in regards to the existing concrete-lined channel (waterway) is a minor lowering of the existing bridge soffit (elevation) by roughly 0.3 feet (3.5 inches), due to a 2% cross-slope for the widened section. Although the proposed lower bridge soffit would reduce the total waterway (area) available at the D/S face of the widened section, the hydraulic analysis indicates sufficient channel capacity and additional freeboard is available to convey the estimated design flow.

The 1990 hydrologic/hydraulic study indicated that most of the watershed upstream of I-5 has already been developed to its ultimate land use; therefore, no significant increases in the design flows are expected (based on current assumptions). In addition, available aerial photographs indicate the ultimate channel improvements (including concrete-lining) have now been completed downstream to Peters Canyon.

SUMMARY INFORMATION FOR THE BRIDGE DESIGNER

NOTE: Elevations shown in this report are based on the North American Vertical Datum of 1988 (NAVD88), unless otherwise indicated.

Assumed Local Pier/Abutment Scour & Long-Term Channelbed Degradation [1] *(depth)*	0.0 feet [1]
Estimated Lowest Bridge Soffit Elevation for Proposed Widening *(above top of Right Bank)*	80.6 feet
Available Minimum Bridge Freeboard [2]	6.8 feet
Available Minimum Channel Freeboard [3] *(at the Left Bank)*	3.8 feet
Available Vertical Clearance from Top of Left Bank to Proposed Lowest Soffit Elevation	3.0 feet
Available Vertical Clearance from Top of Right Bank to Proposed Lowest Soffit Elevation	2.7 feet
Local Peak (Water) Velocity at Proposed Widening Location *(based on 100-year discharge)*	22 fps

NOTES:
Right and Left Bank are determined while looking in the downstream direction (i.e. Right Bank is on Abutment 2/North side).

1 *Provided the existing PCC channel lining remains in good condition and is maintained/repaired, as necessary.*
2 *"Bridge freeboard" is the distance from the 100-year WSEL to the (lowest) bridge soffit elevation of the proposed widening.*
3 *"Channel freeboard" is the distance from the 100-year WSEL to the (lower) top of channel bank elevation.*

Hydrologic / Hydraulic Summary

Total Drainage Basin Area: 12.8 square miles

	Design Flood	Base Flood	Overtopping Flood
Frequency, years	N/A	100	N/A
Discharge, cfs	N/A	8,600	N/A
Water Surface Elevation at Bridge *, feet	N/A	73.8 *	N/A

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

* *Calculated WSEL at the proposed downstream widening location.*

REFERENCES

1) California Department of Transportation (CALTRANS) - Bridge Inspection Reports (BIR's), Supplemental Bridge Reports (SBR's), Bridge File, As-Built Plans, Photos, Digital Highway Inventory Photography Program (DHIPP) - aerial photos, "Planning Study" plan sheet *(dated 2/1/01)*, Final Hydraulic Report (FHR) request letter from Design Branch 15 *(dated 1/26/09)*

2) ***Basis of Design, El Modena-Irvine Channel, Orange County Facility F07, Michelle Drive to Santa Ana Freeway***
Prepared For: City of Tustin
Prepared By: Robert Bein, William Frost & Associates
Study Date: May 17, 1990 *(Revised July 13, 1990 & September 17, 1990)*

3) ***San Diego Creek Flood Control Master Plan***
Prepared For: Orange County Environmental Management Agency (OCEMA)
Prepared By: John M. Tettemer & Associates LTD
Study Date: 1989

4) Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS)
Orange County, CA and Incorporated Areas (3 Volumes)
FIS Number 06059CV001A
(Last Revised: February 18, 2004)

5) FEMA Flood Insurance Rate Map (FIRM)
Orange County, California and Incorporated Areas
Map Number: 06059C0281H (Panel 281 of 550)
(Map Revised: February 18, 2004)

6) Other available documentation/records available at this time:
- MSN Live Search Maps *http://maps.live.com/*
- Google Maps *http://maps.google.com/*
- Orange County Flood Control District (OCFCD)
http://www.ocflood.com/about_FCD_district_overview.asp

State of California Business. Transportation and Housing Agency

Memorandum

To: Matthew Q. Cugini, Chief
Design Branch C

Date: February 5,2009

File: 12-ORA-5
PM 27.6-28.2
EA-0G9901

From: **DEPARTMENT OF TRANSPORTATION**
District 12
Materials and Research Branch **Cat:** 441.01

Subject: **Transmittal of Draft Materials Letter Report for Improvements to Southbound I-5 between Tustin Ranch Road and Jamboree Road in Orange County, California.**

Attached please fine the Final Materials report for the above referenced project for your review.

If you need additional information, please contact Mehrdad Mahdavian at X-4927

Prepared by:

Mehrdad Mahdavian, P.E.
Materials & Research Branch
Division of Project Delivery
RCE No. 47566

Concurred by:

Behdad Baseghi, Ph.D., P.E., G.E.
Chief, Materials & Research Branch
Division of Project Delivery
RCE No. 47051, GE No. 2310

Cc: Frank Lin
Fred Faizi
File

Stale of California **Business, Transportation** and Housing Agency

Memorandum

To: Matthew **Q.** Cugini, Chief
Design Branch C

Date: February 5,2009

File: 12-ORA-5
PM 27.6-28.2
EA-OG9901

From: **DEPARTMENT OF TRANSPORTATION**
District 12
Materials and Research Branch

Cat: 441.01

Subject: **Final Materials Letter Report for Construction of an Auxiliary Lane on Southbound 1-5 from 0.1** Mile **South of Tustin Ranch Road Overcrossing to Jamboree Road Off-ramp in Orange County, California.**

In accordance with your request, Materials and Research (M&R) Branch has reviewed the Project Report submitted for the above-referenced project and conducted Field investigation, sampling and laboratory testing in order to provide you with recommendations for pavement structural sections for the proposed rehabilitation.

Purpose and Scope of Study

The purpose of this Materials Letter Report is to provide pavement and materials related recommendations and to assist the Design Branch in preparing Project Plans, Specifications, and Estimates (PS&E). This Materials Letter Report presents the findings, conclusions and recommendations for widening of Southbound I-5 from 0.1 mile south of Tustin Ranch Road Overcrossing to Jamboree Road Off-ramp, including the Off-ramp, in Cities of Tustin and Irvine in Orange County, California by adding an Auxiliary lane and a shoulder in accordance with Topic 114 of Highway Design Manual (2006).

The scope of work provided for this project included the following tasks:

- Collection and review of available reports and subsurface information;
- Field exploration consisting of drilling exploratory borings and sampling;
- Laboratory testing of selected bulk soil samples;
- Engineering analysis to develop design and recommendations; and
- Preparation of this report presenting our findings, conclusions and recommendations.

Existing Facility

1-5 is a major North-South Interstate freeway that is heavily used for interstate and interregional transportation. In Orange County, I-5 spans a distance of about 44 miles from San Diego County line to Los Angeles County Line. During peak hours, I-5 operates under recurrent traffic

congestion within the project limits in Orange County. The proposed project is a non-capacity increasing operational improvement, which will improve the Level of Service (LOS), weaving, traffic flow, and will reduce traffic congestion along this segment of SB 1-5.

Proposed Project Improvement

The proposed project improvements include the following:

1. Adding an Auxiliary Lane and Shoulder on Southbound I-5 from 0.1 mile south of Tustin Ranch Road Overcrossing to Jamboree Road Off-ramp.
2. Adding an Auxiliary Lane and Shoulder on Southbound 1-5 Off-ramp to Jamboree Road.

Terrain and Surface Drainage

The project site is located in an industrial/commercial area. The topography of the roadway alignment slopes down gently from north to south. Drainage is generally toward the outer shoulders in the traveled way, and toward south along the centerline and median shoulder.

Summary of Field Investigation

Our field investigation was conducted on August 25,2008 and consisted of coring 1-5 at three (3) locations (See Coring MB-I, MB-2, and MB-4 shown on Boring Location Layout Plans). We also cored SB Off-ramp to Jamboree Road on the shoulder (See Coring MB-3 shown on Boring Location Layout Plans). Coring of AC pavement section was conducted at each location, followed by auguring of subgrade soils except for Coring MB-4 where coring was terminated below the pavement section for identifying the various pavement layers only. No sample was taken from this coring site. The purpose of this investigation was to measure the thickness of various pavement sections and to evaluate presence of any base or subbase, as well as sampling of subsurface soils beneath the pavement for laboratory testing and evaluation. Table I presents summary of Coring data as compared to As-built plans.

Each horing was drilled to a depth of about 5 Feet, using a small powered auger and soil samples collected from the subsurface soils were sent to District 7 laboratory for testing. Table 2 presents summary of Laboratory Test Results for these samples.

Subsurface and Groundwater Conditions

Corings MB-I, and MB-2 which were drilled in the right shoulder of SB I-5 near Stations 1516+00, and 1505+00 respectively, encountered about one inch of Rubberized Hot Mix Asphalt (RHMA) over about 5 inches of Hot Mix Asphalt over about 10-12 inches of AB over silty sandy clayey AS. Coring MB-3, which was drilled in the right shoulder of SB I-5 Jamboree Road Off-ramp near Station 494+00 encountered about one inch of RHMA over about 5 inches of Hot Mix Asphalt over about 9 inches of AB over silty sandy AS. Corings MB-4 was drilled in the SB I-5 Auxiliary Lane near Stations 1504+00 encountered about one inch of RHMA over about 6

inches of Hot Mix Asphalt over about 3 inches of Asphalt Treated Permeable Base (ATPB) over about 12 inches of Aggregate Base over silty sandy AS. We did not encounter any groundwater during our coring and have no information regarding the groundwater elevations in this area. Roadway Geotechnical Design-South shall address the groundwater issues. All the pavement thicknesses are estimated and need to be verified during construction. **It is required that groundwater levels be kept a minimum of 5 feet below the pavement structural section.**

Cut and Fill Construction

Construction of the roadway subgrade requires minor cut and fill operation within the roadway R/W. All import fill material that is going to be placed within 4 feet of finished grade shall have an R-value of at least 40 and an Expansion Index of less than 50 and it shall be non-corrosive to metals and concrete especially if any underground utilities or structures are planned to be constructed within the embankment.

Estimate of Settlement

Settlements of the roadway fill and subsurface are expected to be negligible

Seismic Considerations

Roadway Geotechnical Design-South shall provide recommendations for seismic design including liquefaction/seismic settlement and lateral spreading as applicable.

Earthwork Factors

All earthworks shall conform to requirements of Section 19 of Caltrans May 2006 edition of Standard Specifications, and project Special Provisions. Source of imported borrow (if needed) is unknown at this time therefore, earthwork factors cannot yet be determined.

Corrosion Testing

Soil samples obtained from Borings MB-I, through MB-3 were sent to District 7 Materials Laboratory for pH and resistivity testing. Soil samples MR-I and MB-3 had resistivity of less than 1000 ohm-cm and therefore were sent to Headquarters for chloride and sulfate content testing in accordance with CTM 422 and CTM 417 respectively. Results of laboratory corrosion testing are presented in Table 2. Chloride content of both samples were below the 500ppm limit, and sulfate contents of both soil samples were below the 2000ppm, limit that is considered by Caltrans to be corrosive. Therefore the site soils are not considered to be highly corrosive to foundation elements

Site Corrosion Recommendations

The source for sub-grade fill for the roadway and depth of any proposed metal pipe within the project limit is not known at this time. Imported borrow used for sub-grade fill shall be non-

corrosive and free of properties that adversely affect all concrete and steel structures. It is therefore recommended that for metal pipes and concrete structures, site-specific corrosion tests of the soils surrounding the pipe or structure are performed during construction to verify the corrosivity of the soils along the pipe alignment or the structure. The results of these tests shall be submitted to M&R Branch for review. We will provide you with our recommendation for corrosion mitigation after review of the test results. If concrete structures or pipes are planned to be constructed within the native soils, standard reinforced concrete should be suitable for the level of Chlorides. However Type IP (MS) modified Cement or Type II Modified Cement is recommended for Sulfate resistant concrete. For Corrugated Steel Pipe (CSP) with 50-year minimum service life, it is recommended that a 12 gage galvanized pipe with bituminous coating on the soil side shall be used. A Corrugated Aluminum Pipe (CAP) or Corrugated Aluminized Steel Pipe (CASP) shall not be used due to corrosive soil conditions. Plastic pipe is also approved for 50-year service life condition, however abrasion must be evaluated.

Traffic Index

A 20-year Traffic Index (TI) value of 15.5 has been recommended for the Auxiliary Lane by District 12 Traffic Studies Branch in their Memo on August 27, 2008 and has been used in designing the pavement structural sections for the Auxiliary Lane and its shoulder. Due to presence of an ATPB drainage layer within the existing Auxiliary Lane pavement section, the new pavement shall have the same design with an ATPB layer and a Hot Mix Asphalt Layer on top and Rubberized Hot Mix surface layer.

Findings, Conclusions and Recommendations

Our field investigation revealed that the existing pavement is somewhat different than what is shown on the As-Built plans. Attached Table 3 presents a summary of existing pavement as depicted in our coring operation versus the As-built data presented on the April 22, 1997 plans. The main area of difference exists in the pavement section for the SB I-5 Auxiliary Lane and its shoulder, as well as, SB I-5 Off-Ramp to Jamboree Road, which has a 0.1 ft layer of RHMA over the As-Built section. According to As-built plans for Contract No. 12-0G4004, this segment of Southbound 1-5 was overlaid with1 inch of RHMA in 2007. In addition to that, the 1997 As-built plans show presence of an ATPB layer in the shoulder of SB I-5 Off-Ramp to Jamboree Road, but we did not encounter any ATPB layer during our field investigation at this location. Due to presence of an ATPB drainage layer within the existing Auxiliary Lane pavement section, the new pavement shall have the same design with an ATPB layer and a Hot Mix Asphalt Layer on top and Rubberized Hot Mix surface layer. However for the jamboree Road Off-Ramp the ATPB layer is not utilized due to the ramp's grade and super elevation.

The following summarizes our recommendations which are also presented in Table 3:

SB 1-5 Auxiliary Lane *(TI_{20}=15.5, R=21)*

0.1 ft RHMA over 0.65 ft HMA Type A over 0.25 ft ATPB over 2.1 ft Class 2 AB

SB **I-5** Auxiliary Lane Shoulder and **MVP** *(TI_{20}=10, R=21)*

0.1 ft RHMA over 0.4 ft HMA Type A over 1.5ft Class 2 AB

SB **I-5 Off-Ramp** to Jamboree Road, Shoulder, and **MVP** *(TI_{20}=12, R=22)*

0.1 ft RHMA over 0.5 ft HMA Type A over 1.8 ft Class 2 AB

Materials Available

Imported borrow will be required for replacement of unsuitable soils within the project limits. Materials are available from several commercial suppliers throughout Orange, Los Angeles, Riverside and San Bernardino Counties. Furthermore, the Web-Site of Department of Conservation on the Internet contains a current listing of mining operations eligible to sell materials to the State of California. The page can be accessed at: http://www.consrv.ca.gov/omr/index.htm

Limitations

This report is intended for the use of Caltrans for the proposed I-5 Widening in Cities of Tustin and Irvine, California. This report is based on the project as described and the information obtained from the exploratory borings at the approximate locations indicated on the attached plans. The findings and recommendations contained in this report are based on the results of the field investigation, laboratory tests, and engineering analyses. In addition, soils and subsurface conditions encountered in the exploratory borings are presumed to be representative of the project site and may not be accurate. However, subsurface conditions and characteristics of soils between exploratory borings can vary and need to be verified prior to construction. The findings reflect an interpretation of the direct evidence obtained. The recommendations presented in this report are based on the assumption that an appropriate level of quality control and quality assurance (inspections and tests) will be provided during construction. District Materials and Research Branch should be notified of any pertinent changes in the project plans or if subsurface conditions are found to vary from those described herein. Such changes or variations may require a re-evaluation of the recommendations contained in this report.

The data, opinions, and recommendations contained in this report are applicable to the specific design element(s) and location(s) which is (are) the subject of this report. They have no applicability to any other design elements or other locations and any and all subsequent users accept any and all liability resulting from any use or reuse of the data, opinions, and recommendations without prior written consent of the District Materials and Research Branch.

Recommended Materials Specifications

1. The Standard Special Provisions shall include a section which states "Portions of imported borrow placed within 4 feet of the finished grade shall have an R-value of not less than 40, a Plasticity Index of less than 12 and an Expansion Index of less than 50.

2. Imported borrow used for embankment shall be non-corrosive and free of properties that adversely affect all concrete and steel structures. It is recommended that for metal pipes and concrete structures, site-specific corrosion tests of the soils surrounding the pipe or structure are performed during construction to verify the corrosivity of the soils along the pipe alignment or the structure. It is recommended that Type II modified cement shall be used for all concrete structures.

3. The materials used in the pavement section shall comply with Section 26 and 39 of Caltrans Standard Specifications (2006).

4. The following is recommended for the pavement structural section widening: Saw cut to full depth and remove the existing AC pavement and shoulder. Excavate to the proposed subgrade elevation for the full width of the proposed widened section in accordance with Section 19-2 of Caltrans Standard Specifications (2006). Compact the in-situ soils at the subgrade elevation to 95% relative compaction in accordance with Section 19-5.03 of Caltrans Standard Specifications (2006). Place the proposed structural sections, to the design thickness provided above, in accordance with the applicable sections of Caltrans Standard Specifications (2006).

5. It is imperative that special attention is given to the mix design, compaction and temperature requirements for Flexible Pavements as stated in Caltrans Standard Specifications and Project Special Provisions.

6. Hot Mixed Asphalt Concrete shall be Type A and aggregate base and subbase shall be Class 2.

7. Extreme care must be taken to ensure moisture sensitive aggregates are not used for AC mix design.

8. Specifications are required for application of prime coat on AS (unbounded layer) as well as application of Tack Coat between various AC lifts and on all vertical cut faces between new and existing pavement. Prior to application of Tack Coat, the roadway surface shall be dry and free from dust particles.

9. The Prime Coat and Tack Coat shall follow requirements in Section 39-4.02 of Caltrans Standard Specifications (2006).

10. Special attention shall be given to the following sections of May 2006 Standard Specifications:

- Section 25: Aggregate Subbases
- Section 26: Aggregate Rases
- Section 39: Asphalt Concrete

- Section 61: Culvert and Drainage Pipe Joints
- Section 63: CIP Concrete Pipe
- Section 64: Plastic Pipe
- Section 65: RCP
- Section 66: Corrugated Metal Plate Pipe
- Section 68: Subsurface Drains
- Section 73: Concrete Curbs and Sidewalk
- Section 90: Portland Cement Concrete
- Section 92: Asphalts
- Section 93: Liquid Asphalts
- Section 94: Asphaltic Emulsions

11. All pavement related Standard Special Provisions (SSPs) to be included in the project shall be submitted for Materials and Research review and approval.

If you have any questions, please call Mehrdad Mahdavian at x-4927.

Prepared by: Concurred by:

Mehrdad Mahdavian, P.E.
Materials & Research Branch
Division of Project Delivery
RCE No. 47566

Behdad Baseghi, Ph.D., P.E., G.E.
Chief, Materials & Research Branch
Division of Project Delivery
RCE No. 47051, GE No. 2310

Attachments: Figure 1: Site Location Map
Boring Location Layout Plans
Tables 1 through 3
Laboratory Results

Cc: Frank Lin, Fred Faizi, File

REGISTERED PROFESSIONAL ENGINEER
MEHRDAD MAHDAVIAN
No. C 47566
Exp. 12/31/09
CIVIL
STATE OF CALIFORNIA

FIGURES

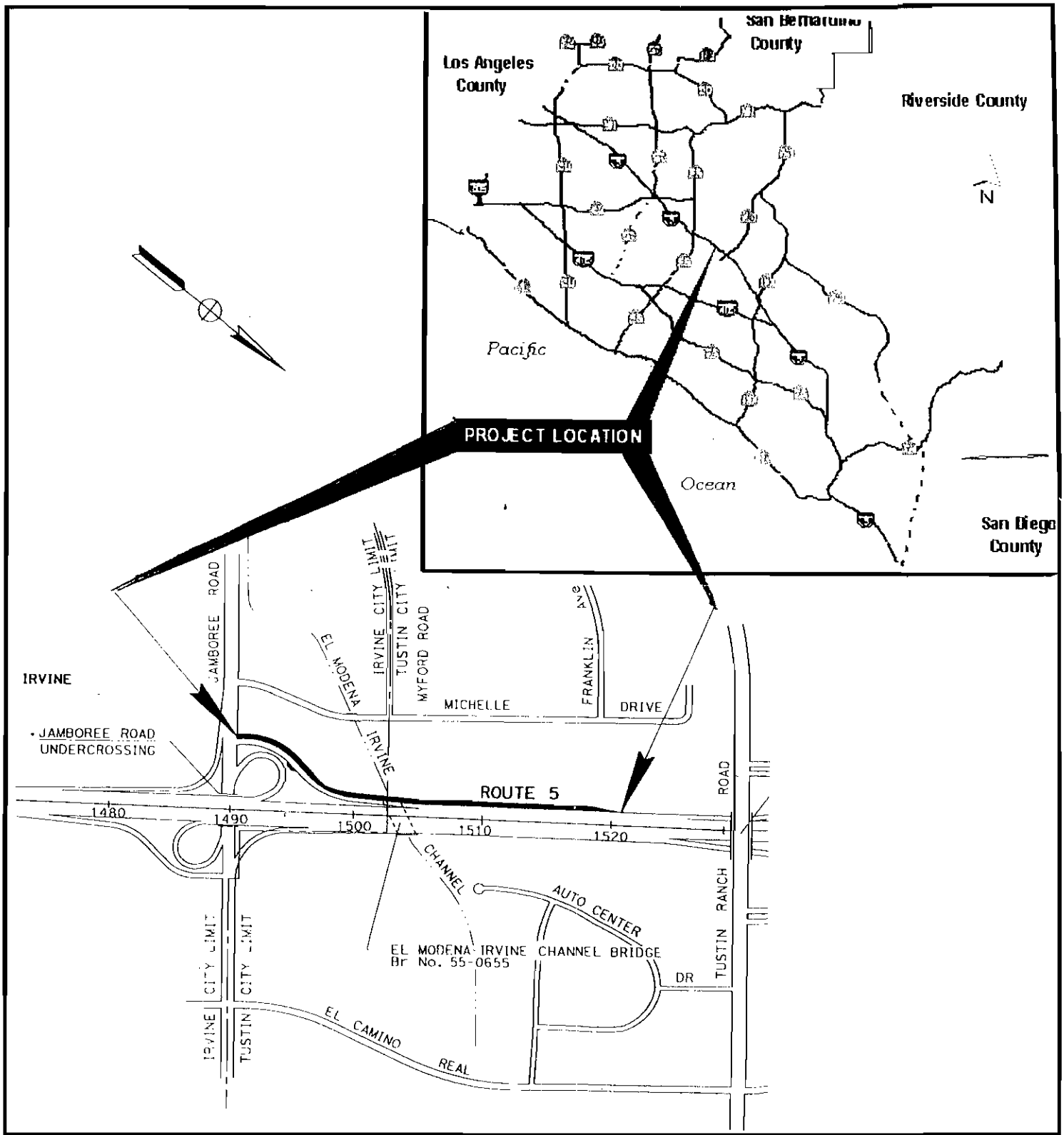


Figure 1: Site Location Map

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
12	Ora	5	27.6/28.1		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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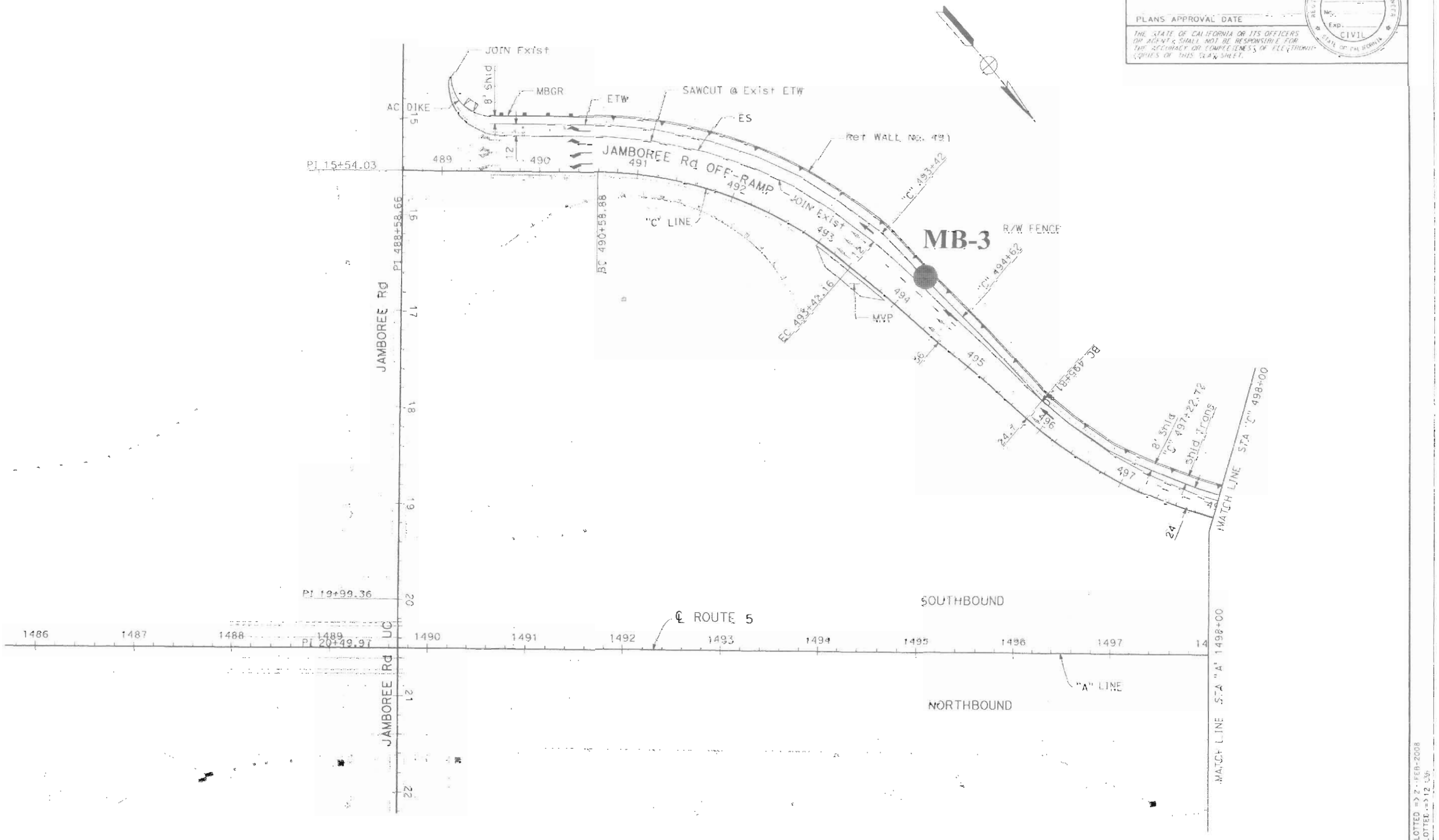

Coring Location Layout Plan

SCALE : 1"=50'

L-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
DESIGN
Caltrans

FUNCTIONAL SUPERVISOR

CALCULATED-DESIGNED BY

CHECKED BY

DATE REVISED	REVISED BY

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00-00-00 TIME PLOTTED => 12:45

BORDER LAST REVISED 3/1/2007

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2-FEB-2008

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CU 12222

EA 089900

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	5	27.6/28.1		

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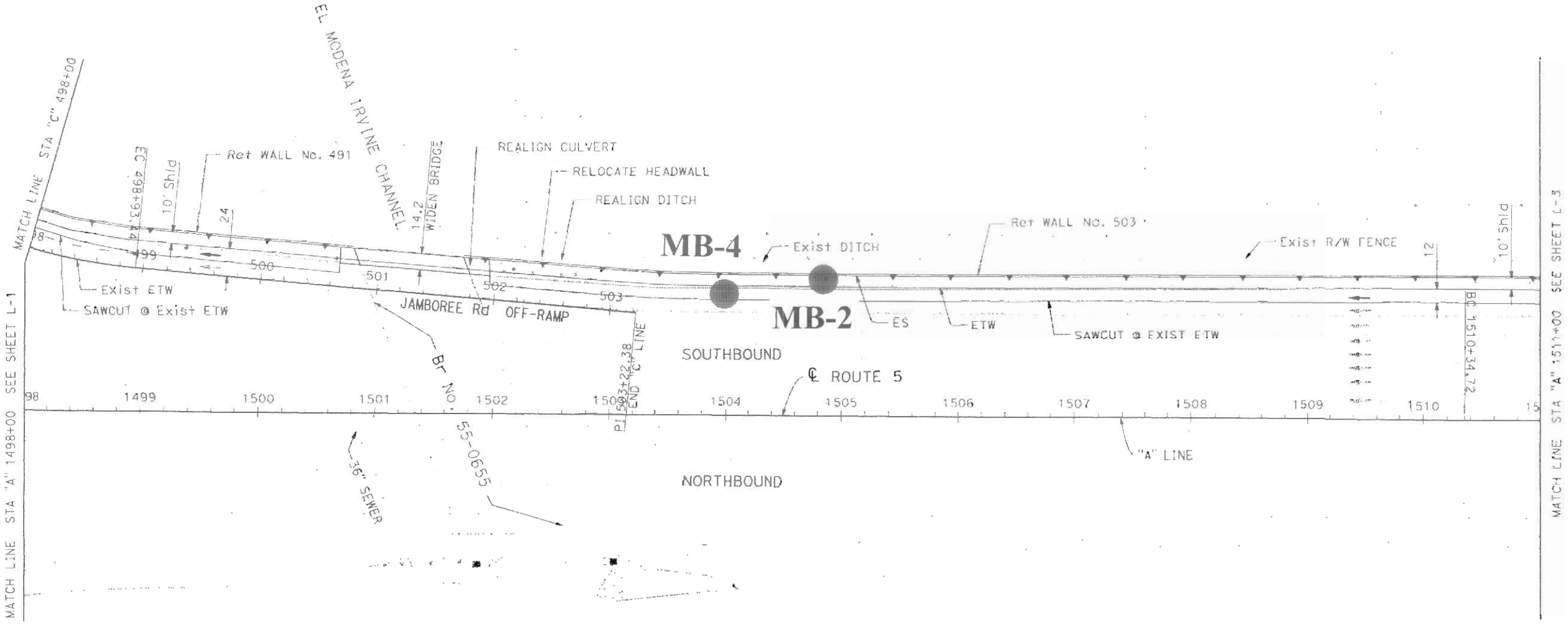

Coring Location Layout Plan

SCALE : 1"=50'

L-2

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21-FEB-2008

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CU 12222

EA 0G9900

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	5	27.6/28.1		

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PLANS APPROVAL DATE

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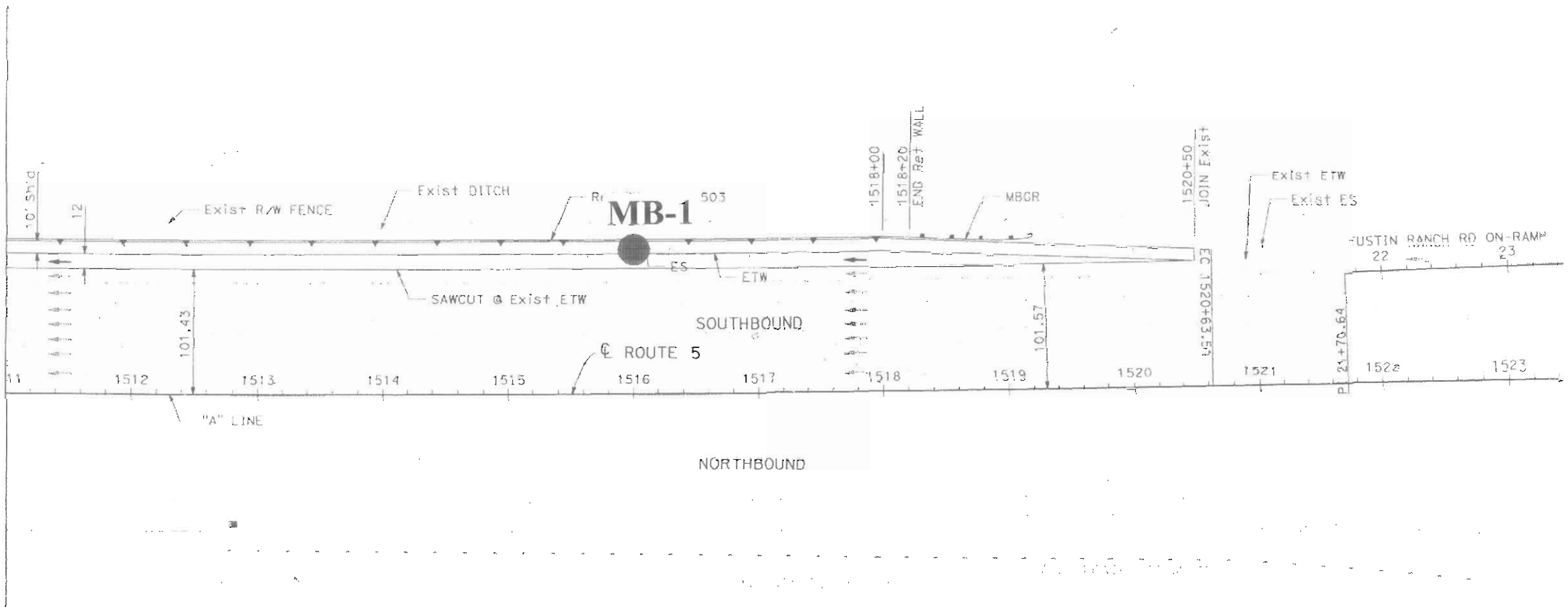

Coring Location Layout Plan

SCALE : 1"=50'

L-3

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TABLES

TABLE 1- SUMMARY OFBORING AND SAMPLING DATA

Route No.	Boring No.	Boring Location	PM	Station	Offset	Sample No.	Sample Depth (ft)	Sample Type	USCS Soil Type	EXISTING RAC/AC/AB/AS (in)	Sampled by	Sampling Date	Date Sent to Lab	Date Received Results
I-5	MB-1	SB Shoulder	28.03	1516+00	110L	MB-1	2-5	Bulk	CL	1/5/12/12	MM	08/25/2008	08/25/2008	09/18/2008
	MB-2	SB Shoulder	27.85	1505+20	115L	MB-2	2-5	Bulk	SM-SC	1/5/10/12	MM	08/25/2008	08/25/2008	09/18/2008
	MB-3	Right Shoulder of SB Off-ramp to Jamboree Road	27.68	1495+00	375L	MB-3	2-5	Bulk	SM-SC	1/5/9/12	MM	08/25/2008	08/25/2008	09/18/2008
	MB-4	Middle of Existing Auxiliary Lane	27.8	1504+00	100L	No Sample	2-5	Bulk	SM-SC	1/6/3(ATPB)/12	MM	N/A	N/A	N/A

N/A **Not Available** or Not Applicable

TABLE 2-SUMMARY OF LABORATORY TEST RESULTS

Route No.	Boring No.	Sample No.	Sample Depth (m)	Percent Passing No. 200 Sieve	SE (%)	USCS	Expansion Index	R-Valne	Corrosivity			
									pH	Sulfate Content (ppm)	Chloride Content (ppm)	Resistivity (Ohm-cm)
I-5	MB-1	MB-1	0.6-1.5	69	6	CL	77	small sample	9.4	175	83	940
	MB-2	MB-2	0.6-1.5	48	8	SM-SC	59	22	9.47	NA [1]	NA [1]	1900
	MB-3	MB-3	0.6-1.5	47	10	SM-SC	53	21	9.39	832	48	850

Notes: 1) NA Not Applicable since Resistivity was <1000 ohm-cm.

TABLE 3-SUMMARY OF CORING VS AS-BUILT DATA

Route No.	Direction	Coring Location	Coring No.	Station	Offset (ft)	Lane No.	Existing Pavement (in)				As-Built Pavement (in)			Recommended Pavement Section for Auxiliary Lane and Shoulder and Off-ramp (in)[2]			
							RAC	AC	AB	AS	AC	AB	AS	RHMA	HMA	ATPB	AB
I-5	South	SB Shoulder near the Beginning of Sound Wall 100	MB-1	1516+00	110L	Shoulder	1	5	12	12+	5	9	12+	1	8	3	25
		SB Shonlder around the Middle of Sound Wall 100	MB-2	1505+20	115L	Shoulder	1	5	10	12+	5	9	12+	1	8	3	25
		SB Shoulder near the End of Sound Wall 100	MB-3	1495+00	375L	Off-Ramp Shoulder	1	5	9	12+	5	3(ATPB)/ 10 (AB)	12+	1	6	3	18
		Left Shoulder of SB Off-ramp to Camino De Estrella near the Termini [4]	MB-4	1504+00	100L	Auxiliary	1	6	3(ATPB)/12(AB)	12+	6	3(ATPB)/ 12(AB)	16	N/A	N/A	N/A	N/A

Notes

1 Coring Data was obtained from core samples taken on August 25,2008.

2 Auxiliary Lane and its shoulder shall have the same structural section. Ramp Lane and its shoulder shall have the same structural section.

3 Acronyms:

HMA Hot Mix Asphalt Concrete, Type A - 19mm Coarse (See Std. Spec. Section 39-2.02)
RAC Rubberized Asphalt Concrete
RHMA Rubberized Hot Mix Asphalt
AB Class 2 Aggregate Base (See Std. Spec. Section 26-1.02A)
ATPB Asphalt Treated Permeable Base (See Std. Spec. Section 29-1.02)
AS Class 2 Aggregate Subbase (See Std. Spec. Section 25)
R R-Value (Caltrans Test Method 301)
TI Traffic Index (by Traffic Studies Branch)
N/A Not Available or Not Applicable

4 PCC Ramp Termini design for the final 45 m of all Off-Ramps should be as Follows:

Ramps	Recommended Pavement Sections	
SB I-5 Jamboree Off-ramp	04	06

ORIGINAL
LAB RESULTS

Behdad

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
FACSIMILE COVER

TO:	FROM:
MEHRDAD MAHDAVIAN	**Office** of Construction District 07 Materials Lab Materials Testing Section 1616 S Maple Avenue Los Angeles, CA 90015 - 3703 (213) 620-5692 CALNET 8-640-5692 (213) 620-3487 <FAX> CALNET 8-640-3487
UNIT I COMPANY	
DISTRICT I CITY District 12	**SENT BY':** ***PRISCILA QUEJARRO*** x - 341
(AREA CODE) P M N E NO, / CALNET 949-756-4927	
FAX > (AREA CODE) PHONE NO / CALNET 949-724-2519	(AREA CODE) PHONE NO I CALNET (213) 6204032 / 8-640-4032 (MaterialTesting) X - 341
OATE 08-September-08	TOTAL PAGES (INCLUDING COVER SHEET) 4

MESSAGE I REMARKS:

Contract No. : 12-0G9601 **Lab. No. : 1131-1134**

The rnatenal described herein was tested based on accepted testing procedures as prescribed in the California Test Methods and testing is now complete.

DISTRI T 7 SOIL & AGGREGATE TESTS

NO. 864 P 2

DIST 7 MATL LAB

SEP 8. 2008 11:45AM

Sample of: SUB-GRADE SOIL

Sampled from: 1 - 5 SB NEAR JAMBOREE ROAD, DEPTH : 3 ' - 5 ' (1 - 1.5 m)

Material Source: JOBSITE

Owner / Mfr.: STATE

Date Sampled: 8/25/08

Materials Lab Stamp

By PSQ for

G. ANYANWU
District Materials Engineer

1 2	0 G 9 6 0 1	M B - 1	1132
	CONTRACT NO.	SAMPLE NO.	LAB. NO.

DATE RCVD: 08/25/08 DATE OUT: 9-10

NUMBER OF CONTAINERS: 1 BAG

NORMAL ☐ PRIORITY ✓ DATE NEEDED:

By: FAX ✓ MAIL PHONE OTHER

R.E.: MEHRDAD MAHDAVIAN
Address:
D-12 MAT & RESEARCH
3337 Michelson Drive, Suite 380
IRVINE, CA 92612-8894

Phone No.: 949-756-4927

Fax. No.: 949-724-2519

DISTRICT MATERIALS LABORATORY
1616 S. Maple Street
Los Angeles, CA 90015

Phone: (213) 620-5692
Calnet: 8-640-5692
Fax: (213) 620-5540
Calnet: 8-640-5540

GRADING ANALYSIS

Total Wt 7064 g By: HC Date: 9/2/08

Wt. Ret.	Size (mm)	Acc. Wt. Ret.	% Ret.	% Pass	Comb. % Pass	SPEC.
	87.5					
	75					
	62.5					
	50					
	37.5					
0	25	0				
19	19	19	0		100	
45	12.5	64	1		99	
74	9.5	138	2		98	
240	4.75	378	5		95	
6686		7064				

FINE GRADE / MECHANICAL ANALYSIS

Dry Wt. (g)						
			0	100	95	
	2.36 mm	19	4	96	91	
	1.18 mm	32	6	94	89	
502.0 g	600 µm	49	10	90	86	
	300 µm	72	14	86	82	
	150 µm	102	20	80	76	
	75 µm	136	27	73	69	

MECH. / HYDRO.	R	Corr.	C.R.	Mat'l in Sus	Comb % Pass
1hr.	5M				
24hr.	1M				

SAND EQUIVALENT

					MIN. SPEC.
Sand R2	0.6	0.6		Avg.	
Clay R1	11.3	11.3		6	
S.E. Value	6	6			

L.A.R.T.	Rev.	Wt.	Wt. Ret.	% Ret.	% Loss	% SPEC
A B	100	5000g				
C D	500	5000g				

No. of spheres = Wt. of spheres =

DURABILITY INDEX

		SPEC.
Dura-Coarse	Sed.Ht =	
Dura-Fine	R2/R1 =	

R-VALUE BATCH

% Run	Size	Wt.
	25 mm	
100	19 mm	1200
99	12.5 mm	1168
98	9.5 mm	1176
95	4.75 mm	1140

R-VALUE

RESULT SPEC.

SP. G. FINE (SSD)

(B) S.S. Dry
(A) Ov. Dry
ABS. %
Wt. S+C+H2O
Wt. S+C
W=Wt. H2O
Bulk = 500 / (500 - W) =

SP. GR. COARSE CT206/CT209, #4

(B) S.S. Dry
(A) Ov. Dry
ABS. %
(C) Wt. S. in H2O
App = A / (A - C) =
SSD = B / (B - C) =
OD = A / (B - C) =

% CRUSHED PARTICLES

%Ret.x(Wt.Cr./Tot.Wt.) = Prod. SPEC.

Wtd. Avg. % CP Rel. No.4 =

% CP = P/R

MOISTURE CONTENT

	SPEC.
Gr. Wet	
Gr. Dry	L.L.
H2O	
Tare	P.L.
Net Dry	
% H2O	P.I.

PLASTICITY INDEX

pH / RESISTIVITY

	Field	Lab.	MIN. SPEC.
Soil pH		9.40	5.5-10.0
H2O			
Min. Resistivity		940	NL/ 1000
Based on 18 gauge CMP.		☆	

Estimated life:

CLEANNESS VALUE

NL	SED. HT.	RESULT

FILM STRIPPING

NL

ORGANIC IMPURITIES

Satisfactory
Unsatisfactory

TEST(S) REQUESTED

			✓
■	Fine Grade	202	✓
■	Coarse Grade	202	✓
	Filler Material	202	
	Mech. Analysis	203	
	Plasticity Index	204	
	% Crushed Particles	205	
	SpG. Coarse	206	
	SpG. Fine (SSD)	207	
	SpG. of Soils	209	
	L.A.R.T.	211	
	Unit Wt.	212	
	Organic Impurities	213	
	Soundness	214	
	Relative Compaction	216	
■	Sand Equivalent	217	✓
	Moisture Content	226	
	Cleaness Value	227	
	Durability Fine	229	
	Durability Coarse	229	
	Reactivity	ASTM C-289	
☆	R-Value	301	✓
	Film Strip	302	
	Mortar Strength	515	
	pH (RC)	532	
	Resistivity (RC)	532	
■	pH (CMP)	643	✓
■	Resistivity (CMP)	643	✓
■	Expansion Index	UBC-29-2	✓
	Max. Dry Density/ Opt. Moist Content	ASTM-D1557	

SAMPLE TYPE

				✓
A.B.		PCC		
A.S.		Dk.Fill		
EMB.		MISC.		
O.G.		Sub-Grade		✓
A.C. Agg.		SOIL		

TL-101 S.I.C. NO.

C 101054

Expansion Index

77.0

Initial Dry Density (pcf)	96.3
Molded Moisture, (%)	12.9

0 - 20 Very Low
21 - 50 Low
51 - 90 Medium
91 - 130 High
≥ 131 Very High/Critical

Laboratory Remarks:

☆Send sample to Sacramento for CT 417 & CT 422, resistivity is < 1000 ohm / cc.

☆ Not enough soil sample to run R-Value, per CT 301.

SPECIFIC GRAVITY OF SOILS

Wt Oven Dry Soil (Wo)
Wt Pycnometer + H_2O (Wa)
Wt Pycnometer + H2O + Soil (Wb)
Wo / (Wo + Wa - Wb)

Wo
Wa
Wb
Spec. Grav.

CONTRACT NO. 1 2 - 0 G 9 6 0 1

LAB. NO. 1 1 3 2

A 07-AOG-SSD (RG/SD 7/98, Rev. DH 03/07/01)

DISTRICT 7 SOIL & AGGREGATE TESTS

Sample of: SUB-GRADE SOIL

Sampled from: I - 5 SB NEAR JAMBOREE ROAD, DEPTH : 3' - 5' (1 - 1.5 m)

Material Source: JOBSITE

Owner / Mfr.: STATE

Date Sampled: 8/25/08

Materials Lab Stamp

By PSQ for

G. ANYANWU
District Materials Engineer

1	2	0	G	9	6	0	1			M	B	-	2	1133
CONTRACT NO.										SAMPLE NO.				LAB NO.

DATE RCV'D: 08/25/08 DATE OUT: 9-10

NUMBER OF CONTAINERS: 1 BAG By MAIL

NORMAL | PRIORITY ✓ DATE NEEDED | PHONE | OTHER

R.E.: MEHRDAD MAHDAVIAN

Address:
D-12 MAT & RESEARCH
3337 Michelson Drive, Suite 380
IRVINE, CA 92612-8894

Phone No.: 949-756-4927

Fax. No.: 949-724-2519

DISTRICT MATERIALS LABORATORY
1616 S. Maple Street
Los Angeles, CA 90015

Phone: (213) 620-5692
Calnet: 8-640-5692
Fax: (213) 620-5540
Calnet: 8-640-5540

GRADING ANALYSIS

Total Wt: 10152 g By: HC Date: 03/06/08

Wt. Ret.	Size (mm)	Acc. Wt. Ret.	% Ret.	% Pass	Comb. % Pass	SPEC.
	87.5					
	75					
	62.5					
	50					
	37.5					
0	25	0				
11	19	11	0		100	
106	12.5	117	1		99	
102	9.5	219	2		98	
248	4.75	467	5		95	
9685		10152				

FINE GRADE / MECHANICAL ANALYSIS

Dry Wt. (g)						
	2.36 mm	9	2	98	93	
	1.18 mm	19	4	96	91	
509.0 g	600 µm	32	6	94	89	
	300 µm	71	14	86	82	
	150 µm	159	31	69	86	
	75 µm	251	49	51	48	

MECH. / HYDRO.		R	Corr.	C.R.	Man'l Sieve	Comb % Pass
1hr.	5M					
24hr.	1M					

SAND EQUIVALENT

				MIN. SPEC.
Sand R2	1.0	1.0	Avg.	
Clay R1	13.7	13.6	8	
S.E. Value	8	8		

L.A.R.T.	Rev.	Wt.	Wt. Ret.	% Ret.	% Loss	% SPEC
A B	100	5000g				
C D	500	5000g				

No. of spheres = Wt. of spheres =

DURABILITY INDEX

		SPEC.
Dura-Coarse	Sed.Ht.=	
Dura-Fine	R2/R1 =	

R-VALUE BATCH

% Run	Size	Wt.
	25 mm	
100	19 mm	1200
99	12.5 mm	1188
98	9.5 mm	1176
95	4.75 mm	1140

R-VALUE

RESULT 22 SPEC.

SP. G. FINE (SSD)

(B) S.S. Dry
(A) Ov. Dry
ABS. %
Wt. S+C+H2O
Wt. S+C
W=Wt. H2O

$$\text{Bulk} = \frac{500}{500 - W} =$$

SP. GR. COARSE CT206/CT209, #4

(B) S.S. Dry
(A) Ov. Dry
ABS. %
(C) Wt. S. in H2O

$$\text{App} = \frac{A}{A - C} =$$

$$\text{SSD} = \frac{B}{B - C} =$$

$$\text{OD} = \frac{A}{B - C} =$$

% CRUSHED PARTICLES

%Ret.x(Wt.Cr/Tot.Wt.) = Prod. | Wtd. Avg. % CP Ret. No.4 =

% CP = P/R

MOISTURE CONTENT

	SPEC.
Gr. Wet	L.L.
Gr. Dry	
H2O	P.L.
Tare	
Net Dry	P.I.
% H2O	

PLASTICITY INDEX

pH / RESISTIVITY

	Field	Lab.	MIN. SPEC.
Soil pH		9.47	5.5~10.0
H2O			
Min. Resistivity		1900	NL/1000

Based on 18 gauge CMP.
Estimated life: 32 yrs.

CLEANNESS VALUE

NL	SED. HT.	RESULT

FILM STRIPPING	ORGANIC IMPURITIES	
NL	Satisfactory	
	Unsatisfactory	

TEST(S) REQUESTED

			✓
■	Fine Grade	202	✓
■	Coarse Grade	202	✓
	Filler Material	202	
	Mech. Analysis	203	
	Plasticity Index	204	
	% Crushed Particles	205	
	SpG. Coarse	206	
	SpG. Fine (SSD)	207	
	SpG. of Soils	209	
	L.A.R.T.	211	
	Unit Wt.	212	
	Organic Impurities	213	
	Soundness	214	
	Relative Compaction	216	
■	Sand Equivalent	217	✓
	Moisture Content	226	
	Cleanness Value	227	
	Durability Fine	229	
	Durability Coarse	229	
	Reactivity	ASTM C-289	
■	R-Value	301	✓
	Film Strip	302	
	Mortar Strength	515	
	pH (RC)	532	
	Resistivity (RC)	532	
■	pH (CMP)	643	✓
■	Resistivity (CMP)	643	✓
■	Expansion Index	UBC-29-2	✓
	Max. Dry Density/ Opt. Moist Content	ASTM-D1557	

SAMPLE TYPE

			✓
A.B.		PCC	
A.S.		Bk.Fill	
BMB.		MISC.	
C.G.		Sub-Grade	✓
A.C. Agg.		SOIL	

TL-101 S.I.C. NO.

Expansion Index: 59.0

Initial Dry Density (pcf)	113.7
Molded Moisture, (%)	8.9

0 - 20 Very Low
21 - 50 Low
51 - 90 Medium
91 - 130 High
≥ 131 Very High/Critical

Laboratory Remarks:

SPECIFIC GRAVITY OF SOILS

Wt Oven Dry Soil (Wo)
Wt Pycnometer + H_1O (Wa)
Wt Pycnometer + H2O + Soil (Wb)
Wo / (Wo + Wa - Wb)

Wo		Spec. Grav.	
Wa			
Wb			

CONTRACT NO. 12-0G9601 LAB. NO. 1133

07-AGG-SSD (AGSD 7/03, Rev. DH 03/17/04)

P. 3
NO. 864
DIST 7 MATL LAB
SEP. 10. 2008 11:46AM

DISTRIC 7 SOIL & AGGREGATE TESTS

Sample of: SUB-GRADE SOIL

Sampled from: I - 5 SB NEAR JAMBOREE ROAD, DEPTH : 3' - 5' (1 - 1.5 m)

Material Source: JOBSITE

Owner / Mfr.: STATE

Date Sampled: 8/25/08

Materials Lab. Stamp

By _____ for

G. ANYANWU

District Materials Engineer

12	0G9601		MB - 3	.34
	CONTRACT NO.		SAMPLE NO.	LAB. NO.

DATE RCV'D: 08/25/08 DATE OUT: 9-10

NUMBER OF CONTAINERS: 1 BAG

By: FAX ✓ MAIL PHONE OTHER

NORMAL PRIORITY ✓ DATE NEEDED

R.E.: MEHRDAD MAHDAVIAN
Address:
D-12 MAT & RESEARCH
3337 Michelson Drive, Suite 380
IRVINE, CA 92612-8894

Phone No.: 949-756-4927

Fax. No.: 949-724-2519

DISTRICT MATERIALS LABORATORY
1616 S. Maple Street
Los Angeles, CA 90015

Phone: (213) 620-5692
Calnet: 8-640-5692
Fax: (213) 620-5540
Calnet: 8-640-5540

GRADING ANALYSIS

Total Wt 10458 g | By: HC | Date: 8/29/08

Wt. Ret.	Size (mm)	Acc. Wt. Ret.	% Ret.	% Pass	Comb. % Pass	SPEC.
	87.5					
	75					
	62.5					
	50					
	37.5					
0	25	0				
20	19	20	0		100	
46	12.5	66	1		99	
74	9.5	140	1		99	
239	4.75	379	4		96	
10079		10458				

FINE GRADE / MECHANICAL ANALYSIS

Dry Wt. (g)						
	2.36 mm	16	3	97	93	
	1.18 mm	33	6	94	90	
510.0 g	600 µm	60	12	88	84	
	300 µm	113	22	78	75	
	150 µm	191	37	63	60	
	75 µm	261	51	49	47	

MECH. / HYDRO.	R	Corr.	C.R.	Bfld In Sm.	Comb % Pass
1hr. 5M					
24hr. 1M					

SAND EQUIVALENT

				MIN. SPEC.
Sand R2	1.2	1.3	Avg.	
Clay R1	13.4	13.4	10	
S.E. Value	9	10		

L.A.R.T.	Rev.	Wt.	Wt. Ret.	% Ret.	% Loss	% SPEC
A B	100	5000g				
C D	500	5000g				

No. of spheres = Wt. of spheres =

DURABILITY INDEX

		SPEC.
Dura-Coarse	Sed. Ht.=	
Dura-Fine	R2/R1 =	

R-VALUE BATCH

% Run	Size	Wt.
	25 mm	
100	19 mm	1200
99	12.5 mm	1188
99	9.5 mm	1188
96	4.75 mm	1152

% CRUSHED PARTICLES

%Ret.x(Wt Cr./Tot.Wt.) = Prod. | SPEC.

Wtd. Avg. % CP Ret. No.4 =

% CP = P/R

R-VALUE	SPEC.
RESULT 21	

SP. G. FINE (SSD)

(B) S.S. Dry
(A) Ov. Dry
ABS. %
Wt. S+C+H2O
Wt. S+C
W=Wt. H2O
Bulk = 500 / (500 - W) =

SP. GR. COARSE CT206/CT209, #4

(B) S.S. Dry
(A) Ov. Dry
ABS. %
(C) Wt. S. in H2O
App = A / (A - C) =
SSD = B / (B - C) =
OD = A / (B - C) =

MOISTURE CONTENT

	SPEC.
Gr. Wet	L.L.
Gr. Dry	
H2O	P.L.
Tare	
Net Dry	P.I.
% H2O	

PLASTICITY INDEX

pH / RESISTIVITY

	Field	Lab.	MIN. SPEC.
Soil pH		9.39	5.5-10.0
H2O			
Min. Resistivity		850	NL/ 1000

Based on 18 gauge CMP. ☆
Estimated life:

CLEANNESS VALUE

NL	SED. HT.	RESULT

FILM STRIPPING

NL

ORGANIC IMPURITIES

Satisfactory
Unsatisfactory

SPECIFIC GRAVITY OF SOILS

Wt Oven Dry Soil (Wo)
Wt Pycnometer + H_2O (Wa)
Wt Pycnometer + H2O + Soil (Wb)
Wo / (Wo + Wa - Wb)

Wo
Wa
Wb
Spec. Grav.

TEST(S) REQUESTED

			✓
■	Fine Grade	202	✓
■	Coarse Grade	202	✓
	Filler Material	202	
	Mech. Analysis	203	
	Plasticity Index	204	
	% Crushed Particles	205	
	SpG. Coarse	206	
	SpG. Fine (SSD)	207	
	SpG. of Soils	209	
	L.A.R.T.	211	
	Unit Wt.	212	
	Organic Impurities	213	
	Soundness	214	
	Relative Compaction	216	
■	Sand Equivalent	217	✓
	Moisture Content	226	
	Cleaness Value	227	
	Durability Fine	229	
	Durability Coarse	229	
	Reactivity	ASTM C-289	
■	R-Value	301	✓
	Film Strip	302	
	Mortar Strength	515	
	pH (RC)	532	
	Resistivity (RC)	532	
■	pH (CMP)	643	✓
■	Resistivity (CMP)	643	✓
■	Expansion Index	UBC-29-2	✓
	Max. Dry Density/ Opt. Moist Content	ASTM-D1557	

SAMPLE TYPE

	A.B.		POC
	A.S.		Bk.Fill
	EMB.		MISC.
	O.G.		Sub-Grade ✓
	A.C. Agg.		SOIL

TL-101 S.I.C. NO.: C 101055

Expansion Index: 53.0

Initial Dry Density (pcf): 114.8
Molded Moisture, (%): 8.8

0 - 20 Very Low
21 - 50 Low
51 - 90 Medium
91 - 130 High
≥ 131 Very High/Critical

Laboratory Remarks:
☆Send sample to Sacramento for CT 417 & CT 422, resistivity is < 1000 ohm / cc.

CONTRACT NO. 12-0G9601

LAB NO. 1134

07-AGG-SAD (RG/6D 7/93, Rev. 04 05/07/01)

NO. 864 P. 4

DIST 7 MAT. LAB

SEP. 10. 2008 11:46AM

<Rudy_C_Lopez@dot.ca.gov
>

0911812008 08:39 AM

To <mehrdad_mahdavian@dot.ca.gov>

cc

bcc

Subject Corrosion Test **Summary** Report -Soil, EA:12-0G9601
(Corr. #s CR080493 & CR080494)

Division of Engineering Services
Materials Engineering and Testing Services
Corrosion Technology Branch
Report Date: 9/18/2008
Reported By: Lopez, Rudy

CORROSION TEST SUMMARY REPORT - Soil/Water

Bridge Name:
Bridge Number:
EA No.: **12-0G9601**
Dist/Co/Rte/PM or **KP: 12 / ORA / 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)
C101054	I-5 SOUTHBOUND	SOIL	3 0-5 0 FT	940	9 30	83	175
C101055	1-5 SB NEAR JAMBOREE RD.	SOIL	3.0-5.0 FT	850	**9.39**	48	**832**

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

COPY OF TRAFFIC INDEX (TI) LETTER

State of California Business, **Housing, and Transportation Agency**

Memorandum

To : Behdad Bascghi, Chief.
Materials Branch
Attn: Mehrdad Mahdavian

Date: 8/27/2008

File: 12-ORA-5
PM 27.6128.2
EA 0G9901

From : DEPARTMENT OF TRANSPORTATION
Traffic Census

Subject: Traffic Index

Per your request, the calculated Traffic Index (T.I.) for mainline Route 5, PM 27.6/28.2 is as follows:

Rte.	P.M.	20 Yr. T.I. 100 %	10 Yr. T.I. 100 %
5	27.6/28.2	**15.5** (Auxiliary lane)	14.0 (Auxiliary lane)
5	27.6/28.2	13.0 (Other mixed flow lanes)	**12.0** (Other mixed flow lanes)
5	RAMPS	**12.0**	**12.0**

This is based on the 2007 Traffic Volumes, 2006 Truck Volumes and the Highway Design Manual. If you have any questions please call Andrew Wong at (919) 756-7658.

Jason Osman, Chief
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