State of California

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: Jose L. Robles – 11
Traffic Project Development

Date: September 9, 2008

File: 11-SD-5
PM 5.4
EA 286001

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design - South

Subject: Geotechnical Foundation Report (GDR), Caltrans Type 1 Retaining Walls and Traffic Signals.

This Geotechnical Foundation Report presents the results of geotechnical evaluation of the project within the limits provided by District 11. The geotechnical evaluation consisted of field reconnaissance, limited subsurface investigation, lab testing and analysis by the Caltrans Office of Geotechnical Design South (OGDS) II to provide design and construction recommendations relevant to the propose project. The proposed improvements would construct two Caltrans standard Type 1 retaining walls and traffic signals to the interchange at Main Street in the City of Chula Vista.

Should you have any questions, please contact Mike Fordham (858) 467-3290

Prepared by: Date: 9/9/08

Mike Fordham

Mike Fordham, P.E.
Transportation Engineer
Geotechnical Branch D

REGISTERED PROFESSIONAL ENGINEER
MICHAEL M. FORDHAM
C61341
EXP. 06/09
CIVIL
STATE OF CALIFORNIA

cc: Abbas Abghari
Brian Hinman

CALIFORNIA DEPARTMENT OF TRANSPORTATION

STRUCTURES FOUNDATION REPORT

SAFETY IMPROVEMENT PROJECT INCUDING SIDEWALKS, TRAFFIC SIGNALS AND RETIANING WALLS, INTERSTATE 5 AT MAIN STREET IN THE CITY OF CHULA

11-SD-5, PM 5.4
11-286001

September 2008

Prepared for:

Caltrans
District 11

By: Office of Geotechnical Design South II, Branch D

Engineering Service Center
Division of Materials and Foundations
Roadway Geotechnical Engineering Design

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1. Scope of Work

The purpose of this work is to review surface and subsurface geotechnical conditions, provide analyses of the anticipated site conditions as they pertain to the project, and to provide geotechnical foundation recommendations for the design and construction of the proposed retaining walls and signal foundations. Our scope of work included:

1. Review of existing data, including published maps, reports, as-built plans, aerial photographs, and other pertinent geotechnical information.
2. Site reconnaissance, geologic mapping and limited subsurface investigation.
3. Engineering analyses based on limited subsurface investigation, archival data and assumed parameters
4. Preparation of this report.

2. Project Description

Caltrans District 11 has proposed a traffic safety improvement project for I-5 at Main Street in The City of Chula Vista (figure 1). The features of the proposed project include the construction of two 6-foot high retaining walls, sidewalks and traffic signals (figure 2). The retaining walls are located on the south side of Main Street on both the east and west side of Interstate 5 (I-5). Retaining wall 1 (RW1) is located on the west side of the Main Street over crossing and extends from station 5+00.00 "Main" to 7+20.00 "Main". Retaining Wall 2 (RW2) is located on the east side of Main Street over crossing and Extends from station 11+72.70 "Main" to 15+60.00 "Main". The retaining walls are to be constructed along the top of an existing 2:1 (Horizontal to Vertical) embankment. The proposed sidewalk will be constructed behind the retaining walls. Traffic signals are proposed at the intersection of I-5 northbound on and off ramps from both east and westbound Main Street.

3. Site Geology and Subsurface Conditions

The project site is located atop alluvial and slopewash. These are undifferentiated and consist of poorly consolidated silts, sands and cobbles derived from nearby bedrock sources. The nearby bedrock sources consist of Bay Point Formation. Bay Point Formation is well exposed in much of the area adjacent to the San Diego Bay. It consists primarily of marine, lagoonal and nonmarine, poorly consolidated, fine and medium grained, pale brown, fossiliferous sandstone, and is was laid down during the late Pleistocene era (figure 3, Kennedy and Tan, 1977).

Tectonically San Diego County rides atop the eastern margin of the Pacific Plate, grinding along the edge of the North American Plate towards the northwest at an average annual rate of 2.5 cm per year. As a result, the region is characterized by complex systems of active northwest trending faults and associated seismicity (figure 4).

Major fault expressions near the project alignment include the San Andreas, San Jacinto, Elsinor, and Rose Canyon Fault Zones. Additionally, a complex system of northwest trending faults offshore from San Diego, which include the Coronado Banks and San Diego Trough Faults, are potential seismic sources that may cause minimal to moderate shaking at the proposed project site.

The project sites will be exposed to seismicity due to its proximity to active fault zones and may experience seismically induced settlement, slope failures and liquefaction during or directly after a seismic event.

A list of all active faults (based on 1996 Caltrans Seismic Hazard Report) with in 50 miles of the site is provided in Table 1.

3.1. Topography and Geology

The San Diego Coastal Plain dominates the topography of the proposed project area. The San Diego Coastal Plain consists of former deltas, tidal flats, tidal inlets and flood plains of San Diego Bay and the Otay River, as well as marine and alluvial terraces. The drainage of the area is westerly towards San Diego Bay, with the most prominent natural drainage being the Otay River.

The proposed project site geology consists of artificially compacted fill atop undifferentiated alluvium and slope wash:

Artificially Compacted Fill: Fill consists of earth material derived usually from local sources. The artificially compacted fill within the project site is predominately reddish brown, very loose to medium dense silty sand to slightly clayey sand with gravel and cobbles (Kennedy and Tan, 1977).

Alluvium and Slope Wash Undifferentiated: The alluvium generally consists of poorly consolidated stream deposits of silt, sand and cobble sized particles derived from bedrock. The deposits intertongue with Holocene slopewash that commonly mantles the lower valley slopes throughout much of the coastal San Diego County. The slopewash deposits are poorly consolidated surficial materials derived chiefly from nearby sources of soil and decomposed bedrock. The slopewash is deposited along the flanks of the lower valley slopes by the interaction of gravity and water. (Kennedy and Tan, 1977)

3.2. Pertinent soil conditions or geologic hazards

Due to the seismicty of the area and the poorly consolidated nature of the alluvium and slopewash combining with the probability of shallow groundwater at or near the project site may result liquefaction, seismically induced settlement and slope failures during a seismic event. The possibility of fault rupture occurring within the project limits is considered low to moderate.

3.3. Project Site Soil

The soil with in the project area consists of artificial fill derived from nearby local sources and alluvium and slope wash consisting of poorly consolidated silt, sand and cobble size particles.

3.4. Project Site Rock

No rock was encountered during the limited subsurface investigation.

4. Ground Water

The groundwater elevation at the site was characterized using both archival data from previous subsurface investigations and nearby groundwater monitoring wells. Groundwater was not encountered during the subsurface investigation performed on June 17, 2008. The groundwater elevation within the proposed project site lies between 1.0 and 5.7 feet above Mean Sea Level (MSL) and may fluctuate depending on time of year tidal activity and precipitation. (Caltrans, 2007)

5. Scour Evaluation

Scour was not evaluated for this foundation Report.

5. Corrosion Evaluation

Two near surface soil samples (top 5 feet of embankment) were obtained during the preparation of the Preliminary Foundation Report. Corrosion tests were performed on both samples. Based on the corrosion test results the near surface soils are not considered to be corrosive. The test results are located in Appendix II (Caltrans, *Preliminary Foundation Report,* 2007)

6. Seismic Study

The project sites will be exposed to seismicity due to its proximity to active fault zones and may experience seismically induced settlement, slope failures and liquefaction during or directly after an event.

A list of all active faults (based on 1996 Caltrans Seismic Hazard Report) with in 50 miles of the site is provided in Table 1.

During the limited subsurface investigation suitable information was not obtained to evaluate the liquefaction potential of the proposed project site. Information gathered from archival bridge log of test boring where evaluated and based on the measured elevation of the groundwater during the development of the bridge boring B-1 (figure 7) and the soil descriptions from boring B-1, the soils consist of dense gravels with a

sand matrix. The liquefaction potential of the soil strata below the groundwater table is considered low.

8. As-Built Foundation Data

As-built foundation data was not evaluated for this report.

9. Foundation Recommendations

9.1. Shallow Foundations

The project proposes to construct two Caltrans standard type 1 retaining walls (Caltrans Standard Plan B3-1). The walls are to be constructed at the top of slope on spread footings. The information obtained from archival data as well as the limited subsurface investigations performed for the preliminary foundation report as well as this foundation report was utilized to determine global stability and bearing capacity of insitu soils. The calculated allowable bearing capacity of the insitu soil is sufficient to support the proposed Caltrans standard type 1 retaining wall on spread footings. Settlement was estimated to be within Caltrans allowable limits for both total and differential settlement. The bearing capacity and settlement calculations are based on an Caltrans Standard Type I retaining wall 8 feet in height.

The proposed retaining walls should be embedded to a depth that is sufficient to allow for a minimum of 8 feet of soil cover. The 8 feet of soil cover should be measured horizontally from the bottom outside corner of the spread footing to the face of the slope (figure 6)

9.2. Deep Foundations

The installation of traffic signals will require the use of CIDH pile foundations. The dimension and depth of the CIDH pile foundation for traffic signals can be determined from the Caltrans Standard Plan (ES-7C through ES-7H and ES-7N). The method used for the subsurface investigation did not provide definitive information about the caving characteristics of the soil. The contractor should be aware that caving may occur during the drilling operation for the construction of he CIDH pile and that the borings may need to be cased.

9.3. Approach Fill Earthwork

Approach fills were not necessary for this project. During OGDS II visual field review of the project site it was noted that the AC pavement adjacent to the bridge abutments on both the east and west side of the Main Street overcrossing are showing sever distress. The cause of the ditress was not investigated for this foundations report.

10. Slope Stability Analyses

A slope stability analysis was performed using GSTABLE. The slope stability analysis included both static and pseudo static analysis. The overall global stability of the slope was evaluated. The proposed slope geometry was determined by the analysis to have a static factor of Safety (FOS) of >1.5 and a pseudo static FOS of >1.1, which meets Caltrans standards. The slope stability evaluation was based on a Caltans Standard Type 1 retaining wall 8 feet in height.

11. General Notes to Designer

The placement of the retaining wall at the crest of a 2:1 (horizontal to vertical) slope requires a minimum horizontal distance of 8 feet between the bottom outer most corner of the foundation and the surface of the slope. This may require the overall height of the retaining wall and the embedment to be increased in order to achieve the required 8 feet of minimum soil cover.

12. Construction Considerations

- All in place utilities should be located prior to construction
- 8 feet of minimum soil cover is required between the bottom outside corner of the spread footing to the face of the slopes. Based on the current geometry provided by District 11 this would require a minimum embedment of 4 feet. This will lead to an increase in the overall height of the retaining wall.
- Calculations were based on an 8-foot retaining wall. If the height of the proposed wall is greater than 8 feet the OGDS II should be contacted to reevaluate the site for the increased height of the proposed retaining wall.
- The project area is predominantly artificial fill, alluvium and slope wash. These materials are rippable by conventional heavy-duty grading equipment and are drillable by auger drill rigs.
- The traffic signal foundations will be constructed in artificial fill and alluvium/slope wash, Caving of the properly compacted artificial fill is considered unlikely, but the caving characteristics of the alluvium/slope wash are unknown. The contractor should be aware of the possibility of caving when drilling in native material and should be prepared to case the excavation if caving does occur.

13. Disclaimers and Contact Information

The recommendations contained in this report are based on specific project information that has been provided by Caltrans District 11 Design. If any conceptual changes are made during final project design, the Office of Geotechnical Design-South II, Branch D should review those changes to determine if these foundation recommendations are still applicable. Any questions regarding the above

recommendations should be directed to the attention of Mike Fordham, (858) 467-3290, at the Office of Geotechnical Design- South II, Branch D.

14. Appendix

TABLE 1

SUMMARY OF NEARBY FUALTS

Fault Name	Fualt Type	Approximate Closest Distance to site	Maximum Credible Earthquake Magnitude
		(miles)	
Newport-Inglewood-Rose Canyon East (NIE)	ST	0.62	7
Newport-Inglewood-Rose Canyon West (NIW)	ST	2.48	7
Point Loma (PTL)	XX	6.21	6.5
Palos Verdes Hills-Coronado Bank (PVC)	ST	15.53	7.75
San Diego Trough (SDT)	XX	31.06	7.5
Whittier Elsinor (WEE)	ST	62.14	7.5
San Clemente (SCE)	ST	62.14	7.25
Earthquake Valley (EQV)	ST	68.35	6.5

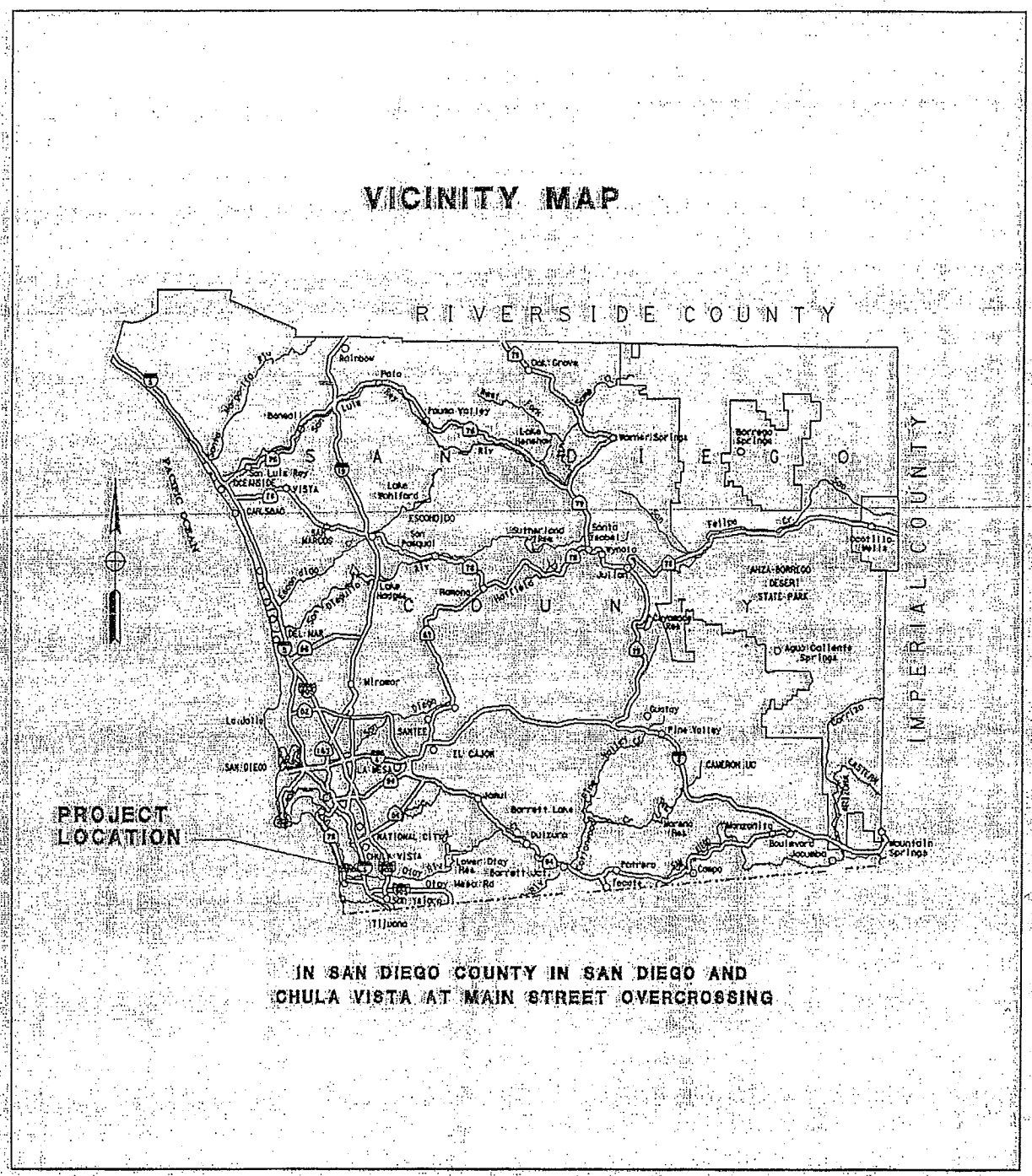
Notes:

1. Fault data is from Caltrans Seismic Hazard Map 1996.
2. Closest distance is scaled from Caltrans Seismic Hazard Map 1996.
3. Fault Type:

   ST = Strike - Slip
   XX = Not Known/Published

11-SD-5
PM 5.4
EA 28600K
11233
20.10.201.010

Figure 1: Project Location Map



INDEX OF PLANS

Figure 1: Project Location Map

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	5	5.4		

STATE OF CALIFORNIA

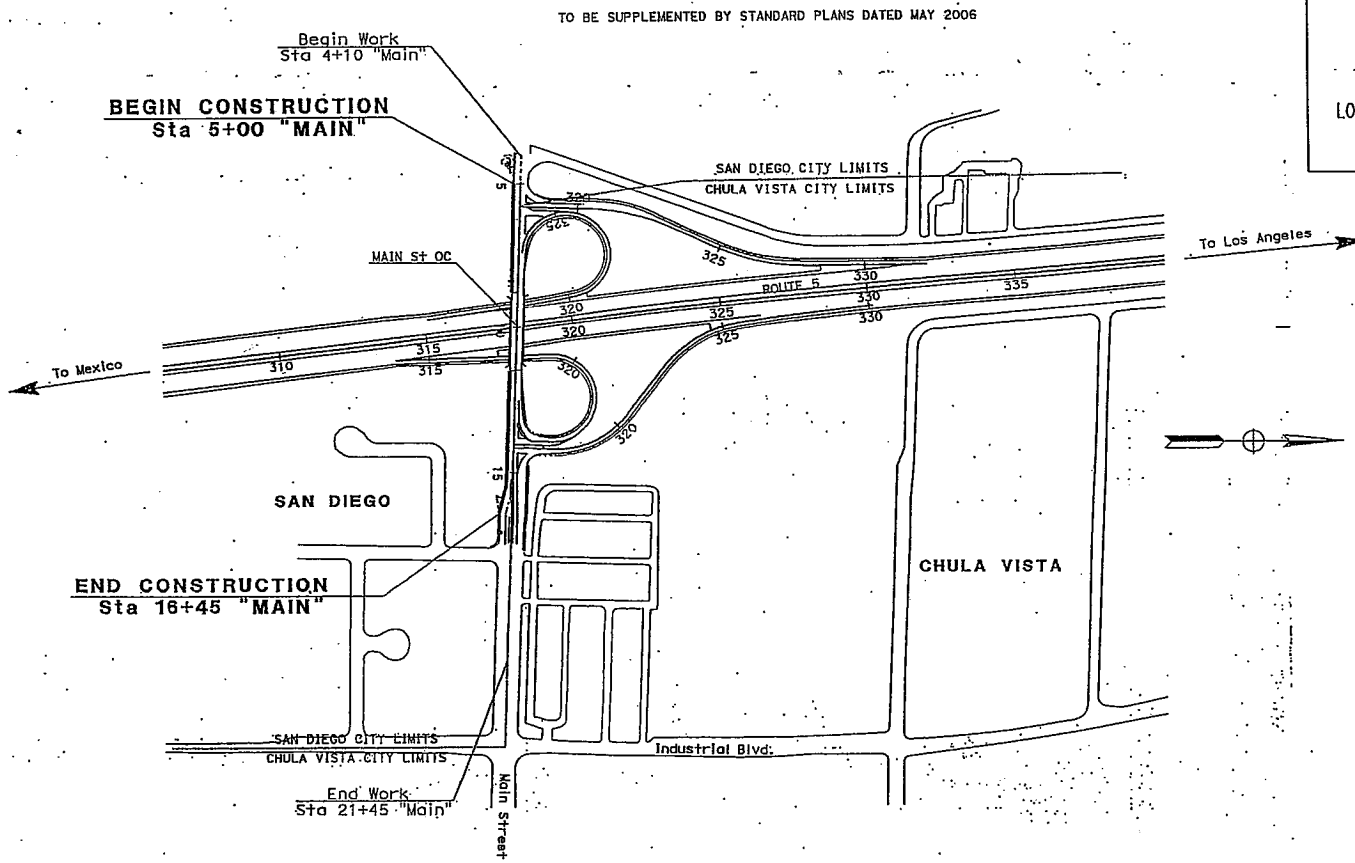
DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON

STATE HIGHWAY

IN SAN DIEGO COUNTY
IN SAN DIEGO AND CHULA VISTA
AT MAIN STREET OVERCROSSING

TO BE SUPPLEMENTED BY STANDARD PLANS DATED MAY 2006



PROJECT MANAGER R. ESTRADA

DESIGN ENGINEER H. TRAN

PROJECT ENGINEER DATE
REGISTERED CIVIL ENGINEER

REGISTERED PROFESSIONAL ENGINEER J. L. ROBLES No. C 64402 Exp. 06-30-09 CIVIL STATE OF CALIFORNIA

PLANS APPROVAL DATE

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THE CONTRACTOR SHALL POSSESS THE CLASS (OR CLASSES) OF LICENSE AS SPECIFIED IN THE "NOTICE TO CONTRACTORS."

NO SCALE

CONTRACT No. 11-286004

LAST REVISION 00-00-00 DATE PLOTTED => 14-MAY-2006 TIME PLOTTED => 16:40

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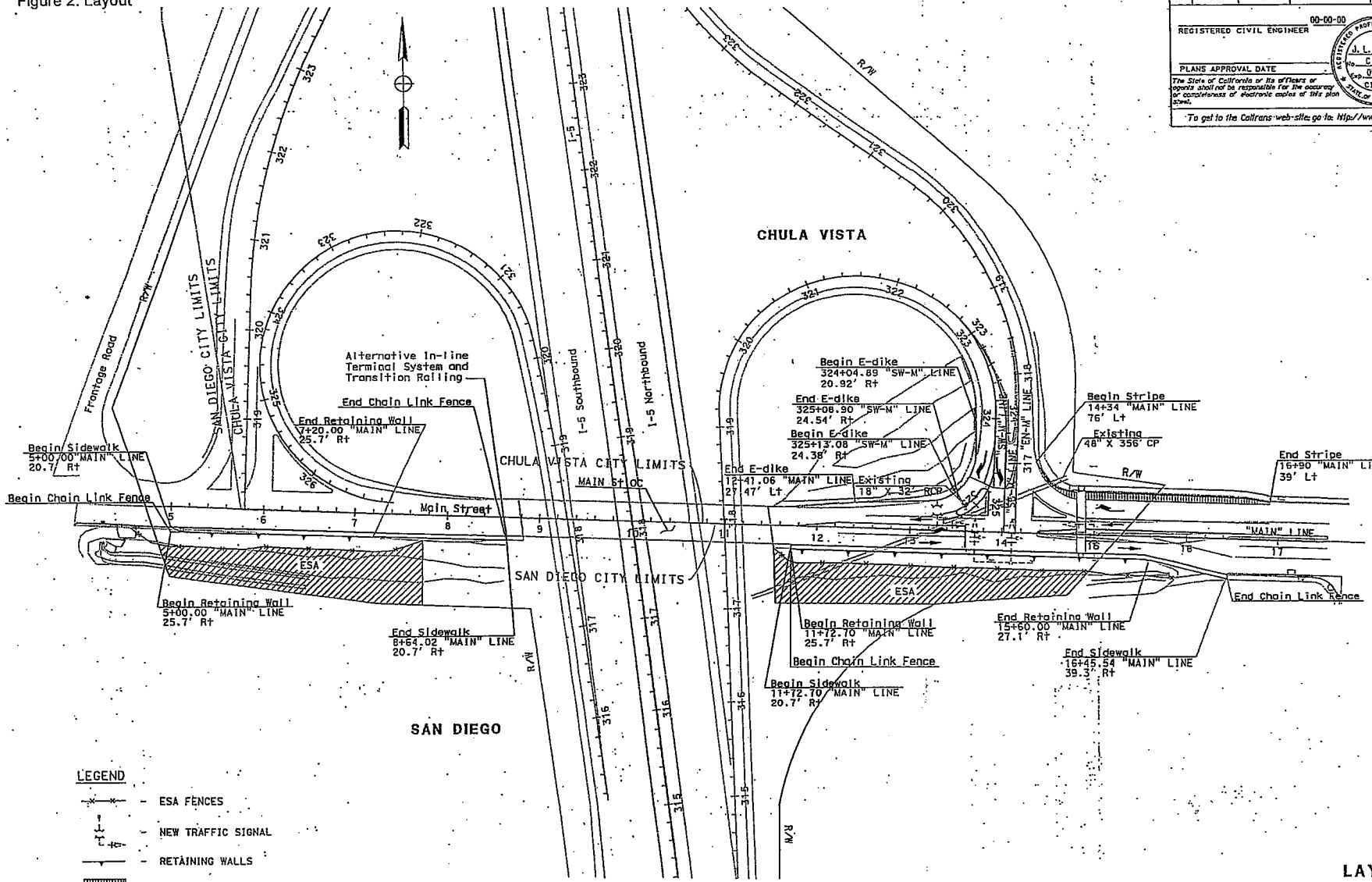
Figure 2: Layout



DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
11	SD	5	5.40		

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Caltrans TRAFFIC PROJECT DEVELOPMENT

PROJECT ENGINEER J. ROBLES | CALCULATED/DESIGNED BY | CHECKED BY H. TRAN | DATE | REVISED BY | DATE REVISED

LAST REVISION 05-12-08 | DATE PLOTTED => 20-MAY-2008 | TIME PLOTTED => 11:10

LAYOUT

L-1

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CU 11233 | EA 286001

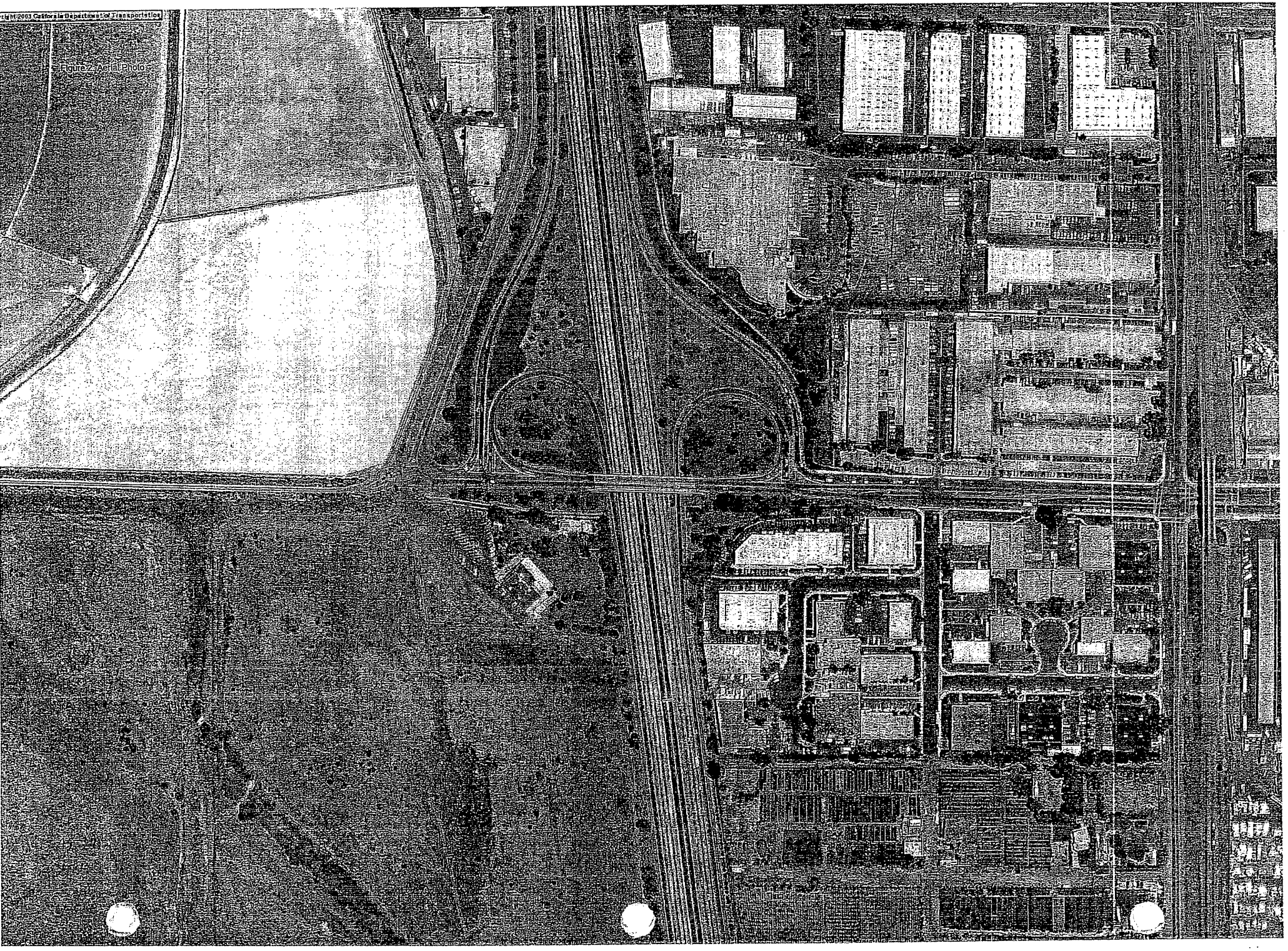

Figure 2 Aerial Photo

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
11	SD	5	5.40		

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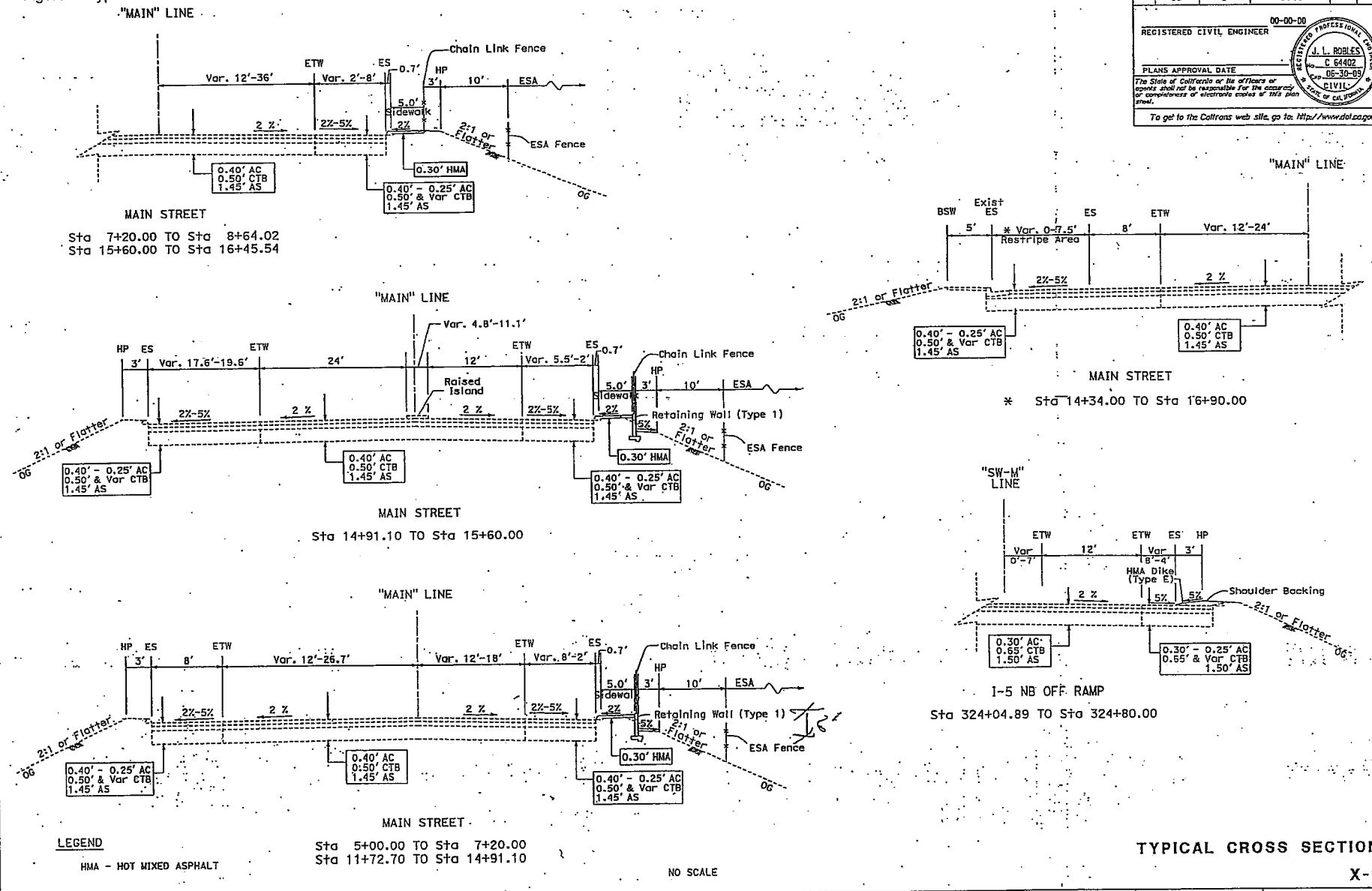
Figure 2: Typical X Section



LEGEND

HMA - HOT MIXED ASPHALT

NO SCALE

TYPICAL CROSS SECTION

X-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

TRAFFIC PROJECT DEVELOPMENT

PROJECT ENGINEER J. ROBLES

CALCULATED/DESIGNED BY H. TRAN

CHECKED BY

DATE REVISED BY

DATE REVISED

LAST REVISION 05-12-08

DATE PLOTTED => 12-JUN-2008

TIME PLOTTED => 11:02

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CU 11233

EA 286001

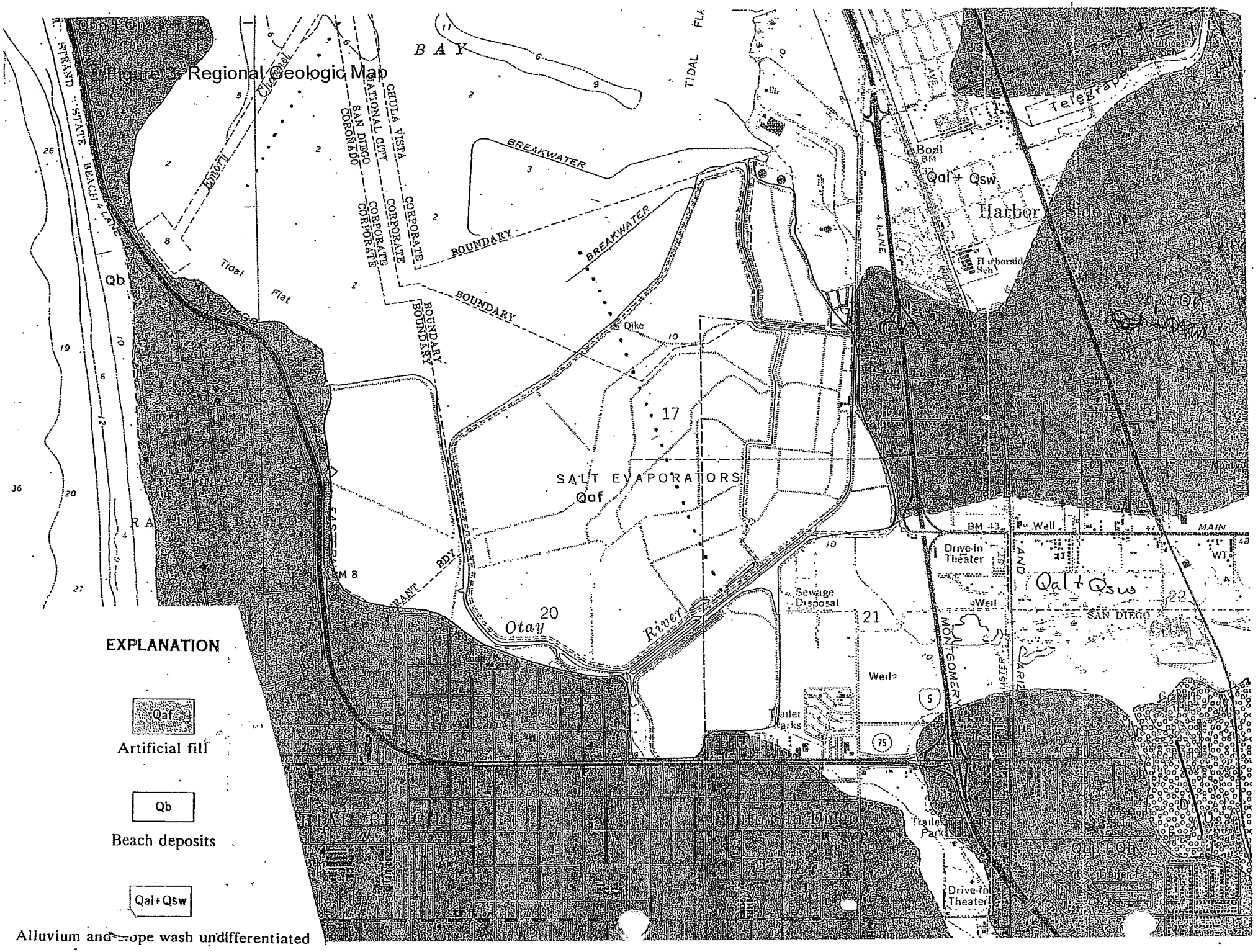


Figure 3 Regional Geologic Map
BAY
BREAKWATER
BOUNDARY
CORPORATE
CHULA VISTA
NATIONAL CITY
SAN DIEGO
CORONADO
Tidal Flat
Channel
Qb+Qn
Qb
Qal+Qsw
Harbor Side
Telegraph
Dike
17
SALT EVAPORATORS
Qaf
20
Otay
River
21
Sewage Disposal
Well
Drive-in Theater
Qal+Qsw
22
SAN DIEGO
MONTGOMERY
Trailer Parks
Trailer Park
Qbp+Qn
EXPLANATION
Qaf
Artificial fill
Qb
Beach deposits
Qal+Qsw
Alluvium and slope wash undifferentiated

Figure 4: Regional Fault Map

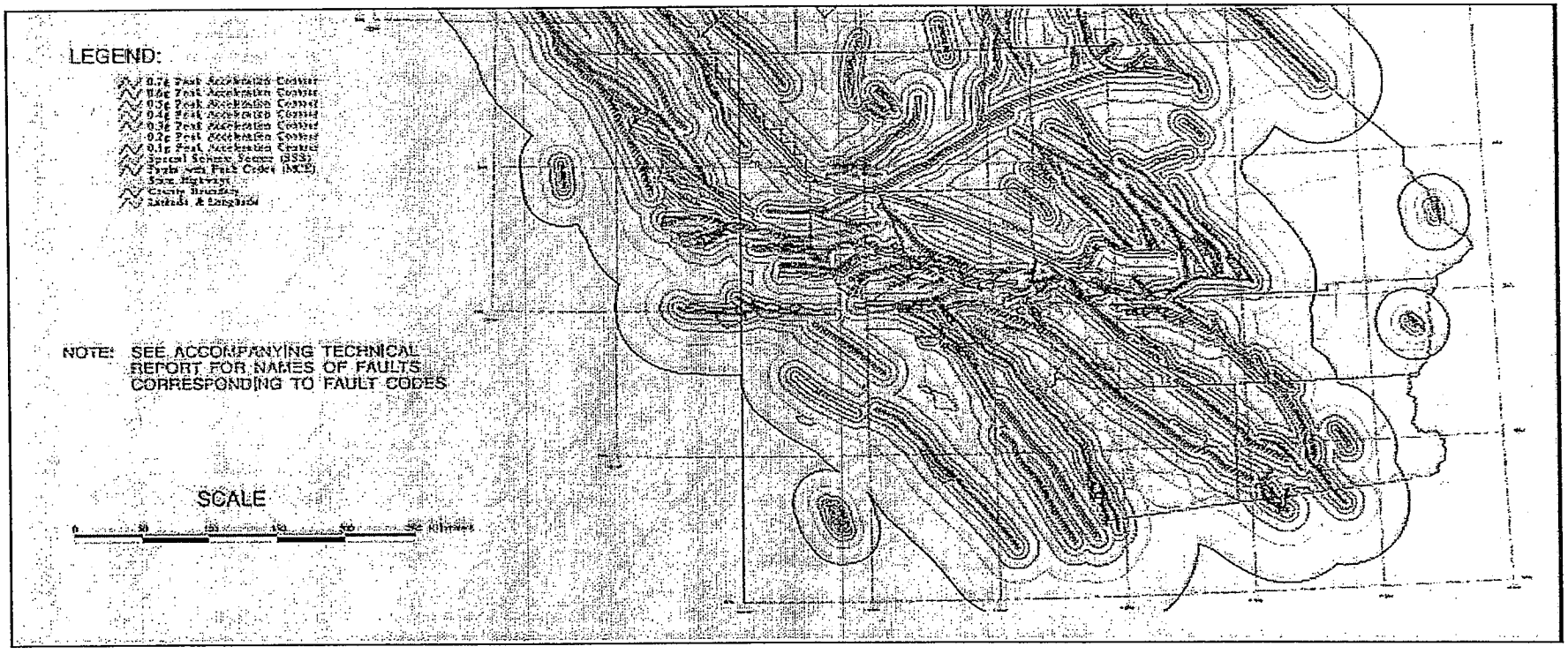


Figure 4: Earthquake Ground Acceleration Contour Map

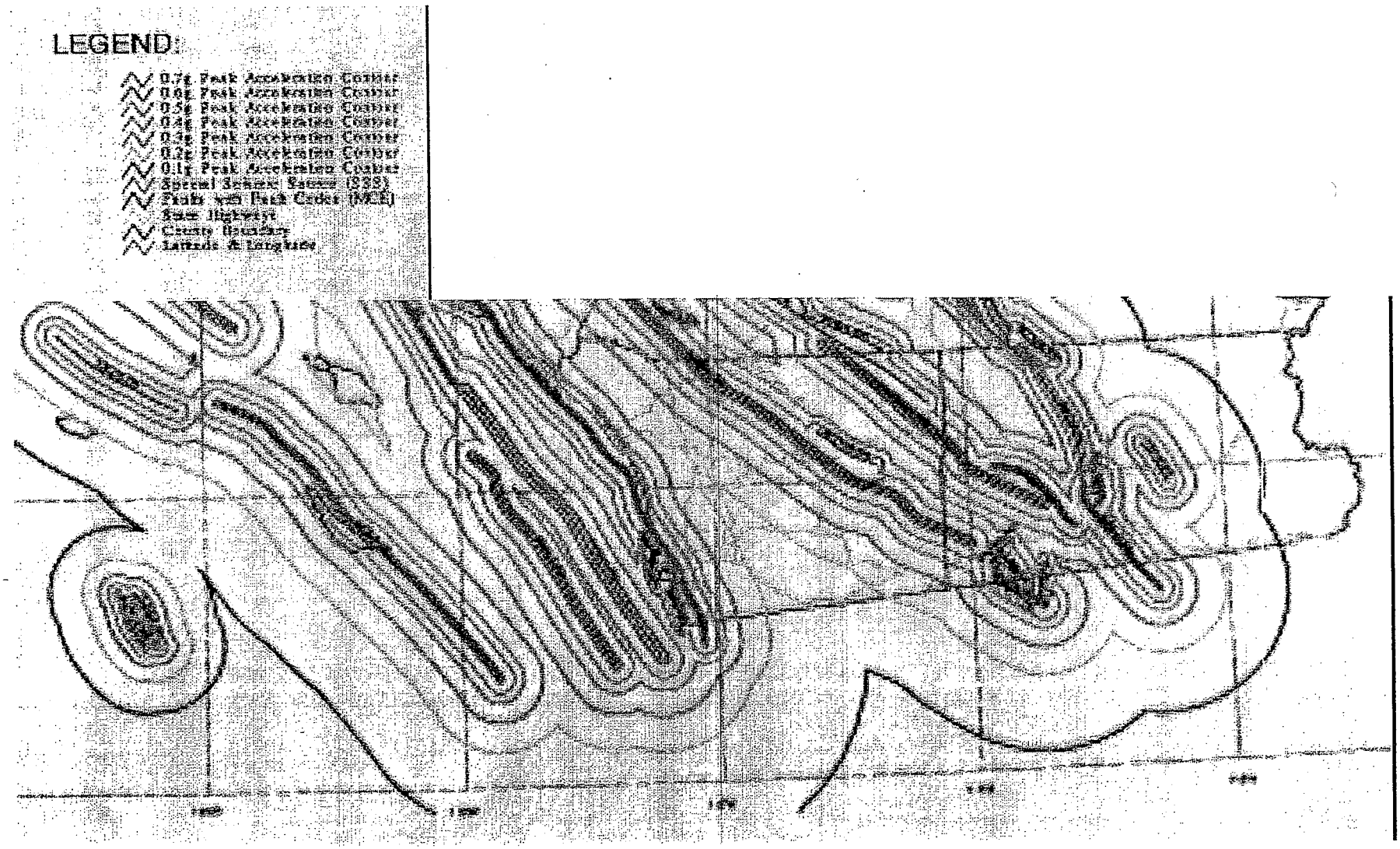
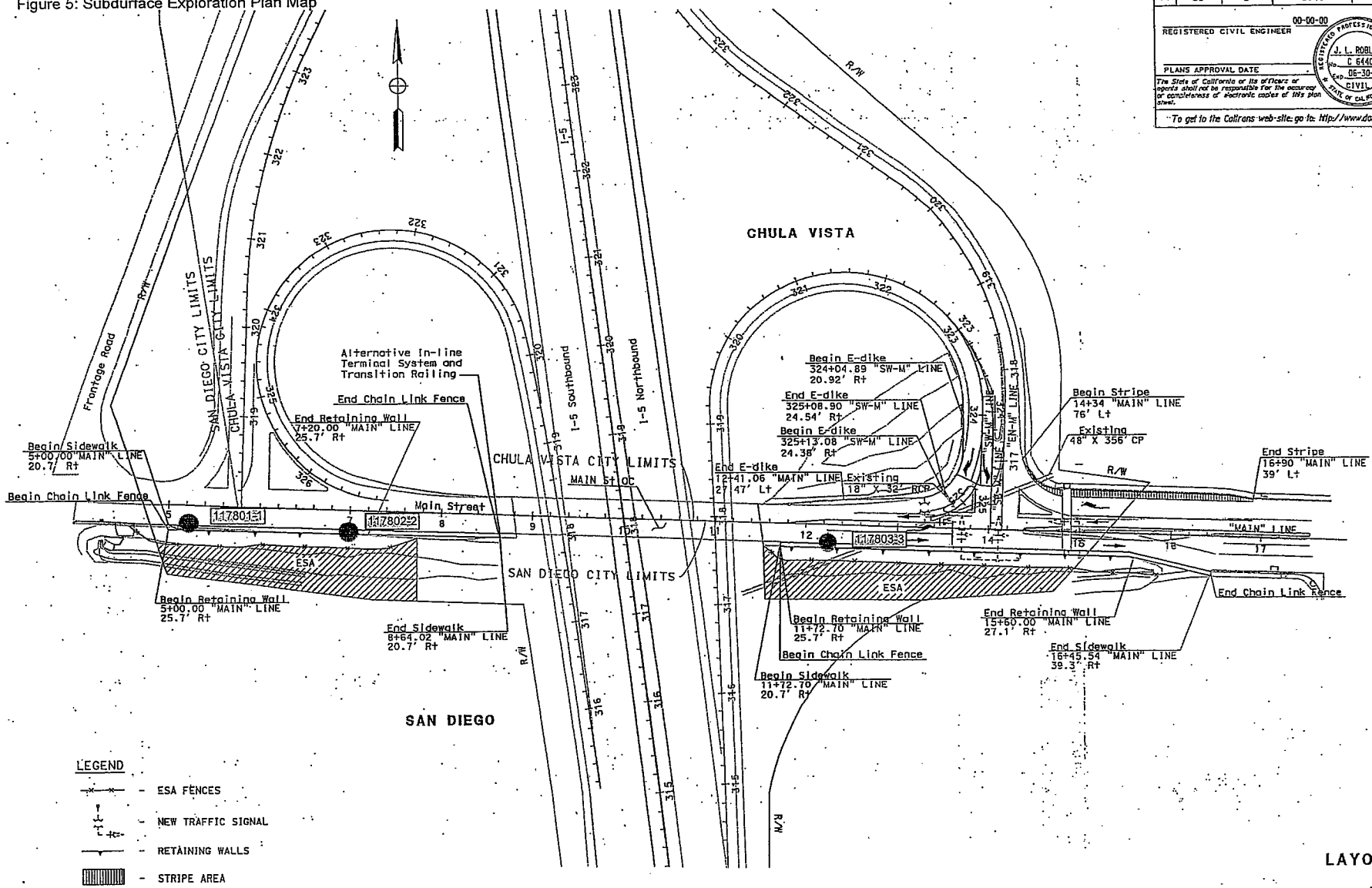


Figure 5: Subdurface Exploration Plan Map



DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
11	SD	5	5.40		

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Caltrans
TRAFFIC PROJECT DEVELOPMENT

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CALCULATED/DESIGNED BY: H. TRAN
CHECKED BY

DATE | REVISED BY | DATE REVISED

LAYOUT

L-1

LAST REVISION 05-12-08 | DATE PLOTTED => 20-MAY-2008 | TIME PLOTTED => 11:19

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DGN FILE => b28600ea001.dgn

CU 11233 | EA 286001

figure 6: X-section showing minimum cover of 8 ft

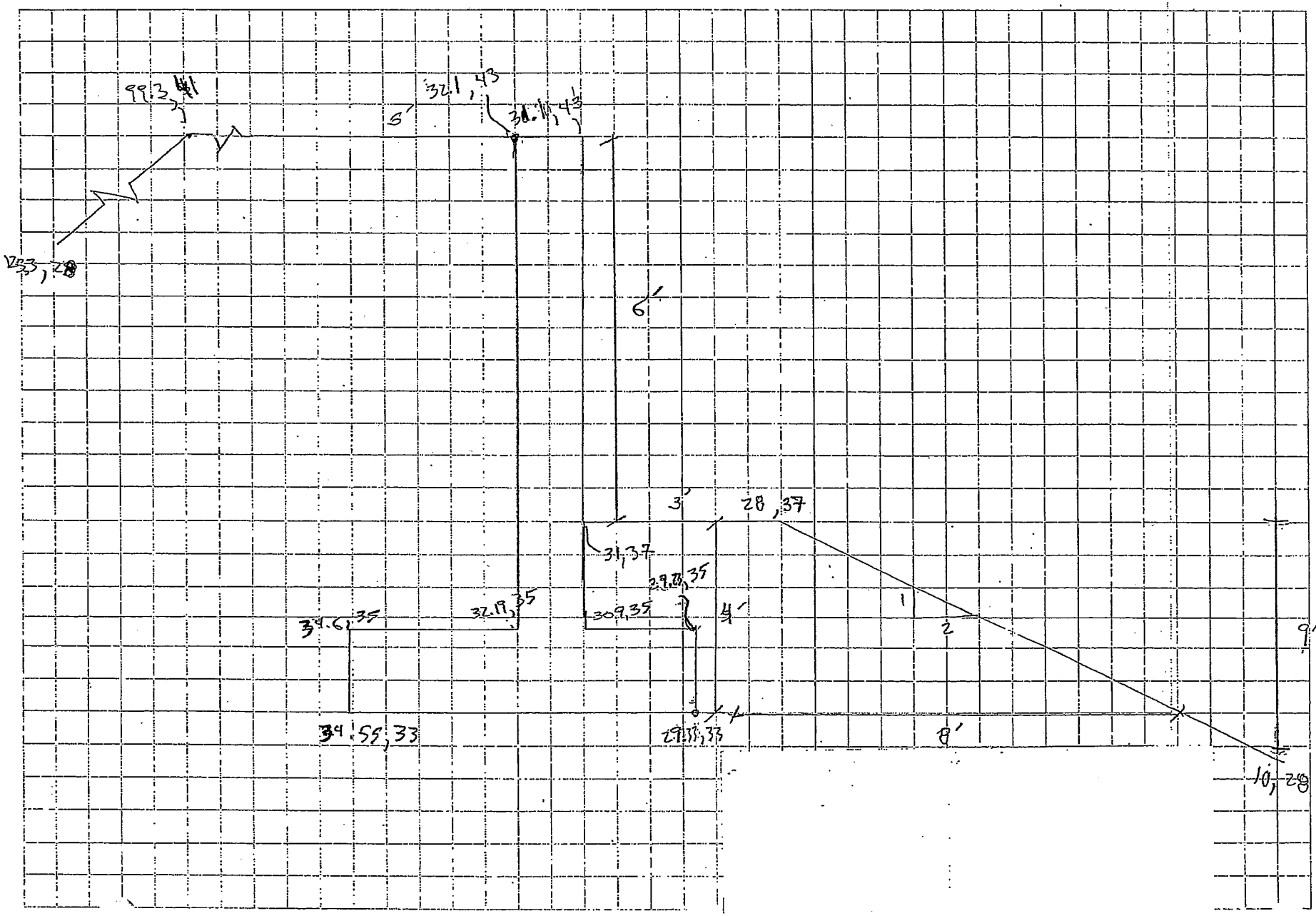
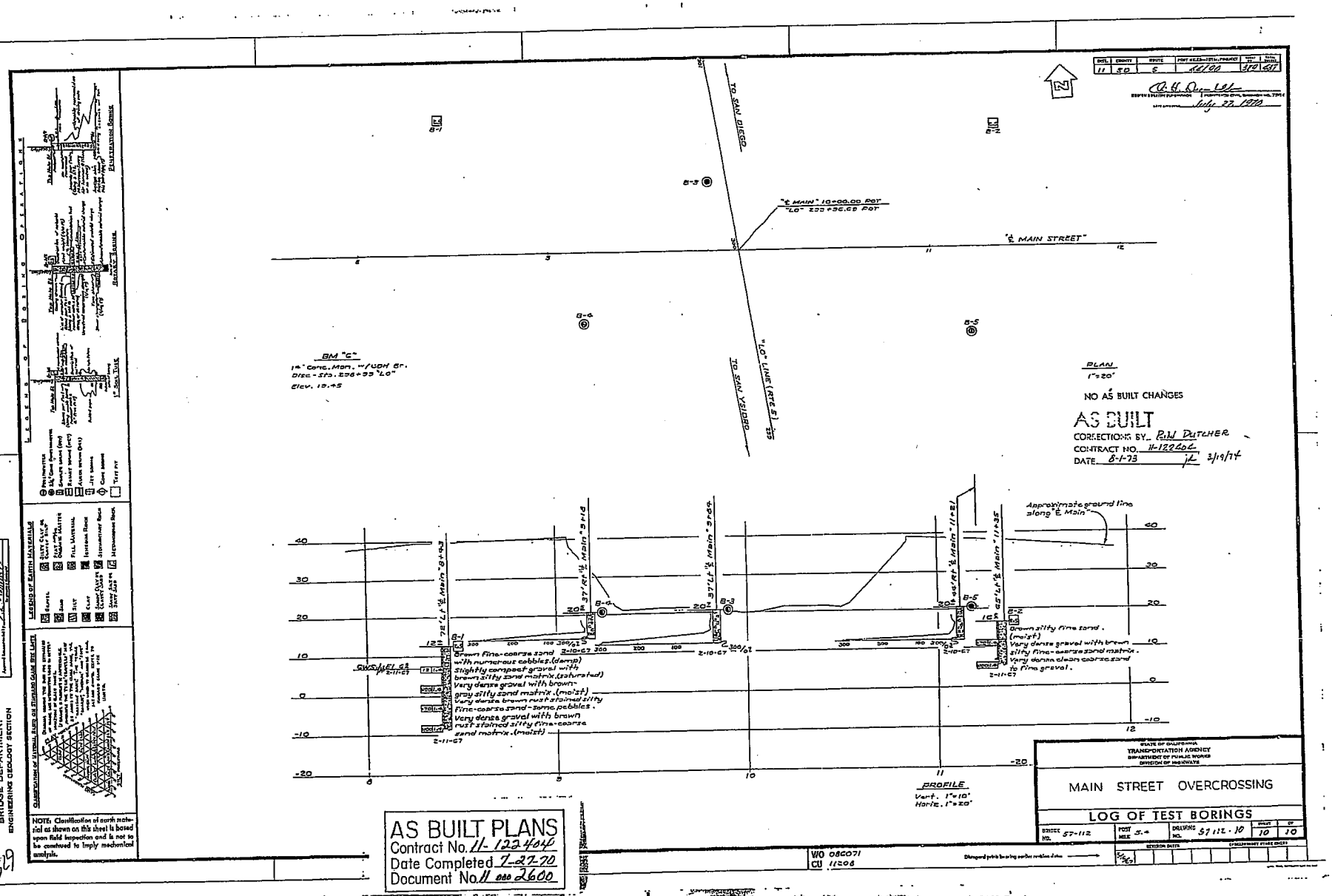


figure 7: Bridge Log of Test Boring



14.1. Appendix I – Log of Test Borings

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
11	SD	5			

REGISTERED CIVIL ENGINEER 9-4-08

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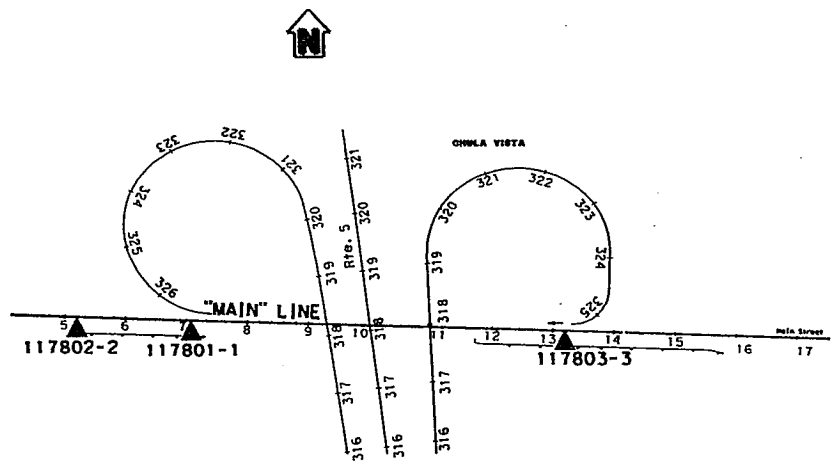
REGISTERED PROFESSIONAL ENGINEER Michael M. Fordham No. C61341 Exp. 6-30-09 CIVIL STATE OF CALIFORNIA

This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, & Presentation Manual (June 2007).

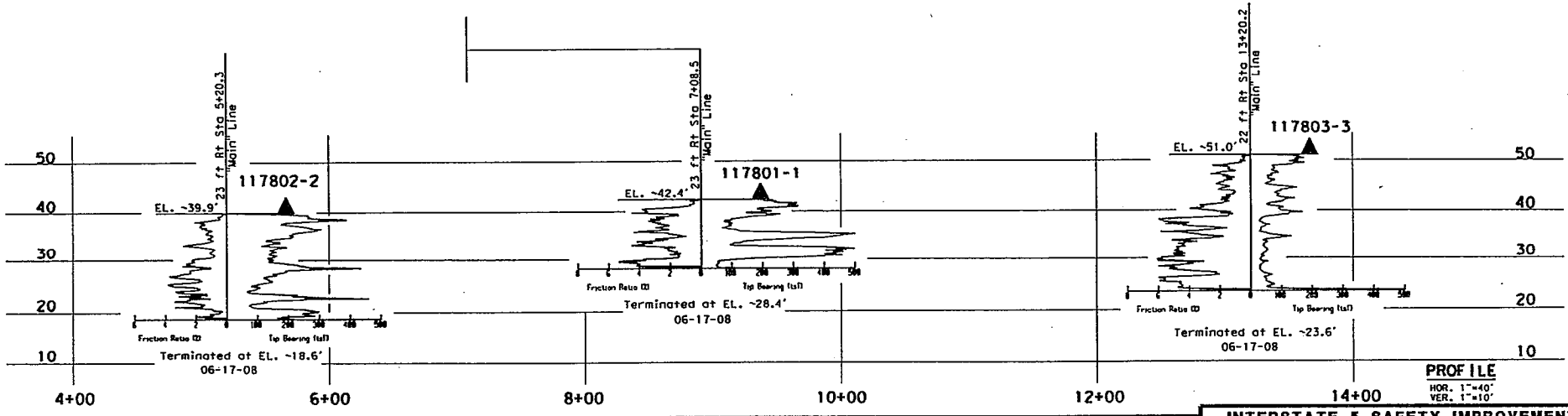
BENCH MARK

BM: WP 102 Elev. 42.670 ft



PLAN
1" = 100'

Note: No ground water encountered during field investigation.



PROFILE
HOR. 1"=40'
VER. 1"=10'

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. 57-0112 POST MILES 5.4	INTERSTATE 5 SAFETY IMPROVEMENT, MAIN STREET CITY OF CHULA VISTA
FUNCTIONAL SUPERVISOR NAME: XX	DRAWN BY: F. Nguyen 08/2008 CHECKED BY: XX	FIELD INVESTIGATION BY: M. Fordham	CU 11 EA 286001		LOG OF TEST BORINGS 1 OF 3

OCS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET OF

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5chulavista1of3 final.dgn 9/8/2008 9:32:29 AM

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No	TOTAL SHEETS
11	SD	5			

REGISTERED CIVIL ENGINEER 9-4-08

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REGISTERED PROFESSIONAL ENGINEER Michael M. Forsman C61341 Exp. 6-30-09 CIVIL STATE OF CALIFORNIA

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

CEMENTATION

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

CONSISTENCY OF COHESIVE SOILS

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

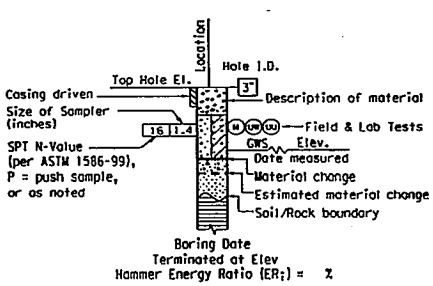
BOREHOLE IDENTIFICATION

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

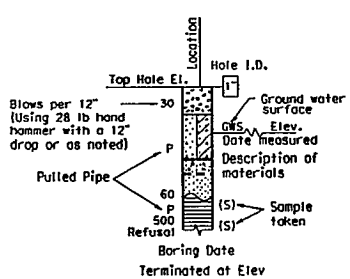
Note: Size in inches.

PLASTICITY OF FINE-GRAINED SOILS

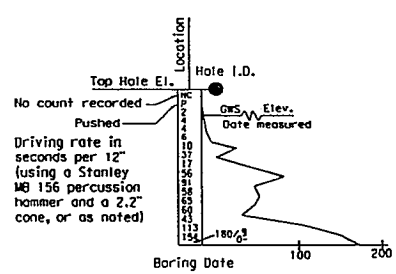
Description	Criteria
Nonplastic	A 1/8-inch thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be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



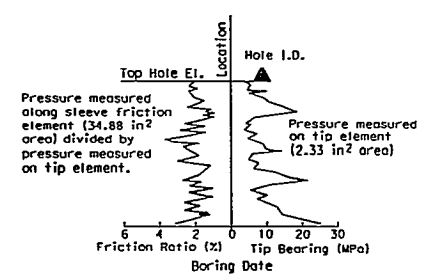
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) SOUNDING

ENGINEERING SERVICES	GEOTECHNICAL SERVICES	STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION	DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH	BRIDGE NO. 57-0112 POST MILE 5.4	INTERSTATE 5 SAFETY IMPROVEMENT, MAIN STREET CITY OF CHULA VISTA LOG OF TEST BORINGS 2 OF 3
	PREPARED BY: F. Nguyen 8/08				

CS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 11 EA 286001

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES SHEET OF

FILE => REQUEST

USERNAME => RUSER DATE PLOTTED => DATE TIME PLOTTED => TIME

ichulavista2of3 final.dgn 9/8/2008 9:33:32 AM

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

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO	TOTAL SHEETS
11	SD	5			

REGISTERED CIVIL ENGINEER 9-4-08

PLANS APPROVAL DATE

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

REGISTERED PROFESSIONAL ENGINEER Michael R. Fordham C61341 Exp. 6-30-09 CIVIL STATE OF CALIFORNIA

GROUP SYMBOLS AND NAMES

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

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

FIELD AND LABORATORY TESTING

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

APPARENT DENSITY OF COHESIONLESS SOILS

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

MOISTURE

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

PERCENT OR PROPORTION OF SOILS

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

PARTICLE SIZE

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

ENGINEERING SERVICES

GEOTECHNICAL SERVICES

PREPARED BY: F. Nguyen 8/08

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES STRUCTURE DESIGN DESIGN BRANCH

BRIDGE NO. 57-0112

POST MILE 5.4

CU 11 EA 286001

INTERSTATE 5 SAFETY IMPROVEMENT, MAIN STREET CITY OF CHULA VISTA

LOG OF TEST BORINGS 3 OF 3

CS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES

SHEET OF

FILE => WREQUEST

USERNAME => RUSER DATE PLOTTED => 8/14/08 TIME PLOTTED => 9:34

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14.2. Appendix II - Laboratory Testing Results

State of California

Business, Transportation and Housing Agency

Addendum

Flex Your Power!
Be energy efficient!

To: JOSE L. ROBLES
Department of Transportation
Traffic Project Development
District 11, MS 230

Date: March 13, 2007

File: 11-SD-5
PM 5.39
EA 11-28600K

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services
Office of Geotechnical Design – South 2, Branch D

Subject: Preliminary Foundation Report for Retaining Walls

Introduction

Our office prepared the Preliminary Foundation Report (FR) for the proposed retaining walls of the proposed safety improvement project on I-5 and Main Street Overcrossing. In order to provide the geotechnical recommendations in a timely manner, the report was sent out on February 23, 2007, before the laboratory testing could be completed. This addendum presents the laboratory testing results and addresses the corrosion potential in the area of the retaining walls.

During the field investigation, one soil sample was obtained at each of the wall locations. The samples were collected from the top 5 feet of the fill materials at Borings HA2 and HA3. The samples were packaged and sent to the laboratory for corrosion potential testing. The boring locations are marked on the Boring Location Sheet in the FR.

The laboratory test results are presented in a document attached to this addendum. The results from both of the samples indicate that the near surface soils are <u>not corrosive</u> to the foundation structures of the retaining walls.

If you have any questions or comments regarding this letter, please call Moussa Jandal at (858) 637-5545.

REGISTERED PROFESSIONAL ENGINEER
MOUSSA H. JANDAL
69265
Expires 06/30/06
CIVIL
STATE OF CALIFORNIA

Moussa Jandal
TE (civil)

cc Brian Hinman
File

Attachment,
Laboratory Test Results

"Lopez, Rudy"
<Rudy_C_Lopez@dot.ca.gov>

03/13/2007 10:24 AM

To "Jandal, Moussa" <moussa_jandal@dot.ca.gov>
cc
bcc
Subject Corrosion Test Summary Report - Soil, EA: 11-28600K (Corr. #s CR070109 & CR070110)

Division of Engineering Services
Materials Engineering and Testing Services
Corrosion Technology Branch
Report Date: 3/13/2007
Reported By: Lopez, Rudy

CORROSION TEST SUMMARY REPORT - Soil/Water

Bridge Name:

Bridge Number:

EA No. 11-28600K

Dist/Co/Rte/PM11 / SD / 5 /
or KP: 5.39

SIC Number (TL101)	Sample Location	Sample Type	Sample Depth	Minimum Resistivity[1] (ohm-cm)	pH[2]	Chloride Content[3] (ppm)	Sulfate Content[4] (ppm)
C578534	I-5/MAIN STREET	SOIL	0-3 FT/BORING HA2	2100	9.14		
C578535	I-5/MAIN STREET	SOIL	0-3 FT/BORING HA3	1900	8.30		

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

☐ This site is corrosive (if checked)

Note: For MSE wall structure backfill material, minimum resisitivity must be 1500 ohm-cm or greater, pH must be between 5.5 and 10.0, chloride content must not be greater than 500 ppm, and sulfate content must not be greater than 2000 ppm.

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

14.3. Appendix III – Analyses and Calculations

SETTLEMENT CALCULATIONS USING CONE PENETRATION TEST RESULTS

Date:	#REF!
Test Id:	117801-1
Project:	i-5SafetyImprovemnt
Site:	11/SD/5/5.4
Location:	SanDiego
Cone Id:	2583.104xx

Fill Height	6	(ft)
Unit Weight of Compacted Fill	120	(lb/ft^3)

Layer #	Soil Type	Soil Transition Depth	Layer Thickness	Ave. Tip Resistance	Ave. Tip Resistance	Compression Coefficient	Embankment Bearing Pressure	Effective Stress at Fill Base	Net Foundation Pressure	Stress Influence Factor	Change in Stress	Settlement	Settlement
			H_o	q_c	q_c	α	q	σ'	Δp	I	Δs	S	S
		(ft)	(ft)	(lb/ft^2)	(bar)		(lb/ft^2)	(lb/ft^2)	(lb/ft^2)		(lb/ft^2)	(ft)	(in)
1	Sand	4.06	4.06	433,933	208	1.50	720	0	720	0.5	360	0.002	0.03
2	Sandy Silt	6.00	1.94	171,836	82	4.50	720	0	720	0.5	360	0.001	0.01
3	Sand Mix	9.01	3.00	648,990	311	1.50	720	0	720	0.5	360	0.001	0.01
4	Sand Silt Mix	13.05	4.04	609,117	292	1.50	720	0	720	0.5	360	0.002	0.02
											Total Settlement	0.006	0.07

SETTLEMENT CALCULATIONS USING CONE PENETRATION TEST RESULTS

Date:	06/17/08
Test Id:	117802-2
Project:	i-5SafetyImprovemnt
Site:	11/SD/5/5.4
Location:	SanDiego
Cone Id:	2583.104xx

Fill Height	6	(ft)
Unit Weight of Compacted Fill	120	(lb/ft^3)

Layer #	Soil Type	Soil Transition Depth	Layer Thickness	Ave. Tip Resistance	Ave. Tip Resistance	Compression Coefficient	Embankment Bearing Pressure	Effective Stress at Fill Base	Net Foundation Pressure	Stress Influence Factor	Change in Stress	Settlement	Settlement
			H_o	q_c	q_c	α	q	σ'	Δp	I	Δs	S	S
		(ft)	(ft)	(lb/ft^2)	(bar)		(lb/ft^2)	(lb/ft^2)	(lb/ft^2)		(lb/ft^2)	(ft)	(in)
1	Sand	10.03	10.03	397,348	190	1.50	720	0	720	0.5	360	0.006	0.07
2	Sand	18.01	7.98	335,006	160	1.50	720	0	720	0.5	360	0.006	0.07
3	Sand Mix	21.10	3.09	383,164	183	1.50	720	0	720	0.5	360	0.002	0.02
											Total Settlement	0.014	0.16

SETTLEMENT CALCULATIONS USING CONE PENETRATION TEST RESULTS

Date:	06/17/08
Test Id:	117803-3
Project:	i-5SafetyImprovemnt
Site:	11/SD/5/5.4
Location:	SanDiego
Cone Id:	2583.104xx

Fill Height	6	(ft)
Unit Weight of Compacted Fill	120	(lb/ft^3)

Layer #	Soil Type	Soil Transition Depth	Layer Thickness	Ave. Tip Resistance	Ave. Tip Resistance	Compression Coefficient	Embankment Bearing Pressure	Effective Stress at Fill Base	Net Foundation Pressure	Stress Influence Factor	Change in Stress	Settlement	Settlement
			H_o	q_c	q_c	α	q	σ'	Δp	I	Δs	S	S
		(ft)	(ft)	(lb/ft^2)	(bar)		(lb/ft^2)	(lb/ft^2)	(lb/ft^2)		(lb/ft^2)	(ft)	(in)
1	Sand	13.01	13.01	186,640	89	1.50	720	0	720	0.5	360	0.017	0.20
2	Sand Mix	20.04	7.03	98,272	47	2.00	720	0	720	0.5	360	0.013	0.15
3	Clays	21.02	0.98	74,071	35	2.50	720	0	720	0.5	360	0.002	0.02
4	Silt Mix	23.03	2.01	68,571	33	4.50	720	0	720	0.5	360	0.002	0.03
5	Sand Mix	27.01	3.97	111,011	53	4.50	720	0	720	0.5	360	0.003	0.03
											Total Settlement	0.052	0.38

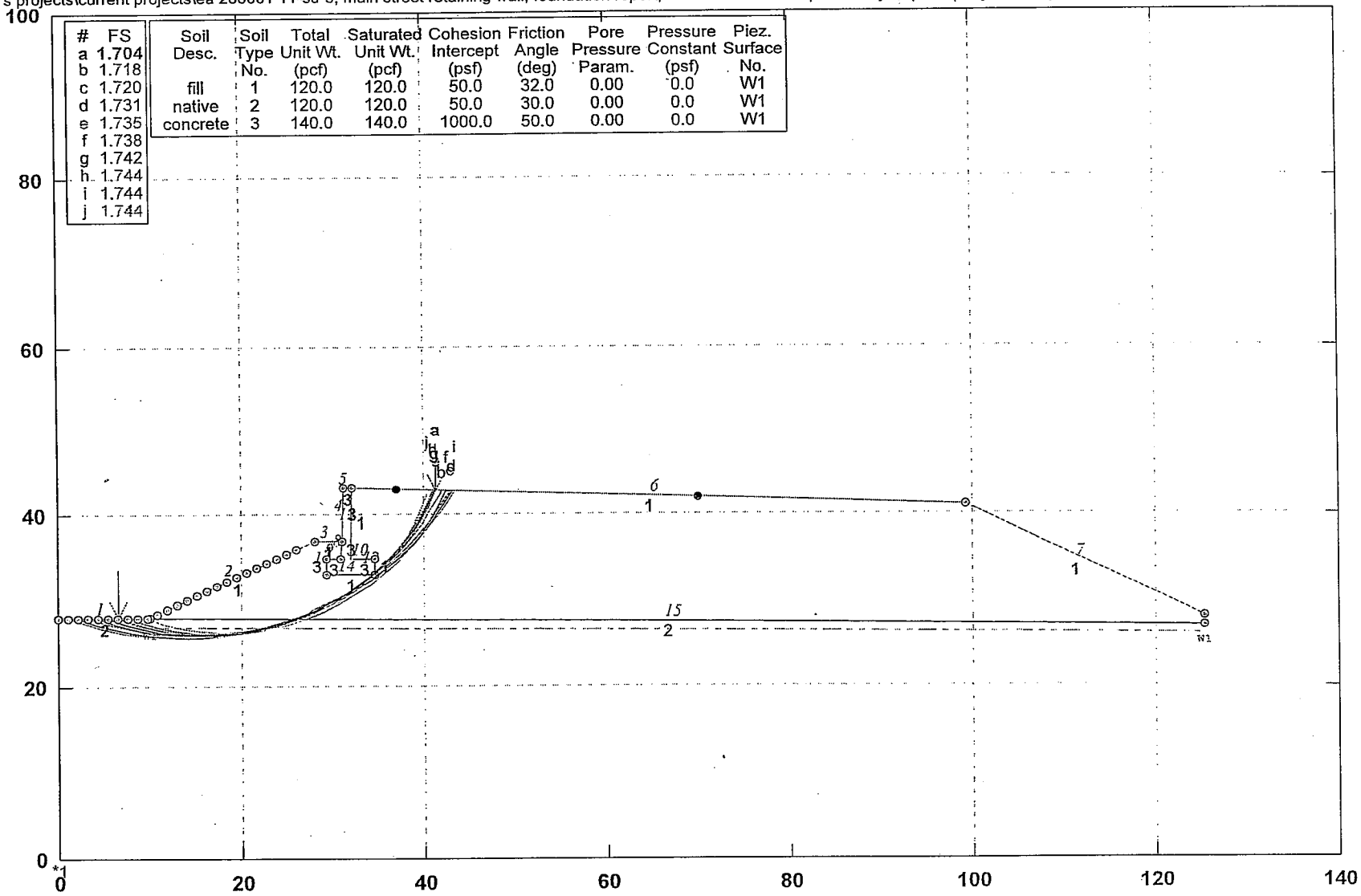
Static H2O at 1ft

11-sd-5 286001 main street oc chula vis 5+20 ret wall

d:\userdata\mike's projects\current projects\ea 286001 11-sd-5, main street retaining wall, foundation report, lotb\calculations\slope stability\slope stability h2o 1ft.pl2 Run By: M FORDHAM CALTRANS 6/27/2008 09

#	FS
a	1.704
b	1.718
c	1.720
d	1.731
e	1.735
f	1.738
g	1.742
h	1.744
i	1.744
j	1.744

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
fill	1	120.0	120.0	50.0	32.0	0.00	0.0	W1
native	2	120.0	120.0	50.0	30.0	0.00	0.0	W1
concrete	3	140.0	140.0	1000.0	50.0	0.00	0.0	W1



GSTABL7 v.2 FSmin=1.704

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

Static H2O at 1ft + 240 psf load

11-sd-5 286001 main street oc chula vis 5+20 ret wall

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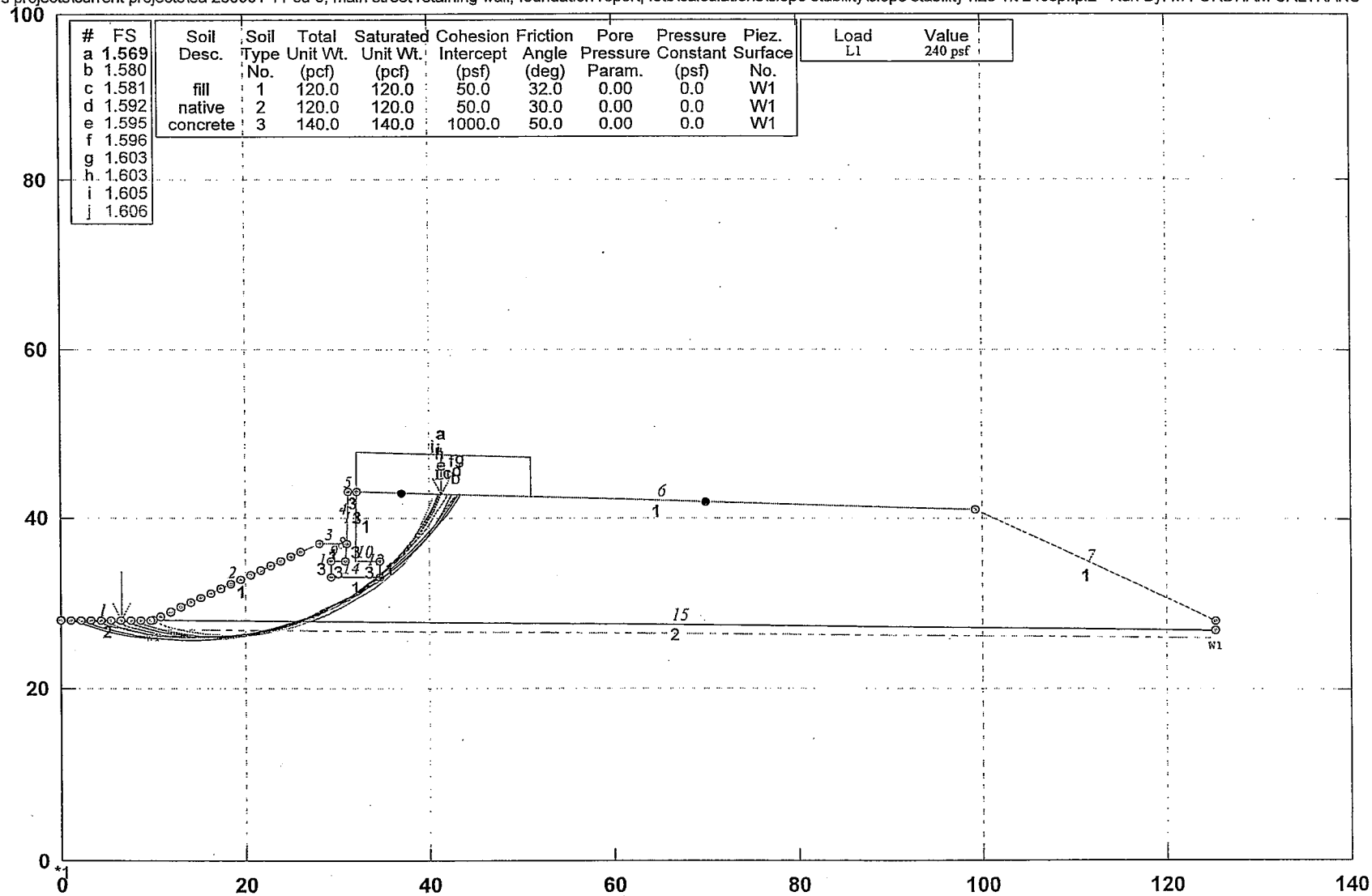
#	FS
a	1.569
b	1.580
c	1.581
d	1.592
e	1.595
f	1.596
g	1.603
h	1.603
i	1.605
j	1.606

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
fill	1	120.0	120.0	50.0	32.0	0.00	0.0	W1
native	2	120.0	120.0	50.0	30.0	0.00	0.0	W1
concrete	3	140.0	140.0	1000.0	50.0	0.00	0.0	W1

Load	Value
L1	240 psf



GSTABL7 v.2 FSmin=1.569

Safety Factors Are Calculated By The Modified Bishop Method

Psuedo static H2O at 1ft

11-sd-5 286001 main street oc chula vis 5+20 ret wall

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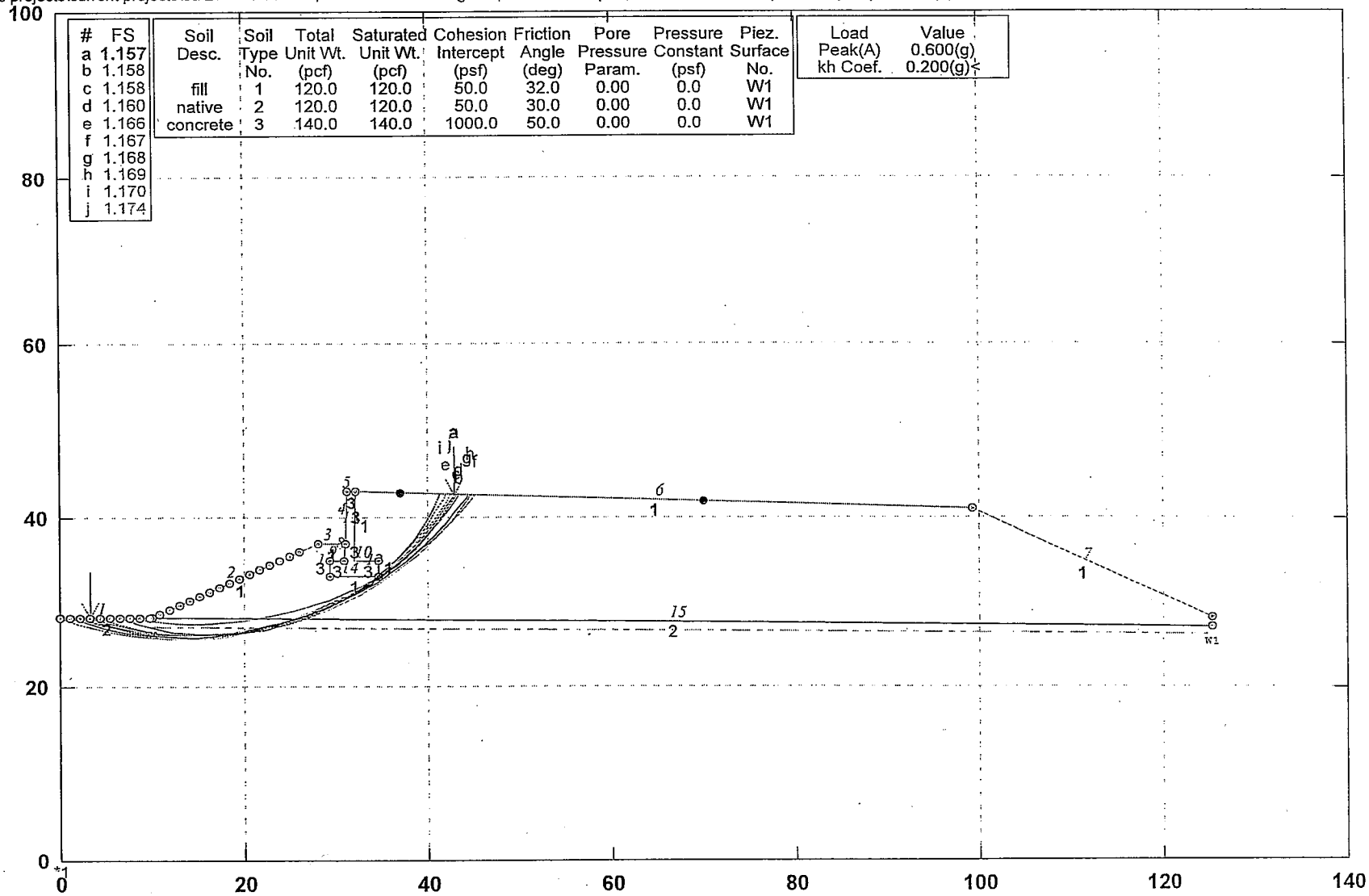
#	FS
a	1.157
b	1.158
c	1.158
d	1.160
e	1.166
f	1.167
g	1.168
h	1.169
i	1.170
j	1.174

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
fill	1	120.0	120.0	50.0	32.0	0.00	0.0	W1
native	2	120.0	120.0	50.0	30.0	0.00	0.0	W1
concrete	3	140.0	140.0	1000.0	50.0	0.00	0.0	W1

Load	Value
Peak(A)	0.600(g)
kh Coef.	0.200(g)



GSTABL7 v.2 FSmin=1.157

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

Static H2O at 5ft

11-sd-5 286001 main street oc chula vis 5+20 ret wall

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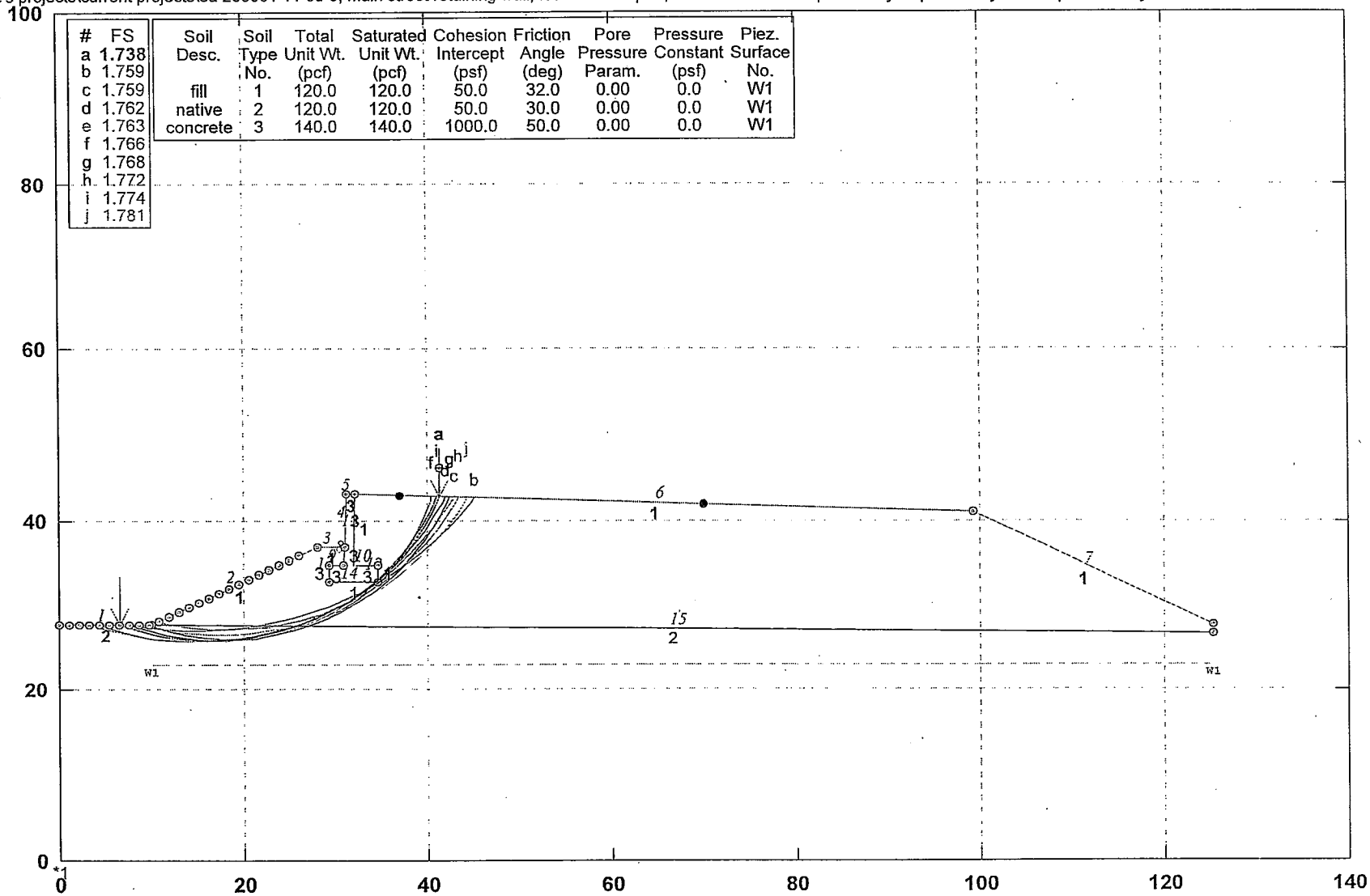
#	FS
a	1.738
b	1.759
c	1.759
d	1.762
e	1.763
f	1.766
g	1.768
h	1.772
i	1.774
j	1.781

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
fill	1	120.0	120.0	50.0	32.0	0.00	0.0	W1
native	2	120.0	120.0	50.0	30.0	0.00	0.0	W1
concrete	3	140.0	140.0	1000.0	50.0	0.00	0.0	W1



GSTABL7 v.2 FSmin=1.738

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

Static H2O at 5ft + 240 psf load

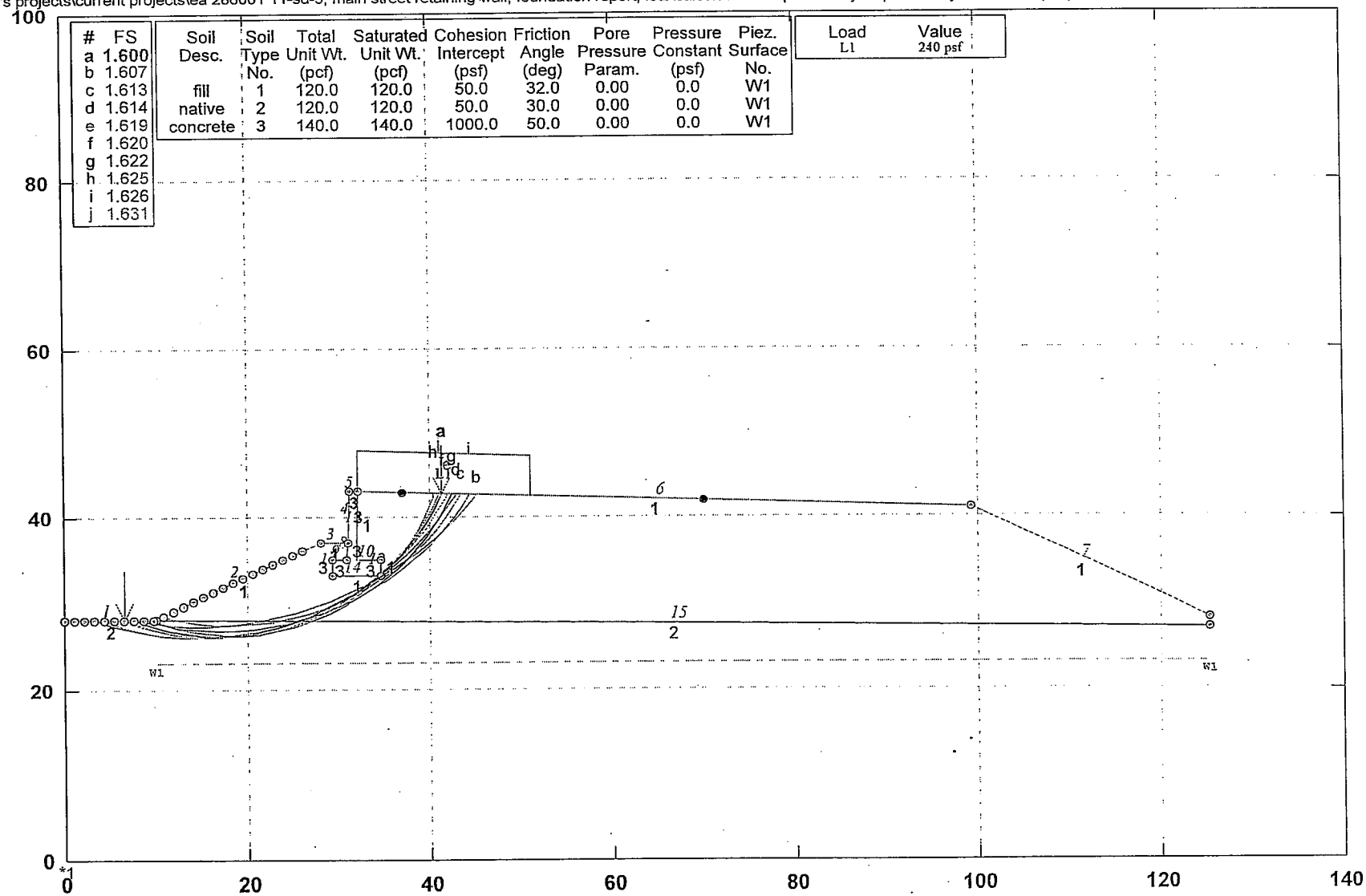
11-sd-5 286001 main street oc chula vis 5+20 ret wall

d:\userdata\mike's projects\current projects\ea 286001 11-sd-5, main street retaining wall, foundation report, lotb\calculations\slope stability\slope stability h2o 5ft 240psf.pl2 Run By: M FORDHAM CALTRANS 6/27/2008 09

#	FS
a	1.600
b	1.607
c	1.613
d	1.614
e	1.619
f	1.620
g	1.622
h	1.625
i	1.626
j	1.631

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
fill	1	120.0	120.0	50.0	32.0	0.00	0.0	W1
native	2	120.0	120.0	50.0	30.0	0.00	0.0	W1
concrete	3	140.0	140.0	1000.0	50.0	0.00	0.0	W1

Load	Value
L1	240 psf



GSTABL7 v.2 FSmin=1.600

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

Psuedo static H2O at 5ft

11-sd-5 286001 main street oc chula vis 5+20 ret wall

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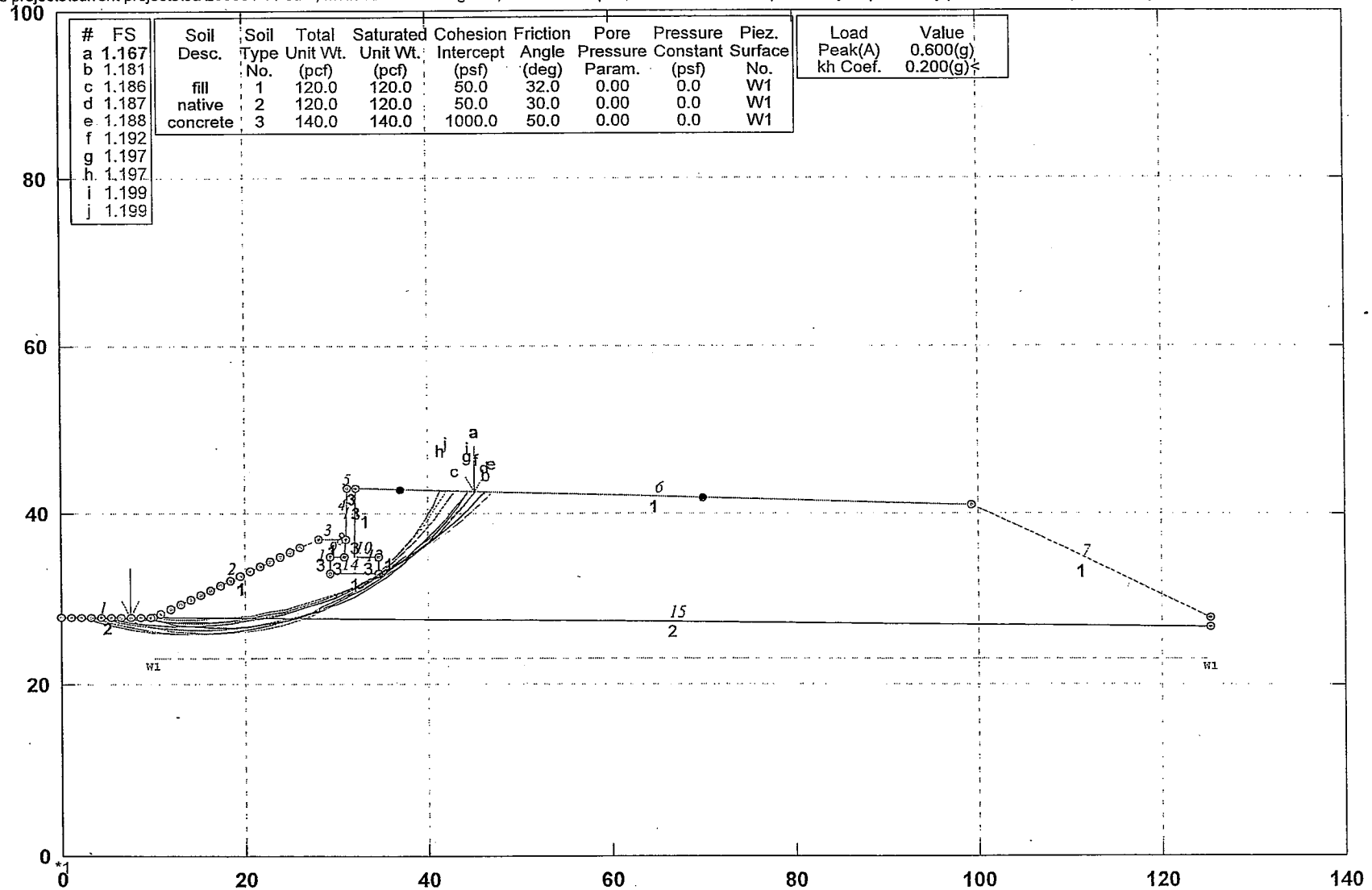
#	FS
a	1.167
b	1.181
c	1.186
d	1.187
e	1.188
f	1.192
g	1.197
h	1.197
i	1.199
j	1.199

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
fill	1	120.0	120.0	50.0	32.0	0.00	0.0	W1
native	2	120.0	120.0	50.0	30.0	0.00	0.0	W1
concrete	3	140.0	140.0	1000.0	50.0	0.00	0.0	W1

Load	Value
Peak(A)	0.600(g)
kh Coef.	0.200(g)



GSTABL7 v.2 FSmin=1.167

Safety Factors Are Calculated By The Modified Bishop Method

GSTABL7

15. References

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