07-LA-001, PM 30.16/30.74
EA: 33880 Project ID: 0717000061
Program Code: 2020.800.100
PPNO:5228
April 2024

Draft Project Report
For Project Approval

In Los Angeles County, within the City of Los Angeles

On Route 1 between Jefferson Boulevard and Fiji Way

I have reviewed the right-of-way information contained in this report and the right-of-way data sheet attached hereto, and find the data to be complete, current and accurate:

Dan E. Murdock, *DEPUTY DISTRICT DIRECTOR, RIGHT OF WAY*

APPROVAL RECOMMENDED:

Robert Sanchez (Apr 22, 2024 10:32 PDT)

***Robert Sanchez**, City of Los Angeles*
SENIOR TRANSPORTATION ENGINEER

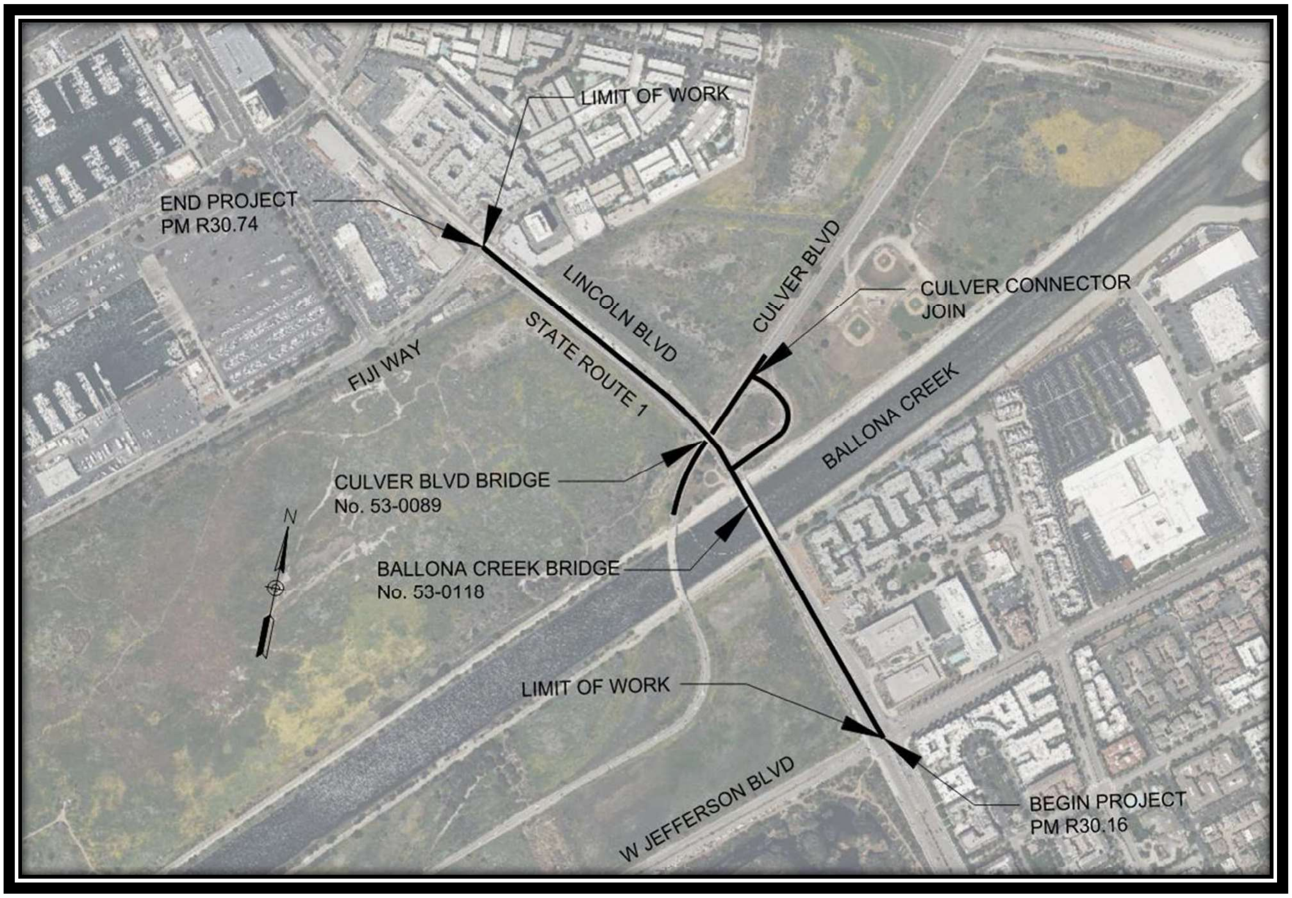
***Shabbir Ahmed**, Caltrans*
PROJECT MANAGER

***Greg Farr**, Caltrans*
DEPUTY DISTRICT DIRECTOR, DESIGN

PROJECT APPROVED:

05/01/2024

Gloria H. Roberts, *DISTRICT DIRECTOR* — *DATE*



VICINITY MAP

On State Route 1 between Jefferson Boulevard and Fiji Way

This draft project report has been prepared under the direction of the following registered civil engineer. The registered civil engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based.

4/8/2024

Paul D. Gervacio, P.E. *Date*
Psomas

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1. INTRODUCTION

Project Description:

This is a locally funded active transportation operational improvement project for State Route 1, Lincoln Boulevard, which is a major route traveling northwest to southeast on the west side of Los Angeles County. It connects major destinations including the City of Santa Monica to the north, and Loyola Marymount University, Otis College of Art and Design and Los Angeles International Airport to the south. The Project segment provides a critical and heavily traveled connection between and amongst the communities of Playa Del Rey, Playa Vista, Westchester, and El Segundo in the south and Marina Del Rey, Del Rey, Venice, Culver City, Mar Vista, and Santa Monica in the north.

Lincoln Boulevard is classified in the City of Los Angeles General Plan as a Boulevard I (Major Highway Class I) and is comprised of three to four lanes in the northbound direction and two to three lanes in the southbound direction within the Project limits. Culver Boulevard is classified as an Avenue I (Major Highway Class II) and Avenue III (Modified Scenic) and is comprised of one lane in each direction in the vicinity of Lincoln Boulevard. Jefferson Boulevard is a Boulevard II (Major Highway Class I) and is comprised of two lanes in each direction, and Fiji Way is a Local Street, comprised of one lane in each direction near the Project.

The Project's Build Alternative includes: realignment of the Lincoln Boulevard centerline approximately 50 feet to the east; addition of one southbound lane along Lincoln Boulevard for a length of approximately 1,800 feet; demolition, replacement, and widening of the Lincoln Boulevard Bridge (Ballona Creek Bridge) over Ballona Creek; demolition, replacement, and widening of the Culver Boulevard Bridge over Lincoln Boulevard; demolition, replacement, and realignment of the connector ramps between Lincoln Boulevard and Culver Boulevard; construction of active transportation improvements including sidewalks and Class IV protected bicycle lanes on both sides of Lincoln Boulevard. The Project would also include utility relocation, landscaping, low-intensity street lighting, striping, signage, drainage, and water quality improvements. The Project would install a striped center median that would allow space to accommodate a future center-running transit facility within the Project limits, which is not included as part of the Project. Construction of the Project Build Alternative would result in three through lanes in the northbound and southbound directions of Lincoln Boulevard between Fiji Way and Jefferson Boulevard from postmile (PM) 30.16 to 30.74, with additional turning lanes at intersections.

Project Limits	07-LA-001, PM 30.16 to PM 30.74	
Number of Alternatives	2	
	Current Cost Estimate:	**Escalated Cost Estimate:**
Capital Outlay Support	$8,780,000 (FY22/23)	$11,414,000 (FY25/26)
Capital Outlay Construction	$59,503,000 (FY22/23)	$77,762,000 (FY25/26)
Capital Outlay Right-of-Way	$17,300,000 (FY22/23)	$21,334,000 (FY25/26)
Funding Source	Coastal Transportation Corridor Specific Plan	
Funding Year	2026	
Type of Facility	6 Lane Conventional Highway	

Number of Structures	2
Environmental Determination or Document	Environmental Impact Report (EIR) / Environmental Assessment (EA)
Legal Description	In Los Angeles County on State Route 001 (SR-1) between Jefferson Boulevard and Fiji Way
Project Development Category	4A

2. RECOMMENDATION

It is recommended that the Draft Project Report (DPR) be approved to circulate the Draft Environmental Document (DED) for public review and comment. The documents would be made available at the California Department of Transportation (Caltrans), nearby local libraries, and via the internet on Caltrans District 7 webpage. All comments received would be taken into consideration and incorporated into the Final Environmental Document as appropriate.

3. BACKGROUND

Project History

The proposed Project is located in the west side of Los Angeles County along Lincoln Boulevard, which is designated as California SR-1 within the Project limits. The Project is located in the Palms-Mar Vista-Del Rey and Westchester-Playa Del Rey Community Plan areas of the City of Los Angeles and is partially within unincorporated Los Angeles County. The northern limit of the Project is just south of the Lincoln Boulevard/Fiji Way intersection. The southern limit of the Project is the Lincoln Boulevard/Jefferson Boulevard intersection. Within the Project limits, Lincoln Boulevard crosses over Ballona Creek, beneath the Culver Boulevard overcrossing, and through the Ballona Wetlands Ecological Reserve (BWER).

A similar project (EA 07279-166050,166060,166070) was previously proposed by Caltrans and an Initial Study/Environmental Assessment (IS/EA) was circulated for that project in 2001. Due to the California Coastal Commission’s concerns about impacts to Ballona Creek and subsequent loss of funding, it was not further developed. More recently, this Project was included in the City of Los Angeles’ Westside Mobility Plan and its environmental document that was adopted in 2018, which was an update to the Coastal Transportation Corridor Specific Plan and West LA Transportation Specific Plan.

Community Interaction

Caltrans District 7 held a combined agency and public Scoping Meeting for the State Route-1 (Lincoln Boulevard) Bridge Multi-Modal Improvement Project (Project) on March 28, 2018. The purpose of the meeting was to explain the Project and alternatives to agencies and the public, explain the environmental process, and gather comments from anyone who desired to provide input. In order to better identify the issues to be addressed for the proposed project, Caltrans solicited comments from public agencies, private entities and interested individuals regarding potential social, economic, traffic, safety, environmental issues, and agency permit, and review requirements related to the project. The scoping process pursuant to CEQA was conducted from March 15, 2018, through April 16, 2018. Public and agency outreach efforts will continue throughout the project development process.

Existing Facility

The existing Lincoln Boulevard right-of-way width between Jefferson Boulevard and Fiji Way varies from 100 feet to 159 feet. Lincoln Boulevard is designated as a Conventional Highway with a posted speed limit of 45 mph within the project limits. The existing lane configuration of Lincoln Boulevard at the intersection with Jefferson Boulevard provides 4 northbound through lanes and 3 southbound through lanes separated by a striped median that varies in width between 24 feet and 0 feet. Approximately 600 feet north of the intersection, the roadway narrows to 3 northbound lanes and 2 southbound lanes. A 5-foot-wide sidewalk exists in the northbound direction between Jefferson Boulevard and the Ballona Creek bridge where it terminates. There is no sidewalk in the southbound direction. A Class III Bike Route is signed in the northbound direction. There are no designated bike facilities in the southbound direction of travel within the project limits. South of Jefferson Boulevard, there is a Class III Bike Route designated in the northbound and southbound direction. North of Fiji Boulevard, there are no designated bike facilities.

Approximately 150 feet north of the Culver Boulevard bridge overcrossing, Lincoln Boulevard begins to widen as it approaches the Fiji Way intersection. The south leg of the Lincoln Boulevard and Fiji Way intersection provides 3 northbound through lanes, 2 left turn lanes and 4 southbound through lanes that taper to 2 lanes as they approach the Ballona Creek bridge.

The Ballona Creek Bridge (Bridge Number 53-0118) was originally constructed in 1937. A seismic retrofit of the bridge was completed in 1994. The existing bridge consists of a concrete deck over haunched steel girders on pile-supported concrete piers. The existing bridge consists of one structure. The existing bridge deck is approximately 332 feet in length with a width of approximately 68 feet. The Ballona Creek Bridge provides 3 northbound through lanes and 2 southbound through lanes. There are no sidewalks.

Culver Boulevard is within City R/W and crosses over Lincoln Boulevard approximately 300 feet north of the Ballona Creek Bridge. The existing lane configuration along Culver Boulevard west of Lincoln Boulevard provides one-lane in each direction. The existing lane configuration east of Lincoln Boulevard provides one lane in the westbound direction and two lanes in the eastbound direction. The existing roadway width is approximately 40 feet.

The Culver Boulevard Overcrossing (Bridge Number 53-0089) was originally constructed in 1937 which provides one lane and sidewalks in both directions. A one-lane ramp provides a connection from northbound Lincoln Boulevard to eastbound Culver Boulevard. A two-lane ramp provides a connection from eastbound and westbound Culver Boulevard to northbound and southbound Lincoln Boulevard. There are no sidewalks along the ramps. The ramps are within City R/W and designed to meet City of Los Angeles standards.

Future Projects

Other project improvement plans are currently being developed for other portions of Lincoln Boulevard in the vicinity of the project study area. Following is a summary of these projects and their current status.

Table 1: Future Projects

Project Description	Description	Timeline
Caltrans Preventative Maintenance (CAPM) (EA 325804)	Pavement rehab curb ramp replacement, modify signal/lighting	PS&E completed in November 2022. Construction schedule pending
Ballona Wetlands Restoration Project	Restoration of Ballona Wetlands	Currently certifying EIR. Construction scheduled for 2024

4. PURPOSE AND NEED

Purpose

The purpose of this project is to create a new multi-modal corridor along SR-1/ Lincoln Boulevard between Fiji Way and Jefferson Boulevard to improve traffic operations and to serve all transportation modes including transit users, bicyclists and pedestrians while minimizing impacts to Ballona Wetlands Reserve, Ballona Creek, and other environmental resources.

Need

Lincoln Boulevard serves as a critical north-south connection on the west side. There are few arterial connections that provide continuous access through the west side, which results in Lincoln Boulevard being oversaturated during peak commute periods. Lincoln Boulevard narrows from three to two lanes in the southbound direction, approximately 1,050 feet north of the existing Ballona Creek Bridge. It narrows from four to three lanes in the northbound direction, approximately 320 feet north of the intersection with Jefferson Boulevard. These lane reductions create a major traffic operations bottleneck.

The average vehicle travel speeds along Lincoln Boulevard are 15 miles per hour (mph) during peak periods when measured between Ozone Avenue in the City of Santa Monica and Sepulveda Boulevard while the posted speed limit is 45 mph. Travel times are greatly impacted by bottlenecks resulting in slower speeds along much of the corridor.

In addition, access for pedestrians along Lincoln Boulevard is disjointed north and south of the Ballona Creek Bridge which does not have sidewalks. Lincoln Boulevard also lacks bicycle facilities across the bridge. Pedestrian and bicycle facilities are also deficient along Culver Boulevard.

4A. Problem, Deficiencies, Justification

The project is a collaborative effort between the City of Los Angeles and Caltrans to improve access to multi-modal travel and traffic operations along the corridor. The proposed improvements to Lincoln Boulevard should alleviate future traffic congestion and accommodate the increased need for multi-modal mobility, access, and future traffic demands. Development and regional growth is expected to increase traffic and further worsen congestion in the area.

As summarized in section 4C of this report, the peak hour at the existing Lincoln Boulevard and Culver Loop intersection already operates at LOS E while the Lincoln Boulevard and Jefferson Boulevard intersection operates at an unacceptable LOS F.

Existing peak hour queue lengths already exceed the available storage for various movements at the Lincoln Boulevard & Fiji Way, Lincoln Boulevard & Culver Loop to Lincoln, and Lincoln Boulevard and Jefferson Boulevard intersections.

The intersections of Lincoln Boulevard and Fiji Way, Lincoln Boulevard and Culver Loop to Lincoln, and Lincoln Boulevard and Jefferson Boulevard all operate at LOS D, E or F during one or more of the peak hours for Opening Year (2025). The operations worsen at the intersections at Lincoln Boulevard and Fiji Way and Lincoln Boulevard and Culver Loop to Lincoln during the AM and PM peak hours under the Design Year (2045) No Build conditions.

4B. Regional and System Planning

Statewide Planning

The Route Concept Report*,* Route 1 (Caltrans District 7, January 1991) identifies the segments from Manchester Avenue to Culver Boulevard and from Culver Boulevard to Washington Boulevard as operating at LOS E and LOS D under existing (1988) conditions, and both segments are projected to operate at LOS F under projected 2010 Null conditions.

Improvements suggested in the Route Concept Report (RCR) to attain the Concept LOS F0 for Year 2010 consist of restriping and peak hour parking restrictions to provide six lanes between Manchester Avenue and Culver Boulevard. Unspecified operational improvements are identified in the RCR. No additional improvements are envisioned in the RCR for the ultimate transportation corridor, due to the heavily built-up nature of the corridor and prohibitive right-of-way costs.

The *Final Draft, District* System *Management Plan,* 995 (DSMP) for District 7 (Caltrans District 7, December 1995) identifies the subject portion of Route 1 as operating at LOS D under 1990 (existing) conditions and LOS F0 under projected 2010 Null conditions. No improvements are identified in the DSMP for this portion of Route 1.

Regional Planning

Route 1, as a State highway, is a part of the Los Angeles County Metropolitan Transportation Authority's (MTA's) Congestion Management Program (CMP) regional highway system.

The Project has been included in and is consistent with the 2023 Federal Transportation Improvement Program (FTIP) (SCAG 2022b). The Project is identified therein as FTIP ID LA0G1714. The Project was added as part of FTIP Amendment 23-00.

The Project is also included in the Southern California Association of Governments (SCAG) 2020 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS). The Project was originally listed as a Strategic Project (RTP ID S1160154) in the Transportation System Project List from the 2020 RTP/SCS that was adopted in September 2020 (SCAG 2020). The Project listing was subsequently updated, and the Project is now listed on the Local Highway Project List as RTP ID 7120001.

Local Planning

The City of Los Angeles' Coastal Transportation Corridor Specific Plan (CTCSP), adopted in 1993, describes specific transportation infrastructure improvements and establishes funding mechanisms and regulatory contracts for the area of Los Angeles generally bounded by the Santa Monica boundary to the north, the El Segundo boundary to the south, the Pacific Ocean to the west, and the San Diego Freeway to the east. Within the project limits, the CTCSP improvement list contained in City of Los Angeles Ordinance 186105 dated 04/04/2019 includes widening of Route 1 to provide an additional southbound travel lane for vehicles, bus-only lanes in the median, cycle tracks on both sides of the roadway to connect bicycle lanes to the south with the Ballona Creek bicycle path and sidewalks on both sides of the street.

4C. Traffic

Traffic and transportation data collection were undertaken to determine existing peak hour traffic volumes and lane configurations within the study area. Existing and proposed pedestrian/bicycle facilities were identified and transit service information for routes within the area was also collected. Weekday intersection turning movement vehicle counts were conducted during the morning (7:00 to 10:00 AM) and evening (3:00 to 6:00 PM) peak periods at the study intersections in November 2019. Peak hour volumes were balanced across the study intersections to account for the differences in unique intersection peak hours. Bicycle and pedestrian crossing volumes were also collected at each of the four study intersections during this time.

The City of Los Angeles Travel Demand Model was used to generate 2040 forecasts within the study area. AM and PM peak hour traffic forecasts were developed for each of the four study intersections based on post-processed model outputs using the difference methodology. This methodology is consistent with methodologies delineated in the National Cooperative Highway Research Program Report (NCHRP) 255 published by the Transportation Research Board (TRB): Highway Traffic Data for Urbanized Area Project Planning and Design (Transportation Research Board, December 1982). The Base Year (2016) and Future Year (2040) models were used to calculate straight-line annual growth rates for turning movements at study intersections. The growth rates were then applied to existing traffic counts (collected November 2019) to develop the Opening Year (2025) and Design Year (2045) No Build Conditions traffic projections. The City of Los Angeles Travel Demand Model network was then edited to include the additional southbound lane on Lincoln Boulevard to reflect Build Conditions, and post-processed volumes were developed as outlined previously for the Opening Year (2025) and Design Year (2045) Build scenarios.

Intersection Traffic Operations

Existing intersection traffic volumes, lane configurations, and signal timings were used to calculate LOS for the study intersections during the AM and PM peak hours. The traffic volumes collected along Lincoln Boulevard reveal peak hour directionality. Peak hour volumes are heavier in the northbound direction in the AM peak hour and in the southbound direction during the PM peak hour. Therefore, the southbound bottleneck due to the lane reduction at the Lincoln Bridge is more prominent during the PM peak hour. As the results show, two of the four study intersections operate at LOS C or better during the PM peak hour. The following intersections operate at LOS D, E, or F during one or more of the peak hours analyzed:

1. Lincoln Boulevard & Fiji Way (LOS D during the AM peak hour) Lincoln Boulevard & Culver Loop to Lincoln Boulevard (LOS E during the AM peak hour),
2. Lincoln Boulevard & Jefferson Boulevard (LOS F during the AM peak hour and LOS D during the PM peak hour)

Table 2: Existing (2019) Conditions Peak Hour Intersection Operations

	Intersection	AM Peak Hour		PM Peak Hour	
		Delay	LOS	Delay	LOS
1	Lincoln Boulevard & Fiji Way	36.1	D	33.4	C
2	Lincoln Boulevard & Culver Loop to Lincoln Boulevard[1]	64.1	E	28.6	C
3	Lincoln Boulevard & Jefferson Boulevard	128.4	F	38.4	D
4	Culver Boulevard & Culver Loop to Lincoln Boulevard[2]	<5.0	A	<5.0	A

Source: Fehr & Peers, 2020.

1 Signal timing modified for the WBR movement to enable HCM2010 analysis.

2 Unsignalized intersection - LOS calculated using HCM 2010, as a Two-Way Stop Control.

Queue Analysis

Table 3 shows the 95th percentile queue lengths for critical turning movements at each of the four intersections in the study area. Queue lengths exceed storage lengths at the following approaches:

- Lincoln Boulevard & Fiji Way – NBL (AM peak hour)
- Lincoln Boulevard & Culver Loop to Lincoln Boulevard – WBR (AM peak hour)
- Lincoln Boulevard & Culver Loop to Lincoln Boulevard – WBL (PM peak hour)
- Lincoln Boulevard & Jefferson Boulevard – SBL (AM and PM peak hours)
- Lincoln Boulevard & Jefferson Boulevard – WBR (AM peak hour)
- Lincoln Boulevard & Jefferson Boulevard – EBL (AM peak hour)

Table 3: Existing (2019) Conditions Peak Hour 95th Percentile Queues

Intersection		Movement	Storage Length (ft)	95th Percentile Queue (ft)	
				AM	PM
1	Lincoln Boulevard & Fiji Way	NBL	330	**#500**	325
		SBL	215	100	75
		EBL	175	100	100
		EBR3	--	--	--
2	Lincoln Boulevard & Culver Loop to Lincoln Boulevard	WBR	310	**#425**[1]	300
		WBL	310	175	**#475**
3	Lincoln Boulevard & Jefferson Boulevard	NBL	200	50	50
		NBR	210	100	50
		SBL	250	**#400**	**m225**
		WBL	440	175	325
		WBR	440	**#700**	275
		EBL	200	**#350**	175
4	Culver Boulevard & Culver Loop to Lincoln Boulevard	WBL	250	50[2]	75[2]

Source: Fehr & Peers, 2020.

Notes: Queue lengths have been rounded to the next 25 feet.

1 This movement has both a protected and permissive right turn, but only the permissive portion was analyzed due to custom phasing.

2 Queue length calculated based on HCM 2010 LOS analysis and an average vehicle length of 25 feet.

3 This movement has a dedicated right-turn lane, with a Yield control, and merges with SB Lincoln Boulevard downstream.

Bold indicates that 95th percentile queue length exceeds available storage.

# indicates that 95th percentile volume exceeds capacity, queue may be longer. m indicates volume for 95th percentile queue is metered by upstream signal.

Travel Demand Forecasts

Future Year Forecasts

Because the widening of the bridge along Lincoln Boulevard would provide additional lane capacity in the southbound direction, travel patterns within the study area would likely change because of the Project. Accordingly, the roadway network in the City of Los Angeles model was adjusted to reflect the lane configuration changes for the Project, and demand volumes were forecasted for the Build and No Build scenarios, for both 2025 and 2045.

Both the AM and PM peak hour volume increases primarily occur in the non-peak direction. These increases indicate that Lincoln Boulevard is essentially at capacity during the AM peak hour in the northbound direction and during the PM peak hour in the southbound direction, limiting the ability for future increases in traffic volumes. During the AM peak hour, larger volume increases occur along Lincoln Boulevard in the southbound direction (as a percentage of existing volumes). During the PM peak hour, larger volume increases occur in the northbound direction. This pattern holds true for both 2025 and 2045.

Traffic volumes in the southbound direction increase more in the Build scenario, when compared to No Build, because of the additional lane capacity. In the northbound direction, volumes remain the same between the No Build and Build scenarios for both 2025 and 2045. Slight volume decreases also occur for some turning movements (e.g., westbound left-turns from Jefferson Boulevard onto Lincoln Boulevard), between the No Build and Build scenarios, due to fewer trips on roadways that serve as an alternate route to southbound Lincoln Boulevard. It should be noted that both the No Build and Build forecasts represent travel demand that may not be fully realized during the peak hours due to the existing bottlenecks and capacity constraints along Lincoln Boulevard to the north and south of the study area.

Average Daily Traffic (ADT) Forecasts

Average daily traffic (ADT) forecasts were developed for the segment of Lincoln Boulevard (northbound and southbound) between Jefferson Boulevard and Fiji Way for the four future year scenarios. ADT forecasts were developed using straight-line growth from 2011 Caltrans ADT data available for the segment, based on the 2016 and 2040 Los Angeles Travel Model volumes. Volumes increase in 2025 and 2045, with larger increases under Build Scenarios, as is seen in turning movement volume forecasts.

Table 4: Lincoln Boulevard Average Daily Traffic (ADT) Volumes

	Opening Year (2025)		Design Year (2045)	
2017 PeMS ADT[1]	**No Build**	**Build**	**No Build**	**Build**
60,000	64,400	67,000	75,800	78,900

[1] 2017 counts from Caltrans Performance Management System (PeMS) are most recent available. Source: Fehr & Peers, 2020.

Opening Year & Design Year Traffic Operations Analysis

This section presents the results of the traffic operations analysis for Opening Year (2025) and Design Year (2045) Conditions. The analysis focuses on intersection operations for the No Build and Build scenarios.

Future Roadway Network Assumptions

No Build Assumptions

Under this scenario, Lincoln Boulevard and Culver Boulevard would remain unchanged. The lane configurations along Culver Boulevard and Lincoln Boulevard in the study area are the same as Existing (2019) Conditions. Existing signal timings were used for this analysis. This scenario does not meet the project Purpose and Need. Rather, it provides a basis for the analysis and evaluation of the proposed Project.

Build Assumptions

Under this scenario, vehicle lane configurations would reflect the following changes:

1. Between Fiji Way and Jefferson Boulevard, the existing 2-lane segment of southbound Lincoln Boulevard would be widened to 3 travel lanes.

2. The Lincoln Boulevard southbound approach lane configuration at the Lincoln Boulevard & Jefferson Boulevard intersection would be changed from two left turn lanes, three through lanes and a shared through/right-turn lane to two left turn lanes, three through lanes and a separate right-turn lane (L-L-T-T-T-TR to L-L-T-T-T-R)

In addition to these added travel lanes, the project would add a protected bike lane and a new sidewalk in each direction along the Lincoln Bridge and a new bike lane and sidewalk in each direction on the Culver Boulevard overcrossing.

OPENING YEAR (2025) INTERSECTION OPERATIONS

No Build and Build intersection traffic operations were evaluated under AM and PM peak hour conditions using Opening Year (2025) volume forecasts.

Table 5 presents the LOS results for each of the study intersections. Two of the four intersections operate at LOS C or better under the No Build and Build scenarios (PM peak hour only). The following intersections operate at LOS D, E, or F during one or more of the peak hours analyzed:

1. Lincoln Boulevard & Fiji Way (LOS D during the AM peak hour, No Build and Build)
2. Lincoln Boulevard & Culver Loop to Lincoln Boulevard (LOS E during the AM peak hour, No Build; and LOS D during the AM peak hour, Build)
3. Lincoln Boulevard & Jefferson Boulevard (LOS F during the AM peak hour, No Build and Build. LOS D during the PM peak hour, No Build and Build)

Decreases in delay in the Build scenario, as at the intersection of Lincoln Boulevard & Culver Loop to Lincoln Boulevard, can be attributed to the additional southbound travel lane on Lincoln Boulevard.

Table 5: Opening Year (2025) Conditions Peak Hour Intersections Operations

		No Build				Build			
		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
	Intersection	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Lincoln Boulevard & Fiji Way	36.8	**D**	34.2	C	36.5	**D**	34.0	C
2	Lincoln Boulevard & Culver Loop to Lincoln Boulevard[1]	75.7	**E**	33.4	C	53.1	**D**	21.1	C
3	Lincoln Boulevard & Jefferson Boulevard	127.3	**F**	39.8	**D**	110.3	**F**	39.2	**D**
4	Culver Boulevard & Culver Loop to Lincoln Boulevard[2]	<5.0	A	<5.0	A	<5.0	A	<5.0	A

Source: Fehr & Peers, 2020.

[1] Signal timing modified for the WBR movement to enable HCM2010 analysis [2]Unsignalized intersection – LOS calculated using HCM 2010, as a Two-Way Stop control. **Bold** indicates intersection operating at LOS D or worse.

DESIGN YEAR (2045) INTERSECTION OPERATIONS

No Build and Build intersection traffic operations were evaluated under AM and PM peak hour conditions using Design Year (2045) volume forecasts.

Table 6 presents the LOS results for each of the study intersections. One of the four intersections is estimated to operate at LOS C or better during both the AM and PM peak hour under No Build and Build scenarios. The following intersection is estimated to operate at LOS D, E, or F during one or more peak hour:

1. Lincoln Boulevard & Fiji Way (LOS D during the AM and PM peak hours, No Build and Build.)
2. Lincoln Boulevard & Culver Loop to Lincoln Boulevard (LOS F during the AM peak hour, No Build, and LOS D during the PM peak hour, No Build, and LOS E during the AM Peak, Build)
3. Lincoln Boulevard & Jefferson Boulevard (LOS F during the AM peak hour, No Build and Build, and LOS D during the PM Peak hour, No Build and Build)

Decreases in delay in the Build scenario, as at the intersection of Lincoln Boulevard & Culver Loop to Lincoln Boulevard, can be attributed to the additional southbound travel lane on Lincoln Boulevard in the Build scenario. The intersection of Lincoln Boulevard & Culver Loop to Lincoln Boulevard is estimated to operate at LOS F and D during the AM and PM peak hours under No Build conditions but improves to LOS E and C during the AM and PM peak hours under Build conditions.

Table 6: Design Year (2045) Conditions Peak Hour Intersection Operations

Intersection		No Build				Build			
		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Lincoln Boulevard & Fiji Way	40.2	**D**	37.4	**D**	41.0	**D**	40.0	**D**
2	Lincoln Boulevard & Culver Loop to Lincoln Boulevard[1]	113.0	**F**	47.7	**D**	70.4	**E**	29.1	C
3	Lincoln Boulevard & Jefferson Boulevard	125.7	**F**	54.3	**D**	107.1	**F**	54.0	**D**
4	Culver Boulevard & Culver Loop to Lincoln Boulevard[2]	<5.0	A	<5.0	A	<5.0	A	<5.0	A

Source: Fehr & Peers, 2020.

[1] Signal timing modified for the WBR movement to enable HCM2010 analysis 2Unsignalized intersection – LOS calculated using HCM 2010, as a Two-Way Stop control Bold indicates intersection operating at LOS D or worse.

Underline indicates LOS worsens under Build Conditions.

Vehicle Miles Traveled (VMT) ANALYSIS

This section summarizes the methodology for estimating daily VMT and presents the results from the City of Los Angeles Travel Demand Model.

The Los Angeles Travel Demand Model was used to estimate VMT by isolating all roadway segments within a 1.5-mile radius of the Lincoln Bridge. The number of vehicles on each roadway segment was multiplied by the segment length within this boundary using the 2040 model, under both No Build and Build Conditions. Straight line growth rates were developed between the 2016 base year model and the 2040 model results, and then applied to 2040 VMT results to determine estimates for Opening Year (2025) and Design Year (2045) Conditions. Table 7 summarizes the results of this analysis, comparing VMT estimates for No Build and Build Conditions. The VMT results for Build Conditions reflects the additional southbound lane on Lincoln Boulevard.

As a result of the Project, VMT in the study area is estimated to decrease by approximately 0.9% compared to No Build conditions in 2025 and decrease by 4.1% in 2045. The decrease in VMT is due to the elimination of the existing southbound bottleneck on the bridge, which results in vehicles using alternate routes that, while time efficient, require traveling a greater distance. The 1.5-mile radius used for this analysis includes alternative routes across Ballona Creek, including SR-90 and Centinela Avenue, both east of the Project. VMT reductions because of the Project can therefore be attributed to the Project's addition of southbound capacity, providing a more direct route for many trips.

Table 7: Vehicle Miles Traveled (VMT)

Year	No Build	Build	Difference	Percent Difference
Opening Year (2025)	615,554	610,131	-5,423	-0.9%
Design Year (2045)	683,464	655,807	-27,657	-4.1%
Source: Fehr & Peers, 2020.				

BICYCLE AND PEDESTRIAN ANALYSIS

Lincoln Boulevard serves as a critical north-south connection on the Westside but the existing pedestrian facilities are discontinuous north and south of the bridge with no sidewalks provided on the bridge. Lincoln Boulevard also lacks bicycle facilities across the bridge despite its connection to the east-west Ballona Creek Bicycle Path that runs just under the Lincoln Bridge parallel to Ballona Creek. This lack of connectivity and protection along a high-volume, high-speed road not only discourages active transportation, but also raises safety concerns for bicyclists and pedestrians attempting to access nearby facilities and destinations.

The proposed Project would improve connectivity and accessibility to the coastal areas of the Westside for all modes of travel. The improvements on the Lincoln Bridge include widening the bridge to accommodate protected bicycle lanes, and sidewalks on both sides of the bridge. These bicycle and pedestrian improvements will extend between Jefferson Boulevard and Fiji Way. Adding a separated bicycle lane along this segment will create a complete bicycle network, on which cyclists safely and conveniently can travel to and through the area.

Class IV protected bicycle lanes on Lincoln Boulevard will provide a connection to the Ballona Creek Bicycle Path as well as existing bicycle facilities south of Jefferson Boulevard and on Fiji Way. Additionally, the proposed improvements will better connect cyclists and pedestrians to the retail and residential developments south of Ballona Creek in Playa Vista off of Jefferson Boulevard. Nearby educational institutions, such as the Westside Neighborhood School, Playa

Vista Elementary School, Loyola Marymount University, and Playa Vista Public Library, will be more accessible via active transportation modes.

With average daily traffic exceeding 60,000 vehicles and a speed limit of 45 miles per hour, industry standards recommend separated bicycle lanes. (National Association of City Transportation Officials). Studies have found that separated bicycle lanes increase cycling and reduce vehicle traffic (Federal Highway Administration, May 2015). Furthermore, separated bicycle lanes are more feasible along routes without parking on the shoulder, few transit stops and limited intersections, all of which are characteristics of this segment of Lincoln Boulevard (California Department of Transportation, December 2015).

Demand for bicycle and pedestrian facilities was noted during traffic counts. The project team counted 80 cyclists and 81 pedestrians in the AM peak hour within the study area. During the PM peak hour, the project team counted 36 cyclists and 66 pedestrians. The proposed separated bicycle facility and sidewalks will promote the safety of current as well as future cyclists and pedestrians.

COLLISION HISTORY DATA

The following TASAS Table B summarizes collision rates for Lincoln Boulevard (State Route 001) from Jefferson Boulevard postmile (PM) 30.163 to Fiji Way PM 30.73. The Table B report was generated on 11/23/2021 and it depicts existing collision rates per million vehicle miles for the most recent requested 3-year period from 01/01/2018 to 12/31/2020 from the Traffic Accident Surveillance and Analysis System (TASAS).

TASAS Table B Collision Rates (01/01/2018 - 12/31/2020)

Segment	Total No. of Collisions	ACTUAL COLLISION RATE (per million vehicle miles)			AVERAGE COLLISION RATE (per million vehicle miles)		
		Fatal Collisions	Fatal + Injury Collisions	Total[1]	Fatal Collisions	Fatal + Injury Collisions	Total[1]
State Route 001 Jefferson Bl to Fiji Way (PM 30.1-30.8)	5	0.000	0.11	0.11	0.008	0.36	0.81

[1] All reported collisions (includes Property Damage Only (PDO) Collisions)

Analysis of the TASAS Table B records shows a total of 5 collisions at this segment and study periods summarized above, with a total rate of fatal and injury related collisions that is below average for similar facilities statewide, and a total rate of collisions that is below average for similar facilities statewide.

Detailed analysis per the TASAS Selective Accident Retrieval (TSAR) generated on 11/23/2021 shows that the primary collision factors at this intersection were:

- 1 “Failure to Yield,”
- 2 “Influence alcohol
- 1 “Speeding”

- 1 “Other Violations”

The types of collisions included:

- 1 “Rear End,”
- 1 “Broadside”
- 2 “Hit Object”
- 1 “Not Stated”

In addition, this intersection has not been flagged in TASAS Table C. Table C identifies high collision frequency spot locations with either Type ‘W’ (Wet) collisions or Type ‘A’ (All) collisions where four or more significant collisions within twelve, six, or a three-month period have occurred.

TRAFFIC ANALYSIS SUMMARY

This section summarizes the results of the Opening Year (2025) and Design Year (2045) AM and PM peak hour traffic analysis results for the Lincoln Bridge Multi-Modal Improvement Project. The Build scenarios are compared to the No Build scenarios.

Intersection Operations

In the Opening Year (2025) scenario, three of the four study intersections are expected to operate at LOS D, E, or F in both No Build and Build scenarios. However, two of the four intersections are expected to operate as LOS C during the PM peak hour, under the No Build and Build scenarios. In the Design Year (2045) scenario, three of the four intersections are expected to operate at LOS D, E, or F in both No Build and Build scenarios. In the Design Year, the intersection of Lincoln Boulevard & Fiji Way is estimated to operate at LOS D during the AM and PM peak hours, under No Build and Build conditions, with minor increases in average delay in the Build scenario due to induced demand for the additional capacity available on Lincoln Boulevard downstream of the intersection. Also, in the Design Year AM and PM peak hours, the intersection of Lincoln Boulevard & Culver Loop to Lincoln Boulevard is expected to operate at LOS F and LOS D under No Build conditions, respectively, and improve to LOS C in the PM peak hour under Build conditions.

Queue Analysis

In the Opening Year (2025) scenario, peak hour queues are estimated to exceed available storage at five of thirteen turn lanes during the AM peak hour and at six of thirteen turn lanes during the PM peak hour under Build conditions, including the added southbound right-turn lane at Lincoln Boulevard and Jefferson Boulevard in the PM peak hour. In the Design Year (2045) scenario, peak hour queues are estimated to exceed available storage at six of thirteen turn lanes during the AM peak hour and at seven of thirteen turn lanes during the PM peak hour under Build conditions, including the added southbound right-turn at Lincoln Boulevard and Jefferson Boulevard in both AM and PM peak hours.

Bicycle and Pedestrian Analysis

With the multi-modal improvements along the Lincoln Bridge, it is expected that bicycle and pedestrian convenience and safety will be improved. The protected bicycle lanes will create a more robust bicycle network in the area that improves the surrounding communities' connectivity to Ballona Creek Bicycle Path and other nearby retail, residential, and academic destinations. The safety risks of cyclists and pedestrians are expected to decrease as exposure to high volume and fast-moving vehicular traffic is minimized due to separated facilities along Lincoln Bridge.

The approved Traffic Engineering Study is included in Attachment L.

5. ALTERNATIVES

There are two alternatives considered for this project which are the no-build alternative and build alternative. Approval of this Draft Project Report does not constitute approval of the preferred or recommended alternative, but that approval would occur after the draft environmental document circulation.

5A. Viable Alternatives

The following project alternatives were studied for the proposed improvements to Lincoln Boulevard from Jefferson Boulevard to Fiji Way.

No-Build Alternative

The No-Build Alternative would not provide any improvements to Lincoln Boulevard and the Lincoln Boulevard Bridge over Ballona Creek. Therefore, demolition and construction of a replacement Culver Boulevard overcrossing would not be required under this alternative. The No Build Alternative would not provide the safety or mobility improvements that would result from the Build Alternative and would not meet the purpose and need for the project.

Build Alternative

The Build Alternative would provide the following engineering features:

Realignment of the Lincoln Boulevard centerline approximately 50 feet to the east; addition of one southbound lane along Lincoln Boulevard for a length of approximately 1,800 feet; demolition, replacement, and widening of the Ballona Creek Bridge over Ballona Creek; demolition, replacement, and widening of the Culver Boulevard Bridge over Lincoln Boulevard; demolition, replacement, and realignment of the connector ramps between Lincoln Boulevard and Culver Boulevard; construction of active transportation improvements including sidewalks, Class IV protected bicycle lanes on both sides of Lincoln Boulevard, ADA-compliant curb ramps, and signal upgrades at intersections within the project limits. Proposed lane widths in Caltrans right of way are 12 feet wide except where they transition to match existing lane widths.

The project would also include utility relocation, landscaping, low-intensity street lighting, striping, signage, drainage, and water quality improvements. The project would install a striped center median that would allow space to accommodate a future center-running transit facility within the project limits, which is not included as part of this project.

Most of the Lincoln Boulevard widening improvements will be to the east to minimize impacts to biological resources to the west. The proposed widening improvements will conform to the existing roadway cross section north of the Jefferson Boulevard intersection and south of the Fiji Way intersection. No improvements are proposed to these two intersections. The Culver Drive/Culver Loop intersection will require reconstruction.

Typical Cross Sections for this alternative are included in Attachment B. Preliminary Drawings for the proposed improvements can be found in Attachment C. Profiles for this alternative are shown in Attachment D.

Lincoln Boulevard Bridge Replacement Advance Planning Study

The proposed improvements to Lincoln Boulevard entail constructing a wider multi-modal corridor to meet the ultimate roadway needs for the project. The project will require replacing the existing structure with a new bridge over the Ballona Creek and widening the roadway along the east side of Lincoln Boulevard.

The proposed bridge will be a three-span continuous wide flange concrete girder bridge, 334'-6" long and 130 feet wide. It accommodates a 110-foot curb-to-curb roadway width with three 12-foot-wide travel lanes in each direction, a 12-foot-wide median, and a combination of a 5-foot-wide buffer and an 8-foot-wide shoulder with a 6-foot-wide Class II bike lane on each side of the bridge. A modified Type 85SW concrete barrier which includes an 8'-0" wide sidewalk and a 2'-0" wide concrete parapet rail will be placed at both edges of the bridge. The concrete parapet rails will receive aesthetic treatments while the aesthetics of the bridge will be addressed through future design efforts. Since the posted speed will be 45 mph at the project area, a traffic barrier separating the sidewalk and the shoulder is not required.

Attachment O provides additional information on the proposed Lincoln Boulevard Bridge including Site Constraints, Structure Hydraulics and Hydrology, and Plan Sheets.

Culver Boulevard Bridge Replacement Advance Planning Study

The proposed improvements to Lincoln Boulevard entail constructing a wider multi-modal corridor to meet the ultimate roadway needs for the project. The proposed project will require replacing and lengthening the existing Culver Boulevard bridge with a new overcrossing to accommodate the widened Lincoln Boulevard.

The proposed bridge will be a single-span wide flange concrete girder bridge, that will be 150'-0" long and 54'-4" wide. The proposed bridge is approximately 4" wider than the existing structure to accommodate the existing 40-foot-wide roadway and a modified Type 732SW concrete barrier. A 6'-2" wide standard sidewalk and a 1'-0" thick concrete parapet wall with Type 7 chain link railing will be provided on each side of the structure. The concrete parapet walls will receive aesthetic treatments. The aesthetics of the bridge will be addressed through future design efforts. Since the posted speed will be 35 mph on Culver Boulevard, a traffic barrier separating the sidewalk and the shoulder is not required.

Lincoln Boulevard will accommodate future transit facilities in the center median as a separate project. This eliminates placing a supporting bent at the centerline of the Lincoln Boulevard as an option and therefore requires a single-span bridge. A single-span bridge will reduce the roadway improvement limits and construction cost while maintaining a proper horizontal clearance of the proposed Lincoln Boulevard. The span length is minimized to reduce the structure depth and minimize the increase in vertical elevation.

Attachment P provides additional information on the proposed Culver Boulevard Bridge including Site Constraints, Structure Hydraulics and Hydrology, and Plan Sheets.

Hydraulics Study

Sea Level Rise (SLR) analysis, HEC-RAS numerical modeling and sediment transport analysis associated with Lincoln Boulevard Multi-Modal Improvement Project was conducted using SLR criteria for California (State of California Sea-Level Rise Guidance 2018 Update).

Two design discharges were analyzed using the HEC-RAS hydraulics models of lower Ballona Creek: Los Angeles County Department of Public Works (LACDPW) Capital Storm discharge (QCAP) and USACE 100-year discharge (USACE). Two sea level change criteria were used for the downstream boundary conditions in HEC-RAS modeling: USACE and California (2018).

No tsunami, wave run-up or other oceanographic factors were included as part of the SLR analysis because Lincoln Boulevard bridge is located approximately 2.5 miles inland of the coast. In addition, the Creek is leveed from its downstream terminus at the Pacific Ocean to upstream of the Lincoln Boulevard bridge crossing. The change in bottom elevation between the terminus and the Lincoln Boulevard Bridge crossing is approximately 7 feet and the opening of the channel is approximately 300 feet. While some open ocean waves may diffract, refract, or reflect through the levee mouth and propagate upstream, it is highly unlikely that open ocean waves would impact Lincoln Boulevard bridge.

All hydraulic analysis in the study employed sea level rise design considerations based on two design parameters USACE (2019) and California (2018). USACE (2019) analysis is expected to be required to comply with future Clean Water Act (CWA) Section 408 permitting requirements. California (2018) analysis is expected to be required for State-related permitting (i.e., Caltrans, CCC, etc.).

Changes in velocity from existing to proposed in the vicinity of Lincoln Boulevard bridge were identified. For all scenarios examined, the average difference in velocity is approximately +0.01 foot per second (fps). That is, all valid hydraulic analyses show that the proposed bridge condition has a negligible impact on velocity compared to the existing bridge condition.

Changes in water surface elevation in NAVD88 from existing to proposed in the vicinity of the bridge ranges from zero to a decrease of 0.02 ft. Therefore, all valid hydraulic analyses show that the proposed project has a negligible impact on depth compared to the existing bridge condition.

Using updated SLR criteria yielded overtopping of the modeled channel for certain proposed runs; runs in which the channel could not contain the full flow are invalid analyses for which conclusions cannot be drawn.

Results of the hydraulic analysis show that the proposed bridge design has minimal impacts on channel water surface elevation and velocity in the vicinity of the bridge. For all valid model runs, the proposed bridge design yields a channel velocity increase of 0.01 feet per second on average. Additionally, the proposed design yields an average decrease in water surface elevation (NAVD88) of 0.02 feet when compared to the hydraulic results of the existing bridge design. The LACDPW scour analysis of the Lincoln Boulevard bridge show that the proposed bridge design results in an additional 0.01 feet of bridge scour compared to the existing condition for all valid analyses. Results of the HEC-18 scour analysis show an average increase of 2.4 feet of total scour for the proposed design in comparison to the existing bridge.

The study assumptions and attachments are included in Attachment Q.

Nonstandard Design Features:

Nonstandard design features for the Build Alternative are briefly summarized in the Table 8. The Design Standard Decision Document (DSDD) was approved on 4/17/2024.

Table 8: Build Alternative Design Exceptions Required

Design Exception Number	Design Standard from Highway Design Manual	Approximate Location	Design Criteria Not Met/ Reasoning	Justification for Probability Rating
#1	**Boldface 202.2(1)** Standards for Superelevation **Boldface 203.2** Standards Curve Radius	Sta.61+93 to Sta.70+78	Standard 5.6% superelevation rate would result in poor Culver Blvd. intersection operations and is not consistent with purpose and need for multimodal corridor improvements.	The proposed normal crown section and curve radius provide a 55-mph comfort speed, exceeding the 50-mph design speed. A 5.6% standard superelevation rate and resultant comfort design speed of 65 mph is not compatible with the proposed pedestrian and bicycle features of the multimodal project.
#2	<u>Underlined 304.1</u> <u>Side Slope Standard</u>	NB 53+30 to 60+11 SB 50+71 to 60+39	2:1 slope ratio is proposed in lieu of standard 4:1to reduce grading limits and environmental impacts	The project proposes a nonstandard embankment side slope of 2:1 along northbound Lincoln Boulevard to minimize the grading limits and environmental impact footprint.
#3	**Boldface 302.1** Shoulder Width	NB 52+49 to 77+09 SB 53+24 to 78+07	Proposed cross section includes 2' wide shoulder and 5' wide bike lane buffer with flexible delineators in lieu of standard 8' wide shoulder consistent with purpose and need for multimodal corridor improvements.	The proposed reduced shoulder width will minimize grading limits, environmental impact footprint, and project right of way requirements.

Highway Safety Manual Analysis

It is Caltrans' policy to perform a Highway Safety Manual (HSM) analysis where applicable on all projects for the alternative designs and nonstandard design features. A HSM analysis was conducted for the proposed nonstandard superelevation rate, 2:1 fill slopes, and right shoulder widths. Part C of the AASHTO HSM provides a quantitative framework to evaluate the safety performance of a facility given certain data. However, the predictive methodology in the HSM, and the available Crash Modification Factors (CMFs) have technical limitations which include urban or rural location, number of lanes, and volume of traffic. The HSM was reviewed for CMF's applicable to evaluate the safety performance of the proposed nonstandard design features and no applicable CMF's were identified. A summary of HSM research conducted on the project is included in the project file.

Utilities

Existing utilities within the Build Alternative limits have been approximately located based on available as-built plans obtained from Caltrans, City, and local private utility companies. The following existing underground and overhead utilities have been identified as being within the Build Alternative area.

- Electric
- Communication
- Gas
- Water
- Storm Drain
- Sanitary Sewer

Determining responsibility for existing utilities that are within the State and City rights of way would follow State and Federal Regulations and Statutes. The project would be responsible for any relocation of existing utilities that are within their own easements or right of way. All utility information within this report would be verified with each corresponding utility agency during the final design phase and prior to construction. Existing utilities in conflict with the proposed retaining wall footings and improvements would be relocated. Further information can be found in the Utility Information sheets in Attachment J.

Stormwater

Stormwater best management practices (BMP's) have been considered during analysis of the project alternatives. A Storm Water Data Report cover is included as Attachment H. The approved Storm Water Data Report cover will be included in final Project Report that will be prepared after public circulation and review of the environmental document.

Erosion Control

Erosion control measures would be implemented as part of this alternative as prescribed in the Storm Water Pollution Prevention Plan (SWPPP) to meet quality discharge requirements. Examples of erosion control measures include but are not limited to hydroseeding, rock slope protection, erosion control blankets, use of straw and fiber rolls. A cost provision is included in the cost estimate to cover erosion control.

Landscaping

Landscaping will include replacement planting and irrigation of the graded area behind the back of the proposed sidewalk on the east side of Lincoln Boulevard between Jefferson Boulevard and the Ballona Creek bridge. The graded areas behind the back of proposed sidewalk throughout the remainder of the project will be revegetated with native, non-irrigated hydroseed.

Retaining Walls

Standard retaining walls are proposed to be constructed at ends of the Lincoln Boulevard Bridge and Culver Drive Bridge to minimize the grading footprint.

Noise Barriers

A potential masonry block sound wall is proposed on the east side of Lincoln Boulevard south of Ballona Creek as shown on the Layout Plan Sheet L-1 in Attachment C.

Non-motorized and Pedestrian Features

The proposed Project would improve connectivity and accessibility to the coastal areas of the west side for all modes of travel. The improvements on the Lincoln Bridge include widening the bridge to accommodate protected bicycle lanes, and sidewalks on both sides of the bridge. These bicycle and pedestrian improvements will extend between Jefferson Boulevard and Fiji Way.

High-Occupancy Vehicle Lanes

No high-occupancy vehicle lanes are proposed to be constructed as part of the project.

Railroad

There are no existing railroad facilities that will be affected by the project.

5B. Rejected Alternatives

Throughout the project development process, several alternatives were considered but not carried forward because they did not meet the project objectives or were not feasible because they would require additional right-of-way or would have significant impacts to the Ballona Wetlands Ecological Reserve (BWER). A brief overview of each alternative considered but eliminated from further analysis is provided below. It should be noted that although these alternatives were rejected as stand-alone alternatives, that ideas that would reduce impacts and still meet the purpose and need of the project have been integrated into the build alternative.

An Alternative that Considers Four Through-Lanes in Each Direction

In 2001, an Initial Study/Environmental Assessment was prepared and circulated for a project within the same project limits. That project would have widened Lincoln Boulevard in both directions to four through lanes between Fiji Way and Jefferson Boulevard. Also, that project would have removed and replaced the Ballona Creek bridge and the Culver Boulevard Overcrossing. An alternative including four through-lanes in each direction would increase vehicular capacity on Lincoln Boulevard. However, such an alternative would result in additional right-of-way needs from the adjacent BWER, wider bridges and additional impacts within Ballona Creek, and the resulting increased impacts that would be related to biological, cultural, and tribal cultural resources. This alternative was previously considered but not carried forward due to its environmental impacts to Ballona Creek and the Ballona Wetlands Ecological Reserve, as well as lack of support for that alternative from key stakeholders including the California Department of Fish and Wildlife and California Coastal Commission.

An Alternative that Completely Avoids the Ballona Wetlands Ecological Reserve (BWER)

The project team looked into design opportunities that would avoid impacts to the BWER and that would keep all project improvements within existing right-of-way. This alternative was analyzed but it was found that it is not possible to meet the Project Purpose to improve traffic operations and to serve transit, bicyclists and pedestrians and completely avoid the BWER. Many design refinements were identified and implemented in the preliminary design to minimize impacts to the BWER which include:

- Establish Caltrans R/W at back of sidewalk instead of at the grading limits to minimize BWER R/W requirements.
- Steepen fill slope ratios from 4:1 to 2:1 to minimize grading and R/W impacts to the BWER.
- Modify proposed Culver Loop intersection to minimize footprint and provide signalized controlled traffic movements and provisions for bicycle and pedestrian crossings.

An Alternative with Reduced Lane Widths

The Coastal Commission requested that an alternative be considered that avoids impacts to the BWER by restriping the road to 10-foot lanes and constructing bicycle lanes and sidewalks entirely within the existing R/W using the saved space. This recommendation would not avoid impacts to the BWER as providing sufficient space for future transit in the median would still require R/W from the BWER.

An Alternative that Limits Permanent Impacts to Only Previously Disturbed Areas

The Coastal Commission requested that an alternative be considered that uses the existing R/W along with only adjacent disturbed areas to satisfy the project's purpose and objectives. The proposed widening improvements have been designed to minimize the project footprint and impact only previously disturbed areas to the greatest extent possible.

An Alternative that Realigns Lincoln Boulevard to the West

To avoid impacts to a jurisdictional feature and potential ESHA that occurs within the Culver Ramp gore area, the PDT considered the desirability of an alternative that would realign Lincoln Boulevard to the west. This alternative was determined to be infeasible because it would require more right-of-way acquisition from the BWER than would the Build Alternative, particularly south of Ballona Creek where right-of-way is already reserved east of the existing alignment adjacent to the Fountain Park at Playa Vista Apartment Homes and adjacent Playa Vista developments that will generally accommodate the project.

An Alternative that Constructs a Bridge that Spans Ballona Creek

To avoid fill entirely within Ballona Creek would require a design was that would entirely span Ballona Creek. The increased span length would require an increase in the bridge structure depth and raise the profile of Lincoln Boulevard over eight feet in elevation. This would also require the profile of Culver Boulevard be raised over eight feet in elevation. These changes would increase the grading footprint and impacts to the BWER and therefore was eliminated from further consideration.

An Alternative that Constructs a Bridge Over Ballona Creek that accounts for a Worst-Case Sea Level Rise Scenario

The bridge over Ballona Creek has been designed to account for the worst-case Sea Level rise scenario.

An Alternative that Reconstructs Lincoln Boulevard as a Causeway

During the scoping period, comments were received that the project should consider reconstructing Lincoln Boulevard partially or wholly as an elevated causeway to minimize the roadway's existing and future biological, hydrological, and floodplain impacts. The proposed roadway vertical profile has been raised for the majority of the project limits between Jefferson Boulevard and Fiji Way, where the proposed project joins the existing roadway improvements, which is consistent with the comment recommendation.

An Alternative that Includes a Left Turn from the Culver Loop onto Southbound Lincoln Boulevard

This recommendation has been implemented by the City of Los Angeles and will be retained as part of the proposed project.

An Alternative that Provides Bicycle and Pedestrian Improvements Only

Implementation of an alternative that would construct bicycle and pedestrian improvements solely along Lincoln Boulevard between Fiji Way and Jefferson Boulevard was considered for this project. This alternative would partially accomplish the project's purpose and need by improving safety and mobility for bicyclists and pedestrians but would not achieve a consistent roadway geometry as it would not construct an additional southbound lane along Lincoln Boulevard and would result in an increase in Vehicle Miles Traveled (VMT). Similarly, this alternative would not improve mobility for transit vehicles in the short term and would not help to facilitate future high-quality transit within the project corridor. Therefore, this alternative was eliminated from further consideration.

An Alternative that Implements Transportation System Management/ Travel Demand Management Improvements Only

A stand-alone alternative featuring Transportation System Management (TSM) and Travel Demand Management (TDM) improvements alone was considered as an alternative for the project. Collectively, TSM and TDM describe a series of strategies that can be implemented to maximize the efficiency of the existing transportation system by reducing the dependence on single occupant vehicles. TSM and TDM are typically low-cost measures to reduce travel demand and/or improve the utilization of existing transportation facilities. TSM focuses on increasing the person-trip capacity of existing transportation systems through techniques such as restriping roadways for channelization, ramp metering, establishing auxiliary lanes, and providing freeway service patrol. TDM techniques focus on influencing an individual's travel behavior by reducing the demand for single occupant vehicle travel, especially during peak commute periods including such strategies as preferential parking for carpoolers, teleconferencing and advanced communication technology. Several TSM strategies have been incorporated into the project, including the addition of and improvements to bicycle and pedestrian facilities, and improvements to signal timing. The project alternatives have also been crafted to improve transit operations along the corridor in the short term as well as to facilitate future implementation of a higher-quality transit service at some time in the future. However, on their own TSM and TDM strategies would not achieve the purpose and need of the project. Therefore, this alternative was eliminated from further analysis as a stand-alone alternative.

Other Alternatives that Make Improvements to Alternate Corridors

Lincoln Boulevard is the only continuous north/south route connecting Venice, Marina del Rey, Playa Vista, and the Westchester areas between the Pacific Ocean in the west and Centinela Avenue in the east. Therefore, few alternative sites are possible that would accomplish the project purpose and need while also avoiding right-of-way and other environmental impacts. As part of the project's 2001 project development process, the following improvements to existing north/south corridors were considered but ultimately rejected. The same decision-making rationale is still true in the current condition.

Widening of Pacific Avenue

This alternative would involve widening of Pacific Avenue from Washington Boulevard to Vista del Mar. A benefit of this alternative is that it would entirely avoid the BWER. However, this option would require additional right of way on both sides of Pacific Avenue and a new high-level bridge over the entrance to Marina del Rey as well as over Ballona Creek. This alternative would result in significant residential and community impacts, as well high costs relative to its benefits. The traffic on Lincoln Boulevard could use this improved Pacific Avenue corridor, thus reducing some traffic congestion in the project area. However, this alternative is not cost effective to reduce projected future congestion levels and congestion related collisions in the project area. Also, it would not improve conditions for pedestrian and bicyclists or transit vehicles along Lincoln Boulevard. Therefore, it is rejected as an alternative to the proposed project.

Widening of Centinela Avenue

The widening of Centinela Avenue, which is an existing north/south arterial street east of Lincoln boulevard, from north Jefferson Boulevard to Venice Boulevard was considered. A benefit of this alternative is that it would entirely avoid the BWER, although it would still require work within Ballona Creek. A primary difference between Centinela Avenue and Lincoln Boulevard is that Centinela Avenue terminates at Washington Boulevard in the north and would therefore not provide the same connectivity benefits as improvements along Lincoln Boulevard. In addition, this alternative would require additional right of way and would have a significant residential and commercial impacts, leading to a high project cost for this alternative. Furthermore, the widening of Centinela Avenue would not serve the purpose and need of the project, including eliminating the southbound lane drop and improving multimodal connectivity and safety in proximity to Lincoln Bridge. Therefore, this alternative was eliminated from consideration.

Widening of Inglewood Boulevard

Widening of Inglewood Boulevard was eliminated for the same reasons as listed above for Centinela Avenue. Given its distance further east, it would achieve even fewer project objectives than improvements to Centinela Avenue would.

Widening of I-405 (San Diego Freeway)

Widening of I-405 was also previously analyzed and dismissed due to right of way constraints, as well as its lack of ability to fulfill the project purpose and need. This alternative would avoid biological and coastal resources; however, it would not be able to provide greater multimodal connectivity between Marina del Rey, Playa del Rey, Westchester, and other coastal communities nearer to Lincoln Boulevard.

6. CONSIDERATIONS REQUIRING DISCUSSION

6A. Hazardous Waste

An Initial Site Assessment (ISA) was prepared for Los Angeles Department of Transportation (LADOT) for the State Route 1 (Lincoln Boulevard) Multimodal Improvement Project in the City of Los Angeles, Los Angeles County, California. The ISA was conducted in general accordance with the scope of work, under guidance provided by the ASTM E1527-13 standard. The information procured during this investigation was used to identify, to the extent practical RECs associated with the Site due to current or past land use. Based upon information obtained during the course of this ISA, Caltrans site evaluation criteria, Caltrans has determined that the following present RECs/HRECs to the project and warrant site investigations:

Acquisition of a small portion of land (4224-009-905) located on the northeast portion of a vacant parcel (formerly Tosco/Unocal/76 Station #5071 facility) is proposed as part of the Project to accommodate widening of Lincoln Boulevard. The underlying ground water has been reportedly impacted by a historic release of VOCs and TPH. The facility was granted closure in April 2013. This is considered a HREC. Site investigation is required to determine current conditions because the parcel will be partially acquired for the project and the State may have liability for the contamination.

Partial acquisition of a several parcels of land (APNs: 4211-007-920, 4211-007-910, 4211-015-900 and 4211-015-903) for use as a TCE and/or permanent easement was noted as historically utilized as part of the Pacific Electric Railway, which ran along the current pathway of Culver Boulevard circa 1924 through circa 1952. Railroads are commonly associated with a variety of contaminants, including herbicides, heavy metals, petroleum products, VOCs, semi-volatile organic compounds (SVOCs), and asbestos.

A partial ROW and TCE parcel (APN 4211-016-900), located on the southwest limits of the Project northwest of Culver Boulevard and Lincoln Boulevard, was listed as a land disposal site known as the Celery Dump. Celery Dump was located south of the partial ROW take, immediately south of Lincoln Boulevard. This is considered a HREC because of the contamination detected on the site.

The area of partial acquisition and TCE at APN 4211-007-900 was observed to be utilized as a stormwater channel known as the Fiji Ditch/Marina Ditch, which drains to the Ballona Creek further south. There is the potential for contaminants to be contained in stormwater conveyance features.

The Project footprint has been utilized as major roadways, Lincoln Boulevard, since circa 1938, and Culver Boulevard, since circa 1963. There is the potential for aerially deposited lead (ADL) to be present in undisturbed areas of soil within the Project footprint originating from historic leaded gasoline emissions, which include areas of undisturbed soil immediately north, south, northeast, and southwest of Lincoln Boulevard and areas north and south of Culver Boulevard.

The Lincoln Boulevard Bridge and the Culver Boulevard Overpass were constructed by at least 1938. It is possible that asbestos-containing materials (ACMs) were used in components of the bridge structures and that lead-based paint (LBP) was applied during bridge construction or operations.

The Project area was found to be within a Methane Zone designated by the City of Los Angeles Department of Building and Safety. Additionally, a previous archeological record for a surrounding site located at the intersection of Lincoln Boulevard and Jefferson Boulevard indicated the presence of methane and hydrogen sulfide gas during an archeological survey.

Guardrails and signs exist at multiple locations within the Project area. At least eleven wooden poles were identified on the northern and southern side of Lincoln Boulevard between the two Ballona Wetland Ecological Reserve areas, north of the Ballona Creek. These structures are assumed to contain treated wood. Treated wood is typically treated with hazardous preserving chemicals that protect the wood from insect predation and fungal decay during its use.

Yellow striping exists along the roadways throughout the Project footprint within Lincoln Boulevard, the Culver Boulevard loop off-ramp, and along Culver Boulevard. It is assumed that the striping contains lead and chromium.

Recommendations

Following are recommendations based on the findings of the ISA: Three shallow borings to 5 ft bags should be advanced within the TCE located at 4801 Lincoln Boulevard (APN 4224-009-905). This property was formerly the Tosco/Unocal/76 Station #5071 facility that experienced a release of petroleum products. Soil samples should be collected and analyzed for TPH, VOCs, and metals in accordance with an approved work plan.

A limited shallow site investigation (SI) is recommended for the TCE and ROW acquisition areas previously encompassing Pacific Electric Railway (APNs: 4211- 007-920, 4211-007-910, 4211-015-900 and 4211-015-903) to evaluate the presence of potential contaminants originating from railroad land use. Railroad contaminants including metals, petroleum hydrocarbons, herbicides, VOCs, SVOCs, and asbestos should be analyzed in samples collected from ADL borings along the former railroad alignment.

Utility structures requiring removal prior to Project construction should have a SI performed for hazardous materials and petroleum products. Removal should be completed in accordance with applicable laws and regulations. Transformers should be removed by the utility that operated the equipment prior to construction.

Groundwater encountered during construction must be tested to determine quality and impact on construction, disposal options or National Pollutant Discharge Elimination System (NPDES) permit discharge limitations, and health and safety requirements. Additionally, groundwater is to be sampled for all acquisition parcels. Caltrans requires SI for all acquisitions including soil and groundwater sampling. This includes the 19 parcels proposed for 19 TCEs and 9 partial ROW acquisitions.

An SI Work Plan and Health and Safety Plan must be prepared in accordance with District 7 requirements for review and approval by the Office of Environmental Engineering prior to performing the work.

The Site has been utilized as major roadways, Lincoln Boulevard, since circa 1938, and Culver Boulevard, since circa 1963. There is the potential for aerially deposited lead to be present in undisturbed areas of soil within the Project footprint originating from historic leaded gasoline emissions. An ADL Site Investigation should be conducted prior to Project construction. The ADL Site Investigation report would classify soil in accordance with hazardous waste criteria and provide recommendations for soil management.

A hazardous materials survey is required for any structures that are potentially impacted by ACMs or LBP. This includes Lincoln Bridge over Ballona Creek, Culver Bridge over Lincoln Boulevard, and the remnants of a Pacific Electric Railway bridge that are immediately north of the Culver Bridge overcrossing and flank Lincoln Boulevard. The survey should be conducted under the oversight of a California Division of Occupational Safety and Health (Cal/OSHA) Certified Asbestos Consultant (CAC) and California Department of Public Health (CDPH) lead Inspector/Assessor and will serve to confirm the presence or absence of ACM and LBP through collection of bulk samples and laboratory analysis. Project special provisions should be prepared that direct the contractor on the management of hazardous building materials during construction.

A site health and safety plan should be prepared by the contractors prior to any field work and should consider potential expose of site workers to potential methane and/or hydrogen sulfide gas, which was observed at a surrounding site. The plan should include monitoring and control measures.

Treated wood waste will need to be appropriately managed as described in Section 12.

Generation of hazardous waste through the removal of street lighting and signal and electrical components (i.e., bulbs or LED bulbs, timers, switches, sensors, circuit boards, etc.) are to be disposed of in accordance with applicable laws and regulations.

6B. Value Analysis

Caltrans and the City of Los Angeles will determine if a Value Analysis will be conducted for the project after approval of the EIR/EA.

6C. Resource Conservation

Energy consumption would be reduced by the reduction of congestion on local streets and freeway ramps. The potential recycling of existing asphalt concrete would be investigated during the design phase of the project along with other potential ways to conserve resources during construction.

6D. Right-of-Way Issues

The proposed project is a widening of the existing Lincoln Boulevard roadway. The proposed right-of- way will be located at the back of sidewalk to minimize project right of way requirements and permanent impacts to the BWER. Roadway grading will be constructed in temporary construction easements. Attachment J shows the location, ownership, and areas of the proposed right-of-way acquisition.

The City of Los Angeles and California Department of Fish and Wildlife are discussing the potential of a right of way exchange in lieu of a purchase of right of way required for the project. In concept, the City of Los Angeles would exchange 1.19 acres of their property located east of the Culver Loop to compensate for the 1.19 acres of the BWER property that would be required to widen Lincoln Boulevard. This and other right of way activities would occur during final design of the project which is subsequent to PA&ED.

6E. Environmental Compliance

A Draft Environmental Impact Report (DEIR) and Environmental Assessment (EA) has been prepared in accordance with Caltrans' environmental procedures, as well as State and Federal environmental regulations.

A open house workshop will be held to provide an overview of the proposed project, environmental studies, and receive comments during the circulation of the DEIR/EA. Following public review of the DEIR, all comments received will be considered. A full and careful review of all responses to comments, as well as the results of any remaining analysis, would be completed. After the public circulation period, the Project Development Team would select a Preferred Alternative, and Caltrans would make the final determination of the project's effects on the environment.

Based on the preliminary results of the PEAR, technical studies were prepared during this PA/ED phase to determine, evaluate, and address potential impacts from the proposed project. The reports prepared are:

- Air Quality Study
- Cultural
    - Extended Phase I (XPI)
    - Historic Property Survey Report (HPSR)
    - Archeological Survey Report (ASR)
    - Historical Resources Evaluation Report (HRER)
- Natural Environment Study
- Noise Study
- Paleontological
- Phase I ESA
- Sea Level Rise/Hydrology
- Traffic Study

- Visual Impact Assessment:

6F. Air Quality Conformity

The project alternative is fully compatible with the design concept and scope described in the 2020RTP/SCS.

6G. Title VI Considerations

The project incorporates provisions for low mobility and minority groups by providing sidewalks in both directions of travel throughout the limits of the project from Jefferson Boulevard to Fiji Way. American with Disabilities Act (ADA) compliant curb ramps will be constructed at the Culver Drive/ Lincoln Boulevard signalized intersection with pedestrian push buttons to initiate the pedestrian crosswalk. The Culver Loop/Culver Dive intersection will be reconstructed to replace high speed ramp connections with dedicated right turn lanes, sidewalks, curb ramps and high visibility cross walks.

6H. Noise Abatement Decision Report

This section represents the Noise Abatement Decision Report (NADR) which:

- Is an evaluation of the reasonableness and feasibility of incorporating noise abatement measures into this project;

- Constitutes the preliminary decision on noise abatement measures to be incorporated into the Draft Environmental Document (DED) (if applicable); and

- Is required for Caltrans to meet the conditions of Title 23 Code of Federal Regulations, Part 772 in accordance with the Federal Highway Administration noise standards.

The Noise Study Report for this project was prepared by Michelle A. Jones, Principal Engineer on 2/15/2023 and approved by Jin S. Lee, P.E., Branch Chief/ Noise & Vibration Branch, Office of Environmental Engineering, Division of Environmental Planning on 3/20/2023.

The project area was reviewed to identify land uses that would be subject to traffic and construction noise impacts from the proposed project. Aerial and digital mapping, street views in Google Maps and field photographs of the project area were used to identify noise sensitive land uses. Sensitive receivers were identified in those areas where frequent outdoor human use would occur, such as multi-family residences and parks and recreation facilities. These sensitive receivers fall into FHWA and Caltrans NAC Activity Categories B and C, each with an activity level of 67 dBA Leq (Equivalent Continuous Sound Pressure Level). Land uses near Lincoln Boulevard consist of multi-family residences and a park. Existing noise levels in the proposed project area range from 43 to 70 dBA Leq (Equivalent Sound Level). Existing traffic noise levels were found to exceed the applicable NAC at representative residential receiver locations on the east side of Lincoln Boulevard, south of Ballona Creek.

Future Traffic Noise Impacts

Under the 2045 No-Build Alternative no improvements would be constructed. The traffic noise modeling results for the design-year 2045 No-Build Alternative range from 43 to 70 dBA Leq, Noise levels for design-year 2045 No-Build conditions are expected to increase up to 1 dB over existing noise levels. This increase is due to an increase in traffic volumes from Existing to future 2045 No-Build conditions. Noise levels at evaluated receivers under 2045 No-Build conditions exceed their respective NAC Activity Category standard.

Build Alternative - The 2045 design-year traffic noise modeling results for the Build Alternative range from 44 to 72 dBA Leq. Noise levels for the design year under the Build Alternative are expected to increase up to 2 dB over design-year 2045 No-Build noise levels. Noise levels exceed their respective NAC Activity Category standard. The proposed project will cause a noise impact to the surrounding area.

Balconies of the multi-family residential units are the frequent outdoor human use areas located along Lincoln Boulevard near Ballona Creek represented by Receivers R1-g, R1-u, R2-g, R2-u, R3-g and R3-u. in the Noise Study Report. No existing wall currently shields these receivers from noise generated from Lincoln Boulevard. However, existing noise levels at some of the outdoor frequent human use areas at this location currently exceed the NAC and would continue to exceed under the No- Build condition. The Build Alternative would slightly increase noise levels compared to No- Build conditions and would continue to exceed the NAC; therefore, a noise abatement evaluation was prepared.

Barrier NB-1 was evaluated along the right of way (ROW) line of Lincoln Boulevard. This is the closest location to Project noise generators for barrier placement. Barrier NB-1 was found to be effective in achieving a minimum 5-dB reduction at a wall height of 10 feet for Receiver R1-g. The Caltrans design goal of 7-dB was achieved at a height of 16 feet for Receiver R1-g. Receivers R1-u and R2-u meet the Caltrans minimum 5-dB reduction at a wall height of 14 feet. Only Receiver R1-u was able to achieve the Caltrans design goal of 7-dB at a height of 16 feet. The following table summarizes the calculated noise reductions and reasonable allowances for each sound wall height.

Table 9: Summary of Reasonableness Determination Data - Barrier NB-1

Barrier ID: **NB-1**						
Predicted Noise Level without Noise Barrier						
Receiver: R-1						
Design Year Noise Level dBA L_{eq}(h): 70						
Design Year Noise Level Minus Existing Noise Level:						
Barrier Heights	**6-feet**	**8-feet**	**10-feet**	**12-feet**	**14-feet**	**16-feet**
Barrier Noise Reduction, dB			5	6	6	7
Number of Benefited Residences			10	20	20	20
Reasonable Allowance Per Benefitted Residence			$107,000	$107,000	$107,000	$107,000
Total Reasonable Allowance			$1,070,000	$2,140,000	$2,140,000	$2,140,000
Note: Shaded Areas-Noise Barrier does not provide a 5-dB noise reduction						

The Noise Study Report conducted for the project identifies one 350 foot long, 16-foot-high sound wall along the easterly back of sidewalk south of Ballona Creek that will benefit 20 residences with a reasonable budget of $2,140,000. The preliminary cost estimate for the soundwall included in the project cost estimate is approximately $500,000 including contingencies.

The preliminary noise abatement decision presented in this report is based on preliminary project alignments and profiles, which may be subject to change. As such, the physical characteristics of noise abatement described herein also may be subject to change. If pertinent parameters change substantially during the final project design, the preliminary noise abatement decision may be changed or eliminated from the final project design. A final decision to construct noise abatement will be made upon completion of the project design. The preliminary noise abatement decision presented here will be included in the draft environmental document, which will be circulated for public review.

6I. Life Cycle Cost Analysis

A Capital Preventive Maintenance (CAPM) Project ID 0716000090, Contract No. 07-325804 has been designed and the schedule for construction is pending. Within the limits of this project the CAPM project would reconstruct the Jefferson Boulevard intersection with PCC and pedestrian ramps at all four curb returns. Pedestrian ramps will be reconstructed at all four curb returns at the Fiji Way intersection. Pavement construction would cold plane 0.2 feet of existing AC pavement and resurface with 0.2 RHMA-Gap Graded. The pavement structural section for the widening and reconstruction of Lincoln Boulevard and Culver Boulevard proposed for this project is 0.5 feet of RHMA over 1.5 feet of Aggregate Base.

6J. Reversible Lanes

Reversible lanes have been considered in the development of the project and are not proposed for the following reasons:

- The length of the project is approximately 2,800 feet with three signalized intersections which is not sufficient for the transitioning of reversible lanes within the project limits.
- The existing and forecast traffic volumes do not support eliminating the existing southbound lane drop chokepoint from the Project. Implementing reversible lanes would only move the chokepoint from one direction of travel to the other direction of travel and would not eliminate the existing operational deficiency.

7. OTHER CONSIDERATIONS AS APPROPRIATE

Public Hearing Process

A Notice of Preparation (NOP) of a Draft Environmental Impact Report for the SR-1 Lincoln Boulevard Multi-Modal Improvement Project was issued for public review and comment on March 15, 2018. A Public Scoping meeting was held on March 28, 2018. A open house workshop will be held to provide an overview the proposed project, environmental studies, and receive comments during the circulation of the DEIR/EA.

Permits

A list of anticipated permits and approvals required for this project which includes but is not limited to the following:

- California Department of Fish and Wildlife (CDFW) Section 1602 Agreement for Streambed Alteration

- State Water Resources Control Board (SWRCB) National Pollutant Discharge Elimination System (NPDES) construction general permit
- SWRCB NPDES Caltrans storm water permit
- Regional Water Quality Control Board (RWQCB) (Region 4) NPDES MS4 Permit
- RWQCB Section 401 Certification
- City of Los Angeles Approval of Standard Urban Storm Water Mitigation Plan (SUSMP)
- City of Los Angeles Certification of Right-of-Way
- Caltrans Approval of Mitigated Negative Declaration
- Caltrans Project Report Approval
- Coastal Development Permit

Cooperative Agreements

The current cooperative agreement is already in place between the City and Caltrans that covers the PA&ED phase of this project.

Transportation Management Plan

The Transportation Management Plan (TMP) considers and provides mitigation for the impacts that construction activities would have on Lincoln Boulevard, Culver Boulevard, and adjacent facilities. The TMP also considers using the following strategies to further mitigate construction impacts:

- Public awareness campaign in advance of and during construction
- Use of real-time communications with motorists such as changeable message signs and highway advisory roadway announcements to alert motorists of upcoming construction activities, detours, and travel conditions
- Comprehensive Stage Construction and Traffic Handling Plans
- Regional coordination with the City of Los Angeles regarding construction activities that impact the corridor.
- All construction activities would be closely coordinated with other construction projects that are occurring.

The TMP Data Sheet is included as Attachment N.

Stage Construction

The widening of Lincoln Boulevard from Jefferson Boulevard to Fiji Way and the replacement of the Culver Boulevard grade separation structure over Lincoln Boulevard will require traffic detours and staging to keep Lincoln Boulevard open to motorists and emergency vehicles at all times during construction. The County of Los Angeles desires that the Ballona Creek Bike Path along the north levy of Ballona Creek remain open at all times during construction of the project.

Short term closures of the bike path may be required during the removal of the existing bridge and the north abutment and during erection of new bridge girders near the path.
Following is a description of the anticipated three stages of construction:

Stage 1- Construct the Culver Boulevard/Lincoln Boulevard Separation Structure:

This will be done as the first stage to provide the ability for existing traffic on Lincoln Boulevard to be shifted to the east side of the new Lincoln Boulevard bridge over Ballona Creek during Stage 3. This bridge construction will necessitate the closure of Culver Boulevard between the connector loop road intersection and Jefferson Boulevard intersection to minimize impacts to the Ballona Wetlands Ecological Reserve. All traffic from this segment of Culver Boulevard would use Jefferson Boulevard to the Lincoln Boulevard intersection. From this intersection, two detour routes would be signed well in advance to suggest drivers take the alternative routes of either:

- Lincoln to Culver to SR-90
- Jefferson to Centinela

This stage would be completed with construction of the revised Culver Boulevard Loop Connector Ramps.

Stage 2 – Construct Widening on East Side of Lincoln Boulevard

A. Open traffic on Culver Boulevard and Culver Boulevard Loop Connector Ramps.
B. Shift traffic to the westerly edge of Lincoln Boulevard pavement to provide work area for east side widening.
C. Lower the bike trail profile on the north side of Ballona Creek.
D. Construct east side of Lincoln Bridge over Ballona Creek.
E. Relocate existing utilities from the existing Lincoln Bridge to new east side of Lincoln Bridge.
F. Construct new Culver Boulevard connector loop intersection with Lincoln Boulevard
G. Construct the east side widening of the Lincoln Boulevard from Jefferson Boulevard to Fiji Way.
H. Relocate overhead utility poles on the east side of Lincoln Boulevard.

Stage 3 – Construct Widening on West Side of Lincoln Boulevard

A. Shift traffic to the easterly edge of Lincoln Boulevard pavement to provide work area for west side widening.
B. Remove existing Lincoln Boulevard bridge.
C. Construct west side of Lincoln Bridge over Ballona Creek.
D. Construct the west side widening of the Lincoln Boulevard from Jefferson Boulevard to Fiji Way.
E. Relocate overhead utility poles on the west side of Lincoln Boulevard.

Temporary railing (type K) and striping would be utilized to shift traffic and protect construction workers and the public. Final roadway overlays and striping would likely occur with limited, short-term closures or reduced travel lane restrictions. Stage Construction and Traffic Handling plans would be developed and approved through the project design process as noted above.

Accommodation of Oversize Loads

Vehicles traveling on SR-1 Lincoln Boulevard would be subject to the existing restricted vertical clearance of 14'-8" until the Culver Dive bridge is reconstructed as one of the first construction activities with a minimum vertical clearance of 15 feet.

Graffiti Control

Lincoln Boulevard is in a suburban area of Los Angeles County. Some existing surrounding retaining walls have architectural treatments applied and anti-graffiti treatments should be considered as deterrent for the proposed bridge abutment walls and potential sound wall.

8. FUNDING, PROGRAMMING AND ESTIMATE

Funding

It has been determined that this project is eligible for Federal-aid funding. Funding for project development will include the Los Angeles' Coastal Transportation Corridor Specific Plan fee program and other City funding sources.

Programming

Fund Source	Fiscal Year Estimate								
20.XX.###.###	Prior	22/23	23/24	24/25	25/26	26/27	28/29	Future	Total
Component	In thousands of dollars ($1,000)								
PA&ED Support	1,500	500	600						2,600
PS&E Support				3,100	2360				5,460
Right-of-Way Support				312	312				624
Construction Support						910	910	910	2,730
Right-of-Way					21,334				21,334
Construction						25,000	27,762	25,000	77,762
Total	1,500	500	600	3,412	24,006	25,910	28,672	25,910	110,510

The support cost ratio is 11.4%

Estimate

The Estimated cost for Alternative 1 is $111M which includes $21.3M in R/W acquisition costs and $11.4M in support cost. See attachment G for Draft Project Report cost estimate.

9. DELIVERY SCHEDULE

The following project milestone scheduled delivery dates are preliminary and intended for planning purposes only:

Project Milestones		Milestone Date (Month/Day/Year)	Milestone Designation (Target/Actual)
BEGIN ENVIRONMENTAL	M020	03/15/2018	Actual
CIRCULATE DED EXTERNALLY	M120	05/07/2024	Target
PA & ED	M200	10/04/2024	Target
PS&E TO DOE	M377	12/01/2025	Target
DRAFT STRUCTURES PS&E	M378	03/01/2026	Target
RIGHT OF WAY CERTIFICATION	M410	06/01/2026	Target
READY TO LIST	M460	09/01/2026	Target
FUND ALLOCATION	M470	12/01/2026	Target
CITY ADVERTISE	M480	02/01/2027	Target
AWARD	M495	05/01/2027	Target
APPROVE CONTRACT	M500	07/01/2027	Target
CONTRACT ACCEPTANCE	M600	12/30/2029	Target
END PROJECT	M800	06/01/2030	Target

10. RISKS

Risk management activities were conducted by the Project Engineer for the project. Based on the project size, these activities include an informal qualitative risk analysis for the project. The main risks for this project are Coastal Development Permit approval, potential right of way exchange between the City and CDFW, and funding. The risk register shall be established and maintained throughout the project lifecycle to help increase project delivery success. Other risks shall be monitored and/or dealt with during the PS&E design process. See Attachment K for the Risk Register.

11. EXTERNAL AGENCY COORDINATION

This project is not to be funded by Federal funds and therefore it is not identified as a Project of Division Interest with FHWA.

12. PROJECT REVIEWS

Scoping team field review ____ N/A
District Program Advisor ____ N/A
Headquarters SHOPP Program Advisor ____ N/A
District Maintenance ____ Scott Sylvan
Headquarters Project Delivery Coordinator ____ Robert Navarro
Project Manager ____ Shabbir Ahmed
FHWA ____ N/A

District Safety Review ____________________ Jamal Fakih
Constructability Review ___________________ Kyle Kunitake
District Design Liaison ___________________ Van Buu Tran

13. PROJECT PERSONNEL

Name	Title	Phone Number
Shabbir Ahmed	CT Project Manager	213-760-7329
Yessuf Tegegne	CT Oversight Design Manager	213-266-6751
Farzana Huda	CT Transportation Engineer-Office of Design C	213-269-1355
Karl Price	CT Sr. Environmental Planner	213-266-3822
Robert Sanchez	City Project Manager	213-485-1062
Tim Hayes	Psomas Design Manager	213-223-1457
Paul Gervacio	Psomas Project Engineer	213-223-1400

14. ATTACHMENTS

A. Vicinity Map

B. Typical Cross Sections

C. Layout Plans

D. Profile Plans

E. Drainage Plans

F. Utility Plans

G. Preliminary Cost Estimate

H. Storm Water Data Report Cover Sheet

I. Draft Environmental Impact Report and Environmental Assessment Cover Sheet

J. Right-of-Way Data Sheet and Requirements Exhibit

K. Risk Register

L. Traffic Engineering Study

M. Right-of-Way Requirements Exhibit

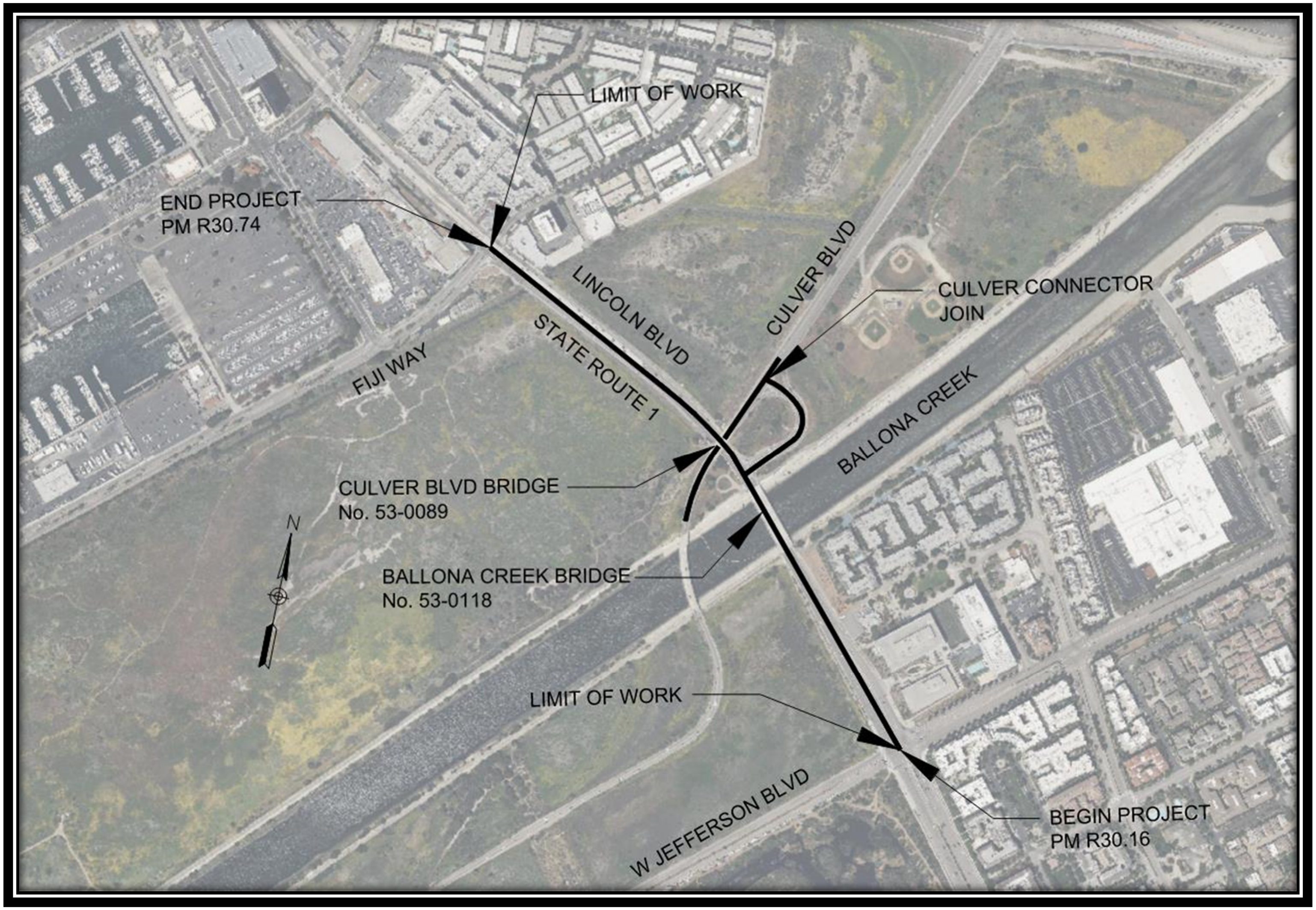
N. Transportation Management Plan (TMP) Data Sheet

O. Lincoln Boulevard Advanced Planning Study (APS)

P. Culver Boulevard Advanced Planning Study (APS)

Q. Lincoln Bridge Multi-Modal Bridge Improvements Hydraulics Study

A. Vicinity Map



VICINITY MAP

On State Route 1 between Jefferson Boulevard and Fiji Way

B. Typical Cross Sections

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
07	LA	001	R30.16/R30.74		

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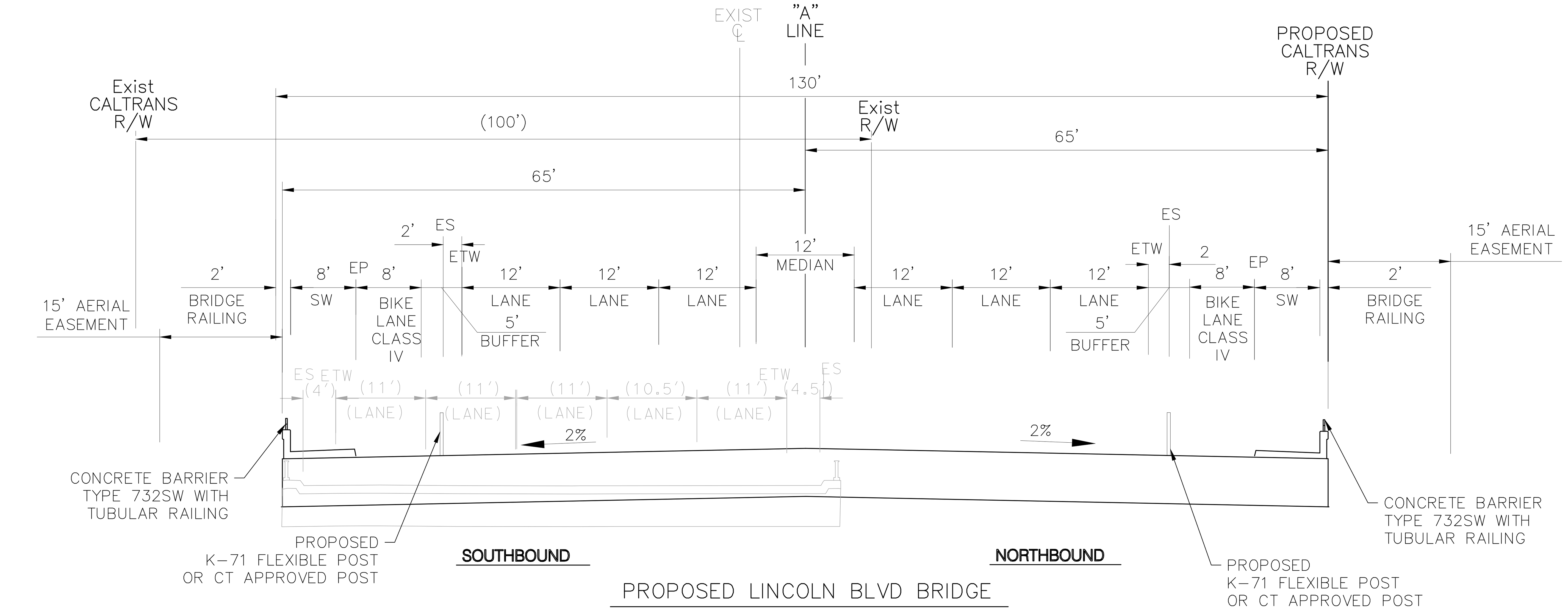
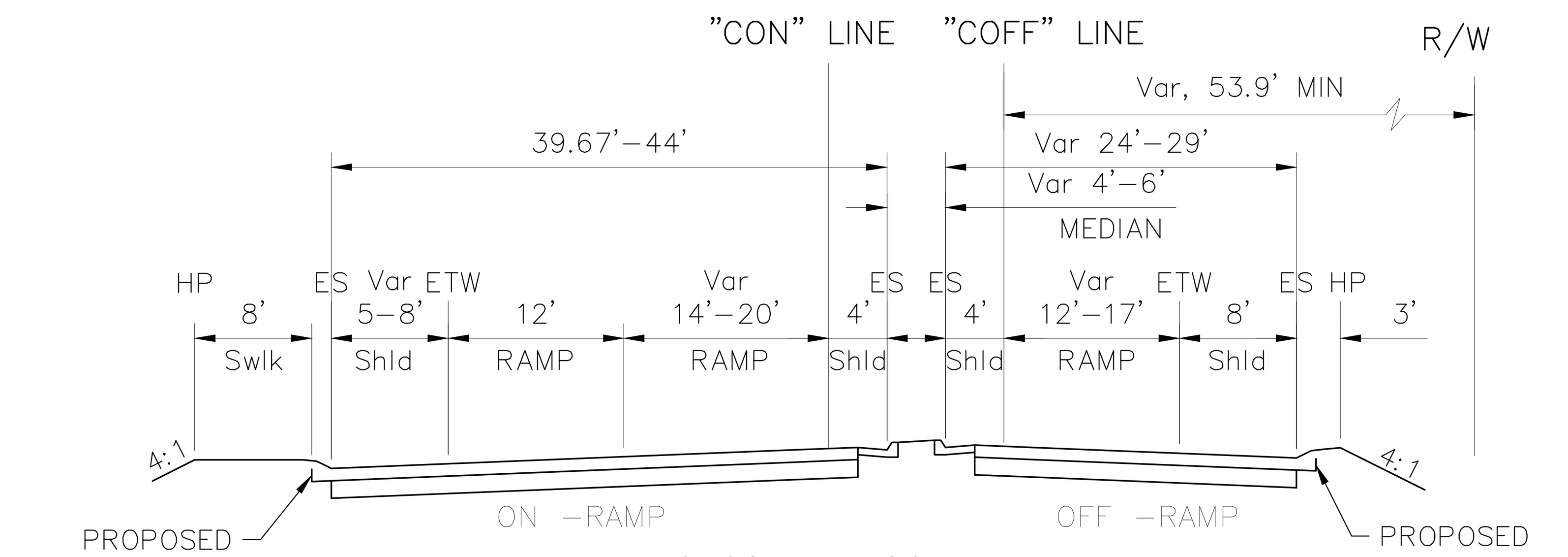
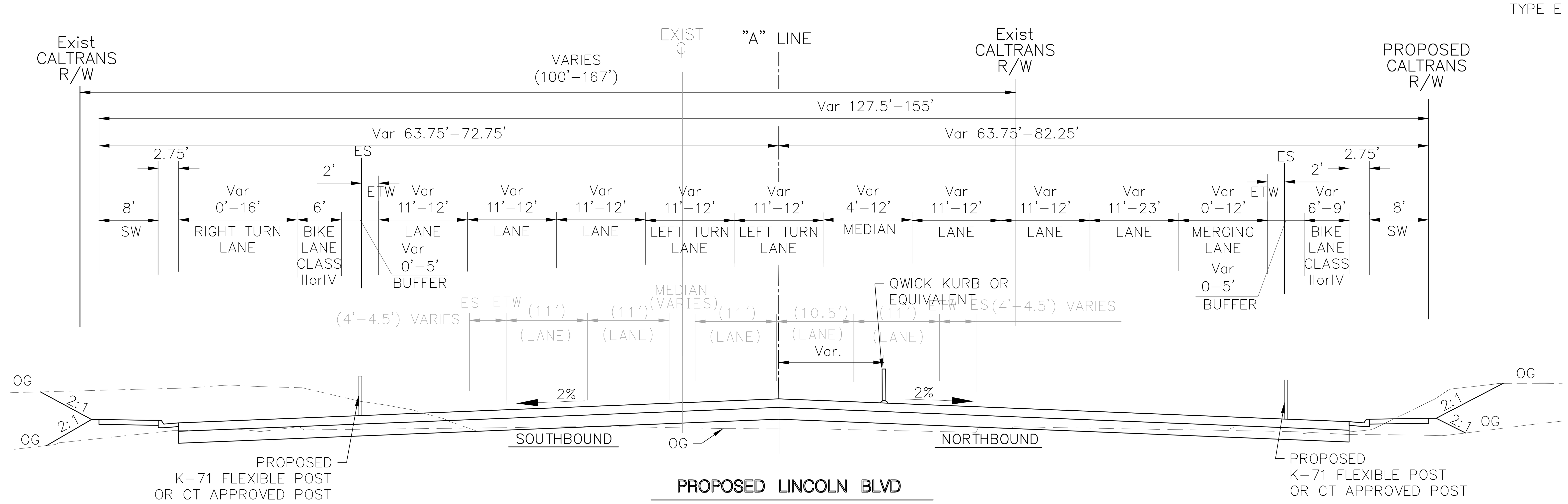


PROPOSED LINCOLN BLVD BRIDGE

STA 60+39.32 TO 64+34.32
Br NO. 53-0118

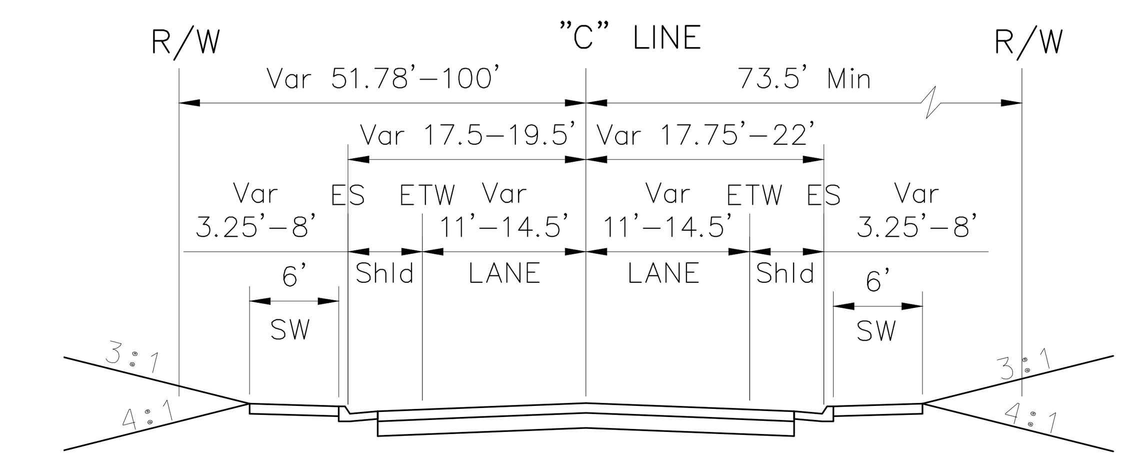


PROPOSED LINCOLN BLVD ON-RAMP AND OFF-RAMP



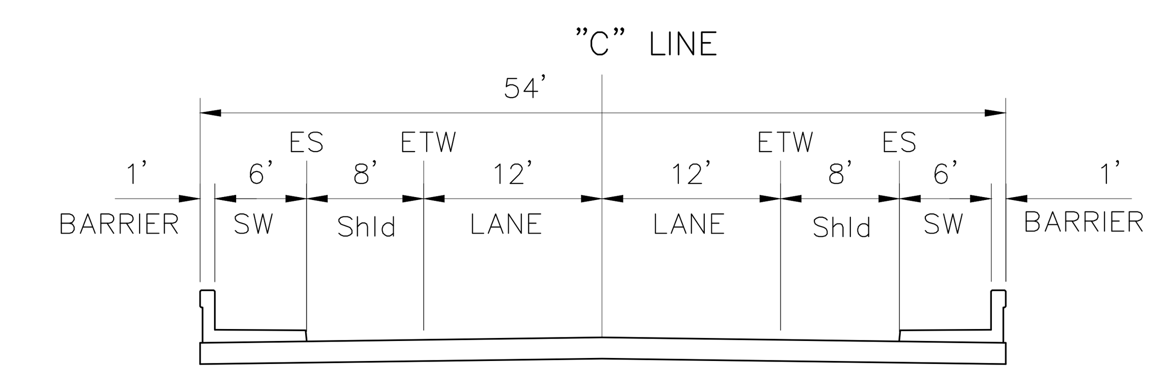
PROPOSED LINCOLN BLVD

STA 50+74.10 TO 58+47.57



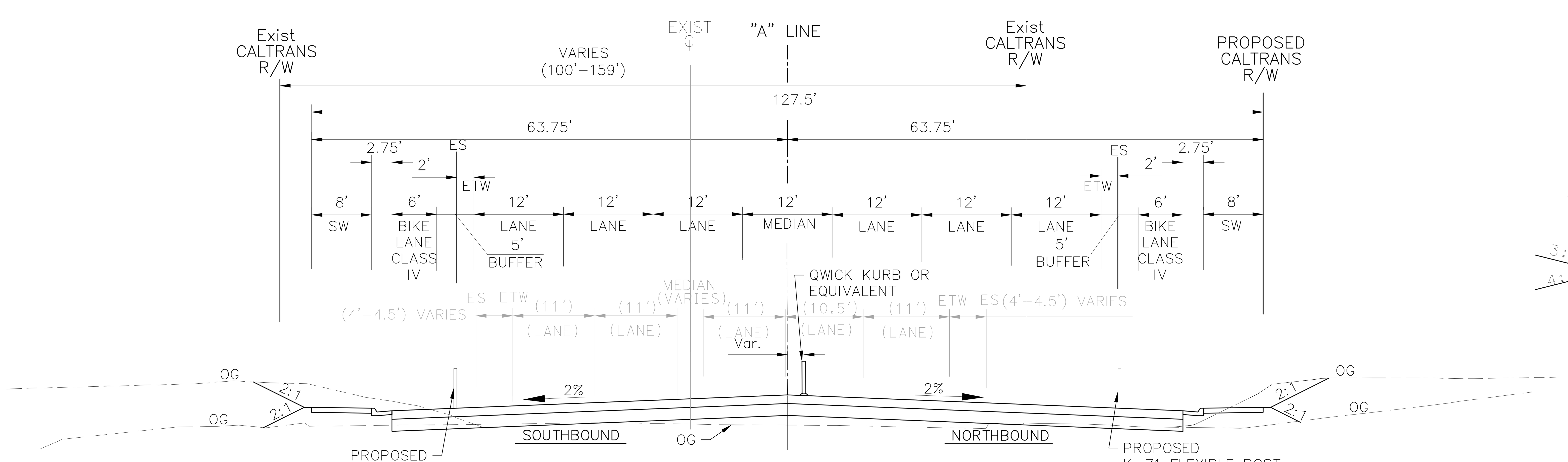
PROPOSED CULVER BLVD

STA 104+17 TO 107+91.75
WEST OF LINCOLN BOULEVARD



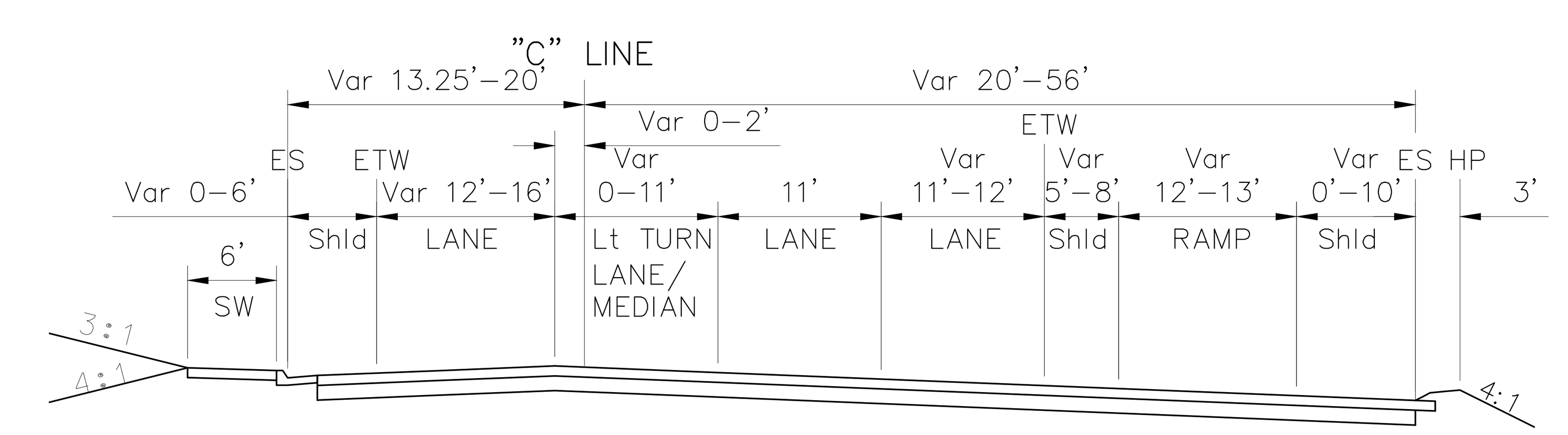
PROPOSED CULVER BLVD OVERCROSSING

STA 107+91.75 TO STA 109+91.75
Br NO. 53-0069



PROPOSED LINCOLN BLVD

STA 58+47.57 TO 60+39.32
STA 64+34.32 TO 78+05.82



PROPOSED CULVER BLVD

STA 109+91.75 TO 117+17.44
EAST OF LINCOLN BOULEVARD

LINCOLN BLVD IMPROVEMENT TYPICAL SECTIONS EA 07-33880

NOT TO SCALE

XS-1

September 28, 2022

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

CONSULTANT FUNCTIONAL SUPERVISOR

CALCULATED-DESIGNED BY | CHECKED BY

REVISED BY | DATE REVISED

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LAST REVISION 00-00-00

C. Layout Plans

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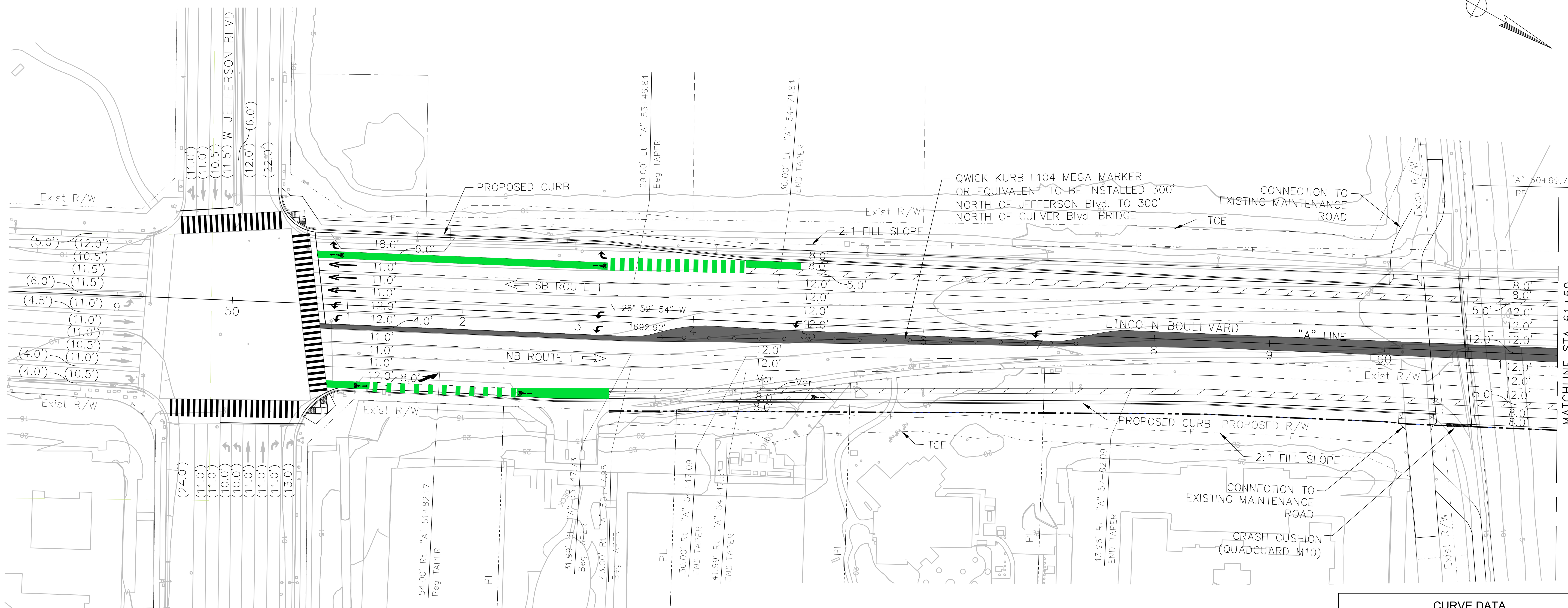

CURVE DATA				
(No.)	R	Δ	T	L
C.1	2000'	25°36'56"	886.72'	894.15'
C.2	8000'	9°58'01"	1389.93'	1391.68'
C.3	760'	56°11'15"	715.79'	745.30'
C.4	138'	110°03'38"	226.24'	265.17'
C.5	151'	110°03'38"	247.48'	290.06'

LINCOLN BLVD IMPROVEMENT LAYOUT
EA 07-33880

SCALE: 1"=50'

L-1

September 28, 2022

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LINCOLN BLVD IMPROVEMENT LAYOUT
EA 07-33880

SCALE: 1"=50'

L-2

September 28, 2022

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PLANS APPROVAL DATE

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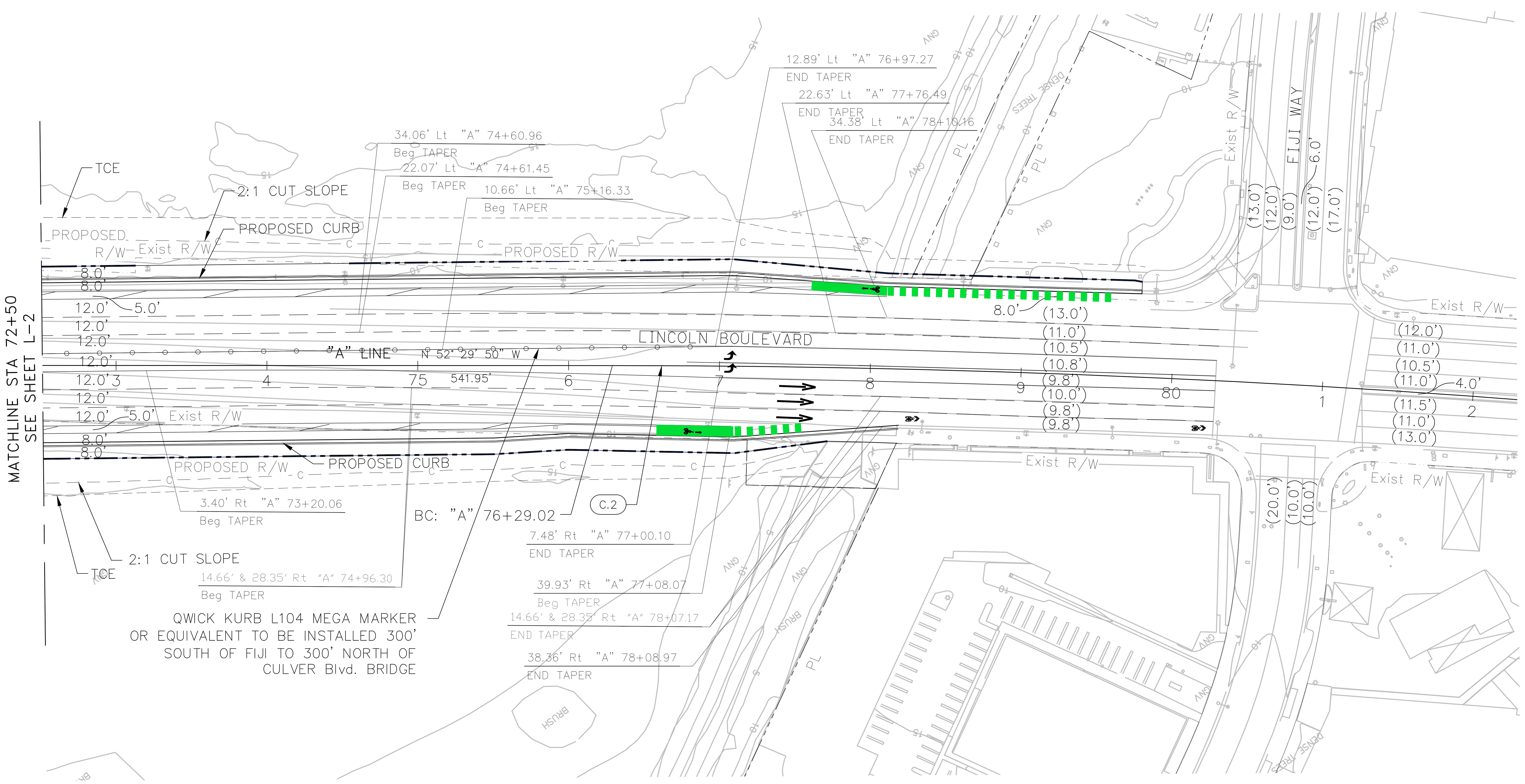

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LINCOLN BLVD IMPROVEMENT LAYOUT EA 07-33880

SCALE: 1"=50'

September 28, 2022

L-3

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D. Profile Plans

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
07	LA	001	R30.16/R30.74		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

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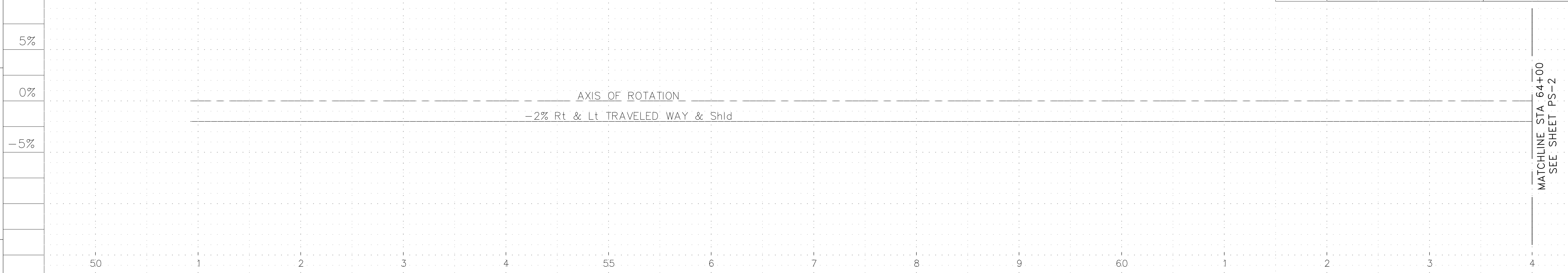
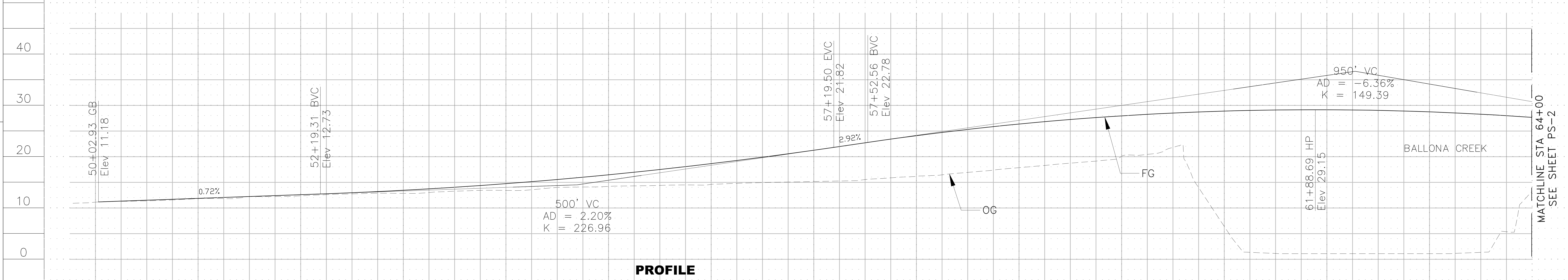
SUITE 3200
LOS ANGELES, CA 90071

CITY OF LOS ANGELES
DEPARTMENT OF PUBLIC WORKS
BUREAU OF ENGINEERING
1149 S. BROADWAY, SUITE 700
LOS ANGELES, CA 90015



SUPERELEVATION DIAGRAM



PROFILE
LINCOLN BOULEVARD CENTER LINE
"A" LINE

LINCOLN BLVD IMPROVEMENT
PROFILE & SUPERELEVATION DIAGRAM
EA 07-33880

SCALE: Horiz 1"=50'
Vert 1"=10'

PS-1
January 30, 2023

STATION	50	1	2	3	4	55	6	7	8	9	60	1	2	3	4	TOTAL
CY Exc																
CY Emb																

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BORDER LAST REVISED 7/2/2010
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DGN FILE => $REQUEST
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 0000
PROJECT NUMBER & PHASE 0717000061

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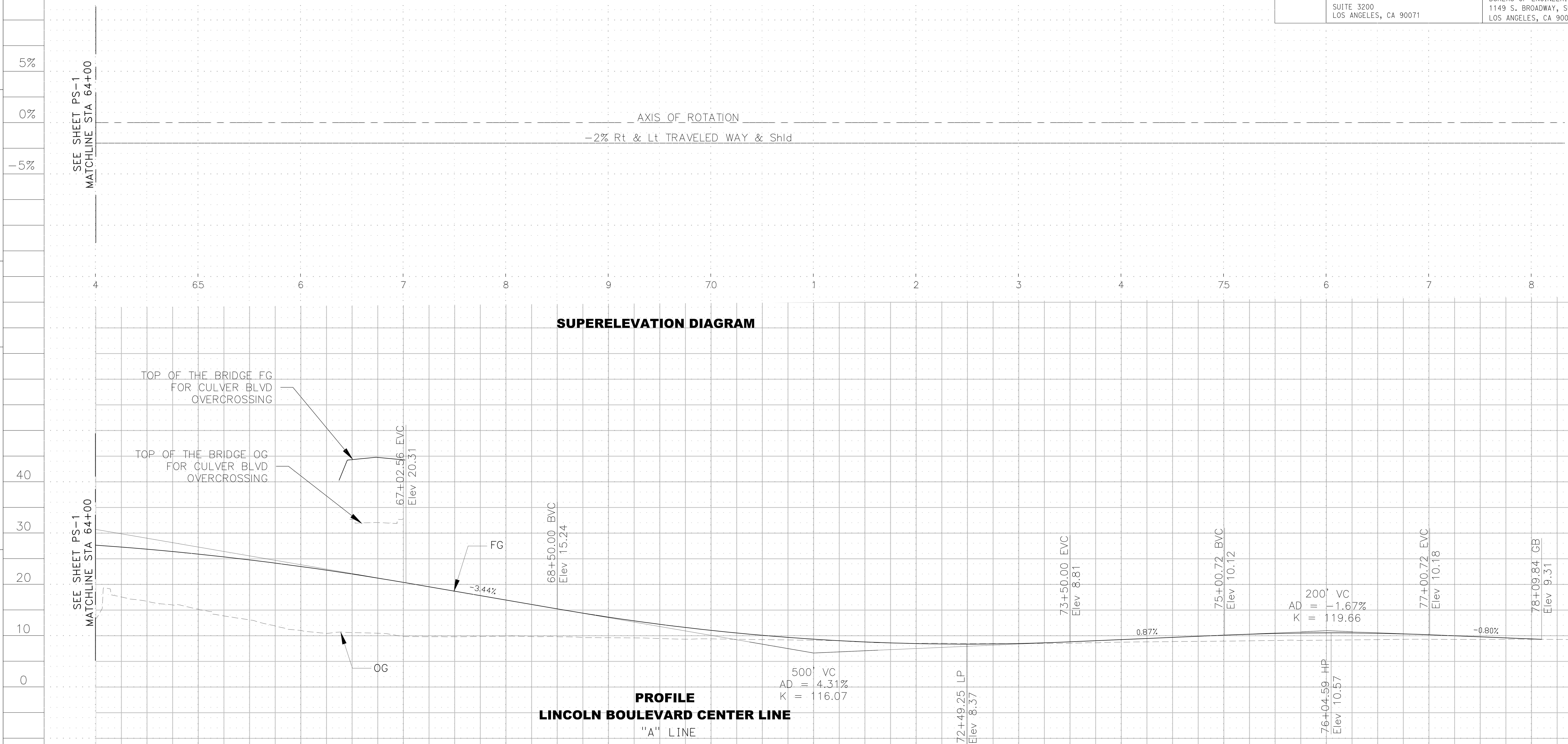

LINCOLN BLVD IMPROVEMENT
PROFILE & SUPERELEVATION DIAGRAM
EA 07-33880

SCALE: Horiz 1"=50'
Vert 1"=10'

PS-2
January 30, 2023

STATION	4	65	6	7	8	9	70	1	2	3	4	75	6	7	8	TOTAL
CY Exc																
CY Emb																

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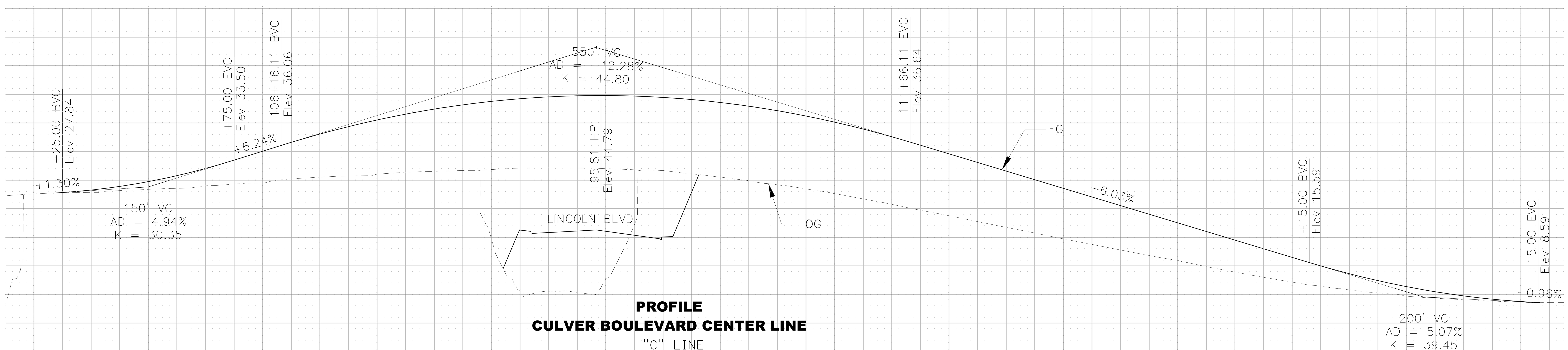
SUPERELEVATION DIAGRAM



PROFILE
CULVER BOULEVARD CENTER LINE
"C" LINE

LINCOLN BLVD IMPROVEMENT
PROFILE & SUPERELEVATION DIAGRAM
EA 07-33880

SCALE: Horiz 1"=50'
Vert 1"=10'

PS-3
January 30, 2023

STATION	4	105	6	7	8	9	110	1	2	3	4	115	6	7	TOTAL
CY Exc															
CY Emb															

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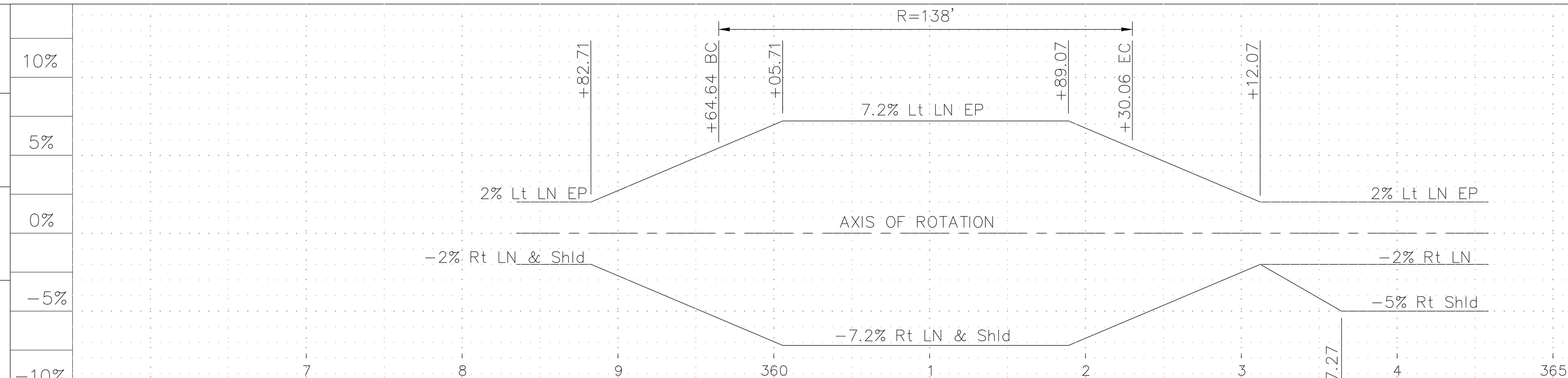
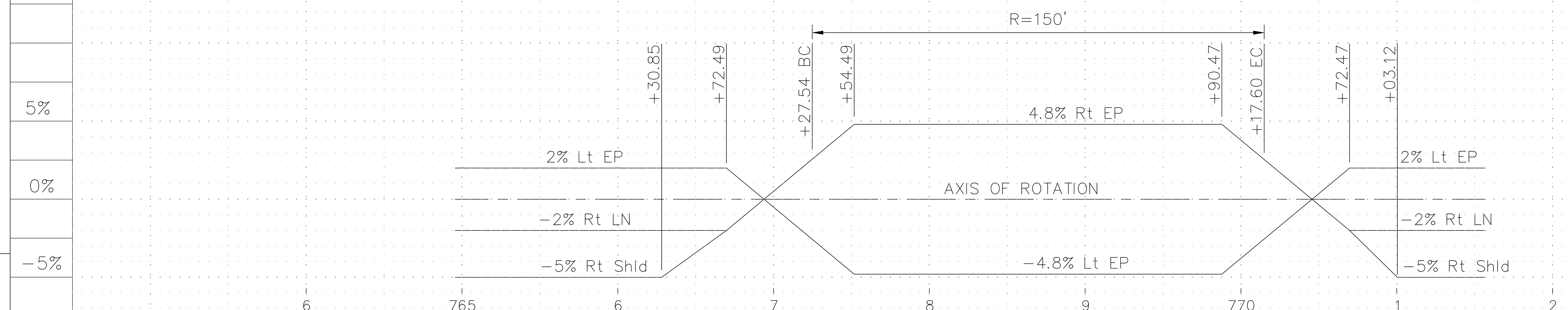
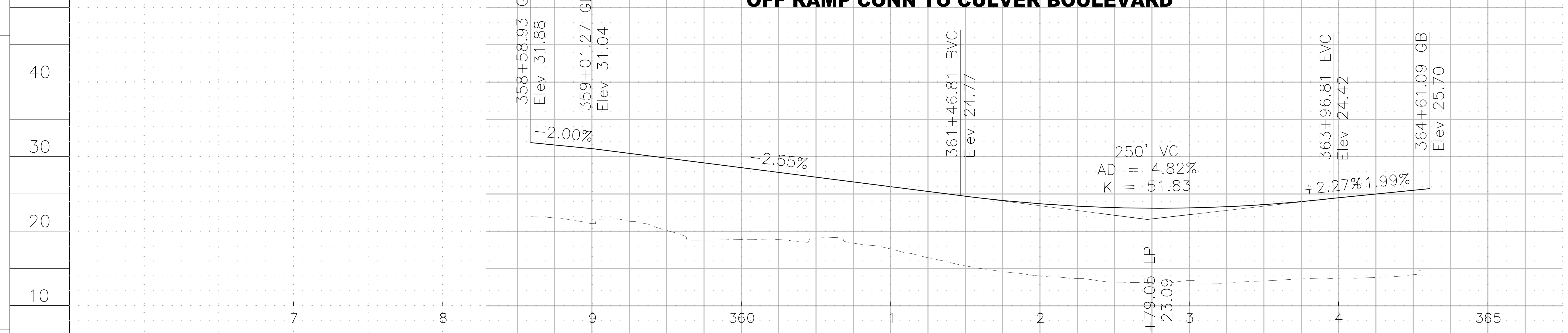


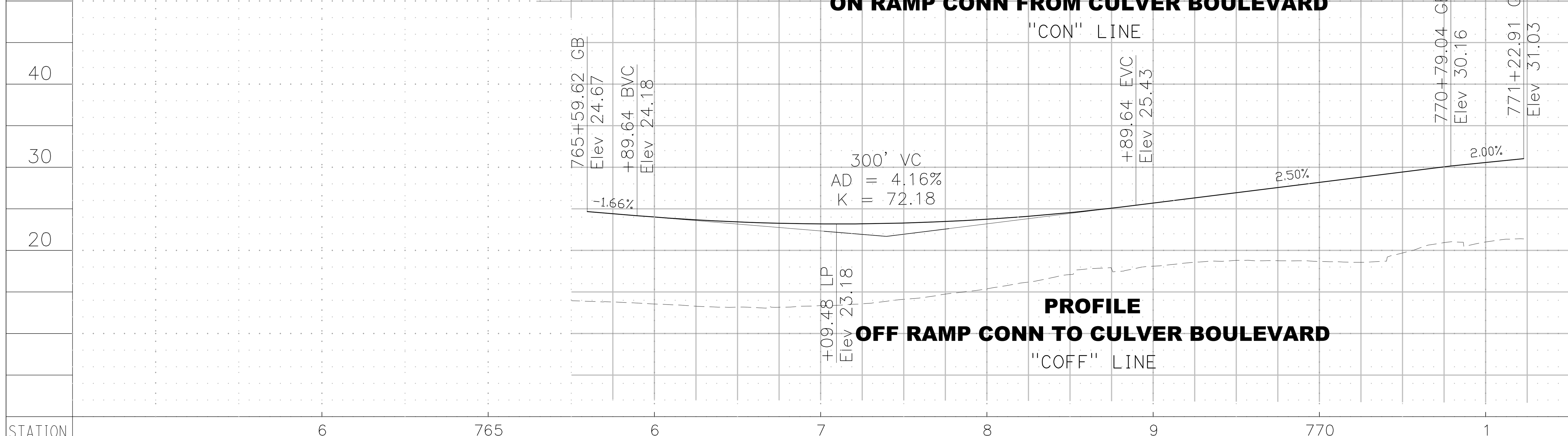
SUPERELEVATION DIAGRAM
ON RAMP CONN FROM CULVER BOULEVARD



SUPERELEVATION DIAGRAM
OFF RAMP CONN TO CULVER BOULEVARD



PROFILE
ON RAMP CONN FROM CULVER BOULEVARD
"CON" LINE



PROFILE
OFF RAMP CONN TO CULVER BOULEVARD
"COFF" LINE

LINCOLN BLVD IMPROVEMENT
PROFILE & SUPERELEVATION DIAGRAM
EA 07-33880

SCALE: Horiz 1"=50'
Vert 1"=10'

PS-4
January 30, 2023

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STATION
CY Exc Emb
TOTAL

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DGN FILE => $REQUEST
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 0000
PROJECT NUMBER & PHASE 0717000061

E. Drainage Plans

NOTES:

FOR ACCURATE RIGHT OF WAY DATA, CONTACT RIGHT OF WAY ENGINEERING AT THE DISTRICT OFFICE.

LEGEND:

2 DRAINAGE SYSTEM NO.

a DRAINAGE UNIT

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
07	LA	001	R30.16/R30.74		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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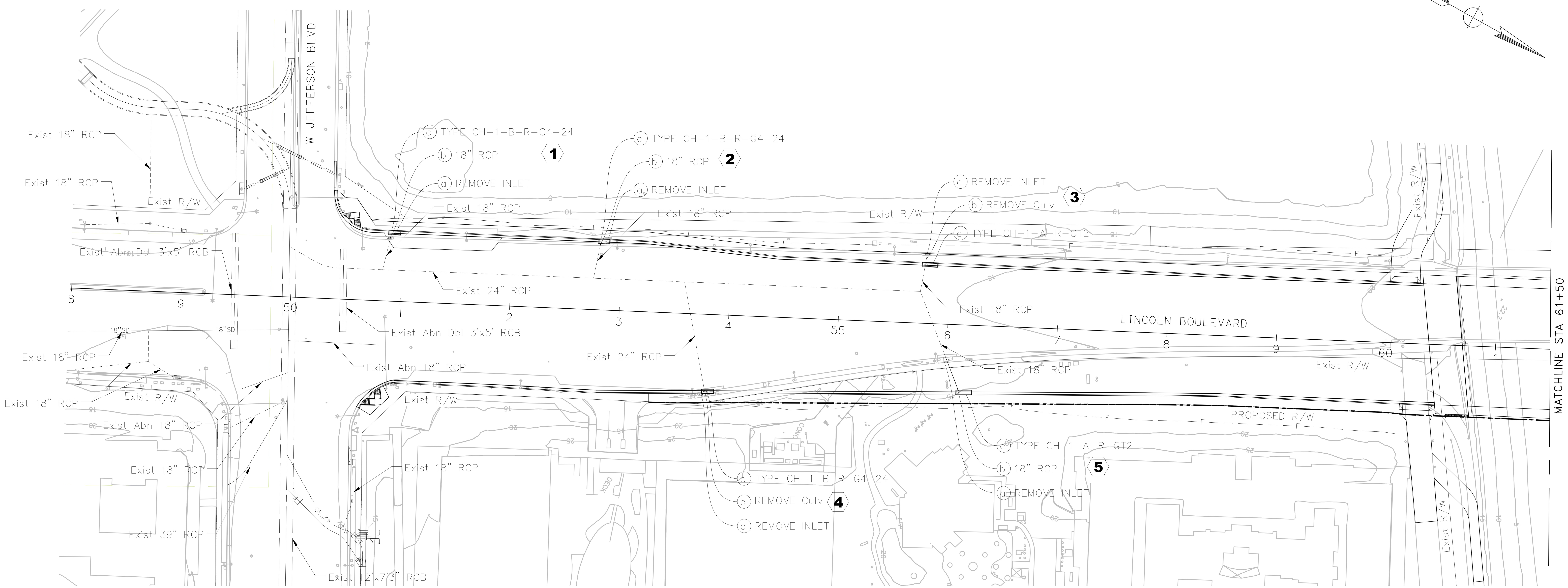

LINCOLN BLVD IMPROVEMENT
DRAINAGE PLAN
EA 07-33880

SCALE: 1"=50'

D-1

April 24, 2023

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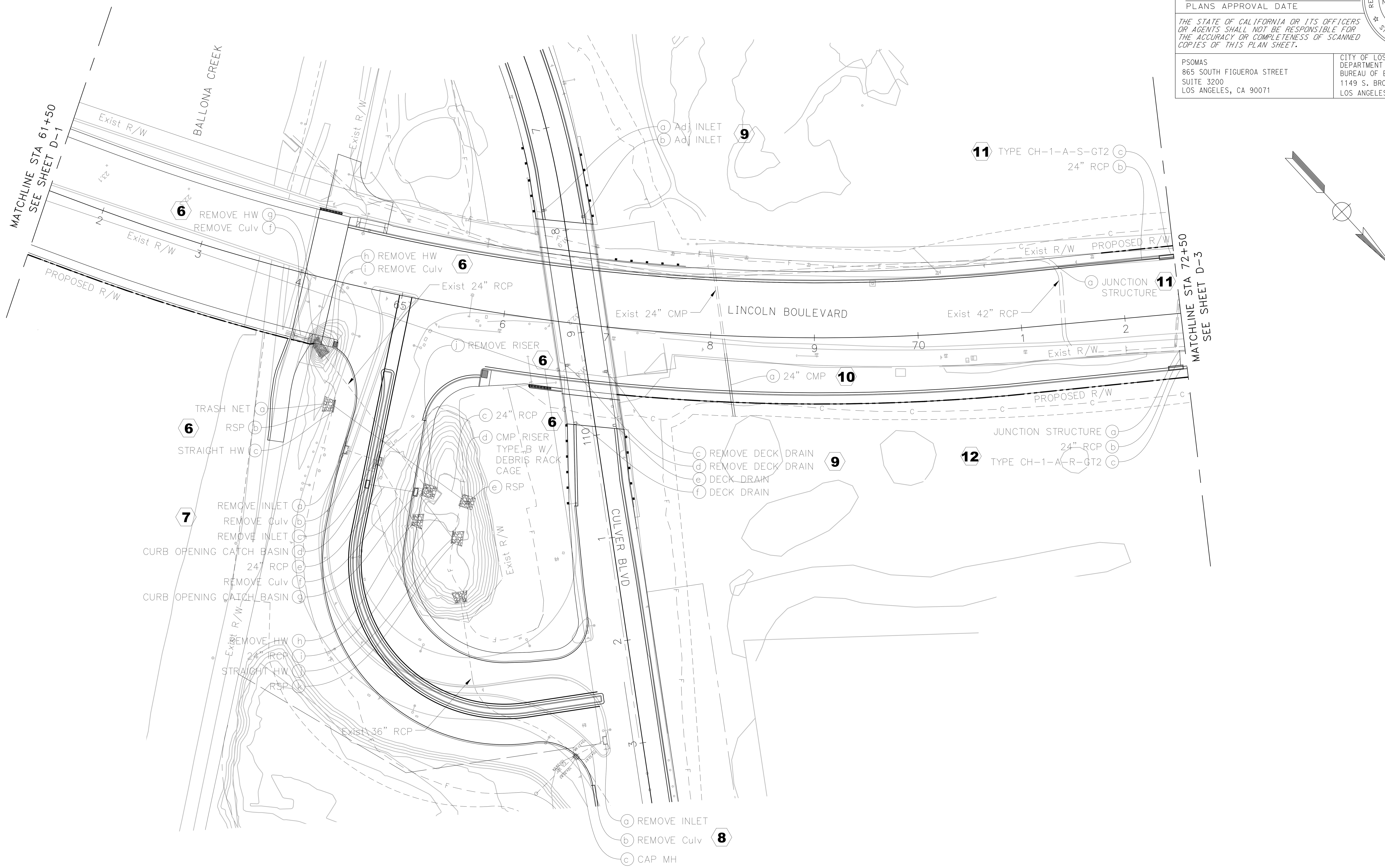

LINCOLN BLVD IMPROVEMENT
DRAINAGE PLAN
EA 07-33880

SCALE: 1"=50'

D-2

April 24, 2023

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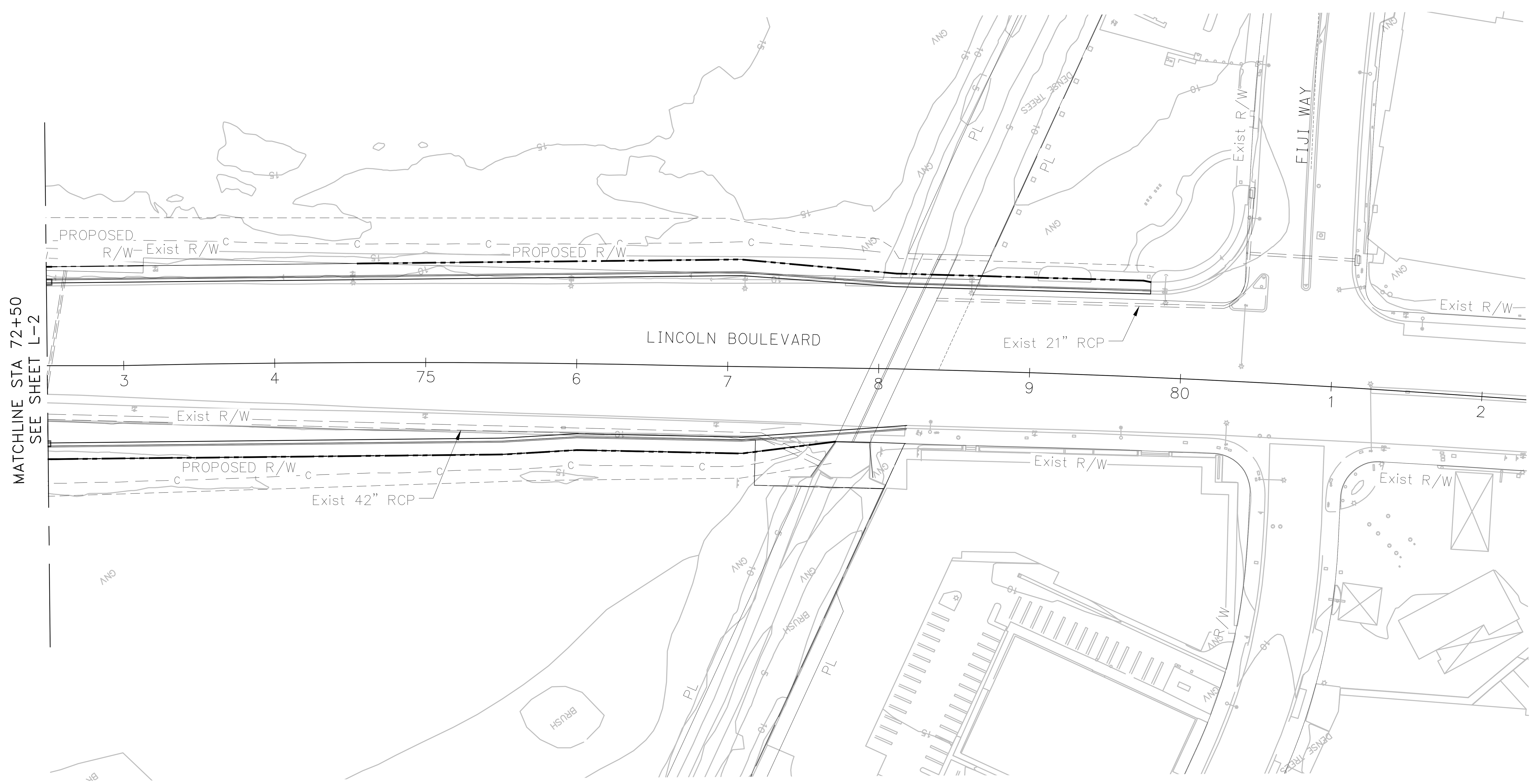

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DATE REVISED

LINCOLN BLVD IMPROVEMENT
DRAINAGE PLAN
EA 07-33880

SCALE: 1"=50'

April 24, 2023

D-3

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BORDER LAST REVISED 7/2/2010

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DGN FILE => $REQUEST

RELATIVE BORDER SCALE IS IN INCHES

0 1 2 3

UNIT 0000

PROJECT NUMBER & PHASE 0717000061

F. Utility Plans

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REGISTERED PROFESSIONAL ENGINEER
No. ______
Exp. ______
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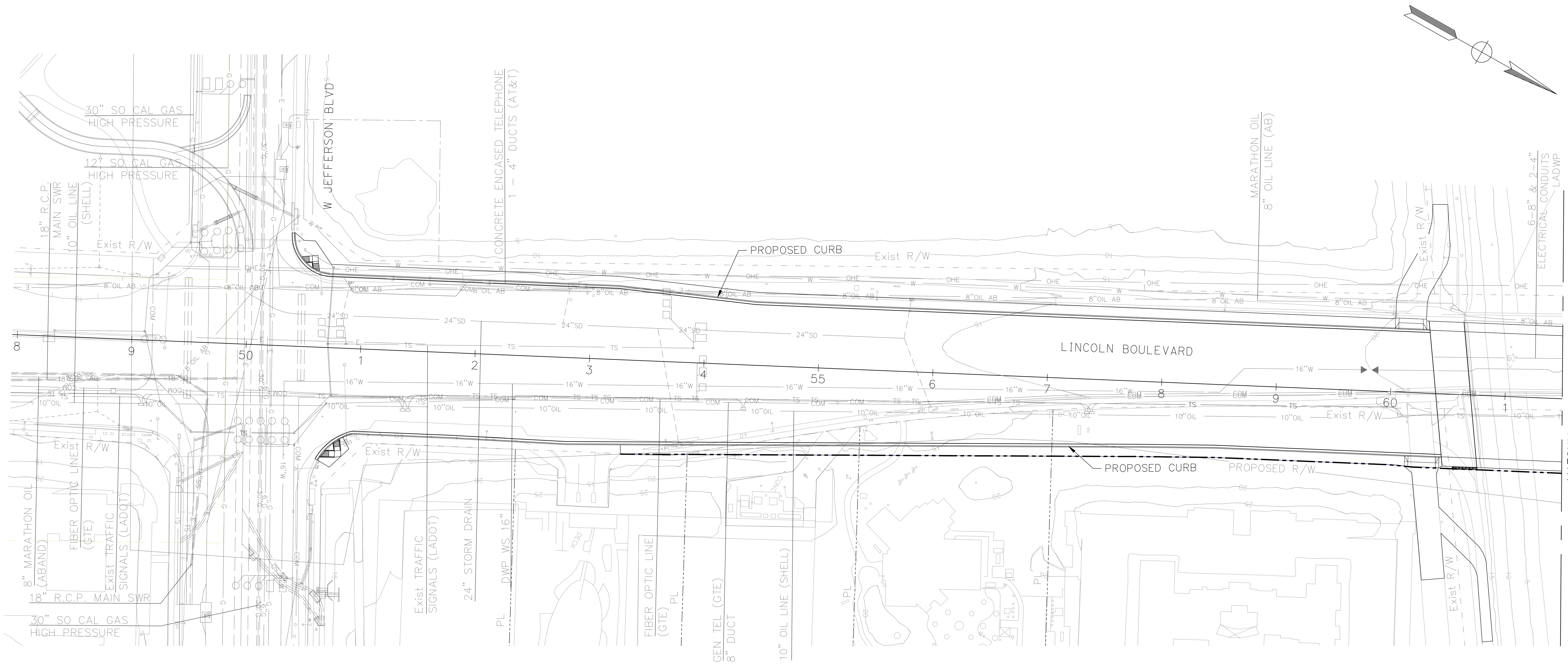
LOS ANGELES, CA 90015

ABBREVIATIONS:

AB	ABANDONED
COM	COMMUNICATION
E	ELECTRICAL
G	GAS
GEN	GENERAL
GTE	GENERAL TELECOM
OHE	OVER HEAD ELECTRICAL
PL	PROPERTY LINE
SD	STORM DRAIN
SWR	SEWER
TE	TELECOM
TS	TRAFFIC SIGNAL
W	WATER



LINCOLN BLVD IMPROVEMENT
EXISTING UTILITIES & STORM DRAINS
EA 07-33880

SCALE: 1"=50'

U-1

September 28, 2022

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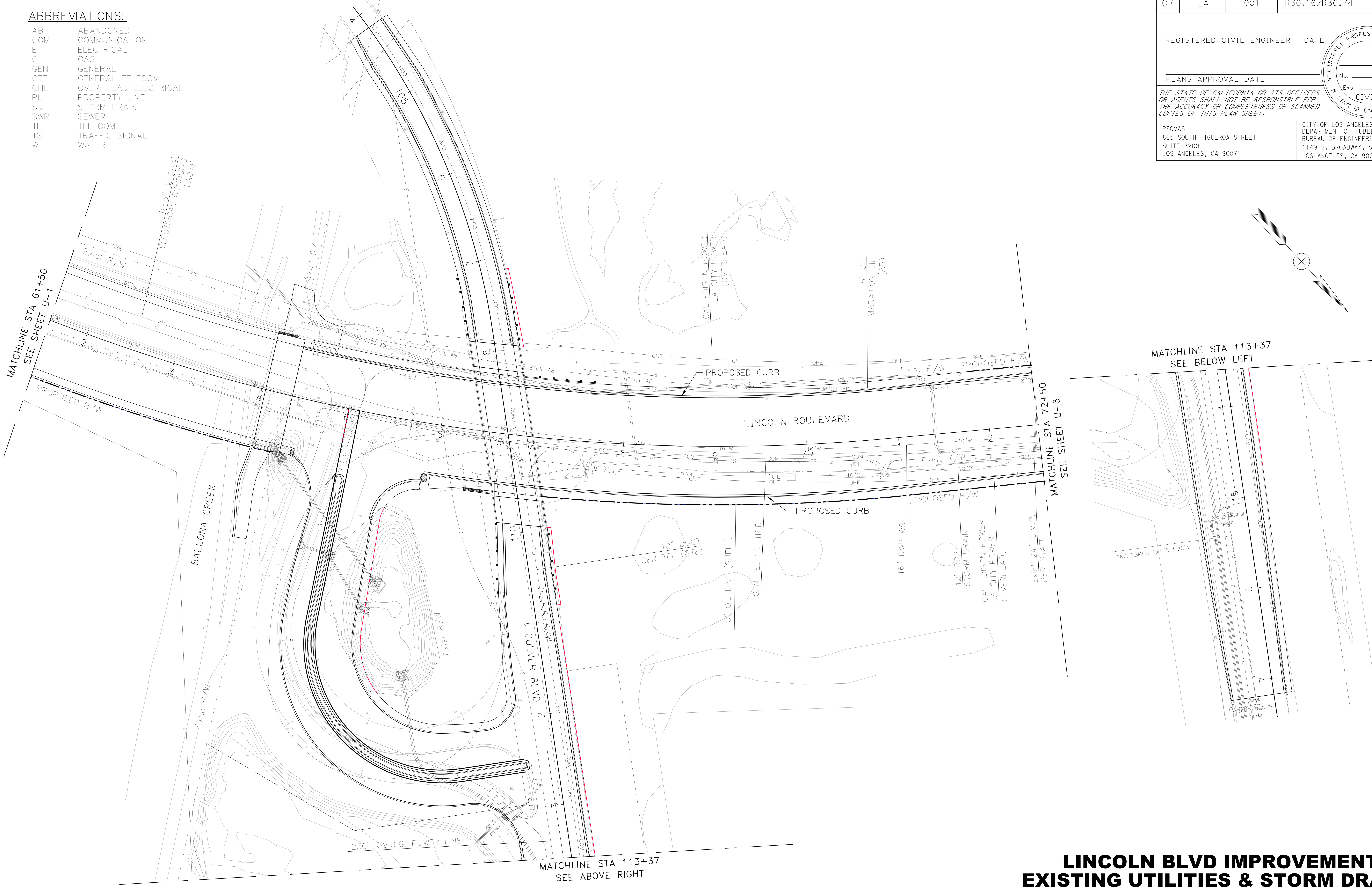

LINCOLN BLVD IMPROVEMENT
EXISTING UTILITIES & STORM DRAINS
EA 07-33880

SCALE: 1"=50'

U-2

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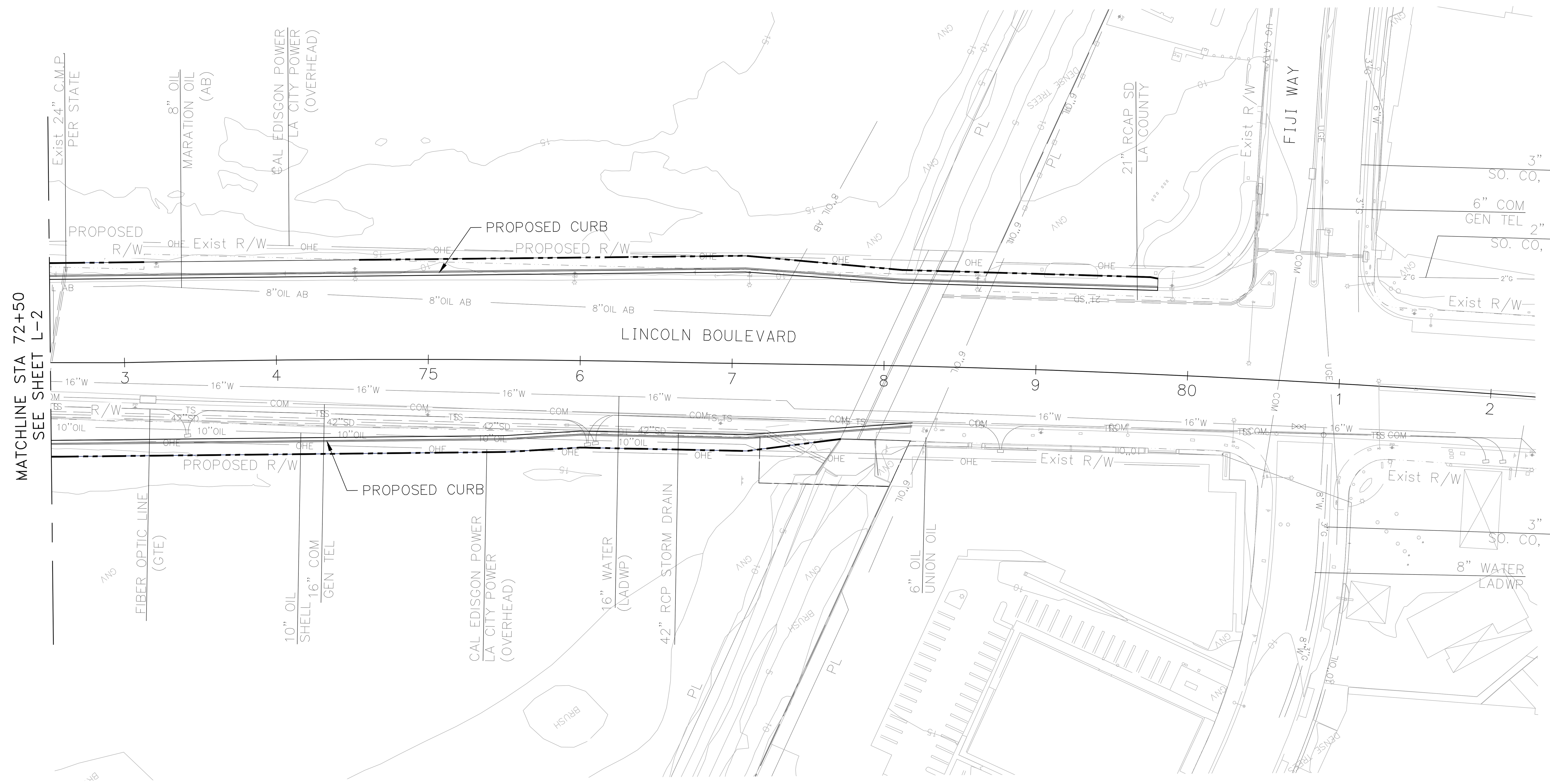

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LINCOLN BLVD IMPROVEMENT
EXISTING UTILITIES & STORM DRAINS
EA 07-33880

SCALE: 1"=50'

September 28, 2022

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G. Preliminary Cost Estimate

PROJECT

PA&ED COST ESTIMATE ©

EA: 07-33880 PID: 717000061

EA: **07-33880**

PID: **717000061**

District-County-Route: 07-LA-001

PM: 30.2 - 30.7

Type of Estimate : Draft Project Report

Program Code : 20.20.800.100

Project Limits : Jefferson Boulevard to Fiji Way

Project Description: Multimodal Corridor Improvements

Scope : Roadway Widening, Bridge Replacement, and Bicycle and Pedestrian Improvements

Alternative : Alternative # 1

SUMMARY OF PROJECT COST ESTIMATE

	Current Year Cost		Escalated Cost	
TOTAL ROADWAY COST	**$**	**30,428,800**	**$**	**39,766,455**
TOTAL STRUCTURES COST	**$**	**29,073,770**	**$**	**37,995,609**
SUBTOTAL CONSTRUCTION COST	**$**	**59,502,570**	**$**	**77,762,064**
TOTAL RIGHT OF WAY COST	**$**	**17,307,070**	**$**	**21,334,000**
TOTAL CAPITAL OUTLAY COSTS	**$**	**76,810,000**	**$**	**99,097,000**
PA/ED SUPPORT	**$**	**2,000,000**	**$**	**2,600,000**
PS&E SUPPORT	**$**	**4,200,000**	**$**	**5,460,000**
RIGHT OF WAY SUPPORT	**$**	**480,000**	**$**	**624,000**
CONSTRUCTION SUPPORT	**$**	**2,100,000**	**$**	**2,730,000**
TOTAL SUPPORT COST	**$**	**8,780,000**	**$**	**11,414,000**
TOTAL PROJECT COST	**$**	**85,600,000**	**$**	**111,000,000** *

Programmed Amount

	Month	/	Year
Date of Estimate (Month/Year)	12	/	2022
Estimated Construction Start (Month/Year)	1	/	2027
Number of Working Days =			783
Estimated Mid-Point of Construction (Month/Year)	6	/	2028
Estimated Construction End (Month/Year)	12	/	2029
Number of Plant Establishment Days			120

Estimated Project Schedule	
PID Approval	2/1/1996
PA/ED Approval	3/1/2024
PS&E	6/1/2026
RTL	9/1/2026
Begin Construction	1/1/2027

Reviewed by District O.E. or Cost Estimate Certifier

Office Engineer / Cost Estimate Certifier	**Date**	**Phone**
	xx/xx/xxxx	(xxx) xxx-xxxx

Approved by Project Manager

Project Manager	**Date**	**Phone**
	xx/xx/xxxx	(xxx) xxx-xxxx

I. ROADWAY ITEMS SUMMARY

	Section		Cost
1	**Earthwork**	$	5,547,300
2	**Pavement Structural Section**	$	5,027,600
3	**Drainage**	$	396,800
4	**Specialty Items**	$	476,900
5	**Environmental**	$	4,650,400
6	**Traffic Items**	$	2,555,000
7	**Detours**	$	56,000
8	**Minor Items**	$	935,500
9	**Roadway Mobilization**	$	1,964,600
10	**Supplemental Work**	$	622,400
11	**State Furnished**	$	796,500
12	**Time-Related Overhead**	$	2,328,300
13	**Total Roadway Contingency**	$	5,071,500

TOTAL ROADWAY ITEMS	$	30,428,800

	Name and Title	Date	Phone
Estimate Prepared By :	Paul Gervacio, Project Engineer	4/23/2024	(916)788-4877
Estimate Reviewed By :	Tim Hayes, Project Manager	4/23/2024	(916)759-4978

By signing this estimate you are attesting that you have discussed your project with all functional units and have incorporated all their comments or have discussed with them why they will not be incorporated.

EA: 07-33880 PID: 717000061

SECTION 1: EARTHWORK

Item code		Unit	Quantity		Unit Price ($)			Cost
190101	Roadway Excavation	CY	19,458	x	35.00	=	$	681,030
70030	Lead Compliance Plan	LS		x		=	$	-
194001	Ditch Excavation	CY		x		=	$	-
198010	Imported Borrow	CY	96,525	x	50.00	=	$	4,826,250
192037	Structure Excavation (Retaining Wall)	CY		x		=	$	-
193013	Structure Backfill (Retaining Wall)	CY		x		=	$	-
193031	Pervious Backfill Material (Retaining Wall)	CY		x		=	$	-
170104	Clearing & Grubbing	ACRE	10	x	3,000.00	=	$	30,000
100100	Develop Water Supply	LS	1	x	10,000.00	=	$	10,000
19801X	Imported Borrow	CY/TON		x		=	$	-
210130	Duff	ACRE		x		=	$	-
XXXXXX	Some Item	Unit		x		=	$	-

TOTAL EARTHWORK SECTION ITEMS $ 5,547,300

SECTION 2: PAVEMENT STRUCTURAL SECTION

Item code		Unit	Quantity		Unit Price ($)			Cost
401050	Jointed Plain Concrete Pavement	CY		x		=	$	-
400050	Continuously Reinforced Concrete Pavement	CY		x		=	$	-
404092	Seal Pavement Joint	LF		x		=	$	-
404093	Seal Isolation Joint	LF		x		=	$	-
413117	Seal Concrete Pavement Joint (Silicone)	LF		x		=	$	-
413118	Seal Pavement Joint (Asphalt Rubber)	LF		x		=	$	-
280010	Rapid Strength Concrete Base	CY		x		=	$	-
410095	Dowel Bar (Drill and Bond)	EA		x		=	$	-
390132	Hot Mix Asphalt (Type A)	TON		x		=	$	-
390137	Rubberized Hot Mix Asphalt (Gap Graded)	TON	14,046	x	160.00	=	$	2,247,360
39300X	Geosynthetic Pavement Interlayer (Type X)	SQYD		x		=	$	-
260203	Class 2 Aggregate Base	CY	22,890	x	80.00	=	$	1,831,200
290201	Asphalt Treated Permeable Base	CY		x		=	$	-
250401	Class 4 Aggregate Subbase	CY		x		=	$	-
374002	Asphaltic Emulsion (Fog Seal Coat)	TON		x		=	$	-
397005	Tack Coat	TON		x		=	$	-
377501	Slurry Seal	TON		x		=	$	-
3750XX	Screenings (Type XX)	TON		x		=	$	-
374492	Asphaltic Emulsion (Polymer Modified)	TON		x		=	$	-
370001	Sand Cover (Seal)	TON		x		=	$	-
731530	Minor Concrete (Textured Paving)	CY		x		=	$	-
394095	Roadside Paving (AC Trail)	SQYD	363	x	180.00	=	$	65,340
731504	Minor Concrete (Curb and Gutter)	LF	9,823	x	45.00	=	$	442,035
731521	Minor Concrete (Sidewalk)	CY	791	x	500.00	=	$	395,500
39407X	Place Hot Mix Asphalt Dike (Type X)	LF		x		=	$	-
150771	Remove Asphalt Concrete Dike	LF		x		=	$	-
420201	Grind Existing Concrete Pavement	SQYD		x		=	$	-
150860	Remove Base and Surfacing	CY		x		=	$	-
390095	Replace Asphalt Concrete Surfacing	CY		x		=	$	-
153248	Remove Concrete (Sidewalk)	SQFT	7,680	x	6.00	=	$	46,080
394090	Place Hot Mix Asphalt (Miscellaneous Area)	SQYD		x		=	$	-
153103	Cold Plane Asphalt Concrete Pavement	SQYD		x		=	$	-
39405X	Shoulder Rumble Strip (HMA, X-In Indentations)	STA		x		=	$	-
413113	Repair Spalled Joints, Polyester Grout	SQYD		x		=	$	-
420102	Groove Existing Concrete Pavement	SQYD		x		=	$	-
390136	Minor Hot Mix Asphalt	TON		x		=	$	-
394095	Roadside Paving (Miscellaneous Areas)	SQYD		x		=	$	-
XXXXXX	Some Item	Unit		x		=	$	-

TOTAL PAVEMENT STRUCTURAL SECTION ITEMS $ 5,027,600

EA: 07-33880 PID: 717000061

SECTION 3: DRAINAGE

Item code		Unit	Quantity		Unit Price ($)			Cost
510092	Structural Concrete, Headwall	CY	9	x	6,200.00	=	$	55,800
510094	Structural Concrete, Drainage Inlet	CY	18	x	4,000.00	=	$	72,000
510502	Minor Concrete (Minor Structure)	CY	2	x	3,500.00	=	$	7,000
520101	Bar Reinforcing Steel	LB	3,596	x	4.00	=	$	14,384
650014	18" Reinforced Concrete Pipe	LF	47	x	415.00	=	$	19,505
650018	24" Reinforced Concrete Pipe	LF	381	x	310.00	=	$	118,110
665023	24" Corrugated Steel Pipe (0.079" Thick)	LF	61	x	250.00	=	$	15,250
665047	48" Corrugated Steel Pipe (0.109" Thick)	LF	3	x	400.00	=	$	1,200
710132	Remove Culvert	LF	296	x	70.00	=	$	20,720
710150	Remove Inlet	EA	11	x	1,900.00	=	$	20,900
710152	Remove Headwall	CY	3	x	3,250.00	=	$	9,750
710196	Adjust Inlet	EA	2	x	3,000.00	=	$	6,000
710262	Cap Inlet	EA	1	x	2,400.00	=	$	2,400
723070	Rock Slope Protection (150 LB, Class III, Method E	CY	7	x	400.00	=	$	2,800
729011	Rock Slope Protection Fabric (Class 8)	SQYD	27	x	80.00	=	$	2,160
750001	Miscellaneous Iron and Steel	LF	4,109	x	7.00	=	$	28,763
XXXXXX	Additional Drainage	LS		x		=	$	-

TOTAL DRAINAGE ITEMS $ 396,800

SECTION 4: SPECIALTY ITEMS

Item code		Unit	Quantity		Unit Price ($)			Cost
080050	Progress Schedule (Critical Path Method)	LS		x		=	$	-
582001	Sound Wall (Masonry Block)	SQFT		x		=	$	-
510530	Minor Concrete (Wall)	CY		x		=	$	-
15325X	Remove Sound Wall	LF/LS		x		=	$	-
070030	Lead Compliance Plan	LS		x		=	$	-
141120	Treated Wood Waste	LB		x		=	$	-
153221	Remove Concrete Barrier	LF		x		=	$	-
839752	Remove Guardrail	LF	2,360	x	30.00	=	$	70,800
150668	Remove Flared End Section	EA		x		=	$	-
8000XX	Chain Link Fence (Type XX)	LF		x		=	$	-
810170	Delineator (Class 1) K-71	EA	250	x	60.00	=	$	15,000
832006	Midwest Guardrail System (Steel Post)	LF	430	x	70.00	=	$	30,100
839301	Single Thrie Beam Barrier	LF		x		=	$	-
839310	Double Thrie Beam Barrier	LF		x		=	$	-
839521	Cable Railing	LF		x		=	$	-
8395XX	Terminal System (Type CAT)	EA		x		=	$	-
839585	Alternative Flared Terminal System	EA		x		=	$	-
839584	Alternative In-line Terminal System	EA		x		=	$	-
4906XX	CIDH Concrete Piling (Insert Diameter)	LF		x		=	$	-
839601	Crash Cushion (Quadguard M10)	EA	3	x	35,000.00	=	$	105,000
839XXX	Crash Cushion (Insert Type)	EA		x		=	$	-
83XXXX	Concrete Barrier (Insert Type)	LF		x		=	$	-
520103	Bar Reinforced Steel (Retaining Wall)	LB		x		=	$	-
510060	Structural Concrete, Retaining Wall	CY		x		=	$	-
513553	Retaining Wall (Masonry Wall)	SQFT		x		=	$	-
511035	Architectural Treatment	SQFT		x		=	$	-
598001	Anti-Graffiti Coating	SQFT		x		=	$	-
203070	Rock Stain	SQFT		x		=	$	-
5136XX	Reinforced Concrete Crib Wall (Type X)	SQFT		x		=	$	-
83954X	Transition Railing (Type X)	EA		x		=	$	-
597601	Prepare and Stain Concrete	SQFT		x		=	$	-
839561	Rail Tensioning Assembly	EA		x		=	$	-
83958X	End Anchor Assembly (Type X)	EA		x		=	$	-
	Qwik Curb	LF	1,100	x	80.00	=	$	88,000
582001	Sound Wall (Masonry Block)	SF	5,600	x	30.00	=	$	168,000

TOTAL SPECIALTY ITEMS $ 476,900

EA: 07-33880 PID: 717000061

SECTION 5: ENVIRONMENTAL

5A - ENVIRONMENTAL MITIGATION

Item code		Unit	Quantity		Unit Price ($)		Cost
	Impact Mitigation and Monitoring	LS	1	x	4,373,200.00	=	$ 4,373,200
130670	Temporary Reinforced Silt Fence	LF		x		=	$ -
141000	Temporary Fence (Type ESA)	LF		x		=	$ -
					Subtotal Environmental Mitigation		*$ 4,373,200*

5B - LANDSCAPE AND IRRIGATION

Item code		Unit	Quantity		Unit Price ($)		Cost
20XXXX	Highway Planting	LS	1	x	30,200.00	=	$ 30,200
20XXXX	Irrigation System	LS	1	x	30,200.00	=	$ 30,200
204099	Plant Establishment Work	LS		x		=	$ -
204101	Extend Plant Establishment Work	LS		x		=	$ -
20XXXX	Follow-up Landscape Project	LS		x		=	$ -
150685	Remove Irrigation Facility	LS		x		=	$ -
20XXXX	Maintain Existing (Irrigation or Planted Areas)	LS		x		=	$ -
206400	Check and Test Existing Irrigation Facilities	LS		x		=	$ -
21011X	Imported Topsoil (X)	CY/TON		x		=	$ -
20XXXX	Rock Blanket, Rock Mulch, DG, Gravel Mulch	SQFT/SQYD		x		=	$ -
200122	Weed Germination	SQYD		x		=	$ -
208304	Water Meter	EA		x		=	$ -
2087XX	XX" Conduit (Use for Irrigation x-overs)	LF		x		=	$ -
20890X	Extend X" Conduit (Use for Extension of Irrigation x-overs)	LF		x		=	$ -
					Subtotal Landscape and Irrigation		*$ 60,400*

5C - EROSION CONTROL

Item code		Unit	Quantity		Unit Price ($)		Cost
210010	Move In/Move Out (Erosion Control)	EA		x		=	$ -
210350	Fiber Rolls	LF		x		=	$ -
210360	Compost Sock	LF		x		=	$ -
2102XX	Rolled Erosion Control Product (X)	SQFT		x		=	$ -
21025X	Bonded Fiber Matrix	SQFT/ACRE		x		=	$ -
210300	Hydromulch	SQFT		x		=	$ -
210420	Straw	SQFT		x		=	$ -
210430	Hydroseed	SQFT		x		=	$ -
210600	Compost	SQFT		x		=	$ -
210630	Incorporate Materials	SQFT		x		=	$ -
					Subtotal Erosion Control		*$ -*

5D - NPDES

4/28/2023 - Added in NPDES quantities to match SWDR - JG

Item code		Unit	Quantity		Unit Price ($)		Cost
130300	Prepare SWPPP	LS	1	x	8,800.00	=	$ 8,800
130200	Prepare WPCP	LS		x		=	$ -
130100	Job Site Management	LS	1	x	50,000.00	=	$ 50,000
130330	Storm Water Annual Report	EA	2	x	2,000.00	=	$ 4,000
130310	Rain Event Action Plan (REAP)	EA	50	x	500.00	=	$ 25,000
130320	Storm Water Sampling and Analysis Day	EA		x		=	$ -
130520	Temporary Hydraulic Mulch	SQYD		x		=	$ -
130550	Temporary Hydroseed	SQYD	10,000	x	1.50	=	$ 15,000
130505	Move-In/Move-Out (Temporary Erosion Control)	EA	3	x	1,500.00	=	$ 4,500
130640	Temporary Fiber Roll	LF	3,500	x	7.50	=	$ 26,250
130900	Temporary Concrete Washout	LS	1	x	10,000.00	=	$ 10,000
130710	Temporary Construction Entrance	EA	4	x	4,600.00	=	$ 18,400
130610	Temporary Check Dam	LF		x		=	$ -
130620	Temporary Drainage Inlet Protection	EA	16	x	275.00	=	$ 4,400
130570	Temporary Cover	SQYD	1,000	x	7.50	=	$ 7,500
130730	Street Sweeping	LS	1	x	10,000.00	=	$ 10,000
					Subtotal NPDES		*$ 183,850*

TOTAL ENVIRONMENTAL $ 4,650,400

Supplemental Work for NPDES

4/28/2023 - Added in NPDES quantities to match SWDR - JG

Item code		Unit	Quantity		Unit Price ($)		Cost
066595	Water Pollution Control Maintenance Sharing*	LS	1	x	21,950.00	=	$ 21,950
066596	Additional Water Pollution Control**	LS	1	x	6,000.00	=	$ 6,000
066597	Storm Water Sampling and Analysis***	LS	1	x	5,000.00	=	$ 5,000
XXXXXX	Some Item	LS		x		=	$ -
					Subtotal Supplemental Work for NDPS		*$ 32,950*

*Applies to all SWPPPs and those WPCPs with sediment control or soil stabilization BMPs.

**Applies to both SWPPPs and WPCP projects.

*** Applies only to project with SWPPPs.

EA: 07-33880 PID: 717000061

SECTION 6: TRAFFIC ITEMS

6A - Traffic Electrical

Item code		Unit	Quantity		Unit Price ($)			Cost
860460	Lighting and Sign Illumination	LS		x		=	$	-
860201	Signal and Lighting	LS		x		=	$	-
860990	Closed Circuit Television System	LS		x		=	$	-
86110X	Ramp Metering System (Location X)	LS		x		=	$	-
86070X	Interconnection Conduit and Cable	LF/LS		x		=	$	-
5602XX	Furnish Sign Structure (Type X)	LB		x		=	$	-
5602XX	Install Sign Structure (Type X)	LB		x		=	$	-
498040	XX" CIDHC Pile (Sign Foundation)	LF		x		=	$	-
86080X	Inductive Loop Detectors	EA/LS		x		=	$	-
8609XX	Traffic Monitoring Station (Type X)	LS		x		=	$	-
15075X	Remove Sign Structure	EA/LS		x		=	$	-
151581	Reconstruct Sign Structure	EA		x		=	$	-
152641	Modify Sign Structure	EA		x		=	$	-
860090	Maintain Existing Traffic Management System Elen	LS		x		=	$	-
86XXXX	Fiber Optic Conduit System	LS		x		=	$	-
861502	Modify signal	EA	1	x	50,000.00	=	$	50,000
870200	Lighting System	LS	1	x	150,000.00	=	$	150,000
870400	Signal and Lighting System	LS	1	x	450,000.00	=	$	450,000
872141	Remove Lighting Systems	LS	1	x	60,000.00	=	$	60,000
XXXXX	Some Item	Unit		x		=	$	-

Subtotal Traffic Electrical $ 710,000

6B - Traffic Signing and Striping

Item code		Unit	Quantity		Unit Price ($)			Cost
820840	Roadside Sign - One Post	EA	36	x	500.00	=	$	18,000
820850	Roadside Sign - Two Post	EA	2	x	700.00	=	$	1,400
5602XX	Furnish Sign	SQFT		x		=	$	-
568016	Install Sign Panel on Existing Frame	SQFT		x		=	$	-
150711	Remove Painted Traffic Stripe	LF		x		=	$	-
141101	Remove Yellow Painted Traffic Stripe (Hazardous	LF		x		=	$	-
150712	Remove Painted Pavement Marking	SQFT		x		=	$	-
820230	Remove Sign	EA	38	x	250.00	=	$	9,500
152320	Reset Roadside Sign	EA		x		=	$	-
152390	Relocate Roadside Sign	EA		x		=	$	-
82010X	Delineator (Class X)	EA		x		=	$	-
840502	Thermoplastic Traffic Stripe	LF	36,000	x	2.00	=	$	72,000
840519	Thermoplastic Crosswalk and Pavement Marking	SQFT	8,370	x	11.00	=	$	92,070
840502	Thermoplastic Traffic Stripe (Enhanced Wet Night \	LF		x		=	$	-
846012	Thermoplastic Crosswalk and Pavement Marking (I	SQFT		x		=	$	-
120090	Construction Area Signs	LS		x		=	$	-
84XXXX	Permanent Pavement Delineation	LS		x		=	$	-

Subtotal Traffic Signing and Striping $ 192,970

6C - Traffic Management Plan

Item code		Unit	Quantity		Unit Price ($)			Cost
128651	Portable Changeable Message Signs	EA	6	x	$ 10,000	=	$	60,000
120159	Temporary Traffic Stripe (Paint)	LF	36,000	x	$ 6	=	$	216,000
129000	Temporary Railing (Type K) Stage 1	LF	5,000	x	$ 30	=	$	150,000
129000	Temporary Railing (Type K) Stage 2	LF	5,000	x	$ 30	=	$	150,000
390132	Hot Mix Asphalt (type A) (Stage 1)	TON	240	x	$ 950	=	$	228,000
390132	Hot Mix Asphalt (type A) (Stage 2)	TON	240	x	$ 950	=	$	228,000
	Traffic Management Plan Administration	LS	1	x	$ 70,000	=	$	70,000

Subtotal Traffic Management Plan $ 1,102,000

6D - Stage Construction and Traffic Handling

Item code		Unit	Quantity		Unit Price ($)			Cost
120199	Traffic Plastic Drum	EA		x		=	$	-
12016X	Channelizer (Type X)	EA		x		=	$	-
120120	Type III Barricade	EA		x		=	$	-
129100	Temporary Crash Cushion Module	EA		x		=	$	-
120100	Traffic Control System	LS	1	x	550,000	=	$	550,000
129110	Temporary Crash Cushion	EA		x		=	$	-
129000	Temporary Railing (Type K)	LF		x		=	$	-
120149	Temporary Pavement Marking (Paint)	SQFT		x		=	$	-
82010X	Delineator (Class X)	EA		x		=	$	-
XXXXXX	Some Item	Unit		x		=	$	-

Subtotal Stage Construction and Traffic Handling $ 550,000

TOTAL TRAFFIC ITEMS $ 2,555,000

EA: 07-33880 PID: 717000061

SECTION 7: DETOURS

Includes constructing, maintaining, and removal

Item code		Unit	Quantity		Unit Price ($)		Cost
190101	Roadway Excavation	CY		x		=	$ -
19801X	Imported Borrow	CY/TON		x		=	$ -
390132	Hot Mix Asphalt (Type A)	TON		x		=	$ -
26020X	Class 2 Aggregate Base	TON/CY		x		=	$ -
250401	Class 4 Aggregate Subbase	CY		x		=	$ -
130620	Temporary Drainage Inlet Protection	EA		x		=	$ -
129000	Temporary Railing (Type K)	LF		x		=	$ -
120100	Traffic Control System	LS	1	x	56,000.00	=	$ 56,000
120149	Temporary Pavement Marking (Paint)	SQFT		x		=	$ -
80010X	Temporary Fence (Type X)	LF		x		=	$ -
XXXXXX	Some Item	LS		x		=	$ -

* Includes constructing, maintaining, and removal

TOTAL DETOURS $ 56,000

SUBTOTAL SECTIONS 1 through 7 $ 18,710,000

SECTION 8: MINOR ITEMS

8A - Other Minor Items

Other Minor Items				5.0%		$ 935,500
Total of Section 1-7	$	18,710,000	x	5.0%	=	$ 935,500

TOTAL MINOR ITEMS $ 935,500

SECTIONS 9: ROADWAY MOBILIZATION

Item code							
999990	Total Section 1-8	$	19,645,500	x	10%	=	$ 1,964,550

TOTAL ROADWAY MOBILIZATION $ 1,964,600

SECTION 10: SUPPLEMENTAL WORK

Item code		Unit	Quantity		Unit Price ($)		Cost
XXXXXX	Some Item	Unit		x		=	$ -

*Cost of **NPDES** Supplemental Work specified in Section 5D* = $ 32,950

Total Section 1-8	$	19,645,500	3%	=	$ 589,365

TOTAL SUPPLEMENTAL WORK $ 622,400

SECTION 11: STATE FURNISHED MATERIALS AND EXPENSES

Item code		Unit	Quantity		Unit Price ($)		Cost
066105	Resident Engineers Office	LS	1	x	30,000.00	=	$30,000
066063	Traffic Management Plan - Public Information	LS	1	x	60,000.00	=	$60,000
066901	Water Expenses	LS		x		=	$0
8609XX	Traffic Monitoring Station (X)	LS		x		=	$0
066841	Traffic Controller Assembly	LS		x		=	$0
066840	Traffic Signal Controller Assembly	LS		x		=	$0
066062	COZEEP Contract	LS	1	x	500,000.00	=	$500,000
066838	Reflective Numbers and Edge Sealer	LS		x		=	$0
066065	Tow Truck Service Patrol	LS		x		=	$0
066916	Annual Construction General Permit Fee	LS	1	x	10,000.00	=	$10,000
XXXXXX	Some Item	Unit		x		=	$0
	Total Section 1-8	$	19,645,500		1%	=	$ 196,455

TOTAL STATE FURNISHED $796,500

SECTION 12: TIME-RELATED OVERHEAD

Total of Roadway and Structures Contract Items excluding Mobilization $46,565,657 (used to calculate TRO)
Total Construction Cost (excluding TRO and Contingency) $52,102,770 (used to check if project is greater than $5 million excluding contingency)

Estimated Time-Related Overhead (TRO) Percentage (0% to 10%) = **5%**

Item code		Unit	Quantity		Unit Price ($)		Cost
090100	Time-Related Overhead	WD	783	X	$2,974	=	$2,328,300

TOTAL TIME-RELATED OVERHEAD $2,328,300

SECTION 13: ROADWAY CONTINGENCY

Risk Amount from Risk Register	(for Known Risks)			#REF!		#REF!
Additional or Residual Contingency	(for Unknown/Undefined Risks)			#REF!		#REF!
Total Section 1-12	$	25,357,300	x	**20%**	=	$5,071,460

TOTAL CONTINGENCY* $5,071,500

EA: 07-33880 PID: 717000061

II. STRUCTURE ITEMS

	Bridge 1		Bridge 2		
DATE OF ESTIMATE	12/13/22		12/13/22		00/00/00
Bridge Name	Lincoln Blvd Bridge		Culver Blvd Bridge		xxxxxxxxxxxxxxxxxxx
Bridge Number	53-0118		53-0089		57-XXX
Structure Type	PC/PS Wide Flange Girders on Coulumns		PC/PS Wide Flange Girders		xxxxxxxxxxxxxxxxxxx
Width (Feet) [out to out]	130 LF		54 LF		0 LF
Total Bridge Length (Feet)	335 LF		150 LF		0 LF
Total Area (Square Feet)	43485 SQFT		8150 SQFT		0 SQFT
Structure Depth (Feet)	5 LF		7 LF		0 LF
Footing Type (pile or spread)	CISS Pile		CIDH Piles		xxxxxxxxxxxxxxxxxxx
Cost Per Square Foot	$372		$658		$0
COST OF EACH	**$16,170,332**		**$5,365,794**		**$0**

	Building 1				
DATE OF ESTIMATE	00/00/00		00/00/00		00/00/00
Building Name	xxxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxxx
Bridge Number	57-XXX		57-XXX		57-XXX
Structure Type	xxxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxxx
Width (Feet) [out to out]	100 LF		0 LF		0 LF
Total Building Length (Feet)	150 LF		0 LF		0 LF
Total Area (Square Feet)	15000 SQFT		0 SQFT		0 SQFT
Structure Depth (Feet)	0 LF		0 LF		0 LF
Footing Type (pile or spread)	xxxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxxx		xxxxxxxxxxxxxxxxxxx
Cost Per Square Foot	$0		$0		$0
COST OF EACH	**$0**		**$0**		**$0**

TOTAL COST OF BRIDGES		**$21,536,126**
TOTAL COST OF BUILDINGS		**$0**
STRUCTURES MOBILIZATION	10%	**$2,153,613**
STRUCTURES CONTINGENCY*	25%	**$5,384,031**

TOTAL COST OF STRUCTURES $29,073,770

Estimate Prepared By:

XXXXXXXXXXXXXXXXX ------ Division of Structures

Date

EA: 07-33880 PID: 717000061

III. RIGHT OF WAY

Fill in all of the available information from the Right of Way Data Sheet.

A)	A1)	Acquisition, including Excess Land Purchases, Damages & Goodwill, Fees	$	13,850,000
	A2)	SB-1210	$	.
B)		Acquisition of Offsite Mitigation	$	0
C)	C1)	Utility Relocation (State Share)	$	3,444,000
	C2)	Potholing (Design Phase)	$	0
D)		Railroad Acquisition	$	0
E)		Clearance / Demolition	$	0
F)		Relocation Assistance (RAP and/or Last Resort Housing Costs)	$	0
G)		Title and Escrow	$	0
H)		Environmental Review	$	0
I)		Condemnation Settlements 0%	$	0
J)		Design Appreciation Factor 0%	$	0
K)		Utility Relocation (Construction Cost)	$	13,070

L)	**TOTAL RIGHT OF WAY ESTIMATE**	**$17,307,070**
M)	**TOTAL R/W ESTIMATE: Escalated**	**$21,334,000**
N)	**RIGHT OF WAY SUPPORT**	**$0**

Support Cost Estimate Prepared By ______________________
Project Coordinator[1] Phone

Utility Estimate Prepared By ______________________
Utility Coordinator[2] Phone

R/W Acquisition Estimate Prepared By ______________________
Right of Way Estimator[3] Phone

Note: Items G & H applied to items A + B

[1] When estimate has Support Costs only [2] When estimate has Utility Relocation [3] When R/W Acquisition is required

H. Storm Water Data Report Cover Sheet

Caltrans®

Dist-County-Route:	07-LA-001
Post Mile Limits:	R30.16 – R30.74
Type of Work:	Lincoln Boulevard Widening Project
Project ID (EA):	0717000061 (338800)

Phase: ☐ PID ☒ PA/ED ☐ PS&E

Applicable Caltrans Post Construction Treatment Requirement: 2012 ☐ 2022 ☒

Regional Water Quality Control Board(s): Region 4 – Los Angeles

Total Disturbed Soil Area: 9.16 acres (within CT R/W) PCTA: 6.14 acres (within CT R/W)

Alternative Compliance (acres): 0.24 ATA 2 (50% Rule)? Yes ☐ No ☒

Estimated Const. Start Date: 1/1/27 Estimated Const. Completion Date: 12/31/30

Risk Level: RL 1 ☐ RL 2 ☒ RL 3 ☐ WPCP ☐ Other: ______

Is (M)WELO applicable?	Yes ☐	No ☒
Is the Project within a TMDL watershed?	Yes ☐	No ☒
Does the project require trash treatment?	Yes ☒	No ☐
Notification of ADL reuse (if yes, provide date):	Yes ☐ Date: ______	No ☒

This Report has been prepared under the direction of the following Licensed Person. The Licensed Person attests to the technical information contained herein and the date upon which recommendations, conclusions, and decisions are based. Professional Engineer or Landscape Architect stamp required at PS&E only.

Brian Wright,
Registered Project Engineer/Landscape Architect

Farzana Huda, Date
Caltrans Designated Oversight Representative

I have reviewed the stormwater quality design issues and find this report to be complete, current and accurate:

REGISTERED PROFESSIONAL ENGINEER
Brian G. Wright
No. C59331
Exp. 6/30/25
CIVIL
STATE OF CALIFORNIA

Shabbir Ahmed, Project Manager *Date*

Rudy Ruiz, District Maintenance Stormwater Coordinator *Date*

Kathleen Hamer, Designated Landscape Architect Representative *Date*

Shao-Chiang Liu, District/Regional Design SW Coordinator *Date*

I. Draft Environmental Impact Report and Environmental Assessment Cover Sheet

State Route 1 (SR-1/Lincoln Boulevard) Multimodal Improvements Project

Along SR-1/Lincoln Boulevard Between Jefferson Boulevard and Fiji Way
in the City and County of Los Angeles
District 07-LA-001, (PM 30.16/30.74)
EA 07-33880--EFIS No. 0717000061
SCH No. 2018031048

Draft Environmental Impact Report/ Environmental Assessment

Prepared by the State of California Department of Transportation and the City of Los Angeles

The environmental review, consultation, and any other actions required by applicable Federal environmental laws for this project are being, or have been, carried out by Caltrans pursuant to 23 USC 327 and the Memorandum of Understanding dated May 27, 2022, and executed by FHWA and Caltrans.

Caltrans

April 2024

J. Right-of Way Data Sheet

To: District Division Chief
Division of Right of Way and Land Surveys

Date: April 19, 2024

Co. LA Rte. 1
Expense Authorization 07-338800

Attention: District Branch Chief
R/W Local Programs

Subject: **RIGHT OF WAY DATA SHEET - LOCAL PUBLIC AGENCIES**

Project Description:

Right of way necessary for the subject project will be the responsibility of Caltrans.

The information in this data sheet was developed by Psomas and Monument.

I. ***Right of Way Engineering***

Will Right of Way Engineering be required for this project?

- No _____
- Yes __X__ (Submit a copy of the *Right of Way Engineering Surveys and Mapping Services checklist for Locally Funded Projects*. This checklist includes, but is not limited to, the following items.)

    - Hard copy (base map) X
    - Appraisal map X
    - Acquisition Documents X
    - Property Transfer Documents X
    - R/W Record Map X
    - Record of Survey X

II. ***Engineering Surveys***

1. Is any surveying or photogrammetric mapping required?

   No _____ Yes __X__ (Complete the following.)

2. Datum Requirements

   Yes __X__ Project will adhere to the following criteria:
   - Horizontal - datum policy is NAD 83, CA-HPGN, EPOCH 1991.35 and English system of units and measures.
   - Vertical - datum policy is NAVD 88.
   - Units - Feet (English)

   No _____ Provide an explanation on additional page.

3. Will land survey monument perpetuation be scoped into the project, if required?

   Yes __X__

   No _____ Provide explanation on additional page.

III. ***Parcel Information (Land and Improvements)***

Are there any property rights required within the proposed project limits?

No _____ Yes __X__ (Complete the following.)

	Part Take*	Full Take	**Estimate
A. Number of Vacant Land Parcels	7	0	$ 216,362
B. Number of Single Family Residential Units	0	0	$ 0
C. Number of Multifamily Residential Units	1	0	$ 7,455,969
D. Number of Commercial/Industrial Parcels	2	0	$ 6,272,923
E. Number of Farm/Agricultural Parcels	0	0	$ 0
F. Permanent and/or Temporary Easements	5	0	$ 41,813
G. Other Parcels (define in "Remarks" section)	1	0	$ 88,825
Totals	16	0	$ 14,075,892

*Part takes include acquisitions which may require a partial fee acquisition and a TCE. Acquisitions listed under F "Permanent and/or Temporary Easements" will require TCE's only.
**Estimates include 18 month's escalation at 3% and a 25% contingency

Provide a general description of the right of way and excess lands required (zoning, use, improvements, critical, or sensitive parcels, etc.).

Widening of the proposed Lincoln Blvd. Bridge over Ballona Creek will require partial fee acquisitions and temporary construction easements from 2 commercial properties and 1 multi-family residential property on the east side of Lincoln Blvd. south of Ballona Creek. The project would eliminate a parking lot belonging to a medical building.

North of Ballona Creek, widening would require a small acquisition from a LA County Flood Control property on the east side of Lincoln but the existing drainage culvert would be unaffected. Small, sliver takes would be required from a landscaped area owned by LA County and a Southern California Edison parcel on the west side of Lincoln.

Throughout the project limits, permanent acquisitions and temporary construction easements would be required from the Ballona Wetlands Ecological Reserve, owned by the State of California and managed by the California Dept. of Fish and Wildlife. The City of Los Angeles will exchange an unused portion of property adjacent to the connector between Lincoln Blvd and Culver Blvd. for the rights required from the Reserve. It is anticipated that this will be a no-cost exchange.

IV. ***Dedications***

Are there any property rights which have been acquired, or anticipate will be acquired, through the "dedication" process for the Project?

No __X__ Yes _____ (Complete the following.)

Number of dedicated parcels ________

Have the dedication parcel(s) been accepted by the municipality involved?

V. ***Excess Lands / Relinquishments***

Are there Caltrans property rights which may become excess lands or potential relinquishment areas?

No __X__ Yes _____ (Provide an explanation on additional page.)

VI. ***Relocation Information***

Are relocation displacements anticipated?

No _____ Yes __X__ (Complete the following.)

A. Number of Single Family Residential Units	0		
Estimated RAP Payments		$	0
B. Number of Multifamily Residential Units	0		
Estimated RAP Payments		$	0
C. Number of Business/Nonprofit	0		
Estimated RAP Payments		$	0
D. Number of Farms	0		
Estimated RAP Payments		$	0
E. Other (define in the "Remarks" section)	1		
Estimated RAP Payments		$	13,067
Totals	1	$	13,067

VII. ***Utility Relocation Information***

Do you anticipate any utility facilities or utility rights of way to be affected?

No _____ Yes __X__ (Complete the following.)

	Utility Description	Owner	State Obligation	Local Obligation	Utility Owner Obligation
A	OH Distribution Power Pole/Streetlight W/ 2 Circuits	CALIFORNIA EDISON/LA DWP		$82,500	
B	OH Distribution Power Pole/Streetlight W/ 2 Circuits	CALIFORNIA EDISON/LA DWP		$82,500	
C	OH Distribution Power Pole/Streetlight W/ 2 Circuits	CALIFORNIA EDISON/LA DWP		$82,500	
D	OH Distribution Power Pole/Streetlight W/ 2 Circuits	CALIFORNIA EDISON/LA DWP		$82,500	
E	OH Distribution Power Pole W/ 2 Circuits	CALIFORNIA EDISON/LA DWP		$80,000	
F	OH Distribution Power Pole W/ 2 Circuits	CALIFORNIA EDISON/LA DWP		$80,000	

	Utility Description	Owner	State Obligation	Local Obligation	Utility Owner Obligation
G	OH Distribution Power Pole W/ 2 Circuits	CALIFORNIA EDISON/LA DWP		$80,000	
H	OH Distribution Power Pole W/ 2 Circuits	CALIFORNIA EDISON/LA DWP		$80,000	
I	OH Distribution Power Pole W/ 2 Circuits	CALIFORNIA EDISON/LA DWP		$80,000	
J	OH Distribution Power Pole W/ 2 Circuits	CALIFORNIA EDISON/LA DWP		$80,000	
K	OH Distribution Power Pole W/ 2 Circuits	CALIFORNIA EDISON/LA DWP		$80,000	
L	OH Distribution Power Pole W/ 2 Circuits	CALIFORNIA EDISON/LA DWP		$80,000	
M	OH Distribution Power Pole W/ 2 Circuits	CALIFORNIA EDISON/LA DWP		$80,000	
N	OH TELEPHONE	OH TELEPHONE		$120,000	$120,000
O	OH COMMUNICATION	OH COMMUNICATION			$240,000
P	Streetlights	CITY		$65,000	
Q	Fire Hydrants	LADWP		$5,000	
R	Guy Pole	CALIFORNIA EDISON/LA DWP		$15,000	
S	OH Distribution/Transmission Power Pole W/2 Circuits	CALIFORNIA EDISON/LA DWP		$95,000	
T	OH Distribution/Transmission Power Pole W/2 Circuits	CALIFORNIA EDISON/LA DWP		$95,000	
U	OH Distribution/Transmission Power Pole W/2 Circuits	CALIFORNIA EDISON/LA DWP		$95,000	
V	OH Distribution/Transmission Power Pole W/2 Circuits	CALIFORNIA EDISON/LA DWP		$95,000	
W	OH Distribution/Transmission Power Pole W/2 Circuits	CALIFORNIA EDISON/LA DWP		$95,000	
X	OH Distribution/Transmission Power Pole W/2 Circuits	CALIFORNIA EDISON/LA DWP		$95,000	
Y	OH Distribution/Transmission Power Pole W/2 Circuits	CALIFORNIA EDISON/LA DWP		$95,000	
Z	OH Distribution/Transmission Power Pole W/2 Circuits	CALIFORNIA EDISON/LA DWP		$95,000	
AA	OH Telephone	OH TELEPHONE		$110,000	$110,000
BB	OH Communication	OH COMMUNICATION		$110,000	$110,000
CC	OH Communication	OH COMMUNICATION			$220,000
DD	OH Communication	OH COMMUNICATION			$220,000
EE	Fire Hydrant	LADWP		$5,000	
FF	Blow Off Structures	LADWP		$4,500	
GG	UG Conduits: 6-8" & 2-4"	LADWP		$140,000	
HH	UG Conduits: 8-6" & 1-4"	LADWP		$130,000	
II	UG Conduits: 1-4"	AT&T		$28,000	$28,000
JJ	UG Conduits: 1-2"	AT&T		$26,000	$26,000
KK	UG Conduits: 4-5"	Frontier		$46,000	$46,000
LL	UG Conduits: 6-4"	Frontier		$45,000	$45,000

	Utility Description	Owner	State Obligation	Local Obligation	Utility Owner Obligation
MM	16" Water	LADWP		$96,000	

	State Obligation	Local Obligation	Utility Owner Obligation
SUBTOTAL:	N/A	$2,755,500	$1,165,000
25% Contingency	N/A	$688,875	$291,250
TOTAL	**N/A**	**$3,444,375**	**$1,456,250**

Any additional information concerning utility involvement on this project?

Additional information is included on the attached Utility Information Sheet.

VIII. ***Rail Information***

Are railroad facilities or railroad rights of way affected?

No __X__ Yes _____ (Complete the following.)

Describe railroad facilities or railroad rights of way affected.

	Owner's Name	Transverse Crossing	Longitudinal Encroachment
A.	N/A	N/A	N/A
B.	N/A	N/A	N/A

Discuss types of agreements and rights required from the railroads. Are grade crossings that require services contracts, or grade separations that require construction and maintenance agreements involved?

IX. ***Clearance Information***

Are there improvements that require clearance?

No __X__ Yes _____ (Complete the following.)

A. Number of Structures to be Demolished ___N/A___
Estimated Cost of Demolition $ ____________

X. ***Hazardous Materials/Waste***

Are there any site(s) and/or improvements(s) in the Project Limits that are known to contain *hazardous materials*? None __X__ Yes _____ (Explain in the "Remarks" section.)

Are there any site(s) and/or improvement(s) in the Project Limits that are suspected to contain *hazardous waste*? None __X__ Yes _____ (Explain in the "Remarks" section.)

XI. ***Project Scheduling***

	Proposed lead time	Completion date
* Preliminary Engineering, Surveys	3 (months)	9/2024
* R/W Engineering Submittals	6 (months)	12/2024
* R/W Appraisals/Acquisition	18 (months)	06/2026
Proposed Environmental Clearance		03/2024
Proposed R/W Certification		09/2026

XII. ***Proposed Funding***

	Local	State	Federal	Other
Acquisition	$13,843,305			
Utilities	$3,444,375			$1,456,250
Relocation Assistance Program	$13,067			
R/W Support Cost	$ 232,587			

XIII. ***Remarks***

Section III – Parcel Information – G (Other Parcels)

A small partial acquisition and TCE would be required from a parcel owned by Southern California Edison. The parcel houses SCE's Tahiti Substation, however, the portion required by the project is an unimproved portion fronting Lincoln Blvd. No impact to the substation operations are anticipated.

Section VI – Relocation Information – E (Other)

A lighted monument sign owned by the Fountain Park Apartments would be impacted by the proposed widening. There would be sufficient space to relocate the sign closer to the building in the after condition, so relocation costs have been included in the estimate.

Project Sponsor Consultant Prepared by:	Project Sponsor Reviewed and Approved by:
Brian J Swanner	Robert Sanchez (Apr 22, 2024 17:12 PDT)
BJ Swanner, Monument	Robert Sanchez, Senior Transportation Engineer, City of Los Angeles
April 19, 2024 Date	April 22, 2024 Date

I have reviewed the right-of-way information contained in this report and the Right-of-Data Sheet attached hereto, completed by the City of Los Angeles and/or its consultant, Psomas, and find the data to be complete as to form and procedures. No inference or assertions are made as to the validity of the data or the values implied by the Right-of-Way Data Sheet.

Mark Lyles

Caltrans District Branch Chief
Local Programs
Division of Right of Way

4/23/2024
Date

K. Risk Register

LEVEL 2 - RISK REGISTER				Project Name:	Lincoln Multimodal Bridge Improvement Project		DIST- EA	07-33880	Project Manager	Shabbir Ahmed						
Risk Identification							Risk Assessment						Risk Response			
Status	ID #	Type	Category	Title	Risk Statement	Current status/assumptions	Probability	Cost Impact	Cost Score	Time Impact	Time Score	Rationale	Strategy	Response Actions	Risk Owner	Updated
Active	1	Threat	Design	Survey File and Mapping	Inaccuracies or incomplete information in the aerial mapping file could lead to rework of the final design.		1-Very Low	1 -Very Low	1	4 -Moderate	4		Mitigate	Conduct detailed topographic field surveys before final design	City of LA	1/31/2023
Active	2	Threat	Environmental	Challenge to EIR/EA	Potential lawsuits may challenge the environmental report due to sensitivities from the community and resource agencies regarding encroachment into ballona wetlands, delaying the start of construction or threatening loss of funding.		3-Moderate	4 -Moderate	12	4 -Moderate	12		Avoid	Proactively coordinate and address concerns of stakeholders and resource agencies during the PA&ED and Design phase.	City of LA	1/31/2023
Active	3	Threat	R/W	Delay of R/W Acquisition	For the acquisition from 2 commercial and 1 multi family residential properties, it may require the use of the condemnation process to acquire R/W, which could delay start of construction by up to two years, increasing construction costs and extending the time for completion.		2-Low	4 -Moderate	8	4 -Moderate	8		Mitigate	Coordinate with property owners and minimize acquisition as much as possible to reduce impacts.	City of LA	1/31/2023
Active	4	Threat	Design	Design Exceptions	Design exceptions are required for nonstandard shoulder width, side slope, and superelevation. The PA&ED DSDD was approved by Caltrans on 4/17/2024. It is unlikely but the justification for the design exceptions may be challenged during final design.		1-Very Low	1 -Very Low	1	4 -Moderate	4		Mitigate	Continuous coordination with Caltrans Design to retain approval of design exceptions.	City of LA	1/31/2023
Active	5	Threat	Construction	Cultural Findings / Buried Objects	The initial findings of the cultural investigation required a XPI, unanticipated buried man-made objects uncovered during construction require removal and disposal resulting in additional costs and extending the schedule.		2-Low	2 -Low	4	2 -Low	4		Mitigate	Conduct XPI and Phase II investigation to minmize the potenial of unanticipated buried man made objects before construction.	City of LA	1/31/2023
Active	6	Threat	Environmental	Coastal Development Permit (CDP)	During the final design phase, a coastal development permit is required from the coastal commission and requires consent from partnering agencies including CDFW, and the impacts to the ballona wetlands could increase the cost of mitigation and extend the schedule for completion.		4-High	4 -Moderate	16	4 -Moderate	16		Mitigate	Continue to coordinate with the California Coastal Commission regarding impacts and further reduce the impacts if at all possible.	City of LA	1/31/2023
Active	7	Threat	Environmental	Wetlands	The widening will encroach on wetlands within the ballona preserve and the mitigation requirements and the R/W exchange will increase costs and extend the schedule.		1-Very Low	1 -Very Low	1	2 -Low	2		Mitigate	Mitigate for the wetland impacts through on and off site mitigation.	City of LA	1/31/2023
Active	8	Threat	R/W	R/W Exchange	The City will exchange 1.19 acres of wetlands located east of the Culver Loop to compensate for the 1.19 acres of Ballona Wetlands Reserve required to widen Lincoln Blvd. This exchange could extend the schedule or require a different approach if both parties do not sign the agreement for the exchange.		2-Low	2 -Low	4	2 -Low	4		Mitigate	Coordinate with CDFW to exchange right of way to offset the impacts to the wetlands from the widening.	City of LA	1/31/2023
Active	9	Threat	Construction	Utility Relocations	Existing utilities in the existing bridge will need to be relocated to the new bridge. The relocation of the utilities, and specifically the electric transmission line, could complicate the construction and delay the schedule.		4-High	4 -Moderate	16	4 -Moderate	16		Mitigate	Coordinate with utility companies to make sure relocation occurs in advance and does not impact construction activities.	City of LA	1/31/2023
Active	10	Threat	Construction	Hazardous Materials	Hazardous materials encountered during construction either through the excavation of earthwork or removal of existing bridge will require an on-site storage area and potential additional costs to dispose at an offsite facility.		1-Very Low	1 -Very Low	1	4 -Moderate	4		Mitigate	Reduce the impacts to contaminated soils and bridge removal and dispose offsite to an approved location.	City of LA	1/31/2023

L. Traffic Engineering Study

Final

Transportation Analysis Report (TAR): Lincoln Bridge Multi-Modal Improvement Project

Prepared for:
City of Los Angeles
& Caltrans

January 2020

LA17-2940

FEHR PEERS

Table of Contents

Appendices

List of Figures

List of Tables

1. INTRODUCTION

Fehr & Peers prepared this Transportation Analysis Report for the Lincoln Bridge Multi-Modal Improvement Project, which proposes to replace the existing Lincoln Boulevard Bridge over Ballona Creek. The new structure will provide enhanced multi-modal travel opportunities, including an additional southbound travel lane, protected bike lanes in both directions, new sidewalks, and additional improvements to Culver Boulevard and Lincoln Boulevard. This report provides an analysis of traffic operations and multi-modal safety. Portions of the analysis results will also be used to comply with environmental impact analysis requirements for the California Environmental Quality Act (CEQA).

PROJECT DESCRIPTION

The Project is located within the City of Los Angeles in Los Angeles County, California. The Project proposed by the City, in cooperation with Caltrans, would replace the existing Lincoln Boulevard Bridge over Ballona Creek with a new structure that will relieve the existing southbound vehicular bottleneck and provide enhanced multi-modal travel opportunities. The new Lincoln Bridge would provide an additional travel lane in the southbound direction, protected bike lanes in both directions, and new sidewalks on both sides of the street. The protected bike lanes and sidewalks would extend from Fiji Way to Jefferson Boulevard. Other improvements include adding new bike lanes and sidewalks on the Culver Boulevard overcrossing, as well as reconfiguring the Lincoln Boulevard southbound approach at Jefferson Boulevard. **Figure 1** presents the Existing Conditions along Lincoln Bridge, as well as the lane configurations of the proposed Project.

The transportation analysis was conducted for five scenarios:

- Existing Conditions (2019)
- Opening Year No Build Conditions (2025)
- Opening Year Build Conditions (2025)
- Design Year No Build Conditions (2045)
- Design Year Build Conditions (2045)

The traffic operations analysis focuses on the AM and PM peak hours.

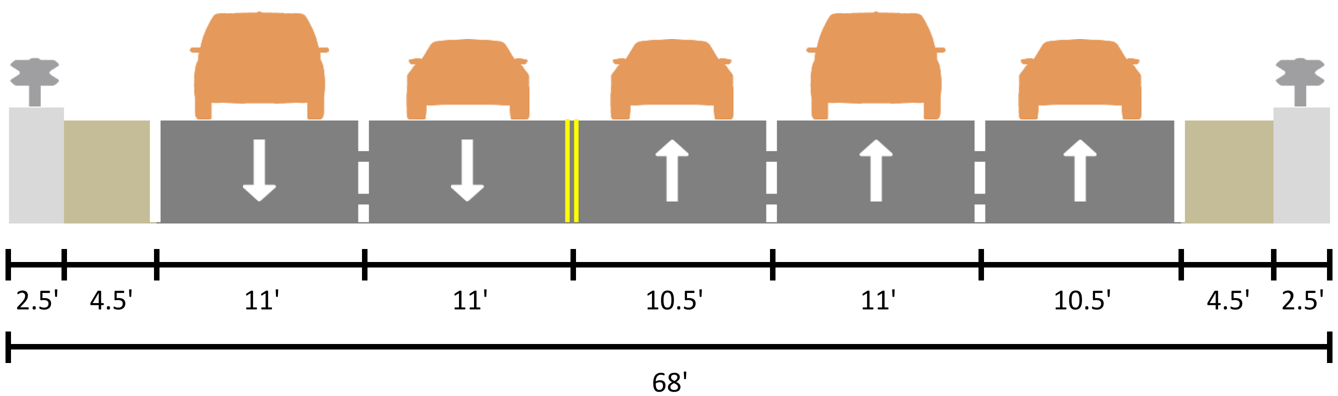
REPORT ORGANIZATION

The report is organized into the following chapters:

- ***Data Collection and Analysis Methodology*** – Chapter 2 presents the study area, data collection and operational analysis methodologies.
- ***Existing (2019) Transportation Conditions*** – Chapter 3 presents the existing physical and operational characteristics of the transportation system within the study area.
- ***Travel Demand Forecasts*** – Chapter 4 presents Opening Year (2025) and Design Year (2045) peak period traffic forecasts for the study area.

- ***Opening Year & Design Year Traffic Operations Analysis*** – Chapter 5 presents Opening Year (2025) and Design Year (2045) traffic operations analysis results.
- ***VMT Analysis*** – Chapter 6 presents the results of the VMT analysis for the study area, both with and without the Project.
- ***Bicycle and Pedestrian Analysis*** – Chapter 7 presents an analysis of how the project is expected to affect bicycle and pedestrian conditions within the study area.
- ***Traffic Analysis Summary*** – Chapter 8 presents an overall summary of the transportation analysis results.

Existing



Build Conditions

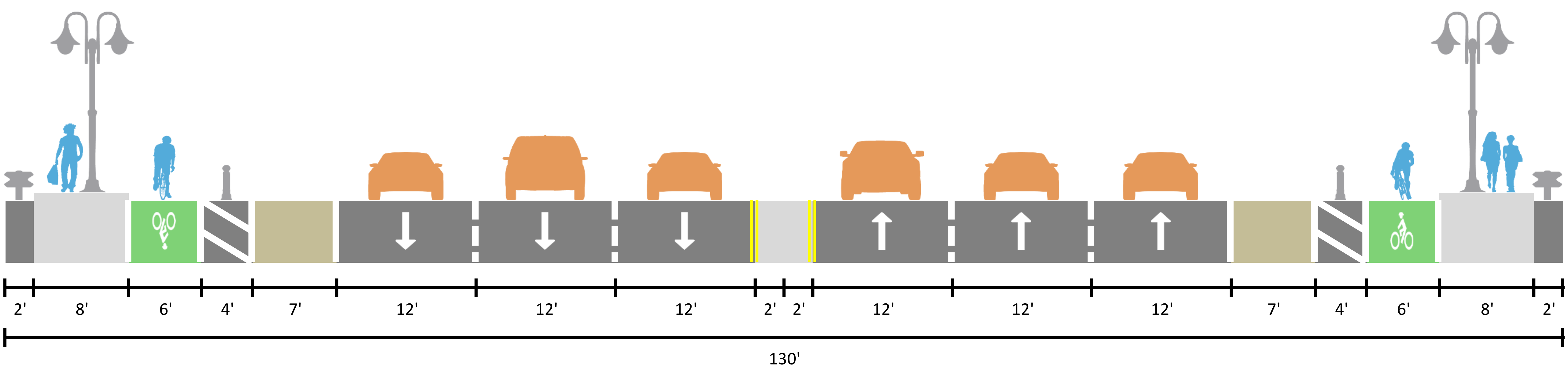


Figure 1

Lincoln Bridge Cross-Sections

2. DATA COLLECTION AND ANALYSIS METHODOLOGY

This chapter presents the study area, data collection and operational analysis methodologies.

STUDY AREA

The study area is defined as Lincoln Boulevard between Fiji Way and Jefferson Boulevard. The study area also includes the Culver Boulevard overpass. **Figure 2** illustrates the transportation analysis study area. This study evaluates the following intersections:

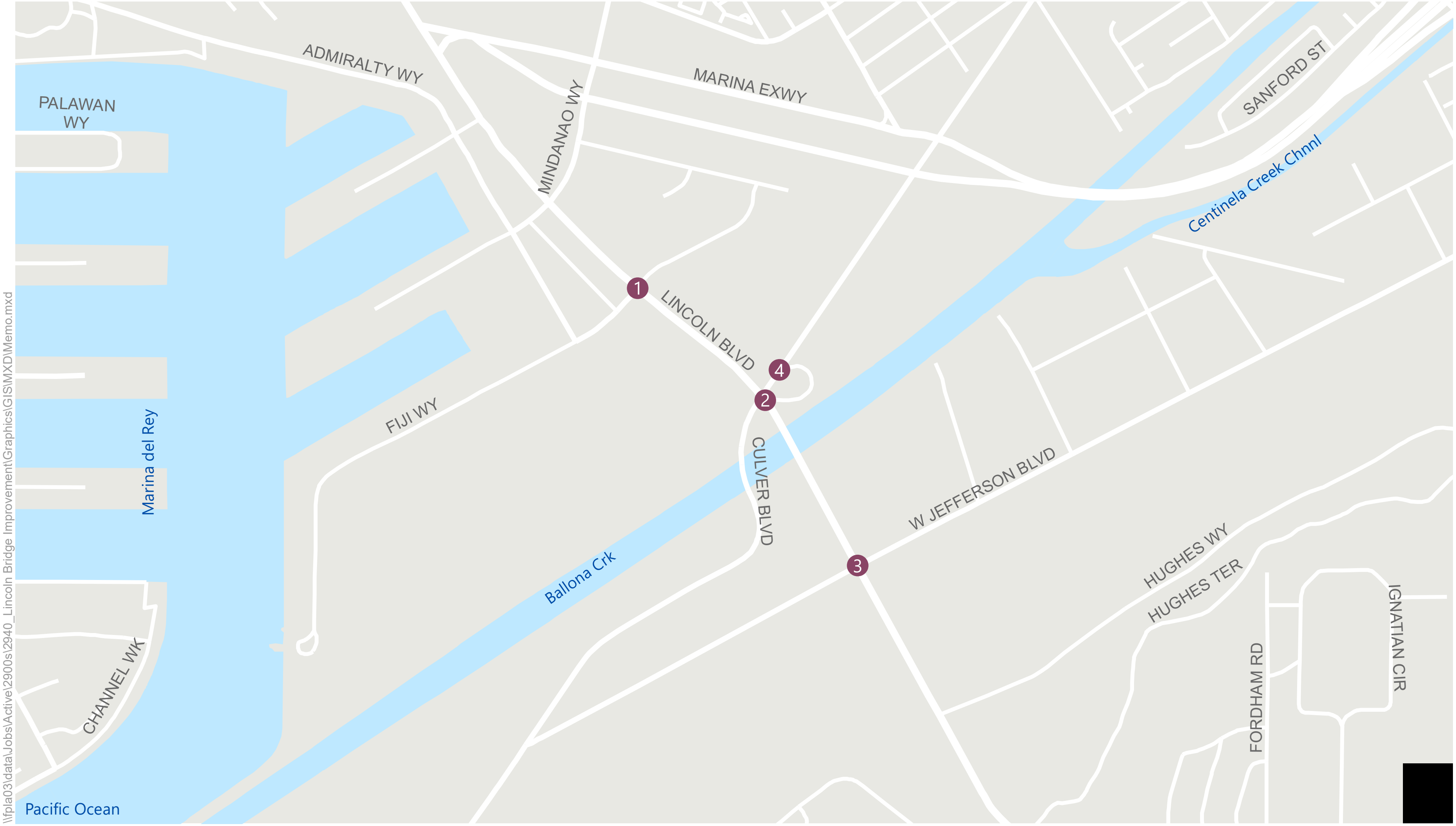
1. Lincoln Boulevard & Fiji Way
2. Lincoln Boulevard & Culver Loop to Lincoln Boulevard
3. Lincoln Boulevard & Jefferson Boulevard
4. Culver Boulevard & Culver Loop to Lincoln Boulevard

TRAVEL DEMAND FORECASTING METHODOLOGY

The 2016 City of Los Angeles Travel Demand Model was used to develop future year forecasts for the Lincoln Bridge Multi-Modal Improvement Project. The base year of the model is 2016 and the future year of the model is 2040. The Los Angeles Travel Demand Model reflects socio-economic data and a transportation network that is consistent with the 2016 Southern California Association of Governments (SCAG) Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) model. As part of the City of Los Angeles Travel Demand Model development, the outputs from each of the four model steps (trip generation, trip distribution, mode choice, and assignment) were verified to be consistent with the outputs from the SCAG regional model at the countywide level.

The City of Los Angeles Model is a focused version of the SCAG RTP model that includes more zonal and roadway network detail within the City of Los Angeles and adjacent cities. In 2016, Fehr & Peers updated the City of Los Angeles Travel Demand Model as part of the *Infill and Complete Streets – Capturing VMT Impacts and Benefits to CEQA Project* with the Department of City Planning. The citywide model update focused on consistency with the latest version of the SCAG regional travel demand model, improving key components of the model process, and meeting or exceeding industry standards for calibration and validation. The details of the updated Los Angeles Travel Demand Model are available as part of the *Model Development Report: 2016 City of Los Angeles Travel Demand Model* (Fehr & Peers, 2017).

Fehr & Peers used the City of Los Angeles Travel Demand Model to generate 2040 forecasts within the study area. AM and PM peak hour traffic forecasts were developed for each of the four study intersections based on post-processed model outputs using the difference methodology. This methodology is consistent with methodologies delineated in the National Cooperative Highway Research Program Report (NCHRP) 255 published by the Transportation Research Board (TRB): Highway Traffic Data for Urbanized Area Project Planning and Design (Transportation Research Board, December 1982). The Base Year (2016) and Future Year (2040) models were used to calculate straight-line annual growth rates for turning movements at study intersections. The growth rates were then applied to existing traffic counts (collected November 2019) to develop the Opening Year (2025) and Design Year (2045) No Build Conditions traffic projections. The City of Los Angeles Travel Demand Model network was then edited to include the additional southbound lane on Lincoln Boulevard to reflect Build Conditions, and post-processed volumes were developed as outlined previously for the Opening Year (2025) and Design Year (2045) Build scenarios.



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● Study Intersections

[redacted]

Figure 2

Lincoln Bridge Study Area

STUDY AREA SOCIO-ECONOMIC DATA

Socio-economic estimates for the study area, including a radius of approximately one mile surrounding the project, were compiled from the Los Angeles Travel Demand Model for the years 2016 and 2040. These years represent the base and future years of the model. **Table 1** compares the population, household, and employment estimates within the project area between 2016 and 2040. The 2040 estimates show approximately 30% growth in population and households and 20% growth in total employment.

TABLE 1: CITY OF LOS ANGELES SOCIO-ECONOMIC DATA COMPARISON

Forecast	Population	Households	Employment
2016 LA Model	43,370	21,000	23,845
2040 LA Model	55,245	26,865	28,015

Source: Fehr & Peers, 2020.

CITY OF LOS ANGELES TRAVEL DEMAND MODEL TRANSPORTATION NETWORK

The highway and transit network transportation system improvements included in the future year scenario of the City of Los Angeles Travel Demand Model were selected from the projects included in the 2040 Plan scenario of the 2016 SCAG RTP/SCS. The SCAG project list is divided into three sections:

- Federal Transportation Improvement Program (FTIP): includes six years of committed funding for projects included on the 2015 FTIP and Amendments 1-7 and 12
- Financially Constrained RTP: includes funded projects beyond those included in the FTIP
- Strategic Plan: includes an unconstrained list of potential projects that the region would pursue given additional funding and commitment

The improvements selected for the City of Los Angeles Travel Demand Model future scenario include those projects from the FTIP and Financially Constrained lists within the boundaries of the City model. These include 48 arterial projects, 19 highway projects, and 19 transit projects. Near the proposed Project, these include:

- Improving the SR-90/SR-1 (Lincoln Boulevard) Intersection
- Widening Sepulveda Boulevard between Jefferson Boulevard and Green Valley Circle
- Widening I-405 between La Tijera Boulevard and Jefferson Boulevard

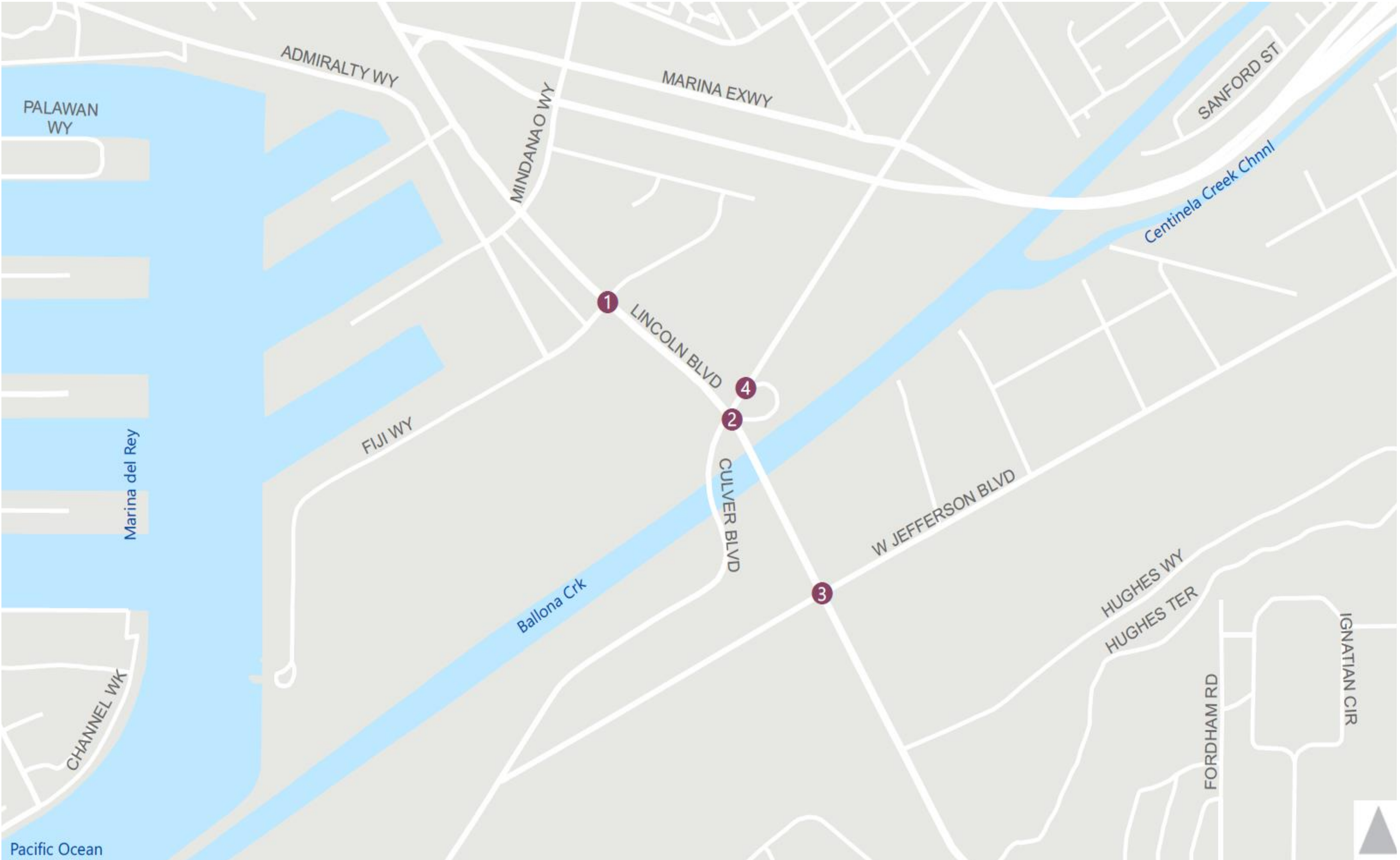
As part of the analysis for this Project, Fehr & Peers added network detail to the City of Los Angeles Travel Demand Model to better reflect existing conditions within the study area. These edits included turn penalties that reflect turning restrictions within the study area, including a westbound protected left turning movement from the Culver Loop to southbound Lincoln Boulevard, as well as a more detailed representation of the existing lane configuration along Lincoln Boulevard. As part of the future year Build model, Fehr & Peers edited the model network to reflect the additional southbound lane on Lincoln Boulevard that is part of the analyzed Project.

DATA COLLECTION AND VOLUME DEVELOPMENT

Traffic and transportation data collection efforts were undertaken to determine existing peak hour traffic volumes and lane configurations within the study area. Existing and proposed pedestrian/bicycle facilities were identified and transit service information for routes within the area was also collected.

LOCAL STREET SYSTEM TRAFFIC DATA

Weekday intersection turning movement vehicle counts were conducted during the morning (7:00 to 10:00 AM) and evening (3:00 to 6:00 PM) peak periods at all of the study intersections in November 2019. All counts were conducted while schools were in session and are included in **Appendix A**. Peak hour volumes were balanced across the study intersections to account for the differences in unique intersection peak hours. The peak hour traffic volumes are shown in **Figure 3**. Bicycle and pedestrian crossing volumes were also collected at each of the four study intersections during this time.



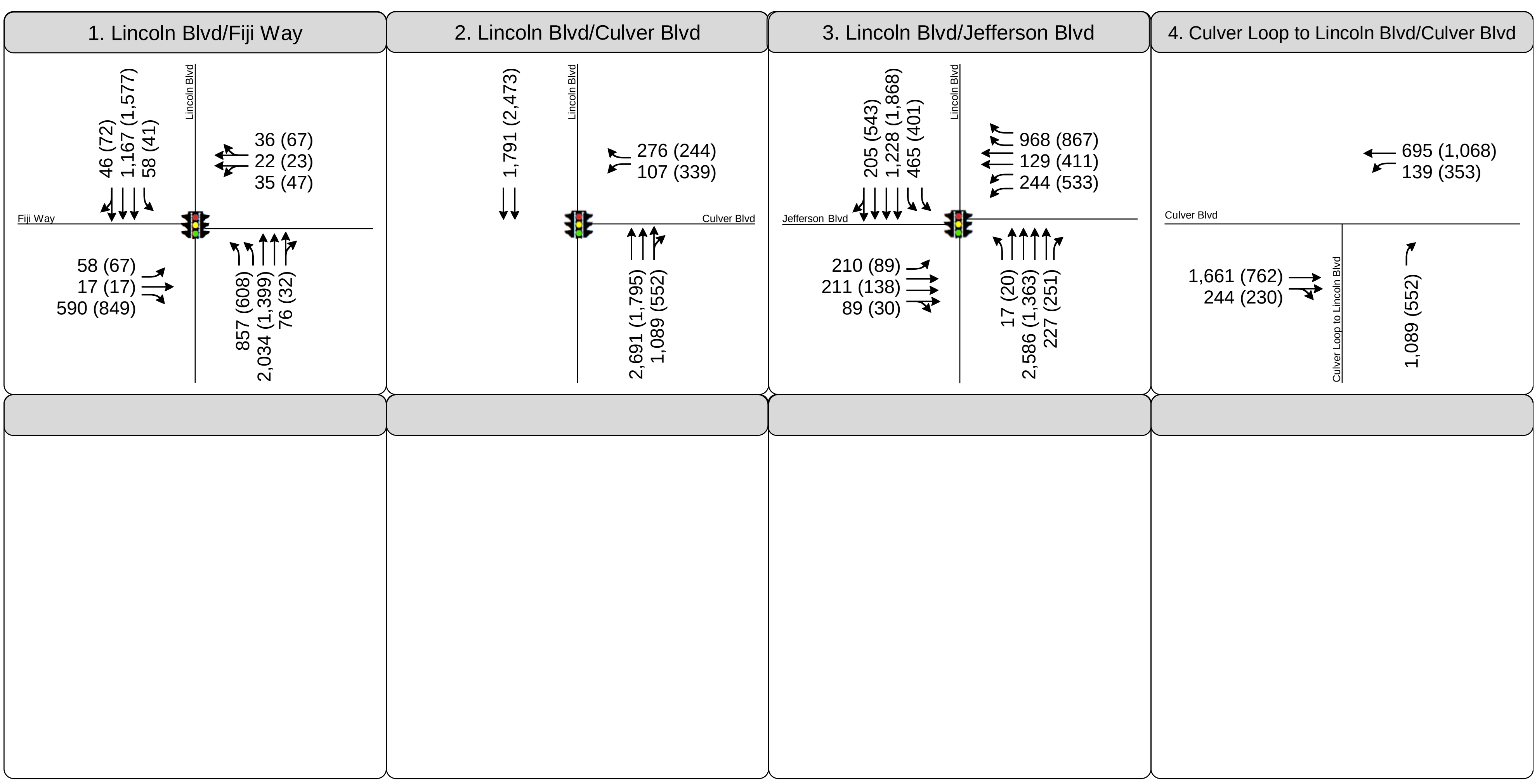


Figure 3

Peak Hour Traffic Volumes and Lane Configurations
Existing (2019) Conditions

TRAFFIC OPERATIONS ANALYSIS METHODOLOGY

Traffic operations for the study area were analyzed using the Synchro 9.0 software program. Synchro calculates vehicle delay and level of service based on procedures outlined in the Transportation Research Board's *2010 Highway Capacity Manual* (HCM 2010).

The analysis results include a descriptive term known as level of service (LOS). LOS is a measure of traffic operating conditions, which varies from LOS A (indicating free-flow traffic conditions with little or no delay) to LOS F (representing over-saturated conditions where traffic flows exceed design capacity resulting in long queues and delays). These ratings represent the perspective of drivers and are an indication of the comfort and convenience associated with driving. Peak hour traffic volumes, lane configurations, and signal timing plans were used as inputs for the LOS calculations. **Table 2** summarizes the relationship between the average control delay per vehicle and LOS for signalized and unsignalized intersections. Results from Synchro were used to determine delay and LOS at all intersections.

TABLE 2: LOS THRESHOLDS FOR SIGNALIZED AND UNSIGNALIZED INTERSECTIONS

LOS	Signalized Intersection Average Control Delay (sec/veh)	Unsignalized Intersection Average Control Delay (sec/veh)	General Description
A	≤ 10	≤ 10	Little to no congestion or delays.
B	> 10 to 20	> 10 to 15	Limited congestion. Short delays.
C	> 20 to 35	> 15 to 25	Some congestion with average delays.
D	> 35 to 55	> 25 to 35	Significant congestion and delays.
E	> 55 to 80	> 35 to 50	Severe congestion and delays.
F	> 80	> 50	Total breakdown with extreme delays.

Source: *2010 Highway Capacity Manual*, Transportation Research Board, 2010.

3. EXISTING (2019) TRANSPORTATION CONDITIONS

This chapter describes the Existing (2019) Conditions of the roadway facilities, pedestrian and bicycle facilities, and transit service. It also presents existing traffic volumes and operations for the study intersections.

ROADWAY NETWORK

As noted above, **Figure 2** illustrates the traffic study area, which is defined as Lincoln Boulevard between Fiji Way and Jefferson Boulevard, and the Culver Boulevard overpass. The characteristics of the major roadways serving the study area are described below. The street descriptions include the designation of the roadway under the *Mobility Plan 2035, An Element of the General Plan* adopted by the Los Angeles City Council in September 2016.

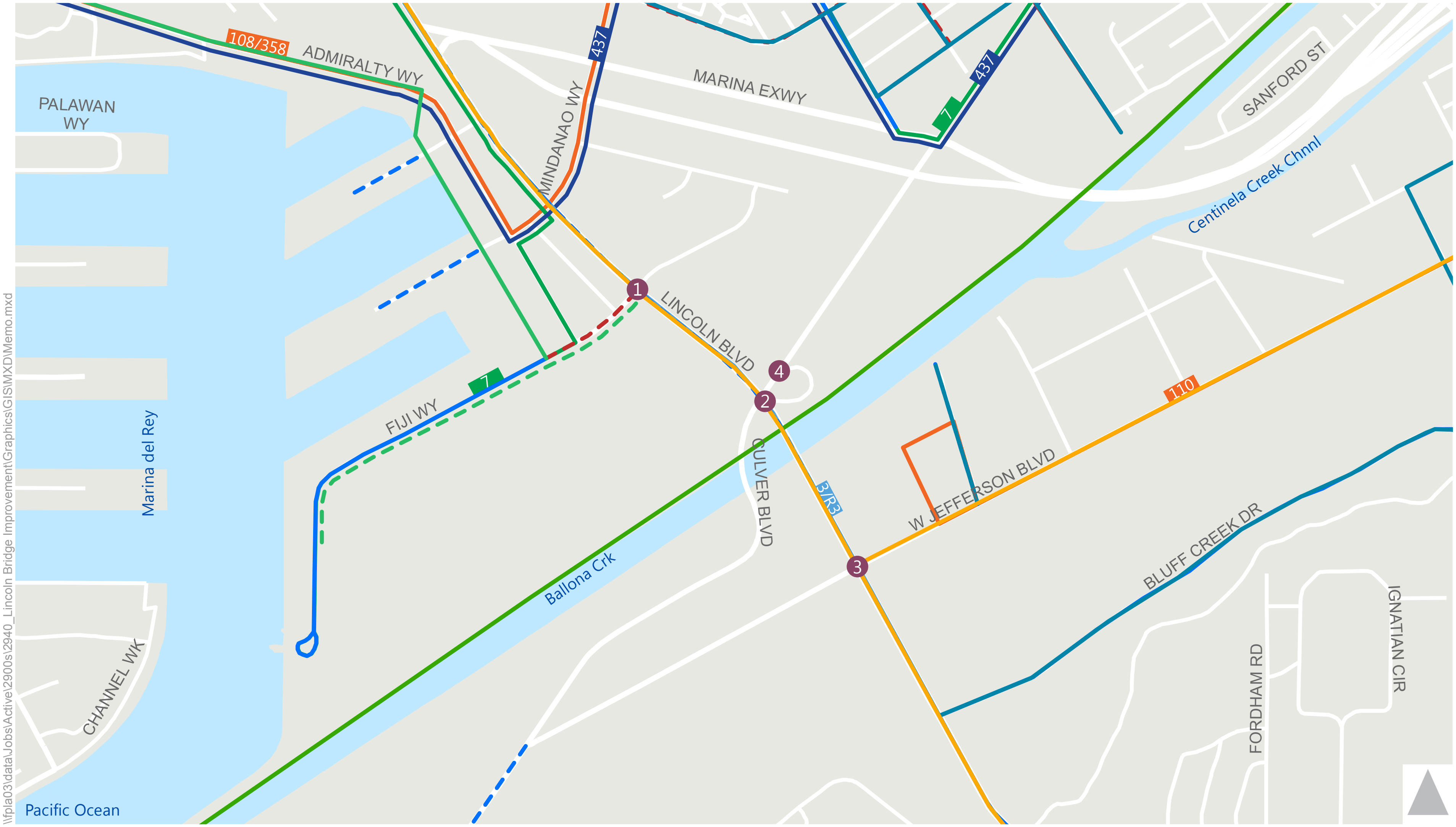
Lincoln Boulevard is designated as a Boulevard I and runs north/south with two to three travel lanes in each direction. On the bridge, the southbound direction provides two travel lanes and the northbound direction provides three travel lanes. At Jefferson Boulevard, the southbound direction widens to provide four travel lanes. Lanes are 10 feet wide and parking is not permitted on either side.

Jefferson Boulevard is designated as a Boulevard II and runs east/west with two to three travel lanes in each direction. Lanes are approximately 10 feet wide and parking is not permitted on either side of the street.

Culver Boulevard is designated as an Avenue I east of the Project and an Avenue III west of the Project. The street runs northeast/southwest with one travel lane in the southwest direction and two lanes in the northeast direction. The Culver Loop provides northbound and southbound access to Lincoln Boulevard with one right-turn lane from Culver Boulevard to northbound Lincoln Boulevard, one protected left-turn lane from Culver Boulevard to southbound Lincoln Boulevard, and one left-turn lane from Lincoln Boulevard onto northeast-bound Culver Boulevard. The Culver overpass provides one travel lane in each direction.

Fiji Way is designated as a Local Street. It runs east/west and provides one to two travel lanes west of Lincoln Boulevard and provides one travel lane in each direction east of Lincoln. Lanes are approximately 10 feet wide with parking permitted on both sides of the street, east of Lincoln.

Figure 4 illustrates those roads in the study area that are classified as enhanced street networks, according to the *Mobility Plan 2035*. The Neighborhood Enhanced Network designation indicates streets have been prioritized for future streetscape improvements to provide a calm and safe environment for walking, biking, and the circulation of slower moving modes. The Bicycle Enhanced Network consists of streets prioritized for safe and comfortable bicycle travel, and enhanced bicycle facilities. The Transit Enhanced Network is a network of streets prioritized for upgrades to improve transit performance and enhance rider facilities, such as transit shelters. Lincoln Boulevard is part of the Transit Enhanced Network.



Study Intersections
Bicycle Enhanced Network
Neighborhood Enhanced Network
Transit Enhanced Network

Figure 4

Mobility Plan 2035 Enhanced Street Network

INTERSECTION TRAFFIC OPERATIONS

Existing intersection traffic volumes, lane configurations, and signal timings were used to calculate LOS for the study intersections during the AM and PM peak hours. Existing lane configurations are shown in **Figure 3.** The results of the LOS analysis were calculated using Synchro 9.0 software and are presented in **Table 3**. LOS calculation sheets are presented in **Appendix B**.

The traffic volumes collected along Lincoln Boulevard reveal peak hour directionality. Peak hour volumes are heavier in the northbound direction in the AM peak hour and in the southbound direction during the PM peak hour. Therefore, the southbound bottleneck due to the lane reduction at the Lincoln Bridge is more prominent during the PM peak hour. As the results show, two of the four study intersections operate at LOS C or better during the PM peak hour. The following intersections operate at LOS D, E, or F during one or more of the peak hours analyzed:

1. Lincoln Boulevard & Fiji Way (LOS D during the AM peak hour)
2. Lincoln Boulevard & Culver Loop to Lincoln Boulevard (LOS E during the AM peak hour)
3. Lincoln Boulevard & Jefferson Boulevard (LOS F during the AM peak hour and LOS D during the PM peak hour)

TABLE 3: EXISTING (2019) CONDITIONS PEAK HOUR INTERSECTION OPERATIONS

Intersection		AM Peak Hour		PM Peak Hour	
		Delay	LOS	Delay	LOS
1	Lincoln Boulevard & Fiji Way	36.1	D	33.4	C
2	Lincoln Boulevard & Culver Loop to Lincoln Boulevard [1]	64.1	E	28.6	C
3	Lincoln Boulevard & Jefferson Boulevard	128.4	F	38.4	D
4	Culver Boulevard & Culver Loop to Lincoln Boulevard [2]	<5.0	A	<5.0	A

Source: Fehr & Peers, 2020.
[1]Signal timing modified for the WBR movement to enable HCM2010 analysis.
[2]Unsignalized intersection - LOS calculated using HCM 2010, as a Two-Way Stop Control.

QUEUE ANALYSIS

Table 4 shows the 95th percentile queue lengths for critical turning movements at each of the four intersections in the study area. Queue lengths exceed storage lengths at the following approaches:

- Lincoln Boulevard & Fiji Way – NBL (AM peak hour)
- Lincoln Boulevard & Culver Loop to Lincoln Boulevard – WBR (AM peak hour)
- Lincoln Boulevard & Culver Loop to Lincoln Boulevard – WBL (PM peak hour)
- Lincoln Boulevard & Jefferson Boulevard – SBL (AM and PM peak hours)
- Lincoln Boulevard & Jefferson Boulevard – WBR (AM peak hour)
- Lincoln Boulevard & Jefferson Boulevard – EBL (AM peak hour)

Queue analysis calculations are presented in **Appendix C**.

TABLE 4: EXISTING (2019) CONDITIONS PEAK HOUR 95TH PERCENTILE QUEUES

	Intersection	Movement	Storage Length (ft)	95th Percentile Queue (ft)	
				AM	PM
1	Lincoln Boulevard & Fiji Way	NBL	330	**#500**	325
		SBL	215	100	75
		EBL	175	100	100
		EBR[3]	--	--	--
2	Lincoln Boulevard & Culver Loop to Lincoln Boulevard	WBR	310	**#425**[1]	300
		WBL	310	175	**#475**
3	Lincoln Boulevard & Jefferson Boulevard	NBL	200	50	50
		NBR	210	100	50
		SBL	250	**#400**	**m225**
		WBL	440	175	325
		WBR	440	**#700**	275
		EBL	200	**#350**	175
4	Culver Boulevard & Culver Loop to Lincoln Boulevard	WBL	250	50[2]	75[2]

Source: Fehr & Peers, 2020.
Notes: Queue lengths have been rounded to the next 25 feet.
[1]This movement has both a protected and permissive right turn, but only the permissive portion was analyzed due to custom phasing.
[2]Queue length calculated based on HCM 2010 LOS analysis and an average vehicle length of 25 feet.
[3]This movement has a dedicated right-turn lane, with a Yield control, and merges with SB Lincoln Boulevard downstream.
Bold indicates that 95th percentile queue length exceeds available storage.
# indicates that 95th percentile volume exceeds capacity, queue may be longer.
m indicates volume for 95th percentile queue is metered by upstream signal.

EXISTING PUBLIC TRANSIT SERVICE

Five local and rapid bus routes currently serve the area, as illustrated in **Figure 5** and described below.

BIG BLUE BUS

Line 3/Rapid 3 runs along Lincoln Boulevard through the study area and connects Santa Monica to the Los Angeles International Airport. The local route has 20 minute headways and the rapid route has 12 minute headways during the peak hours.

METRO

Line 110 runs northeast/southwest along Jefferson Boulevard in the study area. Line 110 runs between Playa Vista and Bell Gardens and has 20 minute headways.

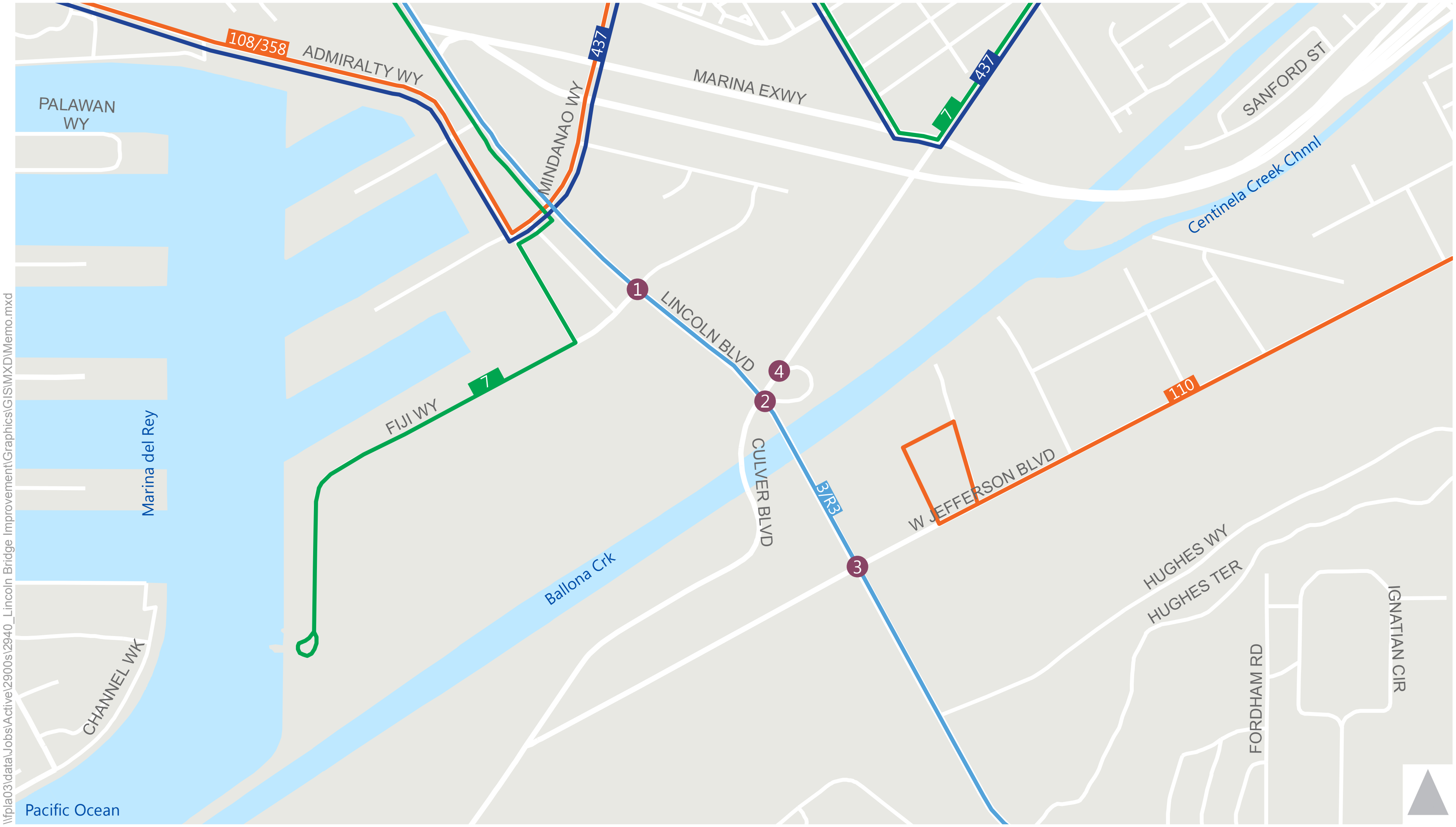
Line 108/358 runs northwest/southeast along Admiralty Way and north along Mindanao Way north of the project site. The line connects Pico Rivera and Marina Del Rey and has 15 minute headways in the peak hours.

CULVER CITY BUS

Line 7 connects Culver City with the Fisherman's Village, running along Fiji Way and north along Lincoln Boulevard. The line has 40 minute headways throughout the day.

LADOT

Line 437 runs northwest/southeast along Admiralty Way and north along Mindanao Way near the project site. The line runs between Venice and Downtown Los Angeles and has six buses that depart in the AM peak hour with 20-30 minute headways. In the PM peak hour, the line has six buses that run with 15-30 minute headways.



- Study Intersections
- Metro Local
- Santa Monica Big Blue Bus
- Culver City Bus
- LADOT Commuter Express

Figure 5

Lincoln Bridge Existing Transit

EXISTING AND PLANNED BICYCLE AND PEDESTRIAN FACILITIES

Figure 6 shows existing and planned designated bicycle facilities in the Project area. As shown, there are existing bike lanes along Fiji Way west of Lincoln Boulevard and on and Lincoln Boulevard south of Jefferson Boulevard in the study area. There is a bike path along Admiralty Way and along the Ballona Creek. Metro's *Active Transportation Strategic Plan (ATSP)* identifies corridors proposed to receive improved bicycle and pedestrian improvements. The ATSP identifies improvements along portions of Lincoln Boulevard (the addition of a bike lane as part of the Project description), Fiji Way, and the southern end of Culver Boulevard within the study area. The City's *Mobility Plan 2035* includes the Ballona Creek Bike Path as part of its Bicycle Enhanced Network (BEN).

The Ballona Wetlands Restoration Project, currently under environmental review, proposes to restore wetlands along Ballona Creek, west of Lincoln Boulevard and includes several possible improvements to the bicycle and pedestrian facilities along the creek and in the study area. The improvement options include a bicycle and pedestrian path on the south side of the creek, a pedestrian-only path on the south side of the creek, and/or a new bicycle and pedestrian bridges over Lincoln Boulevard (just north of the Culver Bridge) and across the creek (west of the Lincoln Bridge). These possible improvements are in addition to the improvements shown in **Figure 6**. Together, the Ballona Wetlands Restoration Project and the Lincoln Bridge Multi-Modal Improvement Project aim to fill gaps in the active transportation network in the area, while offering recreational opportunities along Ballona Creek.

Currently, there are no sidewalks along either side of the Lincoln Bridge. South of the bridge, there is a sidewalk only along the eastern side of Lincoln Boulevard. There are also no sidewalks present north of the bridge until the intersection at Fiji Way. Sidewalks are present on Jefferson Boulevard east of Lincoln Boulevard, and on Fiji Way. There are no sidewalks on Culver Boulevard or on Jefferson Boulevard west of Lincoln. Crosswalks with all four legs are present at Lincoln Boulevard & Jefferson Boulevard, and only three legs are present at Lincoln Boulevard & Fiji Way. With the exception of a continental crosswalk across the westbound right-turn lane at Lincoln Boulevard & Fiji Way, the study intersections do not have high-visibility crosswalks.

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Figure 6

Lincoln Bridge Existing and Planned Bicycle Facilities

COLLISION HISTORY DATA

This section summarizes collision statistics within the study area. Caltrans data recorded 18 collisions on Lincoln Boulevard between Fiji Way and Jefferson Boulevard from July 1, 2012 to June 30, 2015 (**Table 5**). One of those collisions was fatal, and 14 collisions included injuries. Four collisions involved a bicyclist or pedestrian. Speeding was the primary collision factor for five of the 18 collisions. In addition to the 18 collisions along Lincoln Boulevard from Caltrans data, the same time period showed an additional 29 collisions occurring at the Fiji Way and Jefferson Boulevard intersections, according to data included in the SafeTREC UC Berkeley Transportation Injury Mapping System (TIMS). **Table 6** shows the accident rates per million vehicle miles on Lincoln Boulevard between Fiji Way and Jefferson Boulevard.

TIMS data recorded 12 collisions on the Culver Boulevard overcrossing during the same time period. Two collisions involved a fixed object while the remainder involved another motor vehicle. None of the collisions on the Culver Boulevard overcrossing resulted in a fatality and none involved a bicyclist or pedestrian.

TABLE 5: COLLISION CHARACTERISTICS BY LOCATION

Location	Total	Fatal	Injury	Multi-Vehicle	Dark	Bicycle	Pedestrian	Speeding
Lincoln Boulevard	18	1	14	12	8	3	1	5
Culver Boulevard	12	0	12	10	2	0	0	5

Data from July 1, 2012 to June 30, 2015

Source: Caltrans TASAS, 2017 and TIMS, 2017.

TABLE 6: ACCIDENT RATES BY TYPE

Location	Actual			Average		
	Fatal	Fatal + Injury	Total	Fatal	Fatal + Injury	Total
Lincoln Boulevard	0.026	0.39	0.47	0.012	0.37	0.83

Note: Accident rates expressed as number of accidents per million vehicle miles

Data from July 1, 2012 to June 30, 2015

Source: Caltrans TSAR, 2017.

4. TRAVEL DEMAND FORECASTS

The travel demand forecasts were developed using the validated City of Los Angeles model as discussed in greater detail in Chapter 2. The approach to developing travel demand forecasts started with the recognition that regional travel demand models typically do not contain sufficient detail or sensitivity for local applications, such as developing directional arterial and local street volume forecasts. Instead, the regional model provides a starting point for creating a more detailed citywide model. Having a valid City of Los Angeles model is a critical step in ensuring a high level of confidence in the traffic volume forecasts being used to evaluate the Lincoln Bridge Multi-Model Improvement Project.

FUTURE YEAR FORECASTS

Because the widening of the bridge along Lincoln Boulevard would provide additional lane capacity in the southbound direction, travel patterns within the study area would likely change as a result of the Project. Accordingly, the roadway network in the City of Los Angeles model was adjusted to reflect the lane configuration changes for the Project, and demand volumes were forecasted for the Build and No Build scenarios, for both 2025 and 2045.

Figure 7 shows the intersection volumes for Opening Year (2025) No Build Conditions. **Figure 8** shows the intersection volumes for Design Year (2045) No Build Conditions. The addition of the third southbound lane along the Lincoln Boulevard Bridge allows for additional vehicle capacity, and thus requires a set of forecasts different from the No Build scenarios. **Figure 9** and **Figure 10** present the forecasted intersection volumes for the Opening Year (2025) and Design Year (2045) Build scenarios.

Both the AM and PM peak hour volume increases primarily occur in the non-peak direction. These increases indicate that Lincoln Boulevard is essentially at capacity during the AM peak hour in the northbound direction and during the PM peak hour in the southbound direction, limiting the ability for future increases in traffic volumes. During the AM peak hour, larger volume increases occur along Lincoln Boulevard in the southbound direction (as a percentage of existing volumes). During the PM peak hour, larger volume increases occur in the northbound direction. This pattern holds true for both 2025 and 2045.

Traffic volumes in the southbound direction increase more in the Build scenario, when compared to No Build, as a result of the additional lane capacity. In the northbound direction, volumes remain the same between the No Build and Build scenarios for both 2025 and 2045. Slight volume decreases also occur for some turning movements (e.g. westbound left-turns from Jefferson Boulevard onto Lincoln Boulevard), between the No Build and Build scenarios, due to fewer trips on roadways that serve as an alternate route to southbound Lincoln Boulevard. It should be noted that both the No Build and Build forecasts represent travel demand that may not be fully realized during the peak hours due to the existing bottlenecks and capacity constraints along Lincoln Boulevard to the north and south of the study area.

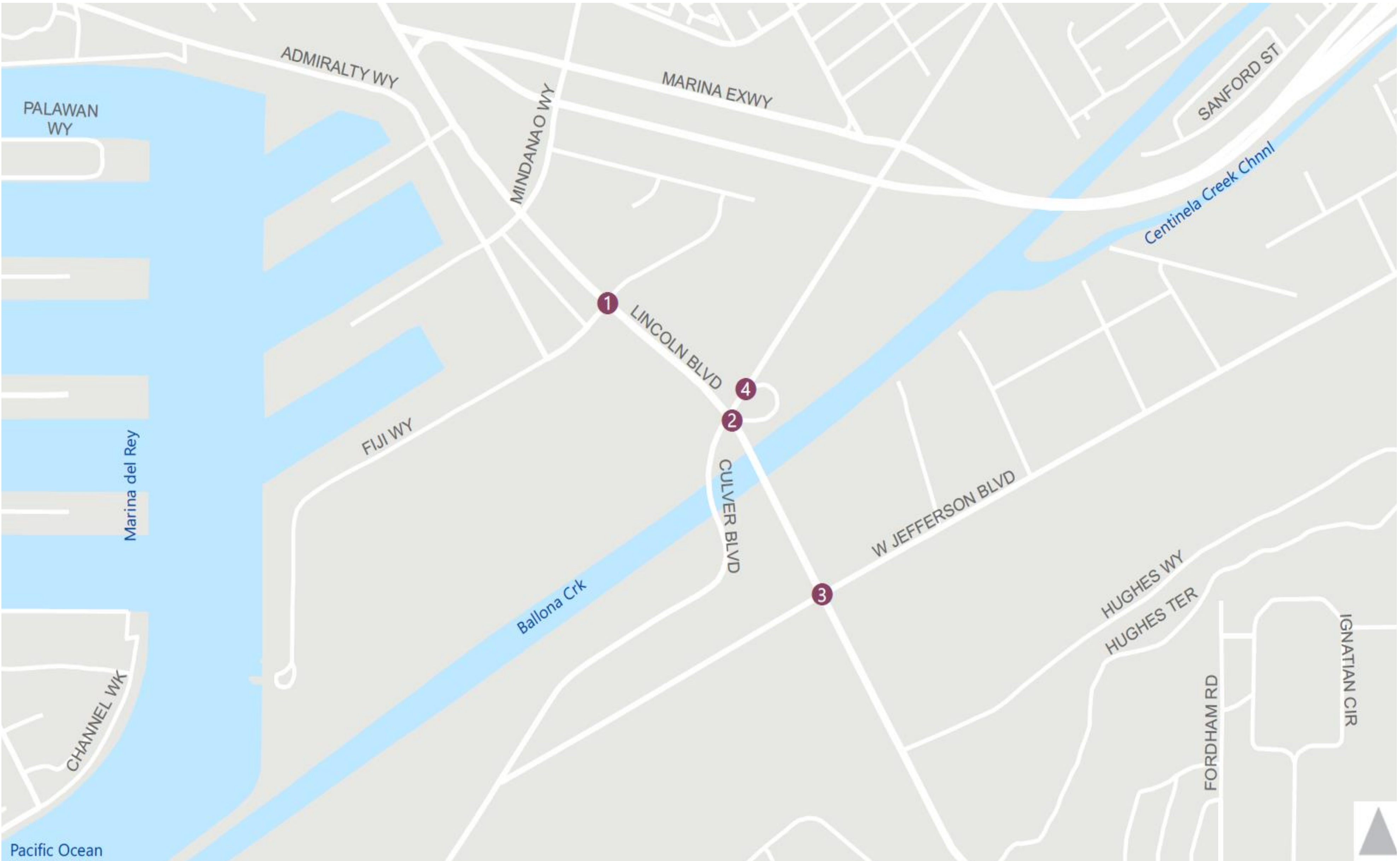
AVERAGE DAILY TRAFFIC (ADT) FORECASTS

Average daily traffic (ADT) forecasts were developed for the segment of Lincoln Boulevard (northbound and southbound) between Jefferson Boulevard and Fiji Way for the four future year scenarios. ADT forecasts were developed using straight-line growth from 2011 Caltrans ADT data available for the segment, based on the 2016 and 2040 Los Angeles Travel Model volumes. Volumes increase in 2025 and 2045, with larger increases under Build Scenarios, as is seen in turning movement volume forecasts.

TABLE 7: LINCOLN BOULEVARD AVERAGE DAILY TRAFFIC (ADT) VOLUMES

2017 PeMS ADT[1]	Opening Year (2025)		Design Year (2045)	
	No Build	Build	No Build	Build
60,000	64,400	67,000	75,800	78,900

[1]2017 counts from Caltrans Performance Management System (PeMS) are most recent available.
Source: Fehr & Peers, 2020.



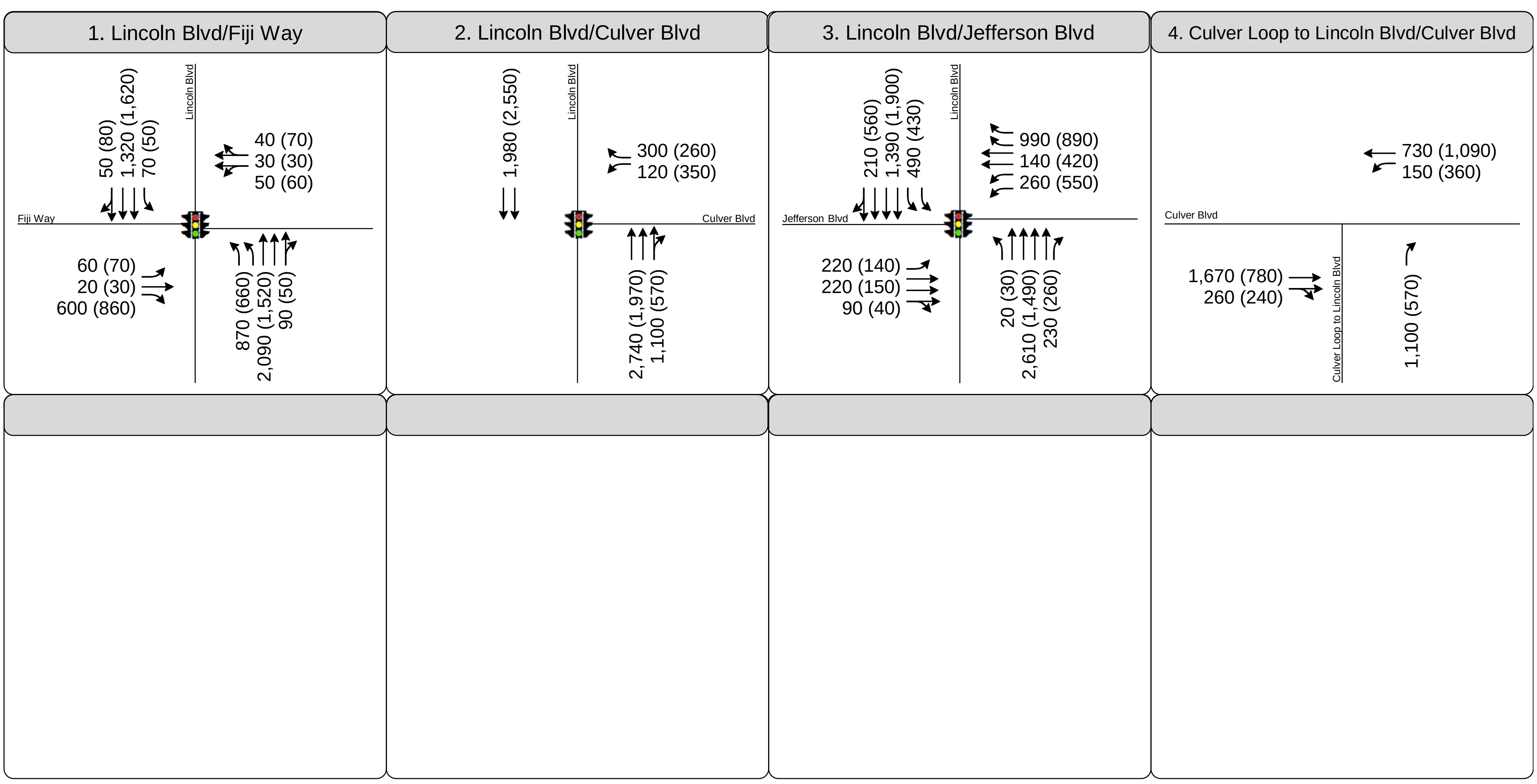
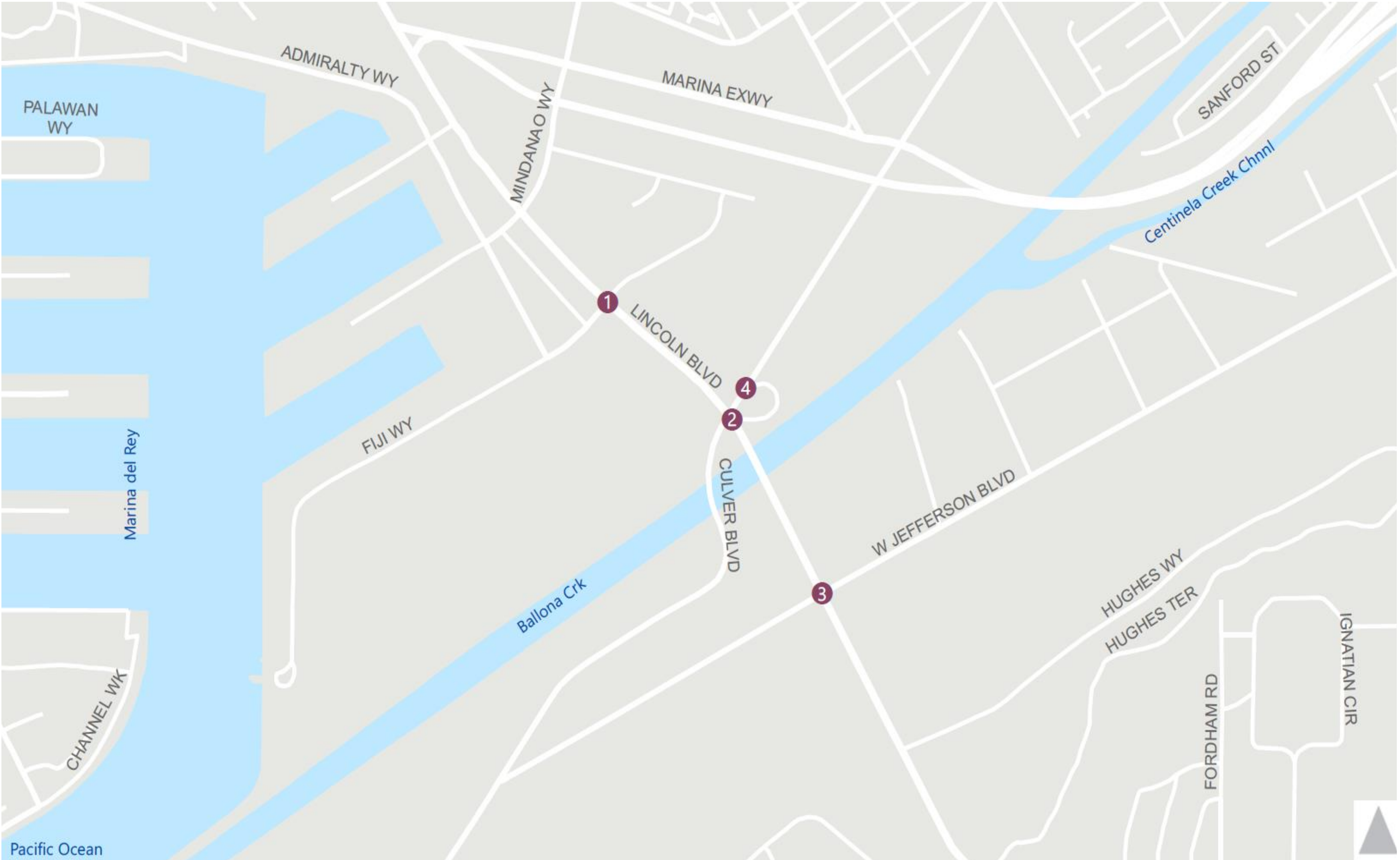


Figure 7

Peak Hour Traffic Volumes and Lane Configurations
Opening Year (2025) No Build



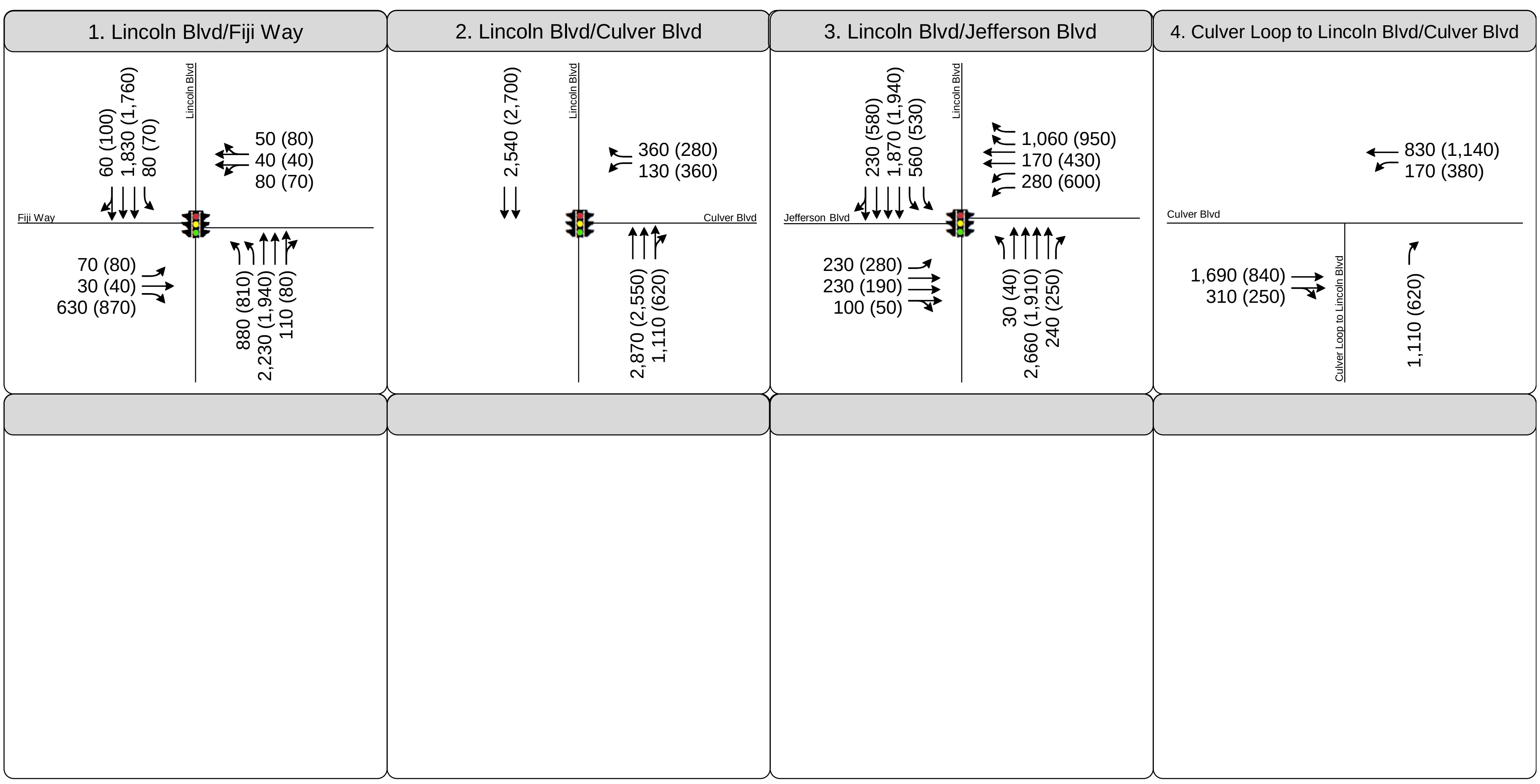


Figure 8

Peak Hour Traffic Volumes and Lane Configurations
Design Year (2045) No Build

Figure 9

Peak Hour Traffic Volumes and Lane Configurations
Opening Year (2025) With Project

Figure 10

Peak Hour Traffic Volumes and Lane Configurations Design Year (2045) With Project

5. OPENING YEAR & DESIGN YEAR TRAFFIC OPERATIONS ANALYSIS

This chapter presents the results of the traffic operations analysis for Opening Year (2025) and Design Year (2045) Conditions. The analysis focuses on intersection operations for the No Build and Build scenarios. Technical calculations supporting the results can be found in **Appendices D** through **G**. The Opening Year (2025) analysis is presented first, followed by the Design Year (2045). The analysis was conducted with the methodology described in **Chapter 2**.

FUTURE ROADWAY NETWORK ASSUMPTIONS

NO BUILD ASSUMPTIONS

Under this scenario, Lincoln Boulevard and Culver Boulevard would remain unchanged. The lane configurations along Culver Boulevard and Lincoln Boulevard in the study area are the same as Existing (2019) Conditions. Existing signal timings were used for this analysis. This scenario does not meet the project Purpose and Need. Rather, it provides a basis for the analysis and evaluation of the proposed Project.

Figure 7 and **Figure 8** present the traffic forecasts and study area lane configurations for the No Build scenario.

BUILD ASSUMPTIONS

Under this scenario, vehicle lane configurations would reflect the following changes:

- Between Fiji Way and Jefferson Boulevard, the existing 2-lane segment of southbound Lincoln Boulevard would be widened to 3 travel lanes
- The Lincoln Boulevard southbound approach lane configuration at the Lincoln Boulevard & Jefferson Boulevard intersection would be changed from two left turn lanes, three through lanes and a shared through/right-turn lane to two left turn lanes, three through lanes and a separate right-turn lane (L-L-T-T-T-TR to L-L-T-T-T-R)

Figure 9 and **Figure 10** present the traffic forecasts and study area lane configurations for the Build scenario. Existing signal timings were also used for this analysis.

In addition to these added travel lanes, the project would add a protected bike lane and a new sidewalk in each direction along the Lincoln Bridge and a new bike lane and sidewalk in each direction on the Culver Boulevard overcrossing.

OPENING YEAR (2025) INTERSECTION OPERATIONS

No Build and Build intersection traffic operations were evaluated under AM and PM peak hour conditions using Opening Year (2025) volume forecasts, as shown in **Figure 7** (No Build) and **Figure 9** (Build).

Table 8 presents the LOS results for each of the study intersections. Results worksheets are presented in **Appendix D.** Two of the four intersections operate at LOS C or better under the No Build and Build scenarios (PM peak hour only). The following intersections operate at LOS D, E, or F during one or more of the peak hours analyzed:

1. Lincoln Boulevard & Fiji Way (LOS D during the AM peak hour, No Build and Build)
2. Lincoln Boulevard & Culver Loop to Lincoln Boulevard (LOS E during the AM peak hour, No Build; and LOS D during the AM peak hour, Build)
3. Lincoln Boulevard & Jefferson Boulevard (LOS F during the AM peak hour, No Build and Build. LOS D during the PM peak hour, No Build and Build)

Decreases in delay in the Build scenario, as at the intersection of Lincoln Boulevard & Culver Loop to Lincoln Boulevard, can be attributed to the additional southbound travel lane on Lincoln Boulevard.

TABLE 8: OPENING YEAR (2025) CONDITIONS PEAK HOUR INTERSECTIONS OPERATIONS

Intersection		No Build				Build			
		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Lincoln Boulevard & Fiji Way	36.8	**D**	34.2	C	36.5	**D**	34.0	C
2	Lincoln Boulevard & Culver Loop to Lincoln Boulevard[1]	75.7	**E**	33.4	C	53.1	**D**	21.1	C
3	Lincoln Boulevard & Jefferson Boulevard	127.3	**F**	39.8	**D**	110.3	**F**	39.2	**D**
4	Culver Boulevard & Culver Loop to Lincoln Boulevard[2]	<5.0	A	<5.0	A	<5.0	A	<5.0	A

Source: Fehr & Peers, 2020.
[1]Signal timing modified for the WBR movement to enable HCM2010 analysis
[2]Unsignalized intersection – LOS calculated using HCM 2010, as a Two-Way Stop control.
Bold indicates intersection operating at LOS D or worse.

OPENING YEAR (2025) QUEUE ANALYSIS

Table 9 shows the 95th percentile queue lengths for critical turning movements at each of the four intersections in the study area. Queue lengths exceed storage capacities at the following approaches:

- Lincoln Boulevard & Fiji Way – NBL (AM peak hour, No Build and Build. PM peak hour, No Build and Build)
- Lincoln Boulevard & Culver Loop to Lincoln Boulevard – WBR (AM and PM peak hours, No Build and Build. PM peak hour, No Build and Build)
- Lincoln Boulevard & Culver Loop to Lincoln Boulevard – WBL (PM peak hour, No Build and Build)
- Lincoln Boulevard & Jefferson Boulevard – SBL (AM and PM peak hours, No Build and Build)
- Lincoln Boulevard & Jefferson Boulevard – SBR (PM peak hour, Build only)
- Lincoln Boulevard & Jefferson Boulevard – WBR (AM peak hour, No Build and Build)
- Lincoln Boulevard & Jefferson Boulevard – EBL (AM and PM peak hours, No Build and Build)

Queue analysis calculations are presented in **Appendix E**.

TABLE 9: OPENING YEAR (2025) CONDITIONS PEAK HOUR 95TH PERCENTILE QUEUES

Intersection		Movement	Storage Length (ft)	95th Percentile Queue (ft)			
				No Build		Build	
				AM	PM	AM	PM
1	Lincoln Boulevard & Fiji Way	NBL	330	**#525**	**350**	**#525**	**350**
		SBL	215	125	100	125	100
		EBL	175	100	100	100	100
		EBR[3]	--	--	--	--	--
2	Lincoln Boulevard & Culver Loop to Lincoln Boulevard	WBR	310	**#500**[1]	**325**[1]	**475**[1]	**350**[1]
		WBL	310	175	**#500**	175	**#500**
3	Lincoln Boulevard & Jefferson Boulevard	NBL	200	75	75	50	75
		NBR	210	100	50	75	50
		SBL	250	**m#425**	**m250**	**#400**	**m#325**
		SBR	125	-	-	150	**m375**
		WBL	440	200	325	175	325
		WBR	440	**#725**	300	**#625**	300
		EBL	200	**#375**	**225**	**#300**	**225**
4	Culver Boulevard & Culver Loop to Lincoln Boulevard	WBL	250	75[2]	75[2]	75[2]	75[2]

Source: Fehr & Peers, 2020.
Notes: Queue lengths have been rounded to the next 25 feet.
[1]This movement has both a protected and permissive right turn, but only the permissive portion was analyzed due to custom phasing.
[2]Queue length calculated based on HCM 2010 LOS analysis and an average vehicle length of 25 feet.
[3]This movement has a dedicated right-turn lane, with a Yield control, and merges with SB Lincoln Boulevard downstream.
Bold indicates that 95th percentile queue length exceeds available storage.
# indicates that 95th percentile volume exceeds capacity, queue may be longer.
m indicates volume for 95th percentile queue is metered by upstream signal.

DESIGN YEAR (2045) INTERSECTION OPERATIONS

No Build and Build intersection traffic operations were evaluated under AM and PM peak hour conditions using Design Year (2045) volume forecasts shown in **Figure 8** (No Build) and **Figure 10** (Build).

Table 10 presents the LOS results for each of the study intersections. Results worksheets are presented in **Appendix F.** One of the four intersections is estimated to operate at LOS C or better during both the AM and PM peak hour under No Build and Build scenarios. The following intersections are estimated to operate at LOS D, E, or F during one or more peak hour:

1. Lincoln Boulevard & Fiji Way (LOS D during the AM and PM peak hours, No Build and Build.)

2. Lincoln Boulevard & Culver Loop to Lincoln Boulevard (LOS F during the AM peak hour, No Build, and LOS D during the PM peak hour, No Build, and LOS E during the AM Peak, Build)
3. Lincoln Boulevard & Jefferson Boulevard (LOS F during the AM peak hour, No Build and Build, and LOS D during the PM Peak hour, No Build and Build)

Decreases in delay in the Build scenario, as at the intersection of Lincoln Boulevard & Culver Loop to Lincoln Boulevard, can be attributed to the additional southbound travel lane on Lincoln Boulevard in the Build scenario. The intersection of Lincoln Boulevard & Culver Loop to Lincoln Boulevard is estimated to operate at LOS F and D during the AM and PM peak hours under No Build conditions, but improves to LOS E and C during the AM and PM peak hours under Build conditions.

TABLE 10: DESIGN YEAR (2045) CONDITIONS PEAK HOUR INTERSECTION OPERATIONS

Intersection		No Build				Build			
		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1	Lincoln Boulevard & Fiji Way	40.2	**D**	37.4	**D**	41.0	**D**	40.0	**D**
2	Lincoln Boulevard & Culver Loop to Lincoln Boulevard[1]	113.0	**F**	47.7	**D**	70.4	**E**	29.1	C
3	Lincoln Boulevard & Jefferson Boulevard	125.7	**F**	54.3	**D**	107.1	**F**	54.0	**D**
4	Culver Boulevard & Culver Loop to Lincoln Boulevard[2]	<5.0	A	<5.0	A	5.6	A	<5.0	A

Source: Fehr & Peers, 2020.
[1]Signal timing modified for the WBR movement to enable HCM2010 analysis
[2]Unsignalized intersection – LOS calculated using HCM 2010, as a Two-Way Stop control
Bold indicates intersection operating at LOS D or worse.
Underline indicates LOS worsens under Build Conditions.

DESIGN YEAR (2045) QUEUE ANALYSIS

Table 11 shows the 95th percentile queue for critical turning movements at each of the four intersections in the study area. Queue lengths are estimated to exceed storage capacities at the following approaches:

- Lincoln Boulevard & Fiji Way – NBL (AM and PM peak hours, No Build and Build)
- Lincoln Boulevard & Culver Loop to Lincoln Boulevard – WBR (AM and PM peak hours, No Build and Build)
- Lincoln Boulevard & Culver Loop to Lincoln Boulevard – WBL (PM peak hour, No Build and Build)
- Lincoln Boulevard & Jefferson Boulevard – SBL (AM and PM peak hours, No Build and Build)
- Lincoln Boulevard & Jefferson Boulevard – SBR (AM and PM peak hours, Build only)
- Lincoln Boulevard & Jefferson Boulevard – WBR (AM and PM peak hours, No Build and Build)
- Lincoln Boulevard & Jefferson Boulevard – EBL (AM and PM peak hours, No Build and Build)

Queue analysis calculations are presented in **Appendix G**.

TABLE 11: DESIGN YEAR (2045) CONDITIONS PEAK HOUR 95TH PERCENTILE QUEUES

Intersection		Movement	Storage Length (ft)	95th Percentile Queue (ft)			
				No Build		Build	
				AM	PM	AM	PM
1	Lincoln Boulevard & Fiji Way	NBL	330	**#525**	**m#475**	**m#525**	**#450**
		SBL	215	125	125	125	125
		EBL	175	100	125	100	125
		EBR[3]	--	**--**	**--**	**--**	**--**
2	Lincoln Boulevard & Culver Loop to Lincoln Boulevard	WBR	310	**600**[1]	**375**[1]	**#600**[1]	**375**
		WBL	310	200	**#525**	225	**#525**
3	Lincoln Boulevard & Jefferson Boulevard	NBL	200	75	100	75	100
		NBR	210	100	75	100	75
		SBL	250	**m#350**	**m#300**	**<u>#500</u>**	**m#375**
		SBR	125	-	-	**m225**	**m#700**
		WBL	440	200	350	200	350
		WBR	440	**#775**	**#475**	**#675**	**#450**
		EBL	200	**#400**	**#475**	**300**	**#475**
4	Culver Boulevard & Culver Loop to Lincoln Boulevard	WBL	250	75[2]	75[2]	100[2]	100[2]

Source: Fehr & Peers, 2020.
Notes: Queue lengths have been rounded to the next 25 feet.
[1]Movement has both a protected & permissive right turn, but only the permissive portion was analyzed due to custom phasing.
[2]Queue length calculated based on HCM 2010 LOS analysis and an average vehicle length of 25 feet.
[3]This movement has a dedicated right-turn lane, with a Yield control, and merges with SB Lincoln Boulevard downstream.
Bold indicates that 95th percentile queue length exceeds available storage.
# indicates that 95th percentile volume exceeds capacity, queue may be longer.
m indicates volume for 95th percentile queue is metered by upstream signal.
<u>Underline</u> indicates queue worsens under Build Conditions.

6. VMT ANALYSIS

An estimate of daily vehicle miles traveled (VMT) related to a project is an important input into the greenhouse gas and air quality sections of an environmental impact report. This section summarizes the methodology for estimating daily VMT and presents the results from the City of Los Angeles Travel Demand Model.

The Los Angeles Travel Demand Model was used to estimate VMT by isolating all roadway segments within a 1.5-mile radius of the Lincoln Bridge. The number of vehicles on each roadway segment was multiplied by the segment length within this boundary using the 2040 model, under both No Build and Build Conditions. Straight line growth rates were developed between the 2016 base year model and the 2040 model results, and then applied to 2040 VMT results to determine estimates for Opening Year (2025) and Design Year (2045) Conditions. **Table 12** summarizes the results of this analysis, comparing VMT estimates for No Build and Build Conditions. The VMT results for Build Conditions reflects the additional southbound lane on Lincoln Boulevard.

As a result of the Project, VMT in the study area is estimated to decrease by approximately 0.9% compared to No Build conditions in 2025, and by 4.1% in 2045. The decrease in VMT is due to the elimination of the existing southbound bottleneck on the bridge, which results in vehicles using alternate routes that, while time efficient, require traveling a greater distance. The 1.5-mile radius used for this analysis includes alternative routes across Ballona Creek, including SR-90 and Centinela Avenue, both east of the Project. VMT reductions as a result of the Project can therefore be attributed to the Project's addition of southbound capacity, providing a more direct route for many trips.

TABLE 12: VEHICLE MILES TRAVELED (VMT)

Year	No Build	Build	Difference	Percent Difference
Opening Year (2025)	615,554	610,131	-5,423	-0.9%
Design Year (2045)	683,464	655,807	-27,657	-4.1%

Source: Fehr & Peers, 2020.

7. BICYCLE AND PEDESTRIAN ANALYSIS

Although Lincoln Boulevard serves as a critical north-south connection on the Westside, existing pedestrian facilities are discontinuous north and south of the bridge with no sidewalks provided on the bridge. Lincoln Boulevard also lacks bicycle facilities across the bridge despite its connection to the east-west Ballona Creek Bicycle Path that runs just under the Lincoln Bridge parallel to Ballona Creek. This lack of connectivity and protection along a high volume, high speed road not only discourages active transportation, but also raises safety concerns for bicyclists and pedestrians attempting to access nearby facilities and destinations.

The proposed Project would improve connectivity and accessibility to the coastal areas of the Westside for all modes of travel. The improvements on the Lincoln Bridge include widening the bridge to accommodate protected bicycle lanes, and sidewalks on both sides. These bicycle and pedestrian improvements will extend between Jefferson Boulevard and Fiji Way. Adding a separated bicycle lane along this segment will create a complete bicycle network, on which cyclists safely and conveniently can travel to and through the area.

Class IV protected bicycle lanes on Lincoln Boulevard will provide a connection to the Ballona Creek Bicycle Path as well as existing bicycle facilities south of Jefferson Boulevard and on Fiji Way. Additionally, the proposed improvements will better connect cyclists and pedestrians to the retail and residential developments south of Ballona Creek in Playa Vista off of Jefferson Boulevard. Nearby educational institutions, such as the Westside Neighborhood School, Playa Vista Elementary School, Loyola Marymount University, and Playa Vista Public Library, will be more accessible via active transportation modes.

With average daily traffic exceeding 60,000 vehicles and a speed limit of 45 miles per hour, industry standards recommend separated bicycle lanes. (National Association of City Transportation Officials). Studies have found that separated bicycle lanes increase cycling and reduce vehicle traffic (Federal Highway Administration, May 2015). Furthermore, separated bicycle lanes are more feasible along routes without parking on the shoulder, few transit stops and limited intersections, all of which are characteristics of this segment of Lincoln Boulevard (California Department of Transportation, December 2015).

Demand for bicycle and pedestrian facilities was noted during traffic counts. The project team counted 80 cyclists and 81 pedestrians in the AM peak hour within the study area. During the PM peak hour, the project team counted 36 cyclists and 66 pedestrians. The proposed separated bicycle facility and sidewalks will promote the safety of current as well as future cyclists and pedestrians. As discussed in the Collision History Data section, four out of 18 collisions between July 2012 and June 2015 involved bicyclists and pedestrians. Additionally, five of the 18 collisions were primarily due to speeding. Physical separation from fast-moving vehicular traffic is beneficial to decrease the risk for bicyclists and pedestrians traveling along the Lincoln Bridge.

8. TRAFFIC ANALYSIS SUMMARY

This section summarizes the results of the Opening Year (2025) and Design Year (2045) AM and PM peak hour traffic analysis results for the Lincoln Bridge Multi-Modal Improvement Project. The Build scenarios are compared to the No Build scenarios.

INTERSECTION OPERATIONS

Opening Year (2025) and Design Year (2045) peak hour intersection operations are summarized in **Table 8** and **Table 10,** respectively. In the Opening Year (2025) scenario, three of the four study intersections are expected to operate at LOS D, E, or F in both No Build and Build scenarios. However, two of the four intersections are expected to operate as LOS C during the PM peak hour, under the No Build and Build scenarios. In the Design Year (2045) scenario, three of the four intersections are expected to operate at LOS D, E, or F in both No Build and Build scenarios. In the Design Year, the intersection of Lincoln Boulevard & Fiji Way is estimated to operate at LOS D during the AM and PM peak hours, under No Build and Build conditions, with minor increases in average delay in the Build scenario due to induced demand for the additional capacity available on Lincoln Boulevard downstream of the intersection. Also, in the Design Year AM and PM peak hours, the intersection of Lincoln Boulevard & Culver Loop to Lincoln Boulevard is expected to operate at LOS F and LOS D under No Build conditions, respectively, and improve to LOS C in the PM peak hour under Build conditions.

QUEUE ANALYSIS

Opening Year (2025) and Design Year (2045) peak hour 95th percentile queue analysis results are summarized in **Table 9** and **Table 11,** respectively. In the Opening Year (2025) scenario, peak hour queues are estimated to exceed available storage at five of thirteen turn lanes during the AM peak hour and at six of thirteen turn lanes during the PM peak hour under Build conditions, including the added southbound right-turn lane at Lincoln Boulevard & Jefferson Boulevard in the PM peak hour. In the Design Year (2045) scenario, peak hour queues are estimated to exceed available storage at six of thirteen turn lanes during the AM peak hour and at seven of thirteen turn lanes during the PM peak hour under Build conditions, including the added southbound right-turn at Lincoln Boulevard & Jefferson Boulevard in both AM and PM peak hours.

BICYCLE AND PEDESTRIAN ANALYSIS

With the multi-modal improvements along the Lincoln Bridge, it is expected that bicycle and pedestrian convenience and safety will be improved. The protected bicycle lanes will create a more robust bicycle network in the area that improves the surrounding communities' connectivity to Ballona Creek Bicycle Path and other nearby retail, residential, and academic destinations. The safety risks of cyclists and pedestrians are expected to decrease as exposure to high volume and fast-moving vehicular traffic is minimized due to separated facilities along Lincoln Bridge.

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Mobility Plan 2035, An Element of the General Plan, City of Los Angeles, 2016.

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National Cooperative Highway Research Program (NCHRP) Report 255: Highway Traffic Data for Urbanized Area Project Planning and Design, Transportation Research Board, December 1982.

Separated Bike Lane Planning and Design Guide, Federal Highway Administration, May 2015.

Urban Bikeway Design Guide: Conventional Bike Lanes, National Association of City Transportation Officials, accessed November 2017: https://nacto.org/publication/urban-bikeway-design-guide/bike-lanes/conventional-bike-lanes/

APPENDIX A – TURNING MOVEMENT VEHICLE COUNTS

Prepared by National Data & Surveying Services

Lincoln Blvd/Pacific Coast Hwy & Fiji Way

Peak Hour Turning Movement Count

ID: 19-05673-001
City: Marina Del Rey

Day: Tuesday
Date: 11/19/2019

	PEAK HOURS	COUNT PERIODS
AM	08:00 AM - 09:00 AM	07:00 AM - 10:00 AM
NOON	NONE	NONE
PM	04:45 PM - 05:45 PM	03:00 PM - 06:00 PM

Lincoln Blvd/Pacific Coast Hwy — SOUTHBOUND

	↲	↓	↳	U	Departing ⇧
AM	46	1179	34	24	2152
NOON	0	0	0	0	0
PM	72	1577	23	18	1541
	0	3	1	0	

Fiji Way — EASTBOUND

	AM	NOON	PM	
Departing ⇦	925	0	705	
U	0	0	2	0
Left	58	0	65	1
Through	17	0	17	1
Right	596	0	849	1

Fiji Way — WESTBOUND

		PM	NOON	AM
Right	0	67	0	36
Through	2	23	0	22
Left	0	47	0	35
U	0	0	0	0
Departing ⇨		72	0	127

CONTROL

Signalized

	AM	NOON	PM
TEV	5014	0	4791
PHF	0.97		0.97

Lincoln Blvd/Pacific Coast Hwy — NORTHBOUND

	Departing ⇩	U	Left	Through	Right
		0	2	3	0
PM	2473	0	608	1391	32
NOON	0	0	0	0	0
AM	1810	0	857	2034	76

Cars (AM)

Approach	Left	Through	Right
Southbound	33	1164	43
Eastbound	57	17	594
Westbound	35	22	35
Northbound	849	1991	74

Cars (NOON)

Approach	Left	Through	Right
Southbound	N/A	N/A	N/A
Eastbound	N/A	N/A	N/A
Westbound	N/A	N/A	N/A
Northbound	N/A	N/A	N/A

Cars (PM)

Approach	Left	Through	Right
Southbound	23	1566	69
Eastbound	64	17	835
Westbound	47	23	67
Northbound	608	137	31

HT (AM)

Approach	Left	Through	Right
Southbound	1	6	3
Eastbound	1	0	2
Westbound	0	0	1
Northbound	8	33	2

HT (NOON)

Approach	Left	Through	Right
Southbound	N/A	N/A	N/A
Eastbound	N/A	N/A	N/A
Westbound	N/A	N/A	N/A
Northbound	N/A	N/A	N/A

HT (PM)

Approach	Left	Through	Right
Southbound	0	5	3
Eastbound	1	0	12
Westbound	0	0	0
Northbound	0	4	1

Pedestrians (Crosswalks)

Crosswalk	PM	NOON	AM	AM	NOON	PM
North leg	12	0	15	20	0	13
South leg	0	0	1	0	0	0
NW corner	0	0	0			
NE corner				0	0	0
SW corner	0	0	0			
SE corner				0	0	0

Crosswalk	Direction	PM	NOON	AM
West leg	↓	2	0	4
West leg	↑	2	0	2
East leg	↓	3	0	7
East leg	↑	7	0	5

Prepared by National Data & Surveying Services

Lincoln Blvd/Pacific Coast Hwy & Culver Blvd

Peak Hour Turning Movement Count

ID: 19-05673-002
City: Marina Del Rey

Day: Tuesday
Date: 11/19/2019

PEAK HOURS		COUNT PERIODS
AM	07:45 AM - 08:45 AM	07:00 AM - 10:00 AM
NOON	NONE	NONE
PM	05:00 PM - 06:00 PM	03:00 PM - 06:00 PM

Lincoln Blvd/Pacific Coast Hwy – SOUTHBOUND

	Right	Through	Left	U-Turn	Exiting (northbound departure)
AM	0	1791	0	0	3004
NOON	0	0	0	0	0
PM	0	2456	0	0	2053
Peds/other	0	2	0	0	

Culver Blvd – WESTBOUND

Movement	PM	NOON	AM	
Right	236	0	276	2
Through	0	0	0	0
Left	339	0	107	0
U-Turn	0	0	0	0
Exiting	552	0	1074	

Culver Blvd – EASTBOUND

Movement	AM	NOON	PM	
Exiting	0	0	0	
U-Turn	0	0	0	0
Left	0	0	0	0
Through	0	0	0	0
Right	0	0	0	0

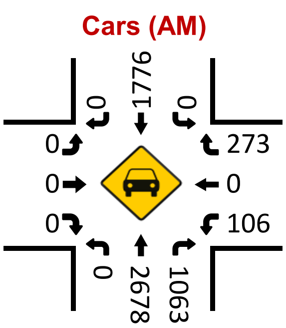
Lincoln Blvd/Pacific Coast Hwy – NORTHBOUND

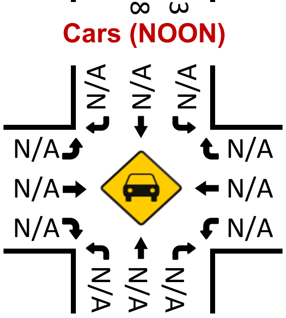
	Exiting (southbound departure)	U-Turn	Left	Through	Right
		0	0	2.5	0.5
PM	2795	0	0	1817	552
NOON	0	0	0	0	0
AM	1898	0	0	2728	1074

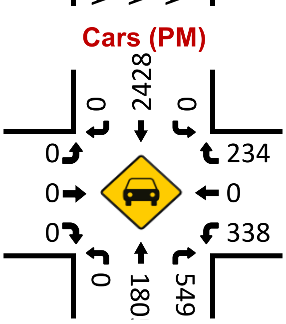
CONTROL

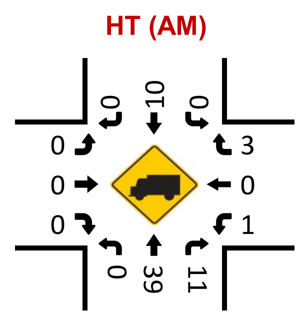
Signalized

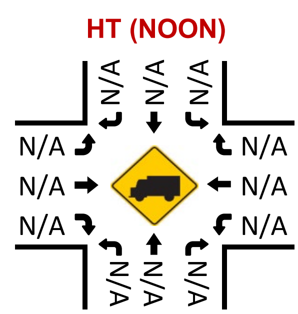
	AM	NOON	PM
TEV	5976	0	5400
PHF	0.92		0.98

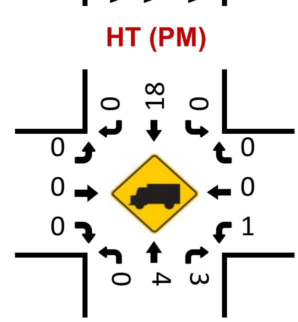


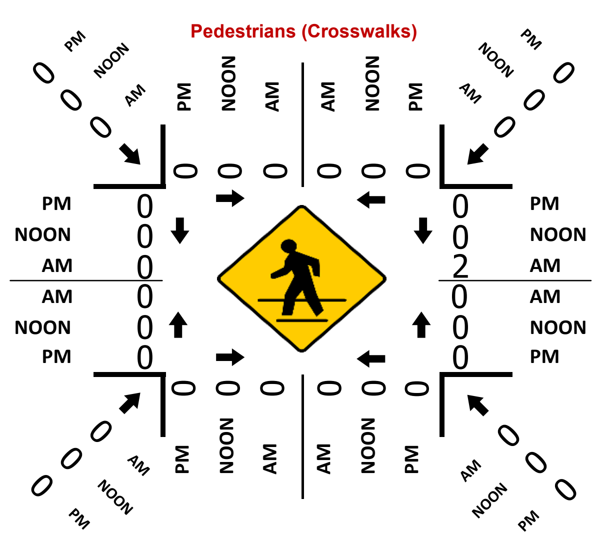












Lincoln Blvd/Pacific Coast Hwy

Prepared by National Data & Surveying Services

Lincoln Blvd/Pacific Coast Hwy & W Jefferson Blvd

Peak Hour Turning Movement Count

ID: 19-05673-003
City: Playa Vista

Day: Tuesday
Date: 11/19/2019

	PEAK HOURS	COUNT PERIODS
AM	07:45 AM - 08:45 AM	07:00 AM - 10:00 AM
NOON	NONE	NONE
PM	05:00 PM - 06:00 PM	03:00 PM - 06:00 PM

Lincoln Blvd/Pacific Coast Hwy — SOUTHBOUND

	Right	Through	Left	U-Turn	Departing
AM	202	1209	458	0	3764
NOON	0	0	0	0	0
PM	540	1841	399	0	2319
Bikes	0	4	2	0	

W Jefferson Blvd — EASTBOUND

	AM	NOON	PM	Bikes
Departing	345	0	969	
U-Turn	0	0	0	0
Left	210	0	89	1
Through	211	0	138	3
Right	89	0	30	0

W Jefferson Blvd — WESTBOUND

	Bikes	PM	NOON	AM
Right	2	867	0	968
Through	2	411	0	129
Left	2	533	0	244
U-Turn	0	0	0	0
Departing		788	0	896

CONTROL

Signalized

	AM	NOON	PM
TEV	6550	0	6482
PHF	0.93		0.97

Lincoln Blvd/Pacific Coast Hwy — NORTHBOUND

	Departing	U-Turn	Left	Through	Right
Bikes		0	1	4	1
PM	2406	2	18	1363	251
NOON	0	0	0	0	0
AM	1545	3	14	2586	227

Cars and HT by approach

	Cars (AM)	HT (AM)	Cars (NOON)	HT (NOON)	Cars (PM)	HT (PM)
SB Right	201	1	N/A	N/A	539	1
SB Through	1197	7	N/A	N/A	1815	17
SB Left	455	3	N/A	N/A	398	1
EB Left	207	3	N/A	N/A	88	1
EB Through	209	2	N/A	N/A	138	0
EB Right	88	1	N/A	N/A	30	0
WB Right	956	12	N/A	N/A	864	3
WB Through	127	2	N/A	N/A	410	1
WB Left	237	7	N/A	N/A	529	4
NB Left	12	2	N/A	N/A	18	0
NB Through	2540	35	N/A	N/A	135	3
NB Right	219	8	N/A	N/A	251	0

Pedestrians (Crosswalks)

Crosswalk	Direction	AM	NOON	PM
North	Eastbound	3	0	3
North	Westbound	0	0	1
West	Southbound	4	0	2
West	Northbound	1	0	3
East	Southbound	1	0	1
East	Northbound	7	0	7
South	Eastbound	8	0	4
South	Westbound	1	0	6
NW diagonal		0	0	0
NE diagonal		0	0	0
SW diagonal		0	0	0
SE diagonal		0	0	0

Prepared by National Data & Surveying Services

Culver Loop to Lincoln Blvd & Culver Blvd

Peak Hour Turning Movement Count

ID: 19-05673-004
City: Playa Vista

Day: Tuesday
Date: 11/19/2019

	PEAK HOURS	COUNT PERIODS
AM	07:45 AM - 08:45 AM	07:00 AM - 10:00 AM
NOON	NONE	NONE
PM	05:00 PM - 06:00 PM	03:00 PM - 06:00 PM

Culver Loop to Lincoln Blvd — SOUTHBOUND

	Right	Through	Left	U-Turn	Departing
AM	0	0	0	0	0
NOON	0	0	0	0	0
PM	0	0	0	0	0
Lanes	0	0	0	0	

Culver Blvd — EASTBOUND

	AM	NOON	PM	Lanes
Departing	695	0	1068	
U-Turn	0	0	0	0
Left	0	0	0	0
Through	1661	0	762	1.5
Right	251	0	230	0.5

Culver Blvd — WESTBOUND

	Lanes	PM	NOON	AM
Right	0	0	0	0
Through	1	1068	0	695
Left	1	353	0	143
U-Turn	0	0	0	0
Departing		1318	0	2750

CONTROL

No Control

	AM	NOON	PM
TEV	3839	0	2969
PHF	0.94		0.96

Culver Loop to Lincoln Blvd — NORTHBOUND

	Departing	U-Turn	Left	Through	Right
Lanes		0	0	0	1
PM	583	0	0	0	556
NOON	0	0	0	0	0
AM	394	0	0	0	1089

Cars (AM)

Approach	Movement 1	Movement 2	Movement 3
Southbound	0	0	0
Eastbound (U / Thru / Right)	0	1653	248
Westbound (U / Thru / Left)	0	684	142
Northbound	0	0	1075

HT (AM)

Approach	Movement 1	Movement 2	Movement 3
Southbound	0	0	0
Eastbound (U / Thru / Right)	0	8	3
Westbound (U / Thru / Left)	0	10	1
Northbound	0	0	13

Cars (NOON)

All movements: N/A

HT (NOON)

All movements: N/A

Cars (PM)

Approach	Movement 1	Movement 2	Movement 3
Southbound	0	0	0
Eastbound (U / Thru / Right)	0	759	230
Westbound (U / Thru / Left)	0	1066	351
Northbound	0	0	553

HT (PM)

Approach	Movement 1	Movement 2	Movement 3
Southbound	0	0	0
Eastbound (U / Thru / Right)	0	3	0
Westbound (U / Thru / Left)	0	2	1
Northbound	0	0	3

Pedestrians (Crosswalks)

Crosswalk	AM	NOON	PM
North leg (both directions)	0	0	0
South leg (both directions)	0	0	0
East leg (both directions)	0	0	0
West leg (both directions)	0	0	0
Diagonals (all corners)	0	0	0

APPENDIX B – EXISTING INTERSECTION LEVEL OF SERVICE (LOS) CALCULATION SHEETS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	58	17	590	34	22	36	857	2034	76	58	1167	46
Future Volume (veh/h)	58	17	590	34	22	36	857	2034	76	58	1167	46
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.97		1.00	0.97		0.94	1.00		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1681	1900	1900	1820	1900	1863	1864	1900	1845	1878	1900
Adj Flow Rate, veh/h	60	18	0	35	23	8	884	2097	75	60	1203	45
Adj No. of Lanes	1	1	1	0	2	0	2	3	0	1	3	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	4	13	0	0	0	0	2	2	2	3	1	1
Cap, veh/h	196	210	202	201	149	53	935	2617	93	409	2475	93
Arrive On Green	0.12	0.12	0.00	0.12	0.12	0.12	0.27	0.52	0.52	0.23	0.49	0.49
Sat Flow, veh/h	1306	1681	1615	1175	1193	422	3442	5040	180	1757	5070	190
Grp Volume(v), veh/h	60	18	0	37	0	29	884	1409	763	60	811	437
Grp Sat Flow(s),veh/h/ln	1306	1681	1615	1240	0	1550	1721	1696	1827	1757	1709	1841
Q Serve(g_s), s	5.6	1.2	0.0	3.1	0.0	2.2	32.7	44.4	44.8	3.5	20.7	20.7
Cycle Q Clear(g_c), s	7.8	1.2	0.0	4.4	0.0	2.2	32.7	44.4	44.8	3.5	20.7	20.7
Prop In Lane	1.00		1.00	0.96		0.27	1.00		0.10	1.00		0.10
Lane Grp Cap(c), veh/h	196	210	202	209	0	193	935	1761	949	409	1669	899
V/C Ratio(X)	0.31	0.09	0.00	0.18	0.00	0.15	0.95	0.80	0.80	0.15	0.49	0.49
Avail Cap(c_a), veh/h	305	349	335	319	0	322	953	1827	984	409	1669	899
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	54.2	50.3	0.0	52.2	0.0	50.8	46.4	25.7	25.8	39.6	22.3	22.3
Incr Delay (d2), s/veh	0.3	0.1	0.0	0.4	0.0	0.4	17.4	3.9	7.2	0.2	1.0	1.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.0	0.6	0.0	1.2	0.0	1.0	17.9	21.7	24.4	1.7	10.0	11.0
LnGrp Delay(d),s/veh	54.5	50.4	0.0	52.6	0.0	51.1	63.8	29.6	33.0	39.8	23.3	24.2
LnGrp LOS	D	D		D		D	E	C	C	D	C	C
Approach Vol, veh/h		78			66			3056			1308	
Approach Delay, s/veh		53.6			51.9			40.4			24.4	
Approach LOS		D			D			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	35.3	72.5		22.2	39.3	68.5		22.2
Change Period (Y+Rc), s	* 5	* 5		6.0	4.0	* 5		6.0
Max Green Setting (Gmax), s	* 18	* 70		27.0	36.0	* 52		27.0
Max Q Clear Time (g_c+I1), s	5.5	46.8		9.8	34.7	22.7		6.4
Green Ext Time (p_c), s	0.1	20.7		0.0	0.6	15.1		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	36.1
HCM 2010 LOS	D

Notes

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↰	↱	↑↑↱			↑↑
Traffic Volume (veh/h)	107	276	2691	1089	0	1791
Future Volume (veh/h)	107	276	2691	1089	0	1791
Number	7	14	6	16	5	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		0.97	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1881	1881	1900	0	1881
Adj Flow Rate, veh/h	116	300	2925	1184	0	1947
Adj No. of Lanes	1	1	3	0	0	2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	1	1	1	0	1
Cap, veh/h	366	324	2711	952	0	2600
Arrive On Green	0.20	0.20	0.73	0.73	0.00	0.73
Sat Flow, veh/h	1810	1599	3895	1309	0	3762
Grp Volume(v), veh/h	116	300	2652	1457	0	1947
Grp Sat Flow(s),veh/h/ln	1810	1599	1712	1611	0	1787
Q Serve(g_s), s	8.2	27.6	109.1	109.1	0.0	48.9
Cycle Q Clear(g_c), s	8.2	27.6	109.1	109.1	0.0	48.9
Prop In Lane	1.00	1.00		0.81	0.00	
Lane Grp Cap(c), veh/h	366	324	2491	1172	0	2600
V/C Ratio(X)	0.32	0.93	1.06	1.24	0.00	0.75
Avail Cap(c_a), veh/h	426	376	2491	1172	0	2600
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	51.0	58.7	20.4	20.4	0.0	12.2
Incr Delay (d2), s/veh	0.5	26.6	38.1	116.9	0.0	2.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.1	14.6	64.1	85.9	0.0	24.5
LnGrp Delay(d),s/veh	51.5	85.3	58.6	137.3	0.0	14.3
LnGrp LOS	D	F	F	F		B
Approach Vol, veh/h	416		4109			1947
Approach Delay, s/veh	75.9		86.5			14.3
Approach LOS	E		F			B

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		114.9		35.1		114.9		
Change Period (Y+Rc), s		5.8		* 4.7		5.8		
Max Green Setting (Gmax), s		104.2		* 35		104.2		
Max Q Clear Time (g_c+I1), s		50.9		29.6		111.1		
Green Ext Time (p_c), s		30.9		0.7		0.0		

Intersection Summary		
HCM 2010 Ctrl Delay		64.1
HCM 2010 LOS		E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	210	211	89	244	129	976	17	2594	227	465	1228	205
Future Volume (veh/h)	210	211	89	244	129	976	17	2594	227	465	1228	205
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		0.98	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1887	1900	1881	1900	1881	1900	1881	1863	1863	1881	1900
Adj Flow Rate, veh/h	226	227	51	262	139	939	18	2789	190	500	1320	207
Adj No. of Lanes	1	3	0	2	2	2	1	4	1	2	4	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	1	1	1	1	0	1	0	1	2	2	1	1
Cap, veh/h	249	333	71	639	478	1173	32	1898	749	978	3232	505
Arrive On Green	0.14	0.08	0.08	0.18	0.13	0.13	0.02	0.29	0.29	0.28	0.57	0.57
Sat Flow, veh/h	1792	4238	904	3476	3610	2814	1810	6471	1560	3442	5676	887
Grp Volume(v), veh/h	226	182	96	262	139	939	18	2789	190	500	1128	399
Grp Sat Flow(s),veh/h/ln	1792	1717	1708	1738	1805	1407	1810	1618	1560	1721	1618	1709
Q Serve(g_s), s	18.6	7.7	8.3	10.0	5.2	12.8	1.5	44.0	0.0	18.2	19.6	19.7
Cycle Q Clear(g_c), s	18.6	7.7	8.3	10.0	5.2	12.8	1.5	44.0	0.0	18.2	19.6	19.7
Prop In Lane	1.00		0.53	1.00		1.00	1.00		1.00	1.00		0.52
Lane Grp Cap(c), veh/h	249	270	134	639	478	1173	32	1898	749	978	2763	973
V/C Ratio(X)	0.91	0.67	0.72	0.41	0.29	0.80	0.57	1.47	0.25	0.51	0.41	0.41
Avail Cap(c_a), veh/h	303	893	444	639	939	1532	125	1898	749	978	2763	973
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	63.6	67.2	67.5	54.0	58.7	15.8	73.1	53.0	23.3	45.0	18.1	18.1
Incr Delay (d2), s/veh	25.9	2.9	7.0	0.4	0.3	2.4	14.8	214.1	0.8	0.4	0.4	1.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.0	3.8	4.2	4.8	2.6	10.0	0.9	47.9	4.9	8.7	8.8	9.7
LnGrp Delay(d),s/veh	89.4	70.2	74.5	54.4	59.0	18.1	87.9	267.1	24.1	45.4	18.6	19.4
LnGrp LOS	F	E	E	D	E	B	F	F	C	D	B	B
Approach Vol, veh/h		504			1340			2997			2027	
Approach Delay, s/veh		79.6			29.5			250.6			25.4	
Approach LOS		E			C			F			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	48.6	50.0	33.6	17.8	7.2	91.4	25.5	25.9
Change Period (Y+Rc), s	* 6	* 6	* 6	* 6	4.6	* 6	4.6	* 6
Max Green Setting (Gmax), s	* 20	* 44	* 25	* 39	10.4	* 54	25.4	* 39
Max Q Clear Time (g_c+I1), s	20.2	46.0	12.0	10.3	3.5	21.7	20.6	14.8
Green Ext Time (p_c), s	0.0	0.0	0.7	1.5	0.0	18.6	0.3	5.1

Intersection Summary	
HCM 2010 Ctrl Delay	128.4
HCM 2010 LOS	F

Notes

Intersection	
Int Delay, s/veh	1.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰	↑		↱
Traffic Vol, veh/h	1661	244	139	695	0	1089
Future Vol, veh/h	1661	244	139	695	0	1089
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	50	140	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	0	0	1	1	0	0
Mvmt Flow	1767	260	148	739	0	1159

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1767	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.115	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.2095	-	-	-
Pot Cap-1 Maneuver	-	-	354	-	0	0
Stage 1	-	-	-	-	0	0
Stage 2	-	-	-	-	0	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	354	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	3.7	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	354	-
HCM Lane V/C Ratio	-	-	-	0.418	-
HCM Control Delay (s)	0	-	-	22.3	-
HCM Lane LOS	A	-	-	C	-
HCM 95th %tile Q(veh)	-	-	-	2	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	67	17	849	47	23	67	608	1399	32	41	1577	72
Future Volume (veh/h)	67	17	849	47	23	67	608	1399	32	41	1577	72
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.97		1.00	0.97		0.94	1.00		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1681	1900	1900	1825	1900	1863	1864	1900	1845	1878	1900
Adj Flow Rate, veh/h	69	18	0	48	24	40	627	1442	30	42	1626	72
Adj No. of Lanes	1	1	1	0	2	0	2	3	0	1	3	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	4	13	0	0	0	0	2	2	2	3	1	1
Cap, veh/h	173	210	202	175	80	138	715	2115	44	596	2776	123
Arrive On Green	0.12	0.12	0.00	0.12	0.12	0.12	0.21	0.41	0.41	0.34	0.55	0.55
Sat Flow, veh/h	1272	1681	1615	1007	636	1107	3442	5127	107	1757	5030	223
Grp Volume(v), veh/h	69	18	0	62	0	50	627	954	518	42	1105	593
Grp Sat Flow(s),veh/h/ln	1272	1681	1615	1365	0	1385	1721	1696	1842	1757	1709	1835
Q Serve(g_s), s	6.8	1.2	0.0	4.5	0.0	4.3	22.9	29.9	29.9	2.1	27.8	27.8
Cycle Q Clear(g_c), s	11.0	1.2	0.0	5.7	0.0	4.3	22.9	29.9	29.9	2.1	27.8	27.8
Prop In Lane	1.00		1.00	0.78		0.80	1.00		0.06	1.00		0.12
Lane Grp Cap(c), veh/h	173	210	202	220	0	173	715	1399	760	596	1886	1012
V/C Ratio(X)	0.40	0.09	0.00	0.28	0.00	0.29	0.88	0.68	0.68	0.07	0.59	0.59
Avail Cap(c_a), veh/h	278	349	335	336	0	288	953	1826	992	596	1886	1012
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	56.6	50.3	0.0	52.4	0.0	51.6	49.9	31.2	31.2	29.1	19.3	19.3
Incr Delay (d2), s/veh	0.6	0.1	0.0	0.7	0.0	0.9	7.6	2.7	4.9	0.0	1.3	2.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.4	0.6	0.0	2.1	0.0	1.7	11.6	14.4	16.1	1.0	13.4	14.7
LnGrp Delay(d),s/veh	57.2	50.4	0.0	53.1	0.0	52.5	57.5	33.9	36.1	29.1	20.6	21.8
LnGrp LOS	E	D		D		D	E	C	D	C	C	C
Approach Vol, veh/h		87			112			2099			1740	
Approach Delay, s/veh		55.8			52.9			41.5			21.2	
Approach LOS		E			D			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	49.1	58.6		22.2	31.0	76.7		22.2
Change Period (Y+Rc), s	* 5	* 5		6.0	4.0	* 5		6.0
Max Green Setting (Gmax), s	* 18	* 70		27.0	36.0	* 52		27.0
Max Q Clear Time (g_c+I1), s	4.1	31.9		13.0	24.9	29.8		7.7
Green Ext Time (p_c), s	0.0	21.7		0.0	2.1	16.8		0.5

Intersection Summary			
HCM 2010 Ctrl Delay			33.4
HCM 2010 LOS			C

Notes

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	339	244	1795	552	0	2473
Future Volume (veh/h)	339	244	1795	552	0	2473
Number	7	14	6	16	5	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		0.97	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1881	1881	1900	0	1881
Adj Flow Rate, veh/h	346	249	1832	563	0	2523
Adj No. of Lanes	1	1	3	0	0	2
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	0	1	1	1	0	1
Cap, veh/h	376	332	2830	830	0	2582
Arrive On Green	0.21	0.21	0.72	0.72	0.00	0.72
Sat Flow, veh/h	1810	1599	4087	1149	0	3762
Grp Volume(v), veh/h	346	249	1590	805	0	2523
Grp Sat Flow(s),veh/h/ln	1810	1599	1712	1644	0	1787
Q Serve(g_s), s	28.1	21.9	36.1	40.0	0.0	99.9
Cycle Q Clear(g_c), s	28.1	21.9	36.1	40.0	0.0	99.9
Prop In Lane	1.00	1.00		0.70	0.00	
Lane Grp Cap(c), veh/h	376	332	2473	1187	0	2582
V/C Ratio(X)	0.92	0.75	0.64	0.68	0.00	0.98
Avail Cap(c_a), veh/h	426	376	2473	1187	0	2582
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	58.2	55.8	10.8	11.3	0.0	19.6
Incr Delay (d2), s/veh	23.7	7.2	1.3	3.1	0.0	13.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	16.5	10.3	17.2	18.9	0.0	53.4
LnGrp Delay(d),s/veh	81.9	63.0	12.1	14.5	0.0	32.7
LnGrp LOS	F	E	B	B		C
Approach Vol, veh/h	595		2395			2523
Approach Delay, s/veh	74.0		12.9			32.7
Approach LOS	E		B			C

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		114.2		35.8		114.2		
Change Period (Y+Rc), s		5.8		* 4.7		5.8		
Max Green Setting (Gmax), s		104.2		* 35		104.2		
Max Q Clear Time (g_c+I1), s		101.9		30.1		42.0		
Green Ext Time (p_c), s		2.2		1.0		60.5		

Intersection Summary			
HCM 2010 Ctrl Delay			28.6
HCM 2010 LOS			C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	93	138	30	533	411	876	20	1378	251	401	1868	543
Future Volume (veh/h)	93	138	30	533	411	876	20	1378	251	401	1868	543
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.98	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1885	1900	1881	1900	1881	1900	1881	1863	1863	1881	1900
Adj Flow Rate, veh/h	96	142	-12	549	424	798	21	1421	207	413	1926	548
Adj No. of Lanes	1	3	0	2	2	2	1	4	1	2	4	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	1	1	1	1	0	1	0	1	2	2	1	1
Cap, veh/h	118	341	0	588	646	1426	35	1791	699	1128	2996	844
Arrive On Green	0.07	0.07	0.00	0.17	0.18	0.18	0.02	0.28	0.28	0.33	0.59	0.59
Sat Flow, veh/h	1792	5314	0	3476	3610	2814	1810	6471	1559	3442	5041	1419
Grp Volume(v), veh/h	96	130	0	549	424	798	21	1421	207	413	1854	620
Grp Sat Flow(s),veh/h/ln	1792	1715	0	1738	1805	1407	1810	1618	1559	1721	1618	1607
Q Serve(g_s), s	7.9	3.6	0.0	23.4	16.4	5.7	1.7	30.5	0.0	13.8	37.6	38.3
Cycle Q Clear(g_c), s	7.9	3.6	0.0	23.4	16.4	5.7	1.7	30.5	0.0	13.8	37.6	38.3
Prop In Lane	1.00		0.00	1.00		1.00	1.00		1.00	1.00		0.88
Lane Grp Cap(c), veh/h	118	341	0	588	646	1426	35	1791	699	1128	2884	955
V/C Ratio(X)	0.81	0.38	0.00	0.93	0.66	0.56	0.60	0.79	0.30	0.37	0.64	0.65
Avail Cap(c_a), veh/h	303	1338	0	589	939	1654	125	1898	725	1128	2884	955
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	69.1	67.1	0.0	61.5	57.3	11.5	73.0	50.3	26.5	38.5	20.0	20.1
Incr Delay (d2), s/veh	12.3	0.7	0.0	22.1	1.1	0.3	15.1	3.7	1.1	0.2	1.1	3.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.3	1.7	0.0	13.0	8.3	7.3	1.0	14.1	5.7	6.6	16.9	17.8
LnGrp Delay(d),s/veh	81.4	67.8	0.0	83.6	58.4	11.8	88.1	54.0	27.6	38.7	21.1	23.5
LnGrp LOS	F	E		F	E	B	F	D	C	D	C	C
Approach Vol, veh/h		226			1771			1649			2887	
Approach Delay, s/veh		73.6			45.2			51.1			24.1	
Approach LOS		E			D			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	55.2	47.5	31.4	16.0	7.5	95.1	14.5	32.8
Change Period (Y+Rc), s	* 6	* 6	* 6	* 6	4.6	* 6	4.6	* 6
Max Green Setting (Gmax), s	* 20	* 44	* 25	* 39	10.4	* 54	25.4	* 39
Max Q Clear Time (g_c+I1), s	15.8	32.5	25.4	5.6	3.7	40.3	9.9	18.4
Green Ext Time (p_c), s	0.6	9.0	0.0	0.7	0.0	12.9	0.2	6.1

Intersection Summary	
HCM 2010 Ctrl Delay	38.4
HCM 2010 LOS	D

Notes

Intersection	
Int Delay, s/veh	1.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	762	230	353	1068	0	552
Future Vol, veh/h	762	230	353	1068	0	552
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	50	140	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	0	0	1	1	0	0
Mvmt Flow	794	240	368	1113	0	575

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	794	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.115	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.2095	-	-	-
Pot Cap-1 Maneuver	-	-	831	-	0	0
Stage 1	-	-	-	-	0	0
Stage 2	-	-	-	-	0	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	831	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	3.2	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	831	-
HCM Lane V/C Ratio	-	-	-	0.442	-
HCM Control Delay (s)	0	-	-	12.7	-
HCM Lane LOS	A	-	-	B	-
HCM 95th %tile Q(veh)	-	-	-	2.3	-

APPENDIX C – EXISTING QUEUE CALCULATION SHEETS

Lane Group	EBL	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	60	18	608	95	884	2175	60	1250
v/c Ratio	0.33	0.07	0.94	0.22	0.95	0.65	0.35	0.53
Control Delay	51.9	44.0	35.5	29.2	65.3	17.0	59.3	26.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.9	44.0	35.5	29.2	65.3	17.0	59.3	26.7
Queue Length 50th (ft)	46	13	114	22	375	377	49	272
Queue Length 95th (ft)	85	35	#325	46	#497	587	90	352
Internal Link Dist (ft)		612		364		482		642
Turn Bay Length (ft)					330			
Base Capacity (vph)	257	349	712	590	950	3349	242	2376
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.23	0.05	0.85	0.16	0.93	0.65	0.25	0.53

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	116	300	4109	1947
v/c Ratio	0.31	0.89	1.16	0.76
Control Delay	51.3	83.9	101.2	16.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	51.3	83.9	101.2	16.0
Queue Length 50th (ft)	95	280	~1782	595
Queue Length 95th (ft)	154	#417	m#1577	718
Internal Link Dist (ft)	551		941	912
Turn Bay Length (ft)		275		
Base Capacity (vph)	424	378	3557	2573
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.27	0.79	1.16	0.76

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	226	323	262	139	1049	18	2789	244	500	1540
v/c Ratio	0.84	0.65	0.54	0.50	1.44	0.21	0.87	0.23	1.07	0.40
Control Delay	87.4	57.8	64.3	72.6	235.1	74.0	38.0	5.0	116.4	22.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	87.4	57.8	64.3	72.6	235.1	74.0	38.0	5.0	116.4	22.6
Queue Length 50th (ft)	215	89	123	70	~598	17	704	37	~274	279
Queue Length 95th (ft)	#326	123	170	106	#686	45	794	76	#393	349
Internal Link Dist (ft)		299		669			900			403
Turn Bay Length (ft)	200		440		340	200		210	250	
Base Capacity (vph)	302	1324	587	938	727	125	3201	1086	466	3875
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.75	0.24	0.45	0.15	1.44	0.14	0.87	0.22	1.07	0.40

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Intersection	
Int Delay, s/veh	1.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1661	244	139	695	0	1089
Future Vol, veh/h	1661	244	139	695	0	1089
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	50	140	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	0	0	1	1	0	0
Mvmt Flow	1767	260	148	739	0	1159

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1767	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.115	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.2095	-	-	-
Pot Cap-1 Maneuver	-	-	354	-	0	0
Stage 1	-	-	-	-	0	0
Stage 2	-	-	-	-	0	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	354	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	3.7	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	354	-
HCM Lane V/C Ratio	-	-	-	0.418	-
HCM Control Delay (s)	0	-	-	22.3	-
HCM Lane LOS	A	-	-	C	-
HCM 95th %tile Q(veh)	-	-	-	2	-

Lane Group	EBL	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	69	18	875	141	627	1475	42	1700
v/c Ratio	0.28	0.05	1.24	0.23	0.81	0.50	0.17	0.74
Control Delay	47.0	41.9	139.9	23.1	55.8	19.1	48.5	32.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.0	41.9	139.9	23.1	55.8	19.1	48.5	32.6
Queue Length 50th (ft)	49	12	~578	26	260	345	28	422
Queue Length 95th (ft)	96	35	#832	56	307	332	68	530
Internal Link Dist (ft)		612		364		482		642
Turn Bay Length (ft)					330			
Base Capacity (vph)	247	349	706	609	950	3073	293	2293
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.28	0.05	1.24	0.23	0.66	0.48	0.14	0.74

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	346	249	2395	2523
v/c Ratio	0.89	0.68	0.67	0.99
Control Delay	82.5	57.0	16.7	36.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	82.5	57.0	16.7	36.2
Queue Length 50th (ft)	325	196	628	~1260
Queue Length 95th (ft)	#474	293	742	#1487
Internal Link Dist (ft)	551		941	912
Turn Bay Length (ft)		275		
Base Capacity (vph)	424	399	3558	2556
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.82	0.62	0.67	0.99

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	96	173	549	424	903	21	1421	259	413	2486
v/c Ratio	0.60	0.46	0.84	0.69	0.76	0.24	0.50	0.24	0.75	0.69
Control Delay	80.8	58.7	70.7	65.0	22.6	74.6	31.1	1.4	66.0	27.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	80.8	58.7	70.7	65.0	22.6	74.6	31.1	1.4	66.0	27.6
Queue Length 50th (ft)	92	49	275	213	222	20	270	0	199	498
Queue Length 95th (ft)	151	77	319	261	257	50	343	28	m213	m505
Internal Link Dist (ft)		299		669			900			403
Turn Bay Length (ft)	200		440		340	200		210	250	
Base Capacity (vph)	302	1321	658	938	1196	125	2841	1094	550	3627
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.13	0.83	0.45	0.76	0.17	0.50	0.24	0.75	0.69

Intersection Summary
m Volume for 95th percentile queue is metered by upstream signal.

Intersection	
Int Delay, s/veh	1.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰	↑		↱
Traffic Vol, veh/h	762	230	353	1068	0	552
Future Vol, veh/h	762	230	353	1068	0	552
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	50	140	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	0	0	1	1	0	0
Mvmt Flow	794	240	368	1113	0	575

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	794	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.115	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.2095	-	-	-
Pot Cap-1 Maneuver	-	-	831	-	0	0
Stage 1	-	-	-	-	0	0
Stage 2	-	-	-	-	0	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	831	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB		WB		NB	
HCM Control Delay, s	0		3.2		0	
HCM LOS					A	

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	831	-
HCM Lane V/C Ratio	-	-	-	0.442	-
HCM Control Delay (s)	0	-	-	12.7	-
HCM Lane LOS	A	-	-	B	-
HCM 95th %tile Q(veh)	-	-	-	2.3	-

APPENDIX D – OPENING YEAR (2025) INTERSECTION LEVEL OF SERVICE (LOS) CALCULATION SHEETS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	60	20	600	50	30	40	870	2090	90	70	1320	50
Future Volume (veh/h)	60	20	600	50	30	40	870	2090	90	70	1320	50
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.97		1.00	0.97		0.94	1.00		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1681	1900	1900	1809	1900	1863	1864	1900	1845	1878	1900
Adj Flow Rate, veh/h	62	21	0	52	31	12	897	2155	90	72	1361	50
Adj No. of Lanes	1	1	1	0	2	0	2	3	0	1	3	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	4	13	0	0	0	0	2	2	2	3	1	1
Cap, veh/h	185	210	202	203	140	54	943	2626	109	400	2465	91
Arrive On Green	0.12	0.12	0.00	0.12	0.12	0.12	0.27	0.52	0.52	0.23	0.49	0.49
Sat Flow, veh/h	1294	1681	1615	1180	1117	434	3442	5006	208	1757	5074	186
Grp Volume(v), veh/h	62	21	0	52	0	43	897	1457	788	72	917	494
Grp Sat Flow(s),veh/h/ln	1294	1681	1615	1193	0	1538	1721	1696	1822	1757	1709	1842
Q Serve(g_s), s	5.9	1.4	0.0	4.8	0.0	3.2	33.3	46.5	47.1	4.3	24.5	24.5
Cycle Q Clear(g_c), s	9.1	1.4	0.0	6.2	0.0	3.2	33.3	46.5	47.1	4.3	24.5	24.5
Prop In Lane	1.00		1.00	0.99		0.28	1.00		0.11	1.00		0.10
Lane Grp Cap(c), veh/h	185	210	202	204	0	192	943	1779	955	400	1660	895
V/C Ratio(X)	0.34	0.10	0.00	0.26	0.00	0.22	0.95	0.82	0.82	0.18	0.55	0.55
Avail Cap(c_a), veh/h	292	349	335	312	0	319	953	1827	981	400	1660	895
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	55.3	50.4	0.0	53.1	0.0	51.2	46.3	25.8	25.9	40.4	23.5	23.5
Incr Delay (d2), s/veh	0.4	0.1	0.0	0.7	0.0	0.6	18.4	4.3	8.0	0.2	1.3	2.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.1	0.7	0.0	1.8	0.0	1.4	18.2	22.7	25.8	2.1	11.9	13.1
LnGrp Delay(d),s/veh	55.7	50.5	0.0	53.8	0.0	51.8	64.8	30.1	33.9	40.7	24.8	25.9
LnGrp LOS	E	D		D		D	E	C	C	D	C	C
Approach Vol, veh/h		83			95			3142			1483	
Approach Delay, s/veh		54.4			52.9			41.0			26.0	
Approach LOS		D			D			D			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	34.6	73.2		22.2	39.6	68.1		22.2				
Change Period (Y+Rc), s	* 5	* 5		6.0	4.0	* 5		6.0				
Max Green Setting (Gmax), s	* 18	* 70		27.0	36.0	* 52		27.0				
Max Q Clear Time (g_c+I1), s	6.3	49.1		11.1	35.3	26.5		8.2				
Green Ext Time (p_c), s	0.1	19.1		0.0	0.3	15.8		0.4				
Intersection Summary												
HCM 2010 Ctrl Delay			36.8									
HCM 2010 LOS			D									
Notes												

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	120	300	2740	1100	0	1970
Future Volume (veh/h)	120	300	2740	1100	0	1970
Number	7	14	6	16	5	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		0.97	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1881	1881	1900	0	1881
Adj Flow Rate, veh/h	130	326	2978	1196	0	2141
Adj No. of Lanes	1	1	3	0	0	2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	1	1	1	0	1
Cap, veh/h	393	348	2660	928	0	2547
Arrive On Green	0.22	0.22	0.71	0.71	0.00	0.71
Sat Flow, veh/h	1810	1599	3902	1302	0	3762
Grp Volume(v), veh/h	130	326	2694	1480	0	2141
Grp Sat Flow(s),veh/h/ln	1810	1599	1712	1612	0	1787
Q Serve(g_s), s	9.1	30.1	106.9	106.9	0.0	64.4
Cycle Q Clear(g_c), s	9.1	30.1	106.9	106.9	0.0	64.4
Prop In Lane	1.00	1.00		0.81	0.00	
Lane Grp Cap(c), veh/h	393	348	2440	1149	0	2547
V/C Ratio(X)	0.33	0.94	1.10	1.29	0.00	0.84
Avail Cap(c_a), veh/h	426	376	2440	1149	0	2547
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	49.5	57.7	21.6	21.6	0.0	15.4
Incr Delay (d2), s/veh	0.5	29.9	53.7	136.6	0.0	3.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.6	16.2	68.0	90.5	0.0	32.8
LnGrp Delay(d),s/veh	50.0	87.6	75.2	158.1	0.0	19.0
LnGrp LOS	D	F	F	F		B
Approach Vol, veh/h	456		4174			2141
Approach Delay, s/veh	76.9		104.6			19.0
Approach LOS	E		F			B

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		112.7		37.3		112.7		
Change Period (Y+Rc), s		5.8		* 4.7		5.8		
Max Green Setting (Gmax), s		104.2		* 35		104.2		
Max Q Clear Time (g_c+I1), s		66.4		32.1		108.9		
Green Ext Time (p_c), s		28.0		0.5		0.0		

Intersection Summary		
HCM 2010 Ctrl Delay		75.7
HCM 2010 LOS		E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	220	220	90	260	140	990	20	2610	230	490	1390	210
Future Volume (veh/h)	220	220	90	260	140	990	20	2610	230	490	1390	210
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		0.98	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1887	1900	1881	1900	1881	1900	1881	1863	1863	1881	1900
Adj Flow Rate, veh/h	237	237	52	280	151	955	22	2806	193	527	1495	213
Adj No. of Lanes	1	3	0	2	2	2	1	4	1	2	4	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	1	1	1	1	0	1	0	1	2	2	1	1
Cap, veh/h	260	345	72	673	501	1156	36	1898	764	937	3194	455
Arrive On Green	0.15	0.08	0.08	0.19	0.14	0.14	0.02	0.29	0.29	0.27	0.55	0.55
Sat Flow, veh/h	1792	4256	889	3476	3610	2814	1810	6471	1560	3442	5757	819
Grp Volume(v), veh/h	237	189	100	280	151	955	22	2806	193	527	1260	448
Grp Sat Flow(s),veh/h/ln	1792	1717	1711	1738	1805	1407	1810	1618	1560	1721	1618	1723
Q Serve(g_s), s	19.5	8.0	8.6	10.6	5.6	13.5	1.8	44.0	0.0	19.7	23.4	23.5
Cycle Q Clear(g_c), s	19.5	8.0	8.6	10.6	5.6	13.5	1.8	44.0	0.0	19.7	23.4	23.5
Prop In Lane	1.00		0.52	1.00		1.00	1.00		1.00	1.00		0.48
Lane Grp Cap(c), veh/h	260	278	139	673	501	1156	36	1898	764	937	2693	956
V/C Ratio(X)	0.91	0.68	0.72	0.42	0.30	0.83	0.61	1.48	0.25	0.56	0.47	0.47
Avail Cap(c_a), veh/h	303	893	445	673	939	1498	125	1898	764	937	2693	956
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	63.2	67.0	67.3	53.1	58.1	16.1	72.9	53.0	22.5	46.9	20.1	20.1
Incr Delay (d2), s/veh	27.6	2.9	6.9	0.4	0.3	3.1	15.3	218.1	0.8	0.8	0.6	1.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.7	3.9	4.3	5.1	2.8	10.3	1.1	48.4	4.8	9.5	10.5	11.5
LnGrp Delay(d),s/veh	90.8	69.9	74.2	53.5	58.4	19.2	88.2	271.1	23.3	47.7	20.7	21.7
LnGrp LOS	F	E	E	D	E	B	F	F	C	D	C	C
Approach Vol, veh/h		526			1386			3021			2235	
Approach Delay, s/veh		80.1			30.4			253.9			27.2	
Approach LOS		F			C			F			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	46.8	50.0	35.0	18.1	7.6	89.2	26.4	26.8
Change Period (Y+Rc), s	* 6	* 6	* 6	* 6	4.6	* 6	4.6	* 6
Max Green Setting (Gmax), s	* 20	* 44	* 25	* 39	10.4	* 54	25.4	* 39
Max Q Clear Time (g_c+I1), s	21.7	46.0	12.6	10.6	3.8	25.5	21.5	15.5
Green Ext Time (p_c), s	0.0	0.0	0.7	1.6	0.0	19.2	0.2	5.3

Intersection Summary	
HCM 2010 Ctrl Delay	127.3
HCM 2010 LOS	F

Notes

Intersection	
Int Delay, s/veh	1.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1670	265	155	730	0	1100
Future Vol, veh/h	1670	265	155	730	0	1100
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	50	140	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	0	0	1	1	0	0
Mvmt Flow	1777	282	165	777	0	1170

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1777	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.115	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.2095	-	-	-
Pot Cap-1 Maneuver	-	-	351	-	0	0
Stage 1	-	-	-	-	0	0
Stage 2	-	-	-	-	0	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	351	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	4.2	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	351	-
HCM Lane V/C Ratio	-	-	-	0.47	-
HCM Control Delay (s)	0	-	-	24	-
HCM Lane LOS	A	-	-	C	-
HCM 95th %tile Q(veh)	-	-	-	2.4	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	70	30	860	60	30	70	660	1520	50	50	1620	80
Future Volume (veh/h)	70	30	860	60	30	70	660	1520	50	50	1620	80
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		1.00	0.97		0.94	1.00		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1681	1900	1900	1818	1900	1863	1864	1900	1845	1878	1900
Adj Flow Rate, veh/h	72	31	0	62	31	43	680	1567	49	52	1670	80
Adj No. of Lanes	1	1	1	0	2	0	2	3	0	1	3	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	4	13	0	0	0	0	2	2	2	3	1	1
Cap, veh/h	173	224	215	185	89	130	766	2245	70	528	2648	127
Arrive On Green	0.13	0.13	0.00	0.13	0.13	0.13	0.22	0.44	0.44	0.30	0.53	0.53
Sat Flow, veh/h	1264	1681	1615	1007	668	976	3442	5065	158	1757	5009	240
Grp Volume(v), veh/h	72	31	0	74	0	62	680	1049	567	52	1139	611
Grp Sat Flow(s),veh/h/ln	1264	1681	1615	1236	0	1415	1721	1696	1831	1757	1709	1831
Q Serve(g_s), s	7.1	2.1	0.0	6.0	0.0	5.2	24.9	32.4	32.4	2.8	30.6	30.7
Cycle Q Clear(g_c), s	12.3	2.1	0.0	8.1	0.0	5.2	24.9	32.4	32.4	2.8	30.6	30.7
Prop In Lane	1.00		1.00	0.84		0.69	1.00		0.09	1.00		0.13
Lane Grp Cap(c), veh/h	173	224	215	216	0	188	766	1504	812	528	1807	968
V/C Ratio(X)	0.42	0.14	0.00	0.34	0.00	0.33	0.89	0.70	0.70	0.10	0.63	0.63
Avail Cap(c_a), veh/h	267	349	335	317	0	294	953	1827	986	528	1807	968
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	56.7	49.8	0.0	53.0	0.0	51.1	49.0	29.2	29.2	32.8	21.7	21.7
Incr Delay (d2), s/veh	0.6	0.1	0.0	0.9	0.0	1.0	8.9	2.7	4.9	0.1	1.7	3.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.5	1.0	0.0	2.5	0.0	2.1	12.8	15.7	17.5	1.4	14.8	16.3
LnGrp Delay(d),s/veh	57.3	49.9	0.0	53.9	0.0	52.1	57.9	31.9	34.1	32.9	23.3	24.8
LnGrp LOS	E	D		D		D	E	C	C	C	C	C
Approach Vol, veh/h		103			136			2296			1802	
Approach Delay, s/veh		55.0			53.1			40.1			24.1	
Approach LOS		E			D			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	44.1	62.6		23.3	32.9	73.7		23.3
Change Period (Y+Rc), s	* 5	* 5		6.0	4.0	* 5		6.0
Max Green Setting (Gmax), s	* 18	* 70		27.0	36.0	* 52		27.0
Max Q Clear Time (g_c+I1), s	4.8	34.4		14.3	26.9	32.7		10.1
Green Ext Time (p_c), s	0.1	23.2		0.1	2.1	15.4		0.6

Intersection Summary	
HCM 2010 Ctrl Delay	34.2
HCM 2010 LOS	C

Notes

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	350	260	1970	570	0	2540
Future Volume (veh/h)	350	260	1970	570	0	2540
Number	7	14	6	16	5	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		0.97	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1881	1881	1900	0	1881
Adj Flow Rate, veh/h	357	265	2010	582	0	2592
Adj No. of Lanes	1	1	3	0	0	2
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	0	1	1	1	0	1
Cap, veh/h	386	341	2864	778	0	2562
Arrive On Green	0.21	0.21	0.72	0.72	0.00	0.72
Sat Flow, veh/h	1810	1599	4164	1086	0	3762
Grp Volume(v), veh/h	357	265	1704	888	0	2592
Grp Sat Flow(s),veh/h/ln	1810	1599	1712	1657	0	1787
Q Serve(g_s), s	29.0	23.4	42.1	49.1	0.0	107.5
Cycle Q Clear(g_c), s	29.0	23.4	42.1	49.1	0.0	107.5
Prop In Lane	1.00	1.00		0.66	0.00	
Lane Grp Cap(c), veh/h	386	341	2455	1188	0	2562
V/C Ratio(X)	0.93	0.78	0.69	0.75	0.00	1.01
Avail Cap(c_a), veh/h	426	376	2455	1188	0	2562
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	57.9	55.7	12.0	13.0	0.0	21.2
Incr Delay (d2), s/veh	24.9	9.1	1.6	4.3	0.0	20.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	17.1	11.2	20.2	23.6	0.0	59.7
LnGrp Delay(d),s/veh	82.8	64.8	13.6	17.3	0.0	41.9
LnGrp LOS	F	E	B	B		F
Approach Vol, veh/h	622		2592			2592
Approach Delay, s/veh	75.1		14.9			41.9
Approach LOS	E		B			D

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		113.3		36.7		113.3		
Change Period (Y+Rc), s		5.8		* 4.7		5.8		
Max Green Setting (Gmax), s		104.2		* 35		104.2		
Max Q Clear Time (g_c+I1), s		109.5		31.0		51.1		
Green Ext Time (p_c), s		0.0		1.0		52.4		

Intersection Summary		
HCM 2010 Ctrl Delay		33.4
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	140	150	40	550	420	890	30	1490	260	430	1900	560
Future Volume (veh/h)	140	150	40	550	420	890	30	1490	260	430	1900	560
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.98	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1885	1900	1881	1900	1881	1900	1881	1863	1863	1881	1900
Adj Flow Rate, veh/h	144	155	-2	567	433	813	31	1536	216	443	1959	565
Adj No. of Lanes	1	3	0	2	2	2	1	4	1	2	4	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	1	1	1	1	0	1	0	1	2	2	1	1
Cap, veh/h	168	343	0	646	606	1326	44	1840	738	1044	2879	820
Arrive On Green	0.09	0.07	0.00	0.19	0.17	0.17	0.02	0.28	0.28	0.30	0.57	0.57
Sat Flow, veh/h	1792	5316	0	3476	3610	2814	1810	6471	1559	3442	5026	1431
Grp Volume(v), veh/h	144	153	0	567	433	813	31	1536	216	443	1891	633
Grp Sat Flow(s),veh/h/ln	1792	1715	0	1738	1805	1407	1810	1618	1559	1721	1618	1604
Q Serve(g_s), s	11.9	4.3	0.0	23.8	17.0	7.6	2.6	33.4	0.0	15.4	40.9	41.8
Cycle Q Clear(g_c), s	11.9	4.3	0.0	23.8	17.0	7.6	2.6	33.4	0.0	15.4	40.9	41.8
Prop In Lane	1.00		0.00	1.00		1.00	1.00		1.00	1.00		0.89
Lane Grp Cap(c), veh/h	168	343	0	646	606	1326	44	1840	738	1044	2780	919
V/C Ratio(X)	0.86	0.45	0.00	0.88	0.71	0.61	0.71	0.83	0.29	0.42	0.68	0.69
Avail Cap(c_a), veh/h	303	1338	0	646	939	1585	125	1898	752	1044	2780	919
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	67.0	67.4	0.0	59.4	59.0	12.7	72.7	50.4	24.4	41.8	22.4	22.6
Incr Delay (d2), s/veh	11.6	0.9	0.0	13.1	1.6	0.5	18.9	4.6	1.0	0.3	1.4	4.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.4	2.1	0.0	12.6	8.6	7.7	1.5	15.5	5.7	7.4	18.6	19.5
LnGrp Delay(d),s/veh	78.6	68.3	0.0	72.5	60.6	13.2	91.6	55.0	25.4	42.1	23.8	26.8
LnGrp LOS	E	E		E	E	B	F	E	C	D	C	C
Approach Vol, veh/h		297			1813			1783			2967	
Approach Delay, s/veh		73.3			43.1			52.1			27.2	
Approach LOS		E			D			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	51.5	48.7	33.9	16.0	8.2	91.9	18.7	31.2
Change Period (Y+Rc), s	* 6	* 6	* 6	* 6	4.6	* 6	4.6	* 6
Max Green Setting (Gmax), s	* 20	* 44	* 25	* 39	10.4	* 54	25.4	* 39
Max Q Clear Time (g_c+I1), s	17.4	35.4	25.8	6.3	4.6	43.8	13.9	19.0
Green Ext Time (p_c), s	0.5	7.3	0.0	0.9	0.0	9.7	0.2	6.2

Intersection Summary	
HCM 2010 Ctrl Delay	39.8
HCM 2010 LOS	D

Notes

Intersection	
Int Delay, s/veh	1.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	780	245	365	1090	0	570
Future Vol, veh/h	780	245	365	1090	0	570
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	50	140	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	0	0	1	1	0	0
Mvmt Flow	813	255	380	1135	0	594

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	813	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.115	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.2095	-	-	-
Pot Cap-1 Maneuver	-	-	817	-	0	0
Stage 1	-	-	-	-	0	0
Stage 2	-	-	-	-	0	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	817	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	3.3	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	817	-
HCM Lane V/C Ratio	-	-	-	0.465	-
HCM Control Delay (s)	0	-	-	13.2	-
HCM Lane LOS	A	-	-	B	-
HCM 95th %tile Q(veh)	-	-	-	2.5	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	60	20	610	50	30	40	870	2090	90	70	1350	50
Future Volume (veh/h)	60	20	610	50	30	40	870	2090	90	70	1350	50
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.97		1.00	0.97		0.94	1.00		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1681	1900	1900	1810	1900	1863	1864	1900	1845	1879	1900
Adj Flow Rate, veh/h	61	20	0	51	31	8	888	2133	89	71	1378	49
Adj No. of Lanes	1	1	1	0	2	0	2	3	0	1	3	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	4	13	0	0	0	0	2	2	2	3	1	1
Cap, veh/h	189	210	202	205	156	40	937	2618	109	402	2476	88
Arrive On Green	0.12	0.12	0.00	0.12	0.12	0.12	0.27	0.52	0.52	0.23	0.49	0.49
Sat Flow, veh/h	1298	1681	1615	1195	1245	321	3442	5007	208	1757	5081	181
Grp Volume(v), veh/h	61	20	0	51	0	39	888	1443	779	71	927	500
Grp Sat Flow(s),veh/h/ln	1298	1681	1615	1195	0	1567	1721	1696	1822	1757	1709	1843
Q Serve(g_s), s	5.8	1.4	0.0	4.7	0.0	2.9	32.9	45.9	46.4	4.2	24.8	24.8
Cycle Q Clear(g_c), s	8.7	1.4	0.0	6.1	0.0	2.9	32.9	45.9	46.4	4.2	24.8	24.8
Prop In Lane	1.00		1.00	1.00		0.21	1.00		0.11	1.00		0.10
Lane Grp Cap(c), veh/h	189	210	202	205	0	196	937	1774	953	402	1666	898
V/C Ratio(X)	0.32	0.10	0.00	0.25	0.00	0.20	0.95	0.81	0.82	0.18	0.56	0.56
Avail Cap(c_a), veh/h	296	349	335	313	0	325	953	1827	981	402	1666	898
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	54.9	50.4	0.0	53.1	0.0	51.0	46.4	25.7	25.9	40.3	23.4	23.4
Incr Delay (d2), s/veh	0.4	0.1	0.0	0.6	0.0	0.5	17.7	4.2	7.8	0.2	1.3	2.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.1	0.6	0.0	1.7	0.0	1.3	18.0	22.5	25.2	2.1	12.0	13.3
LnGrp Delay(d),s/veh	55.3	50.4	0.0	53.7	0.0	51.5	64.1	29.9	33.6	40.5	24.8	25.9
LnGrp LOS	E	D		D		D	E	C	C	D	C	C
Approach Vol, veh/h		81			90			3110			1498	
Approach Delay, s/veh		54.1			52.8			40.6			25.9	
Approach LOS		D			D			D			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	34.8	73.0		22.2	39.4	68.4		22.2				
Change Period (Y+Rc), s	* 5	* 5		6.0	4.0	* 5		6.0				
Max Green Setting (Gmax), s	* 18	* 70		27.0	36.0	* 52		27.0				
Max Q Clear Time (g_c+I1), s	6.2	48.4		10.7	34.9	26.8		8.1				
Green Ext Time (p_c), s	0.1	19.6		0.0	0.5	15.9		0.4				
Intersection Summary												
HCM 2010 Ctrl Delay			36.5									
HCM 2010 LOS			D									
Notes												

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	120	310	2740	1100	0	2010
Future Volume (veh/h)	120	310	2740	1100	0	2010
Number	7	14	6	16	5	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		0.97	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1881	1881	1900	0	1881
Adj Flow Rate, veh/h	122	316	2796	1122	0	2051
Adj No. of Lanes	1	1	3	0	0	3
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	0	1	1	1	0	1
Cap, veh/h	383	339	2682	935	0	3689
Arrive On Green	0.21	0.21	0.72	0.72	0.00	0.72
Sat Flow, veh/h	1810	1599	3903	1302	0	5474
Grp Volume(v), veh/h	122	316	2529	1389	0	2051
Grp Sat Flow(s),veh/h/ln	1810	1599	1712	1612	0	1712
Q Serve(g_s), s	8.5	29.1	107.7	107.7	0.0	28.1
Cycle Q Clear(g_c), s	8.5	29.1	107.7	107.7	0.0	28.1
Prop In Lane	1.00	1.00		0.81	0.00	
Lane Grp Cap(c), veh/h	383	339	2459	1158	0	3689
V/C Ratio(X)	0.32	0.93	1.03	1.20	0.00	0.56
Avail Cap(c_a), veh/h	426	376	2459	1158	0	3689
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	50.0	58.1	21.1	21.1	0.0	9.9
Incr Delay (d2), s/veh	0.5	28.6	25.8	98.5	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.3	15.6	59.0	79.0	0.0	13.3
LnGrp Delay(d),s/veh	50.4	86.7	46.9	119.6	0.0	10.5
LnGrp LOS	D	F	F	F		B
Approach Vol, veh/h	438		3918			2051
Approach Delay, s/veh	76.6		72.7			10.5
Approach LOS	E		E			B

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		113.5		36.5		113.5		
Change Period (Y+Rc), s		5.8		* 4.7		5.8		
Max Green Setting (Gmax), s		104.2		* 35		104.2		
Max Q Clear Time (g_c+I1), s		30.1		31.1		109.7		
Green Ext Time (p_c), s		35.9		0.6		0.0		

Intersection Summary			
HCM 2010 Ctrl Delay			53.1
HCM 2010 LOS			D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	210	220	90	260	140	990	20	2610	240	490	1410	230
Future Volume (veh/h)	210	220	90	260	140	990	20	2610	240	490	1410	230
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		0.98	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1887	1900	1881	1900	1881	1900	1881	1863	1863	1881	1881
Adj Flow Rate, veh/h	212	222	49	263	141	905	20	2636	191	495	1424	180
Adj No. of Lanes	1	3	0	2	2	2	1	4	1	2	3	1
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Percent Heavy Veh, %	1	1	1	1	0	1	0	1	2	2	1	1
Cap, veh/h	236	327	69	587	446	1194	34	1898	725	1036	3003	922
Arrive On Green	0.13	0.08	0.08	0.17	0.12	0.12	0.02	0.29	0.29	0.30	0.58	0.58
Sat Flow, veh/h	1792	4252	892	3476	3610	2814	1810	6471	1560	3442	5136	1576
Grp Volume(v), veh/h	212	177	94	263	141	905	20	2636	191	495	1424	180
Grp Sat Flow(s),veh/h/ln	1792	1717	1710	1738	1805	1407	1810	1618	1560	1721	1712	1576
Q Serve(g_s), s	17.5	7.5	8.1	10.2	5.3	11.5	1.6	44.0	0.0	17.6	23.9	8.0
Cycle Q Clear(g_c), s	17.5	7.5	8.1	10.2	5.3	11.5	1.6	44.0	0.0	17.6	23.9	8.0
Prop In Lane	1.00		0.52	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	236	264	131	587	446	1194	34	1898	725	1036	3003	922
V/C Ratio(X)	0.90	0.67	0.72	0.45	0.32	0.76	0.59	1.39	0.26	0.48	0.47	0.20
Avail Cap(c_a), veh/h	303	893	445	589	939	1579	125	1898	725	1036	3003	922
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	64.1	67.4	67.6	56.0	60.0	15.2	73.0	53.0	24.7	42.8	17.9	14.6
Incr Delay (d2), s/veh	23.6	2.9	7.0	0.5	0.4	1.5	15.0	178.2	0.9	0.3	0.5	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.2	3.7	4.1	4.9	2.7	9.3	1.0	43.1	5.0	8.4	11.4	3.6
LnGrp Delay(d),s/veh	87.7	70.3	74.7	56.6	60.4	16.7	88.0	231.2	25.5	43.2	18.4	15.1
LnGrp LOS	F	E	E	E	E	B	F	F	C	D	B	B
Approach Vol, veh/h		483			1309			2847			2099	
Approach Delay, s/veh		78.8			29.4			216.4			24.0	
Approach LOS		E			C			F			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	51.1	50.0	31.3	17.5	7.4	93.7	24.3	24.5
Change Period (Y+Rc), s	* 6	* 6	* 6	* 6	4.6	* 6	4.6	* 6
Max Green Setting (Gmax), s	* 20	* 44	* 25	* 39	10.4	* 54	25.4	* 39
Max Q Clear Time (g_c+I1), s	19.6	46.0	12.2	10.1	3.6	25.9	19.5	13.5
Green Ext Time (p_c), s	0.2	0.0	0.7	1.5	0.0	17.7	0.3	5.0

Intersection Summary	
HCM 2010 Ctrl Delay	110.3
HCM 2010 LOS	F

Notes

Intersection	
Int Delay, s/veh	1.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1670	270	160	730	0	1100
Future Vol, veh/h	1670	270	160	730	0	1100
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	50	140	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	0	0	1	1	0	0
Mvmt Flow	1740	281	167	760	0	1146

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1740	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.115	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.2095	-	-	-
Pot Cap-1 Maneuver	-	-	363	-	0	0
Stage 1	-	-	-	-	0	0
Stage 2	-	-	-	-	0	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	363	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	4.1	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	363	-
HCM Lane V/C Ratio	-	-	-	0.459	-
HCM Control Delay (s)	0	-	-	23.1	-
HCM Lane LOS	A	-	-	C	-
HCM 95th %tile Q(veh)	-	-	-	2.3	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	70	30	910	60	30	70	660	1540	50	50	1710	80
Future Volume (veh/h)	70	30	910	60	30	70	660	1540	50	50	1710	80
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.97		1.00	0.97		0.94	1.00		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1681	1900	1900	1818	1900	1863	1864	1900	1845	1878	1900
Adj Flow Rate, veh/h	71	31	0	61	31	23	673	1571	48	51	1745	79
Adj No. of Lanes	1	1	1	0	2	0	2	3	0	1	3	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	4	13	0	0	0	0	2	2	2	3	1	1
Cap, veh/h	183	220	212	202	114	86	760	2250	69	531	2677	121
Arrive On Green	0.13	0.13	0.00	0.13	0.13	0.13	0.22	0.44	0.44	0.30	0.53	0.53
Sat Flow, veh/h	1284	1681	1615	1120	872	654	3442	5070	155	1757	5024	227
Grp Volume(v), veh/h	71	31	0	62	0	53	673	1051	568	51	1187	637
Grp Sat Flow(s),veh/h/ln	1284	1681	1615	1153	0	1493	1721	1696	1832	1757	1709	1834
Q Serve(g_s), s	6.9	2.1	0.0	5.7	0.0	4.1	24.6	32.5	32.5	2.7	32.3	32.4
Cycle Q Clear(g_c), s	11.0	2.1	0.0	7.8	0.0	4.1	24.6	32.5	32.5	2.7	32.3	32.4
Prop In Lane	1.00		1.00	0.98		0.44	1.00		0.08	1.00		0.12
Lane Grp Cap(c), veh/h	183	220	212	206	0	196	760	1506	813	531	1821	977
V/C Ratio(X)	0.39	0.14	0.00	0.30	0.00	0.27	0.89	0.70	0.70	0.10	0.65	0.65
Avail Cap(c_a), veh/h	281	349	335	306	0	310	953	1827	987	531	1821	977
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	55.8	50.0	0.0	53.4	0.0	50.9	49.1	29.1	29.1	32.6	21.7	21.7
Incr Delay (d2), s/veh	0.5	0.1	0.0	0.8	0.0	0.7	8.7	2.7	4.9	0.1	1.8	3.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.5	1.0	0.0	2.1	0.0	1.7	12.6	15.8	17.5	1.3	15.6	17.2
LnGrp Delay(d),s/veh	56.3	50.1	0.0	54.2	0.0	51.6	57.8	31.8	34.1	32.7	23.6	25.1
LnGrp LOS	E	D		D		D	E	C	C	C	C	C
Approach Vol, veh/h		102			115			2292			1875	
Approach Delay, s/veh		54.4			53.0			40.0			24.3	
Approach LOS		D			D			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	44.3	62.7		23.0	32.7	74.3		23.0
Change Period (Y+Rc), s	* 5	* 5		6.0	4.0	* 5		6.0
Max Green Setting (Gmax), s	* 18	* 70		27.0	36.0	* 52		27.0
Max Q Clear Time (g_c+I1), s	4.7	34.5		13.0	26.6	34.4		9.8
Green Ext Time (p_c), s	0.1	23.2		0.1	2.1	14.6		0.5

Intersection Summary	
HCM 2010 Ctrl Delay	34.0
HCM 2010 LOS	C

Notes

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	350	270	1980	570	0	2680
Future Volume (veh/h)	350	270	1980	570	0	2680
Number	7	14	6	16	5	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		0.97	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1881	1881	1900	0	1881
Adj Flow Rate, veh/h	357	276	2020	582	0	2735
Adj No. of Lanes	1	1	3	0	0	3
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	0	1	1	1	0	1
Cap, veh/h	386	341	2868	775	0	3681
Arrive On Green	0.21	0.21	0.72	0.72	0.00	0.72
Sat Flow, veh/h	1810	1599	4170	1081	0	5474
Grp Volume(v), veh/h	357	276	1709	893	0	2735
Grp Sat Flow(s),veh/h/ln	1810	1599	1712	1658	0	1712
Q Serve(g_s), s	29.0	24.6	42.4	49.6	0.0	48.4
Cycle Q Clear(g_c), s	29.0	24.6	42.4	49.6	0.0	48.4
Prop In Lane	1.00	1.00		0.65	0.00	
Lane Grp Cap(c), veh/h	386	341	2454	1188	0	3681
V/C Ratio(X)	0.93	0.81	0.70	0.75	0.00	0.74
Avail Cap(c_a), veh/h	426	376	2454	1188	0	3681
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	57.8	56.1	12.0	13.0	0.0	12.9
Incr Delay (d2), s/veh	24.8	11.5	1.7	4.4	0.0	1.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	17.1	12.0	20.3	23.8	0.0	23.0
LnGrp Delay(d),s/veh	82.7	67.6	13.7	17.4	0.0	14.3
LnGrp LOS	F	E	B	B		B
Approach Vol, veh/h	633		2602			2735
Approach Delay, s/veh	76.1		15.0			14.3
Approach LOS	E		B			B

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		113.3		36.7		113.3		
Change Period (Y+Rc), s		5.8		* 4.7		5.8		
Max Green Setting (Gmax), s		104.2		* 35		104.2		
Max Q Clear Time (g_c+I1), s		50.4		31.0		51.6		
Green Ext Time (p_c), s		44.6		1.0		52.0		

Intersection Summary	
HCM 2010 Ctrl Delay	21.1
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	140	150	30	550	420	890	30	1490	260	435	1990	605
Future Volume (veh/h)	140	150	30	550	420	890	30	1490	260	435	1990	605
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.98	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1884	1900	1881	1900	1881	1900	1881	1863	1863	1881	1881
Adj Flow Rate, veh/h	141	152	-45	556	424	745	30	1505	168	439	2010	524
Adj No. of Lanes	1	3	0	2	2	2	1	4	1	2	3	1
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Percent Heavy Veh, %	1	1	1	1	0	1	0	1	2	2	1	1
Cap, veh/h	165	339	0	626	589	1337	43	1826	725	1073	2976	913
Arrive On Green	0.09	0.07	0.00	0.18	0.16	0.16	0.02	0.28	0.28	0.31	0.58	0.58
Sat Flow, veh/h	1792	5314	0	3476	3610	2814	1810	6471	1559	3442	5136	1576
Grp Volume(v), veh/h	141	107	0	556	424	745	30	1505	168	439	2010	524
Grp Sat Flow(s),veh/h/ln	1792	1715	0	1738	1805	1407	1810	1618	1559	1721	1712	1576
Q Serve(g_s), s	11.6	3.0	0.0	23.4	16.7	6.6	2.5	32.6	0.0	15.1	40.6	31.4
Cycle Q Clear(g_c), s	11.6	3.0	0.0	23.4	16.7	6.6	2.5	32.6	0.0	15.1	40.6	31.4
Prop In Lane	1.00		0.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	165	339	0	626	589	1337	43	1826	725	1073	2976	913
V/C Ratio(X)	0.85	0.32	0.00	0.89	0.72	0.56	0.70	0.82	0.23	0.41	0.68	0.57
Avail Cap(c_a), veh/h	303	1337	0	626	939	1609	125	1898	743	1073	2976	913
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	67.1	66.8	0.0	60.0	59.5	12.1	72.7	50.4	24.3	40.7	21.8	19.9
Incr Delay (d2), s/veh	11.6	0.5	0.0	14.6	1.7	0.4	18.3	4.4	0.7	0.3	1.2	2.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.3	1.4	0.0	12.5	8.5	6.7	1.5	15.2	4.3	7.2	19.5	14.2
LnGrp Delay(d),s/veh	78.7	67.4	0.0	74.6	61.2	12.5	91.0	54.7	25.0	41.0	23.0	22.5
LnGrp LOS	E	E		E	E	B	F	D	C	D	C	C
Approach Vol, veh/h		248			1725			1703			2973	
Approach Delay, s/veh		73.8			44.5			52.5			25.6	
Approach LOS		E			D			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	52.8	48.3	33.0	15.9	8.2	92.9	18.4	30.5
Change Period (Y+Rc), s	* 6	* 6	* 6	* 6	4.6	* 6	4.6	* 6
Max Green Setting (Gmax), s	* 20	* 44	* 25	* 39	10.4	* 54	25.4	* 39
Max Q Clear Time (g_c+I1), s	17.1	34.6	25.4	5.0	4.5	42.6	13.6	18.7
Green Ext Time (p_c), s	0.5	7.7	0.0	0.6	0.0	10.8	0.2	5.8

Intersection Summary	
HCM 2010 Ctrl Delay	39.2
HCM 2010 LOS	D

Notes

Intersection	
Int Delay, s/veh	2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	790	250	370	1090	0	570
Future Vol, veh/h	790	250	370	1090	0	570
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	50	140	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	0	0	1	1	0	0
Mvmt Flow	823	260	385	1135	0	594

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	823	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.115	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.2095	-	-	-
Pot Cap-1 Maneuver	-	-	810	-	0	0
Stage 1	-	-	-	-	0	0
Stage 2	-	-	-	-	0	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	810	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	3.4	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	810	-
HCM Lane V/C Ratio	-	-	-	0.476	-
HCM Control Delay (s)	0	-	-	13.4	-
HCM Lane LOS	A	-	-	B	-
HCM 95th %tile Q(veh)	-	-	-	2.6	-

APPENDIX E – OPENING YEAR (2025) QUEUE CALCULATION SHEETS

Lane Group	EBL	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	62	21	619	124	897	2248	72	1413
v/c Ratio	0.34	0.08	0.96	0.28	0.95	0.69	0.36	0.61
Control Delay	51.5	43.9	38.4	31.9	66.0	19.6	57.5	29.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.5	43.9	38.4	31.9	66.0	19.6	57.5	29.0
Queue Length 50th (ft)	46	15	130	32	382	500	56	332
Queue Length 95th (ft)	87	38	#352	58	#509	622	104	412
Internal Link Dist (ft)		612		364		482		642
Turn Bay Length (ft)					330			
Base Capacity (vph)	251	349	709	583	950	3238	242	2331
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.06	0.87	0.21	0.94	0.69	0.30	0.61

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	130	326	4174	2141
v/c Ratio	0.33	0.92	1.19	0.84
Control Delay	50.9	87.4	116.7	20.5
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	50.9	87.4	116.7	20.5
Queue Length 50th (ft)	106	306	~1852	778
Queue Length 95th (ft)	170	#477	m#1612	898
Internal Link Dist (ft)	551		941	912
Turn Bay Length (ft)		275		
Base Capacity (vph)	424	378	3507	2535
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.31	0.86	1.19	0.84

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	237	334	280	151	1065	22	2806	247	527	1721
v/c Ratio	0.86	0.66	0.56	0.53	1.47	0.25	0.89	0.24	1.13	0.45
Control Delay	88.8	58.7	64.3	72.8	245.6	74.8	39.6	5.2	133.7	25.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	88.8	58.7	64.3	72.8	245.6	74.8	39.6	5.2	133.7	25.5
Queue Length 50th (ft)	225	93	131	76	~616	21	727	38	~304	350
Queue Length 95th (ft)	#352	128	181	113	#702	52	809	79	m#409	410
Internal Link Dist (ft)		299		669			900			403
Turn Bay Length (ft)	200		440		340	200		210	250	
Base Capacity (vph)	302	1324	587	938	726	125	3156	1080	466	3826
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.78	0.25	0.48	0.16	1.47	0.18	0.89	0.23	1.13	0.45

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Intersection	
Int Delay, s/veh	1.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1670	265	155	730	0	1100
Future Vol, veh/h	1670	265	155	730	0	1100
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	50	140	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	0	0	1	1	0	0
Mvmt Flow	1777	282	165	777	0	1170

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1777	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.115	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.2095	-	-	-
Pot Cap-1 Maneuver	-	-	351	-	0	0
Stage 1	-	-	-	-	0	0
Stage 2	-	-	-	-	0	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	351	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	4.2	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	351	-
HCM Lane V/C Ratio	-	-	-	0.47	-
HCM Control Delay (s)	0	-	-	24	-
HCM Lane LOS	A	-	-	C	-
HCM 95th %tile Q(veh)	-	-	-	2.4	-

Queues
1: Lincoln Blvd & Fiji Way

2025 (Opening Year) No Build
PM PEAK HOUR

Lane Group	EBL	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	72	31	887	165	680	1619	52	1752
v/c Ratio	0.30	0.09	1.26	0.27	0.83	0.58	0.20	0.78
Control Delay	47.5	42.5	147.1	25.4	56.4	21.6	50.0	34.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.5	42.5	147.1	25.4	56.4	21.6	50.0	34.9
Queue Length 50th (ft)	52	21	~600	34	281	356	38	455
Queue Length 95th (ft)	99	50	#856	67	336	372	81	554
Internal Link Dist (ft)		612		364		482		642
Turn Bay Length (ft)					330			
Base Capacity (vph)	241	349	706	602	950	2897	285	2234
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.09	1.26	0.27	0.72	0.56	0.18	0.78

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	357	265	2592	2592
v/c Ratio	0.91	0.73	0.73	1.02
Control Delay	83.8	61.8	18.1	45.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	83.8	61.8	18.1	45.0
Queue Length 50th (ft)	336	220	740	~1442
Queue Length 95th (ft)	#498	324	828	#1559
Internal Link Dist (ft)	551		941	912
Turn Bay Length (ft)		275		
Base Capacity (vph)	424	392	3543	2543
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.84	0.68	0.73	1.02

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	144	196	567	433	918	31	1536	268	443	2536
v/c Ratio	0.70	0.49	0.79	0.73	0.86	0.33	0.55	0.24	0.88	0.73
Control Delay	80.9	57.0	64.0	67.0	33.4	76.7	33.3	1.6	71.0	31.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	80.9	57.0	64.0	67.0	33.4	76.7	33.3	1.6	71.0	31.2
Queue Length 50th (ft)	138	54	274	216	273	30	310	3	221	521
Queue Length 95th (ft)	207	83	315	266	289	66	402	33	m223	m500
Internal Link Dist (ft)		299		669			900			403
Turn Bay Length (ft)	200		440		340	200		210	250	
Base Capacity (vph)	302	1323	722	938	1073	125	2791	1107	503	3473
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.48	0.15	0.79	0.46	0.86	0.25	0.55	0.24	0.88	0.73

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Intersection	
Int Delay, s/veh	1.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	780	245	365	1090	0	570
Future Vol, veh/h	780	245	365	1090	0	570
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	50	140	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	0	0	1	1	0	0
Mvmt Flow	813	255	380	1135	0	594

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	813	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.115	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.2095	-	-	-
Pot Cap-1 Maneuver	-	-	817	-	0	0
Stage 1	-	-	-	-	0	0
Stage 2	-	-	-	-	0	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	817	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	3.3	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	817	-
HCM Lane V/C Ratio	-	-	-	0.465	-
HCM Control Delay (s)	0	-	-	13.2	-
HCM Lane LOS	A	-	-	B	-
HCM 95th %tile Q(veh)	-	-	-	2.5	-

Lane Group	EBL	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	61	20	622	123	888	2225	71	1429
v/c Ratio	0.33	0.08	0.96	0.28	0.95	0.69	0.36	0.61
Control Delay	50.9	43.6	38.9	31.5	65.8	19.7	57.2	29.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.9	43.6	38.9	31.5	65.8	19.7	57.2	29.2
Queue Length 50th (ft)	45	14	134	31	377	501	55	341
Queue Length 95th (ft)	87	37	#359	58	#501	610	103	417
Internal Link Dist (ft)		612		364		482		642
Turn Bay Length (ft)					330			
Base Capacity (vph)	251	349	708	584	950	3223	242	2333
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.06	0.88	0.21	0.93	0.69	0.29	0.61

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	122	316	3918	2051
v/c Ratio	0.31	0.91	1.11	0.56
Control Delay	50.9	85.4	84.0	11.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	50.9	85.4	84.0	11.3
Queue Length 50th (ft)	99	293	~1657	345
Queue Length 95th (ft)	160	#451	m#1483	381
Internal Link Dist (ft)	551		941	912
Turn Bay Length (ft)		275		
Base Capacity (vph)	424	379	3526	3664
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.29	0.83	1.11	0.56

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	212	313	263	141	1000	20	2636	242	495	1424	232
v/c Ratio	0.82	0.64	0.56	0.51	1.35	0.23	0.82	0.23	1.06	0.45	0.23
Control Delay	85.7	57.8	65.0	72.7	196.1	74.3	35.1	4.7	110.4	18.8	9.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	85.7	57.8	65.0	72.7	196.1	74.3	35.1	4.7	110.4	18.8	9.4
Queue Length 50th (ft)	202	86	125	71	~527	19	627	34	~264	278	43
Queue Length 95th (ft)	292	120	170	107	#613	48	724	72	#382	353	121
Internal Link Dist (ft)		299		669			900			403	
Turn Bay Length (ft)	200		440		340	200		210	250		125
Base Capacity (vph)	302	1324	587	938	740	125	3233	1091	466	3159	1019
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.70	0.24	0.45	0.15	1.35	0.16	0.82	0.22	1.06	0.45	0.23

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Intersection	
Int Delay, s/veh	1.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1670	270	160	730	0	1100
Future Vol, veh/h	1670	270	160	730	0	1100
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	50	140	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	0	0	1	1	0	0
Mvmt Flow	1740	281	167	760	0	1146

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1740	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.115	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.2095	-	-	-
Pot Cap-1 Maneuver	-	-	363	-	0	0
Stage 1	-	-	-	-	0	0
Stage 2	-	-	-	-	0	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	363	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	4.1	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	363	-
HCM Lane V/C Ratio	-	-	-	0.459	-
HCM Control Delay (s)	0	-	-	23.1	-
HCM Lane LOS	A	-	-	C	-
HCM 95th %tile Q(veh)	-	-	-	2.3	-

Lane Group	EBL	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	71	31	929	163	673	1622	51	1827
v/c Ratio	0.29	0.09	1.32	0.27	0.83	0.58	0.19	0.81
Control Delay	47.4	42.5	172.7	25.4	56.3	21.6	50.0	36.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.4	42.5	172.7	25.4	56.3	21.6	50.0	36.0
Queue Length 50th (ft)	51	21	~674	33	278	356	37	483
Queue Length 95th (ft)	99	50	#932	67	332	374	80	590
Internal Link Dist (ft)		612		364		482		642
Turn Bay Length (ft)					330			
Base Capacity (vph)	242	349	706	602	950	2897	284	2242
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.29	0.09	1.32	0.27	0.71	0.56	0.18	0.81

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	357	276	2602	2735
v/c Ratio	0.91	0.76	0.73	0.75
Control Delay	83.8	64.1	16.2	15.4
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	83.8	64.1	16.2	15.4
Queue Length 50th (ft)	336	232	735	593
Queue Length 95th (ft)	#498	340	825	643
Internal Link Dist (ft)	551		941	912
Turn Bay Length (ft)		275		
Base Capacity (vph)	424	392	3542	3654
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.84	0.70	0.73	0.75

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	141	182	556	424	899	30	1505	263	439	2010	611
v/c Ratio	0.69	0.48	0.78	0.72	0.83	0.32	0.54	0.24	0.86	0.70	0.64
Control Delay	81.0	61.3	64.0	66.8	31.0	76.4	33.0	1.5	70.4	27.1	20.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	81.0	61.3	64.0	66.8	31.0	76.4	33.0	1.5	70.4	27.1	20.6
Queue Length 50th (ft)	135	54	270	212	262	29	299	2	211	438	245
Queue Length 95th (ft)	203	82	310	261	280	65	389	31	m#322	615	m364
Internal Link Dist (ft)		299		669			900			403	
Turn Bay Length (ft)	200		440		340	200		210	250		125
Base Capacity (vph)	302	1320	714	938	1081	125	2793	1105	512	2860	959
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.14	0.78	0.45	0.83	0.24	0.54	0.24	0.86	0.70	0.64

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Intersection	
Int Delay, s/veh	2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	790	250	370	1090	0	570
Future Vol, veh/h	790	250	370	1090	0	570
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	50	140	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	0	0	1	1	0	0
Mvmt Flow	823	260	385	1135	0	594

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	823	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.115	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.2095	-	-	-
Pot Cap-1 Maneuver	-	-	810	-	0	0
Stage 1	-	-	-	-	0	0
Stage 2	-	-	-	-	0	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	810	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	3.4	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	810	-
HCM Lane V/C Ratio	-	-	-	0.476	-
HCM Control Delay (s)	0	-	-	13.4	-
HCM Lane LOS	A	-	-	B	-
HCM 95th %tile Q(veh)	-	-	-	2.6	-

APPENDIX F – DESIGN YEAR (2045) INTERSECTION LEVEL OF SERVICE (LOS) CALCULATION SHEETS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	70	30	630	80	40	50	880	2230	110	80	1830	60
Future Volume (veh/h)	70	30	630	80	40	50	880	2230	110	80	1830	60
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		1.00	0.97		0.95	1.00		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1681	1900	1900	1799	1900	1863	1864	1900	1845	1879	1900
Adj Flow Rate, veh/h	72	31	0	82	41	23	907	2299	110	82	1887	60
Adj No. of Lanes	1	1	1	0	2	0	2	3	0	1	3	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	4	13	0	0	0	0	2	2	2	3	1	1
Cap, veh/h	187	237	228	216	136	76	949	2650	126	357	2388	76
Arrive On Green	0.14	0.14	0.00	0.14	0.14	0.14	0.28	0.53	0.53	0.20	0.47	0.47
Sat Flow, veh/h	1276	1681	1615	1142	965	541	3442	4973	236	1757	5104	162
Grp Volume(v), veh/h	72	31	0	82	0	64	907	1563	846	82	1263	684
Grp Sat Flow(s),veh/h/ln	1276	1681	1615	1142	0	1506	1721	1697	1816	1757	1710	1847
Q Serve(g_s), s	7.0	2.1	0.0	7.7	0.0	5.0	33.7	51.9	52.9	5.1	40.5	40.6
Cycle Q Clear(g_c), s	11.9	2.1	0.0	9.8	0.0	5.0	33.7	51.9	52.9	5.1	40.5	40.6
Prop In Lane	1.00		1.00	1.00		0.36	1.00		0.13	1.00		0.09
Lane Grp Cap(c), veh/h	187	237	228	216	0	212	949	1808	968	357	1600	864
V/C Ratio(X)	0.39	0.13	0.00	0.38	0.00	0.30	0.96	0.86	0.87	0.23	0.79	0.79
Avail Cap(c_a), veh/h	272	349	335	302	0	313	953	1827	978	357	1600	864
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	55.4	48.9	0.0	53.2	0.0	50.1	46.3	26.3	26.6	43.3	29.2	29.2
Incr Delay (d2), s/veh	0.5	0.1	0.0	1.1	0.0	0.8	19.3	5.8	10.8	0.3	4.0	7.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.5	1.0	0.0	2.8	0.0	2.1	18.5	25.6	29.2	2.5	20.0	22.5
LnGrp Delay(d),s/veh	55.9	49.0	0.0	54.3	0.0	50.9	65.6	32.1	37.4	43.6	33.2	36.5
LnGrp LOS	E	D		D		D	E	C	D	D	C	D
Approach Vol, veh/h		103			146			3316			2029	
Approach Delay, s/veh		53.8			52.8			42.6			34.8	
Approach LOS		D			D			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	31.4	74.3		24.3	39.8	65.8		24.3
Change Period (Y+Rc), s	* 5	* 5		6.0	4.0	* 5		6.0
Max Green Setting (Gmax), s	* 18	* 70		27.0	36.0	* 52		27.0
Max Q Clear Time (g_c+I1), s	7.1	54.9		13.9	35.7	42.6		11.8
Green Ext Time (p_c), s	0.1	14.3		0.1	0.2	8.5		0.7

Intersection Summary	
HCM 2010 Ctrl Delay	40.2
HCM 2010 LOS	D

Notes

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	130	350	2870	1110	0	2540
Future Volume (veh/h)	130	350	2870	1110	0	2540
Number	7	14	6	16	5	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		0.97	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1881	1881	1900	0	1881
Adj Flow Rate, veh/h	141	380	3120	1207	0	2761
Adj No. of Lanes	1	1	3	0	0	2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	1	1	1	0	1
Cap, veh/h	426	376	2618	884	0	2483
Arrive On Green	0.24	0.24	0.69	0.69	0.00	0.69
Sat Flow, veh/h	1810	1599	3938	1273	0	3762
Grp Volume(v), veh/h	141	380	2793	1534	0	2761
Grp Sat Flow(s),veh/h/ln	1810	1599	1712	1618	0	1787
Q Serve(g_s), s	9.7	35.3	104.2	104.2	0.0	104.2
Cycle Q Clear(g_c), s	9.7	35.3	104.2	104.2	0.0	104.2
Prop In Lane	1.00	1.00		0.79	0.00	
Lane Grp Cap(c), veh/h	426	376	2378	1124	0	2483
V/C Ratio(X)	0.33	1.01	1.17	1.37	0.00	1.11
Avail Cap(c_a), veh/h	426	376	2378	1124	0	2483
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	47.6	57.3	22.9	22.9	0.0	22.9
Incr Delay (d2), s/veh	0.5	48.9	83.2	170.2	0.0	56.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.9	20.7	76.4	99.3	0.0	70.6
LnGrp Delay(d),s/veh	48.0	106.3	106.1	193.1	0.0	79.7
LnGrp LOS	D	F	F	F		F
Approach Vol, veh/h	521		4327			2761
Approach Delay, s/veh	90.5		136.9			79.7
Approach LOS	F		F			E

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		110.0		40.0		110.0		
Change Period (Y+Rc), s		5.8		* 4.7		5.8		
Max Green Setting (Gmax), s		104.2		* 35		104.2		
Max Q Clear Time (g_c+I1), s		106.2		37.3		106.2		
Green Ext Time (p_c), s		0.0		0.0		0.0		

Intersection Summary		
HCM 2010 Ctrl Delay		113.0
HCM 2010 LOS		F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	230	230	100	280	170	1060	30	2660	240	565	1875	230
Future Volume (veh/h)	230	230	100	280	170	1060	30	2660	240	565	1875	230
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		0.98	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1887	1900	1881	1900	1881	1900	1881	1863	1863	1881	1900
Adj Flow Rate, veh/h	247	247	63	301	183	1030	32	2860	204	608	2016	234
Adj No. of Lanes	1	3	0	2	2	2	1	4	1	2	4	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	1	1	1	1	0	1	0	1	2	2	1	1
Cap, veh/h	270	356	86	734	565	1141	44	1898	792	857	3119	362
Arrive On Green	0.15	0.09	0.09	0.21	0.16	0.16	0.02	0.29	0.29	0.25	0.53	0.53
Sat Flow, veh/h	1792	4128	996	3476	3610	2814	1810	6471	1560	3442	5916	686
Grp Volume(v), veh/h	247	203	107	301	183	1030	32	2860	204	608	1653	597
Grp Sat Flow(s),veh/h/ln	1792	1717	1691	1738	1805	1407	1810	1618	1560	1721	1618	1748
Q Serve(g_s), s	20.4	8.6	9.2	11.2	6.8	15.7	2.6	44.0	0.0	24.2	36.6	36.7
Cycle Q Clear(g_c), s	20.4	8.6	9.2	11.2	6.8	15.7	2.6	44.0	0.0	24.2	36.6	36.7
Prop In Lane	1.00		0.59	1.00		1.00	1.00		1.00	1.00		0.39
Lane Grp Cap(c), veh/h	270	297	146	734	565	1141	44	1898	792	857	2559	922
V/C Ratio(X)	0.92	0.68	0.73	0.41	0.32	0.90	0.72	1.51	0.26	0.71	0.65	0.65
Avail Cap(c_a), veh/h	303	893	440	734	939	1433	125	1898	792	857	2559	922
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	62.8	66.5	66.8	51.1	56.2	17.0	72.6	53.0	21.1	51.4	25.4	25.5
Incr Delay (d2), s/veh	29.1	2.8	6.9	0.4	0.3	7.0	19.5	230.8	0.8	2.7	1.3	3.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	12.3	4.2	4.6	5.4	3.4	12.1	1.6	50.1	5.0	11.8	16.7	18.6
LnGrp Delay(d),s/veh	91.9	69.3	73.7	51.5	56.6	24.1	92.2	283.8	21.9	54.1	26.7	29.0
LnGrp LOS	F	E	E	D	E	C	F	F	C	D	C	C
Approach Vol, veh/h		557			1514			3096			2858	
Approach Delay, s/veh		80.2			33.4			264.5			33.0	
Approach LOS		F			C			F			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	43.4	50.0	37.7	19.0	8.3	85.1	27.2	29.5
Change Period (Y+Rc), s	* 6	* 6	* 6	* 6	4.6	* 6	4.6	* 6
Max Green Setting (Gmax), s	* 20	* 44	* 25	* 39	10.4	* 54	25.4	* 39
Max Q Clear Time (g_c+I1), s	26.2	46.0	13.2	11.2	4.6	38.7	22.4	17.7
Green Ext Time (p_c), s	0.0	0.0	0.8	1.7	0.0	13.7	0.2	5.8

Intersection Summary	
HCM 2010 Ctrl Delay	125.7
HCM 2010 LOS	F

Notes

Intersection	
Int Delay, s/veh	1.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1690	310	170	830	0	1110
Future Vol, veh/h	1690	310	170	830	0	1110
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	50	140	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	0	0	1	1	0	0
Mvmt Flow	1798	330	181	883	0	1181

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1798	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.115	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.2095	-	-	-
Pot Cap-1 Maneuver	-	-	345	-	0	0
Stage 1	-	-	-	-	0	0
Stage 2	-	-	-	-	0	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	345	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	4.5	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	345	-
HCM Lane V/C Ratio	-	-	-	0.524	-
HCM Control Delay (s)	0	-	-	26.4	-
HCM Lane LOS	A	-	-	D	-
HCM 95th %tile Q(veh)	-	-	-	2.9	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	80	40	870	70	40	80	810	1940	80	70	1760	100
Future Volume (veh/h)	80	40	870	70	40	80	810	1940	80	70	1760	100
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		1.00	0.97		0.95	1.00		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1681	1900	1900	1819	1900	1863	1864	1900	1845	1877	1900
Adj Flow Rate, veh/h	82	41	0	72	41	53	835	2000	79	72	1814	101
Adj No. of Lanes	1	1	1	0	2	0	2	3	0	1	3	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	4	13	0	0	0	0	2	2	2	3	1	1
Cap, veh/h	171	240	230	185	101	138	900	2566	101	392	2385	133
Arrive On Green	0.14	0.14	0.00	0.14	0.14	0.14	0.26	0.51	0.51	0.22	0.48	0.48
Sat Flow, veh/h	1245	1681	1615	946	711	972	3442	5019	198	1757	4964	276
Grp Volume(v), veh/h	82	41	0	89	0	77	835	1350	729	72	1247	668
Grp Sat Flow(s),veh/h/ln	1245	1681	1615	1207	0	1421	1721	1696	1824	1757	1708	1823
Q Serve(g_s), s	8.3	2.8	0.0	7.3	0.0	6.4	30.8	42.0	42.3	4.3	38.8	39.0
Cycle Q Clear(g_c), s	14.7	2.8	0.0	10.0	0.0	6.4	30.8	42.0	42.3	4.3	38.8	39.0
Prop In Lane	1.00		1.00	0.81		0.68	1.00		0.11	1.00		0.15
Lane Grp Cap(c), veh/h	171	240	230	222	0	203	900	1734	932	392	1642	876
V/C Ratio(X)	0.48	0.17	0.00	0.40	0.00	0.38	0.93	0.78	0.78	0.18	0.76	0.76
Avail Cap(c_a), veh/h	252	349	335	311	0	295	953	1827	982	392	1642	876
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	57.2	49.0	0.0	52.9	0.0	50.5	46.8	25.8	25.9	40.9	27.6	27.7
Incr Delay (d2), s/veh	0.8	0.1	0.0	1.2	0.0	1.2	14.4	3.5	6.5	0.2	3.4	6.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.9	1.3	0.0	3.0	0.0	2.6	16.4	20.4	22.9	2.1	19.0	21.2
LnGrp Delay(d),s/veh	58.0	49.1	0.0	54.1	0.0	51.7	61.2	29.3	32.4	41.1	31.0	33.9
LnGrp LOS	E	D		D		D	E	C	C	D	C	C
Approach Vol, veh/h		123			166			2914			1987	
Approach Delay, s/veh		55.0			53.0			39.2			32.3	
Approach LOS		E			D			D			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	34.0	71.5		24.5	38.0	67.5		24.5				
Change Period (Y+Rc), s	* 5	* 5		6.0	4.0	* 5		6.0				
Max Green Setting (Gmax), s	* 18	* 70		27.0	36.0	* 52		27.0				
Max Q Clear Time (g_c+I1), s	6.3	44.3		16.7	32.8	41.0		12.0				
Green Ext Time (p_c), s	0.1	22.2		0.1	1.3	9.8		0.8				
Intersection Summary												
HCM 2010 Ctrl Delay			37.4									
HCM 2010 LOS			D									
Notes												

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	360	280	2550	620	0	2700
Future Volume (veh/h)	360	280	2550	620	0	2700
Number	7	14	6	16	5	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		0.97	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1881	1881	1900	0	1881
Adj Flow Rate, veh/h	367	286	2602	633	0	2755
Adj No. of Lanes	1	1	3	0	0	2
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	0	1	1	1	0	1
Cap, veh/h	394	349	2977	663	0	2545
Arrive On Green	0.22	0.22	0.71	0.71	0.00	0.71
Sat Flow, veh/h	1810	1599	4350	932	0	3762
Grp Volume(v), veh/h	367	286	2088	1147	0	2755
Grp Sat Flow(s),veh/h/ln	1810	1599	1712	1688	0	1787
Q Serve(g_s), s	29.8	25.6	67.5	91.6	0.0	106.8
Cycle Q Clear(g_c), s	29.8	25.6	67.5	91.6	0.0	106.8
Prop In Lane	1.00	1.00		0.55	0.00	
Lane Grp Cap(c), veh/h	394	349	2438	1202	0	2545
V/C Ratio(X)	0.93	0.82	0.86	0.95	0.00	1.08
Avail Cap(c_a), veh/h	426	376	2438	1202	0	2545
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	57.5	55.9	15.9	19.4	0.0	21.6
Incr Delay (d2), s/veh	26.1	12.7	4.1	17.1	0.0	44.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	17.8	12.5	33.0	47.8	0.0	67.8
LnGrp Delay(d),s/veh	83.6	68.6	20.1	36.5	0.0	66.4
LnGrp LOS	F	E	C	D		F
Approach Vol, veh/h	653		3235			2755
Approach Delay, s/veh	77.0		25.9			66.4
Approach LOS	E		C			E

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		112.6		37.4		112.6		
Change Period (Y+Rc), s		5.8		* 4.7		5.8		
Max Green Setting (Gmax), s		104.2		* 35		104.2		
Max Q Clear Time (g_c+I1), s		108.8		31.8		93.6		
Green Ext Time (p_c), s		0.0		0.9		10.6		

Intersection Summary	
HCM 2010 Ctrl Delay	47.7
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	280	190	50	600	430	950	40	1910	250	530	1945	585
Future Volume (veh/h)	280	190	50	600	430	950	40	1910	250	530	1945	585
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		0.98	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1885	1900	1881	1900	1881	1900	1881	1863	1863	1881	1900
Adj Flow Rate, veh/h	289	196	9	619	443	874	41	1969	206	546	2005	591
Adj No. of Lanes	1	3	0	2	2	2	1	4	1	2	4	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	1	1	1	1	0	1	0	1	2	2	1	1
Cap, veh/h	303	336	15	924	623	1088	53	1898	878	737	2438	707
Arrive On Green	0.17	0.07	0.07	0.27	0.17	0.17	0.03	0.29	0.29	0.21	0.49	0.49
Sat Flow, veh/h	1792	5042	229	3476	3610	2814	1810	6471	1560	3442	5002	1451
Grp Volume(v), veh/h	289	133	72	619	443	874	41	1969	206	546	1944	652
Grp Sat Flow(s),veh/h/ln	1792	1715	1840	1738	1805	1407	1810	1618	1560	1721	1618	1600
Q Serve(g_s), s	24.0	5.6	5.7	23.9	17.4	13.5	3.4	44.0	0.0	22.2	51.4	52.9
Cycle Q Clear(g_c), s	24.0	5.6	5.7	23.9	17.4	13.5	3.4	44.0	0.0	22.2	51.4	52.9
Prop In Lane	1.00		0.12	1.00		1.00	1.00		1.00	1.00		0.91
Lane Grp Cap(c), veh/h	303	229	123	924	623	1088	53	1898	878	737	2366	780
V/C Ratio(X)	0.95	0.58	0.59	0.67	0.71	0.80	0.77	1.04	0.23	0.74	0.82	0.84
Avail Cap(c_a), veh/h	303	892	478	924	939	1334	125	1898	878	737	2366	780
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	61.7	68.0	68.0	49.2	58.5	16.4	72.3	53.0	16.8	55.0	32.9	33.3
Incr Delay (d2), s/veh	39.0	2.3	4.5	1.9	1.5	3.0	20.4	31.0	0.6	4.0	3.4	10.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	15.2	2.7	3.1	11.7	8.8	9.1	2.0	23.7	4.4	11.0	23.6	25.6
LnGrp Delay(d),s/veh	100.7	70.3	72.5	51.1	60.1	19.4	92.6	84.0	17.4	59.0	36.2	43.6
LnGrp LOS	F	E	E	D	E	B	F	F	B	E	D	D
Approach Vol, veh/h		494			1936			2216			3142	
Approach Delay, s/veh		88.4			38.8			78.0			41.7	
Approach LOS		F			D			E			D	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	38.1	50.0	45.9	16.0	9.0	79.1	30.0	31.9				
Change Period (Y+Rc), s	* 6	* 6	* 6	* 6	4.6	* 6	4.6	* 6				
Max Green Setting (Gmax), s	* 20	* 44	* 25	* 39	10.4	* 54	25.4	* 39				
Max Q Clear Time (g_c+I1), s	24.2	46.0	25.9	7.7	5.4	54.9	26.0	19.4				
Green Ext Time (p_c), s	0.0	0.0	0.0	1.1	0.0	0.0	0.0	6.5				
Intersection Summary												
HCM 2010 Ctrl Delay			54.3									
HCM 2010 LOS			D									
Notes												

Intersection	
Int Delay, s/veh	2.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	840	255	385	1140	0	620
Future Vol, veh/h	840	255	385	1140	0	620
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	50	140	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	0	0	1	1	0	0
Mvmt Flow	875	266	401	1188	0	646

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	875	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.115	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.2095	-	-	-
Pot Cap-1 Maneuver	-	-	775	-	0	0
Stage 1	-	-	-	-	0	0
Stage 2	-	-	-	-	0	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	775	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	3.7	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	775	-
HCM Lane V/C Ratio	-	-	-	0.517	-
HCM Control Delay (s)	0	-	-	14.5	-
HCM Lane LOS	A	-	-	B	-
HCM 95th %tile Q(veh)	-	-	-	3	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	70	30	670	80	40	50	895	2235	110	80	1960	60
Future Volume (veh/h)	70	30	670	80	40	50	895	2235	110	80	1960	60
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		1.00	0.97		0.95	1.00		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1681	1900	1900	1798	1900	1863	1864	1900	1845	1879	1900
Adj Flow Rate, veh/h	71	31	0	82	41	11	913	2281	108	82	2000	59
Adj No. of Lanes	1	1	1	0	2	0	2	3	0	1	3	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	4	13	0	0	0	0	2	2	2	3	1	1
Cap, veh/h	198	236	227	216	173	46	952	2647	124	359	2392	70
Arrive On Green	0.14	0.14	0.00	0.14	0.14	0.14	0.28	0.53	0.53	0.20	0.47	0.47
Sat Flow, veh/h	1288	1681	1615	1142	1227	329	3442	4976	234	1757	5119	151
Grp Volume(v), veh/h	71	31	0	82	0	52	913	1550	839	82	1335	724
Grp Sat Flow(s),veh/h/ln	1288	1681	1615	1142	0	1557	1721	1697	1817	1757	1710	1849
Q Serve(g_s), s	6.7	2.1	0.0	7.7	0.0	3.9	33.9	51.2	52.2	5.1	44.4	44.5
Cycle Q Clear(g_c), s	10.6	2.1	0.0	9.8	0.0	3.9	33.9	51.2	52.2	5.1	44.4	44.5
Prop In Lane	1.00		1.00	1.00		0.21	1.00		0.13	1.00		0.08
Lane Grp Cap(c), veh/h	198	236	227	216	0	219	952	1805	966	359	1598	864
V/C Ratio(X)	0.36	0.13	0.00	0.38	0.00	0.24	0.96	0.86	0.87	0.23	0.84	0.84
Avail Cap(c_a), veh/h	285	349	335	302	0	323	953	1827	978	359	1598	864
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	54.4	48.9	0.0	53.2	0.0	49.7	46.3	26.2	26.4	43.2	30.3	30.3
Incr Delay (d2), s/veh	0.4	0.1	0.0	1.1	0.0	0.6	19.8	5.6	10.4	0.3	5.3	9.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.4	1.0	0.0	2.8	0.0	1.7	18.7	25.3	28.9	2.5	22.1	25.0
LnGrp Delay(d),s/veh	54.8	49.0	0.0	54.3	0.0	50.2	66.1	31.8	36.8	43.5	35.6	39.8
LnGrp LOS	D	D		D		D	E	C	D	D	D	D
Approach Vol, veh/h		102			134			3302			2141	
Approach Delay, s/veh		53.0			52.7			42.6			37.3	
Approach LOS		D			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	31.6	74.2		24.3	40.0	65.7		24.3
Change Period (Y+Rc), s	* 5	* 5		6.0	4.0	* 5		6.0
Max Green Setting (Gmax), s	* 18	* 70		27.0	36.0	* 52		27.0
Max Q Clear Time (g_c+I1), s	7.1	54.2		12.6	35.9	46.5		11.8
Green Ext Time (p_c), s	0.1	15.0		0.1	0.0	5.1		0.6

Intersection Summary		
HCM 2010 Ctrl Delay		41.0
HCM 2010 LOS		D

Notes

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	170	370	2870	1110	0	2710
Future Volume (veh/h)	170	370	2870	1110	0	2710
Number	7	14	6	16	5	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		0.97	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1881	1881	1900	0	1881
Adj Flow Rate, veh/h	173	378	2929	1133	0	2765
Adj No. of Lanes	1	1	3	0	0	3
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	0	1	1	1	0	1
Cap, veh/h	426	376	2618	884	0	3568
Arrive On Green	0.24	0.24	0.69	0.69	0.00	0.69
Sat Flow, veh/h	1810	1599	3938	1272	0	5474
Grp Volume(v), veh/h	173	378	2622	1440	0	2765
Grp Sat Flow(s),veh/h/ln	1810	1599	1712	1618	0	1712
Q Serve(g_s), s	12.1	35.3	104.2	104.2	0.0	53.4
Cycle Q Clear(g_c), s	12.1	35.3	104.2	104.2	0.0	53.4
Prop In Lane	1.00	1.00		0.79	0.00	
Lane Grp Cap(c), veh/h	426	376	2378	1124	0	3568
V/C Ratio(X)	0.41	1.00	1.10	1.28	0.00	0.78
Avail Cap(c_a), veh/h	426	376	2378	1124	0	3568
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	48.5	57.3	22.9	22.9	0.0	15.1
Incr Delay (d2), s/veh	0.6	47.5	53.1	133.7	0.0	1.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.1	20.5	66.4	87.9	0.0	25.7
LnGrp Delay(d),s/veh	49.1	104.9	76.0	156.6	0.0	16.9
LnGrp LOS	D	F	F	F		B
Approach Vol, veh/h	551		4062			2765
Approach Delay, s/veh	87.4		104.6			16.9
Approach LOS	F		F			B

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		110.0		40.0		110.0		
Change Period (Y+Rc), s		5.8		* 4.7		5.8		
Max Green Setting (Gmax), s		104.2		* 35		104.2		
Max Q Clear Time (g_c+I1), s		55.4		37.3		106.2		
Green Ext Time (p_c), s		41.4		0.0		0.0		

Intersection Summary	
HCM 2010 Ctrl Delay	70.4
HCM 2010 LOS	E

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	210	230	100	280	170	1060	30	2660	250	580	1980	320
Future Volume (veh/h)	210	230	100	280	170	1060	30	2660	250	580	1980	320
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		1.00	1.00		0.98	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1887	1900	1881	1900	1881	1900	1881	1863	1863	1881	1881
Adj Flow Rate, veh/h	212	232	55	283	172	983	30	2687	201	586	2000	269
Adj No. of Lanes	1	3	0	2	2	2	1	4	1	2	3	1
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Percent Heavy Veh, %	1	1	1	1	0	1	0	1	2	2	1	1
Cap, veh/h	236	339	76	623	497	1194	43	1898	741	986	2904	891
Arrive On Green	0.13	0.08	0.08	0.18	0.14	0.14	0.02	0.29	0.29	0.29	0.57	0.57
Sat Flow, veh/h	1792	4193	942	3476	3610	2814	1810	6471	1560	3442	5136	1576
Grp Volume(v), veh/h	212	188	99	283	172	983	30	2687	201	586	2000	269
Grp Sat Flow(s),veh/h/ln	1792	1717	1701	1738	1805	1407	1810	1618	1560	1721	1712	1576
Q Serve(g_s), s	17.5	8.0	8.5	10.9	6.5	13.1	2.5	44.0	0.0	22.0	41.6	13.4
Cycle Q Clear(g_c), s	17.5	8.0	8.5	10.9	6.5	13.1	2.5	44.0	0.0	22.0	41.6	13.4
Prop In Lane	1.00		0.55	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	236	277	137	623	497	1194	43	1898	741	986	2904	891
V/C Ratio(X)	0.90	0.68	0.72	0.45	0.35	0.82	0.70	1.42	0.27	0.59	0.69	0.30
Avail Cap(c_a), veh/h	303	893	442	623	939	1538	125	1898	741	986	2904	891
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	64.1	67.0	67.3	55.0	58.6	15.8	72.7	53.0	23.9	46.0	23.2	17.1
Incr Delay (d2), s/veh	23.6	2.9	7.0	0.5	0.4	2.9	18.3	190.2	0.9	1.0	1.4	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.2	3.9	4.3	5.3	3.3	10.9	1.5	44.7	5.2	10.5	20.0	6.1
LnGrp Delay(d),s/veh	87.7	69.9	74.3	55.5	59.0	18.8	91.0	243.2	24.8	47.0	24.6	17.9
LnGrp LOS	F	E	E	E	E	B	F	F	C	D	C	B
Approach Vol, veh/h		499			1438			2918			2855	
Approach Delay, s/veh		78.3			30.8			226.6			28.5	
Approach LOS		E			C			F			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	49.0	50.0	32.9	18.1	8.2	90.8	24.3	26.7				
Change Period (Y+Rc), s	* 6	* 6	* 6	* 6	4.6	* 6	4.6	* 6				
Max Green Setting (Gmax), s	* 20	* 44	* 25	* 39	10.4	* 54	25.4	* 39				
Max Q Clear Time (g_c+I1), s	24.0	46.0	12.9	10.5	4.5	43.6	19.5	15.1				
Green Ext Time (p_c), s	0.0	0.0	0.7	1.6	0.0	9.6	0.3	5.6				
Intersection Summary												
HCM 2010 Ctrl Delay			107.1									
HCM 2010 LOS			F									
Notes												

Intersection	
Int Delay, s/veh	1.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1700	340	200	830	0	1110
Future Vol, veh/h	1700	340	200	830	0	1110
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	50	140	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	0	0	1	1	0	0
Mvmt Flow	1771	354	208	865	0	1156

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1771	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.115	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.2095	-	-	-
Pot Cap-1 Maneuver	-	-	353	-	0	0
Stage 1	-	-	-	-	0	0
Stage 2	-	-	-	-	0	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	353	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	5.6	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	353	-
HCM Lane V/C Ratio	-	-	-	0.59	-
HCM Control Delay (s)	0	-	-	28.9	-
HCM Lane LOS	A	-	-	D	-
HCM 95th %tile Q(veh)	-	-	-	3.6	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	80	40	1090	70	40	80	810	1980	80	70	2120	100
Future Volume (veh/h)	80	40	1090	70	40	80	810	1980	80	70	2120	100
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		1.00	0.97		0.95	1.00		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1681	1900	1900	1820	1900	1863	1864	1900	1845	1878	1900
Adj Flow Rate, veh/h	82	41	0	71	41	26	827	2020	79	71	2163	99
Adj No. of Lanes	1	1	1	0	2	0	2	3	0	1	3	0
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	4	13	0	0	0	0	2	2	2	3	1	1
Cap, veh/h	184	234	225	203	132	85	894	2576	100	394	2438	111
Arrive On Green	0.14	0.14	0.00	0.14	0.14	0.14	0.26	0.51	0.51	0.22	0.49	0.49
Sat Flow, veh/h	1272	1681	1615	1067	946	609	3442	5021	196	1757	5022	229
Grp Volume(v), veh/h	82	41	0	74	0	64	827	1363	736	71	1469	793
Grp Sat Flow(s),veh/h/ln	1272	1681	1615	1113	0	1508	1721	1696	1824	1757	1709	1833
Q Serve(g_s), s	8.1	2.8	0.0	6.7	0.0	5.0	30.4	42.5	42.8	4.2	50.4	51.1
Cycle Q Clear(g_c), s	13.0	2.8	0.0	9.5	0.0	5.0	30.4	42.5	42.8	4.2	50.4	51.1
Prop In Lane	1.00		1.00	0.96		0.40	1.00		0.11	1.00		0.12
Lane Grp Cap(c), veh/h	184	234	225	210	0	210	894	1741	936	394	1659	890
V/C Ratio(X)	0.45	0.17	0.00	0.35	0.00	0.31	0.92	0.78	0.79	0.18	0.89	0.89
Avail Cap(c_a), veh/h	271	349	335	299	0	313	953	1827	982	394	1659	890
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	56.1	49.3	0.0	53.5	0.0	50.3	46.9	25.8	25.8	40.7	30.2	30.4
Incr Delay (d2), s/veh	0.6	0.1	0.0	1.0	0.0	0.8	14.0	3.6	6.6	0.2	7.3	13.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.9	1.3	0.0	2.5	0.0	2.1	16.2	20.7	23.2	2.1	25.4	29.0
LnGrp Delay(d),s/veh	56.8	49.5	0.0	54.5	0.0	51.1	60.9	29.4	32.5	41.0	37.5	43.5
LnGrp LOS	E	D		D		D	E	C	C	D	D	D
Approach Vol, veh/h		123			138			2926			2333	
Approach Delay, s/veh		54.3			52.9			39.1			39.7	
Approach LOS		D			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	34.2	71.7		24.1	37.8	68.1		24.1
Change Period (Y+Rc), s	* 5	* 5		6.0	4.0	* 5		6.0
Max Green Setting (Gmax), s	* 18	* 70		27.0	36.0	* 52		27.0
Max Q Clear Time (g_c+I1), s	6.2	44.8		15.0	32.4	53.1		11.5
Green Ext Time (p_c), s	0.1	21.9		0.1	1.3	0.0		0.6

Intersection Summary	
HCM 2010 Ctrl Delay	40.0
HCM 2010 LOS	D

Notes

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	360	280	2590	600	0	3280
Future Volume (veh/h)	360	280	2590	600	0	3280
Number	7	14	6	16	5	2
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00		0.97	1.00	
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1881	1881	1900	0	1881
Adj Flow Rate, veh/h	367	286	2643	612	0	3347
Adj No. of Lanes	1	1	3	0	0	3
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	0	1	1	1	0	1
Cap, veh/h	394	349	3005	640	0	3657
Arrive On Green	0.22	0.22	0.71	0.71	0.00	0.71
Sat Flow, veh/h	1810	1599	4389	899	0	5474
Grp Volume(v), veh/h	367	286	2101	1154	0	3347
Grp Sat Flow(s),veh/h/ln	1810	1599	1712	1695	0	1712
Q Serve(g_s), s	29.8	25.6	68.6	92.2	0.0	80.8
Cycle Q Clear(g_c), s	29.8	25.6	68.6	92.2	0.0	80.8
Prop In Lane	1.00	1.00		0.53	0.00	
Lane Grp Cap(c), veh/h	394	349	2438	1207	0	3657
V/C Ratio(X)	0.93	0.82	0.86	0.96	0.00	0.92
Avail Cap(c_a), veh/h	426	376	2438	1207	0	3657
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	57.5	55.9	16.1	19.5	0.0	17.9
Incr Delay (d2), s/veh	26.1	12.7	4.3	17.3	0.0	4.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	17.8	12.5	33.6	48.5	0.0	39.4
LnGrp Delay(d),s/veh	83.6	68.6	20.4	36.8	0.0	22.6
LnGrp LOS	F	E	C	D		C
Approach Vol, veh/h	653		3255			3347
Approach Delay, s/veh	77.0		26.2			22.6
Approach LOS	E		C			C

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		
Phs Duration (G+Y+Rc), s		112.6		37.4		112.6		
Change Period (Y+Rc), s		5.8		* 4.7		5.8		
Max Green Setting (Gmax), s		104.2		* 35		104.2		
Max Q Clear Time (g_c+I1), s		82.8		31.8		94.2		
Green Ext Time (p_c), s		20.9		0.9		10.0		

Intersection Summary		
HCM 2010 Ctrl Delay		29.1
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	280	190	30	600	430	960	40	1910	270	530	2330	780
Future Volume (veh/h)	280	190	30	600	430	960	40	1910	270	530	2330	780
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.98	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1884	1900	1881	1900	1881	1900	1881	1863	1863	1881	1881
Adj Flow Rate, veh/h	283	192	-41	606	434	907	40	1929	193	535	2354	683
Adj No. of Lanes	1	3	0	2	2	2	1	4	1	2	3	1
Peak Hour Factor	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Percent Heavy Veh, %	1	1	1	1	0	1	0	1	2	2	1	1
Cap, veh/h	303	342	0	919	618	1089	52	1898	876	742	2515	771
Arrive On Green	0.17	0.07	0.00	0.26	0.17	0.17	0.03	0.29	0.29	0.22	0.49	0.49
Sat Flow, veh/h	1792	5312	0	3476	3610	2814	1810	6471	1560	3442	5136	1575
Grp Volume(v), veh/h	283	151	0	606	434	907	40	1929	193	535	2354	683
Grp Sat Flow(s),veh/h/ln	1792	1714	0	1738	1805	1407	1810	1618	1560	1721	1712	1575
Q Serve(g_s), s	23.4	4.2	0.0	23.3	17.0	14.3	3.3	44.0	0.0	21.7	64.8	58.6
Cycle Q Clear(g_c), s	23.4	4.2	0.0	23.3	17.0	14.3	3.3	44.0	0.0	21.7	64.8	58.6
Prop In Lane	1.00		0.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	303	342	0	919	618	1089	52	1898	876	742	2515	771
V/C Ratio(X)	0.93	0.44	0.00	0.66	0.70	0.83	0.77	1.02	0.22	0.72	0.94	0.89
Avail Cap(c_a), veh/h	303	1337	0	919	939	1339	125	1898	876	742	2515	771
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	61.5	67.3	0.0	49.1	58.6	16.7	72.4	53.0	16.7	54.6	36.1	34.5
Incr Delay (d2), s/veh	34.6	0.9	0.0	1.7	1.5	3.9	20.8	24.8	0.6	3.4	8.2	14.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	14.5	2.0	0.0	11.4	8.6	9.8	1.9	22.9	4.2	10.7	32.4	28.4
LnGrp Delay(d),s/veh	96.1	68.2	0.0	50.9	60.0	20.6	93.2	77.8	17.3	58.0	44.2	48.6
LnGrp LOS	F	E		D	E	C	F	F	B	E	D	D
Approach Vol, veh/h		434			1947			2162			3572	
Approach Delay, s/veh		86.4			38.8			72.7			47.1	
Approach LOS		F			D			E			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	38.4	50.0	45.7	16.0	8.9	79.4	30.0	31.7
Change Period (Y+Rc), s	* 6	* 6	* 6	* 6	4.6	* 6	4.6	* 6
Max Green Setting (Gmax), s	* 20	* 44	* 25	* 39	10.4	* 54	25.4	* 39
Max Q Clear Time (g_c+I1), s	23.7	46.0	25.3	6.2	5.3	66.8	25.4	19.0
Green Ext Time (p_c), s	0.0	0.0	0.0	0.9	0.0	0.0	0.0	6.7

Intersection Summary		
HCM 2010 Ctrl Delay		54.0
HCM 2010 LOS		D

Notes

Intersection	
Int Delay, s/veh	2.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	890	250	390	1140	0	600
Future Vol, veh/h	890	250	390	1140	0	600
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	50	140	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	0	0	1	1	0	0
Mvmt Flow	927	260	406	1188	0	625

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	927	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.115	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.2095	-	-	-
Pot Cap-1 Maneuver	-	-	741	-	0	0
Stage 1	-	-	-	-	0	0
Stage 2	-	-	-	-	0	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	741	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	4	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	741	-
HCM Lane V/C Ratio	-	-	-	0.548	-
HCM Control Delay (s)	0	-	-	15.6	-
HCM Lane LOS	A	-	-	C	-
HCM 95th %tile Q(veh)	-	-	-	3.4	-

APPENDIX G – DESIGN YEAR (2045) QUEUE CALCULATION SHEETS

Lane Group	EBL	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	72	31	649	175	907	2412	82	1949
v/c Ratio	0.37	0.11	0.98	0.36	0.96	0.83	0.34	0.87
Control Delay	51.0	43.3	44.0	35.8	67.0	26.7	55.0	39.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.0	43.3	44.0	35.8	67.0	26.7	55.0	39.5
Queue Length 50th (ft)	52	21	166	48	388	632	63	576
Queue Length 95th (ft)	100	50	#416	84	#519	707	116	#690
Internal Link Dist (ft)		612		364		482		642
Turn Bay Length (ft)					330			
Base Capacity (vph)	239	349	705	576	950	2909	242	2236
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.09	0.92	0.30	0.95	0.83	0.34	0.87

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	141	380	4327	2761
v/c Ratio	0.33	1.01	1.26	1.11
Control Delay	50.2	104.1	146.8	80.9
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	50.2	104.1	146.8	80.9
Queue Length 50th (ft)	116	~377	~1968	~1622
Queue Length 95th (ft)	182	#598	m#1676	#1734
Internal Link Dist (ft)	551		941	912
Turn Bay Length (ft)		275		
Base Capacity (vph)	424	377	3439	2482
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.33	1.01	1.26	1.11

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	247	355	301	183	1140	32	2860	258	608	2263
v/c Ratio	0.88	0.67	0.58	0.58	1.54	0.33	0.92	0.25	1.30	0.60
Control Delay	91.3	58.7	63.8	73.2	278.8	77.0	43.2	5.4	192.7	30.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	91.3	58.7	63.8	73.2	278.8	77.0	43.2	5.4	192.7	30.7
Queue Length 50th (ft)	236	100	141	92	~685	31	765	41	~390	507
Queue Length 95th (ft)	#377	135	192	132	#763	68	#900	84	m#334	m459
Internal Link Dist (ft)		299		669			900			403
Turn Bay Length (ft)	200		440		340	200		210	250	
Base Capacity (vph)	302	1324	587	938	738	125	3092	1068	466	3754
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.82	0.27	0.51	0.20	1.54	0.26	0.92	0.24	1.30	0.60

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Intersection						
Int Delay, s/veh	1.5					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰	↑		↱
Traffic Vol, veh/h	1690	310	170	830	0	1110
Future Vol, veh/h	1690	310	170	830	0	1110
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	50	140	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	0	0	1	1	0	0
Mvmt Flow	1798	330	181	883	0	1181

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1798	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.115	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.2095	-	-	-
Pot Cap-1 Maneuver	-	-	345	-	0	0
Stage 1	-	-	-	-	0	0
Stage 2	-	-	-	-	0	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	345	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	4.5	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	345	-
HCM Lane V/C Ratio	-	-	-	0.524	-
HCM Control Delay (s)	0	-	-	26.4	-
HCM Lane LOS	A	-	-	D	-
HCM 95th %tile Q(veh)	-	-	-	2.9	-

Lane Group	EBL	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	82	41	897	195	835	2082	72	1917
v/c Ratio	0.35	0.12	1.27	0.32	0.91	0.72	0.33	0.92
Control Delay	49.1	43.0	154.0	26.5	60.9	23.1	55.2	44.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.1	43.0	154.0	26.5	60.9	23.1	55.2	44.7
Queue Length 50th (ft)	60	28	~619	42	347	484	55	561
Queue Length 95th (ft)	111	61	#873	78	#452	546	104	#652
Internal Link Dist (ft)		612		364		482		642
Turn Bay Length (ft)					330			
Base Capacity (vph)	233	349	705	610	950	2894	242	2086
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.12	1.27	0.32	0.88	0.72	0.30	0.92

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	367	286	3235	2755
v/c Ratio	0.92	0.80	0.91	1.09
Control Delay	85.3	70.8	23.5	70.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	85.3	70.8	23.5	70.1
Queue Length 50th (ft)	348	257	1145	~1615
Queue Length 95th (ft)	#521	370	m1150	#1727
Internal Link Dist (ft)	551		941	912
Turn Bay Length (ft)		275		
Base Capacity (vph)	424	380	3541	2531
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.87	0.75	0.91	1.09

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Group Flow (vph)	289	248	619	443	979	41	1969	258	546	2608
v/c Ratio	0.96	0.57	0.72	0.77	1.07	0.41	0.77	0.24	1.17	0.85
Control Delay	103.3	60.0	56.5	69.6	81.0	79.5	42.7	3.0	136.2	38.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	103.3	60.0	56.5	69.6	81.0	79.5	42.7	3.0	136.2	38.6
Queue Length 50th (ft)	284	72	287	222	~396	39	484	19	~326	536
Queue Length 95th (ft)	#470	103	346	271	#454	82	569	53	m#297	m481
Internal Link Dist (ft)		299		669			900			403
Turn Bay Length (ft)	200		440		340	200		210	250	
Base Capacity (vph)	302	1324	863	938	919	125	2551	1091	466	3060
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.96	0.19	0.72	0.47	1.07	0.33	0.77	0.24	1.17	0.85

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Intersection	
Int Delay, s/veh	2.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	840	255	385	1140	0	620
Future Vol, veh/h	840	255	385	1140	0	620
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	50	140	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	0	0	1	1	0	0
Mvmt Flow	875	266	401	1188	0	646

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	875	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.115	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.2095	-	-	-
Pot Cap-1 Maneuver	-	-	775	-	0	0
Stage 1	-	-	-	-	0	0
Stage 2	-	-	-	-	0	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	775	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	3.7	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	775	-
HCM Lane V/C Ratio	-	-	-	0.517	-
HCM Control Delay (s)	0	-	-	14.5	-
HCM Lane LOS	A	-	-	B	-
HCM 95th %tile Q(veh)	-	-	-	3	-

Lane Group	EBL	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	71	31	684	174	913	2393	82	2061
v/c Ratio	0.32	0.10	0.99	0.32	0.96	0.86	0.34	0.98
Control Delay	48.4	42.6	48.2	34.7	67.6	29.2	55.0	52.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.4	42.6	48.2	34.7	67.6	29.2	55.0	52.3
Queue Length 50th (ft)	51	21	214	48	391	623	63	~640
Queue Length 95th (ft)	99	50	#480	84	#525	697	116	#761
Internal Link Dist (ft)		612		364		482		642
Turn Bay Length (ft)					330			
Base Capacity (vph)	239	349	705	573	950	2789	242	2113
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.09	0.97	0.30	0.96	0.86	0.34	0.98

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	173	378	4062	2765
v/c Ratio	0.41	1.00	1.18	0.78
Control Delay	52.0	102.3	114.8	17.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	52.0	102.3	114.8	17.1
Queue Length 50th (ft)	144	371	~1767	607
Queue Length 95th (ft)	220	#594	m#1549	658
Internal Link Dist (ft)	551		941	912
Turn Bay Length (ft)		275		
Base Capacity (vph)	424	378	3439	3567
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.41	1.00	1.18	0.78

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	212	333	283	172	1071	30	2687	253	586	2000	323
v/c Ratio	0.82	0.66	0.58	0.56	1.41	0.32	0.84	0.24	1.26	0.64	0.32
Control Delay	85.7	57.9	65.1	73.1	221.3	76.4	36.9	4.9	180.2	30.2	18.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	85.7	57.9	65.1	73.1	221.3	76.4	36.9	4.9	180.2	30.2	18.2
Queue Length 50th (ft)	202	92	134	86	~582	29	659	37	~364	513	138
Queue Length 95th (ft)	292	126	181	125	#664	65	764	78	#488	577	m224
Internal Link Dist (ft)		299		669			900			403	
Turn Bay Length (ft)	200		440		340	200		210	250		125
Base Capacity (vph)	302	1326	587	938	759	125	3187	1083	466	3104	1003
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.70	0.25	0.48	0.18	1.41	0.24	0.84	0.23	1.26	0.64	0.32

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Intersection	
Int Delay, s/veh	1.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1700	340	200	830	0	1110
Future Vol, veh/h	1700	340	200	830	0	1110
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	50	140	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	0	0	1	1	0	0
Mvmt Flow	1771	354	208	865	0	1156

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1771	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.115	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.2095	-	-	-
Pot Cap-1 Maneuver	-	-	353	-	0	0
Stage 1	-	-	-	-	0	0
Stage 2	-	-	-	-	0	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	353	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	5.6	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	353	-
HCM Lane V/C Ratio	-	-	-	0.59	-
HCM Control Delay (s)	0	-	-	28.9	-
HCM Lane LOS	A	-	-	D	-
HCM 95th %tile Q(veh)	-	-	-	3.6	-

Lane Group	EBL	EBT	EBR	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	82	41	1112	194	827	2102	71	2265
v/c Ratio	0.35	0.12	1.58	0.32	0.91	0.73	0.32	1.08
Control Delay	49.1	43.0	288.3	26.4	60.3	23.3	55.0	83.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.1	43.0	288.3	26.4	60.3	23.3	55.0	83.0
Queue Length 50th (ft)	60	28	~1003	41	343	493	55	~800
Queue Length 95th (ft)	111	61	#1267	78	#444	555	103	#893
Internal Link Dist (ft)		612		364		482		642
Turn Bay Length (ft)					330			
Base Capacity (vph)	233	349	704	611	950	2894	242	2092
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.12	1.58	0.32	0.87	0.73	0.29	1.08

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	WBL	WBR	NBT	SBT
Lane Group Flow (vph)	367	286	3255	3347
v/c Ratio	0.92	0.80	0.92	0.92
Control Delay	85.3	70.8	24.5	24.2
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	85.3	70.8	24.5	24.2
Queue Length 50th (ft)	348	257	1150	973
Queue Length 95th (ft)	#521	370	m1158	1047
Internal Link Dist (ft)	551		941	912
Turn Bay Length (ft)		275		
Base Capacity (vph)	424	380	3543	3638
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.87	0.75	0.92	0.92

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	283	222	606	434	970	40	1929	273	535	2354	788
v/c Ratio	0.95	0.54	0.71	0.77	1.06	0.40	0.75	0.25	1.15	0.93	0.90
Control Delay	101.5	65.6	56.5	69.6	80.4	79.2	41.6	2.9	133.5	43.0	36.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	101.5	65.6	56.5	69.6	80.4	79.2	41.6	2.9	133.5	43.0	36.6
Queue Length 50th (ft)	277	71	280	217	~392	38	468	19	~313	705	444
Queue Length 95th (ft)	#458	101	338	266	#450	80	551	53	m#367	#1025	m#687
Internal Link Dist (ft)		299		669			900			403	
Turn Bay Length (ft)	200		440		340	200		210	250		125
Base Capacity (vph)	302	1321	853	938	913	125	2576	1097	466	2524	878
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.94	0.17	0.71	0.46	1.06	0.32	0.75	0.25	1.15	0.93	0.90

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Intersection						
Int Delay, s/veh	2.3					

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑	↱	↰	↑		↱
Traffic Vol, veh/h	890	250	390	1140	0	600
Future Vol, veh/h	890	250	390	1140	0	600
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	Yield	-	None	-	Free
Storage Length	-	50	140	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	96	96	96	96
Heavy Vehicles, %	0	0	1	1	0	0
Mvmt Flow	927	260	406	1188	0	625

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	927	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	-	4.115	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	-	2.2095	-	-	-
Pot Cap-1 Maneuver	-	-	741	-	0	0
Stage 1	-	-	-	-	0	0
Stage 2	-	-	-	-	0	0
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	741	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	4	0
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	-	-	-	741	-
HCM Lane V/C Ratio	-	-	-	0.548	-
HCM Control Delay (s)	0	-	-	15.6	-
HCM Lane LOS	A	-	-	C	-
HCM 95th %tile Q(veh)	-	-	-	3.4	-

M. Right-of-Way Requirements Exhibit

R/W ACQUISITION AND TCE

OWNER	APN	R/W AREA	TCE AREA
STATE OF CA	4211-007-911	0.6 ACRE	0.6 ACRE
LA COUNTY FLOOD CONTROL DISTRICT	4211-007-900	191 SF	763 SF
STATE OF CA	4211-016-900	0.06 ACRE	1 ACRE
SO. CAL EDISON CO SBE PAR 1	4224-009-801	107 SF	403 SF
LA COUNTY	4224-009-905	0.03 ACRE	0.03 ACRE
STATE OF CA	4211-007-920	172 SF	0.2 ACRE
LA COUNTY	4211-007-910	0.2 ACRE	0.2 ACRE
STATE OF CA	4211-007-915	–	0.2 ACRE
STATE OF CA	4211-007-919	0.5 ACRE	0.4 ACRE
STATE OF CA	4211-015-904	–	0.2 ACRE
STATE OF CA	4211-015-903	–	0.3 ACRE
STATE OF CA	4211-015-902	–	1.3 ACRE
STATE OF CA	4211-015-900	–	0.4 ACRE
ESEX FOUNTAIN PARK ARTS., LP	4211-022-001	0.4 ACRE	0.3 ACRE
ORION WEST GROUP, LLC	4211-022-004	0.2 ACRE	0.08 ACRE
5510 5570 LINCOLN BLVD., LLC	4211-022-013	0.05 ACRE	0.06 ACRE
5510 5570 LINCOLN BLVD., LLC	4211-022-014	10 SF	0.02 ACRE

LEGEND:

- TCE
- STRIPED MEDIAN
- EXIST RIGHT-OF-WAY
- 2:1 CUT DAYLIGHT
- 2:1 FILL DAYLIGHT
- PROPOSED CT RIGHT-OF-WAY (R/W)
- PROPOSED CITY OF LA RIGHT-OF-WAY (R/W)
- TEMPORARY CONSTRUCTION EASEMENT (TCE)
- RIGHT-OF-WAY ACQUISITION

LINCOLN BLVD IMPROVEMENT
ALTERNATIVE 1 - 130' WIDTH OF BRIDGE

SCALE: 1" = 100'

10/19/22

N. Transportation Management Plan (TMP) Data Sheet

TMP ESTIMATE

TRANSPORTATION MANAGEMENT PLAN DATA SHEET
(Preliminary TMP Elements and Costs)

CO/RTE/PM	LA /001 / PM 30.2/30.7	EA# 33880 ID#0717000061
Project Limit:	On State Route 1 in City of Los Angeles between Jefferson Boulevard and Fiji Way	
Project Description:	Widen roadway and bridges to eliminate bottle neck and improve traffic operations for bicycles, pedestrians and transit.	

1 PUBLIC INFORMATION

	☑	a.	Brochures and Mailers		5,000
	☐	b.	Press Release		5,000
	☐	c.	Paid Advertising		
	☐	d.	Public Information Center/Kiosk		
	☐	e.	Public Meeting/Speakers Bureau		
	☐	f.	Telephone Hotline		
	☐	g.	Internet		
	☑	h.	Others	All inclusive	5,000
Subtotal			15,000		

2 MOTORISTS INFROMATION STRATEGIES

	☐	a.	Changeable Message Signs	(CMS)	
128652	☑	b.	Portable Changeable Message Signs	(PCMS)	
120090	☑	c.	Ground Mounted Signs		
	☐	d.	Highway Advisory Radio		
	☐	e.	Caltrans Highway Information Network	(CHIN)	
	☐	f.	Others	See Cost Estimate Item 6C for Items	1,278,000
Subtotal			1,278,000		

3 INCIDENT MANAGEMENT

066062	☑	a.	Construction Zone Enhanced Enforcement Program (COZEEP)	
	☐	b.	Freeway Service Patrol	
066063	☑	c.	Traffic Management Team	25,000
	☐	d.	Helicopter Surveillance	
	☐	e.	Traffic Surveillance Stations (Portable CCTV and traffic monitoring stations)	
	☐	f.	Others	
	☐	g.	Others	
	☐	h.	Others	
Subtotal			25,000	

4 CONSTRUCTION STRATEGIES

	120100	☒	a.	Traffic Control Lane Closure		
		☐	b.	Reversible Lanes		
		☐	c.	Total Facility Closure		
		☐	d.	Contra Flow		
		☐	e.	Truck Traffic Restrictions		
	120204	☒	f.	Reduced Speed Zone		10,000
		☐	g.	Temperory Radar Speed Feedback Sign System		20,000
		☐	h.	Connector and Ramp Closures		
		☐	i.	Incentive and Disincentive		
		☐	j.	Moveable Barrier		
	066070	☒	k.	Others/ Maintain Traffic		
	Subtotal			30,000		

5 DEMAND MANAGEMENT

☐	a.	HOV Lanes/Ramps (New or Convert)	
☐	b.	Park and Ride Lots	
☐	c.	Rideshare Incentives	
☐	d.	Variable Work Hours	
☐	e.	Telecommute	
☐	f.	Ramp Metering (Temporary Installation)	
☐	g.	Ramp Metering (Modify Existing)	
☐	h.	Others	
Subtotal		0	

6 ALTERNATIVE ROUTE STRATEGIES

☐	a.	Add Capacity to Freeway Connector	
☐	b.	Street Improvement (traffic signal timing modification and striping modification)	
☐	c.	Traffic Control Officers	
☐	d.	Parking Restrictions	
☐	e.	Others	
Subtotal		0	

7 OTHER STRATEGIES

☐	a.	Application of New Technology	
☐	b.	Others TBD	
Subtotal		0	

TOTAL ESTIMATED COST OF TMP ADMINISTRATION **$1,348,000**

Project Notes:

Assumptions/Comments:

Note1:
As outlined in Deputy Directive 60-R-2, this TMP is a living document, subject to change as required by changing circumstances. If there is material change to the project scope which will affect the function or adequacy of the TMP, then changes to the TMP must be addressed. If traffic conditions at the project site demonstrate that TMP elements need to be adjusted to adequately address congestion, then the TMP shall be altered accordingly.

Note2:
Hospitals with emergency services and fire stations that may require access through work zones at all hours should be accommodated. Schools, major venues, shopping malls, and other heavily utilized areas should also be notified of construction activities that may impact their services. These services and businesses should be notified and coordinated with the use of the Public Information strategies.

O. Lincoln Boulevard Advanced Planning Study (APS)

LINCOLN BOULEVARD (SR-01) MULTI-MODAL IMPROVEMENT PROJECT
From Jefferson Boulevard to Fiji Way
PM 30.16 to PM 30.74
EA 33880 PROJECT ID 0717000061

ADVANCE PLANNING STUDY
DESIGN MEMO

LINCOLN BOULEVARD BRIDGE REPLACEMENT OVER BALLONA CREEK
BRIDGE No. 53-0118

Prepared for:

Los Angeles Department of Transportation
&
California Department of Transportation

Submitted by:

PSOMAS

555 South Flower Street, Suite 4300
Los Angeles, CA 90071

Prepared by:

CNS Engineers, Inc.

11870 Pierce Street, Suite 265
Riverside, CA 92505

December 2022

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1.0 PROJECT DESCRIPTION

Lincoln Boulevard is a major route traveling northwest to southeast on the Westside of Los Angeles County, connecting major destinations including the City of Santa Monica to the north, and Loyola Marymount University, Otis College of Art and Design and Los Angeles International Airport to the south. The Project segment provides a critical and heavily traveled connection between and amongst the communities of Playa Del Rey, Playa Vista, Westchester, and El Segundo in the south and Marina Del Rey, Del Rey, Venice, Culver City, Mar Vista, and Santa Monica in the north.

Lincoln Boulevard is classified in the City of Los Angeles General Plan as a Boulevard I (Major Highway Class I) and is comprised of three to four lanes in the northbound direction and two to three lanes in the southbound direction within the Project limits. Culver Boulevard is classified as an Avenue I (Major Highway Class II) and Avenue III (Modified Scenic) and is comprised of one lane in each direction in the vicinity of Lincoln Boulevard. Jefferson Boulevard is a Boulevard II (Major Highway Class I) and is comprised of two lanes in each direction, and Fiji Way is a Local street, comprised of one lane in each direction near the Project.

The Project's build alternative includes: realignment of the Lincoln Boulevard centerline approximately 50 feet to the east; addition of one southbound lane along Lincoln Boulevard for a length of approximately 1,800 feet; demolition, replacement, and widening of the Lincoln Boulevard Bridge over Ballona Creek; demolition, replacement, and widening of the Culver Boulevard Bridge over Lincoln Boulevard; demolition, replacement, and realignment of the connector ramps between Lincoln Boulevard and Culver Boulevard; construction of active transportation improvements including sidewalks and Class IV protected bicycle lanes on both sides of Lincoln Boulevard. The Project would also include utility relocation, landscaping, low-intensity street lighting, striping, signage, drainage, and water quality improvements. The Project would install a striped center median that would allow space to accommodate a future center-running transit facility within the Project limits, which is not included as part of the Project. Construction of the Project build alternative would result in three through lanes in the northbound and southbound directions of Lincoln Boulevard between Fiji Way and Jefferson Boulevard, with additional turning lanes at intersections.

2.0 PROJECT LOCATION

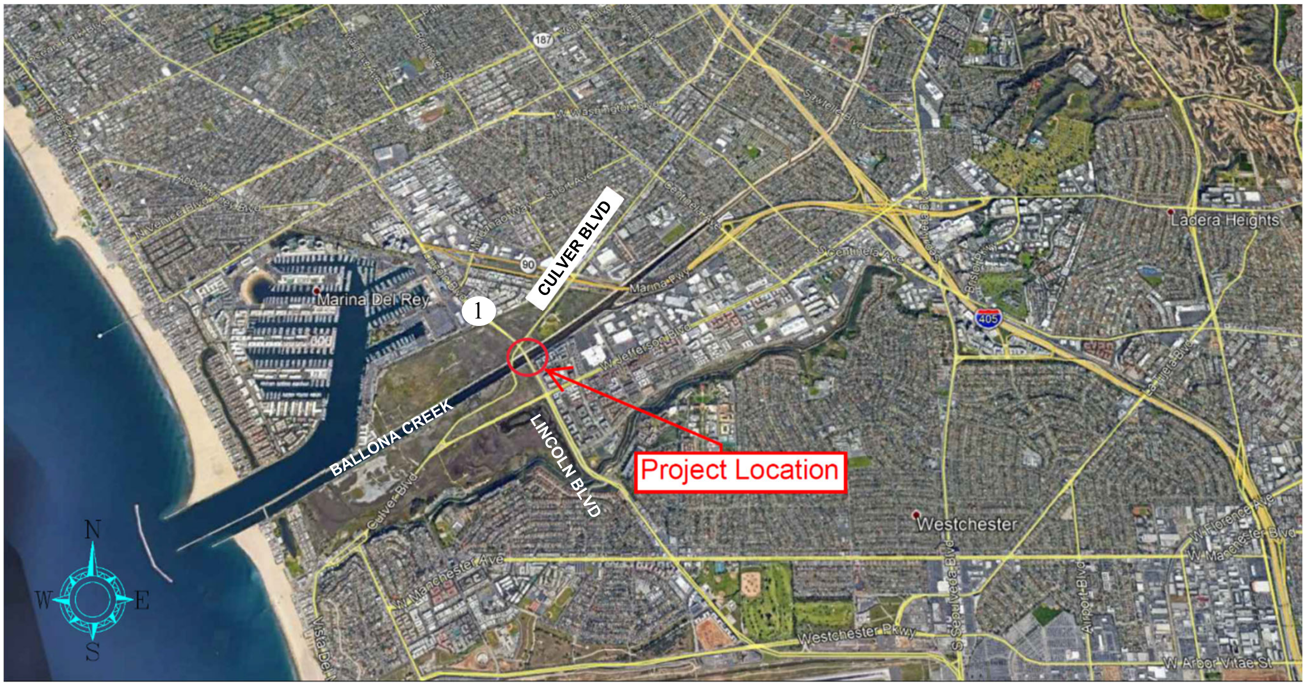


Figure 1: Project Regional Map

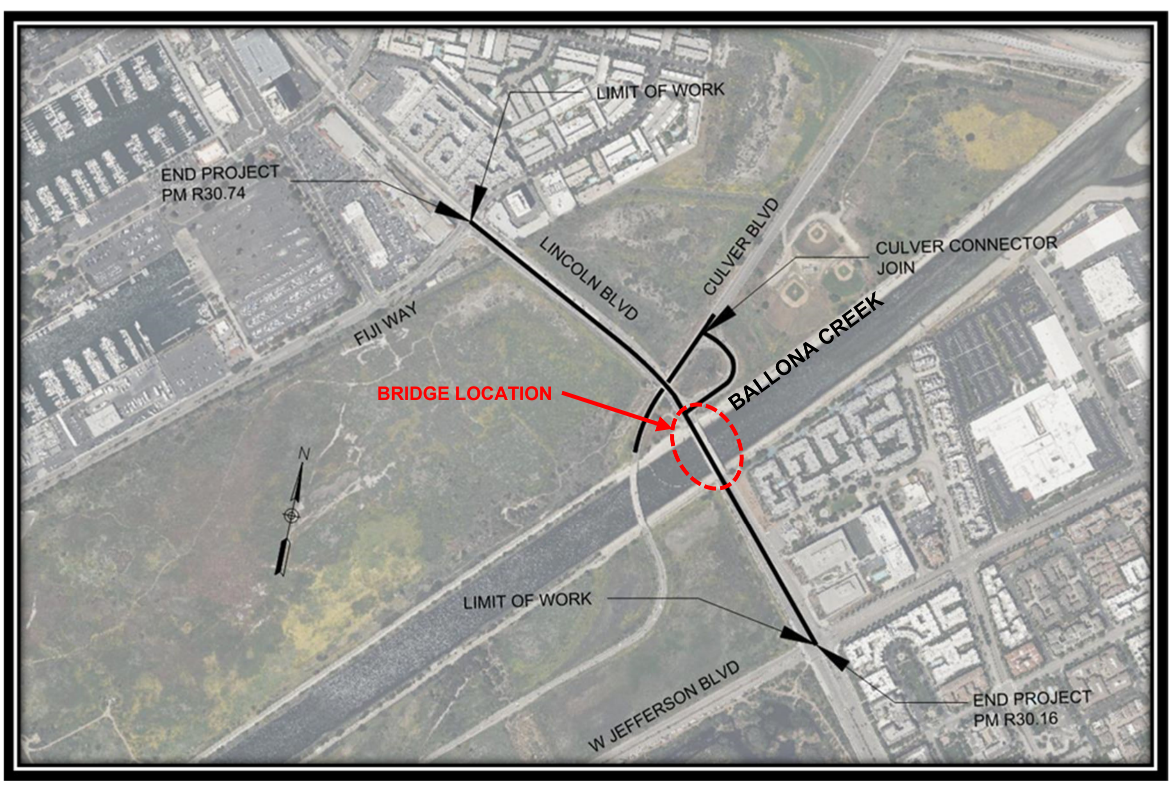


Figure 2: Project Vicinity Map

3.0 PURPOSE AND NEED

Purpose

The Project purpose is to create a new multi-modal corridor along SR-1/ Lincoln Boulevard between Fiji way and Jefferson Boulevard to serve transit, bicyclists and pedestrians while minimizing impacts to Ballona Wetlands Reserve and Ballona Creek and other environmental resources.

Need

Lincoln Boulevard serves as a critical north-south connection on the Westside. There are few arterial connections that provide continuous access through the Westside, which results in Lincoln Boulevard being oversaturated during peak commute periods. Lincoln Boulevard narrows from three to two lanes in the southbound direction, approximately 1,050 feet north of the existing Lincoln Bridge over Ballona Creek, and from four to three lanes in the northbound direction, approximately 320 feet north of the intersection with Jefferson Blvd, to the intersection with Fiji Way. These lane reductions create a major bottleneck.

The average vehicle travel speeds along Lincoln Boulevard are 15 mph during peak periods when measured between Ozone Ave in the City of Santa Monica and Sepulveda Boulevard while the design speed is 50 mph. Travel times are greatly impacted by bottlenecks resulting in slower speeds along much of the corridor.

In addition, access for pedestrians along Lincoln Boulevard is disjointed north and south of the Ballona Creek bridge which does not have sidewalks. Lincoln Boulevard also lacks bicycle facilities across the bridge. Pedestrian and bicycle facilities are also deficient along Culver Boulevard.

4.0 EXISTING STRUCTURE

The existing Lincoln Boulevard Bridge over Ballona Creek is a four-span riveted steel plate girder bridge, which was constructed in 1937 (Bridge No. 53-0118). The existing bridge is approximately 334’-6” long and 69’-0” wide with span lengths varying from 77’-3” to 90’-0”. The structure is skewed at approximately 5 degrees with the Ballona Creek. The existing bridge deck includes a curb-to-curb roadway width of 64 feet which is currently striped with 5 traffic lanes (3 lanes in the northbound direction and 2 lanes in the southbound direction), and two 2’-6” wide curbs with open concrete railing and pilasters. The deck concrete was cast on top of steel plate girders spanning between girders and is continuous over the piers. The bridge superstructure is supported on reinforced concrete pier walls with a width varying from 2’-6” to 4’-6” and open end seat-type abutments. All abutments and piers are supported on vertical driven treated timber piles.

5.0 PROPOSED STRUCTURE

5.1 General Description

The proposed improvements to the Lincoln Boulevard entail constructing a wider multi-modal corridor to meet the ultimate roadway needs for the project. The project will require replacing the existing structure with a new bridge over the Ballona Creek and widening the roadway along the east side of Lincoln Boulevard.

The proposed bridge will be a three-span continuous wide flange concrete girder bridge, 334'-6" long and 130 feet wide. It accommodates a 110-foot curb-to-curb roadway width with three 12-foot-wide traffic lanes in each direction, a 12-foot-wide median, and a combination of a 5-foot-wide buffer and an 8-foot-wide shoulder with a 6-foot-wide Class II bike lane on each side of the bridge. A modified Type 85SW concrete barrier which includes an 8'-0" wide sidewalk and a 2'-0" wide concrete parapet rail will be placed at both edges of the bridge. The concrete parapet rails will receive aesthetic treatments while the aesthetics of the bridge will be addressed through future design efforts. Since the posted speed will be only 45 MPH at the project area, a traffic barrier separating the sidewalk and the shoulder is not required.

The four-span alternative with three piers which match the existing pier locations was considered to maintain the existing channel configuration, and hence prevents the potential adverse hydraulic effects on the downstream Culver Boulevard Bridge. However, apart from being more cost-effective, the recommended three-span alternative will eliminate conflicts with the existing timber piles by using a different span configuration. Additionally, reducing the number of piers from existing three to proposed two can minimize the impacts to the water surface elevation and backwater effect.

5.2 Design Alternatives Evaluated

5.2a California Wide Flange Precast Prestressed (PC/PS) Concrete Girder (Option 1)

A typical span length of 111'-6" with a structure depth of 5 feet is proposed for the California Wide Flange PC/PS Concrete Girder alternative, which satisfies the standard depth-to-span ratio of 4% for a continuous deck. The shallow depth-to-span ratio will minimize the profile grade required for the vertical clearance at the existing Class I bike path that crosses under Lincoln Boulevard running along the north bank of Ballona Creek and the adjacent Culver Boulevard Overcrossing of Lincoln Boulevard located north side of the bridge. The span length falls under the preferred length of 80 feet to 180 feet for California Wide Flange PC/PS Concrete Girder as described in Caltrans Bridge Design Aids Section 6-1. The noted superstructure depth includes 4'-0" deep California standard wide flange girders, a nominal haunch depth of 4" and a cast-in-place 8" concrete deck slab.

The use of PC/PS concrete girder will eliminate the need for extensive falsework in the channel. In addition, the duration of construction will be shortened as compared to a cast-in-place option.

5.2b Cast-In-Place Prestressed (CIP/PS) Concrete Box Girder (Option 2)

CIP/PS concrete slab superstructure is also a feasible structure alternative for the proposed bridge replacement. This alternative will have the same span configuration and structure depth as PC/PS option which also satisfies the standard depth-to-span ratio of 4% for a continuous deck.

For this alternative, falsework during construction will be required in the channel. This will increase the duration of construction as compared to the PC/PS option.

5.2c Abutments

Open-end high cantilever seat-type abutments founded on 36-inch diameter Cast-In-Drilled-Hole (CIDH) concrete piles are proposed to support the superstructure. Driven concrete piles were considered; however, as battered piles are prohibited to be used at abutments subjected to seismic down drag loads as described in Caltrans Memo-To-Designers Section 5-1, the small diameter driven piling as opposed to large diameter CIDH piles, may not be capable of providing adequate lateral support. Concrete slope paving at the abutments will match with the existing channel conditions. Abutments will be skewed to match the channel flow direction.

5.2d Piers

Two multi-column piers consisting of six 66-inch diameter concrete pile extension columns per pier with dropped pier caps are proposed to support the superstructure. It was evaluated that the multiple pile column pier is the most feasible and cost-effective alternative for the earthen channel invert based on the geotechnical and hydraulic scour standpoints. Piers will be skewed to match with the channel flow direction. The total cross section area of the pile extension columns is significantly smaller than the conventional pile footings, which will ease the environmental permitting. In addition, the conventional footing with small diameter driven pile is not recommended due to unfavorable subsurface soil conditions as the site is classified as S2 per Seismic Design Criteria (SDC) V2.0. Moreover, pier wall alternative is not recommended as Caltrans no longer supports it due to its questionable seismic performance.

According to the Structure Preliminary Geotechnical Report, the piers can be supported on either 66-inch diameter Cast-In-Steel-Shell (CISS) piles or Type I, or Type II Cast-In-Drilled-Hole (CIDH) concrete piles. The construction of CISS piles and pile extension columns will not be affected by the presence of running water channel as the pile will be plugged at the bottom of the piles. The concrete will be cast inside the driven piles in dry condition after removal of soils in the top portion of the piles. The piles will be driven to the specified tips by using a large hammer, noise issues must be considered during the pile type selection process due to the proximity to the residential development. On the other hand, wet construction method must be considered during CIDH concrete piling due to presence of running water, where temporary casings or permanent casings must be used. As such, the use of the CISS piles is more suitable than the use of CIDH concrete piles if the noises during pile driving is not an issue, and appears more cost effective. The CISS pile option is used in the APS for estimating purpose. The selected piles and pile extension columns will be designed to accommodate the calculated scour per Caltrans design criteria.

5.3 Recommended Alternative

Since the traffic on the Lincoln Blvd that serves as Boulevard I (Major Highway Class I) crosses over a running water channel, the construction duration and method are important key factors to select the structure type. A precast concrete bridge can be built fast and does not require falsework that will impact to the channel flow during construction. In addition, the costs for the considered alternatives are competitive with the cost variation in the marginal 10% range. Therefore, the California Wide Flange PC/PS Concrete Girder superstructure is recommended for this bridge. The general plan of the recommended alternative is provided in **Appendix C.**

5.3a Superstructure

A California Wide Flange PC/PS Concrete Girder superstructure is recommended for the bridge.

5.3b Substructure

Open-end high cantilever seat-type abutments and multiple pile column piers are recommended for the bridge.

5.3c Approach Slab

Since the proposed bridge is on a six-lane road in an urban area (a multilane urbanized highway facility) with seat-type abutments, Structure Approach Slab Type N (30S) is proposed. The proposed approach slab type is based on the selection process for Structure Approach Pavement System as described in Caltrans MTD 5-3.

6.0 SITE CONSTRAINTS

The proposed bridge will require removal of the existing Lincoln Boulevard Bridge. As the Ballona Creek is a perennial river, temporary cofferdams will be required for the demolition of existing piers. The obstruction to the flood conveyance capacity is also a major concern for the construction. To minimize the impact to the creek, the large diameter piles will be installed by a pile driving rig on a barge or on a temporary trestle platform that is advanced along the bridge by using temporary piles and/or the permanent CISS piles. Installation of new pile columns and removal of the existing pier walls are part of the Contractor's construction means and methods.

According to the environmental permit specialist from Psomas, maximum 70-day duration is allowed for the pile driving in normal construction hours to limit the noise impacts to the residential neighborhood located near the southeast area of the bridge. Additionally, bubble curtains will be applied at Ballona Creek.

As the Los Angeles County desires that the bike path along the north levee of Ballona Creek remains open at all times, the adjustment of the bridge profile will be limited by roadway constraints such that there will be roadway modification on the approaches while the required bike path vertical clearance of ten feet is satisfied. A short-term closure of the bike path may be required during removal of the existing bridge and the north abutment and during erection of the girders near the path.

7.0 STRUCTURE DESIGN CRITERIA

7.1 Load and Resistance Factor Design

The structure will be designed in accordance with the AASHTO LRFD Bridge Design Specification, 8th edition with latest California Amendments. Design live loads will consist of HL-93 load and California permit load. Load combinations per AASHTO LRFD Code Section 3.4.1 will be applied.

7.2 Seismic Design

The design of the new bridge will comply with Caltrans Seismic Design Criteria (SDC) version 2.0 in its entirety.

8.0 STRUCTURE HYDRAULICS & HYDROLOGY

A preliminary hydrology, hydraulics and scour study report for Lincoln Blvd Bridge multi-modal bridge improvements is provided in **Appendix G.**

8.1 Hydrology Analysis

There are three design hydrologies for the project reach of Ballona Creek: US Army Corps of Engineers (USACE) 100-year discharge; Federal Emergency Management Agency (FEMA) 100-year discharge; and the Los Angeles County Department of Public Works (LACDPW) 50-year burned-and-bulked, or Capital Storm discharge (QCAP). For the purposes of the present study only the USACE and QCAP discharges are used. The discharges are summarized in **Table 1**. No changes to the channel or watershed are proposed as part of the project, and the project will not alter the hydrology in the proposed condition.

Table 1: Design Discharges for Ballona Creek at Lincoln Boulevard

FEMA (CFS)	USACE (CFS)	QCAP (CFS)
44,270	46,000	51,240

8.2 Sea Level Rise Design Considerations

All hydraulic analysis in the present study employs sea level rise design considerations based on two design parameters USACE (2019) and State of California Sea-Level Rise Guidance 2018 update (California 2018). USACE (2019) analysis is expected to be required to comply with future Clean Water Act (CWA) Section 408 permitting requirements. California (2018) analysis is expected to be required for State-related permitting (i.e. Caltrans, CCC, etc.).

For USACE criteria, the present study utilizes the USACE 2013 dataset as well as the Santa Monica, CA Gage 9410840 for the year 2100, which is the furthest out in time for which the projections are valid. State sea level rise criteria utilize data from Table 25 in California (2018), Santa Monica gage. Additionally, in the present study of California (2018) criteria, only the high emissions values for the low, medium-high and extreme risk aversion are used for modeling.

The values used for sea level change/rise (SLC/SLR) values for present study are summarized in **Table 2**

Table 2: Sea Level Change/Rise Values by Agency for Santa Monica, CA

AGENCY	USACE	CALIFORNIA		
Criteria	Intermediate (ft)	Low (ft)	Medium-high (ft)	Extreme (ft)
Value	4.15	3.30	6.80	10.0

It is important to note that the USACE projections include the local rate of vertical land movement, and the California (2018) does not specify a starting sea surface elevation from which to conduct analysis.

8.2 Hydraulic and Scour Analysis

Hydraulic analysis

The impacts of the proposed bridge on channel hydraulics are evaluated by comparing the existing and proposed velocity and water surface elevations (WSE) for different events using HEC-RAS numerical model. These events considered a combination of hydrologic conditions and sea level rise scenarios as necessary to maintain validity of the hydraulic analysis. Results of the hydraulic analysis show that the proposed bridge design has minimal impacts on channel water surface elevation and velocity in the vicinity of the bridge. For all valid model runs, the proposed bridge design yields a channel velocity increase of 0.01 feet per second on average. Additionally, the proposed design yields an average decrease in water surface elevation (NAVD88) of 0.02 feet when compared to the hydraulic results of the existing bridge design.

The provided freeboard is 3.5’ under the design flood event. The required freeboard on this project will need to meet criteria from Caltrans and the USACE. While the Caltrans criteria is simple to apply (2-ft at 50-year event and 0-ft at 100-year event), the USACE freeboard criteria varies based on a number of conditions such as the size and shape of the channel, the lining, velocity, flow depth, etc. Also, the design flood event is based on input from multiple agencies and will likely change in the future. Therefore, at this phase of the design, optimizing the freeboard by lowering the bridge a small amount would not be prudent.

Scour Analysis

Two approaches to scour analysis are utilized to understand the impacts to sediment transport and channel bed response resulting from the proposed Lincoln Blvd Bridge improvements. The first approach follows the guidelines of LACDWP and the second employs bridge scour calculations using the hydraulic design package in HEC-RAS based on HEC-18.

Table 3 summarizes the total scour results for the total design scour after LACDPW (2006) comparing the existing and proposed condition bridges for all valid analyses. The proposed bridge condition results in an additional 0.01 feet of bridge scour compared to the existing condition for all valid analyses.

Table 3: LACDPW Scour Results (feet) at Lincoln Blvd Bridge

Discharge	Initial Elevation	SLR Scenario	Existing	Proposed
USACE	MHHW	USACE – Int	24.22	24.23
		CA – Low	22.48	22.49
	MSL	USACE – Int	22.56	22.57
		CA – Low	22.57	22.58
		CA – M-H	22.42	22.43
QCAP	MHHW	USACE – Int	23.11	23.12
		CA – Low	23.15	23.16
	MSL	USACE – Int	23.21	23.22
		CA- Low	23.22	23.23
		CA – M-H	23.11	23.12

Note: MHHW = Mean Higher High Water, and MSL = Mean Sea Level

Table 4 summarizes HEC-18 scour results after FHWA (2012) comparing the existing and proposed condition bridges for all valid simulations examined. The analyses show that on average, the proposed bridge condition results in an increase of 2.5 feet of pier scour and a decrease in 0.1 feet of contraction scour when compared to the existing condition.

Table 4: HEC-18 Scour Results (feet) at Lincoln Bridge

Discharge	Initial Elevation	SLR Scenario	Existing				Proposed			
			Contraction	Pier	Abutment	Total	Contraction	Pier	Abutment	Total
USACE	MHHW	USACE – Int	0.94	9.72	0.0	10.66	0.87	12.21	0.0	13.08
		CA – Low	0.97	9.74	0.0	10.71	0.88	12.23	0.0	13.11
	MSL	USACE – Int	0.99	9.76	0.0	10.75	0.92	12.26	0.0	13.18
		CA – Low	1.00	9.77	0.0	10.77	0.91	12.27	0.0	13.18
		CA – M-H	0.94	9.72	0.0	10.66	0.87	12.20	0.0	13.07
QCAP	MHHW	USACE – Int	1.00	9.97	0.0	10.97	0.92	12.51	0.0	13.43
		CA – Low	1.02	9.98	0.0	11.00	0.93	12.52	0.0	13.45
	MSL	USACE – Int	1.02	10.00	0.0	11.02	0.94	12.55	0.0	13.49
		CA – Low	1.03	10.00	0.0	11.03	0.95	12.56	0.0	13.51
		CA – M-H	0.99	9.97	0.0	10.96	0.92	12.51	0.0	13.43

9.0 FOUNDATIONS

A Structure Preliminary Geotechnical Report (SPGR) is provided in **Appendix F**. A short summary of the report is provided below.

9.1 Description of Subsurface Soil Conditions

The site is located within the Los Angeles basin section of the Peninsular Ranges geomorphic province of southern California. The Los Angeles basin is generally underlain by Quaternary alluvial deposits, which overlies several thousand feet of Tertiary marine and non-marine sediments. The previous investigations indicate that the site is underlain by Quaternary Alluvial Floodplain Deposits (Map Symbol – Qa), which are covered with both hydraulic fill and conventional fill.

Quaternary-age alluvial sediments primarily associated with the Ballona Creek drainage are believed to underlie the entire site to the maximum depth explored. The upper portion of these alluvial deposits (from a few feet above mean sea level down to about 35 feet or 40 feet below mean sea level) is typically poorly consolidated, and most commonly consists of interbedded lean and fat clay (CL or CH) and silt (ML and MH), with occasional beds of silty and clayey sand (SM and SC). At elevations approximately 35 feet or 45 feet below mean sea level (MSL), the density of the alluvium typically increases, and the beds of silty, clayey, and poorly graded sand (SM, SC, or SP) become more common. Laboratory tests indicate that the alluvium is moderate to highly compressible.

The existing bridge abutments are believed to be underlain by compacted fill, as well as hydraulic fill soils placed during the development of Marina Del Rey. The hydraulic fills are similar in composition to the underlying alluvium, as they were likely generated from these deposits. Consequently, the hydraulic fill is not differentiated from the alluvium on the logs. Hydraulic fill was likely placed to roughly 0 feet to 5 feet (MSL), with conventional fill placed above that elevation.

9.2 Groundwater

Temporary groundwater monitoring wells were established within four of the hollow stem borings conducted at the Playa Vista development immediately southeast of the Lincoln Boulevard bridge (Group Delta, 1999), while they were destroyed during the construction of the Playa Vista residential development. Based on the final readings within these monitoring wells, the groundwater elevations at that location varied from roughly 2 feet to 5 feet (MSL) in December 1998. Additionally, the High Groundwater Map suggests that groundwater levels may rise to about 5 feet below existing grades in the site vicinity (CDMG, 1998).

It should be noted that groundwater levels at the site are likely to be closely related to the water surface elevation within Ballona Creek. Floods within the channel may cause the groundwater levels to temporarily rise within the surrounding levees (although the concrete armor on the channel walls may increase the lag time in groundwater response). Groundwater levels may also fluctuate over time throughout the site due to changes in the water surface elevation and flow within the creek, as well as variations in rainfall, irrigation, or site drainage conditions.

9.3 Scour Evaluation

The Lincoln Boulevard Bridge crosses the Ballona Creek channel, where the potential for scour may be high during heavy storm flow, or as the result of tsunami. For preliminary scour evaluations, the scour depth as a minimum should be extended to the elevation of the bottom of the existing pile cap in the channels, which is estimated at about be extended to El. -10 feet.

9.4 Corrosion Evaluation

Corrosion tests were performed on selected samples collected from the previous exploratory borings at the site. The available test data indicates that the site soils are not corrosive based on Caltrans Corrosion Guidelines (Caltrans, 2021b). However, the available resistivity tests do suggest that the on-site soils may be extremely corrosive to buried metals, based on the nomography provided in Figure 855.3B of 2020 Caltrans Highway Design Manual (Caltrans, 2020a). Typical corrosion control measures should be incorporated into the project design.

9.5 Preliminary Seismic Information and Recommendations

The site is not located within an Alquist-Priolo Earthquake Fault Zone (CDMG, 1992), and no evidence of active or potentially active faulting was encountered during our previous site investigation or literature review. Consequently, ground rupture is not considered a significant geologic hazard at the site.

The current Caltrans ARS Online tool (V3.0.2) was used to develop a preliminary design spectrum for the site located at a latitude of 33.9750° north, and a longitude of 118.4323° west. The ARS design spectrum incorporated an average shear wave velocity (V_{s30}) of 210 m/s (or 690 ft/s). The preliminary Caltrans ARS design spectrum for the site has a Peak Ground Acceleration (PGA) of 0.6g. The deaggregated mean earthquake moment magnitude (M) is 6.6 and the mean site-to-source distance (R) for the 1.0 seconds spectral acceleration is 16.6 kilometers. Note that loose soil at the site (N_{60}<10) would classify as Class S2 soil per Section 6.1.3 of the Caltrans Seismic Design Criteria, Version 2.0.

9.7 Liquefaction and Lateral Spreading

The site is located within an area previously identified as susceptible to liquefaction. Based on the preliminary liquefaction settlement analyses, the bottom of the liquefiable layers may extend to elevations -25 feet to -30 feet. Additionally, the total liquefaction settlement associated with the design level earthquake at the site should typically vary from about 1 inch to 3 inches. Liquefaction settlement may result in a downdrag load on the piles, settlement of the approach embankments, and lateral spreading of the abutments. Liquefaction also creates the potential for loss of near-surface soil strength resulting in a reduced lateral pile capacity. In liquefied soils, a pile foundation needs to be designed to satisfy the seismic axial bearing stability requirements in compression extreme events for two different combinations – a) permanent loads and inertial loads resulting from the ground motion-induced inertia of the superstructure during the shaking, and b) permanent loads and liquefaction induced downdrag after the cessation of the shaking (Caltrans, 2020b).

Based on simplified empirical methods, there appears to be a strong potential for lateral spread of the Ballona Creek levees in the site vicinity. Previous analyses suggest that displacements along the levees may vary from roughly 6 inches to 18 inches (Group Delta, 2013).

The presence of the abutment piles helps reduce the displacement at the abutment locations compared to the surrounding levees. Lateral spread analyses including soil-pile interaction may be conducted per Caltrans Geotechnical Manual (Caltrans, 2020c), Memo to Designers 20-15 (Caltrans, 2017b), and Attachment 1 to the memo for lateral spreading analysis.

9.6 Preliminary Foundation Recommendations

To resist lateral spreading seismic displacements, large diameter (36-inch or greater) CIDH, or CISS pile foundation systems are recommended for supporting the bridge structure both at bents and abutments. Although large diameter CIDH piles are feasible at bents and the abutment, special construction techniques (slurry, casing, etc.) and integrity testing (gamma-gamma logging) will be required due to shallow groundwater and caving-prone soils. Since CISS piles are driven, noise issues should be considered in the pile type section process due to the proximity to the residential development.

With proposed pile cut-offs at or around the elevation of 0 to 5 feet, downdrag loads may be experienced along up to 30 to 35 feet of the pile length, negating any pile resistance down to about El. -40 feet within the denser alluvial deposits. For estimation of pile lengths, an average nominal (ultimate) soil skin friction resistance of 1.5 ksf, and 2 ksf is assumed below El. -40 feet for CIDH piles and CISS piles, respectively. This will likely result in pile lengths of about 70 feet to 85 feet, tipping at elevations between -65 feet to -80 feet.

Smaller diameter driven piles are not recommended due to unfavorable subsurface soil conditions as the site is classified as S2 per the SDC V2.0., Section 6.1, and Section 6.2.3. Shallow foundations are not feasible for supporting the bridge structure due to seismic settlement and lateral spreading issues.

10.0 GEOMETRIC APPROVAL DRAWING (GAD)

The GAD plans for the bridge are provided in **Appendix D**.

11.0 CONSTRUCTION

11.1 Falsework

No falsework is required for the construction of the precast girder bridge.

11.2 Stage Construction

The proposed bridge will be constructed in two stages. Partial traffic on the Lincoln Boulevard will be closed at Stage II; however, at least two lanes of traffic in each direction always be maintained during the construction of the bridge and the roadway improvements. The construction staging plan is provided in **Appendix C**.

During the initial stage, the existing bridge will remain to maintain the existing five lanes of traffic. The easterly portion of the roadway will be regraded for the proposed Lincoln Boulevard improvements and the east half of the bridge. Barge or temporary trestle platform will be used to install the new CISS concrete piles in the existing soft bottom invert of Ballona Creek. Once Stage I bridge construction is completed, the traffic will be shifted off the existing bridge and onto the newly constructed northerly portion.

During the second stage, the existing bridge will be removed, and the westerly portion of the roadway will be regraded for the construction of the proposed Lincoln Boulevard improvements and the west half of the bridge. Temporary cofferdams will be constructed around the existing pile footings in the existing earthen creek invert for the demolition and removal of the existing piers. The existing piers will be demolished to 3 feet below the original channel design invert, and the footings and timber piles will be abandoned in place. The installation of CISS concrete piles at Stage II is similar to Stage I construction, however, the existing piers may be utilized by the Contractor to support a trestle platform for the piling rig. The existing timber piles at each abutment will be removed to avoid conflicts with new CIDH concrete piles. A deck closure pour will be constructed during this stage to connect two stages of the bridge structure.

Temporary railing (Type K) will be set along the edges of the closure pour during Stage II construction to facilitate safety of the construction.

11.3 Traffic Detours

No long-term traffic detours are anticipated for construction of the bridge.

12.0 UTILITIES

Based on the As-Built Plans and Google Maps, the following utilities in the project area were identified:

- Four 5” telephone conduits are attached to the exterior girder on the west side of the existing bridge.
- Twelve 4” telephone conduits are attached to the first interior girder on the west side of the existing bridge.
- A 16” pipe waterpipe owned by the Los Angeles Department of Water and Power (LADWP) is attached to the second interior girder on the west side of the existing bridge.
- Six 9” power ducts and two 5” power ducts are placed in the second girder bay of from the west side of the existing bridge.
- Eight 6” power ducts and two 4” power ducts are placed at the second bay of girders from the east side of the existing bridge.
- A 4” and a 2” communication conduits are placed at the easterly exterior girder bay of existing bridge.
- A solar-powered streetlight is present beside the shoulder on the west side of Lincoln Boulevard near the south approach of the existing bridge.
- A southbound traffic signal pole with a streetlight is present near the north approach of the structure.
- A streetlight is located beside the east side shoulder of the Lincoln Boulevard near the north approach of the existing bridge.

Electrical conduits running through the existing bridge may be temporarily deenergized during the relocation from the existing bridge to the new constructed Lincoln Boulevard bridge. Further coordination will be conducted to relocate these utilities during the final design phase of the project.

13.0 BRIDGE AESTHETICS

The aesthetics of the bridge will be addressed through future design efforts. Aesthetics are typically explored as part of the detailed design preparation and are often based on input from the community. Aesthetic considerations will include preserving the view sheds from the bridge and incorporating artistic design features into the bridge design. No project-specific aesthetic designs are envisioned at this time.

14.0 SLOPE PROTECTION

Concrete lined slopes will be provided at the abutments to match the existing conditions.

15.0 ENVIRONMENTAL CONSTRAINTS

The project is located in a highly sensitive coastal environment (Ballona Wetlands) and will face scrutiny from regulatory and resource agencies, as well as legacy stakeholders. Minimizing the impact to the creek is required during the construction of Lincoln Boulevard Bridge. Additionally, the proposed new bridge is widening to the east to minimize potential wetland impacts along the west side of the Lincoln Blvd.

16.0 PERMITS AND AGREEMENTS

Various agencies with jurisdiction at or near the Lincoln Blvd Bridge will require agreements, construction and/or encroachment permits in order to construct the project. The permitting agencies will be identified in the environmental documentation.

17.0 RIGHT OF WAY

Right of way acquisition and dedication including temporary construction easements are required for the proposed roadway improvement and bridge replacement.

18.0 CONSTRUCTION COSTS

The estimated costs with an APS-level contingency of 25% for the Lincoln Boulevard Bridge over Ballona Creek replacement is $28,230,000. Detailed cost estimates are provided in **Appendix B**.

19.0 BRIDGE SUMMARY

Table 5: Lincoln Boulevard Bridge Over Ballona Creek Summary

Structure Name	Lincoln Boulevard Bridge over Ballona Creek
Structure Type	California Wide Flange Precast Prestressed Concrete Girder
Spans	3
Structure Depth	5'-0"
Abutments	High Cantilever Seat-Type
Pier	Multi-column pier with a dropped pier cap supported on 66" Diameter CISS Concrete Pile Columns.
Minimum Freeboard	3'-6"
Vertical Clearance	10’-0” minimum to the bike path
Temporary Minimum Vertical Clearances	N/A
Barriers	Type 85SW
Slope Paving	Full Slope (Grouted ripraps)
Structure Approach	Type N (30S)
Utilities in Bridge	Several utilites (Water pipe, electrical conduits)
Temperature Range	10^0 to 80^0
Freeze-Thaw area	No

APPENDIX A
APS CHECKLIST

Consultant Prepared Advance Planning Study (APS) Checklist

Date: 12/15/2022	Consultant Firm (for structures): CNS ENGINEERS, INC.		Phone No: (951) 687-1005
Designed by: Quyet Nguyen			Phone No: (951) 687-1005
EA: 33880	County: LOS ANGELES	Rte: 01 (LINCOLN BLVD)	KP(PM) 30.16 to 30.74
Project Description: SR-01 - Lincoln Blvd Multimodal Bridge Project			
Bridge No(s): 53-0118	Bridge Name(s):		
Total number of bridges in project: 02		APS Alternative Letter or Number (if more than one):	
Purpose of this APS:	Initial APS Cost & Feasibility ☒	Revised scope ☐	Update cost ☐

Part A Items to collect and considerations prior to beginning the APS

All items listed in Part A are to be made available and submitted if requested by the Liaison Engineer. (Mark **N/A** if not applicable)

- ☒ Preliminary profile grade of proposed structure.
- ☒ Typical section of the proposed structure. (Including barrier type, sidewalks, cross slope %, etc.)
- ☒ Grades or spot elevations of roadway below the structure.
- N/A ☐ Typical section of roadway below the structure. (Including shoulders, gutters, embankment slope.)
- ☒ Site map: including horizontal alignment of new structure and the roadway below, topo, contours, etc.
- ☒ Stage construction or detour plan for traffic <u>on the structure.</u>
  (number of lanes to remain open, Temp Railing, etc.)
- N/A ☐ Stage construction or detour plan for the roadway <u>below the structure</u>.
  (falsework openings for each stage and any restrictions.)
- ☒ "As Built" plans for existing structures.
- N/A ☐ Future widening plans of upper and lower roadway (verify with Route Concept Report).
- ☒ Site aerial photograph (at the proposed structure).
- ☒ Environmental and/or permit requirements (areas of potential impact, construction windows, etc.)
- ☒ Overhead and underground utility plans
- ☒ Any other information that you feel is necessary to complete the study. (Other concerns that may affect the APS: local agency requirements such as aesthetics, improvements in vicinity of structure, airspace usage, other obstructions, etc.)

Consultant Prepared Advance Planning Study (APS) Checklist

Sheet 2 of 2

Part B Considerations during the APS design and cost estimate preparation

1. Has this project been discussed with:
   - the OSFP Liaison Engineer? (Local projects) ☐ No ☒
   - the Caltrans District Project Manager? Yes ☒ No ☐
   - the roadway consultant? Yes ☒ No ☐

2. Have the Caltrans Structures Maintenance records been reviewed? Yes ☒ No ☐
   If the records recommend any work for the structure, is it included in the APS? N/A Yes ☒ No ☐

3. Are there special aesthetic considerations? Budget Included, Details not yet known Yes ☐ No ☒

4. (Widenings and Modifications)
   Has this project been reviewed for seismic retrofit requirements? N.A. New Structures Yes ☐ No ☒
   Are seismic retrofit requirements included in the APS? Yes ☐ No ☒

5. Any special Railroad requirements? Yes ☐ No ☒
   Shoofly required? Yes ☐ No ☒
   Cost of shoofly included as a separate item in the project cost estimate? Yes ☐ No ☒

6. Any special foundation requirements, including scour critical work, special excavation such as Type A, Type D, and/or hazardous or contaminated material? Yes ☒ No ☐

7. Any special construction requirements, including limited site accessibility or seasonal work? Yes ☒ No ☐

8. Other items to be included in the cost such as slope paving, approach slabs, and/or adjacent retaining walls? Yes ☒ No ☐

9. Remove existing bridge? Yes ☒ No ☐
   Total Deck Area: 23,081 SF

10. Any other unusual or special requirements? Yes ☐ No ☒

11. Provide and attach a consultant prepared Design Memo to summarize and document any important assumptions, discussions, decisions, unusual items, local agency requirements such as aesthetics, improvements in vicinity of the structure, airspace usage, other obstructions, or any items noted above. Summary attached? Yes ☒ No ☐

Designer: (Printed Name)	Designer's Signature:	Date:
QUYET NGUYEN	[signature]	12/15/22

APPENDIX B
APS ESTIMATE

	GENERAL PLAN ESTIMATE	X	ADVANCE PLANNING ESTIMATE

RCVD BY:

IN EST:
OUT EST:

BRIDGE: LINCOLN BLVD BRIDGE | **BR. No.: 53-0XXX** | **DISTRICT:** 07
TYPE: PC/PS WIDE FLANGE GIRDERS ON COLUMNS | **RTE:**
CU: | **CO:** LA
EA: 33880 | **PM:**

LENGTH: 334.50 **WIDTH:** 130.00 **AREA (SF) =** 43,485

DESIGN SECTION: CNS Engineers, Inc. .
 # OF STRUCTURES IN PROJECT : 1 | **EST. NO.**
PRICES BY : Q. Nguyen | **COST INDEX:**
QUANTITIES BY: T. Ge | **DATE:** 10/1/2021
QUANTITIES CHECKED BY: Q. Nguyen | **DATE:** 10/1/2021

	CONTRACT ITEMS	TYPE	UNIT	QUANTITY	PRICE	AMOUNT
1	BRIDGE REMOVAL		LS	1.00	$415,000.00	$415,000
2	STRUCTURE EXCAVATION (BRIDGE)	TYPE D	CY	2,730	$145.00	$395,850
3	STRUCTURE BACKFILL (BRIDGE)		CY	2,510	$100.00	$251,000
4	36" CAST-IN-DRILLED-HOLE CONCRETE PILING		LF	10,560	$600.00	$6,336,000
6	FURNISH 66" CAST-IN-STEEL SHELL CONCRETE PILING		LF	2,136	$1,200.00	$2,563,000
7	DRIVE 66" CAST-IN-STEEL SHELL CONCRETE PILE		EA	12	$25,000.00	$300,000
8	STRUCTURAL CONCRETE, BRIDGE FOOTING		CY	690	$500.00	$345,000
9	STRUCTURAL CONCRETE, BRIDGE		CY	1,420	$1,200.00	$1,704,000
10	STRUCTURAL CONCRETE, BRIDGE (POLYMER FIBER)		CY	1,400	$1,250.00	$1,750,000
11	STRUCTURAL CONCRETE, APPROACH SLAB	TYPE N(30S)	CY	340	$1,000.00	$340,000
12	FURNISH PRECAST PRESTRESSED CONCRETE GIRDER (110'-120')	(110'-120')	EA	51	$35,000.00	$1,785,000
13	ERECT PRECAST PRESTRESSED CONCRETE GIRDER		EA	51	$8,000.00	$408,000
14	JOINT SEAL ASSEMBLY (MR 2")		LF	262	$100.00	$26,200
15	BAR REINFORCING STEEL (BRIDGE)		LB	2,272,095	$1.30	$2,954,000
16	BRIDGE DECK DRAINAGE SYSTEM	TYPE D-1	LB	10,710	$8.00	$86,000
17	TUBULAR HANDRAILING		LF	708	$80.00	$56,628
18	CONCRETE BARRIER TYPE (MODIFIED TYPE 85SW	TYPE 85SW	LF	732	$300.00	$219,553
19	BRIDGE AESTHETIC TREATMENT		LS	1	$390,404.62	$390,405

SUBTOTAL	$20,325,636
MOBILIZATION (@ 10 %)	$2,258,404.00
SUBTOTAL BRIDGE ITEMS	$22,584,040
CONTINGENCIES @25%	$5,646,010
BRIDGE TOTAL COST	$28,230,050
COST PER SQ. FT.	$649.00
BRIDGE REMOVAL (CONTINGENCIES INCL.)	
WORK BY RAILROAD OR UTILITY FORCES	
BRIDGE SEISMIC RETROFIT CONTINGENCIES	
GRAND TOTAL	$28,230,050
FOR BUDGET PURPOSES - SAY	**$28,230,000**

ROUTING

1. DES SECTION
2. OFFICE OF BRIDGE DESIGN - NORTH
3. OFFICE OF BRIDGE DESIGN - CENTRAL
4. OFFICE OF BRIDGE DESIGN - SOUTH
5. OFFICE OF BRIDGE DESIGN - WEST
6. OFFICE OF BRIDGE DESIGN SOUTHERN CALIFORNIA

COMMENTS:

☐ GENERAL PLAN ESTIMATE ☒ ADVANCE PLANNING ESTIMATE

RCVD BY:

IN EST:

OUT EST:

BRIDGE: LINCOLN BLVD BRIDGE **BR. No.: 53-0XXX** **DISTRICT:** 07

TYPE: CIP/PS CONCRETE BOX GIRDER **RTE:**

CU: **CO:** LA

EA: 33880 **PM:**

LENGTH: 334.50 **WIDTH:** 130.00 **AREA (SF) =** 43,485

DESIGN SECTION: CNS Engineers, Inc. .

 # OF STRUCTURES IN PROJECT : 1 **EST. NO.**

PRICES BY : Q. Nguyen **COST INDEX:**

QUANTITIES BY: T. Ge **DATE:** 10/1/2021

QUANTITIES CHECKED BY: Q. Nguyen **DATE:** 10/1/2021

	CONTRACT ITEMS	TYPE	UNIT	QUANTITY	PRICE	AMOUNT
1	BRIDGE REMOVAL		LS	1.00	$415,000.00	$415,000
2	STRUCTURE EXCAVATION (BRIDGE)	TYPE D	CY	2,730	$145.00	$395,850
3	STRUCTURE BACKFILL (BRIDGE)		CY	2,510	$100.00	$251,000
4	36" CAST-IN-DRILLED-HOLE CONCRETE PILING		LF	10,560	$600.00	$6,336,000
5	FURNISH 66" CAST-IN-STEEL SHELL CONCRETE PILING		LF	2,136	$1,200.00	$2,563,000
6	DRIVE 66" CAST-IN-STEEL SHELL CONCRETE PILE		EA	12	$25,000.00	$300,000
7	PRESTRESSING CAST-IN-PLACE CONCRETE		LS	1	$337,000.00	$337,000
8	STRUCTURAL CONCRETE, BRIDGE FOOTING		CY	690	$500.00	$345,000
9	STRUCTURAL CONCRETE, BRIDGE		CY	2,050	$1,200.00	$2,460,000
10	STRUCTURAL CONCRETE, BRIDGE (POLYMER FIBER)		CY	1,210	$1,250.00	$1,513,000
11	STRUCTURAL CONCRETE, APPROACH SLAB	TYPE N(30S)	CY	340	$1,000.00	$340,000
13	JOINT SEAL ASSEMBLY (MR 2")		LF	262	$100.00	$26,200
14	BAR REINFORCING STEEL (BRIDGE)		LB	2,207,835	$1.30	$2,870,000
15	BRIDGE DECK DRAINAGE SYSTEM	TYPE D-1	LB	10,710	$8.00	$86,000
16	TUBULAR HANDRAILING		LF	708	$80.00	$56,628
17	CONCRETE BARRIER TYPE (MODIFIED TYPE 85SW	TYPE 85SW	LF	732	$300.00	$219,553
18	BRIDGE AESTHETIC TREATMENT		LS	1	$361,984.62	$361,985

SUBTOTAL	$18,876,216
MOBILIZATION (@ 10 %)	$2,097,357.33
SUBTOTAL BRIDGE ITEMS	$20,973,573
CONTINGENCIES @25%	$5,243,393
BRIDGE TOTAL COST	$26,216,967
COST PER SQ. FT.	$603.00
BRIDGE REMOVAL (CONTINGENCIES INCL.)	
WORK BY RAILROAD OR UTILITY FORCES	
BRIDGE SEISMIC RETROFIT CONTINGENCIES	
GRAND TOTAL	$26,216,967
FOR BUDGET PURPOSES - SAY	**$26,217,000**

COMMENTS:

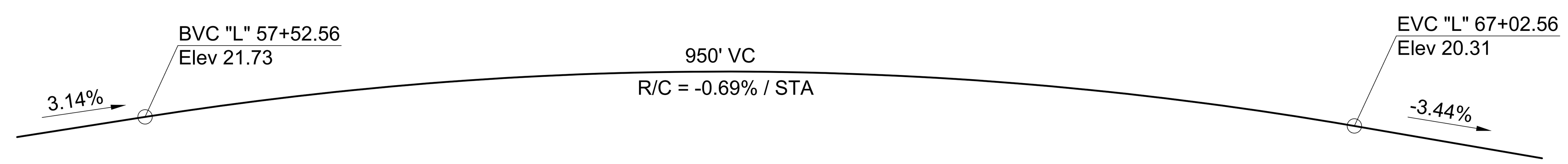
ROUTING

1. DES SECTION
2. OFFICE OF BRIDGE DESIGN - NORTH
3. OFFICE OF BRIDGE DESIGN - CENTRAL
4. OFFICE OF BRIDGE DESIGN - SOUTH
5. OFFICE OF BRIDGE DESIGN - WEST
6. OFFICE OF BRIDGE DESIGN SOUTHERN CALIFORNIA

APPENDIX C
APS PLAN SHEETS

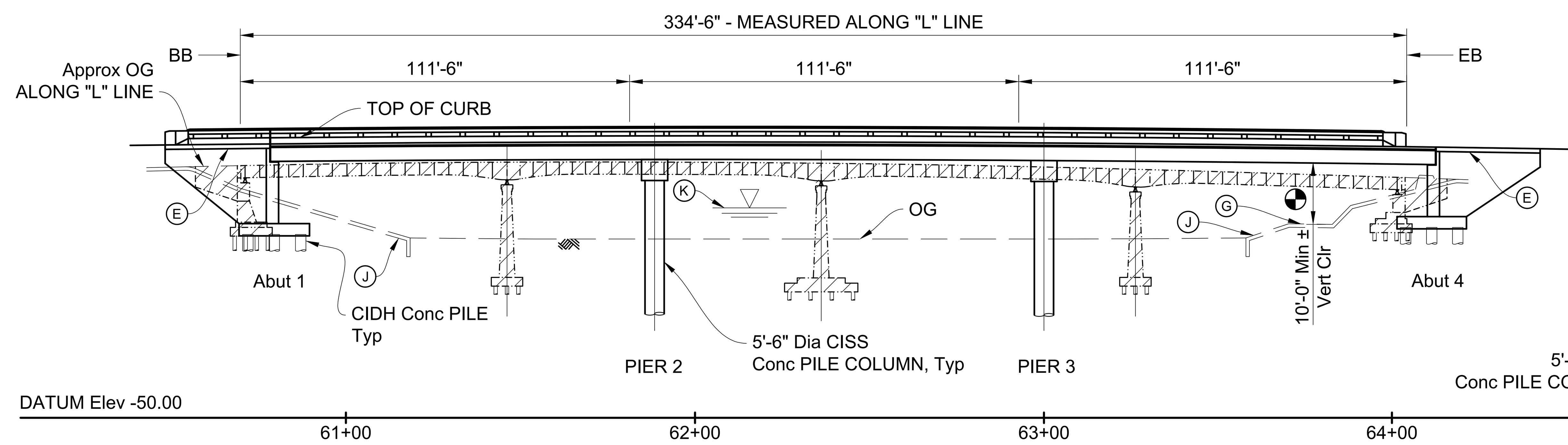
DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT
7	LA	1	30.16–30.74

CNS ENGINEERS, INC.
11870 PIERCE ST, STE 265
RIVERSIDE, CA 92505



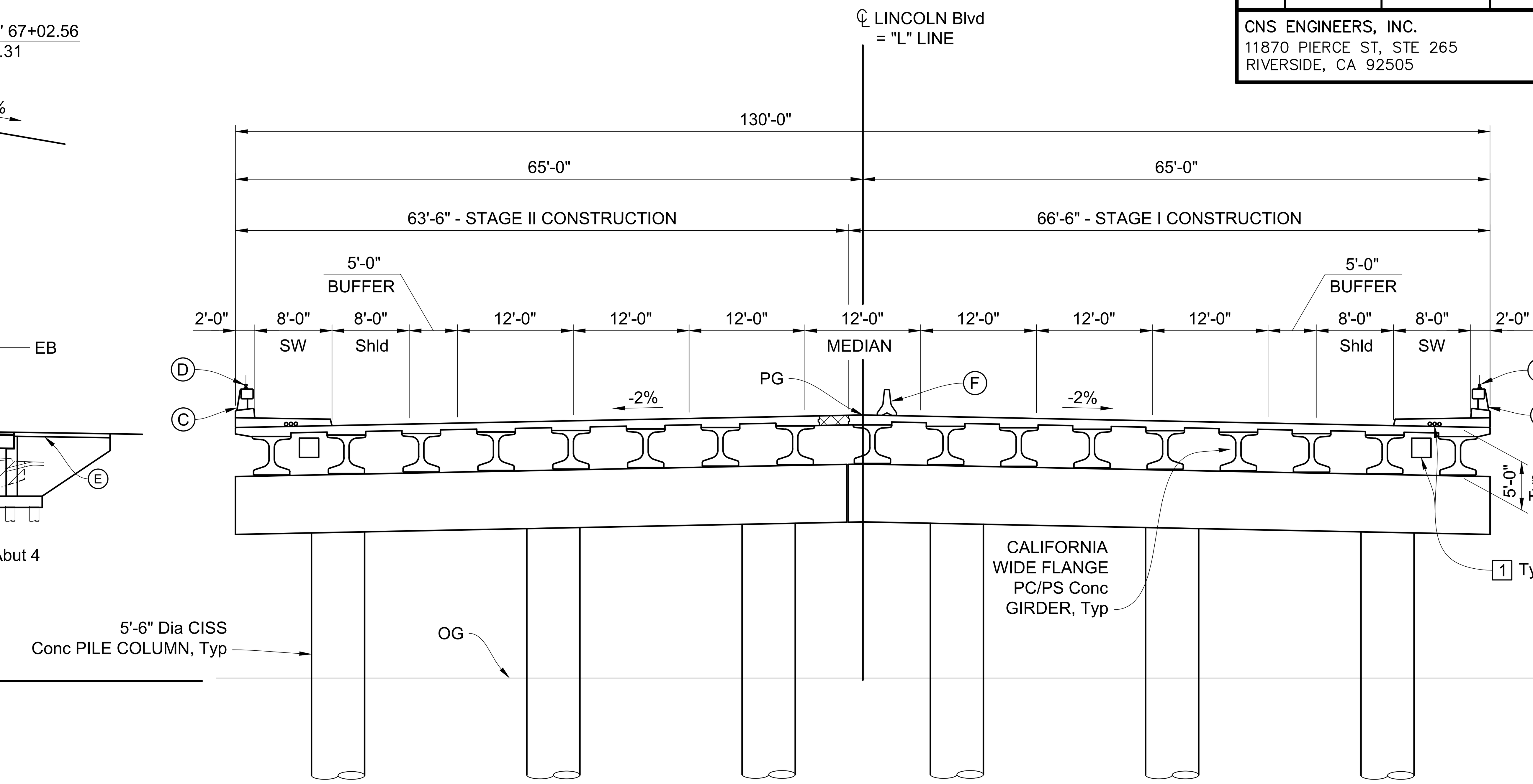
PROFILE GRADE

NO SCALE



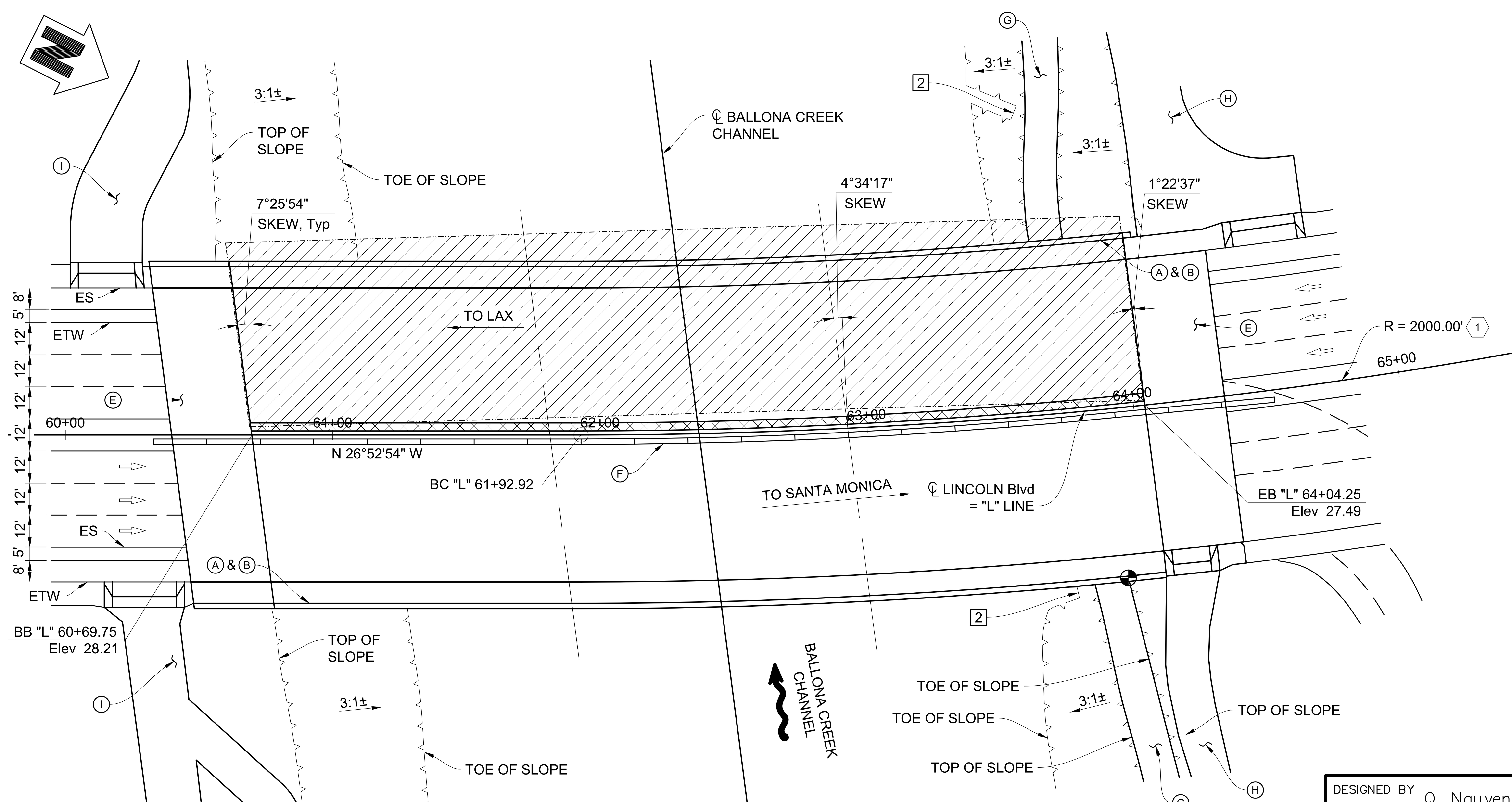
ELEVATION

1" = 30'-0"



TYPICAL SECTION

1" = 10'-0"



PLAN

1" = 30'-0"

LEGEND:

- Exist Structure
- Traffic Direction
- Bridge (Br. No. 53-0118) Removal
- Closure Pour
- Point of Minimum Vertical Clearance

KEY NOTES:

- (A) Paint "Br. No. 53-0XXX"
- (B) Paint "LINCOLN BLVD BRIDGE OVER BALLONA CREEK"
- (C) Conc Barrier, Type 85SW (Mod)
- (D) Tubular Handrailing
- (E) Structure Approach, Type N (30S)
- (F) Temporary K-Rail
- (G) Exist Bike Path
- (H) Proposed Bike Path Ramp
- (I) Proposed Maintenance Road Ramp
- (J) Exist Grouted Riprap
- (K) Water Surface Elevation

UTILITIES:

- 1 Future Utility Opening
- 2 Storm Drain

NOTE:

Date of Estimate		12/22/2022
Str Depth	=	5'-0"
Length	=	334'-6"
Width	=	130'-0"
Area	=	43,485 sqft
Avg Cost per Sq Ft Including 10% Mobilization & 25% Contingency	=	$649.00
Total Cost	=	$28,230,000

CURVE DATA TABLE

CURVE No.	R	Δ	T	L
1	2000.00'	25°36'56.00"	886.72'	894.15'

DESIGNED BY Q. Nguyen	DATE	
DRAWN BY T. Ge	DATE	Quyet Nguyen PROJECT ENGINEER
CHECKED BY J. Lu	DATE	
APPROVED J. Lu	DATE	

PLANNING STUDY

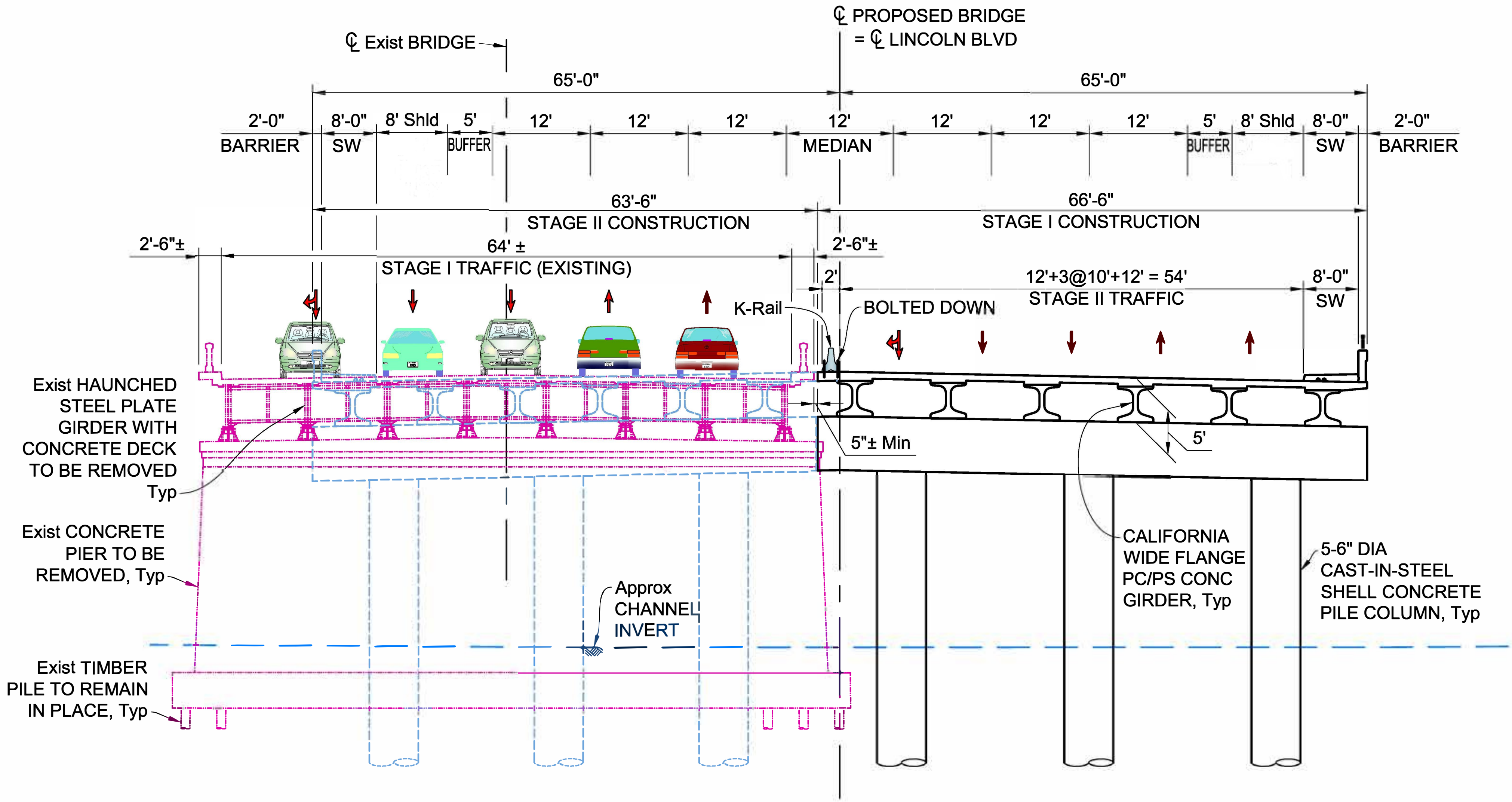
LINCOLN BLVD BRIDGE OVER BALLONA CREEK (REPLACE)

UNIT: X	BRIDGE No.: X
CONTRACT No.: X	PROJECT No. & PHASE: X

DESIGN OVERSIGHT

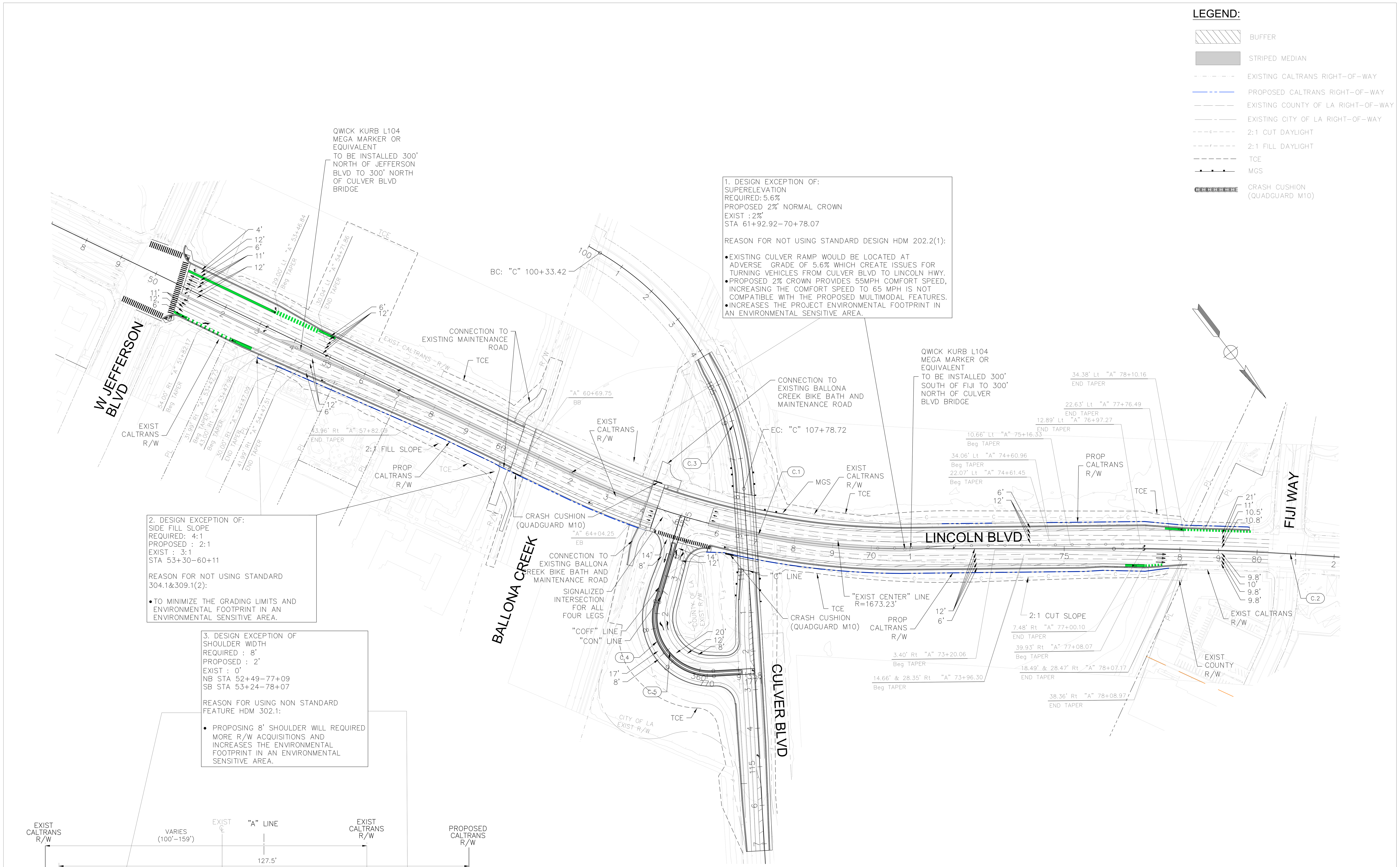
SIGN OFF DATE

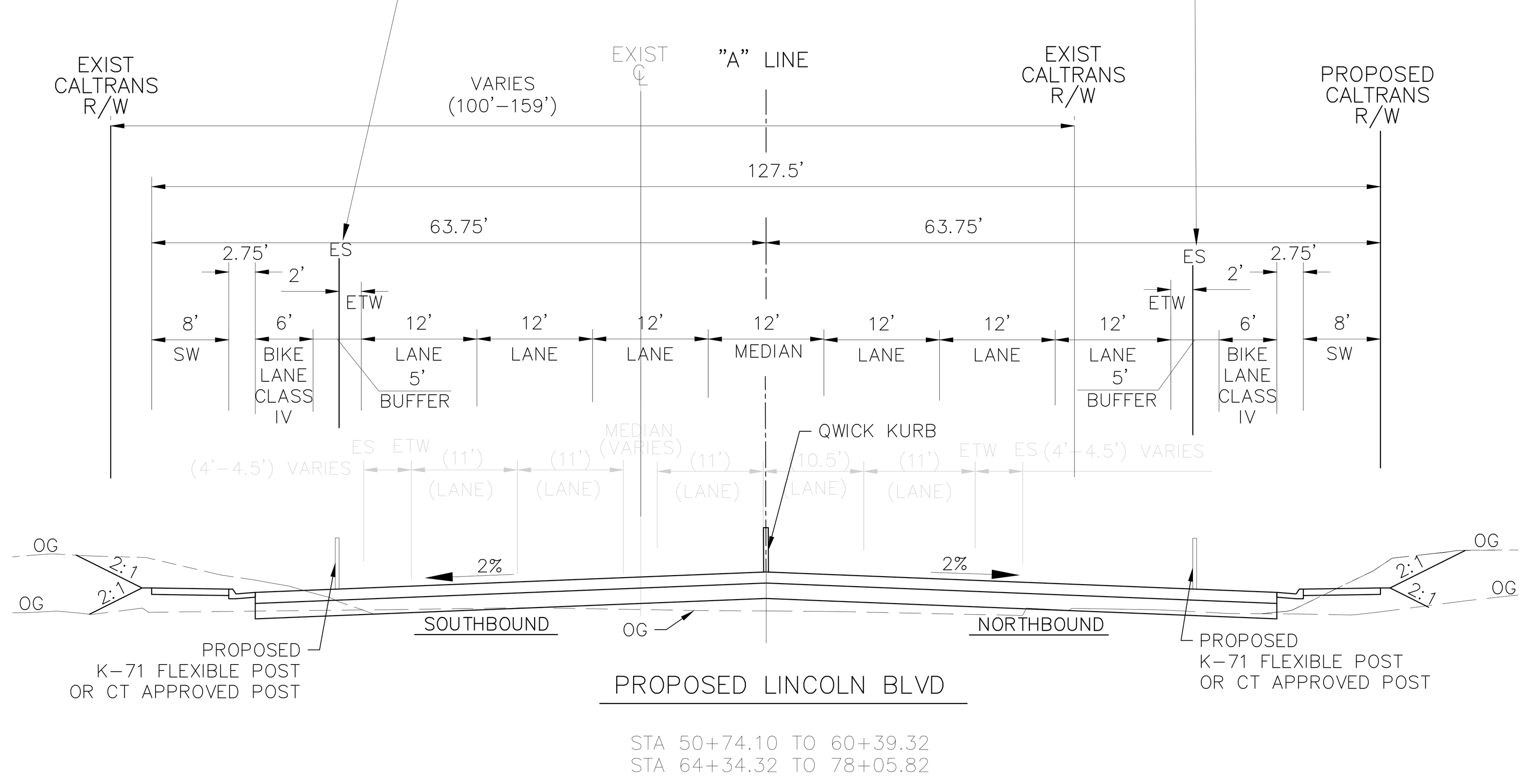
PREPARED FOR THE STATE OF CALIFORNIA — DEPARTMENT OF TRANSPORTATION

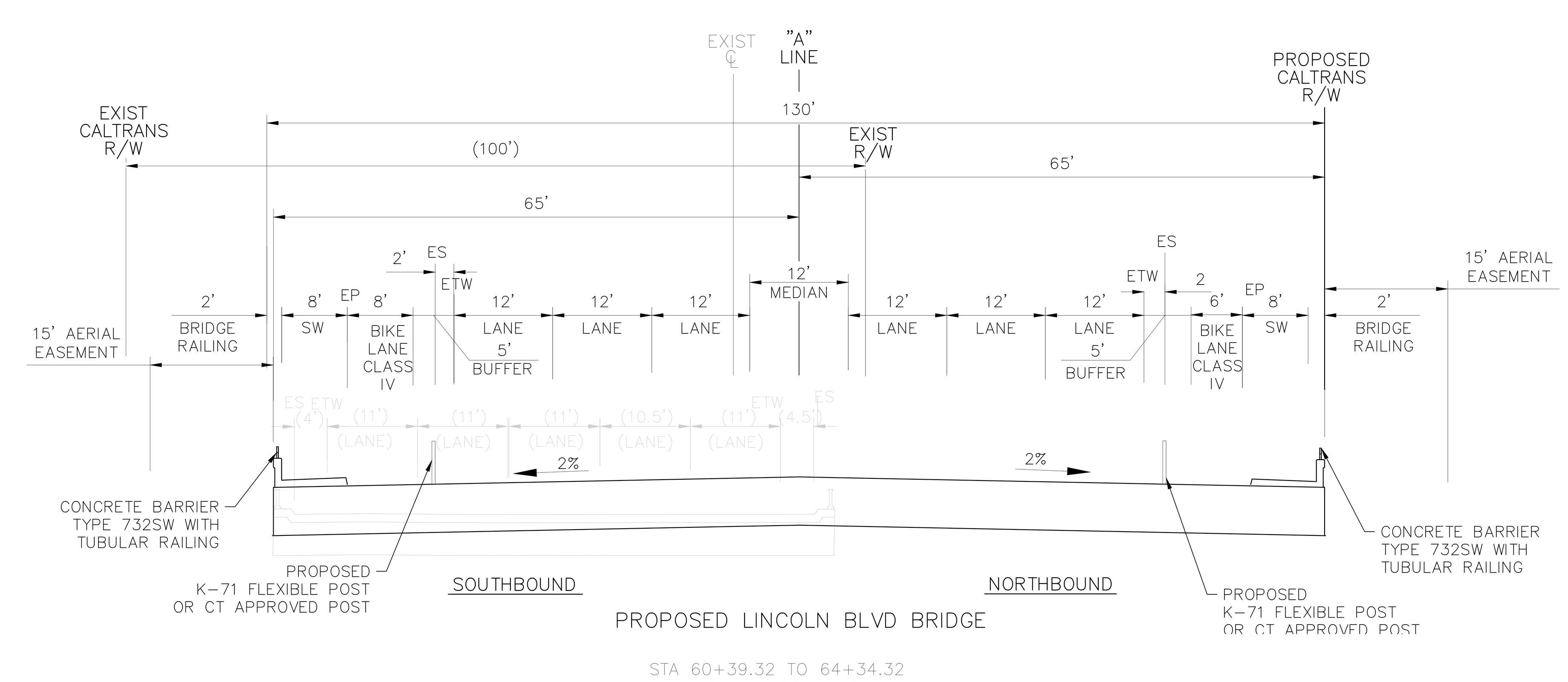


STAGE CONSTRUCTION - LINCOLN BLVD BRIDGE
LOOKING NORTH - NEAR SOUTH ABUTMENT

APPENDIX D
GAD PLANS







	DESIGN SPEED	POST SPEED LIMIT
LINCOLN BLVD	50 MPH	45 MPH
CULVER BLVD ("C" STA 104+17–110+12)	40 MPH	35 MPH
CULVER BLVD ("C" STA 110+12+117+17)	50 MPH	45 MPH
ON&OFF–RAMP	25 MPH	

CURVE DATA

No.	R	Δ	T	L
C.1	2000'	25°36'56"	886.72'	894.15'
C.2	8000'	9°58'01"	1389.93'	1391.68'
C.3	760'	56°11'15"	715.79'	745.30'
C.4	151'	110°03'38"	247.48'	290.06'
C.5	138'	110°03'38"	226.24'	265.17'

GEOMETRIC REVIEW DOCUMENT
LINCOLN BLVD IMPROVEMENT
ALTERNATIVE 1

EA 07-33880
SCALE 1" = 100'

November 7, 2022

APPENDIX E

SELECTED STRUCTURE AS-BUILT PLANS

California Department of Transportation
Division of Maintenance

Structure Maintenance and Investigations

BRIDGE **I**NSPECTION **R**ECORDS **I**NFORMATION **S**YSTEM

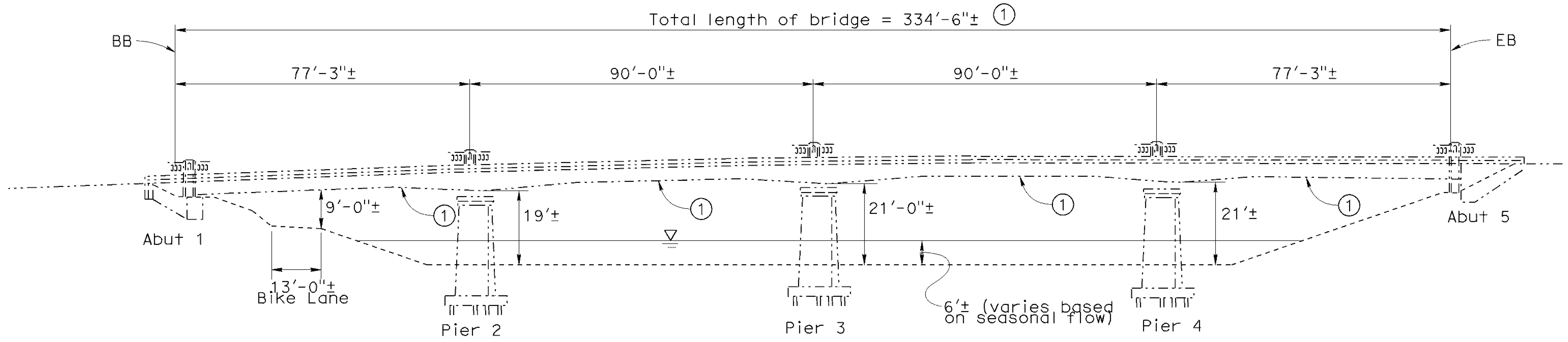
The requested documents have been generated by BIRIS.

These documents are the property of the California Department of Transportation and should be handled in accordance with Deputy Directive 55 and the State Administrative Manual.

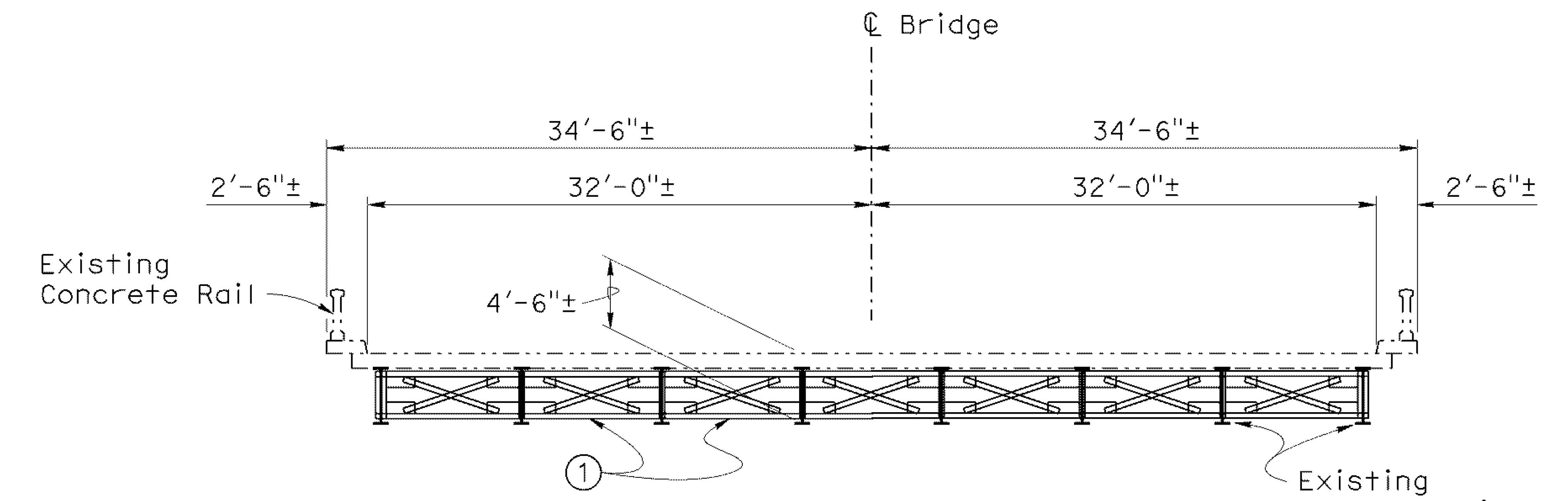
Records for "Confidential" bridges may only be released outside the Department of Transportation upon execution of a confidentiality agreement.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
07	LA	1,90,405	Var	22R1	40

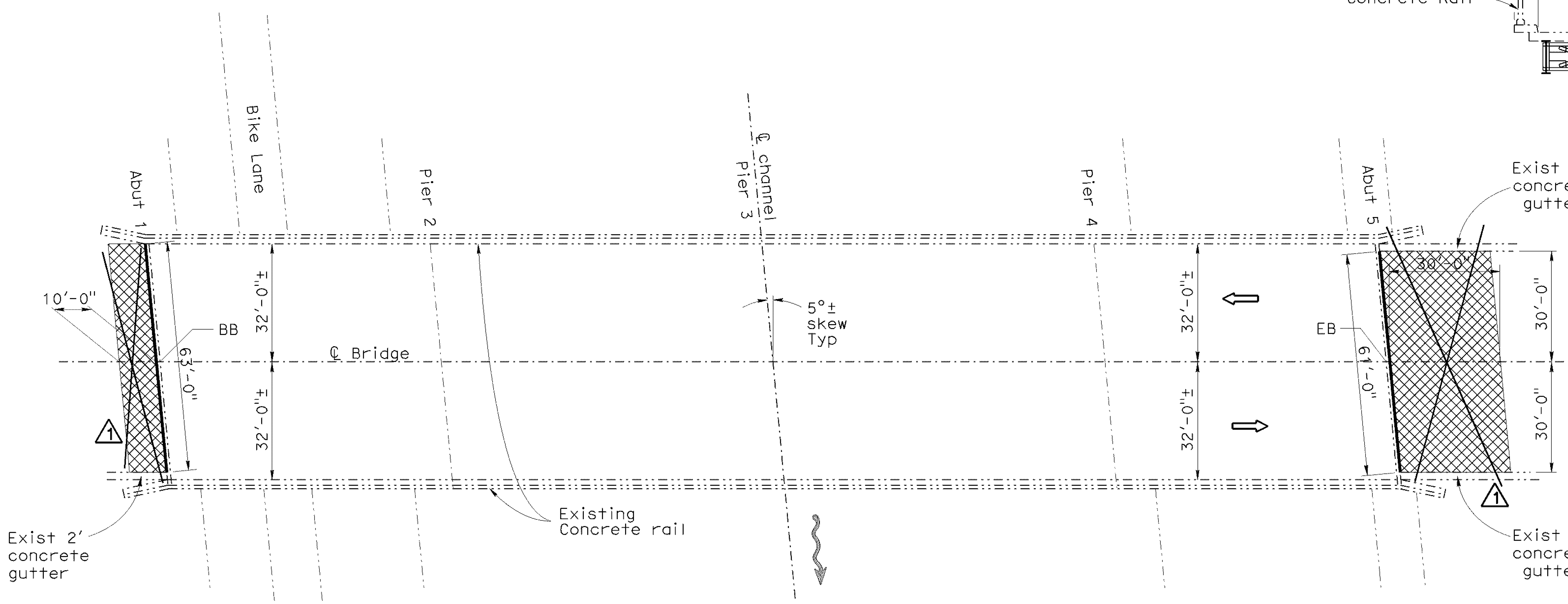
REGISTERED CIVIL ENGINEER 11/30/11 DATE
3-19-12
PLANS APPROVAL DATE
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.
PROFESSIONAL ENGINEER, VINH DUC L. DANG, No. C65096, Exp. 09/30/13, CIVIL, STATE OF CALIFORNIA



ELEVATION
1" = 20'



TYPICAL SECTION
NO SCALE



PLAN
1" = 20'

LEGEND:

- Indicates existing.
- Indicates direction of traffic.
- (1) Clean and spot blast cleaning of existing paint system on steel members (including steel rocker bearings) and apply undercoats and finish coats of the specified paint system to the entire bridge.
- Indicates limits of remove existing approach and place new Structure Approach Type R. For details see "STRUCTURE APPROACH TYPE R, DETAILS NO.2" sheet.
- Indicates limits of existing joint seal removal and placement of new joint seal. Prior to placement of new joint, remove unsound concrete and patch with rapid setting concrete.

BALLONA CREEK BRIDGE NO. 53-0118

QUANTITIES

~~REMOVE UNSOUND CONCRETE~~	~~2~~	~~CF~~
~~AGGREGATE BASE (APPROACH SLAB)~~	~~9~~	~~CY~~
~~STRUCTURAL CONCRETE, APPROACH SLAB (TYPE R)~~	~~85~~	~~CY~~
RAPID SETTING CONCRETE (PATCH)	2	CF
JOINT SEAL (MR 1/2")	124	LF
CLEAN STRUCTURAL STEEL (EXISTING BRIDGE)	LUMP SUM	
PAINT STRUCTURAL STEEL (EXISTING BRIDGE)	LUMP SUM	
SPOT BLAST CLEAN AND PAINT UNDERCOAT	2,500	SQFT
WORK AREA MONITORING	LUMP SUM	

MARK	DATE	REVISION(S) DESCRIPTIONS	DES	CHK	DET
1	07/01/13	Deleted approach slab replacement	VD	RP	TD

REGISTERED CIVIL ENGINEER: DATE: 07/01/13

BALLONA CREEK
Br No. 53-0118, Rte 1, PM 30.36
1" = 20'

CONTRACT CHANGE ORDER NO._____
SHEET ____ OF ____

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL. EXISTING UTILITY FACILITIES HAVE NOT BEEN PLOTTED ON THESE PLANS.

DESIGN	BY Vinh Dang	CHECKED Ramesh Patel	LOAD FACTOR DESIGN	LIVE LOADING: HS20-44 AND ALTERNATIVE AND PERMIT DESIGN LOAD
DETAILS	BY Tom Dang	CHECKED Ramesh Patel	LAYOUT	BY Tom Dang / CHECKED Vinh Dang
QUANTITIES	BY Vinh Dang	CHECKED Ramesh Patel	SPECIFICATIONS	BY Rebecca Franti / PLANS AND SPECS COMPARED Rebecca Franti

TONY D. BRAKE
DESIGN ENGINEER

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF MAINTENANCE
STRUCTURE MAINTENANCE DESIGN

BRIDGE NO. Various
POST MILE Various

ROUTE 1, 90, 405 BRIDGES
GENERAL PLAN NO. 4

CONTRACT No: 07-4Y1501
TRANSFER DATE: 07-08-2014
FIELD CORRECTION DATE: 12-05-2013
CORRECTIONS TRANSFERRED BY: T.D.
FIELD CORRECTIONS BY: A. Deremegerdichian

NO AS BUILT CORRECTIONS

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
07	LA	1,90,405	Var	36	40

REGISTERED CIVIL ENGINEER 11/30/11 DATE
3-19-12
PLANS APPROVAL DATE
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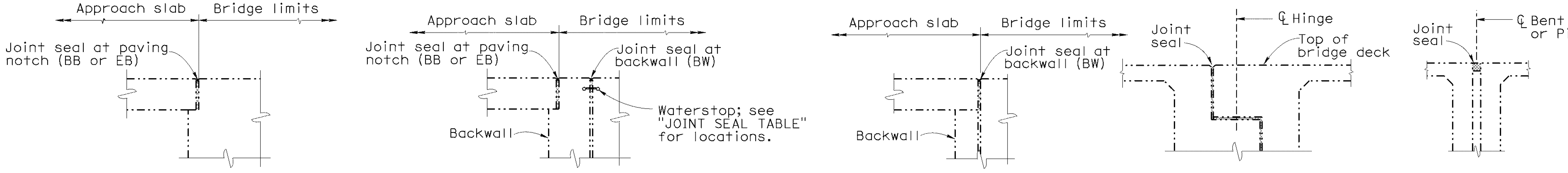
REGISTERED PROFESSIONAL ENGINEER VINH DUC L. DANG No. C65096 Exp. 09/30/13 CIVIL STATE OF CALIFORNIA



JOINT SEAL LOCATION

NO SCALE

JOINT SEAL TABLE

BRIDGE NAME	BRIDGE NUMBER	LOCATION	MINIMUM "MR" (INCHES)	APPROX LENGTH (FT)	EXISTING WATERSTOP	APPROX DEPTH TO CLEAN EXP JOINT (INCHES)	REMOVE UNSOUND CONCRETE (CU FT)	RAPID SETTING CONCRETE PATCH (CU FT)
Los Angeles River	53-0341	Abut 1	1½	94	No	12	2	2
		Hinge 4	1½	68	No	12		
		Abut 8, BW	1½	68	No	12		
		Abut 8, PN *	½	66	No	——		
De Forest Avenue UC	53-1047	Abut 1, PN *	½	66	No	——	2	2
		Abut 1, BW	½	68	No	6		
		Abut 3, BW	½	68	No	6		
Ballona Creek	53-0118	Abut 1, PN *	½	63	No	——	2	2
		Abut 5, PN *	½	61	No	——		
Inglewood Blvd UC	53-1952	Abut 1	1½	145	No	12	2	2
		Abut 4	1½	151	No	12		
Mesmer Avenue UC	53-1950	Abut 1	½	414	No	6	2	2
		Abut 5	½	360	No	6		
Route 90/405 Separation	53-1851	Abut 1	½	155	No	6	2	2
		Abut 31	½	146	No	6		
E90-S405 Connector OC	53-1853G	Abut 1	1½	38	No	12	2	2
		Abut 4	1½	43	No	12		
W90-N405 Connector OC	53-1855F	Abut 8E	½	28	No	6	1	1
La Cienega Blvd SB OC	53-1250	Abut 1	½	130	No	6	2	2
		Abut 4 *	½	56	No	——		
Centinella Avenue UC	53-1253	Abut 1	½	460	No	6	4	4
		Bent 2	½	403	No	6		
		Bent 3	½	371	No	6		
		Bent 4	½	354	No	6		
		Bent 5	½	359	No	6		
		Abut 6	½	370	No	6		
Slauson Avenue UC	53-1401	Abut 1	½	210	No	6	2	2
		Abut 3	½	196	No	6		
S405-W90 Connector OC	53-1974F	Abut 1	½	31	No	6	2	2
		Abut 3	½	84	No	6		
Port Road UC	53-1402	Abut 1	½	225	No	6	2	2
		Abut 2	½	217	No	6		
McDonald Street UC	53-1347	Abut 1	1½	144	No	12	2	2
		Abut 2	1½	143	No	12		
Braddock Drive UC	53-1258	Abut 1	½	148	No	6	2	2
		Abut 2	½	148	No	6		
Washington Place UC	53-1261	Abut 1	½	136	No	6	2	2
		Abut 2	½	136	No	6		

* Indicates new approach slabs placement. Joint cleaning not required.

NOTES:

The following notes apply to JOINT SEAL TYPE A:

Install Joint Seal (MR = ½") or Silicone Joint Seal 3" up into curb or barrier rail on the low side of the deck where deck joint aligns with curb or barrier rail joint.

For details not shown see RSP B6-21 sheet.

The following notes apply to JOINT SEAL TYPE B:

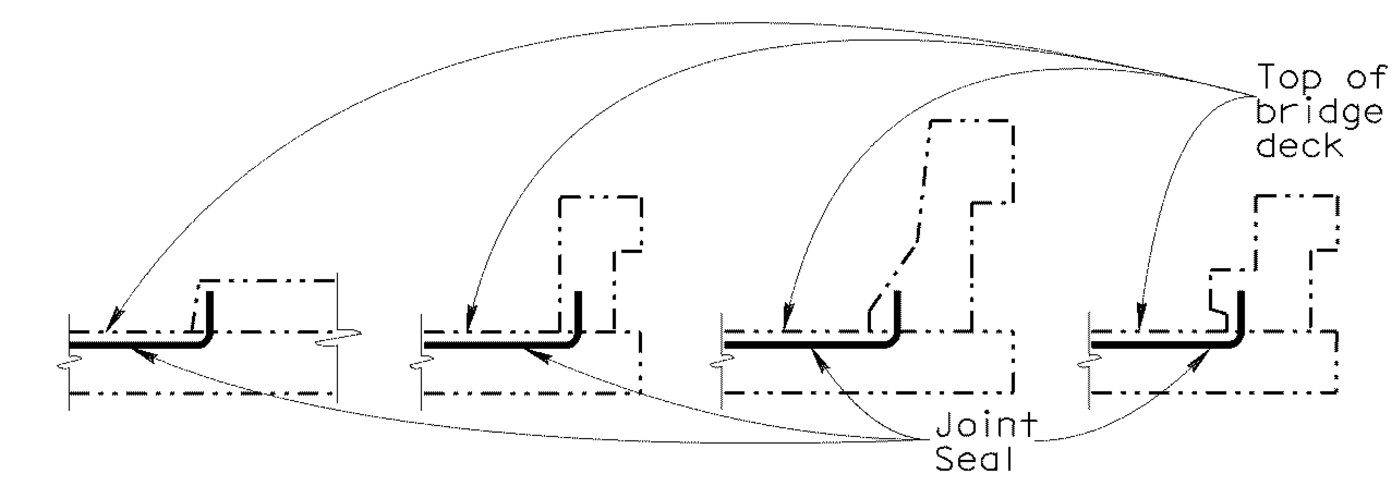
1) Seal must satisfy both minimum Movement Rating (MR) and minimum W1 requirements.

2) Minimum W1 is the calculated maximum width of the joint based on field measurements. After the joints have been cleaned, minimum W1 is to be recalculated by the Engineer.

3) W1 shall be the smaller of the values determined as follows:
   A) 0.85 times the manufacturer's designed minimum uncompressed width of the seal.
   B) The width of the seal on the third successive test cycle of the pressure deflection test, when compressed to an average pressure of 3.0 PSI.

4) Bend Type B joint seal 6 inches up into curb or rail on the low side of the deck where deck joint matches curb or rail joint.

For details not shown see RSP B6-21 sheet.



BARRIER RAIL

JOINT SEAL AT LOW SIDE OF DECK

Note: Details shown for illustration purposes only.

For use only where deck joint matches the sidewalk, curb or barrier rail joint.

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL. EXISTING UTILITY FACILITIES HAVE NOT BEEN PLOTTED ON THESE PLANS.

	BY	CHECKED
DESIGN	Vinh Dang	Ramesh Patel
DETAILS	Tom Dang	Ramesh Patel
QUANTITIES	Vinh Dang	Ramesh Patel

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF MAINTENANCE
STRUCTURE MAINTENANCE DESIGN

BRIDGE NO. Various
POST MILE Varies

ROUTE 1, 90, 405 BRIDGES
MISCELLANEOUS DETAILS NO. 1

STRUCTURES MAINTENANCE DETAIL SHEET (ENGLISH) (REV. 09-01-10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2

UNIT: 3489
PROJECT NUMBER & PHASE: 0700001094
CONTRACT NO.: 4Y1501

DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES 5/27/11 6/28/11 8/15/11
SHEET 18 OF 22

FILE => 07-4y1501-b-miscdt01.dgn

USERNAME => s129239 DATE PLOTTED => 24-JUL-2014 TIME PLOTTED => 14:31

DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	LA	1,90,405	Var	137	167

M. Z. Haleem
REGISTERED ENGINEER - CIVIL

REGISTERED PROFESSIONAL ENGINEER — M. Z. HALEEM — No. 24743 — Exp. 12-31-97 — CIVIL — STATE OF CALIFORNIA

9-19-94
PLANS APPROVAL DATE

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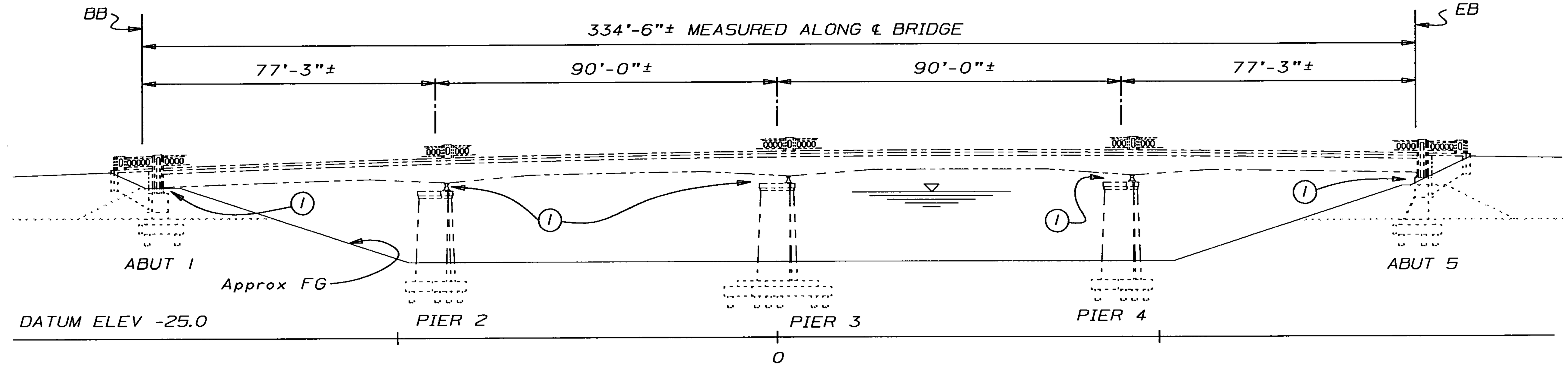


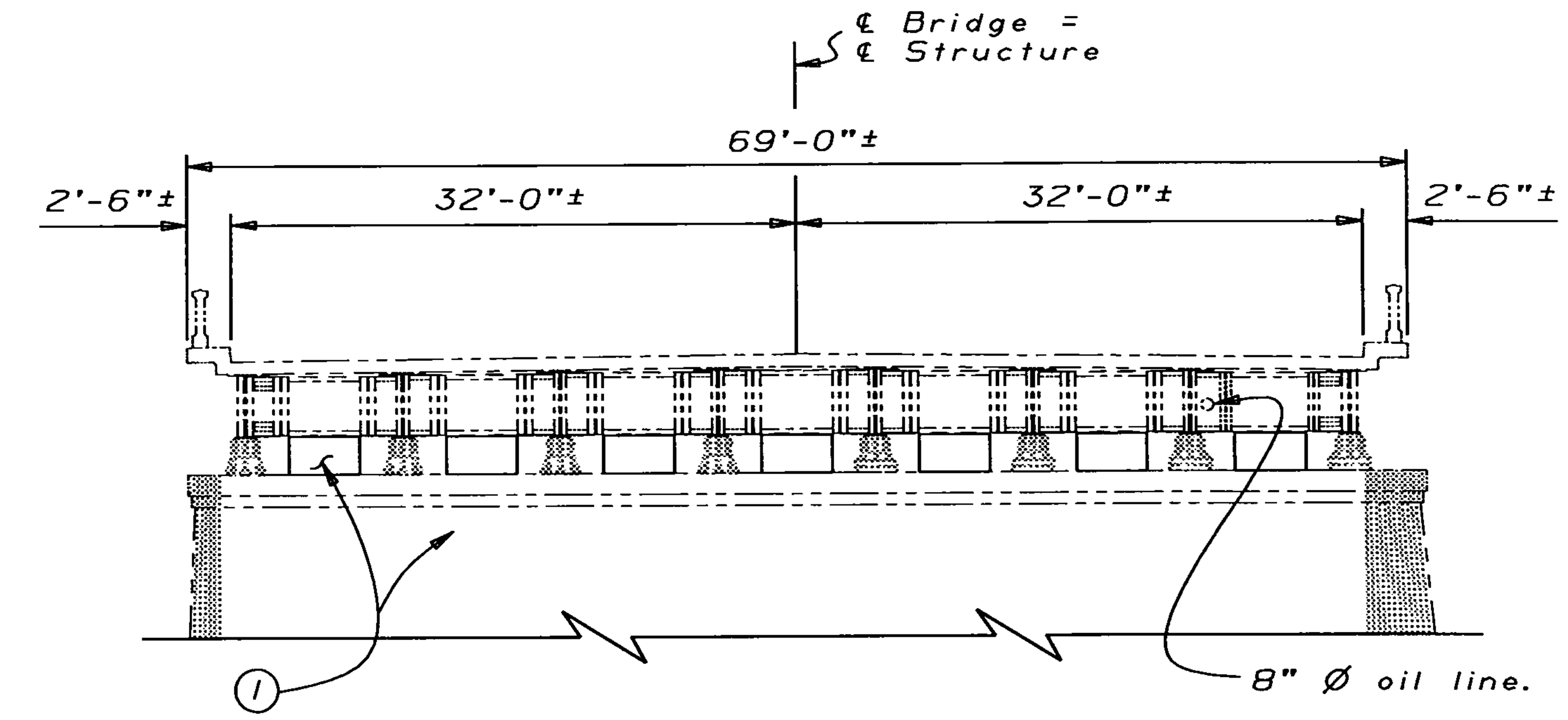
ELEVATION
1"=20'

(1) Concrete Pedestals to be placed between existing bearing assemblies. Typical at Abutments and Piers.

- BALLONA CREEK BR. 53-118

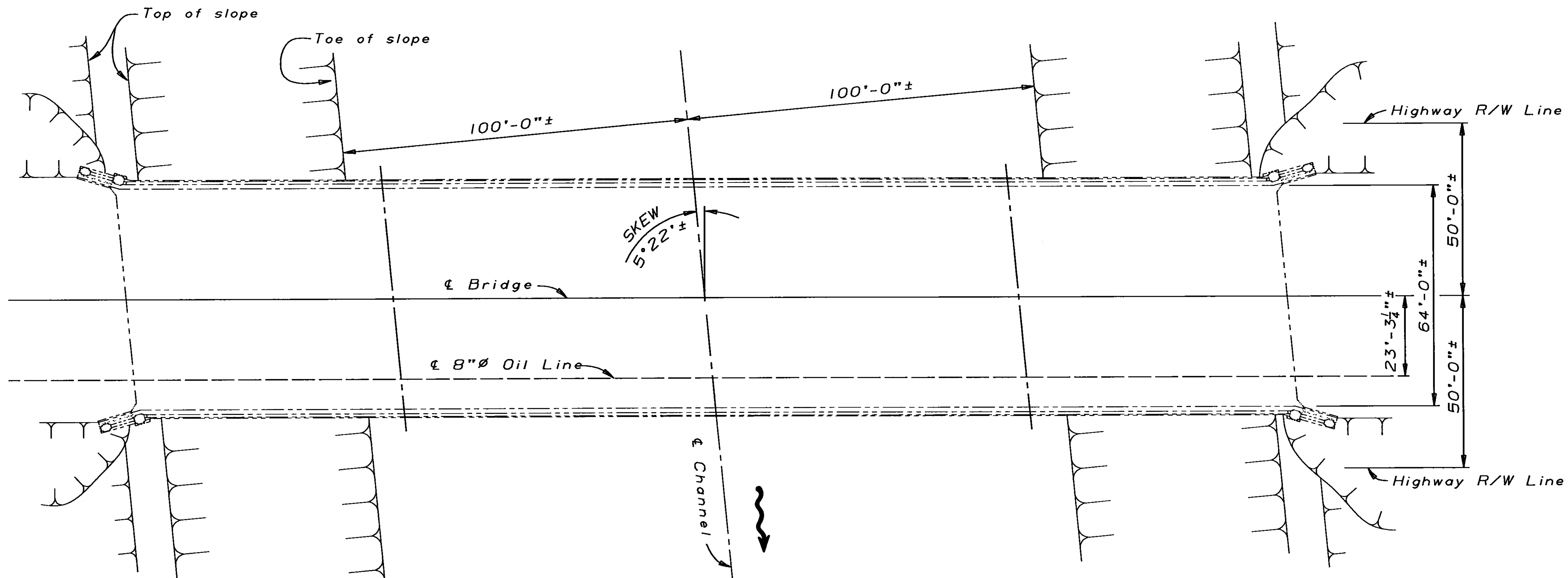
QUANTITIES

STRUCTURAL CONCRETE, BRIDGE	26	CY
DRILL AND BOND DOWEL	175	LF
BAR REINFORCING STEEL (BRIDGE)	3,140	LB



TYPICAL SECTION
1/8"=1'-0"

Note:
Pier shown, Abutments similar



PLAN
1"=20'

INDEX TO PLANS

Sheet No.	Title
1	General Plan
2	Abutment Details
3	Pier Details

GENERAL NOTES
LOAD FACTOR DESIGN

DESIGN: BRIDGE DESIGN SPECIFICATIONS (1983 AASHTO with Interims and Revisions by CALTRANS)

SEISMIC LOADING: Peak Rock Acceleration = 0.7 g
Depth of Alluvium ≥ 150 ft.

REINFORCED CONCRETE: (EXIST) f_y = 40,000 psi
f'_c = 5,000 psi
n = 9

(NEW CONST) f_s = 60,000 psi
f_c = 4,000 psi
n = 9

NO CORRECTIONS THIS SHEET
AS BUILT
CORRECTIONS BY H.O.WILL/BJE
CONTRACT NO. 07-119964
DATE 6-12-96/9-9-97

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

EARTHQUAKE RETROFIT PROJECT NO. 198

DESIGN ENGINEER: Ramin Rashedi	DESIGN: BY Zak Haleem/B. Wu	CHECKED Kien T. Le	LOAD FACTOR DESIGN	
	DETAILS: BY Dale Kubochi 2-92	CHECKED Kien T Le	LAYOUT: BY Zack Haleem	CHECKED Kien T Le
	QUANTITIES: BY Lai Fong	CHECKED Dae Yoo	SPECIFICATIONS: BY [signature] 8/94	PLANS AND SPECS COMPARED [signature]

DS OSD 2138 (CADD 4/89)

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 11

BRIDGE NO. 53-118
POST MILE 30.36

BALLONA CREEK BRIDGE
GENERAL PLAN

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 07
EA 119961

DISREGARD PRINTS BEARING EARLIER REVISION DATES
REVISION DATES (PRELIMINARY STAGE ONLY): 2-20-92, 11-3-92, 8-12-93, 8-17-93, 12-8-93, 12-13-93, 8-8-94, 8-11-94

SHEET 1 OF 3

DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	LA	1,90,405	Var	138	167

M.Z. Haleem
REGISTERED ENGINEER - CIVIL

REGISTERED PROFESSIONAL ENGINEER — M.Z. HALEEM — No. 24743 — Exp. 12-31-97 — CIVIL — STATE OF CALIFORNIA

9-19-94
PLANS APPROVAL DATE

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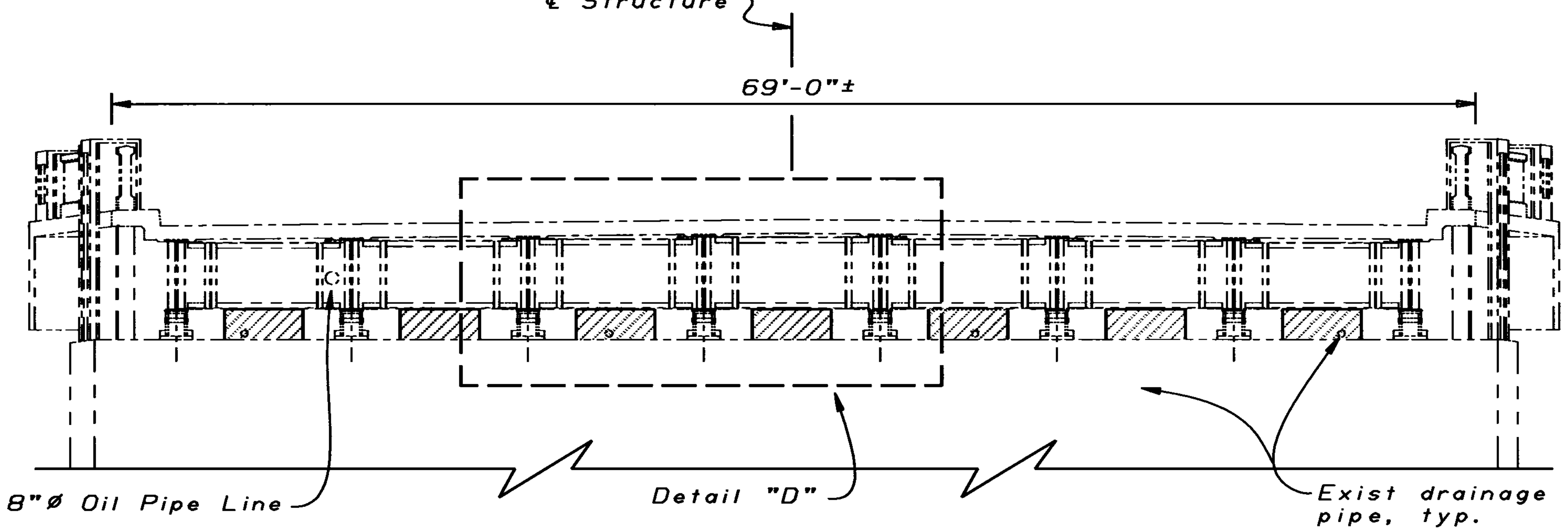
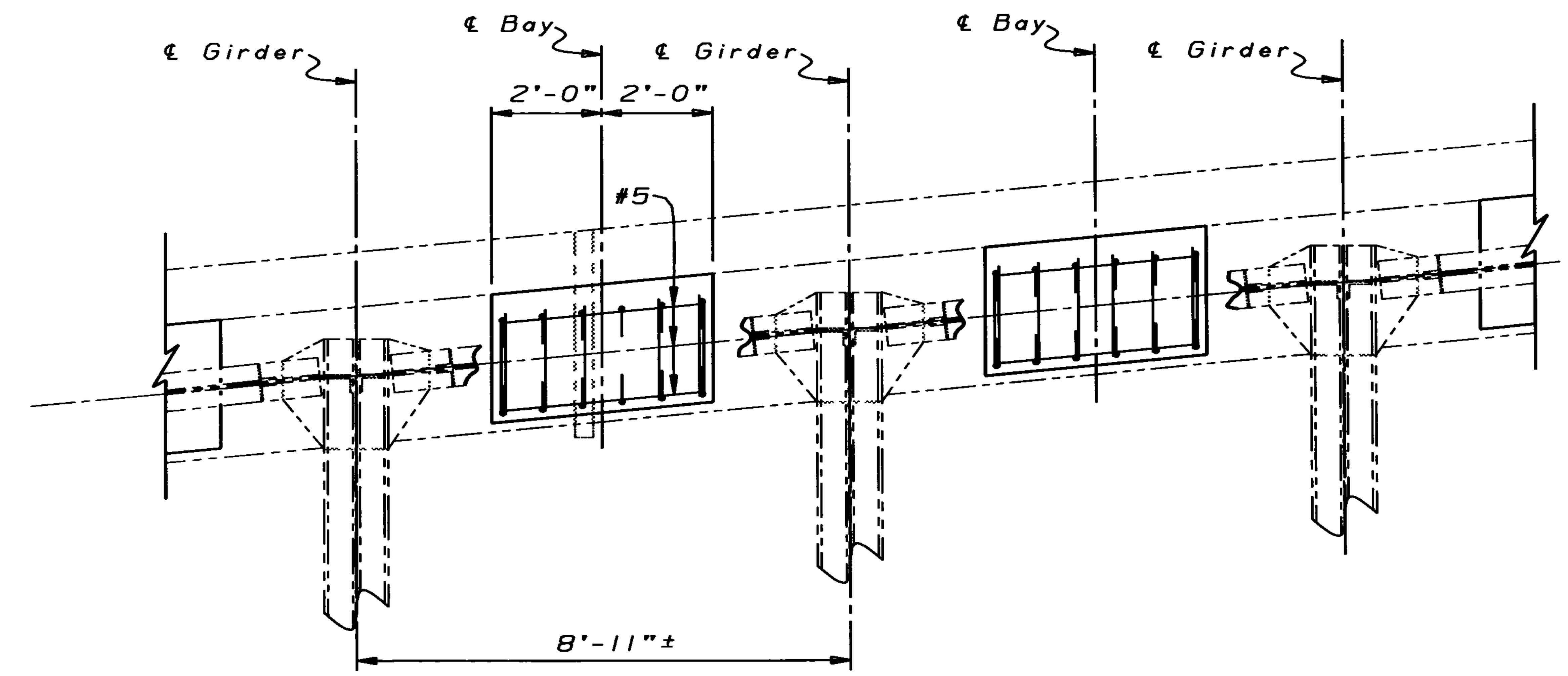
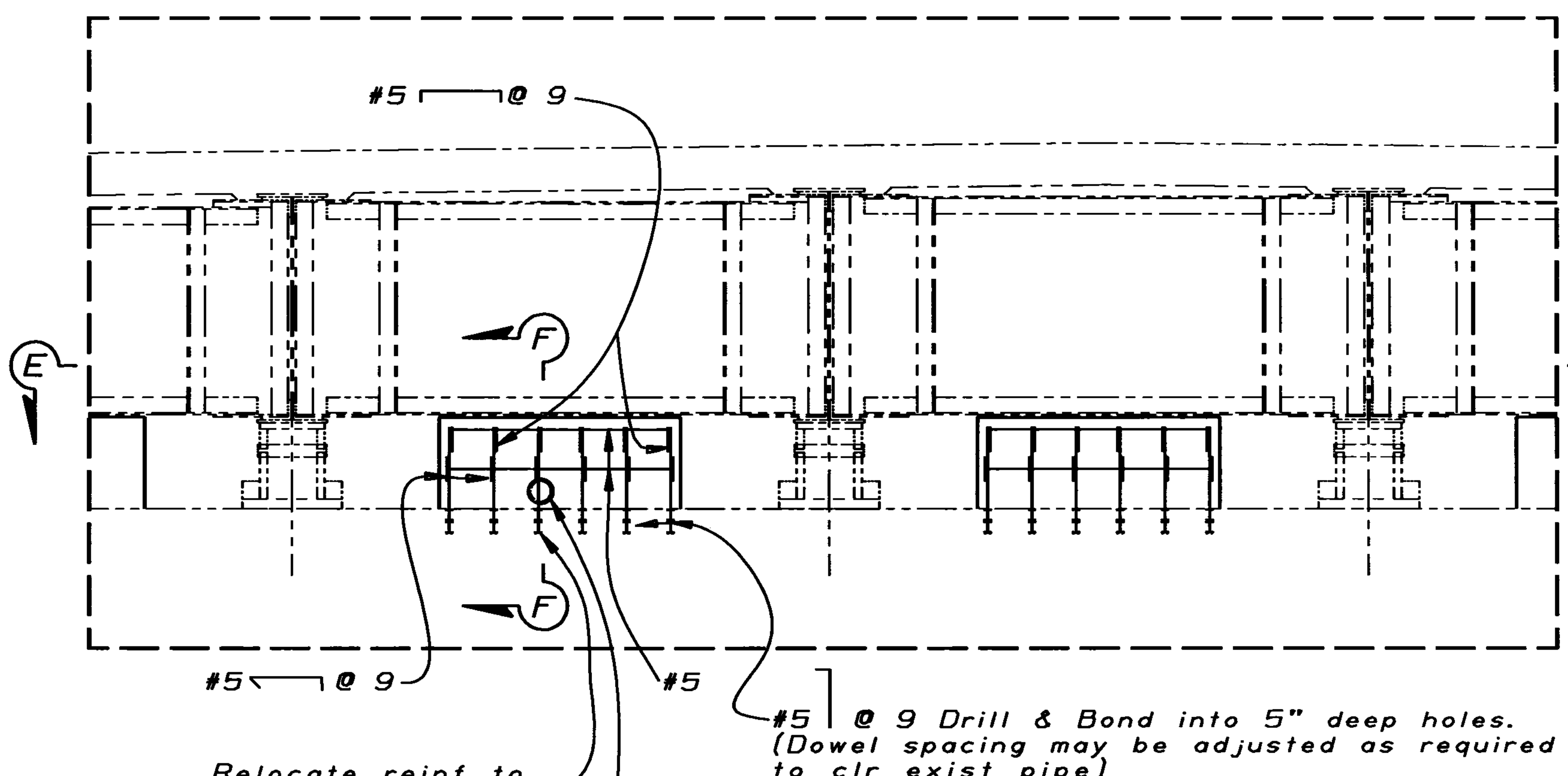
Note:
Details shown are similar for Abut 1 and Abut 5
New concrete pedestal, tot 7 per Abut



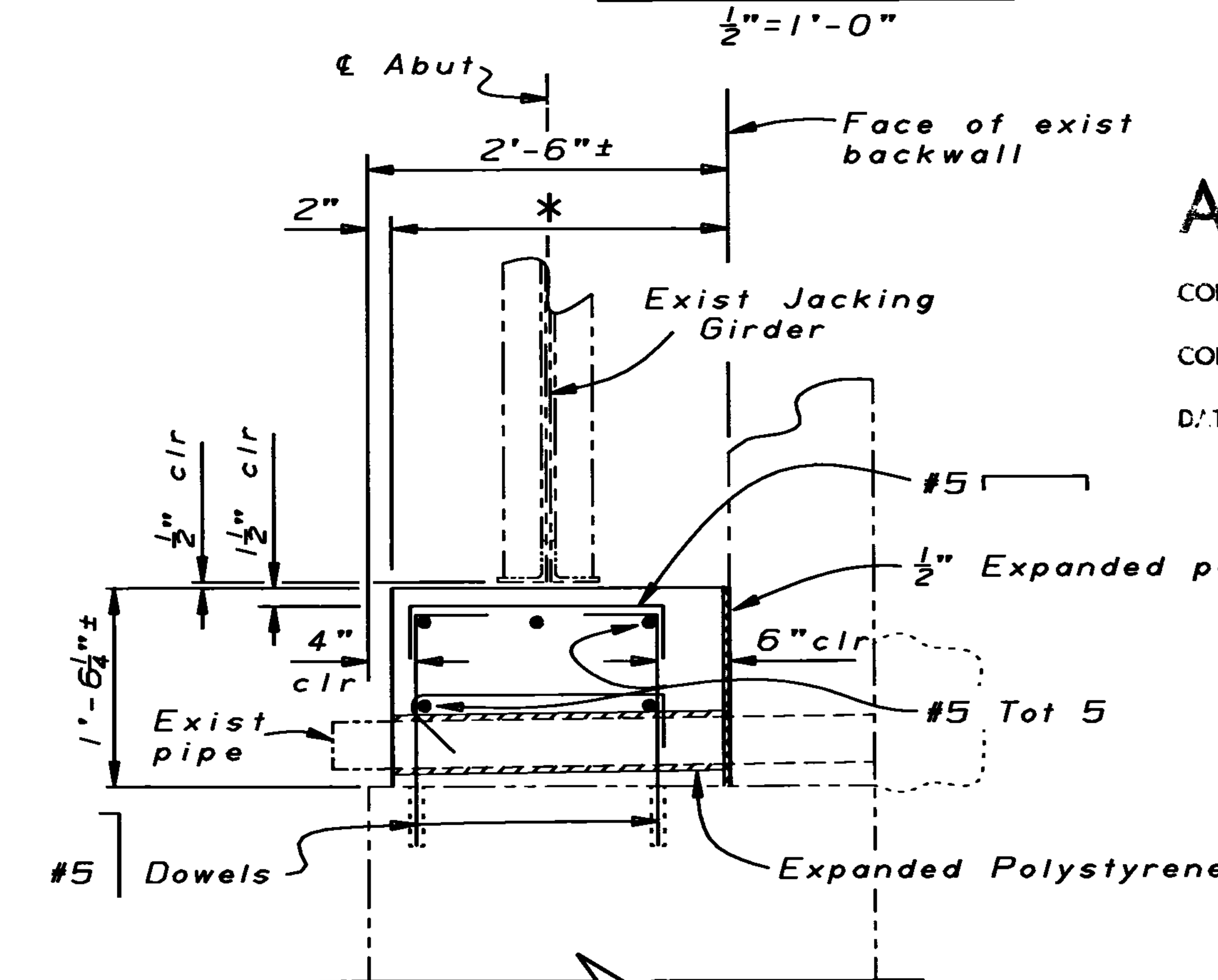
ELEVATION
3/16"=1'-0"



SECTION E-E
1/2"=1'-0"



DETAIL "D"
1/2"=1'-0"



SECTION F-F
1"=1'-0"

* Slope to drain
1/4" max vert drop

NO CORRECTIONS THIS SHEET
AS BUILT
CORRECTIONS BY H.O. WILL/BJE
CONTRACT NO. 07-119964
DATE 6-12-96/9-9-97

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

EARTHQUAKE RETROFIT PROJECT NO. 198

	BY	CHECKED
DESIGN	Zak Haleem/B. Wu	Kien T. Le
DETAILS	Dale Kubochi 8-93	Kien T Le
QUANTITIES	Lai Fong	Dae Yoo

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 11

BRIDGE NO. 53-118
POST MILE 30.36

BOLLONA CREEK BRIDGE
ABUTMENT DETAILS

DS OSD 2139 (CADD 4/89)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 07
EA 119961

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 8-10-93, 12-9-93, 12-13-93, 7-5-94, 8-8-94

SHEET 2 OF 3

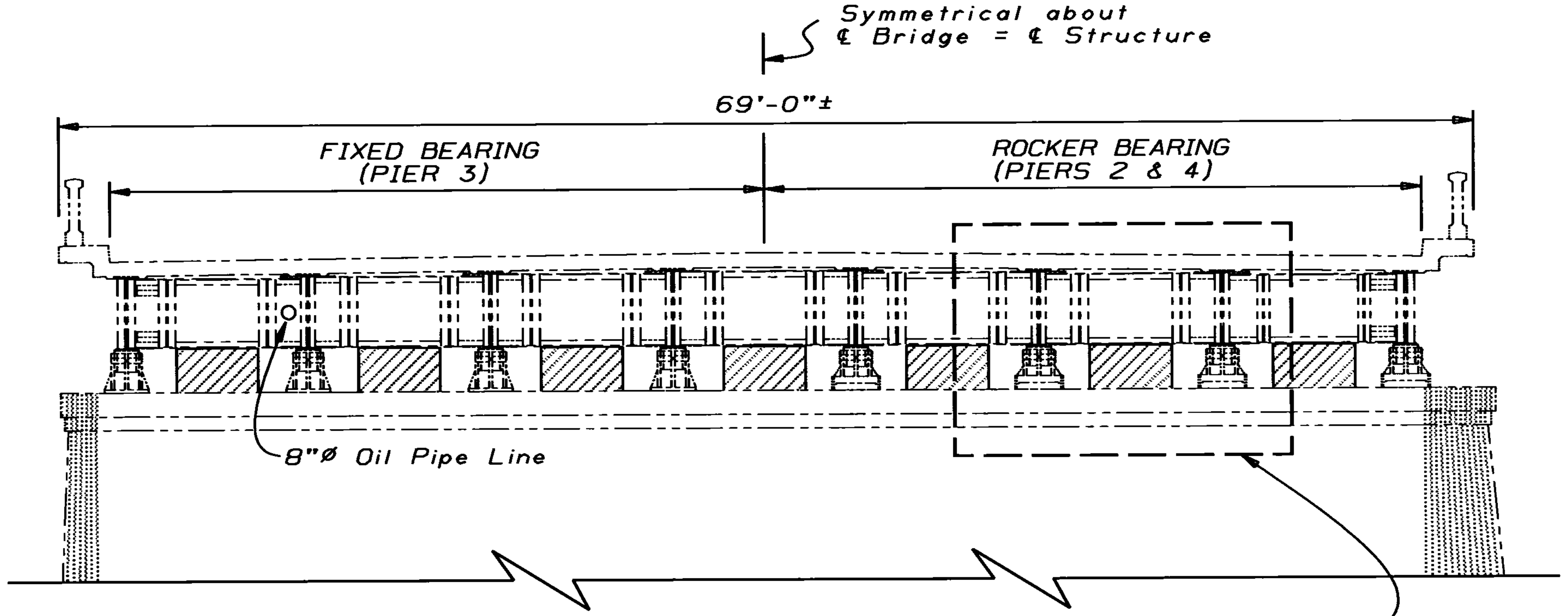
DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	LA	1,90,405	Var	139	167

REGISTERED ENGINEER - CIVIL

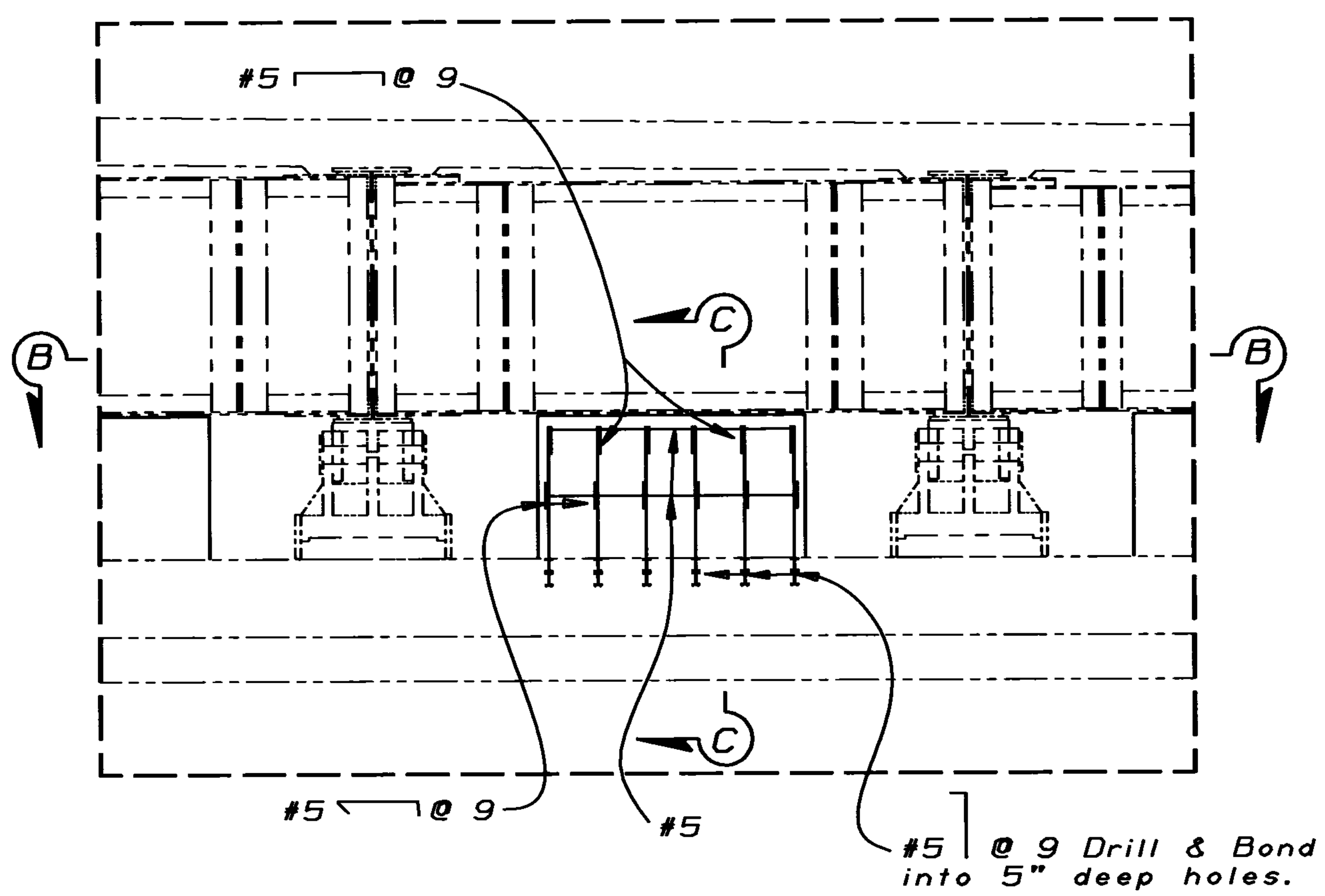
REGISTERED PROFESSIONAL ENGINEER — M.Z. HALEEM — No. 24743 — Exp. 12-31-97 — CIVIL — STATE OF CALIFORNIA

9-19-94
PLANS APPROVAL DATE

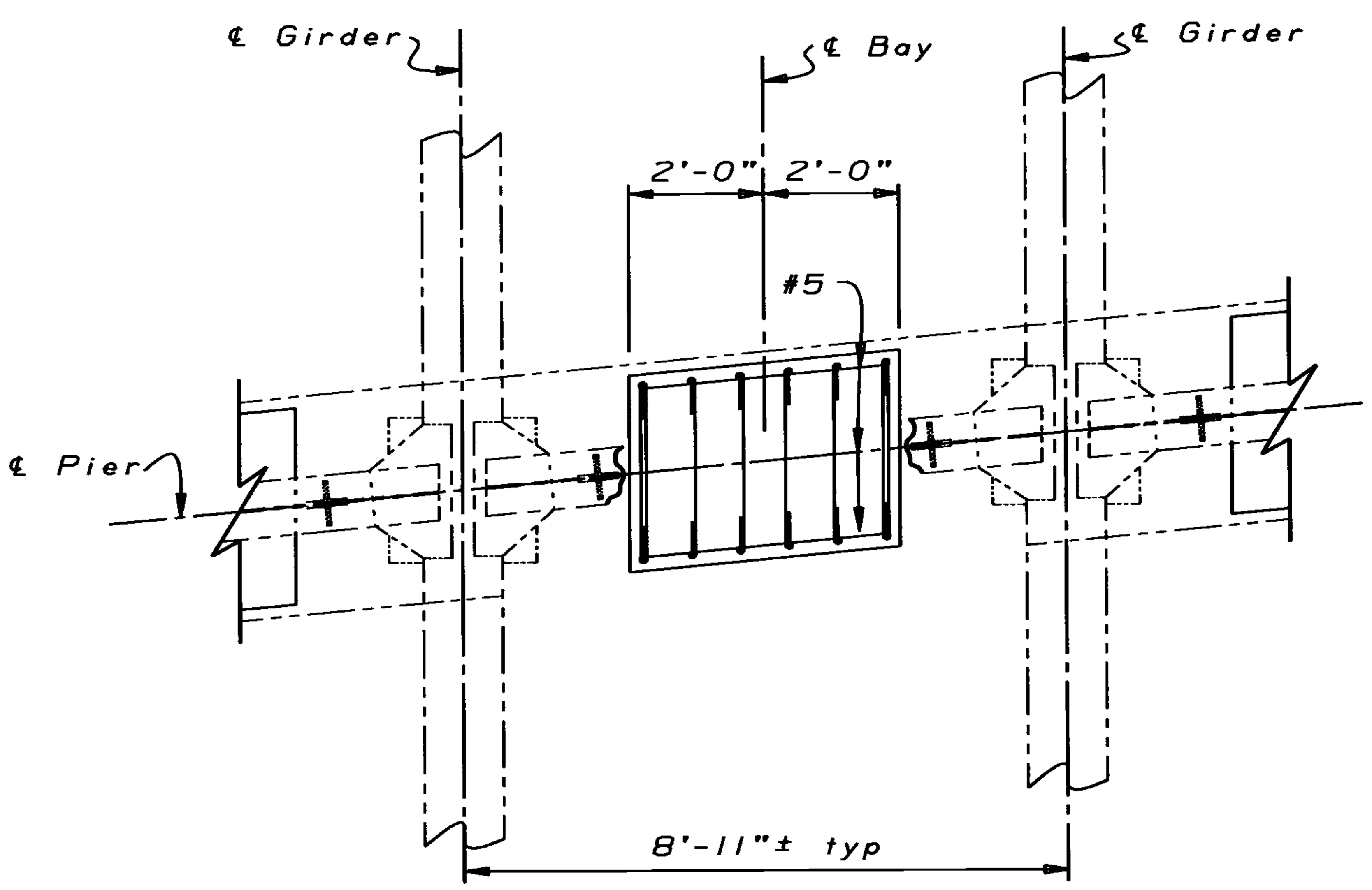
Note:
Details shown are similar for Piers 2, 3, and 4
New concrete pedestals, tot 7 per pier



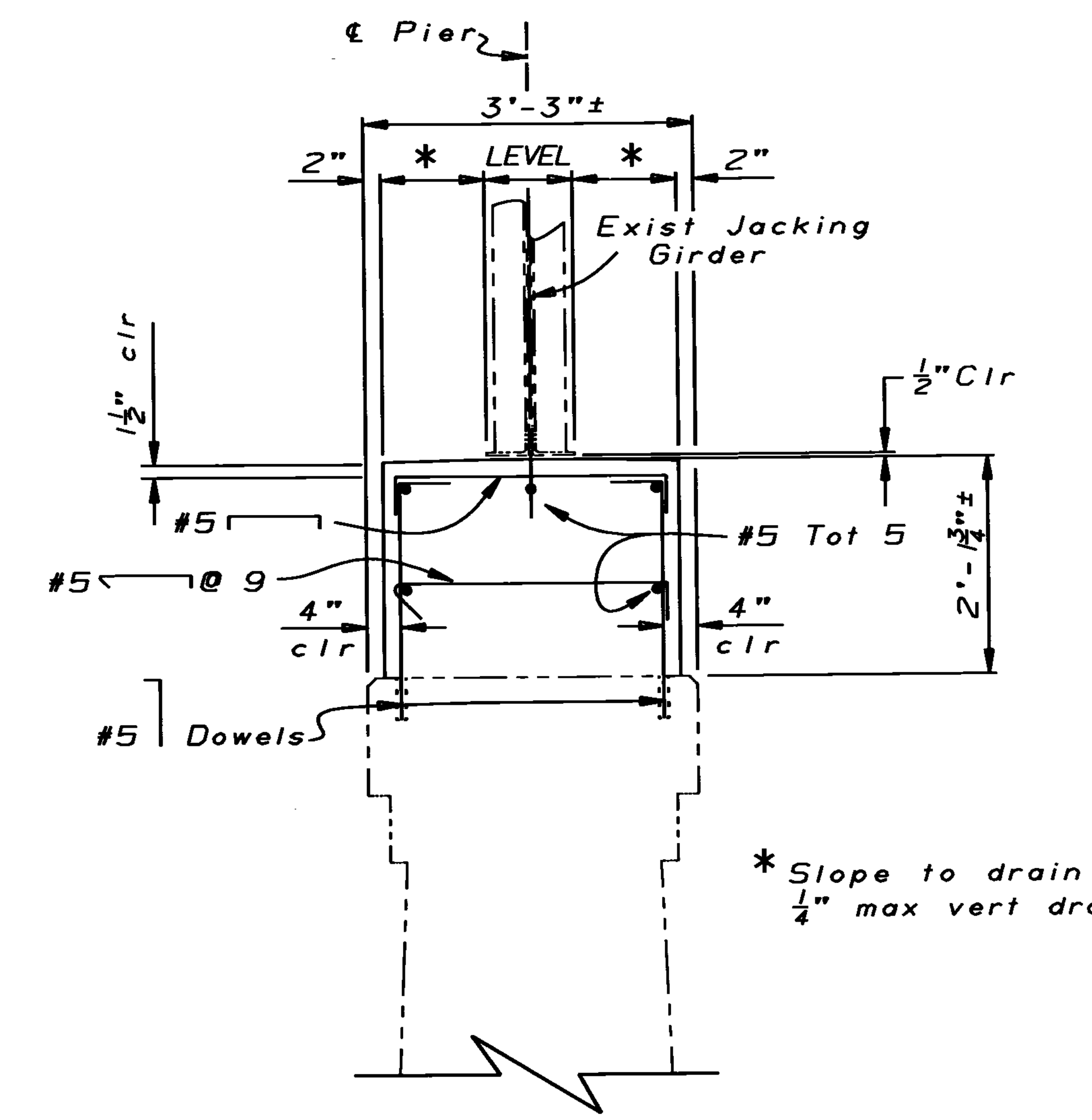
ELEVATION
3/16"=1'-0"



DETAIL "A"
1/2"=1'-0"



SECTION B-B
1/2"=1'-0"



SECTION C-C
3/4"=1'-0"

NO CORRECTIONS THIS SHEET
AS BUILT
CORRECTIONS BY Ho WILL/RJE
CONTRACT NO. 07-119964
DATE 6-12-96/9-9-97

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

EARTHQUAKE RETROFIT PROJECT NO. 198

BALLONA CREEK BRIDGE
PIER DETAILS

	BY	CHECKED
DESIGN	Zak Haleem/B. Wu	Kien T. Le
DETAILS	Dale Kubochi 8-93	Kien T Le
QUANTITIES	Lai Fong	Dae Yoo

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 11

BRIDGE NO. 53-118
POST MILE 30.36

DS OSD 2139 (CADD 4/89)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 07
EA 119961

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 8-17-93, 12-9-93, 12-13-93, 7-5-94, 8-8-94

SHEET 3 OF 3

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION - OFFICE OF COMPUTER SERVICES

JOINTS & DRAINS (BJD)

07-LA-1-9.93-LA

Wilmington OH

CNTY	SUFFIX	BRIDGE NUMBER	SUFFIX
53		352	

1 8

TYPE (1)

UPDATE CODE	JOINT LOCATION	SKEW	JOINT LENGTH	MOVEMENT RATING	JOINT TYPE	YEAR PLACED	JOINT RATING	HEADER TYPE	OVERLAY THICKNESS	HEADER RATING	DATE OF RATINGS MO/YR
11	12	17	19	23	26	28	30	31	32	35	36
	PN001	16	80	0.6	AA	36	6	0	2.0	0	0787
	HA003	16	80	0.6	AA	36	6	0	2.0	0	0787
	HB003	16	80	0.6	AA	36	6	0	2.0	0	0787
	HA006	16	80	0.6	AA	36	6	0	2.0	0	0787
	HB006	16	80	0.6	AA	36	6	0	2.0	0	0787
	PN008	16	80	0.6	AA	36	6	0	2.0	0	0787
				.					.		
				.					.		
				.					.		
				.					.		
				.					.		

TYPE (2)	UPDATE CODE	TEMP. RANGE
	11	12

TYPE (3)	UPDATE CODE	NO. OF DECK DRAINS
	11	15
		000

UPDATE CODE - FOR ADDS AND CHANGES - LEAVE BLANK
FOR DELETES - ENTER 'D'

JOINT LOCATION - P2 = JT.@PIER #2, B12A = PORTION OF JOINT @ BENT #12, H1 = JT@HINGE #1
L2 = LONGITUDINAL JOINT #2

SKEW - OF EACH JOINT TO ONE DEGREE

LENGTH OF JOINT OR SEAL - TO NEAREST FOOT, CURB TO CURB EXCEPT INCLUDE SIDEWALK IF SEALED

MOVEMENT RATING - TO TENTH OF INCH

JT OR SEAL TYPE - AA = TYPE A, BB = TYPE B, MM = TYPE M
SF = STEEL FINGER, SS = STEEL SLIDE PLATES
TR = TRANSFLEX, WF = WABOFLEX, WA = WABO
ALU STRIP, RV = DELASTIFLEX RV, DL = DELASTIFLEX DL,
ALUMINUM = AL, MAUER = MR, OP = OPEN

YEAR SEAL PLACED - YEAR ONLY

HEADER TYPES -
A = REINF. CONCRETE
B = STEEL PLATE
C = METAL TUBING
D = METAL ANGLES
E = POLYESTER STYRENE
F = POLYURETHANE
G = EPOXY MORTAR
H = FONDU
J = SET 45
K = 201

OVERLAY THICKNESS - MAXIMUM TO TENTH OF INCH

DATE OF RATINGS - MONTH, YEAR

CONDITION RATINGS (JOINTS & HEADERS) -
8 = NEW OR NO REPAIRS NEEDED
6 = MINOR REPAIRS NEEDED
4 = MARGINAL CONDITION - GOOD FOR 1 YR.
2 = REPLACE NOW OR AS SOON AS POSSIBLE

TEMPERATURE RANGE - AMBIENT RANGE FOR SITE TO ONE DEGREE

NUMBER OF DECK DRAINS - DO NOT INCLUDE SCUPPER DRAINS

IN CASE OF QUESTION CONTACT:
Name Robert Y. Wong
Phone ATSS640-3718 Date July, 87

— FOR USE BY OFFICE STRUCTURES MAINTENANCE —

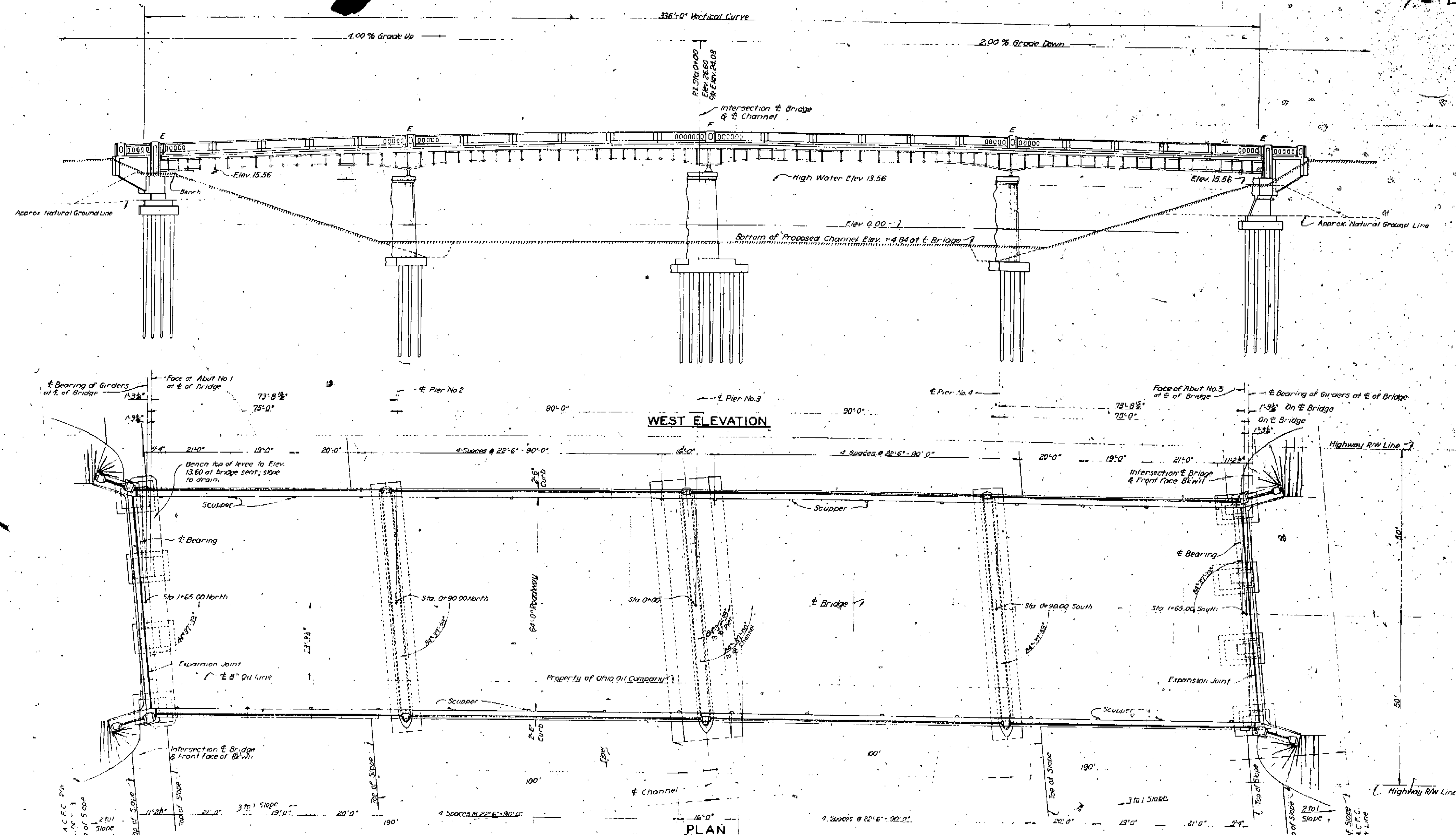
DAS-CS-051

WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY

7-LA-1

①



GENERAL NOTES

All design is based on the use of concrete having an ultimate strength of 3000 lbs. per sq. in.
Floor slab shall be poured as shown on slab details, sheet No 9.
Provide substantial keys at all construction joints.
Exposed edges of concrete shall be beveled ¾" where no other bevel is noted.

PAINT: Shop - All structural metal shall be thoroughly cleaned at the shop and shall receive one shop coat of red lead paint, except metal to be galvanized or encased in concrete, which shall not be painted. Finished surfaces of pins, castings and base plates shall be protected by a coat of white lead and tallow.

Field - All structural metal not encased in concrete shall receive the second and third coats of paint in the field. For surfaces inaccessible after erection, both field coats shall be red lead. For all other surfaces both field coats shall be aluminum.

Payment for shop cleaning and painting shall be included in the unit price bid for the item so cleaned and painted.

Detail shop drawings for all Structural Steel, Cast Steel and Wrought Iron shall be submitted to the Corps of Engineers, U.S. Army, in duplicate and shall be approved before material is ordered or work started.

Quantity of "Bridge Excavation" given is based on assumption that proposed channel excavation is not made.

Quantity of "Bridge Excavation" is estimated as the quantity removed from within vertical planes which are 1 ft outside the neat lines of footings or walls.

Quantity of "Treated Timber Piles" is based on an estimated length of 40 ft. per pile for abutments and 30 ft. for piers.

Where bituminous felt is specified on plans for use in partition or expansion joints, it shall be securely stitched to one face of concrete with copper wire.

Unless otherwise noted, all reinforcing bars shall be lapped a minimum of 50 diameters.

8" oil line to be relocated and erected on bridge by owner.

DESIGN DATA

DESIGN SPECIFICATIONS: A.A.S.H.O. Standard Specifications for Highway Bridges of 1935, modified as indicated on this sheet and the stress sheet.
LIVE LOAD: Highway H-20 A.A.S.H.O. 1935.
FUTURE SIDEWALKS: Structure is designed to support two future 5 ft. sidewalks. See stress sheet.
PILE LOADS: Design of foundations is based upon a maximum pile pressure of 22 tons per pile for vertical loads and a maximum pressure of 25 tons per pile for combinations of vertical and horizontal loads.
SEISMIC FORCE: In addition to the horizontal forces specified in the A.A.S.H.O. Specifications, the structure is designed to withstand a horizontal force in any direction equal to 8 % of the vertical load. This force is applied in combination with dead load plus ½ live load.

TABLE OF ESTIMATED QUANTITIES

ITEM	UNIT	QUANTITY
Bridge Excavation	Cu. Yds.	3,500
Treated Timber Piles	Lin. Ft.	12,400
† Concrete in Piers and Abutments	Cu. Yds.	1,310.3
Concrete in Roadway Slab and Curb	Cu. Yds.	709.7
Concrete in Handrail	Cu. Yds.	43.0
Reinforcing Steel	Lbs.	309,930
* Fabricated Structural Steel	Lbs.	854,000
Cast Steel in Bridge Shoes	Lbs.	30,400
Wrought Iron Scuppers	Lbs.	1,870

See sheet No. 12 for estimated quantities for temporary bridge; this table does not include any quantities for temporary bridge.
* Includes anchor bolts, pins, lead plates under shoes and expansion shields in addition to structural steel in girder spans.
† Concrete in handrail on abutments is included in this item.

#53-118

CONTRACT PLANS
Contract No. ______
Document No. 70001934

Note: This drawing is not to scale, follow dimensions.

FEDERAL PROJ. NO. 13-130 (L.A.C.F.C.D. NO. 1)

DATE	REVISION	REV.	CHK.	APP.
Feb. 6, 1937	Revised quantity of cast steel	H.E.C.	L.F.	B.R.S.

DESIGNED BY
SVERDRUP AND PARCEL
CONSULTING ENGINEERS
ST. LOUIS, MO. LOS ANGELES, CALIF.

LOS ANGELES COUNTY FLOOD CONTROL
BALLONA CREEK
ROOSEVELT HIGHWAY BRIDGE
GENERAL PLAN AND ELEVATION

SHEET NO. 1 OF 13 SHEETS — SCALE AS SHOWN
DATUM IS MEAN SEA LEVEL

U.S. ENGINEER OFFICE. LOS ANGELES, CALIF. JAN. 9, 1937

SUBMITTED BY: [signature]
CAPTAIN, CORPS OF ENGINEERS, U.S. ARMY
CHIEF ENGINEERING DIVISION

APPROVED BY: [signature]
MAJOR, CORPS OF ENGINEERS, U.S. ARMY
DISTRICT ENGINEER

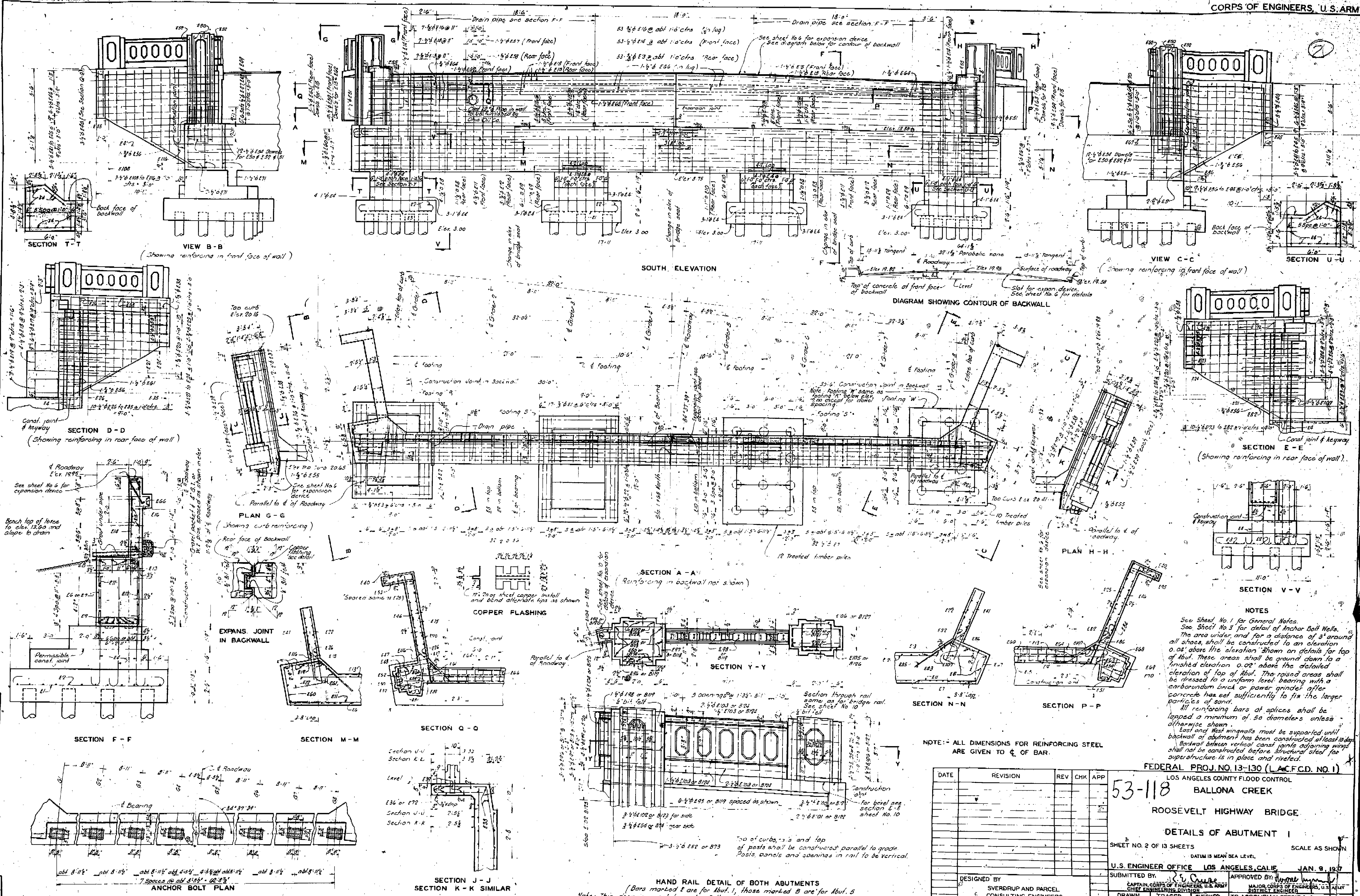
DRAWN	TRACED	CHECKED	TO ACCOMPANY SPECIFICATION
H.E.C.	H.E.C.	L.F.	DATED

SERIAL NO. 2677 1-9-1 FILE NO. 5/52 5

A-550

WAR DEPARTMENT

CORPS OF ENGINEERS, U.S. ARMY



NOTE:- ALL DIMENSIONS FOR REINFORCING STEEL ARE GIVEN TO ℄ OF BAR.

NOTES

See Sheet No. 1 for General Notes.

See Sheet No. 3 for detail of Anchor Bolt Wells.

The area under, and for a distance of 3" around all shoes, shall be constructed to an elevation 0.04' above the elevation shown on details for top of Abut. These areas shall be ground down to a finished elevation 0.02' above the detailed elevation of top of Abut. The raised areas shall be dressed to a uniform level bearing with a carborundum brick or power grinder after concrete has set sufficiently to fix the larger particles of sand.

All reinforcing bars at splices shall be lapped a minimum of 50 diameters unless otherwise shown.

East and West wingwalls must be supported until backwall of abutment has been constructed at least 10 days.

Backwall between vertical const. joints adjoining wings shall not be constructed before structural steel for superstructure is in place and riveted.

FEDERAL PROJ. NO. 13-130 (L.A.C.F.C.D. NO. 1)

DATE	REVISION	REV	CHK	APP

LOS ANGELES COUNTY FLOOD CONTROL

53-118

BALLONA CREEK

ROOSEVELT HIGHWAY BRIDGE

DETAILS OF ABUTMENT 1

SHEET NO. 2 OF 13 SHEETS — SCALE AS SHOWN

DATUM IS MEAN SEA LEVEL

U.S. ENGINEER OFFICE LOS ANGELES, CALIF. JAN. 9, 1937

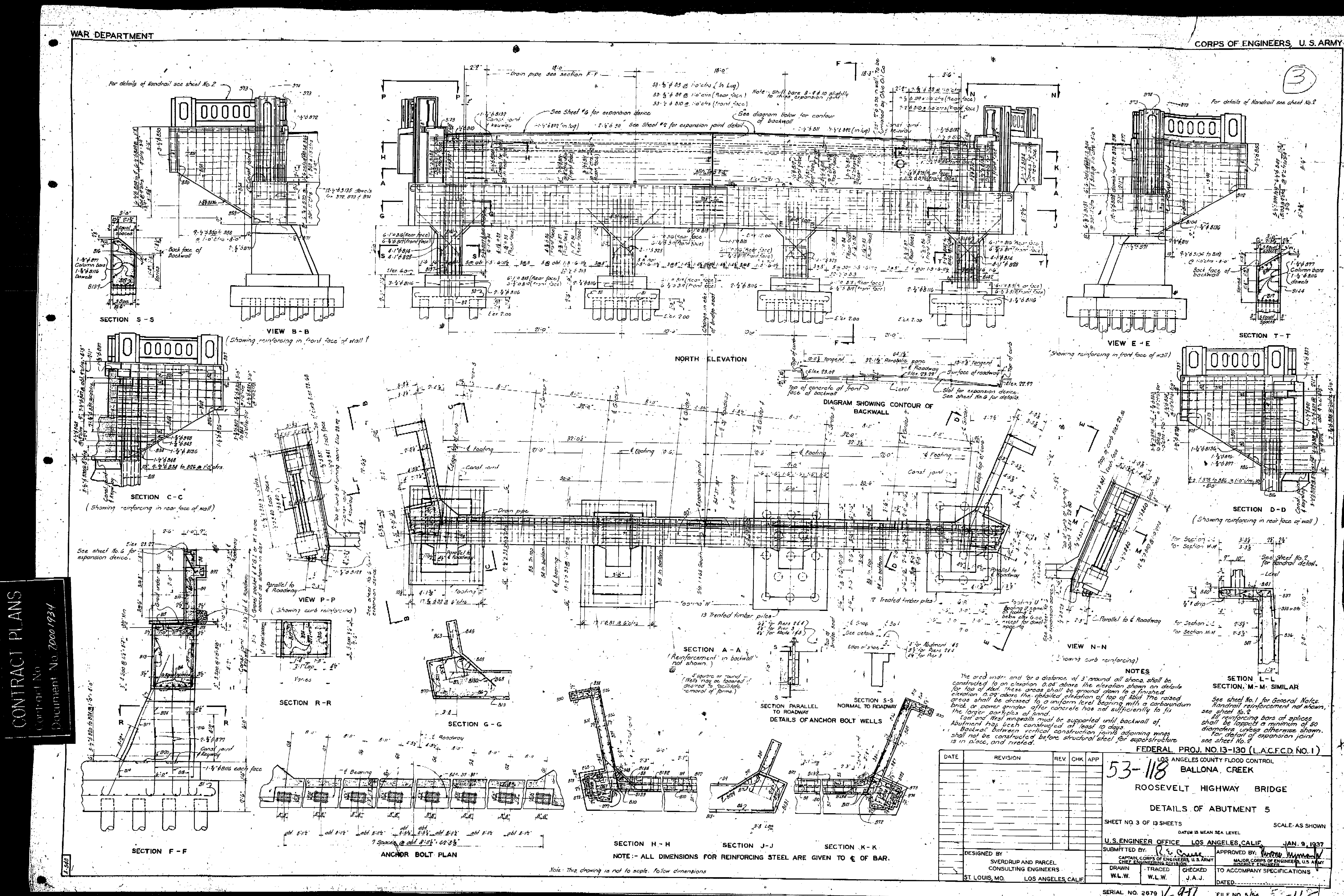
SUBMITTED BY: R. E. Cruse — CAPTAIN, CORPS OF ENGINEERS, U.S. ARMY, CHIEF ENGINEERING DIVISION

APPROVED BY: [signature] — MAJOR, CORPS OF ENGINEERS, U.S. ARMY, DISTRICT ENGINEER

DESIGNED BY SVERDRUP AND PARCEL CONSULTING ENGINEERS, ST. LOUIS, MO. — LOS ANGELES, CALIF.

DRAWN	TRACED	CHECKED	TO ACCOMPANY SPECIFICATIONS
F.H.P.	W.L.W.	J.A.J.	DATED

SERIAL NO. 2678 V [illegible] FILE NO. 5/53 [illegible]

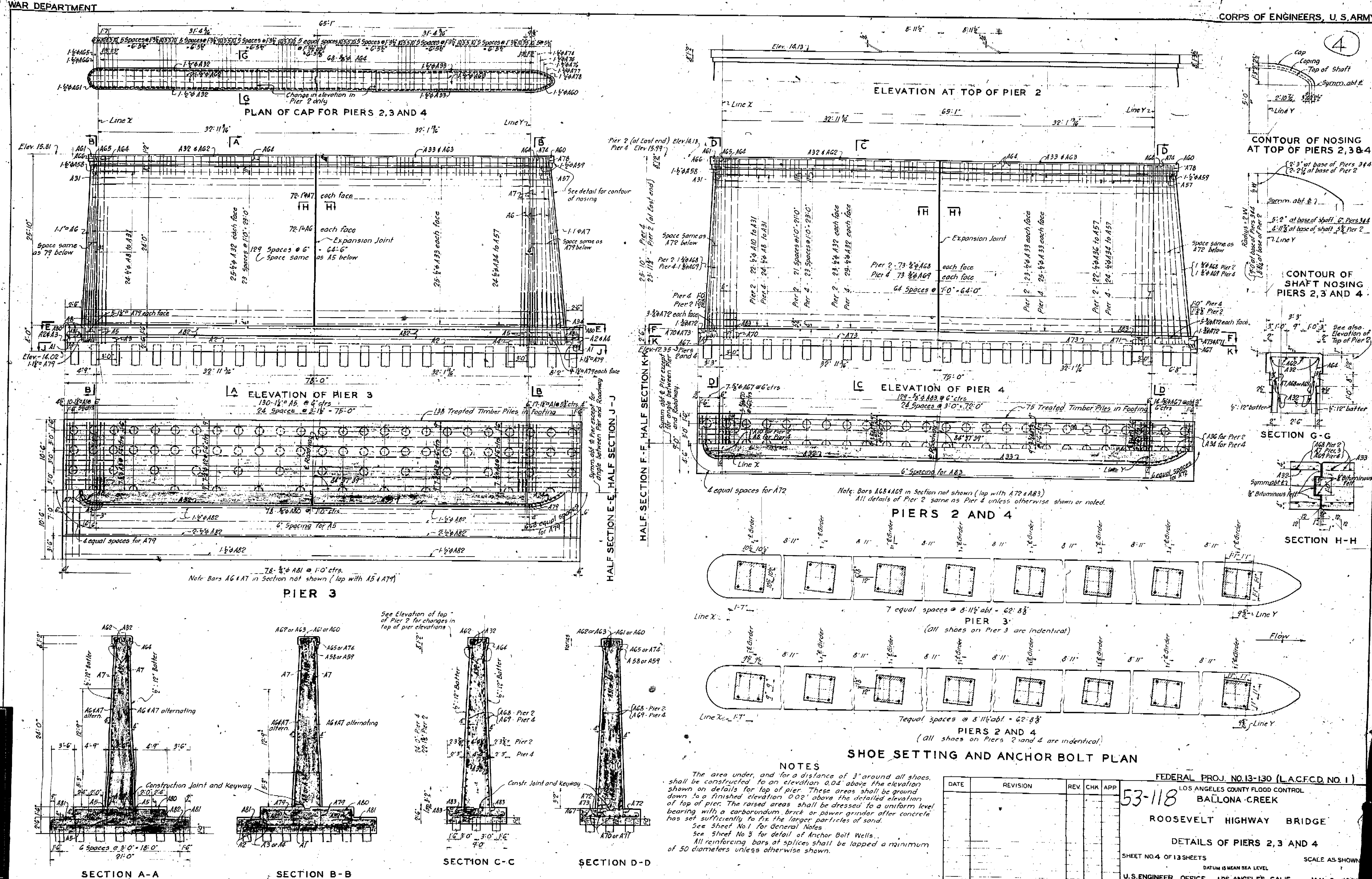


I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE ______ SIGNATURE ______ TITLE ______

WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY



NOTES

The area under, and for a distance of 3" around all shoes, shall be constructed to an elevation 0.04' above the elevation shown on details for top of pier. These areas shall be ground down to a finished elevation 0.02' above the detailed elevation of top of pier. The raised areas shall be dressed to a uniform level bearing with a carborundum brick or power grinder after concrete has set sufficiently to fix the larger particles of sand.

See Sheet No. 1 for General Notes

See Sheet No 3 for detail of Anchor Bolt Wells.

All reinforcing bars at splices shall be lapped a minimum of 50 diameters unless otherwise shown.

NOTE: ALL DIMENSIONS FOR REINFORCING STEEL ARE GIVEN TO ℄ OF BAR.

Note: This drawing is not to scale. Follow dimensions.

DATE	REVISION	REV.	CHK	APP

DESIGNED BY SVERDRUP AND PARCEL CONSULTING ENGINEERS ST. LOUIS, MO. LOS ANGELES, CALIF.

FEDERAL PROJ. NO. 13-130 (L.A.C.F.C.D. NO. 1)

53-118 LOS ANGELES COUNTY FLOOD CONTROL

BALLONA CREEK

ROOSEVELT HIGHWAY BRIDGE

DETAILS OF PIERS 2, 3 AND 4

SHEET NO. 4 OF 13 SHEETS — SCALE AS SHOWN

DATUM IS MEAN SEA LEVEL

U.S. ENGINEER OFFICE LOS ANGELES, CALIF. JAN. 9, 1937

SUBMITTED BY: [signature] CAPTAIN, CORPS OF ENGINEERS, U.S. ARMY CHIEF ENGINEERING DIVISION

APPROVED BY: [signature] MAJOR, CORPS OF ENGINEERS, U.S. ARMY DISTRICT ENGINEER

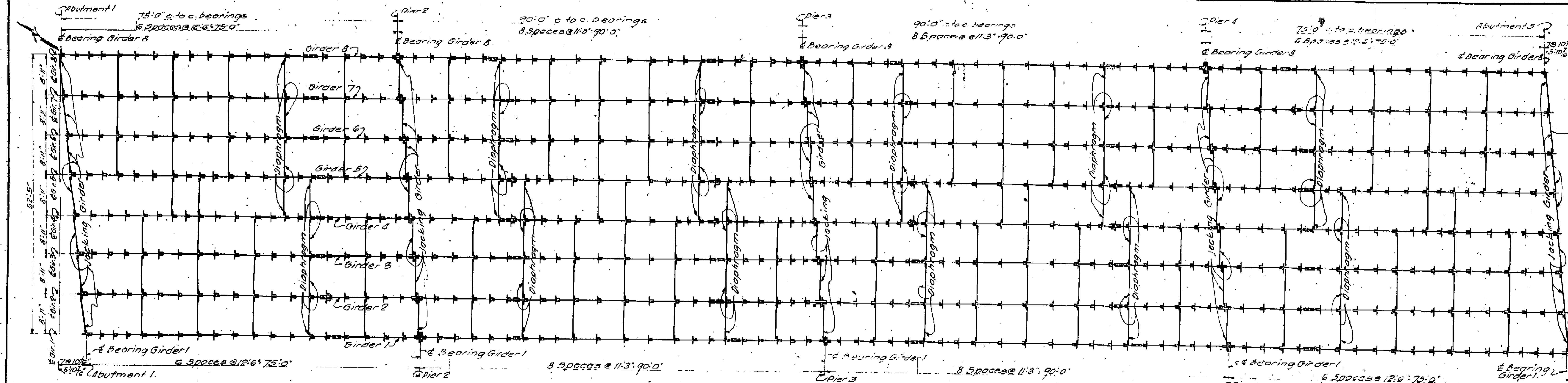
DRAWN	TRACED	CHECKED	TO ACCOMPANY SPECIFICATIONS
F.W.K.	F.W.K.	J.A.J.	DATED

SERIAL NO. 2880 V-917 FILE NO. 5/55 53-118

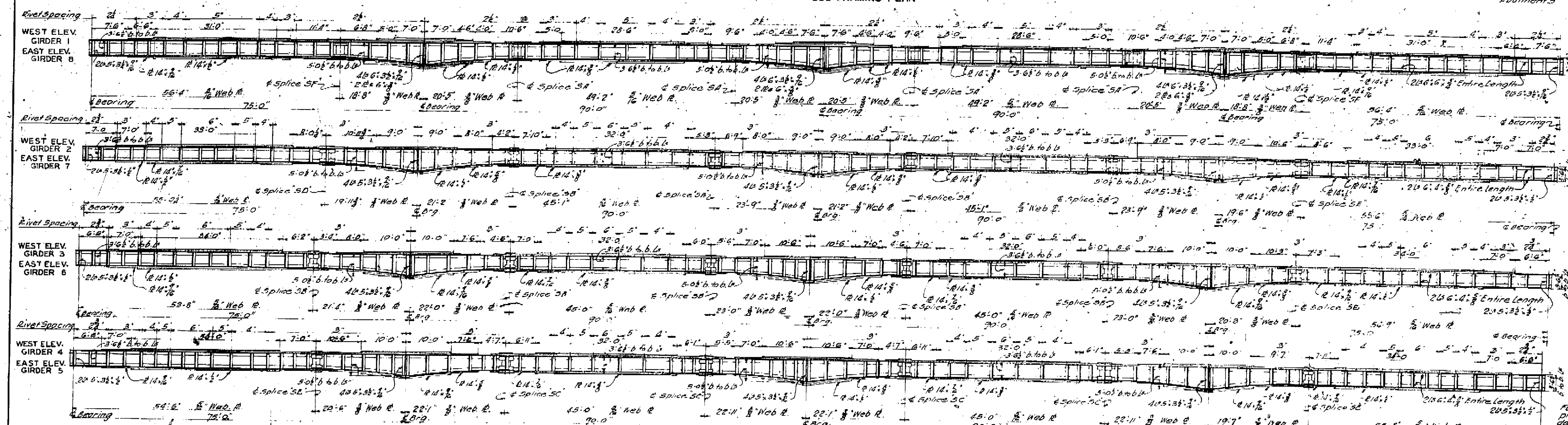
WAR DEPARTMENT

CORPS OF ENGINEERS, U.S. ARMY

(5)



STRUCTURAL STEEL FRAMING PLAN



NOTE All dimensions given in framing plan and in elevations of girders are truly horizontal dimensions at back of top flange Ls.

DESIGN DATA

DESIGN
In accordance with the A.A.S.H.O. Standard Specifications for Highway Bridges for 1935, modified as indicated on this sheet.

LIVE LOAD
Highway H20-A.A.S.H.O. and future sidewalk.

SEISMIC FORCE
In addition to the horizontal forces specified in the A.A.S.H.O. specifications the structure is designed to withstand a horizontal force "S" in any direction equal to 8% of the vertical load. This force is applied in combination with dead load plus ½ live load.

UNIT STRESSES
In accordance with A.A.S.H.O. 1935 specifications except as noted for the following combinations of loading:-
Roadway Slab:-
D.L.+L.L.+I. Concrete 900#/□"
Reinforcing Steel 16000#/□"
Remainder of Superstructure.
D.L.+L.L.+I. 95% Normal Unit Stress.
D.L.+L.L.+I+30# Wind 125% Normal Unit Stress.
D.L.+50# Wind. 125% Normal Unit Stress
D.L.+½(L.L.+I)+S 125% Normal Unit Stress.
Any of above+temperature 133% Nor. Unit Stress.

MATERIALS
All structural steel shall be carbon steel as specified in the Standard Specifications of the American Society for Testing Materials having the serial designation A7-34.

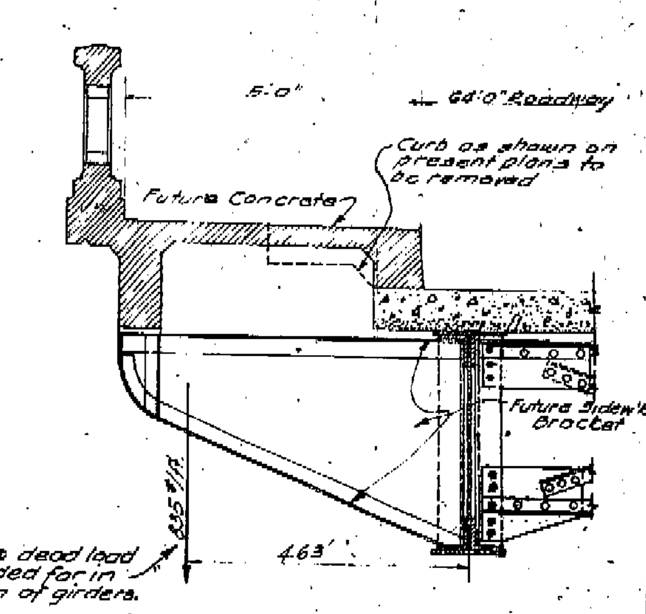
RIVETS
Rivets shall be ⅞" except where otherwise noted.

FIELD CONNECTIONS
Riveted except as noted on details.

FABRICATION
In accordance with A.A.S.H.O. 1935 Specifications for punched work; except that holes for girder splices shall be sub-punched ¾" and reamed to 15/16" in the shop after girder has been assembled and adjusted to the proper cambered position. See accompanying specifications.

SHOP DRAWINGS
Shop drawings for all structural steel and castings shall be submitted to the Contracting Officer and shall be approved before steel is fabricated.

PAINT
See Sheet #1 for notes.



DETAIL OF PROPOSED FUTURE SIDEWALK

NOTE
Line "A" is a line joining the back of top flange Ls at ℄ of bearings on abutments 1 and 5.

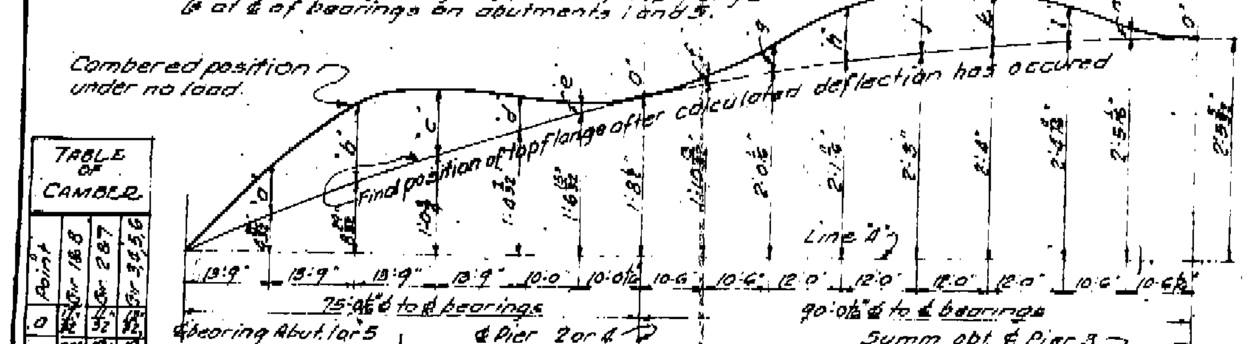


TABLE OF CAMBER

CAMBER DIAGRAM

Back of top flange angles for all girders to be constructed in conformity with this diagram when girders are under no load.

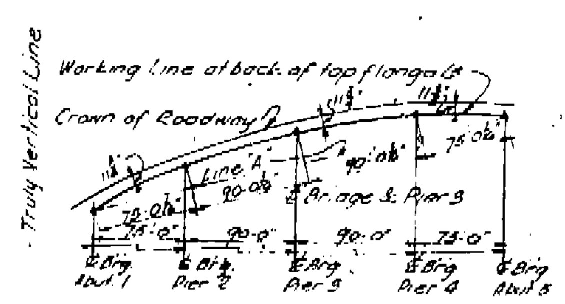
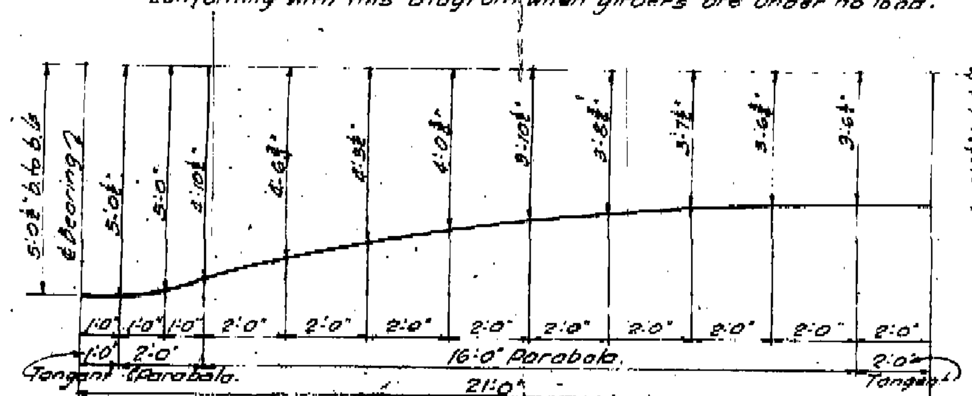


DIAGRAM OF WORKING LINE

NOTES

For details of girders see Sheet #7.
Top and bottom cover plates are the same material and points of cut-off are the same.
Stiffeners at intermediate cross frames are 3½"x4"x5/16" Ls with fills. Other intermediate stiffeners are 3½"x4"x5/16" Ls crimped. In lieu of crimping the fabricator may provide fills at his own expense.
For details of cross frames, diaphragms and jacking girders see Sheet #6.
Position of splices shall be substantially as shown but may be shifted slightly in either direction, if desired by the fabricator.



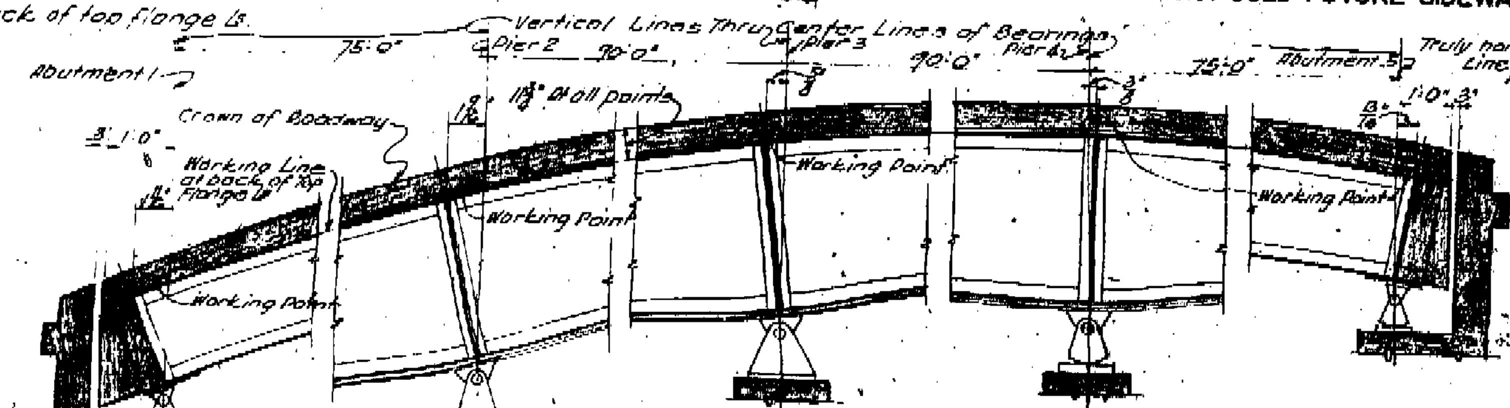
ORDINATES TO CURVED BOTTOM FLANGES AT ALL PIERS

TABLE OF MAXIMUM MOMENTS AND SHEARS

"A" 28'-0" "D" 47'-0" (75'-0") "B" 45'-0" "E" 45'-0" (90'-0") "C" 45'-0" "E" 45'-0" (90'-0") "B" 47'-0" "D" 28'-0" (75'-0") "A"

Moments in ft kips, Shears in kips	ITEM	"A" Shear	"D" Moment	"B" Moment	"B" Shear AB	"B" Shear BC	"E" Moment	"C" Moment	"C" Shear CB
GIRDERS 1 & 8	D.L. includes future walk	65.6	+ 898.7	- 1805.2	113.7	108.8	+ 669.7	- 1695.4	106.3
	L.L. Future Walk	14.2	+ 236.1	- 371.5	20.4	21.5	+ 234.1	- 385.1	21.2
	U.L.L. Roadway	12.9	+ 215.4	- 339.0	18.6	19.6	+ 213.6	- 351.4	19.3
	C.L.L. Roadway	15.25	+ 160.8	- 94.6	15.25	15.25	+ 154.5	- 90.0	15.25
	I	4.85	+ 64.9	- 59.4	4.65	4.75	+ 63.5	- 72.3	5.45
	Total	112.8	+ 1575.9	- 2669.7	172.6	169.9	+ 1335.4	- 2594.2	167.7
GIRDERS 2 & 7	D.L.	39.5	+ 541.8	- 1088.4	68.5	65.6	+ 403.8	- 1022.2	64.1
	U.L.L.	21.9	+ 364.7	- 574.0	31.5	33.3	+ 361.7	- 595.0	32.7
	C.L.L.	25.8	+ 271.6	- 159.8	25.8	25.8	+ 261.0	- 152.0	25.8
	I.	8.3	+ 109.7	- 100.5	7.9	8.1	+ 107.4	- 122.4	9.6
	Total	95.5	+ 1287.8	- 1922.7	133.7	132.8	+ 1133.9	- 1891.6	132.2
GIRDERS 3,4,5 & 6	D.L.	44.5	+ 609.5	- 1224.4	77.1	73.8	+ 454.2	- 1149.9	72.1
	U.L.L.	21.9	+ 364.7	- 574.0	31.5	33.3	+ 361.7	- 595.0	32.7
	C.L.L.	25.8	+ 271.6	- 159.8	25.8	25.8	+ 261.0	- 152.0	25.8
	I.	8.3	+ 109.7	- 100.5	7.9	8.1	+ 107.4	- 122.4	9.6
	Total	100.5	+ 1355.5	- 2058.7	142.3	141.0	+ 1184.3	- 2019.3	140.2

NOTE This drawing is not to scale. Follow dimensions.



WORKING DIMENSIONS OF GIRDERS

DATE	REVISION	REV.	CHK.	APP.
2-5-37	Note on Optional Web Splice Removed	W.L.W.	L.F.	B.R.S.

FEDERAL PROJ. NO. 13-130 (L.A.C.F.C.D. NO. 1)

53-118

LOS ANGELES COUNTY FLOOD CONTROL

BALLONA CREEK

ROOSEVELT HIGHWAY BRIDGE

STRESS SHEET-SUPERSTRUCTURE

SHEET NO. 5 OF 13 SHEETS — SCALE AS SHOWN

DATUM IS MEAN SEA LEVEL

U.S. ENGINEER OFFICE LOS ANGELES, CALIF. JAN. 9, 1937

DESIGNED BY: SVERDRUP AND PARCEL CONSULTING ENGINEERS, ST. LOUIS, MO. LOS ANGELES, CALIF.

SUBMITTED BY: R. E. Cruse — CAPTAIN, CORPS OF ENGINEERS, U.S. ARMY, CHIEF ENGINEERING DIVISION

APPROVED BY: [signature] — MAJOR, CORPS OF ENGINEERS, U.S. ARMY, DISTRICT ENGINEER

DRAWN A.J.S. | TRACED A.J.S. | CHECKED L.F.

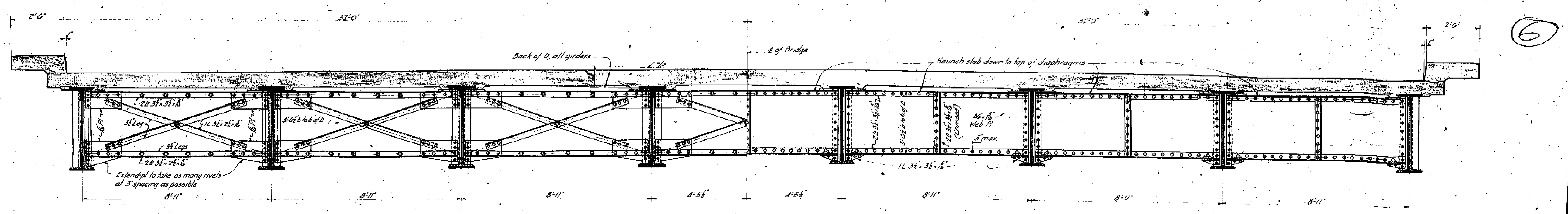
TO ACCOMPANY SPECIFICATIONS DATED ......

SERIAL NO. 2681 V-9-11 FILE NO. 5/56 53-118

4560

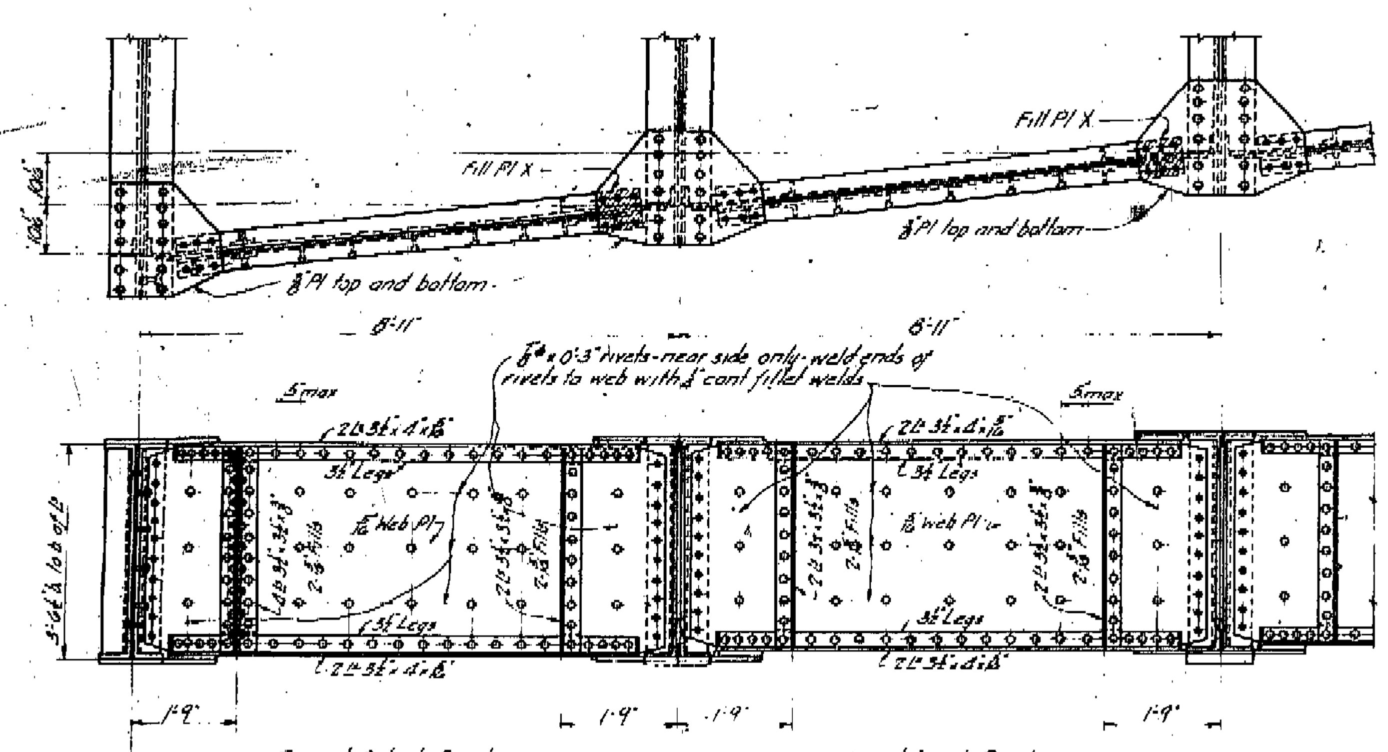
WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY

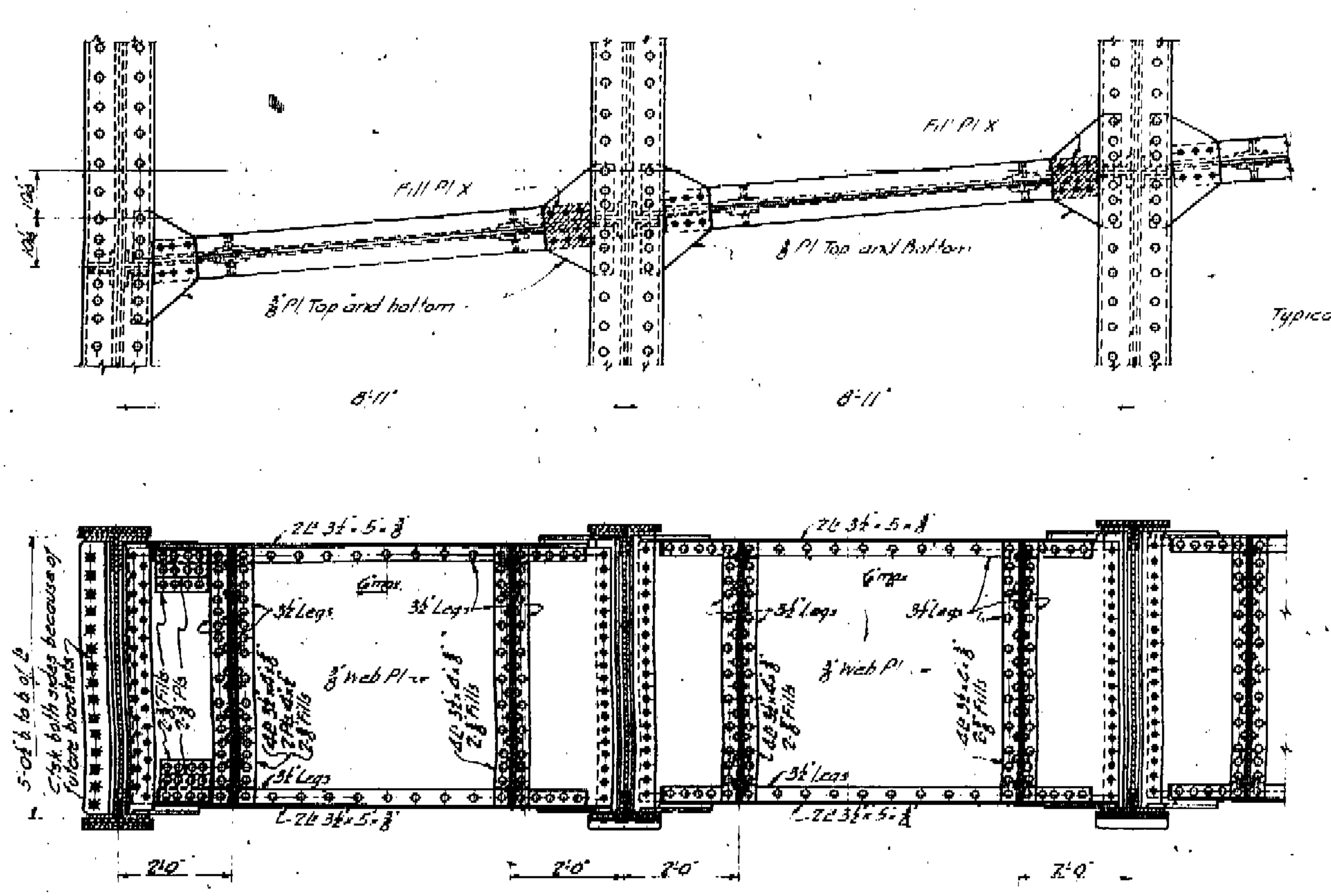


HALF CROSS SECTION SHOWING CROSS FRAMES
(All cross frames are the same except as shown and except at pipe support)

HALF CROSS SECTION SHOWING DIAPHRAGMS
(All diaphragms are the same except at pipe support)



JACKING GIRDERS OVER ABUTMENTS 1 AND 5



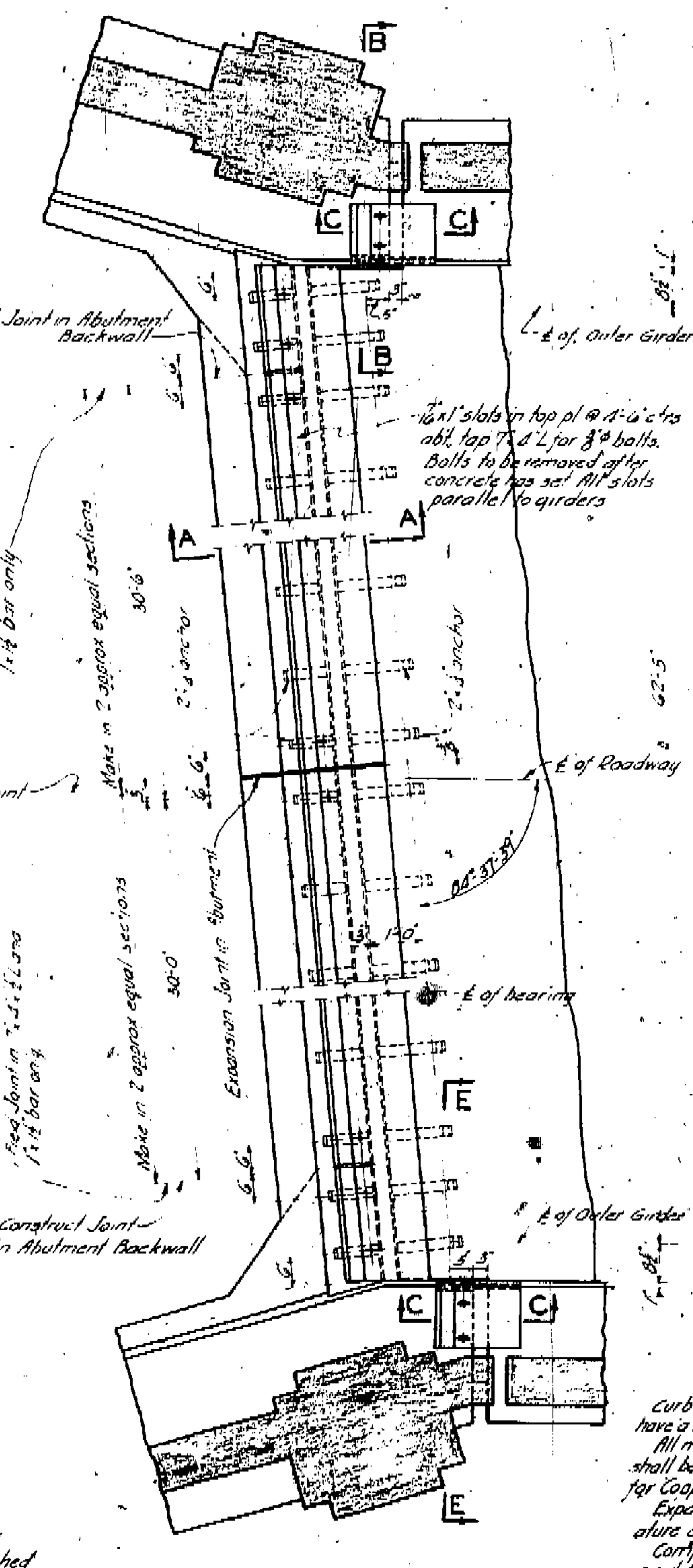
JACKING GIRDERS OVER PIERS 2, 3 AND 4

All stiffeners on jacking girders shall be milled to bear top and bottom. Fills under these stiffeners shall be shop welded to web with 3×1/4" fillet welds at 6" ctrs, each edge of fill.

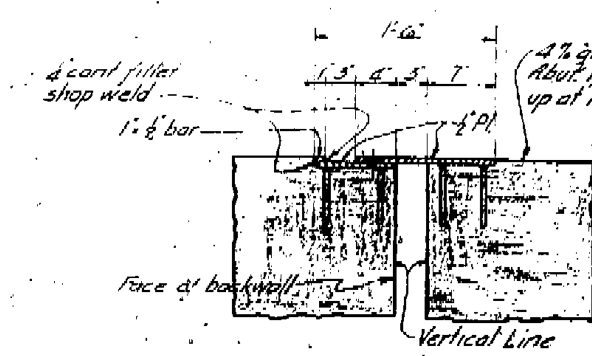
Fills shown are minimum fills required to keep flanges of jacking girders horizontal; if desirable for duplication, fabricator may increase thickness of fills.

THICKNESS OF FILLS X ON JACKING GIRDERS											
Location		ABUT. 1		PIER 2		PIER 3		PIER 4		ABUT. 5	
		East End	West End	East End	West End	East End	West End	East End	West End	East End	West End
At Panel 1-2	Top	0	3/8"	0	1/8"	0	0	3/16"	0	1/16"	0
	Bottom	3/8"	0	3/8"	0	1/4"	0	0	0	0	3/16"
At Panel 7-8	Top	0	3/8"	0	3/8"	0	1/4"	0	0	3/16"	0
	Bottom	3/8"	0	1/8"	0	0	0	0	3/16"	0	3/16"
At All other Panels	Top	0	3/8"	0	1/4"	0	1/8"	0	0	1/16"	0
	Bottom	3/8"	0	1/4"	0	1/8"	0	0	0	0	3/16"

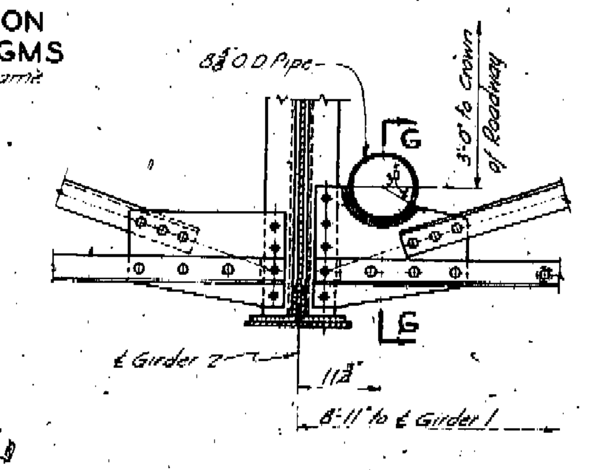
Shop weld fill plates X to gussets with cont. fillet weld



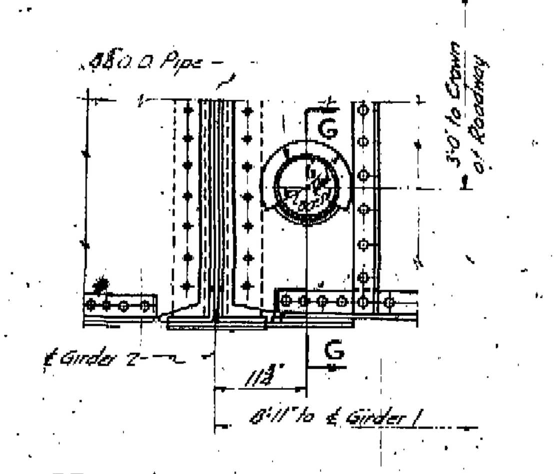
DETAILS OF EXPANSION DEVICES AT ABUTMENTS 1 AND 5



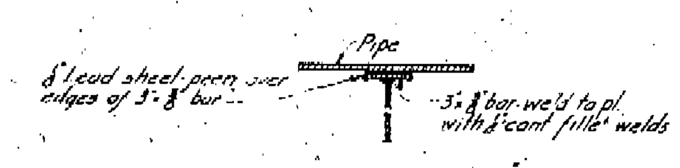
SECTION C-C



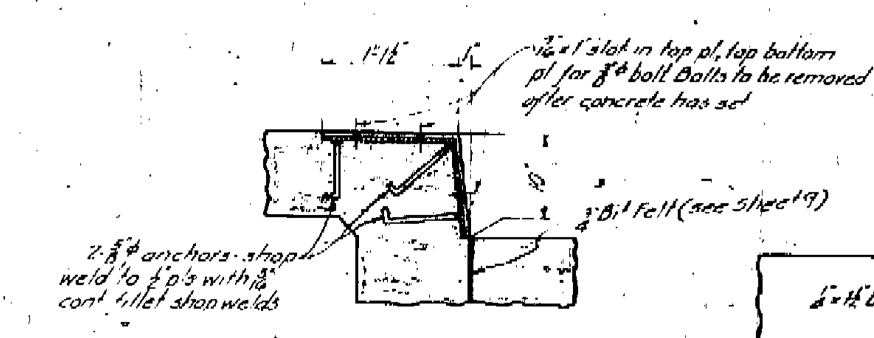
DETAILS OF PIPE SUPPORT AT CROSS FRAMES



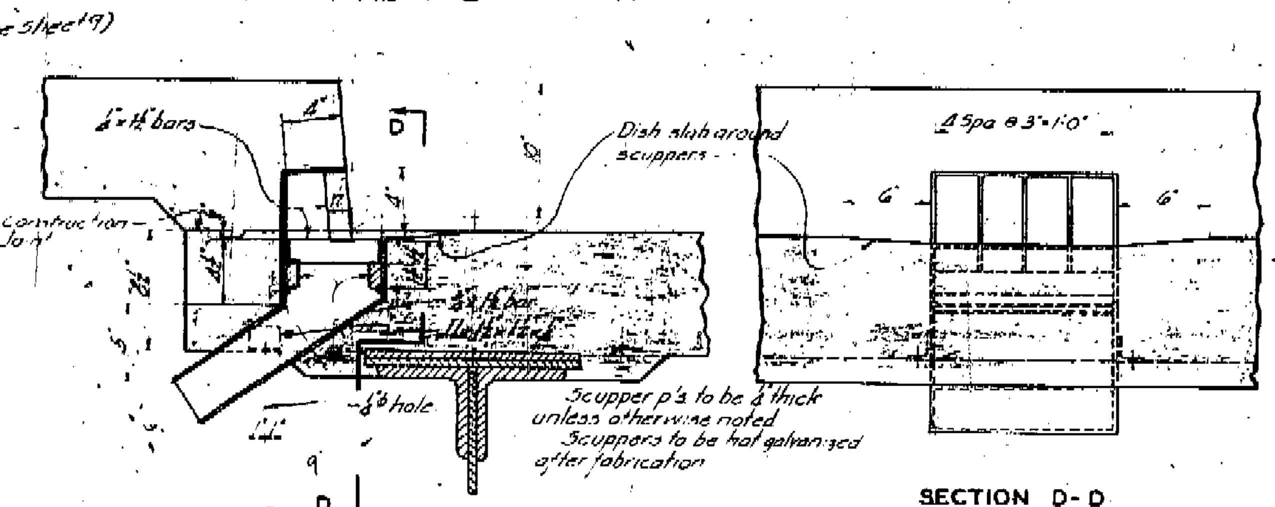
DETAILS OF PIPE SUPPORT AT DIAPHRAGMS & JACKING GIRDERS



PART SECTION G-G



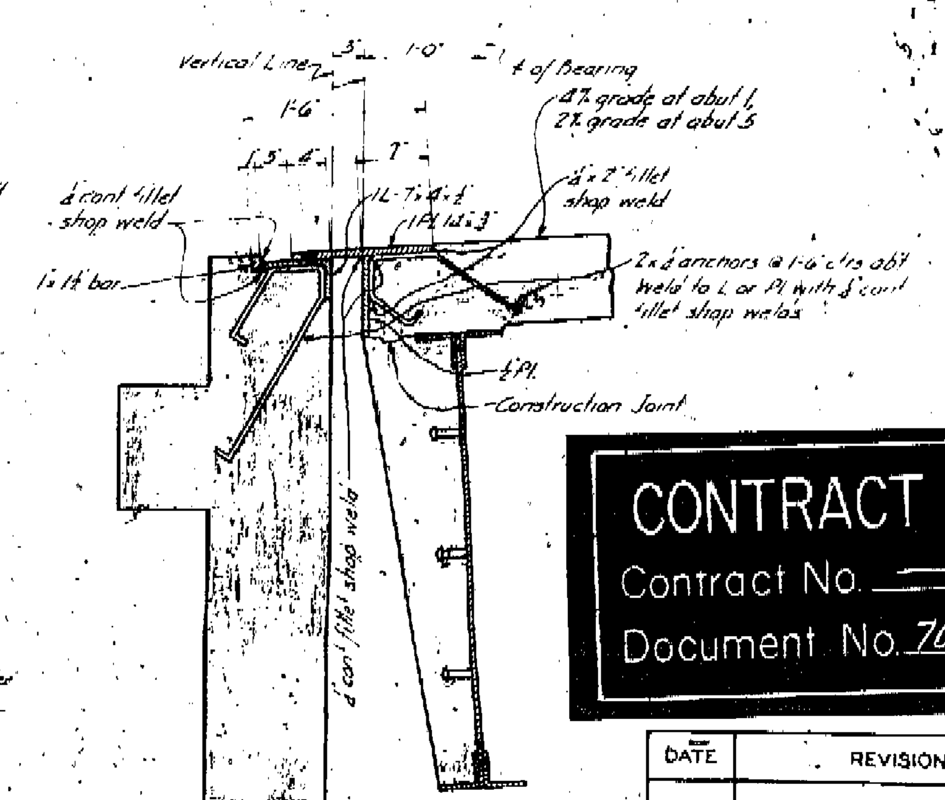
PART SECTION B-B
SECTION E-E OPP. HAND



SECTION D-D

DETAIL OF SCUPPERS
(32 Required)

See sheet #1 for location of scuppers.
All material in scuppers to be wrought iron.
Scuppers to be shop welded throut with 1/4" continuous welds.
Longitudinal curb reinforcing to be bent around scuppers where necessary. Vertical curb bars to be re spaced about scuppers using the same number of bars as indicated on concrete details.
Wrought iron plates shall conform to A.S.T.M. specifications, Serial Designation A42-35T.
Wrought iron bars and angles shall conform to A.S.T.M. specifications, Serial Designation A41-30.
Hot galvanizing shall conform to A.S.T.M. specifications, Serial Designation A123-33.



SECTION A-A

Curb expansion device to be so fabricated that the five 1/4" plates will have a snug fit and slide freely, one over the other.
All material in expansion devices (except anchors and 3/4" bolts) shall be copper bearing steel and shall conform to A.S.T.M. specifications for Copper Steel, Serial Designation A7-34.
Expansion devices are shown in normal position at a temperature of 70° Fahrenheit.
Complete expansion devices, including copper steel, shall be paid for at the contract unit price for "Fabricated Structural Steel".
Roadway expansion device shall be shaped to conform accurately to surface of roadway.
The bearing surfaces shall have a snug fit and slide freely.

NOTES

See sheet #1 for General Notes
See sheet #7 for additional steel details
All rivets 7/8" ⌀ unless otherwise noted
Lead sheets for pipe supports are not included in "Fabricated Structural Steel" but shall be furnished in connection with the placing of pipes.

Note: This drawing is not to scale. Follow dimensions.

CONTRACT PLANS
Contract No. ______
Document No. 70001934

FEDERAL PROJ. NO. 13-130 (L.A.C.F.C.D. NO. 1.)

DATE	REVISION	REV.	CHK.	APP.

53-118

LOS ANGELES COUNTY FLOOD CONTROL
BALLONA CREEK
ROOSEVELT HIGHWAY BRIDGE
TYPICAL CROSS SECTION & MISC. DETAILS

SHEET NO. 6 OF 13 SHEETS. SCALE AS SHOWN
DATUM IS MEAN SEA LEVEL

U.S. ENGINEER OFFICE LOS ANGELES, CALIF. JAN. 9, 1937

SUBMITTED BY: CAPTAIN, CORPS OF ENGINEERS, U.S. ARMY, CHIEF ENGINEERING DIVISION
APPROVED BY: MAJOR, CORPS OF ENGINEERS, U.S. ARMY, DISTRICT ENGINEER

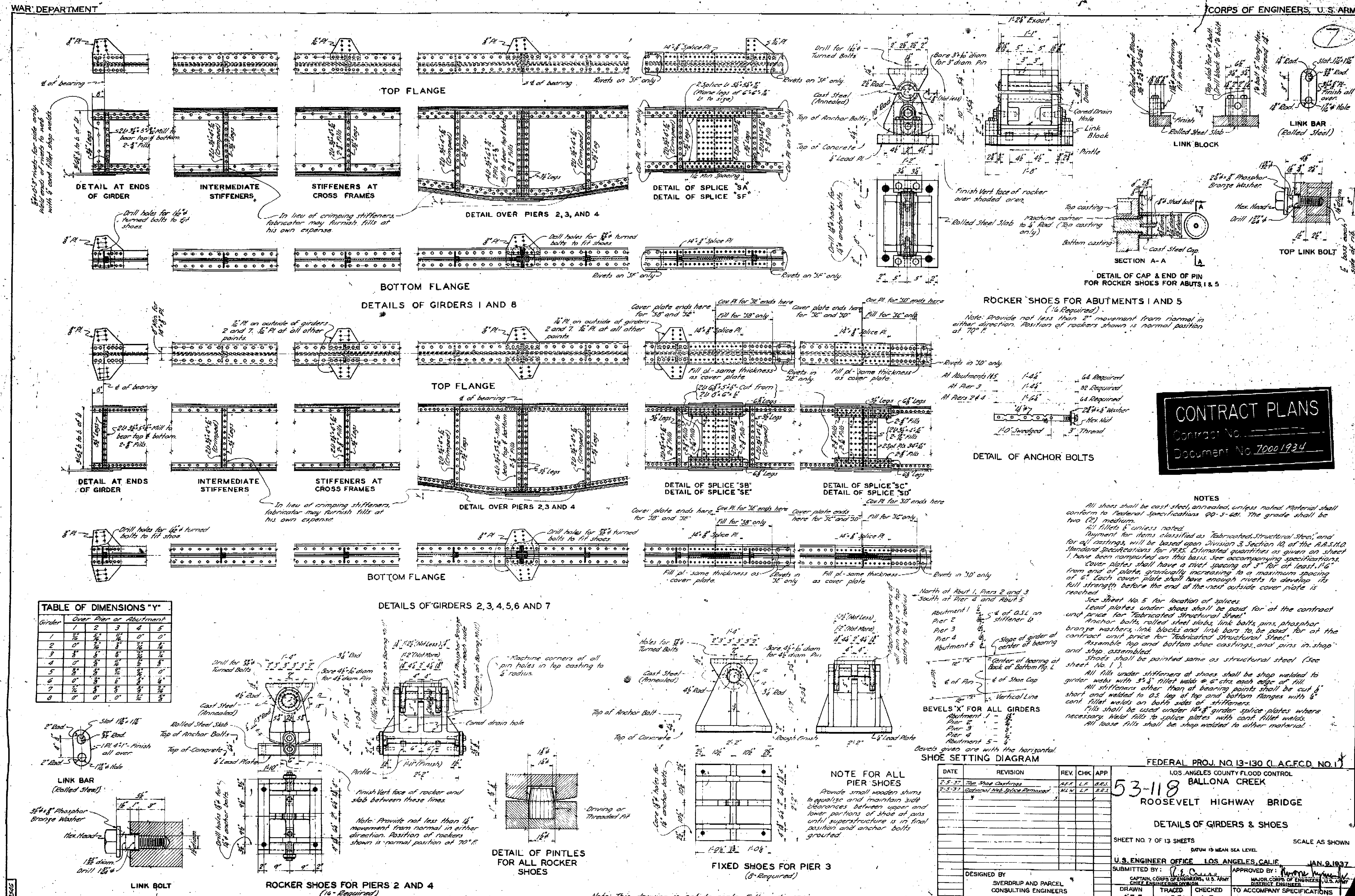
DESIGNED BY SVERDRUP AND PARCEL CONSULTING ENGINEERS, ST. LOUIS, MO. LOS ANGELES, CALIF.

DRAWN A.E.F. | TRACED H.A.T. | CHECKED L.F.

TO ACCOMPANY SPECIFICATIONS DATED ______

SERIAL NO. 2682 V-977 FILE NO. 5/57

WAR DEPARTMENT — CORPS OF ENGINEERS, U. S. ARMY



CONTRACT PLANS
Contract No.
Document No. 70001934

TABLE OF DIMENSIONS "Y"

Girder	Over Pier or Abutment				
	1	2	3	4	5
1	7/16"	5/16"	11/16"	0"	0"
2	0"	7/16"	7/8"	7/16"	1/16"
3	3/8"	1/8"	3/4"	7/16"	7/16"
4	0"	5/8"	11/16"	1/2"	5/8"
5	3/8"	3/8"	9/16"	9/16"	0"
6	0"	3/8"	1/2"	5/8"	1/4"
7	7/16"	5/8"	7/8"	3/4"	7/16"
8	0"	0"	0"	7/16"	5/8"

NOTES

All shoes shall be cast steel, annealed, unless noted. Material shall conform to Federal Specifications QQ-S-681. The grade shall be two (2) medium.

All fillets 1/8" unless noted.

Payment for items classified as "Fabricated Structural Steel," and for all castings, will be based upon Division 3, Section 10, of the A.A.S.H.O. Standard Specifications for 1935. Estimated quantities as given on sheet 1 have been computed on this basis. See accompanying specifications.

Cover plates shall have a rivet spacing of 3" for at least 1'-6" from end of plate, gradually increasing to a maximum spacing of 6". Each cover plate shall have enough rivets to develop its full strength before the end of the next outside cover plate is reached.

See sheet No. 5 for location of splices.

Lead plates under shoes shall be paid for at the contract unit price for "Fabricated Structural Steel."

Anchor bolts, rolled steel slabs, link bolts, pins, phosphor bronze washers, link blocks and link bars to be paid for at the contract unit price for "Fabricated Structural Steel."

Assemble top and bottom shoe castings, and pins in shop and ship assembled.

Shoes shall be painted same as structural steel (See sheet No. 1).

All fills under stiffeners at shoes shall be shop welded to girder webs with 3" x 1/4" fillet welds @ 6" ctrs. each edge of fill.

All stiffeners other than at bearing points shall be cut 1/8" short and welded to O.S. leg at top and bottom flanges with 1/4" cont. fillet welds on both sides of stiffeners.

Fills shall be used under 14" x 3/8" girder splice plates where necessary. Weld fills to splice plates with cont. fillet welds.

All loose fills shall be shop welded to other material.

FEDERAL PROJ. NO. 13-130 (L.A.C.F.C.D. NO. 1)

DATE	REVISION	REV.	CHK.	APP.
2-5-37	Top Shoe Castings	A.E.F.	L.F.	B.B.S.
2-5-37	Optional Web Splice Removed	M.L.W.	L.F.	B.B.S.

DESIGNED BY
SVERDRUP AND PARCEL
CONSULTING ENGINEERS
ST. LOUIS, MO. LOS ANGELES, CALIF.

LOS ANGELES COUNTY FLOOD CONTROL

53-118

BALLONA CREEK

ROOSEVELT HIGHWAY BRIDGE

DETAILS OF GIRDERS & SHOES

SHEET NO. 7 OF 13 SHEETS — SCALE AS SHOWN

DATUM IS MEAN SEA LEVEL

U.S. ENGINEER OFFICE LOS ANGELES, CALIF. JAN. 9, 1937

SUBMITTED BY: [signature] CAPTAIN, CORPS OF ENGINEERS, U.S. ARMY, CHIEF, ENGINEERING DIVISION

APPROVED BY: [signature] MAJOR, CORPS OF ENGINEERS, U.S. ARMY, DISTRICT ENGINEER

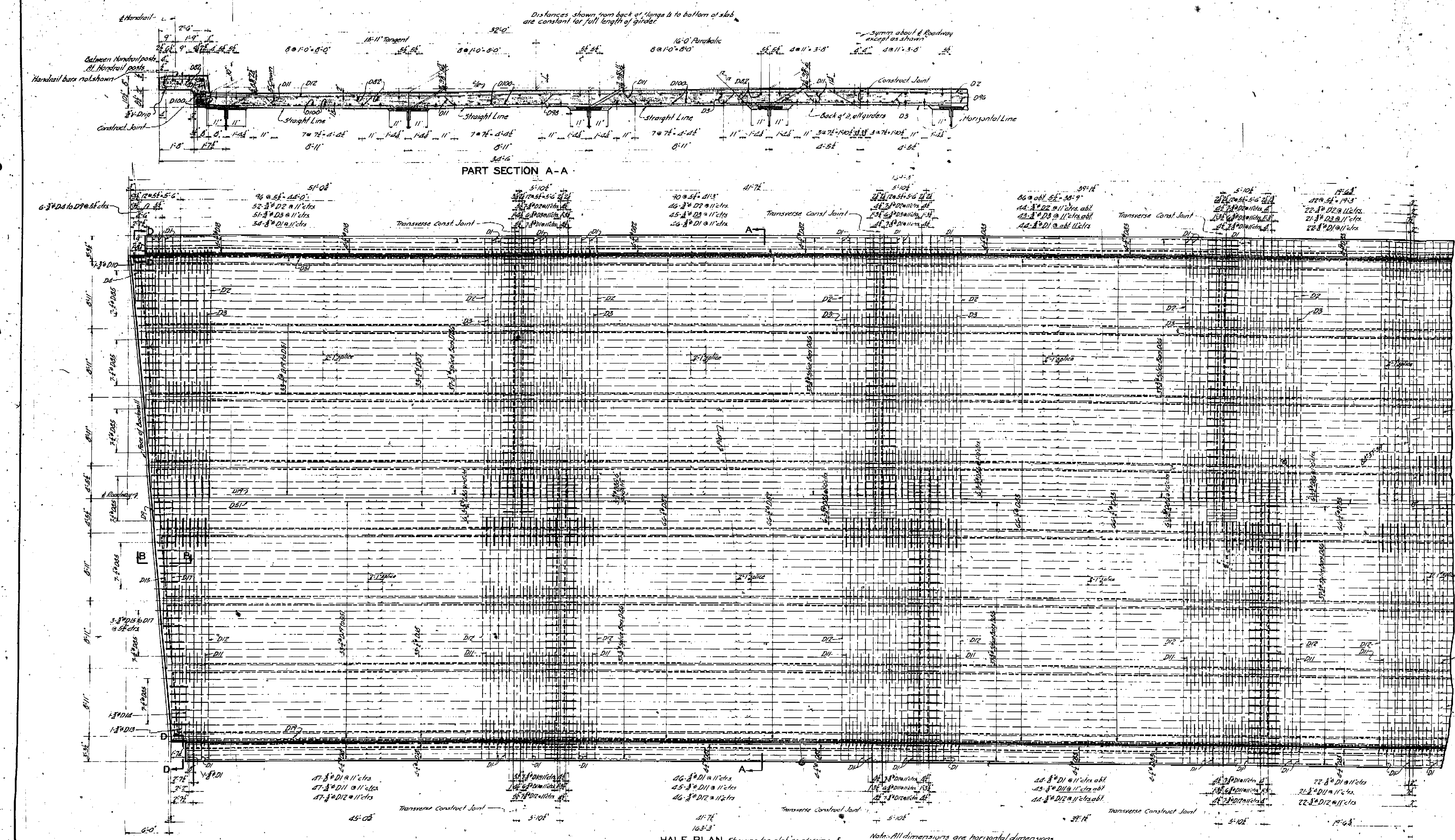
DRAWN	TRACED	CHECKED	TO ACCOMPANY SPECIFICATIONS
A.E.F.	A.E.F.	L.F.	DATED

SERIAL NO. 2683 V-9-17 FILE NO. 5/58 53-118

WAR DEPARTMENT

CORPS OF ENGINEERS, U.S. ARMY

(8)



CONTRACT PLANS
Contract No. ______
Document No. 7200/1934

NOTES
See Sheet #1 for General Notes
All spliced bars shall lap a minimum of 50 diameters
All bars at end of slab shall be moved or bent slightly in field where necessary to clear expansion device.
See Sheets #5, 6 and #7 for details at girders and expansion device.
Bend bars in slab and curb where necessary to clear scuppers. See Sheet #6 for scupper details.
See Sheet #9 for bottom slab reinforcing, pouring diagram, Section B-B, Section D-D and section thru transverse slab joint.
See Sheet #10 for handrail details.

NOTE: ALL DIMENSIONS FOR REINFORCING STEEL ARE GIVEN TO ℄ OF BAR

Note: This drawing is not to scale. Follow dimensions

DATE	REVISION	REV	CHK	APP

DESIGNED BY
SVERDRUP AND PARCEL
CONSULTING ENGINEERS
ST. LOUIS, MO. LOS ANGELES, CALIF

FEDERAL PROJ. NO. 13-130 (L.A.C.F.C.D. NO. 1)

LOS ANGELES COUNTY FLOOD CONTROL

53-118 BALLONA CREEK

ROOSEVELT HIGHWAY BRIDGE

SLAB DETAILS

SHEET NO. 8 OF 13 SHEETS SCALE AS SHOWN

DATUM IS MEAN SEA LEVEL

U.S. ENGINEER OFFICE LOS ANGELES, CALIF. JAN. 9, 1937

SUBMITTED BY: R. E. Cruse
CAPTAIN, CORPS OF ENGINEERS, U.S. ARMY
CHIEF ENGINEERING DIVISION

APPROVED BY: [signature]
MAJOR, CORPS OF ENGINEERS, U.S. ARMY
DISTRICT ENGINEER

DRAWN	TRACED	CHECKED
G. F.	H. A. T.	L. F.

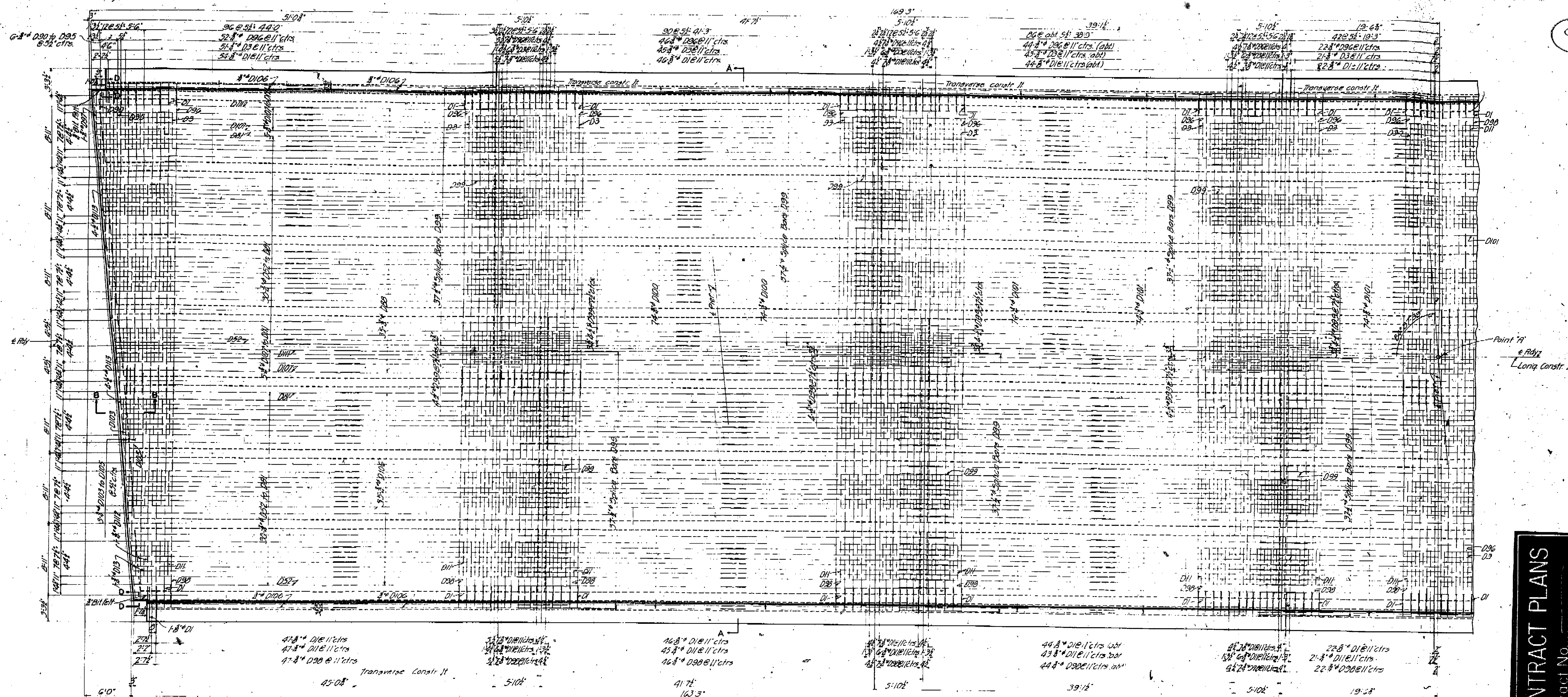
TO ACCOMPANY SPECIFICATIONS
DATED ______

SERIAL NO. 2884 V-977 FILE NO. 5/59 53-118

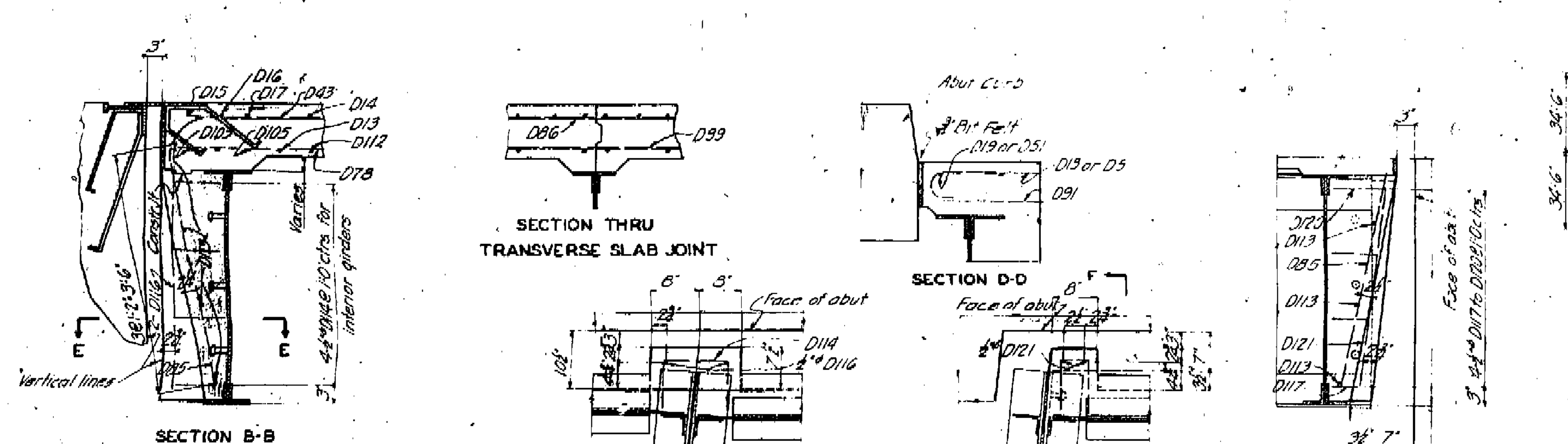
WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY

(9)



HALF PLAN Showing bottom slab reinforcing
Note slab and reinforcing symmetrical about point A by rotation
All dimensions are horizontal dimensions.



SECTION B-B
Long. Girder not shown.
Leave opening for oil pipe in concrete encasement of jacking girder; opening to be same size and location as on jacking girder.

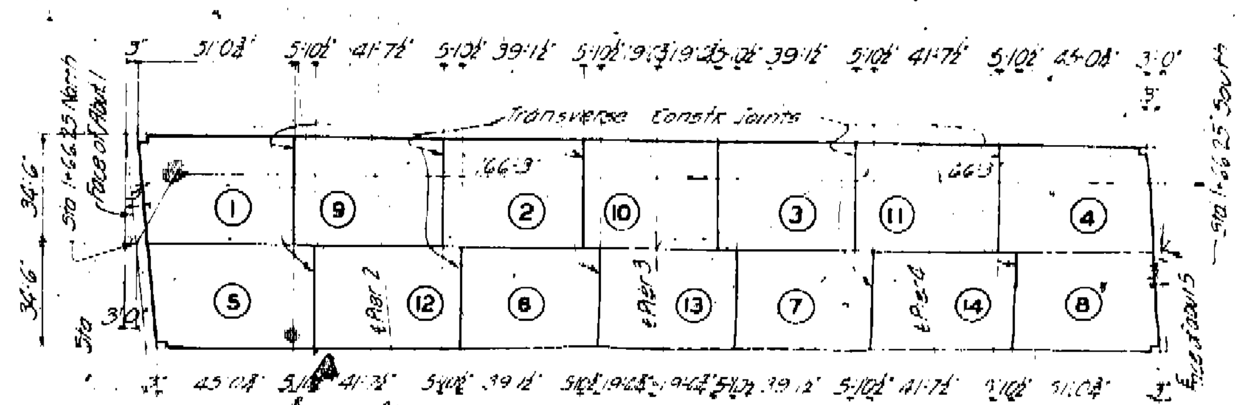
SECTION THRU TRANSVERSE SLAB JOINT

PART SECTION E-E
Showing encasement at ends of interior girders

SECTION D-D

PART SECTION E-E
Showing encasement at ends of outside girders

PART SECTION F-F
Cut bars D113 where necessary in field to clear long. and jacking girders.



SEQUENCE FOR POURING SLAB

If desirable from the standpoint of construction the "Sequence for Pouring Slab" may be varied by eliminating certain portions of the longitudinal construction joint and pouring adjacent sections simultaneously, that is pour section 5 with section 1, section 6 with section 2, section 7 with section 3, section 8 with section 4, section 9 with section 12, section 10 with section 13 and section 11 with section 14.

NOTE ALL DIMENSIONS FOR REINFORCING STEEL ARE GIVEN TO ℄ OF BAR.

NOTES
See sheet #1 for general notes
All spliced bars shall lap a minimum of 50 diameters
All bars in end of slab shall be moved slightly in field where necessary to clear expansion device.
See sheets #5 & #7 for details of structural steel and exp. device.
Bend bars in slab and curb where necessary to clear scuppers. See sheet #6 for scupper details.
See sheet #8 for top slab reinforcing and section AA.
See sheet #10 for handrail details

This drawing is not to scale. Follow dimensions.

DATE	REVISION	REV.	CHK.	APP

DESIGNED BY
SVERDRUP AND PARCEL
CONSULTING ENGINEERS
ST. LOUIS, MO. LOS ANGELES, CALIF.

FEDERAL PROJ. NO. 13-130 (L.A.C.F.C.D. NO. 1)
LOS ANGELES COUNTY FLOOD CONTROL
53-118 BALLONA CREEK
ROOSEVELT HIGHWAY BRIDGE
SLAB DETAILS
SHEET NO. 9 OF 13 SHEETS SCALE AS SHOWN
- DATUM IS MEAN SEA LEVEL
U.S. ENGINEER OFFICE LOS ANGELES, CALIF. JAN. 9, 1937
SUBMITTED BY: R. E. Cruse
CAPTAIN, CORPS OF ENGINEERS, U.S. ARMY, CHIEF ENGINEERING DIVISION
APPROVED BY: [signature]
MAJOR, CORPS OF ENGINEERS, U.S. ARMY, DISTRICT ENGINEER

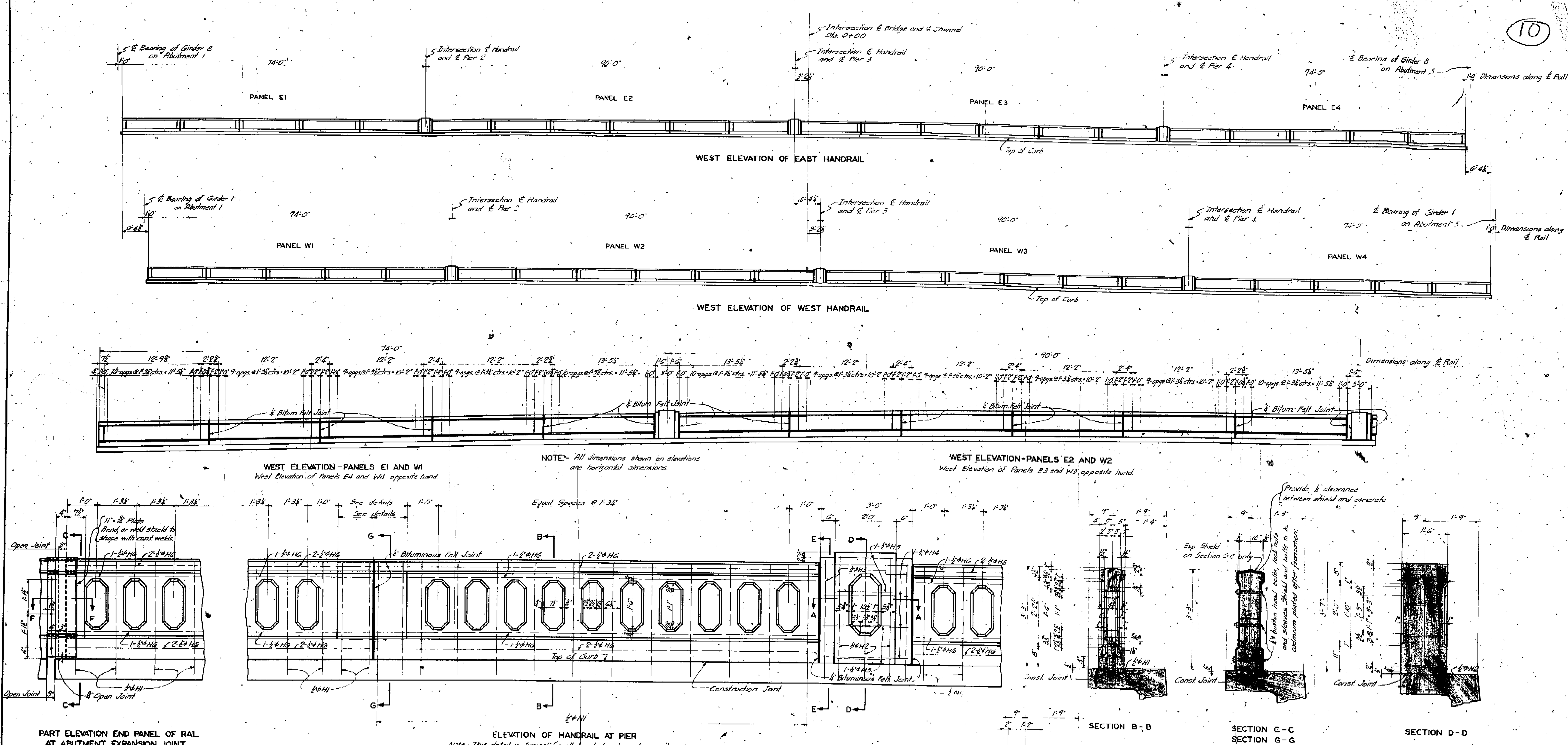
DRAWN	TRACED	CHECKED	TO ACCOMPANY SPECIFICATIONS
G.F.	G.F.	L.F.	DATED

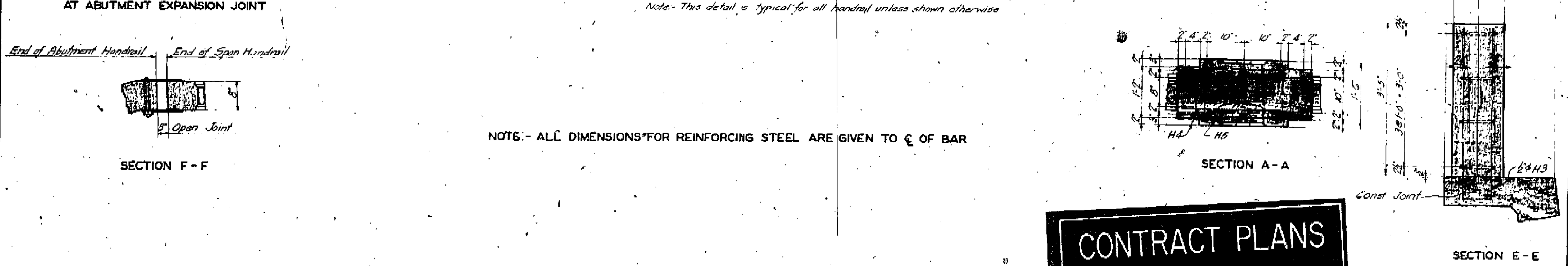
SERIAL NO. 2885 V-917 FILE NO. 5/60 53-118

WAR DEPARTMENT

CORPS OF ENGINEERS, U.S. ARMY

(10)





NOTES

See Sheet No. 1 for General Notes.

Top of curb, rails and tops of posts shall be constructed parallel to grade. Posts, sub-posts, panels and openings in rail to be vertical.

Metal shields at expansion joints and the bolts and sleeves for same shall be paid for at the contract unit price for "Fabricated Structural Steel."

Cadmium Plating shall conform to the requirements of "Tentative Specifications for Electro-deposited Coating of Cadmium on Structural Steel," A.S.T.M. serial designation A165-35T (Type N.S.)

Note:- This drawing is not to scale. Follow dimensions.

DATE	REVISION	REV.	CHK.	APP.

DESIGNED BY SVERDRUP AND PARCEL CONSULTING ENGINEERS, ST. LOUIS, MO. LOS ANGELES, CALIF.

FEDERAL PROJ. NO. 13-130 (L.A.C.F.C.D. NO. 1)

LOS ANGELES COUNTY FLOOD CONTROL

53-118 BALLONA CREEK

ROOSEVELT HIGHWAY BRIDGE

DETAILS OF HANDRAILING

SHEET NO. 10 OF 13 SHEETS — SCALE AS SHOWN

DATUM IS MEAN SEA LEVEL

U.S. ENGINEER OFFICE LOS ANGELES, CALIF. JAN. 9, 1937

SUBMITTED BY: R. E. Cruse — CAPTAIN, CORPS OF ENGINEERS, U.S. ARMY, CHIEF ENGINEERING DIVISION

APPROVED BY: MAJOR, CORPS OF ENGINEERS, U.S. ARMY, DISTRICT ENGINEER

DRAWN	TRACED	CHECKED	TO ACCOMPANY SPECIFICATIONS
J.M.W.	J.M.W.	L.F.	DATED

SERIAL NO. 2886 V-947 — FILE NO. 5/61 53-118

CONTRACT PLANS
Contract No.
Document No. 70001934

WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY

ABUTMENT 1

Mark	No. Req'd	Size	Length	Shape	Location
E1	38	3/4	13'-5"	Bent	Footing
E2	46	3/4	10'-2"	do	do
E3	34	3/4	12'-2"	do	do
E4	58	1	9'-10"	do	do
E5	4	3/4	6'-8"	Straight	Bridgeseat
E6	32	do	12'-8"	Bent	do
E7	32	do	12'-7"	do	do
E8	10	1	40'-1"	do	do
E9	14	1	27'-0"	Straight	do
E10	7	do	28'-2"	do	do
E11	8	3/4	37'-5"	do	do
E12	6	do	36'-0"	do	do
E13	60	3/4	10'-5"	do	do
E14	64	3/4	7'-9"	do	do
E15	29	do	30'-0"	do	do
E16	60	3/4	4'-11"	Bent	do
E17	6	3/4	7'-7"	do	do
E18	4	do	7'-7"	do	do
E19	3	do	7'-3"	do	do
E20	14	do	7'-0"	do	Wingwall
E21	2	do	6'-5"	do	do
E22	2	do	8'-8"	do	do
E23	2	do	9'-6"	do	do
E24	2	do	11'-5"	do	do
E25	8	do	8'-3"	do	do
E26	1	do	7'-4"	Straight	do
E27	1	do	7'-2"	do	do
E28	1	do	6'-8"	do	do
E29	1	do	6'-1"	do	do
E30	1	do	5'-7"	do	do
E31	1	do	5'-0"	do	do
E32	1	do	4'-5"	do	do
E33	1	do	3'-11"	do	do
E34	1	do	3'-5"	do	do
E35	1	do	3'-3"	do	do
E36	12	3/4	9'-8"	Bent	do
E37	4	3/4	13'-6"	Straight	do
E38	4	3/4	13'-11"	Bent	do
E39	10	3/4	11'-3"	Straight	do
E40	12	do	5'-1"	do	do
E41	2	do	5'-6"	do	do
E42	2	do	6'-9"	do	do
E43	2	do	8'-0"	do	do
E44	2	do	9'-3"	do	do
E45	2	do	10'-6"	do	do
E46	12	do	12'-2"	do	do
E47	6	do	9'-10"	Bent	Pilaster
E48	6	do	6'-5"	do	do
E49	6	do	7'-2"	do	do
E50	6	do	9'-11"	Straight	do
E51	6	do	6'-6"	do	do
E52	12	do	9'-9"	do	do
E53	4	do	10'-0"	Bent	Wingwall
E54	24	do	4'-2"	Straight	Pilaster
E55	4	do	5'-1"	Bent	do
E56	4	do	7'-6"	do	Wingwall
E57	1	3/4	4'-3"	Straight	Backwall
E58	1	3/4	7'-0"	do	do
E59	18	3/4	6'-6"	do	do
E60	6	3/4	13'-0"	Bent	Bridgeseat
E61	3	3/4	9'-7"	Straight	Backwall
E62	1	do	5'-10"	do	do
E63	10	do	4'-6"	do	do
E64	4	3/4	10'-2"	Bent	do
E65	1	3/4	22'-2"	Straight	do
E66	4	do	26'-2"	do	do
E67	6	3/4	12'-2"	Bent	Bridgeseat
E68	6	3/4	9'-10"	do	Pilaster
E69	6	do	6'-1"	do	do
E70	6	do	7'-2"	do	do
E71	4	do	4'-10"	Straight	Bridgeseat
E72	12	3/4	9'-8"	Bent	Wingwall
E73	1	3/4	3'-3"	Straight	do
E74	1	do	3'-5"	do	do
E75	1	do	3'-11"	do	do
E76	1	do	4'-5"	do	do
E77	1	do	5'-0"	do	do
E78	1	do	5'-6"	do	do
E79	1	do	6'-0"	do	do
E80	1	do	6'-7"	do	do
E81	1	do	7'-1"	do	do
E82	1	do	7'-7"	do	do
E83	3	do	7'-5"	Bent	Backwall
E84	6	do	7'-10"	do	do
E85	4	do	7'-9"	do	do
E86	1	do	9'-5"	Straight	Wingwall
E87	1	do	8'-10"	do	do
E88	1	do	8'-4"	do	do
E89	1	do	7'-9"	do	do
E90	1	do	7'-3"	do	do
E91	1	do	6'-9"	do	do
E92	1	do	6'-2"	do	do
E93	1	do	5'-7"	do	do
E94	1	do	5'-1"	do	do
E95	4	do	10'-1"	Bent	do

ABUTMENT 1

Mark	No. Req'd	Size	Length	Shape	Location
E96	10	3/4	9'-2"	Bent	Pilaster
E97	10	do	10'-6"	do	do
E98	14	do	7'-6"	do	Rail
E99	8	do	5'-7"	do	do
E100	6	do	4'-3"	do	Post
E101	4	do	8'-5"	do	do
E102	6	do	5'-5"	Straight	Pilaster
E103	12	do	6'-10"	do	Rail
E104	2	do	2'-11"	do	do
E105	2	do	4'-5"	Bent	Post
E106	8	do	7'-10"	do	do
E107	3	do	4'-5"	Straight	Backwall
E108	1	do	5'-3"	do	Wingwall
E109	1	do	5'-1"	do	do
E110	1	do	3'-3"	do	do
E111	1	do	6'-10"	do	do
E112	1	do	7'-5"	do	do
E113	1	do	7'-11"	do	do
E114	1	do	8'-6"	do	do
E115	1	do	9'-0"	do	do
E116	1	do	9'-7"	do	do

ABUTMENT 5

Mark	No. Req'd	Size	Length	Shape	Location
B1	34	1	14'-8"	Bent	Footing
B2	34	3/4	13'-3"	do	do
B3	50	3/4	10'-7"	do	do
B4	14	1	27'-0"	Straight	Bridgeseat
B5	10	1	40'-0"	do	do
B6	8	3/4	37'-9"	Straight	do
B7	6	do	30'-0"	do	do
B8	60	3/4	4'-11"	Bent	Lug
B9	16	do	10'-6"	Straight	Backwall
B10	64	3/4	7'-9"	do	do
B11	27	do	30'-0"	do	do
B12	1	do	22'-0"	do	do
B13	64	do	12'-9"	Bent	Bridgeseat
B14	8	do	10'-3"	do	Columns
B15	7	do	25'-2"	Straight	Bridgeseat
B16	32	do	10'-2"	do	Columns
B17	24	3/4	7'-6"	do	do
B18	24	do	5'-5"	Bent	do
B19	24	3/4	7'-0"	do	do
B20	2	3/4	17'-11"	do	do
B21	8	do	17'-1"	do	do
B22	2	do	16'-3"	do	do
B23	2	do	15'-5"	do	do
B24	2	do	14'-7"	do	do
B25	24	1	10'-0"	do	do
B26	2	3/4	3'-3"	Straight	Wingwall
B27	1	do	4'-0"	do	do
B28	1	do	4'-7"	do	do
B29	1	do	5'-2"	do	do
B30	1	do	5'-10"	do	do
B31	1	do	6'-5"	do	do
B32	1	do	7'-1"	do	do
B33	1	do	7'-9"	do	do
B34	1	do	8'-5"	do	do
B35	12	3/4	4'-8"	Bent	Curb
B36	8	3/4	19'-2"	do	do
B37	4	3/4	13'-11"	do	do
B38	4	3/4	10'-0"	do	do
B39	7	do	7'-0"	do	do
B40	10	3/4	11'-3"	Straight	do
B41	4	do	19'-6"	do	do
B42	1	3/4	11'-2"	Bent	do
B43	1	do	9'-8"	do	do
B44	1	do	7'-11"	do	do
B45	1	do	6'-2"	do	do
B46	1	do	6'-4"	Straight	Backwall
B47	7	do	7'-7"	Bent	do
B48	3	do	9'-3"	Straight	do
B49	4	3/4	12'-3"	do	Wingwall
B50	13	do	5'-1"	do	do
B51	1	do	5'-9"	do	do
B52	1	do	6'-4"	do	do
B53	1	do	7'-0"	do	do
B54	1	do	7'-8"	do	do
B55	1	do	8'-3"	do	do
B56	1	do	8'-11"	do	do
B57	1	do	9'-7"	do	do

ABUTMENT 5

Mark	No. Req'd	Size	Length	Shape	Location
B58	1	3/4	10'-2"	Straight	Wingwall
B59	1	do	10'-7"	do	do
B60	1	do	9'-5"	do	do
B61	1	do	8'-5"	do	do
B62	1	do	7'-7"	do	do
B63	1	do	5'-11"	do	do
B64	1	do	4'-9"	do	do
B65	6	do	9'-10"	Bent	Pilaster
B66	6	do	6'-5"	do	do
B67	6	do	7'-2"	do	do
B68	4	do	7'-7"	do	Backwall
B69	4	do	10'-1"	do	Wingwall
B70	6	3/4	13'-0"	do	Bridgeseat
B71	3	3/4	4'-9"	Straight	do
B72	6	do	6'-5"	do	Pilaster
B73	12	do	9'-10"	do	do
B74	6	do	10'-0"	do	do
B75	1	3/4	7'-0"	do	Backwall
B76	1	do	4'-5"	do	do
B77	18	3/4	4'-5"	do	Columns
B78	2	3/4	5'-3"	do	Wingwall
B79	1	do	4'-0"	do	do
B80	1	do	4'-7"	do	do
B81	1	do	5'-2"	do	do
B82	1	do	5'-10"	do	do
B83	1	do	6'-5"	do	do
B84	1	do	7'-0"	do	do
B85	1	do	7'-7"	do	do
B86	1	do	8'-2"	do	do
B87	7	do	7'-10"	Bent	Backwall
B88	7	3/4	7'-0"	do	Wingwall
B89	4	do	7'-4"	do	Backwall
B90	12	3/4	9'-5"	do	Curb
B91	3	3/4	9'-7"	Straight	Backwall
B92	4	do	26'-2"	do	Lug
B93	1	3/4	11'-2"	Bent	Wingwall
B94	1	do	9'-8"	do	do
B95	1	do	7'-11"	do	do
B96	1	do	6'-2"	do	do
B97	1	do	5'-5"	do	do
B98	1	do	5'-6"	do	do
B99	1	3/4	10'-7"	Straight	do
B100	1	do	9'-4"	do	do
B101	1	do	8'-1"	do	do
B102	1	do	6'-9"	do	do
B103	1	do	5'-6"	do	do
B104	1	do	7'-11"	do	do
B105	1	do	9'-5"	do	do
B106	1	do	8'-9"	do	do
B107	1	do	8'-2"	do	do
B108	1	do	7'-7"	do	do
B109	1	do	7'-0"	do	do
B110	1	do	6'-5"	do	do
B111	1	do	5'-10"	do	do
B112	1	do	5'-3"	do	do
B113	6	do	9'-8"	Bent	Pilaster
B114	6	do	6'-1"	do	do
B115	6	do	7'-2"	do	do
B116	18	3/4	7'-0"	do	Footing
B117	10	3/4	4'-2"	do	Pilaster
B118	10	do	10'-5"	do	do
B119	14	do	7'-6"	do	Rail
B120	8	do	5'-7"	do	do
B121	6	do	9'-3"	do	Post
B122	4	do	5'-5"	do	do
B123	6	do	5'-5"	Straight	Pilaster
B124	12	do	6'-10"	do	Rail
B125	2	do	2'-11"	do	do
B126	8	do	9'-5"	Bent	Post
B127	8	do	7'-10"	do	do
B128	4	3/4	5'-1"	do	Pilaster
B129	4	do	7'-3"	do	Backwall
B130	3	do	7'-3"	do	do
B131	6	do	12'-3"	do	Bridgeseat
B132	4	3/4	10'-2"	do	Backwall
B133	18	3/4	6'-6"	Straight	do
B134	10	do	4'-6"	do	do
B135	24	do	4'-2"	do	Pilaster
B136	4	3/4	7'-6"	Bent	Wingwall
B137	1	3/4	20'-5"	do	Columns
B138	1	do	19'-6"	do	do
B139	1	do	18'-8"	do	do
B140	1	do	17'-10"	do	do
B141	1	do	17'-0"	do	do
B142	1	do	17'-11"	do	do
B143	1	do	19'-1"	do	do
B144	1	do	18'-5"	do	do
B145	1	do	17'-5"	do	do
B146	1	do	16'-7"	do	do

PIERS

Mark	No. Req'd	Size	Length	Shape	Location
A1	27	1 1/8	23'-3"	Bent	Base
A2	28	3/4	4'-2"	do	do
A3	13	do	9'-5"	do	do
A4	13	do	12'-8"	do	do
A5	262	1 1/8	21'-10"	do	do
A6	145	1	18'-0"	Straight	Shaft
A7	145	1 1/4	25'-6"	do	do
A8	2	3/4	9'-11"	Bent	do
A9	2	do	9'-10"	do	do
A10	3	do	9'-8"	do	do
A11	3	do	9'-7"	do	do
A12	3	do	9'-5"	do	do
A13	3	do	9'-4"	do	do
A14	3	do	9'-2"	do	do
A15	3	do	9'-0"	do	do
A16	3	do	8'-11"	do	do
A17	3	do	8'-9"	do	do
A18	3	do	8'-8"	do	do
A19	3	do	8'-6"	do	do
A20	3	do	8'-5"	do	do
A21	3	do	8'-3"	do	do
A22	3	do	8'-1"	do	do
A23	3	do	8'-0"	do	do
A24	3	do	7'-10"	do	do
A25	3	do	7'-9"	do	do
A26	3	do	7'-7"	do	do
A27	3	do	7'-6"	do	do
A28	3	do	7'-4"	do	do
A29	3	do	7'-3"	do	do
A30	3	do	7'-1"	do	do
A31	3	do	6'-11"	do	do
A32	152	3/4	32'-9"	Straight	do
A33	152	do	32'-0"	do	do
A34	2	do	15'-6"	Bent	do
A35	2	do	15'-5"	do	do
A36	3	do	15'-1"	do	do
A37	3	do	14'-10"	do	do
A38	3	do	14'-7"	do	do
A39	3	do	10'-4"	do	do
A40	3	do	14'-1"	do	do
A41	3	do	13'-10"	do	do
A42	3	do	13'-8"	do	do
A43	3	do	13'-6"	do	do
A44	3	do	13'-2"	do	do
A45	3	do	12'-11"	do	do
A46	3	do	12'-8"	do	do
A47	3	do	12'-5"	do	do
A48	3	do	12'-2"	do	do
A49	3	do	11'-11"	do	do
A50	3	do	11'-8"	do	do
A51	3	do	11'-5"	do	do
A52	3	do	11'-2"	do	do
A53	3	do	11'-0"	do	do
A54	3	do	10'-9"	do	do
A55	3	do	10'-6"	do	do
A56	3	do	10'-3"	do	do
A57	3	do	10'-0"	do	do
A58	3	do	7'-10"	do	Coping
A59	3	do	10'-11"	do	do
A60	3	do	9'-11"	do	Cap
A61	3	do	8'-6"	do	do
A62	6	do	34'-1"	Straight	do
A63	6	do	35'-1"	do	do
A64	204	do	8'-0"	Bent	do
A65	3	do	8'-0"	do	do
A66	3	do	7'-8"	do	do
A67	42	3/4	10'-3"	do	Base
A68	148	3/4	23'-8"	Straight	Shaft
A69	148	do	25'-6"	do	do
A70	10	do	7'-9"	Bent	Base
A71	10	do	11'-5"	do	do
A72	36	do	5'-8"	do	do
A73	24	do	34'-8"	do	do
A74	3	3/4	7'-10"	do	Cap
A75	3	do	7'-8"	do	do
A76	3	do	7'-4"	do	do
A77	3	do	6'-11"	do	do
A78	3	do	6'-5"	do	do
A79	30	1 1/8	19'-5"	do	Base
A80	78	3/4	19'-9"	do	do
A81	156	do	7'-8"	do	do
A82	20	3/4	39'-10"	Straight	do
A83	316	3/4	11'-5"	Bent	do

SLAB

Mark	No. Req'd	Size	Length	Shape	Location
D1	736	3/4	5'-0"	Bent	Curb
D2	372	3/4	35'-2"	do	Slab
D3	356	do	42'-5"	do	do
D4	2	do	11'-9"	do	do
D5	2	do	16'-8"	do	do
D6	2	do	22'-6"	do	do
D7	2	do	27'-5"	do	do
D8	2	do	32'-4"	do	do
D9	2	do	37'-3"	do	do
D10	2	do	3'-8"	do	do
D11	348	do	39'-1"	do	do
D12	360	do	36'-6"	do	do
D13	4	do	32'-2"	do	do
D14	4	do	35'-6"	do	do
D15	2	do	22'-3"	Straight	do
D16	2	do	26'-0"	do	do
D17	2	do	32'-1"	do	do
D18	98	3/4	33'-1"	do	Curb & Slab
D19	4	do	27'-3"	do	Slab
D20	4	do	27'-5"	do	do
D21	4	do	27'-6"	do	do
D22	4	do	27'-6"	do	do
D23	4	do	27'-7"	do	do
D24	4	do	27'-8"	do	do
D25	4	do	27'-10"	do	do
D26	4	do	27'-11"	do	do
D27	4	do	28'-0"	do	do
D28	4	do	28'-1"	do	do
D29	4	do	28'-3"	do	do
D30	4	do	28'-4"	do	do
D31	4	do	28'-5"	do	do
D32	4	do	28'-6"	do	do
D33	4	do	28'-7"	do	do
D34	4	do	28'-9"	do	do
D35	4	do	28'-10"	do	do
D36	4	do	28'-11"	do	do
D37	4	do	29'-0"	do	do
D38	4	do	29'-1"	do	do
D39	4	do	29'-3"	do	do
D40	4	do	29'-4"	do	do
D41	4	do	29'-5"	do	do
D42	4	do	29'-6"	do	do
D43	4	do	29'-7"	do	do
D44	4	do	29'-9"	do	do
D45	4	do	29'-10"	do	do
D46	4	do	29'-11"	do	do
D47	4	do	30'-0"	do	do
D48	4	do	30'-1"	do	do
D49	4	do	30'-2"	do	do
D50	4	do	30'-3"	do	do
D51	4	do	30'-5"	do	do
D52	4	3/4	27'-10"	do	do
D53	4	do	27'-11"	do	do
D54	4	do	28'-0"	do	do
D55	4	do	28'-1"	do	do
D56	4	do	28'-2"	do	do
D57	4	do	28'-3"	do	do
D58	4	do	28'-5"	do	do
D59	4	do	28'-5"	do	do
D60	4	do	28'-6"	do	do
D61	4	do	28'-7"	do	do
D62	4	do	28'-9"	do	do
D63	4	do	28'-10"	do	do
D64	4	do	28'-11"	do	do
D65	4	do	29'-0"	do	do
D66	4	do	29'-1"	do	do
D67	4	do	29'-2"	do	do
D68	4	do	29'-3"	do	do
D69	4	do	29'-4"	do	do
D70	4	do	29'-5"	do	do
D71	4	do	29'-6"	do	do
D72	4	do	29'-8"	do	do
D73	4	do	29'-9"	do	do
D74	4	do	29'-10"	do	do
D75	4	do	29'-11"	do	do
D76	4	do	30'-0"	do	do
D77	4	do	30'-1"	do	do
D78	4	do	30'-2"	do	do
D79	4	do	30'-3"	do	do
D80	4	do	30'-4"	do	do
D81	4	do	30'-5"	do	do
D82	296	3/4	24'-8"	do	do
D83	444	do	23'-5"	do	do
D85	98	do	7'-0"	Bent	Diaph
D86	480	3/4	6'-7"	Straight	Curb & Slab
D87	66	1 1/4	22'-6"	do	Slab
D88	70	3/4	23'-0"	do	do
D89	2	do	11'-1"	do	do
D90	2	do	16'-0"	do	do
D91	2	do	21'-10"	do	do
D92	2	do	26'-7"	do	do
D93	2	do	31'-8"	do	do
D94	2	do	36'-7"	do	do
D95	2	do	36'-7"	do	do
D96	370	do	38'-8"	do	do

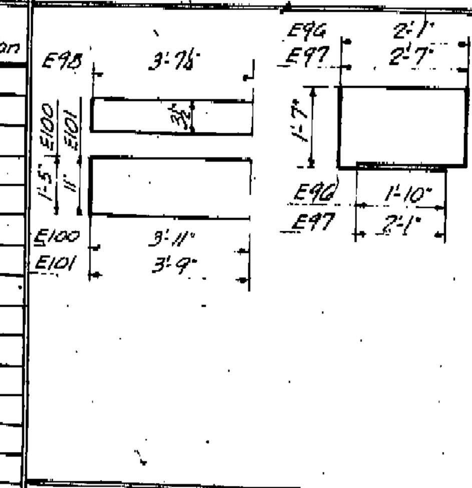
SLAB

Mark	No. Req'd	Size	Length	Shape	Location
D97	2	3/4	3'-0"	Straight	Slab
D98	360	do	29'-9"	do	do
D99	492	1/2	4'-6"	do	do
D100	296	3/4	28'-2"	do	do
D101	444	do	23'-11"	do	do
D103	2	do	16'-0"	do	do
D104	2	do	20'-11"	do	do
D105	2	do	25'-10"	do	do
D106	86	do	26'-0"	do	do
D107	4	do	30'-5"	do	do
D108	4	do	30'-6"	do	do
D109	4	do	30'-7"	do	do
D110	4	do	30'-8"	do	do
D111	4	do	30'-9"	do	do
D112	4	do	28'-10"	do	do
D113	16	3/4	33'-0"	do	Diaph.
D114	48	do	2'-2"	Bent	do
D116	24	do	3'-3"	Straight	do
D117	4	do	1'-0"	Bent	do
D118	4	do	1'-2"	do	do
D119	4	do	1'-5"	do	do
D120	4	do	1'-7"	do	do
D121	8	do	3'-4"	Straight	do

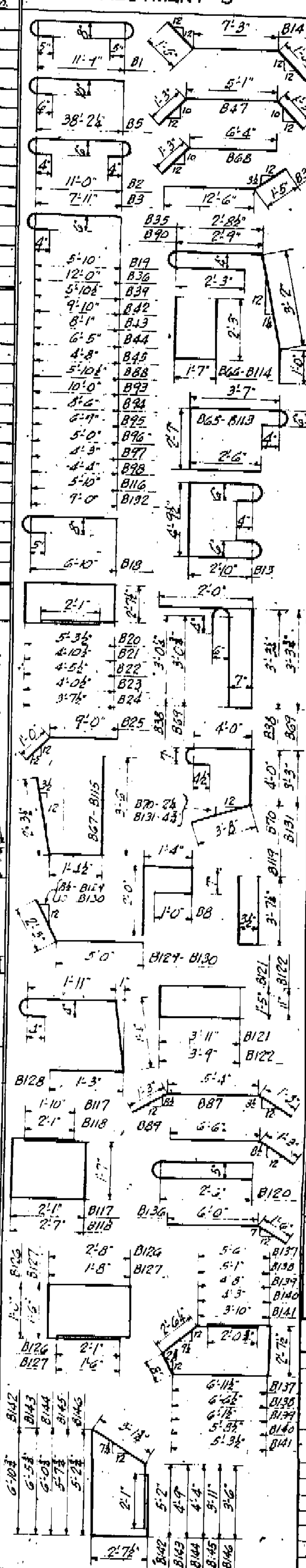
HANDRAIL

Mark	No. Req'd	Size	Length	Shape	Location
H1	600	1/2	7'-6"	Bent	Rail
H2	18	do	9'-0"	do	Post
H3	12	do	8'-4"	do	do
H4	24	do	8'-6"	do	do
H5	24	do	7'-2"	do	do
H6	264	do	14'-2"	Straight	Rail

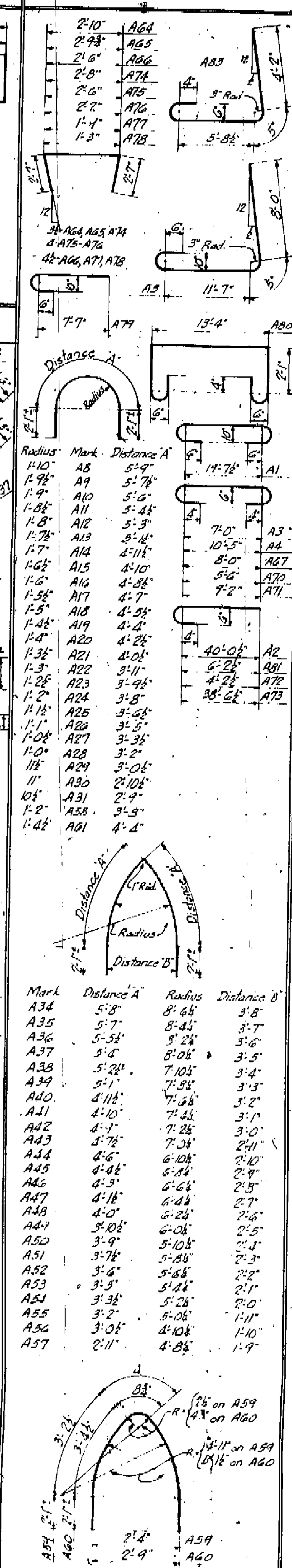
ABUTMENT 1



ABUTMENT 5



PIERS



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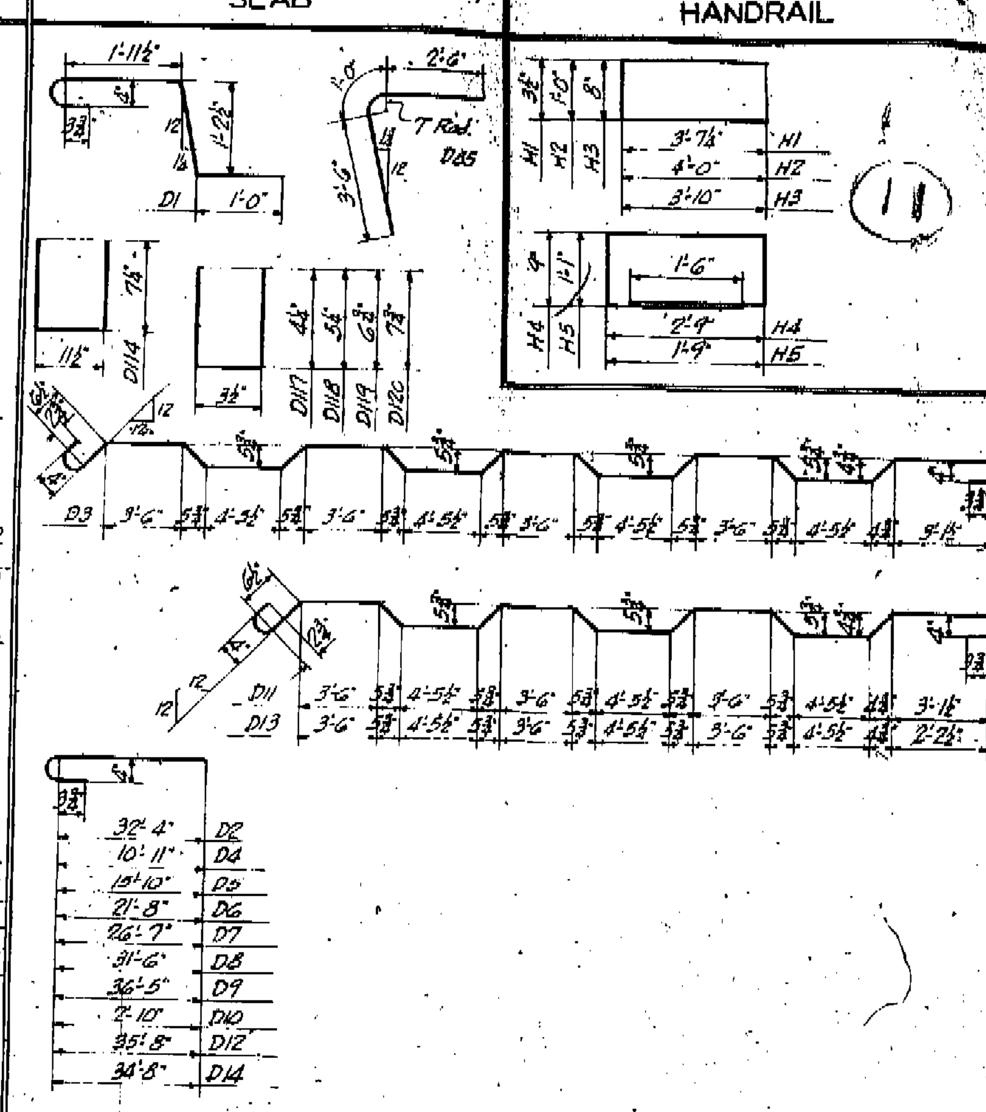
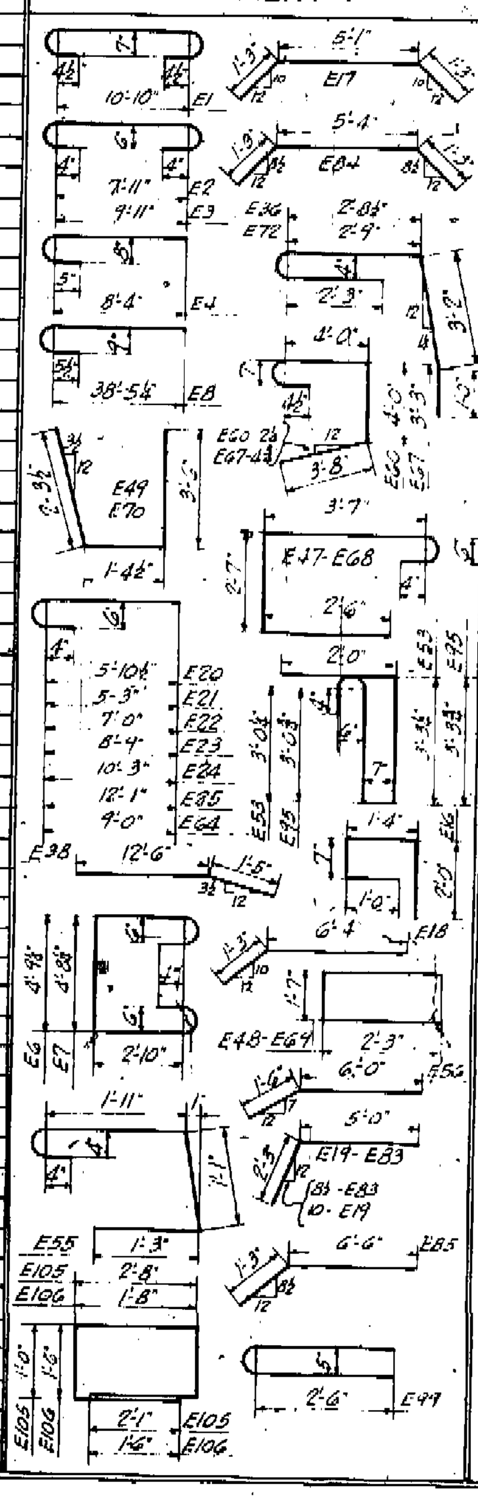


ABUTMENT 1



CONTRACT PLANS
Contract No. ______
Document No. 70001934

NOTES

List of bars and bending sketches on this sheet include all reinforcing required.

All bars shall be new billet intermediate grade, open hearth steel, deformed and shall conform to Federal Specifications QQ-B-71, Bars, Reinforcement, Concrete, Type 2, Grade 2.

Dimensions are to the ℄ of bar and lengths given are computed along ℄ of bar.

DATE	REVISION	REV.	CHK.	APP.

FEDERAL PROJ. NO. 13-130 (L.A.C.F.C.D. NO. 1)

53-118

LOS ANGELES COUNTY FLOOD CONTROL
BALLONA CREEK
ROOSEVELT HIGHWAY BRIDGE

BAR LIST

SHEET NO. 11 OF 13 SHEETS — SCALE AS SHOWN

DATUM IS MEAN SEA LEVEL

U.S. ENGINEER OFFICE LOS ANGELES, CALIF. JAN. 9, 1937

SUBMITTED BY: R. E. Crause — CAPTAIN, CORPS OF ENGINEERS, U.S. ARMY, CHIEF ENGINEERING DIVISION

APPROVED BY: MAJOR, CORPS OF ENGINEERS, U.S. ARMY, DISTRICT ENGINEER

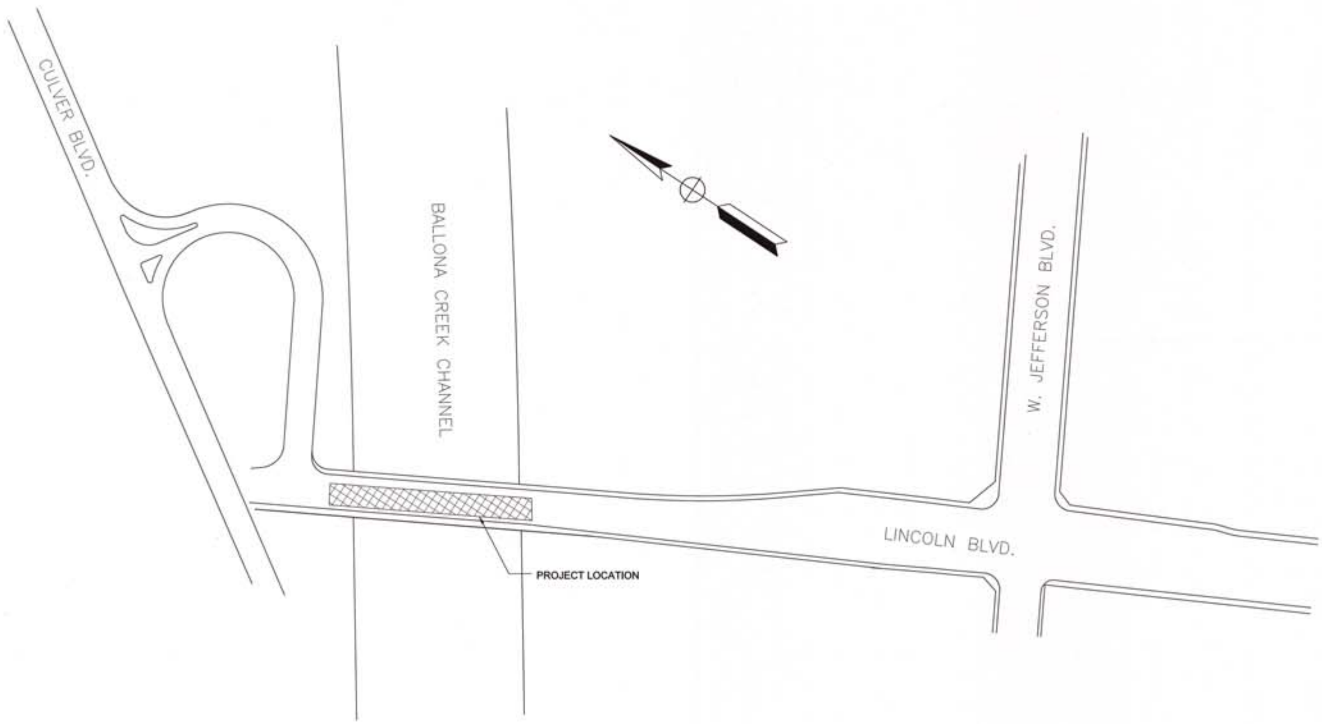
DESIGNED BY SVERDRUP AND PARCEL CONSULTING ENGINEERS, ST. LOUIS, MO. — LOS ANGELES, CALIF.

DRAWN	TRACED	CHECKED	TO ACCOMPANY SPECIFICATIONS
J.M.W.	J.M.W.	L.F.	DATED

SERIAL NO. 2887 — FILE NO. 5-112

A-686

LINCOLN BLVD BRIDGE
CROSSING OVER BALLONA CREEK



SITE PLAN
NO SCALE

ROUTE 1
LINCOLN BLVD OVER BALLONA CREEK CROSSING
P.M. 30.36
BR 53-0118

REF:

SPAC. MAP:	100-156
O.H. MAP:	102-156
T.G.:	702-C1
CKT MAP:	441, 442
LINE NAME:	LINCOLN BRIDGE CROSSING

INDEX TO PLANS

EXPECTED CONSTRUCTION COMPLETION: 04-01-16

Parkia, Inc.
Engineering & Construction
471 W. LAMBERT RD., SUITE 111
BREA, CA 92821
TEL: (714) 773-1077
www.parkiainc.com

REV. NO.	REV. DATE	INIT'L.	REVISION DESCRIPTION	APPV.	TAT NO.
▽					
▽					
▽					
▽					
▽					
▽					
▽					

DRAWING CIRCULATION

PRELIM.			FINAL		
ENGR 4	DSP 1		ENGR 2	VGS 1	
SP(MW) 2			SP(MW) 5	WOD 2	
D(WL) 2			D(WL) 6		
DSP 1			COE 1		
1			DDFT 1		
MFGR 1			DSP 1		
VGS 1			LSMS 1		

DWP

REGISTERED PROFESSIONAL ENGINEER EDGAR MERCADO No. C 59110 EXP. 6-30-17 CIVIL STATE OF CALIFORNIA

SERVICE CENTER JOB LOCATION: WL
SERVICE CENTER CONSTRUCTION: WL

WR #	CONST #	PROJECT #	NON-CONST #
822768	KYV85	P240974	KYV86

CITY OF LOS ANGELES
DEPARTMENT OF
WATER AND POWER
DISTRIBUTION ENGINEERING SECTION

DESIGN	F. HAKEMI	DRAFTING	L. WEI
OK	D. KALANI	CHECKER	E. MERCADO
APPROVED	D. KALANI	DATE	03/17/2016

LINCOLN BLVD BR 53-0118
CROSSING OVER BALLONA CREEK

TITLE SHEET

11H5031 SHEET 1 OF 9

CONSTRUCTION NOTES:

1. CONTACT DUANE PALMER AT (213) 367-2674 PRIOR TO CONSTRUCTION.
2. NO CHANGES FROM DESIGN, EITHER HORIZONTAL OR VERTICAL, SHALL BE MADE WITHOUT FIRST OBTAINING PERMISSION FROM THE ENGINEER OF RECORD. FOREMAN'S COMPLETED PRINT MUST SHOW DEPTH OF CONDUIT AT MANHOLES AND DEPTH OF MANHOLES. ANY CHANGE IN CONDUIT POSITION SHALL BE SHOWN AND ANY CHANGE IN DEPTH SHALL BE SHOWN AT THAT POINT.
3. THE OPENING IN THE INTERMEDIATE SUPPORTS SHALL BE SUCH AS TO ALLOW FREE AND UNRESTRICTED MOVEMENT OF CONDUITS DURING INSTALLATION AND DURING THERMAL CONTRACTION AND EXPANSION OF THE CONDUITS. THE OPENING SHALL NOT BE SO LARGE AS TO ALLOW THE PASSAGE OF CONDUIT ENDBELL.
4. THERE SHALL BE ONE SINGLE EXPANSION JOINT WITH O RING PLACED ON BOTH SIDES OF EACH BRIDGE EXPANSION JOINT FOR EACH CONDUIT RUN. IN ADDITION THERE SHOULD BE AN EXPANSION JOINT AT A MAXIMUM SPACING OF 48 FT ON EACH CONDUIT RUN AND WITHIN 3' MAXIMUM FROM BOTH SIDES OF EACH BRIDGE ABUTMENT.THERE SHALL ALSO BE AN EXPANSION/DEFLECTION COUPLING AT EACH ABUTMENT AS SHOWN ON PLANS.
5. AFTER THE INSTALLATION OF THE FIRST EXPANSION JOINTS, SPLIT ANCHOR RINGS AND CONDUITS. IT IS RECOMMENDED TO CONDUCT AN ALIGNMENT CHECK TO ENSURE THE CONDUIT RUN WILL TRAVEL FREELY.
6. WHERE CONDUIT WORK REQUIRES SURVEY, THE LOCATION OF CURBS AS SHOWN ON THE DRAWING SHALL BE VERIFIED AND NOTED AT THE TIME OF SUCH SURVEY.
7. CONTRACTOR SHALL CONTACT DESIGN ENGINEER AFTER JOB HAS BEEN STAKED.

SPECIFICATION AND STANDARDS:

1. ALL CONSTRUCTION DONE UNDER THE CONTRACT SPECIFICATION AND THE CONSTRUCTION DRAWINGS SHALL BE IN ACCORDANCE WITH THE SECTION 62.00-62.05 OF THE LOS ANGELES MUNICIPAL CODE, STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (SSPWC) AND THE DEPARTMENT OF WATER AND POWER STANDARD SPECIFICATION 104 AND APPENDIX I UNLESS SPECIFIED DIFFERENTLY IN THE CONSTRUCTION DRAWINGS. CONTRACTOR SHALL ALSO FOLLOW ALL REQUIREMENTS PER CALTRANS STANDARDS AND SPECIFICATIONS WHICHEVER IS MORE STRICT.
2. IN GENERAL, TRENCHES FOR DUCT WORK SHALL NOT BE WIDER THAN NECESSARY FOR PROPER PLACEMENT SUCH WORK. REMOVAL OF SURFACING SHALL BE IN STRAIGHT AND PARALLEL LINES. PAVEMENT SHALL BE SAW CUT TO A MINIMUM DEPTH OF TWO INCHES PRIOR TO REMOVAL.
3. ALL CONDUIT AND FITTINGS IN THE OPEN GIRDER BRIDGE, AND AS SHOWN ON THE DRAWINGS, SHALL BE FIBERGLASS REINFORCED THERMOSETTING RESIN CONDUIT (RTRC). INSTALLATIONS SHALL COMPLY WITH THE LATEST APPLICABLE UL/CSA/NEMA STANDARDS, UNLESS OTHERWISE NOTED OR APPROVED BY THE LOS ANGELES DEPARTMENT OF WATER AND POWER STANDARDS ENGINEER.
4. COVER OVER ALL CONDUIT ENCASEMENT SHALL BE 42" MINIMUM BELOW STREET FINISHED SURFACE, UNLESS OTHERWISE NOTED.
5. ALL CONDUIT THAT THE DEPARTMENT ACCEPTS AS PART OF ITS DISTRIBUTION SYSTEM WILL BE APPROVED AND MAY REQUIRE TESTING BY LADWP AT THE REQUEST OF A DEPARTMENT REPRESENTATIVE. TEST SAMPLES OF CONDUIT SHALL BE MADE AVAILABLE FOR INSPECTION TWO (2) NORMAL WORKING DAYS PRIOR TO INSTALLATION. WHERE CONDUIT FAILS TO MEET DEPARTMENT OF WATER AND POWER'S (DWP) STANDARD SPECIFICATIONS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPLACEMENT OF THE SUBSTANDARD WITH STANDARD CONDUIT.
6. IT IS THE CONTRACTOR'S RESPONSIBILITY TO PLACE AND MAINTAIN TEMPORARY RESURFACING ON ALL EXCAVATIONS IN PAVED STREETS AND SIDEWALK. THE MAINTENANCE OF THE TEMPORARY RESURFACING SHALL CONTINUE UNTIL PERMANENT RESURFACING IS PLACED BY THE CONTRACTOR.
7. PRIOR TO ACCEPTANCE, A CYLINDRICAL MANDREL, AS SPECIFIED IN UNDERGROUND CONSTRUCTION STANDARD 2-210, SHALL BE DRAWN, BY THE CONTRACTOR, THROUGH EACH COMPLETED DUCT BY HAND WITHOUT MECHANICAL ASSISTANCE. THE CONTRACTOR WILL BE RESPONSIBLE FOR REPLACING ANY DUCT SECTION THROUGH WHICH THE MANDREL WILL NOT PASS. REPLACED OR REPAIRED CONDUIT SHALL BE LEFT EXPOSED FOR INSPECTION.
8. PULL TAPE SHALL BE INSTALLED IN EACH DUCT PER SPECIFICATION 104.
9. EXCAVATIONS/SHORING SHALL COMPLY WITH REQUIREMENTS OF "CAL-OSHA" EXCAVATIONS TRENCHES EARTHWORK, CONSTRUCTION SAFETY ORDERS, SECTIONS 1504, 1539-1543 LATEST EDITION. DEPTH OF EXCAVATION SHALL NOT EXCEED 20-FT.
10. ALL STEEL BEAMS, PLATES AND ANGLES TO BE USED IN THE BRIDGE CONDUIT SYSTEM SHALL BE HOT-DIP GALVANIZED AND SHALL CONFORM TO ASTM A36 STRUCTURAL STEEL OR BETTER. ALL BOLTS SHALL BE CALTRANS APPROVED AND THREADED RODS SHALL CONFORM TO ASTM A449, TYPE 1. ALL NUTS FLAT WASHERS AND LOCK WASHERS TO CONFORM TO ASTM A563. ALL BOLTS, NUTS, AND WASHERS SHALL BE HOT-DIPPED GALVANIZED FINISH OR ZINC PLATED FINISH, UNLESS OTHERWISE NOTED IN CALTRANS STANDARDS.
11. CHEMICAL ADHESIVES TO BE USED FOR DRILL & BOND SHALL BE SELECTED FROM THE PRE-QUALIFIED PRODUCTS LIST AT: HTTP://WWW.DOT.CA.GOV/HQ/ESC/APPROVED_PRODUCTS_LIST/

NOTIFICATION AND INSPECTION:

1. FULL INSPECTION AND APPROVAL BY THE DEPARTMENT OF WATER AND POWER (DWP) IS REQUIRED BEFORE FINAL ACCEPTANCE OF UNDERGROUND CONSTRUCTION. ACCEPTANCE IS REQUIRED PRIOR TO THE INSTALLATION OF CABLE AND EQUIPMENT.
2. NOTIFY DWP AT THE FOLLOWING TELEPHONE NUMBER, TWO (2) NORMAL WORKING DAYS IN ADVANCE OF CONSTRUCTION: # (213) 367-6070

GENERAL:

1. ALL WORK PERFORMED ACCORDING TO THIS DRAWING SHALL BE DONE AS TO COMPLY WITH ALL THE CONDITIONS, RESTRICTIONS, CONSTRUCTION METHODS AND SAFETY REQUIREMENTS IMPOSED BY THE EXCAVATION PERMIT ISSUED TO DWP, AND THOSE REQUIREMENTS IMPOSED BY CAL OSHA.
2. CONDUIT EXPANSION, SPLIT ANCHOR, AND EXPANSION/DEFLECTION LOCATIONS SHOWN TO CLARIFY RESTRICTION AND LIMITATIONS. CONTRACTOR SHALL PROVIDE SHOP DRAWING OF CONDUIT PLACEMENT PER HIS/HER MEANS AND METHOD WHICH TO BE APPROVED BY DWP.
3. DWP ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OF THE SUBSTRUCTURE INFORMATION HEREIN PROVIDED. THE USER ASSUMES RESPONSIBILITY FOR VERIFYING SUBSTRUCTURE LOCATIONS BEFORE EXCAVATING AND ASSUMES ALL LIABILITY FOR DAMAGE TO UNDERGROUND FACILITIES AS A RESULT OF SUCH EXCAVATION. CALL UNDERGROUND SERVICE ALERT AT 811 TWO (2) DAYS BEFORE DIGGING.

STRUCTURAL STEEL:

1. STRUCTURAL STEEL SHALL CONFORM TO THE FOLLOWING REQUIREMENTS:
   ANGLES & PLATES — ASTM A36, GRADE 36
2. WELDING: ALL WELDING SHALL BE IN ACCORDANCE WITH THE CURRENT EDITION OF THE BRIDGE WELDING CODE, AWS D1.5. WELDING TO BE ALLOWED ONLY AS SHOWN ON DESIGN DRAWINGS AND APPROVED SHOP DRAWINGS.
3. WELDED JOINTS SHALL CONFORM TO THE PRE-QUALIFIED DETAILS OF AWS D1.5, FIGURE 2.4. ALTERNATE JOINTS DETAILS MAY BE SUBMITTED FOR APPROVAL. ALL WELDING SHALL BE DONE TO MINIMIZE DISTORTION. THE WELDING SEQUENCE AND PROCEDURES TO BE USED SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL.
4. WHEN WELDING A709, GRADE 50W, OR A588 STEEL, WELD METAL MUST BE COMPATIBLE WITH A709, GRADE 50W, OR A588 STEEL IN STRENGTH, CORROSION RESISTANCE AND WEATHERED APPEARANCE.
5. THE FABRICATOR SHALL SUBMIT COPIES OF WELDER'S CERTIFICATE FOR ALL WELDING PROCESSES.
6. THE FABRICATOR SHALL SUBMIT THREE (3) COPIES OF DETAILED SHOP DRAWINGS PRIOR TO BEGINNING FABRICATION. FABRICATION SHALL NOT BEGIN UNTIL SHOP DRAWINGS ARE APPROVED.
7. THE FABRICATOR SHALL SHOP ASSEMBLE THE SPANS PRIOR TO SHIPPING. DURING ASSEMBLY AND REAMING ALL BOLTS SHALL BE PLACED IN HOLES AS WORK PROGRESSES TO ASSURE PROPER FIT.
8. SHOP ASSEMBLED SPANS SHALL BE INSPECTED BY THE ENGINEER OR HIS/HER REPRESENTATIVE BEFORE THE STEEL IS DISASSEMBLED AND/OR SHIPPED TO THE ERECTION SITE. PIECES SHALL BE MATCH-MARKED AS REQUIRED.
9. REAMING OF HOLES DURING FIELD ERECTION IS NOT ALLOWED, UNLESS APPROVED BY THE ENGINEER.
10. ALL STRUCTURAL STEEL SHALL BE BLAST CLEANED PRIOR TO SHIPMENT AS FOLLOWS, EXCEPT AS NOTED OTHERWISE. ALL ASTM A709 STEEL, OTHER SURFACES VISIBLE FROM SIDES AND ALL FAYING SURFACES REGARDLESS OF LOCATION: MINIMUM SSPC-SP6, COMMERCIAL BLAST CLEANING. ALL REMAINING STEEL SURFACES: SSPC-SP1, SOLVENT CLEANING. ALL STEEL MEMBERS SHALL BE COATED WITH GRAY PRIMER AND CLEARLY MARKED AFTER BLAST CLEANING HAS BEEN COMPLETED.

SURVEY:

1. PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL HAVE THE CONSTRUCTION REQUIRED HEREON LAID OUT BY A LAND SURVEYOR LICENSED IN THE STATE OF CALIFORNIA.
2. CONTRACTOR SHALL MAINTAIN ALL SURVEY MARKS REQUIRED TO COMPLETE CONSTRUCTION. MISSING OR DAMAGED SURVEY MARKS SHALL BE REPLACED BY THE CONTRACTOR'S SURVEY AS REQUIRED.
3. CONTRACTOR SHALL PROVIDE A COPY OF THE SURVEYOR'S FIELD NOTES TO THE DEPARTMENT REPRESENTATIVE ON THE FIRST DAY OF CONSTRUCTION.
4. CONTRACTOR SHALL PROVIDE AN AS-BUILT FOR THE CONSTRUCTED ELECTRICAL UNDERGROUND CONDUIT AND SUBSTRUCTURES. THE INFORMATION SHOWN ON THE AS-BUILT SURVEY SHALL INCLUDE, BUT NOT LIMITED TO, CONDUIT DEPTHS AND APPROVED CHANGES AS FOLLOWINGS:
   (1) CONDUIT DEPTHS SHALL BE SHOWN AT 50 FEET INTERVALS AND WHENEVER THERE IS A SUDDEN CHANGE IN THE CONDUIT DEPTH.
   (2) ALL DEPTHS SHALL BE GIVEN FROM THE STREET FINISHED GRADE TO TO THE TOP OF THE CONDUIT.
   (3) ANY CHANGE IN CONDUIT POSITION SHALL BE SHOWN AND ANY CHANGES IN DEPTH SHALL BE SHOWN AT THAT POINT.
   (4) THE AS-BUILT ALIGNMENT OF THE CONDUIT SYSTEM SHALL BE VERIFIED AND RECORDED BY THE CONTRACTOR'S SURVEYOR.
5. CONTRACTOR SHALL PROVIDE AS BUILT NOTES TO LADWP ENGINEER PRIOR TO FINAL ACCEPTANCE.

DESIGN NOTES

LOAD FACTOR DESIGN:

DESIGN:	CALTRANS BRIDGE DESIGN SPECIFICATION-APRIL 2000 (LFD)
DEAD LOAD:	(1996 AASHTO WITH INTERIMS AND REVISIONS BY CALTRANS)
LIVE LOADING:	HS44 WITH LOW-BOY
SEISMIC DESIGN:	CALTRANS SEISMIC DESIGN CRITERIA (SDC), VERSION 1.7 DATED APRIL 2013

MATERIAL

1.0 CONCRETE:

1.1 MINIMUM COMPRESSIVE STRENGTH AT 28 DAYS UNLESS NOTED OTHERWISE CAST-IN-PLACE REINFORCED CONCRETE ABUTMENTS - 4,000 PSI

1.2 CONCRETE COVER FOR REINFORCING STEEL SHALL BE AS NOTED BELOW, UNLESS NOTED OTHERWISE ON THE DRAWINGS. DIMENSIONS SHOWN ON DRAWINGS FOR COVER ARE CLEAR DIMENSIONS FROM FACE OF CONCRETE.

SURFACES CAST & PERMANENTLY EXPOSED TO EARTH	- 3"
WALLS	- 2"
CAP BEAM	- 2"

1.3 ALL EXPOSED CONCRETE EDGES SHALL BE CHAMFERED ¾" UNLESS NOTED OTHERWISE SHOWN ON THE DRAWINGS.

2.0 STRUCTURAL STEEL:

2.1 STRUCTURAL STEEL SHALL CONFORM TO ASTM A36, GRADE 36

3.0 REINFORCING STEEL:

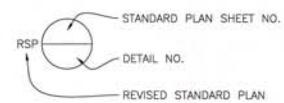
3.1 ALL REINFORCING STEEL SHALL CONFORM TO ASTM A706, GR 60.

3.2 ALL BAR BENDS AND LAP SPLICES WHERE PERMITTED SHALL BE IN ACCORDANCE WITH ACI 318.

CALTRANS STANDARD PLANS 2015

A10A	ABBREVIATIONS (SHEET 1 OF 2)
A10B	ABBREVIATIONS (SHEET 2 OF 2)
A10C	LINES AND SYMBOLS (SHEET 1 OF 3)
A10D	LINES AND SYMBOLS (SHEET 2 OF 3)
A10E	LINES AND SYMBOLS (SHEET 3 OF 3)
A62C	LIMITS OF PAYMENT FOR EXCAVATION AND BACKFILL - BRIDGE
B7-10	UTILITY OPENING - BOX GIRDER

PLAN SYMBOL



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DRAWING CIRCULATION

PRELIM.				FINAL			
ENGR	4	DSP	1	ENGR	2	VGS	1
SP(MW)	2			SP(MW)	5	WOO	2
D(WL)	2			D(WL)	6		
DSP	1			CDE	1		
	1			DDFT	1		
MFGR	1			DSP	1		
VGS	1			LSMS	1		

DWP

REGISTERED PROFESSIONAL ENGINEER EDGAR MERCADO No. C69110 EXP 6-30-16 CIVIL STATE OF CALIFORNIA

EXPECTED CONSTRUCTION COMPLETION: 04-01-16

SERVICE CENTER JOB LOCATION	WL	SERVICE CENTER CONSTRUCTION	WL

WR #	CONST #	PROJECT #	NON-CONST #
822768	KYVB5	P240974	KYVB6

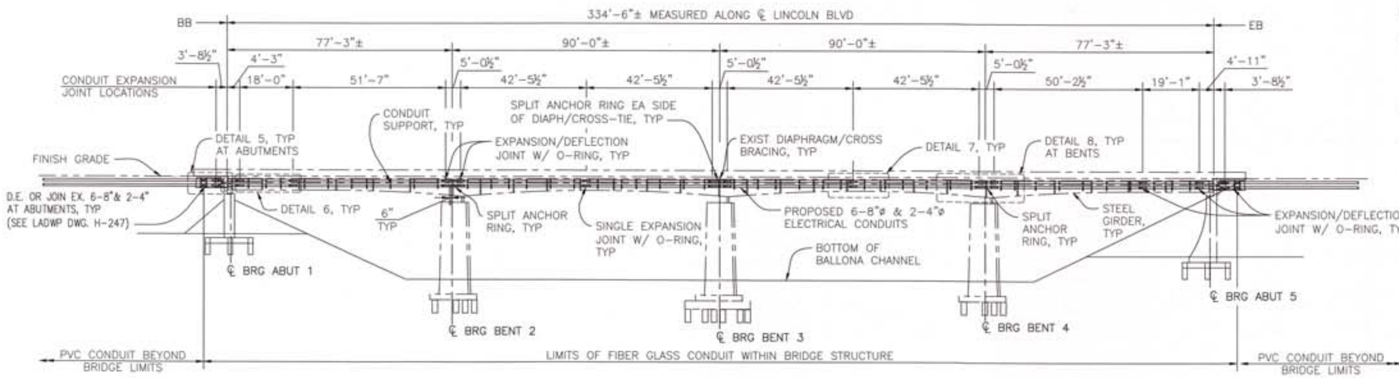
CITY OF LOS ANGELES
DEPARTMENT OF
WATER AND POWER
DISTRIBUTION ENGINEERING SECTION

DESIGN	F. HAKEMI	DRAFTING	L. WEI
CK	D. KALANI	CHECKER	E. MERCADO
APPROVED	D. KALANI	DATE	03/17/2016

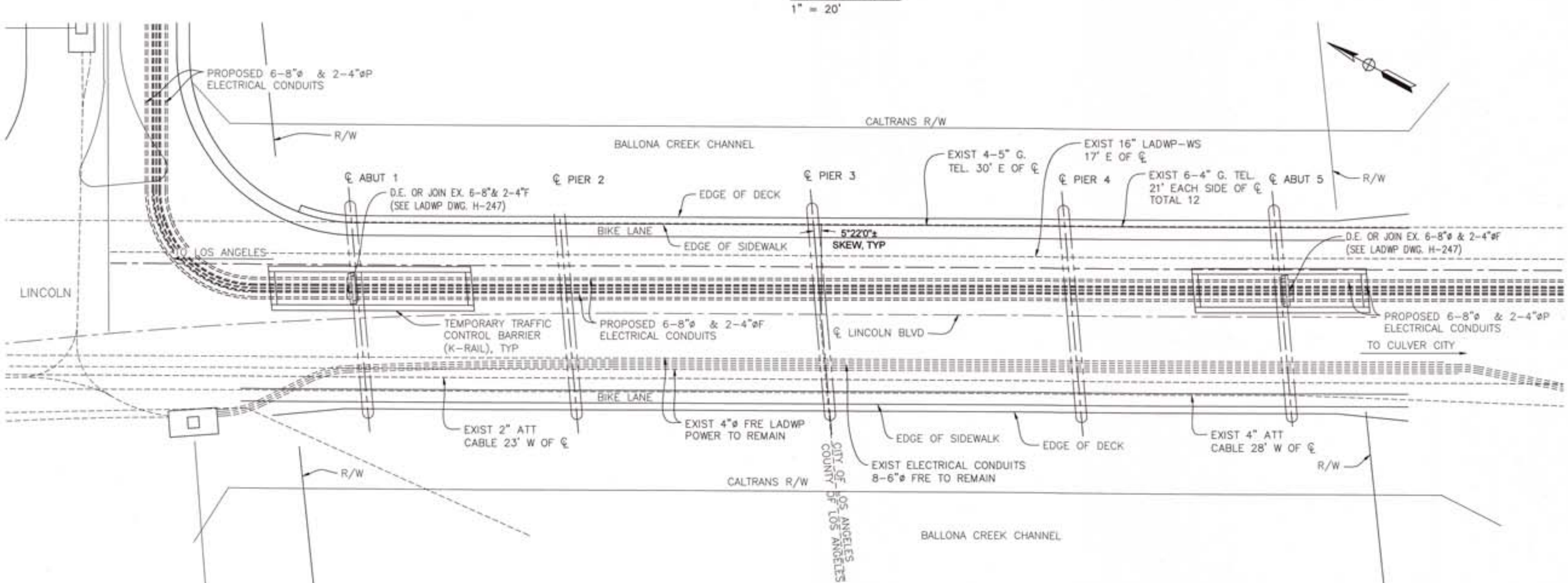
LINCOLN BLVD BR 53-0118
CROSSING OVER BALLONA CREEK

DESIGN & CONSTRUCTION NOTES

11H5031 SHEET 2 OF 9



ELEVATION
1" = 20'



PLAN
1" = 20'

NOTES:

1. FOR ADDITIONAL INFORMATION ON UNDER-BRIDGE CROSSING CONDUIT INSTALLATION SEE LADWP STANDARD SHEET H-247.
3. FOR "DETAIL-5", SEE "ABUTMENT RETROFIT DETAILS NO. 1" SHEET.
4. FOR "DETAIL-6", "DETAIL-7" AND "DETAIL-8", SEE "ABUTMENT RETROFIT DETAILS NO. 2" SHEET.

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REV. NO.	REV. DATE	INIT'L	REVISION DESCRIPTION	APPV.	TAT NO.

DRAWING PRELIM.				CIRCULATION FINAL			
ENGR	4	DSP	1	ENGR	2	VGS	1
SP(MW)	2			SP(MW)	5	WOD	2
D(WL)	2			D(WL)	6		
DSP	1			COE	1		
	1			DDFT	1		
MFOR	1			DSP	1		
VGS	1			LSMS	1		

REGISTERED PROFESSIONAL ENGINEER EDGAR MERCADO No. C59110 EXP. 6-30-16 CIVIL STATE OF CALIFORNIA

SERVICE CENTER JOB LOCATION WL
SERVICE CENTER CONSTRUCTION WL

CITY OF LOS ANGELES
DEPARTMENT OF
WATER AND POWER
DISTRIBUTION ENGINEERING SECTION

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APPROVED	D. KALANI	DATE	03/17/2016

EXPECTED CONSTRUCTION COMPLETION: 04-01-16

WR #	CONST #	PROJECT #	NON-CONST #
822768	KYV85	P240974	KYV86

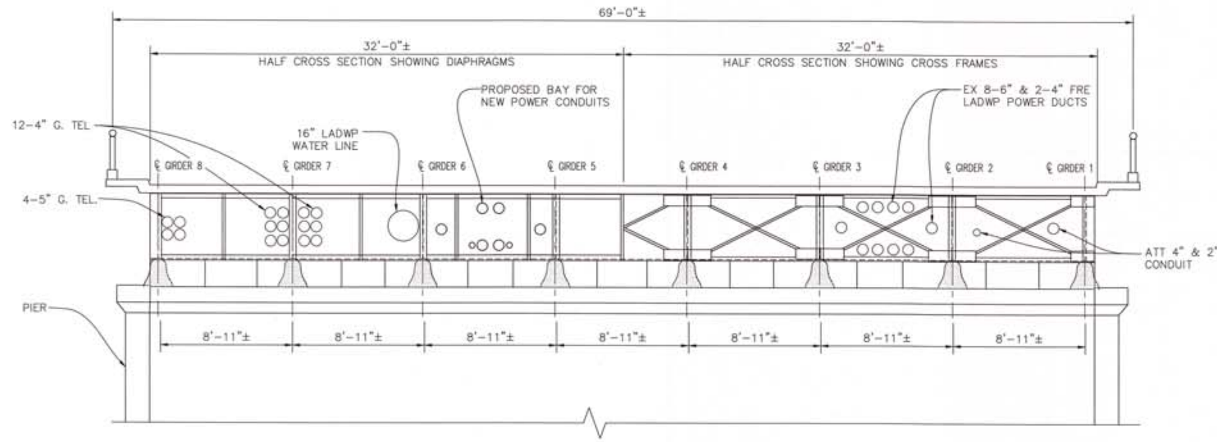
LINCOLN BLVD BR 53-0118
CROSSING OVER BALLONA CREEK

GENERAL PLAN

11H5031 SHEET 3 OF 9

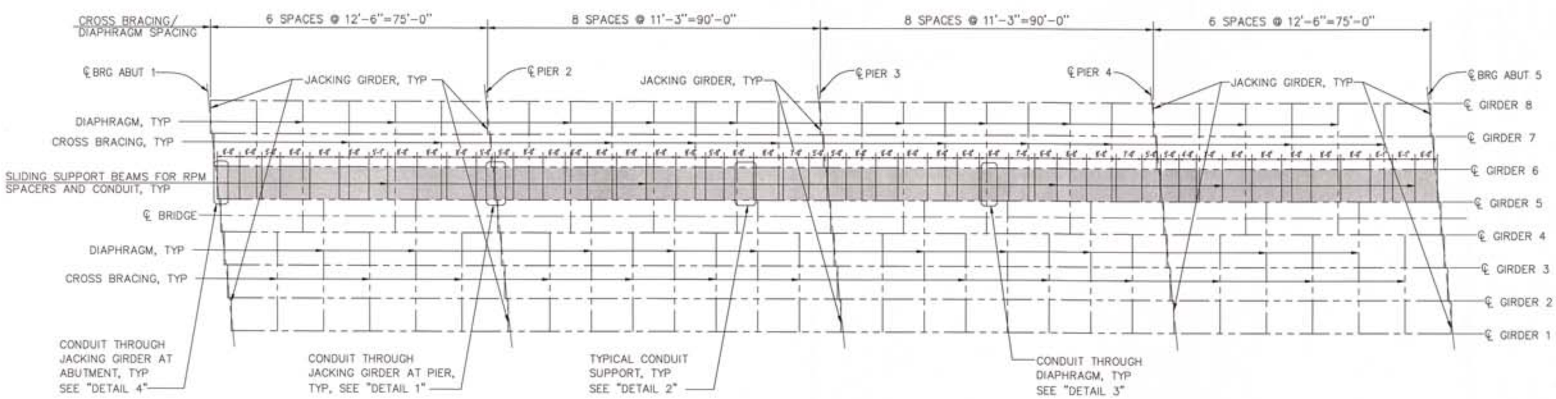
NOTES:

1. ADJUST SLIDING SUPPORT BEAMS AS NEEDED TO AVOID CONFLICT WITH EXISTING CROSS BRACING.
2. FOR ADDITIONAL INFORMATION ON UNDER-BRIDGE CROSSING CONDUIT INSTALLATION SEE LADWP STANDARD SHEET H-247.
3. FOR "DETAIL-1", "DETAIL-2", "DETAIL-3" AND "DETAIL-4", SEE "CONDUIT SUPPORT DETAILS NO. 2" SHEET.



TYPICAL SECTION

NO SCALE



UTILITY SUPPORT LAYOUT

1/2"=1'-0"

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DRAWING CIRCULATION

PRELIM.			FINAL		
ENGR 4	DSP 1		ENGR 2	VGS 1	
SP(MW) 2			SP(MW) 5	WOD 2	
D(WL) 2			D(WL) 6		
DSP 1			COE 1		
1			DDFT 1		
MFGR 1			DSP 1		
VGS 1			LSMS 1		

DWP

EXPECTED CONSTRUCTION COMPLETION: 04-01-16

SERVICE CENTER JOB LOCATION	WL	SERVICE CENTER CONSTRUCTION	WL

WR #	CONST #	PROJECT #	NON-CONST #
822768	KYV85	P240974	KYV86

CITY OF LOS ANGELES
DEPARTMENT OF
WATER AND POWER
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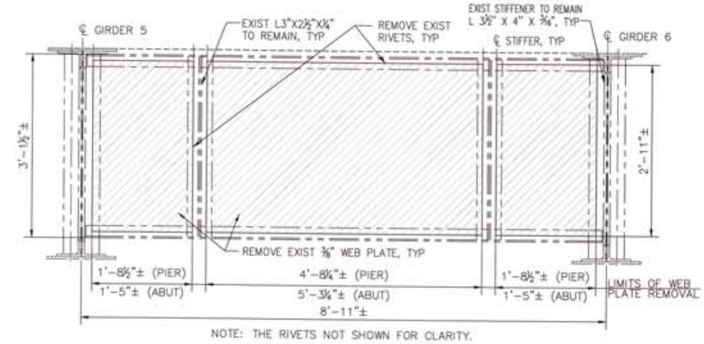
OK	D. KALANI	CHECKER	E. MERCADO
APPROVED	D. KALANI	DATE	03/17/2016

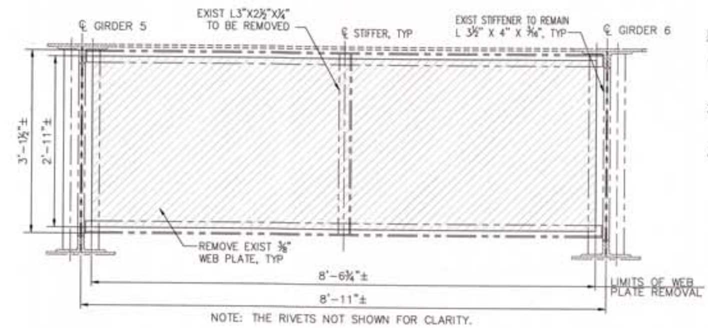
LINCOLN BLVD BR 53-0118
CROSSING OVER BALLONA CREEK

CONDUIT SUPPORT DETAILS NO. 1

11H5031 SHEET 4 OF 9



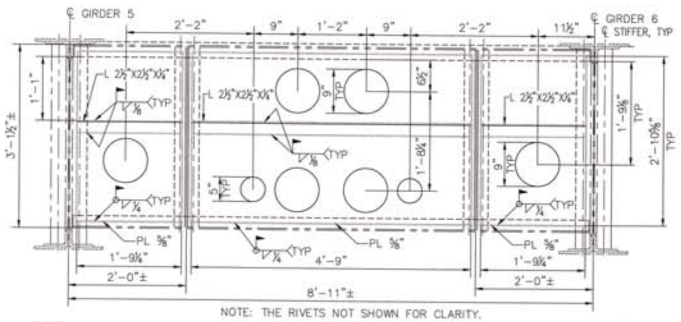
LIMITS OF PLATE REMOVAL – EXIST JACKING GIRDER AT ABUTMENTS & PIERS
1"=1'-0"



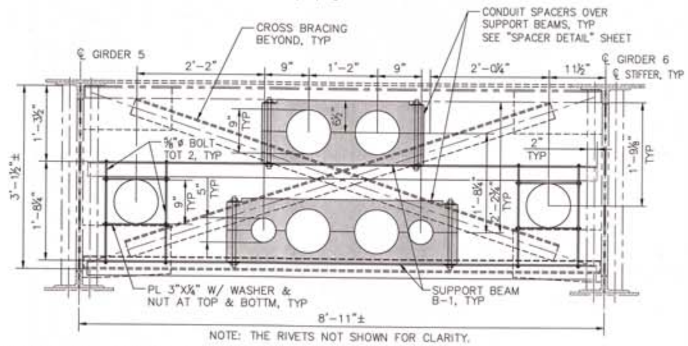
LIMITS OF PLATE REMOVAL – EXIST DIAPHRAGM AT SPANS 1, 2, 3 & 4
1"=1'-0"

NOTES:

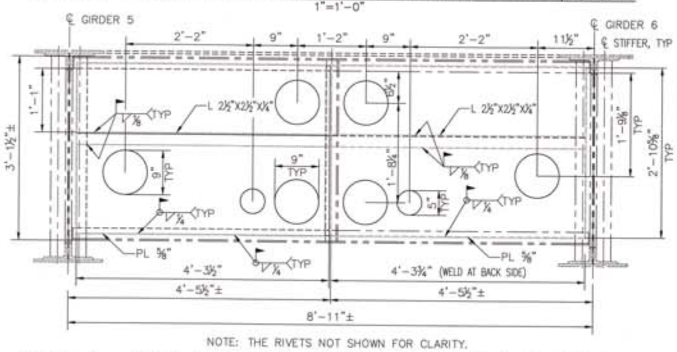
1. IN CONTRACTOR OPTION BOLT CONNECTION CAN BE EMPLOYED INSTEAD OF FIELD WELDING.
2. FOR BOLT OPTION; REMOVE EXISTING RIVETS, PREPARE HOLES THEN INSTALL NEW BOLTS IN THE SAME HOLES.
3. MAKE HOLES ON THE EXISTING STEEL SECTION IN PLACE TO INSTALL NEW BOLTS.



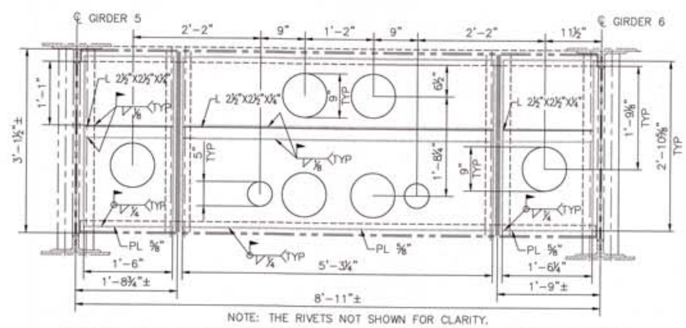
DETAIL 1 – EXIST JACKING GIRDER RETROFIT AT PIERS 2, 3 & 4
1"=1'-0"



DETAIL 2 – TYPICAL SUPPORT BEAM CONNECTION AT SPANS 1, 2, 3 & 4
1"=1'-0"



DETAIL 3 – EXIST DIAPHRAGM RETROFIT AT SPANS 1, 2, 3 & 4
1"=1'-0"



DETAIL 4 – EXIST JACKING GIRDER RETROFIT AT ABUTMENTS
1"=1'-0"

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EXPECTED CONSTRUCTION COMPLETION: 04-01-16

W/O #	CONST #	PROJECT #	NON-CONST #
822768	KYV85	P240974	KYV86

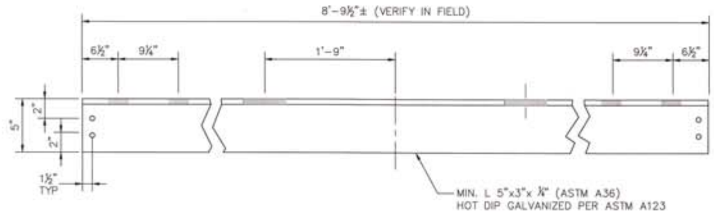
CITY OF LOS ANGELES
DEPARTMENT OF WATER AND POWER
DISTRIBUTION ENGINEERING SECTION

DESIGN F. HAKEMI · DRAFTING L. WEI
CK D. KALANI · CHECKER E. MERCADO
APPROVED D. KALANI · DATE 03/17/2016

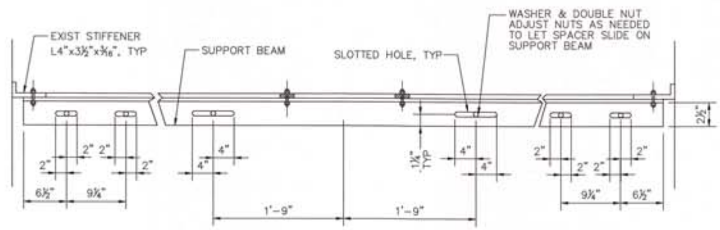
LINCOLN BLVD BR 53-0118
CROSSING OVER BALLONA CREEK

CONDUIT SUPPORT DETAILS NO. 2

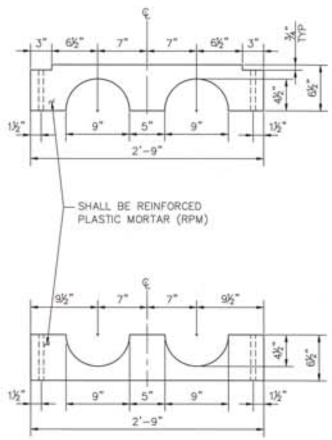
11H5031 SHEET 5 OF 9



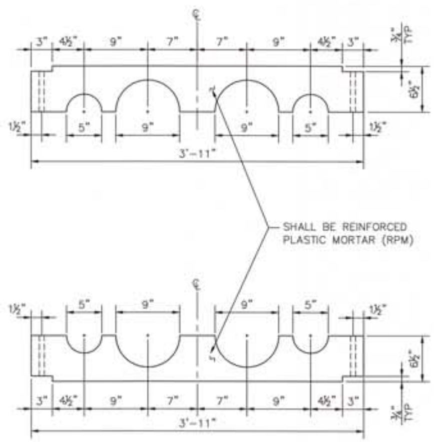
SLIDING SUPPORT BEAM B-1
NO SCALE



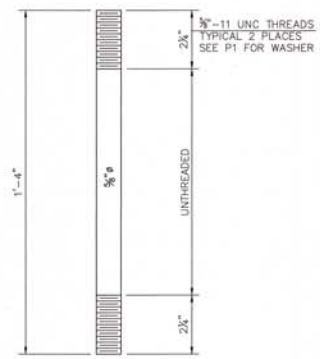
SLIDING SUPPORT BEAM ASSEMBLY
NO SCALE



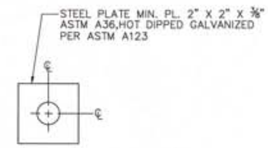
TOP CONDUIT SPACER – FRONT VIEW
NO SCALE



BOTTOM CONDUIT SPACER – FRONT VIEW
NO SCALE



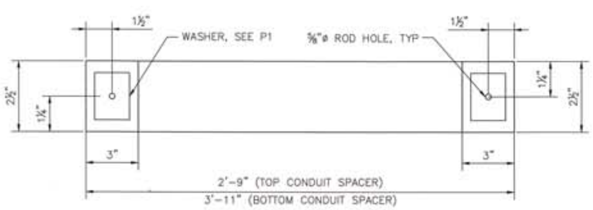
THREADED ROD DETAIL
NO SCALE



P1–WASHER
NO SCALE

NOTES:

1. ALL ANCHOR BOLTS SHALL BE APPROVED BY CALTRANS. ALL THREADED RODS SHALL COMPLY WITH THE SPECIFICATIONS OF THE HS THREADED RODS ASTM A449, TYPE 1.



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DRAWING CIRCULATION

PRELIM.				FINAL			
ENGR	4	DSP	1	ENGR	2	VGS	1
SP(MW)	2			SP(MW)	5	WOD	2
D(WL)	2			D(WL)	6		
DSP	1			COE	1		
	1			DDFT	1		
MFOR	1			DSP	1		
VGS	1			LSMS	1		

EXPECTED CONSTRUCTION COMPLETION: 04-01-16

SERVICE CENTER JOB LOCATION	WL	SERVICE CENTER CONSTRUCTION	WL

WR #	CONST #	PROJECT #	NON-CONST #
822768	KYV85	P240974	KYV86

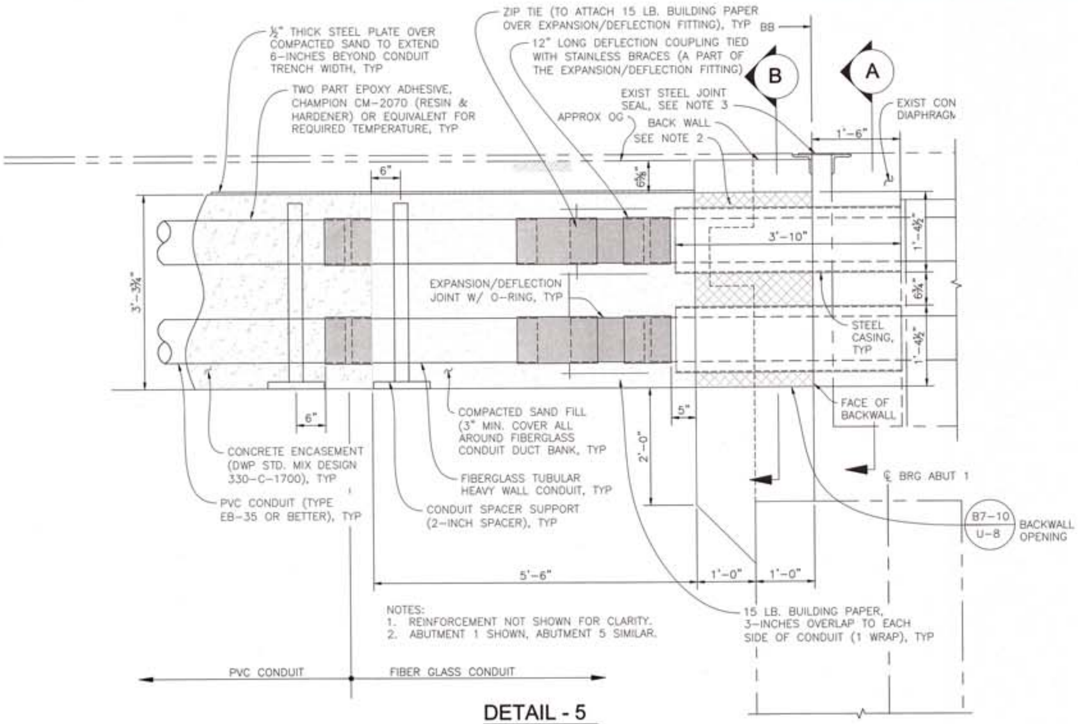
CITY OF LOS ANGELES
DEPARTMENT OF
WATER AND POWER
DISTRIBUTION ENGINEERING SECTION

DESIGN	F. HAKEMI	DRAFTING	L. WEI
CK	D. KALANI	CHECKER	E. MERCADO
APPROVED	D. KALANI	DATE	03/17/2016

LINCOLN BLVD BR 53-0118
CROSSING OVER BALLONA CREEK

CONDUIT SUPPORT DETAILS NO. 3

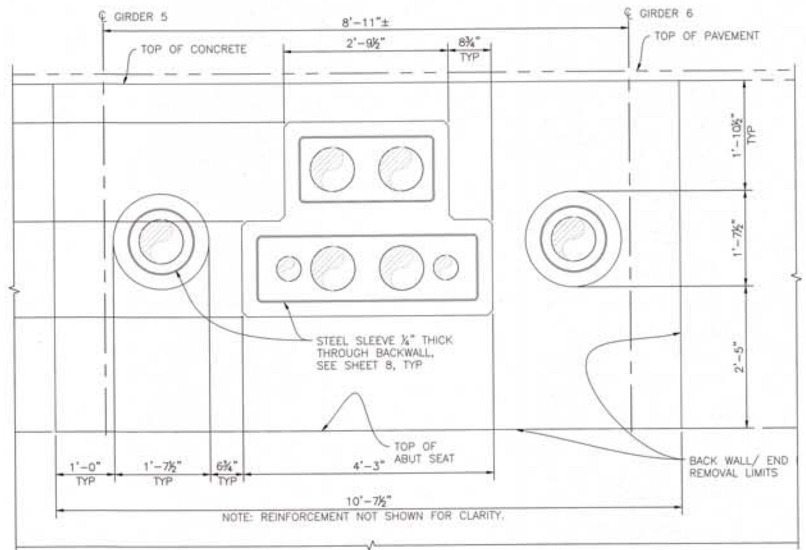
11H5031 SHEET 6 OF 9



NOTES:
1. REINFORCEMENT NOT SHOWN FOR CLARITY.
2. ABUTMENT 1 SHOWN, ABUTMENT 5 SIMILAR.

DETAIL - 5

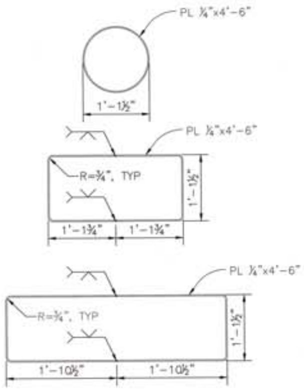
1" = 1'-0"



NOTE: REINFORCEMENT NOT SHOWN FOR CLARITY.

SECTION A - A

1" = 1'-0"



NOTE: SEE DETAIL-5 FOR STEEL SLEEVE LIMITS.

STEEL SLEEVE DETAILS

1" = 1'-0"

NOTES:

1. THE EXACT LOCATION, ELEVATION, SIZE, AND DIRECTION OF OPENINGS SHALL BE IN ACCORDANCE WITH THE PROJECT UTILITY PLANS AND AS DIRECTED BY THE ENGINEER.
2. SEAL UTILITIES AT ABUTMENTS WITH CONCRETE OR MORTAR, AFTER TIGHTLY WRAPPING UTILITY WITH 2 LAYERS OF 15 LBS BUILDING PAPER.
3. EXIST STEEL JOINT SEAL ASSEMBLY SHALL BE PROTECTED IN PLACE. IF ANY DAMAGE OCCURRED DURING CONSTRUCTION, IT SHOULD BE REPLACED IN KIND WITH THE ENGINEER OF RECORD'S APPROVAL.
4. FOR "SECTION B-B", SEE "ABUTMENT RETROFIT DETAILS NO. 3" SHEET.

EXPECTED CONSTRUCTION COMPLETION: 04-01-16

Parkia, Inc.
Engineering & Construction
471 W. LAMBERT RD., SUITE 111
BREA, CA 92821
TEL: (714) 773-1077
www.parkiainc.com

REV. NO.	REV. DATE	INIT'L	REVISION DESCRIPTION	APP'V.	TAT NO.

PRELIM.		CIRCULATION FINAL	
ENGR 4	DSP 1	ENGR 2	VGS 1
SP(MW) 2		SP(MW) 5	WOO 2
D(WL) 2		D(WL) 6	
DSP 1		COE 1	
1		DOFT 1	
MFGR 1		DSP 1	
VGS 1		LSMS 1	

SERVICE CENTER JOB LOCATION: WL
SERVICE CENTER CONSTRUCTION: WL

CITY OF LOS ANGELES
DEPARTMENT OF
WATER AND POWER
DISTRIBUTION ENGINEERING SECTION

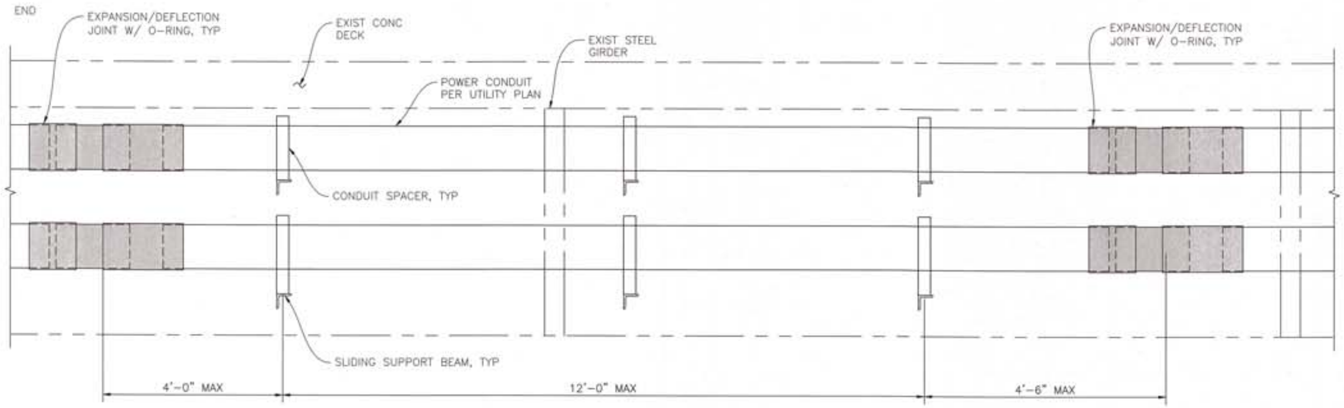
DESIGN: F. HAKEMI | DRAFTING: L. WO
CK: D. KALANI | CHECKER: E. MERCADO
APPROVED: D. KALANI | DATE: 03/17/2016

WR #	CONST #	PROJECT #	NON-CONST #
822768	KYV85	P240974	KYV86

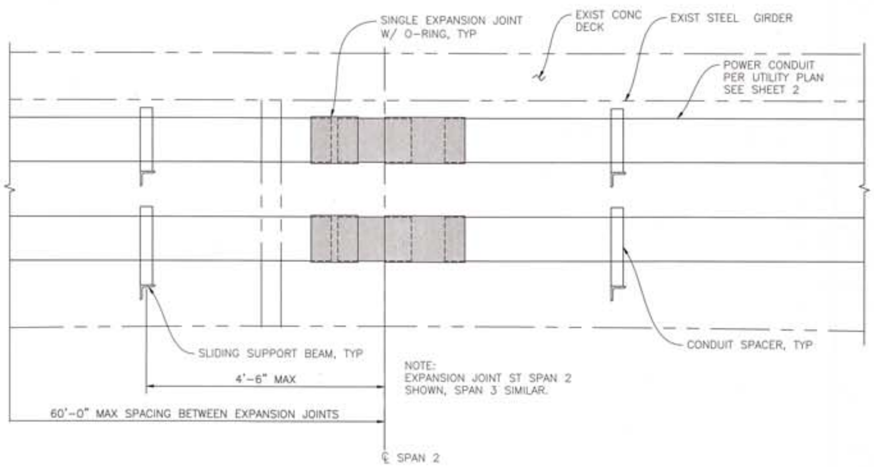
LINCOLN BLVD BR 53-0118
CROSSING OVER BALLONA CREEK

ABUTMENT RETROFIT DETAILS NO. 1

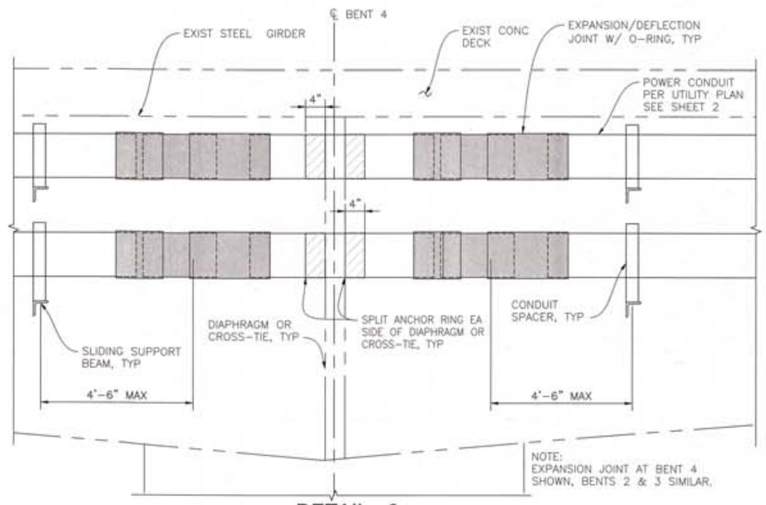
11H5031 SHEET 7 OF 9



DETAIL - 6
1" = 1' - 0"



DETAIL - 7
1" = 1' - 0"



DETAIL - 8
1" = 1' - 0"

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BREA, CA 92821
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www.parkiainc.com

EXPECTED CONSTRUCTION COMPLETION: 04-01-16

REV. NO.	REV. DATE	INIT'L	REVISION DESCRIPTION	APP'V	TAT NO.

DRAWING CIRCULATION PRELIM.			FINAL		
ENGR 4	DSP 1		ENGR 2	VGS 1	
SP(MW) 2			SP(MW) 5	WOD 2	
D(WL) 2			D(WL) 6		
DSP 1			COE 1		
1			DDFT 1		
MFOR 1			DSP 1		
VGS 1			LSMS 1		

DWP

SERVICE CENTER JOB LOCATION: WL
SERVICE CENTER CONSTRUCTION: WL

CITY OF LOS ANGELES
DEPARTMENT OF
WATER AND POWER
DISTRIBUTION ENGINEERING SECTION

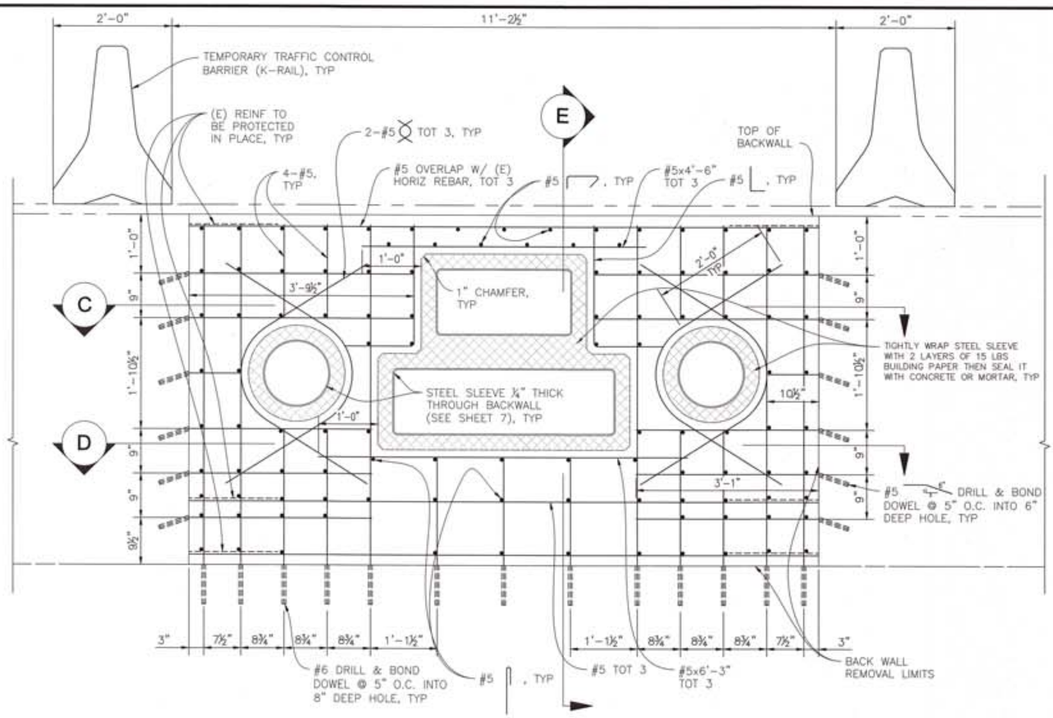
DESIGN: F. HAKEMI
DRAFTING: L. WEI
OK: D. KALANI
CHECKER: E. MERCADO
APPROVED: D. KALANI
DATE: 03/17/2016

WR #	CONST #	PROJECT #	NON-CONST #
822768	KYV85	P240974	KYV86

LINCOLN BLVD BR 53-0118
CROSSING OVER BALLONA CREEK

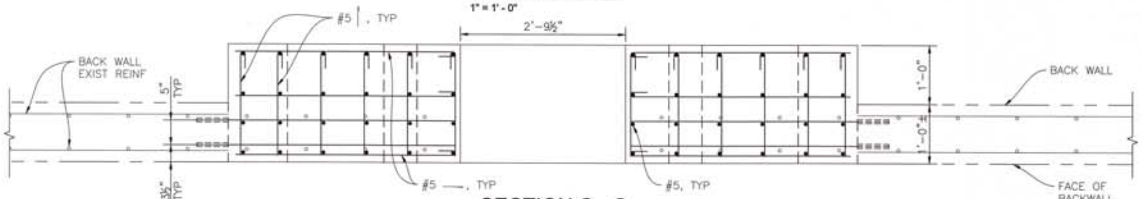
ABUTMENT RETROFIT DETAILS NO. 2

11H5031 SHEET 8 OF 9



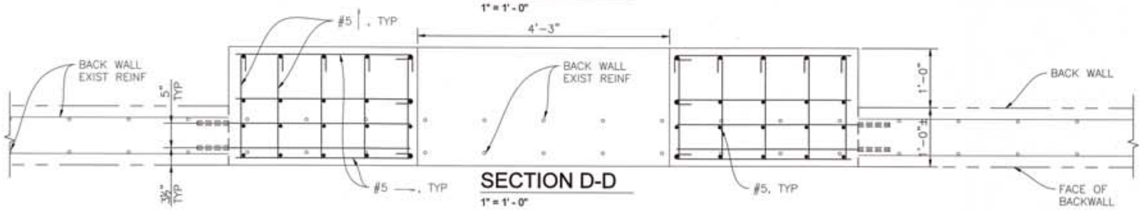
SECTION B - B

1" = 1'- 0"



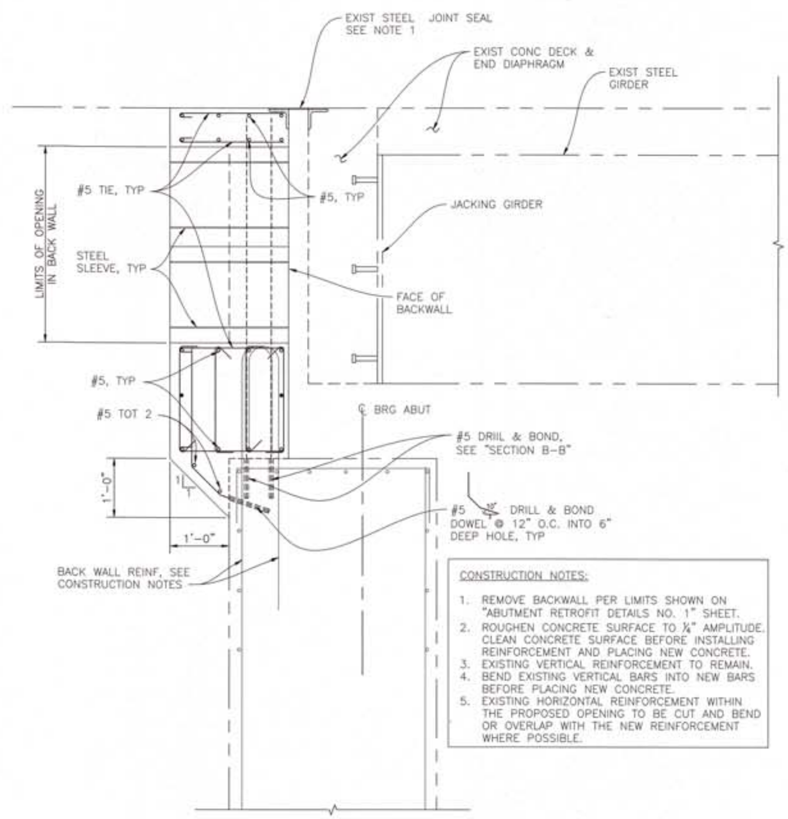
SECTION C - C

1" = 1'- 0"



SECTION D-D

1" = 1'- 0"



CONSTRUCTION NOTES:

1. REMOVE BACKWALL PER LIMITS SHOWN ON "ABUTMENT RETROFIT DETAILS NO. 1" SHEET.
2. ROUGHEN CONCRETE SURFACE TO ¼" AMPLITUDE. CLEAN CONCRETE SURFACE BEFORE INSTALLING REINFORCEMENT AND PLACING NEW CONCRETE.
3. EXISTING VERTICAL REINFORCEMENT TO REMAIN.
4. BEND EXISTING VERTICAL BARS INTO NEW BARS BEFORE PLACING NEW CONCRETE.
5. EXISTING HORIZONTAL REINFORCEMENT WITHIN THE PROPOSED OPENING TO BE CUT AND BEND OR OVERLAP WITH THE NEW REINFORCEMENT WHERE POSSIBLE.

SECTION E-E

1" = 1'- 0"

NOTES:

1. EXIST STEEL JOINT SEAL ASSEMBLY SHALL BE PROTECTED IN PLACE. IF ANY DAMAGE OCCURRED DURING CONSTRUCTION, IT SHOULD BE REPLACED IN KIND WITH THE ENGINEER OF RECORD'S APPROVAL.

EXPECTED CONSTRUCTION COMPLETION: 04-01-16

Parkia, Inc.
Engineering & Construction
471 W. LAMBERT RD., SUITE 111
BREA, CA 92821
TEL: (714) 773-1077
www.parkiainc.com

REV. NO.	REV. DATE	INIT'L	REVISION DESCRIPTION	APP'D	TAT NO.

DRAWING PRELIM.				CIRCULATION FINAL			
ENGR	4	DSP	1	ENGR	2	VGS	1
SP(MW)	2			SP(MW)	5	WOD	2
D(WL)	2			D(WL)	6		
DSP	1			COE	1		
	1			DOFT	1		
MFGR	1			DSP	1		
VGS	1			LSMS	1		

SERVICE CENTER JOB LOCATION: WL — SERVICE CENTER CONSTRUCTION: WL

CITY OF LOS ANGELES
DEPARTMENT OF
WATER AND POWER
DISTRIBUTION ENGINEERING SECTION

DESIGN	F. HAKEMI	DRAFTING	L. WEI
DK	D. KALANI	CHECKER	E. MERCADO
APPROVED	D. KALANI	DATE	03/17/2016

WR #	CONST #	PROJECT #	NON-CONST #
822768	KYV85	P240974	KYV86

LINCOLN BLVD BR 53-0118
CROSSING OVER BALLONA CREEK

ABUTMENT RETROFIT DETAILS NO. 3

11H5031 SHEET 9 OF 9

APPENDIX F
STRUCTURE PRELIMINARY GEOTECHNICAL REPORT

STRUCTURE PRELIMINARY GEOTECHNICAL REPORT
LINCOLN BOULEVARD BRIDGE REPLACEMENT
LOS ANGELES, CALIFORNIA

Submitted to

PSOMAS
and
CALTRANS

Prepared for

PSOMAS
555 South Flower Street, Suite 4300
Los Angeles, California, 90071

Prepared by

GROUP DELTA CONSULTANTS, INC.
370 Amapola Avenue, Suite 212
Los Angeles, California 90501

Group Delta Project No. LA1590
December 20, 2022
(Revised May 18, 2023)

GROUP DELTA

PSOMAS
555 South Flower Street, Suite 4300
Los Angeles, California, 90071

December 20, 2022 (Revised 5/18/2023)
Project No. LA1590

Attention: Tim Hayes
Project Manager

SUBJECT: Structure Preliminary Geotechnical Report
Lincoln Boulevard Bridge Replacement
Los Angeles, California

Dear Mr. Hayes,

Group Delta is pleased to submit our Structure Preliminary Geotechnical Report (SPGR) for the subject new bridge structure replacing the existing Lincoln Boulevard bridge in accordance with our revised proposal dated October 4, 2022. Please feel free to contact us if you have questions or comments.

Sincerely,
GROUP DELTA CONSULTANTS, INC.

REGISTERED PROFESSIONAL ENGINEER
PIROOZ KASHIGHANDI
No. GE 3104
GEOTECHNICAL
STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER
ASHEESH PRADHAN
No. C 89285
CIVIL
STATE OF CALIFORNIA

PK Ghandi

Pirooz Kashighandi, Ph.D., G.E.
Senior Geotechnical Engineer

Asheesh Pradhan, Ph.D., P.E.
Project Engineer

Distribution: Addressee (PDF file to Psomas)

370 Amapola Avenue, Suite 212, Torrance, CA 90501 TEL: (310) 320-5100
Anaheim – Irvine – Ontario – San Diego – Torrance
www.GroupDelta.com

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STRUCTURE PRELIMINARY GEOTECHNICAL REPORT
LINCOLN BOULEVARD BRIDGE REPLACEMENT
LOS ANGELES, CALIFORINA

1.0 INTRODUCTION

The following document presents a Structure Preliminary Geotechnical Report (SPGR) for the proposed new Lincoln Boulevard bridge replacing the existing Lincoln Boulevard bridge (Bridge No. 53-0118) in Los Angeles, California. Lincoln Boulevard crosses Ballona Creek about 1,000 feet northwest of West Jefferson Boulevard, as shown on the Site Location Map, Figure 1A. The site vicinity is shown in more detail in Figure 1B. Photographs of the bridge at present, and during construction in 1937 are provided in Figures 1C and 1D respectively.

A preliminary layout for the proposed new bridge is shown in the Proposed Development, Figure 2A. The bridge profile and deck configuration are shown in Figure 2B. The approximate locations of 36 explorations that have previously been conducted within about 1,500 feet of Lincoln Boulevard are shown in the Existing Explorations, Figure 3A. An aerial photograph showing the approximate locations of the 4 explorations we propose for the final design is provided in Figure 3B.

The purpose of this study was to characterize the pertinent geotechnical conditions at the site and provide preliminary geotechnical input for the proposed bridge. Our conclusions and recommendations are based on the previous subsurface explorations and laboratory testing, as well as supplemental engineering analyses, and our previous experience with similar geologic conditions. This SPGR was prepared in general accordance with Caltrans Guidelines for the Preparation of Foundation Reports for Bridges (Caltrans, 2021a).

1.1 Purpose and Scope of Work

This SPGR is provided to support Advanced Planning Studies at the Project Approval/Environmental Document (PA/ED) stage of the project, in accordance with Caltrans's "Foundation Reports for Bridges" (Caltrans, 2021a). The scope of work included:

- A review of the surface characteristics of the site, available geologic hazard maps, geotechnical reports, and aerial photographs.
- A review of 36 explorations that were conducted in the site vicinity between 1998 and 2013.
- A review of previous laboratory tests conducted on samples collected from the exploratory borings.
- Analysis of the available field and laboratory data to help develop preliminary geotechnical input for the proposed bridge.
- Summary of anticipated site conditions, geology, and subsurface conditions.

- Summary of subsurface data and as-built foundation data.
- Preliminary scour and corrosion evaluation.
- Preliminary seismic information and recommendations.
- Preliminary evaluation of the liquefaction and seismic settlement and evaluation of the slope stability (lateral spreading) of the abutments based on liquefied soil profile, depths of liquefaction, etc.
- Preliminary recommendations for foundation type, size, and capacity.
- Recommend scope of additional investigations for final design, and
- Preparation of this report.

2.0 PROJECT DESCRIPTION

2.1 Project

The project consists of the construction of a new precast girder bridge along Lincoln Boulevard crossing over the Ballona Creek about 1,000 feet northwest of West Jefferson Boulevard replacing the existing Lincoln Boulevard bridge. Based on the structural drawings for the planning study, the bridge has three equal-length spans of 111.5 feet, and a total length of 334.5 feet. The bridge will be approximately 130 feet wide with six lanes. The bridge will be supported by two piers and two abutments. Concrete cantilever wing walls are proposed to be supported on the abutment piles.

The new bridge is proposed to be constructed over the existing bridge in phases allowing the flow of vehicular traffic during construction. Half of the width of the bridge will be constructed first confining the traffic to the other half of the existing bridge. Then the traffic will be confined to the completed half of the new bridge while the other half is being constructed. As discussed above, the existing bridge will be demolished.

2.2 Pertinent Reports and Investigations

The following reports and investigations from nearby projects performed by Group Delta and Pacific Soils Engineering were available and reviewed.

- Group Delta's nearby project Ballona Wetlands (Group Delta, 2013) that included three rotary wash (RW) borings, one hollow stem auger (HSA) boring, and six cone penetration test (CPT) soundings.

- Group Delta's nearby development project in Playa Vista (Group Delta, 1999) that included eleven borings and 8 CPTs.

- Pacific Soils Engineering's nearby development project in Playa Vista (Pacific Soils Engineering, 1998) that included eight exploratory borings and twelve CPTs.

2.3 Project Datum

The elevation data presented herein reflect feet above Mean Sea Level (MSL) based on the North American Vertical Datum of 1988 (NAVD88). Topographic roadway elevations, the elevation of the proposed bridge, and elevations from the as-built plans of the existing bridge are based on the National Geodetic Vertical Datum of 1929 (NGVD29). We understand that an approximate conversion to NAVD88 may be made by adding 2.3 feet to these NGVD29 elevations. The horizontal datum is the North American Datum of 1983 (NAD83).

2.4 Exceptions to Policies and Procedures

No exceptions to policy or procedures are proposed.

3.0 FIELD INVESTIGATION

3.1 Existing Field and Laboratory Data

No new explorations were performed as part of this study. The available subsurface data in the site vicinity included three previous geotechnical investigations conducted near the Lincoln Boulevard Multi-Modal Improvement Project between 1998 and 2013. The data from the most recent field investigation for the Ballona Wetlands Restoration Project is reproduced in Figures A-1 through A-10 in Appendix A (Group Delta, 2013). The Ballona Wetlands study included the advancement of three rotary wash (RW) borings, one hollow-stem-auger (HSA) boring, and six cone penetrometer test (CPT) soundings within about 1,500 feet of Lincoln Boulevard. These explorations were advanced between September 14th and October 16th of 2012 (Group Delta, 2013).

Photocopies of 11 exploratory borings and 8 CPT soundings we previously conducted for the Playa Vista development are attached as the second Appendix A (Group Delta, 1999). Photocopies of 8 exploratory borings and 12 CPT soundings conducted by others for the Playa Vista development are also attached as the third Appendix A (Pacific Soils Engineering, 1998). The approximate locations for all these borings and CPT soundings are shown in the Existing Explorations, Figure 3A.

Soil samples were collected from the borings for laboratory testing and analyses. Previous testing programs included gradation analyses and Atterberg Limits to aid in material classification using the Unified Soil Classification System (USCS). Tests were conducted on relatively intact samples to estimate the in-situ dry density and moisture content of the materials encountered on site. Corrosivity tests were conducted to evaluate the pH, resistivity, chloride, and sulfate content of the on-site soils. Direct shear tests were conducted on relatively intact soil samples to aid in strength characterization. Consolidation tests were conducted on undisturbed samples of the alluvium to help characterize the potential for settlement. The laboratory test results for the three studies noted above are also presented in Appendix B (Group Delta, 1999 and 2013, and Pacific Soils Engineering, 1998).

The explorations utilized in this study are shown in Figure 3A and summarized in Table 1 below.

Table 1: Summary of Existing Subsurface Investigation

Exploration No.	Completion Date	Drill Rig Type	Hammer Type	Hammer Efficiency (%)	Approximate Ground Surface Elevation (ft)	Exploration Depth (ft)	Ground Water Depth (ft)	Approximate Groundwater Elevation (ft)
Group Delta Consultants, Inc (1999)								
B-302R	12/11/1998	RW	Auto	--	17.5	66.5	20.0	2.5
B-304H	10/29/1998	HSA	Auto	--	14.6	31.0	12.2	2.4
B-305H	10/29/1998	HSA	Auto	--	15.3	31.0	12.0	3.3
B-306R	11/04/1998	RW	Auto	--	16.8	51.5	--	--
B-307R	11/06/1998	RW	Auto	--	11.4	61.0	--	--
B-309R	11/04/1998	RW	Auto	--	12.8	61.0	--	--
B-313H	10/29/1998	HSA	Auto	--	12.6	26.0	8.4	4.2
B-315H	10/30/1998	HSA	Auto	--	13.3	26.0	8.0	5.3
B-316R	11/03/1998	RW	Auto	--	14.1	57.5	--	--
B-317R	11/05/1998	RW	Auto	--	9.5	61.0	--	--
B-319R	11/05/1998	RW	Auto	--	11.7	61.0	--	--
C-301C	12/07/1998	CPT	--	--	--	68.0	14	--
C-303C	12/07/1998	CPT	--	--	--	61	14	--
C-308	11/03/1998	CPT	--	--	--	62	10	--
C-310C	11/03/1998	CPT	--	--	--	62	8	--
C-311C	11/03/1998	CPT	--	--	--	63	8	--
C-312C	11/03/1998	CPT	--	--	--	69	8	--
C-314C	11/03/1998	CPT	--	--	--	64	8	--
C-318C	11/03/1998	CPT	--	--	--	64	8	--
Group Delta Consultants, Inc (2013)								
A-RW013	09/26/2012	RW	Auto	84	13.8	56.5	--	--
A-RW015	10/02/2012	RW	Auto	84	17.1	61.5	--	--
B-RW049	10/01/2012	RW	Auto	84	17.6	69	--	--
B-HSA051	10/16/2012	HSA	Auto	84	6.3	21.5	NE	--
A-CPT-012	09/24/2012	--	--	--	13.8	48.1	--	--
A-CPT-014	09/24/2012	--	--	--	16.0	52.0	--	--
A-CPT-025	09/26/2012	--	--	--	20.0	65.1	--	--

Exploration No.	Completion Date	Drill Rig Type	Hammer Type	Hammer Efficiency (%)	Approximate Ground Surface Elevation (ft)	Exploration Depth (ft)	Ground Water Depth (ft)	Approximate Groundwater Elevation (ft)
B-CPT-050	09/14/2012	--	--	--	20.2	64.1	--	--
C-CPT-060	10/10/2012	--	--	--	14.6	49.0	--	--
A-CPT-065	09/26/2012	--	--	--	20.5	63.3	--	--
Pacific Soils Engineering (1998)								
PSB-1	12/05/1997	HSA	Auto	--	16	71	14	2
PSB-2	12/09/1997	HSA	Auto	--	16	71	15	1
PSB-3	12/09/1997	HSA	Auto	--	16	71	15	1
PSB-4	12/09/1997	HSA	Auto	--	16	71	10	6
PSB-5	12/10/1997	HSA	Auto	--	16	66	--	--
PSB-6	12/10/1997	HSA	Auto	--	16	71	10	6
PSB-7	12/10/1997	HSA	Auto	--	16	71	17	-1
PSB-8	12/11/1997	HSA	Auto	--	16	71	15	1
PSCPT-1	12/10/1997	CPT	--	--	--	~50	--	--
PSCPT-2	12/10/1997	CPT	--	--	--	~50	--	--
PSCPT-3	12/10/1997	CPT	--	--	--	~50	--	--
PSCPT-4	12/10/1997	CPT	--	--	--	~52	--	--
PSCPT-5	12/10/1997	CPT	--	--	--	~50	--	--
PSCPT-6	12/10/1997	CPT	--	--	--	~51	--	--
PSCPT-7	12/10/1997	CPT	--	--	--	~51	--	--
PSCPT-8	12/10/1997	CPT	--	--	--	~51	--	--
PSCPT-9	12/10/1997	CPT	--	--	--	~50	--	--
PSCPT-10	12/10/1997	CPT	--	--	--	~50	--	--
PSCPT-11	12/10/1997	CPT	--	--	--	~50	--	--
PSCPT-12	12/10/1997	CPT	--	--	--	~51	--	--

Notes: RW = rotary wash; HSA = hollow stem auger, NE = not encountered

4.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

4.1 Site Conditions

The subject bridge site is located within the City of Marina Del Rey in Los Angeles County, California along Lincoln Boulevard between Station 60+69.75 and 64+04.25. The approximate location and extent of the project are shown in the Site Location Map, Figure 1A. The areas located both north and west of the roadway are primarily undeveloped wetlands associated with Ballona Creek, as discussed in the referenced report (Group Delta, 2013) however the area on the southeast has been developed with residential structures (Playa Vista). The area located immediately southeast of the Lincoln Boulevard Bridge was investigated previously as "Area De" of the Playa Vista Development (Group Delta, 1999).

The bridge is located at latitude 33.9750° north and longitude 118.4323° west, as shown on the Site Vicinity Plan, Figure 1B. A photograph showing the current configuration of the bridge is presented in Figure 1C. An aerial photograph showing the bridge during construction in 1937 is provided in Figure 1D.

Ballona Creek flows from the northeast to the southwest in the site vicinity. Topographic maps shown in Figure 2A indicate that existing elevations along Lincoln Boulevard vary from a low of about 18 feet near the northern abutment to a high of about 21.5 feet at the southern abutment. The bottom of the Ballona Creek channel appears to be located near the mean sea level, as shown in Figure 2B. The as-built drawings shown in Appendix C suggest that the flow height in the channel is typically on the order of 6 feet, although the flow height may vary considerably due to seasonal fluctuations in rainfall.

The site vicinity has been repeatedly developed over the years. The Pacific Electric Railroad was constructed in the 1880s immediately north of present-day Culver Boulevard (see Figure 1D). The rail has since been demolished, although portions of the ballasted trackway may remain below grade. The Ballona Wetlands were opened to oil and gas exploration in the 1930s, and numerous oil derricks and dikes were constructed in the area through the 1950s. Ballona Creek was channelized and protected with reinforced concrete in 1934 (see Figure 1C). However, previous improvements included some rip-rap slope protection along the creek, which may also remain beneath the ground surface. Development of the Marina Del Rey project in the 1950s included dredging of the harbor and the placement of hydraulic fill throughout the wetlands.

4.2 Site Geology

The site is located within the Los Angeles basin section of the Peninsular Ranges geomorphic province of southern California. The Los Angeles basin is generally underlain by Quaternary alluvial deposits, which overlie several thousand feet of Tertiary marine and non-marine sediments. The previous investigations indicate that the site is underlain by Quaternary Alluvial Floodplain Deposits (Map Symbol – Qa), which are covered with both hydraulic fill and conventional fill. The general geology in the site vicinity is shown on the Local Geologic Map, Figure 4A. Logs describing the subsurface conditions encountered in the borings and CPT soundings are provided in Appendix A. The various geologic materials encountered at the site are described in more detail below.

4.2.1 Alluvial Floodplain Deposits (Qa)

Quaternary-age alluvial sediments primarily associated with the Ballona Creek drainage are believed to underlie the entire site to the maximum depth explored. The upper portion of these alluvial deposits (from a few feet above mean sea level down to about 35 feet or 40 feet below mean sea level) is typically poorly consolidated, and most commonly consists of interbedded lean and fat clay (CL or CH) and silt (ML and MH), with occasional beds of silty and clayey sand (SM and SC). The CPT data suggests that the fine-grained soils within this zone are typically soft to medium stiff, with estimated undrained shear strengths (Su) generally ranging from about 400 pounds per square foot (psf) to 1,000 psf. The sandy soils in this zone generally varied in thickness from about 2 feet to 5 feet and were typically loose in relative density based on correlations to the available SPT blow count data ($N_{60} < 10$).

At elevations approximately 35 feet or 45 feet below mean sea level (MSL), the density of the alluvium typically increases, and the beds of silty, clayey, and poorly graded sand (SM, SC, or SP) become more common. The corrected SPT blow counts in these deeper beds of sandy alluvium typically varied from 30 to 50 or more, indicating dense to very dense conditions. Most of the CPT soundings met with refusal within these deeper alluvial deposits, with the CPT tip resistance in excess of 300 tons per square foot (TSF). The fine-grained soil layers within the deeper alluvial deposits were typically stiff to very stiff in consistency, with undrained shear strengths (Su) from the CPT interpretations typically ranging from about 1,500 psf to 2,000 psf.

Laboratory tests indicate that the alluvium is moderate to highly compressible. The results of previous consolidation tests conducted on samples of the alluvium collected in the site vicinity are presented in Appendix B. These previous tests suggest that the upper alluvial deposits are essentially normally consolidated, with a slight over-consolidation in the deeper alluvium. Our previous settlement analyses indicate that a 10-foot fill load over the alluvium may result in roughly 10 inches to 20 inches of settlement (Group Delta, 2013). Based on settlement monitoring of surcharge fill loads placed at the Playa Vista Development, it appears that the settlement should typically be 90 percent completed within about 3 months to 6 months of the completion of the fill placement (Group Delta, 1999).

Shear wave velocities were previously measured at 7 locations for the Ballona Wetlands restoration project, with an average value of Vs_{30} of 202 m/s at these locations (Group Delta, 2013). The closest measurement to the subject site was in sounding A-SCPT-022, roughly 3,000 feet west of Lincoln Boulevard (Group Delta, 2013). The average shear wave velocity in the upper 100 feet of the soil profile (Vs_{30}) at the location of A-SCPT-022 was approximately 210 m/s.

4.2.2 Artificial Fill (af)

The existing bridge abutments are believed to be underlain by compacted fill, as well as hydraulic fill soils placed during the development of Marina Del Rey. The hydraulic fills are similar in composition to the underlying alluvium, as they were likely generated from these deposits. Consequently, the hydraulic fill is not differentiated from the alluvium on the logs. Hydraulic fill was likely placed to roughly 0 feet to 5 feet (MSL), with conventional fill placed above that elevation.

The Artificial Fill (af) observed at the four borings locations conducted near the subject site was located at elevations ranging from 0 feet to 8 feet (MSL) or higher (Group Delta, 2013). As observed in these borings, the fill typically consisted of silty sand (SM) and sandy silt (ML) that is fine to medium-grained and moist. The corrected SPT blow counts (N_{60}) collected within the fill ranged from 5 to 11 and averaged 9. This indicates that the fill is loose on average. Higher-density compacted fill is anticipated at the bridge abutment locations due to typical construction and compaction requirements in such areas. However, supplemental investigations will be needed to characterize the fill at the precise abutment locations. Although not directly observed in the previous borings, some riprap is also anticipated within the fill, based on historic aerial photographs of Ballona Creek.

4.2.3 Groundwater

Groundwater was not measured in the exploratory borings and CPT soundings conducted for the most recent site investigation (Group Delta, 2013). However, temporary groundwater monitoring wells were established within four of the hollow stem borings conducted at the Playa Vista development immediately southeast of the Lincoln Boulevard bridge (Group Delta, 1999). The groundwater elevations at that location varied from roughly 2 feet to 5 feet (MSL) in December 1998. We understand that these monitoring wells were destroyed during the construction of the Playa Vista residential development. The final groundwater readings within these monitoring wells are summarized in the table below. The approximate monitoring well locations are shown in Figure 3A.

Observation Well ID	Groundwater Record Date	Ground Surface Elevation [FT]	Groundwater Depth [FT]	Groundwater Elevation [FT], MSL
B-304H	12/23/98	16.7	14.4	2.3
B-305H	12/23/98	17.4	14.9	2.5
B-313H	12/23/98	14.6	10.5	4.1
B-315H	12/23/98	15.4	10.0	5.4

We understand that water surface elevations in the Ballona Creek channel typically vary from roughly 2 feet to 5 feet (MSL), depending in part on tidal fluctuations. The flow height in the creek may rise to roughly 6 feet to 10 feet (MSL) during winter storm events. Note that the available plans suggest that the bottom of the Ballona Creek channel is located at about 0 feet, whereas the approach abutments vary in height from about 14 feet to 21 feet, as shown in Figure 2A. The High Groundwater Map suggests that groundwater levels may rise to about 5 feet below existing grades in the site vicinity (see Figure 4B, CDMG, 1998).

It should be noted that groundwater levels at the site are likely to be closely related to the water surface elevation within Ballona Creek. Floods within the channel may cause the groundwater levels to temporarily rise within the surrounding levees (although the concrete armor on the channel walls may increase the lag time in groundwater response). Groundwater levels may also fluctuate over time throughout the site due to changes in the water surface elevation and flow within the creek, as well as variations in rainfall, irrigation, or site drainage conditions.

5.0 AS-BUILT FOUNDATION DATA

The existing 4-lane bridge was constructed in 1937 and is a 4-span bridge with a total length of about 334.5 feet. The bridge includes a cast-in-place concrete deck supported by steel girders with bolted steel braces (see Figure 1C). Each of the three pier walls for the 4-span bridge is supported by reinforced concrete pile caps bearing on groups of driven piles. The abutments are also believed to be supported by vertical-driven piles. Although the as-built pile foundation details are not available, we anticipate that untreated timber piles may have been used. The available plans and elevations, and details of the piers and abutments are shown in Appendix C.

6.0 SCOUR EVALUATION

The Lincoln Boulevard Bridge crosses the Ballona Creek channel, where the potential for scour may be high during heavy storm flow, or as the result of a tsunami. The FEMA Flood Maps and Tsunami Inundation Zones for the site are shown in Figures 7A and 7B. Note that the existing concrete lining on Ballona Creek should help to reduce the potential for scour on the banks of the creek (although the bottom of the channel does not appear to be lined). The scour elevations should be estimated following the California Bank and Shore Rock Slope Protection Design Manual (Caltrans, 2000).

A report of recent hydrological study performed by Michael Baker (Michael Baker, 2022) for the existing and proposed bridge dated October 2022 was provided by Psomas. The report is presented in Appendix D.

For preliminary scour evaluations, the scour depth as a minimum should be extended to the elevation of the bottom of the existing pile cap in the channels, which is estimated at about be extended to El. -10 feet.

A D_{50} value of 0.075 millimeters can be used for preliminary scour evaluation, based on a soil type of clay and silt and their mixture at this elevation of 0 feet. The preliminary scour evaluation should be revised and updated after the completion of the site-specific field investigation.

7.0 CORROSION EVALUATION

Corrosion tests were performed on selected samples collected from the previous exploratory borings at the site, as summarized in Table 2. The corrosion potential for the on-site soils was assessed in accordance with the Caltrans Corrosion Guidelines (Caltrans, 2021b). Caltrans defines a corrosive environment as an area where the soil has either a chloride concentration of 500 parts per million (ppm) or greater, a sulfate concentration of 1,500 ppm or greater, or a pH of 5.5 or less. The available test data indicates that the site soils are not corrosive based on Caltrans' criteria. However, additional corrosion testing should be conducted as part of the site-specific evaluation.

Table 2: Summary of Soil Corrosivity

Boring Number and Year	Sample Depth (feet)	pH	Chloride Content (ppm)	Sulfate Content (ppm)	Minimum Resistivity (ohm-cm)
B-304H	0 to 5	8.1	<10	130	250
B-305H	0 to 5	8.2	<10	120	240
B-313H	0 to 5	7.8	30	260	130

Resistivity serves as an indicator parameter for the possible presence of soluble salts. A minimum resistivity value for soil and/or water less than or equal to 1500 ohm-cm indicates the presence of high quantities of soluble salts and a higher propensity for corrosion. However, resistivity is not included as a parameter to define a corrosive area for structures except for MSE walls (Caltrans, 2021b). A corrosion consultant may be referred for specific recommendations.

8.0 PRELIMINARY SEISMIC INFORMATION AND RECOMMENDATIONS

The project is located in a seismically active area, as shown on the Regional Fault Map, Figure 5A. A detailed Local Fault Map is provided in Figure 5B. Other potential geologic and seismic hazards include ground rupture, strong ground shaking, seismic settlement, slope instability, lateral spread, tsunamis, and earthquake-induced flooding. Each hazard is discussed in more detail below.

8.1 Ground Rupture

Ground rupture is the result of movement on an active fault reaching the ground surface. Known faults within 100 kilometers (km) of the site are shown on the Regional Fault Map, Figure 5A. The approximate locations of both the active and potentially active faults in the site vicinity are shown on the Local Fault Map, Figure 5B (Jennings, C. W., 1994).

The site is not located within an Alquist-Priolo Earthquake Fault Zone (CDMG, 1992), and no evidence of active or potentially active faulting was encountered during our previous site investigation or literature review. Consequently, ground rupture is not considered a significant geologic hazard at the site.

8.2 Seismicity and ARS Curve

The current Caltrans ARS Online tool (V3.0.2) was used to develop a preliminary design spectrum for the site located at a latitude of 33.9750° north, and a longitude of 118.4323° west. The ARS design spectrum incorporated an average shear wave velocity (Vs_{30}) of 210 m/s (or 690 ft/s), based on the direct shear wave velocity measurements conducted in CPT sounding A-SCPT-022. The preliminary Caltrans ARS design spectrum for the site has a Peak Ground Acceleration (PGA) of 0.6g, as shown in Figure 6. The deaggregated mean earthquake moment magnitude (M) is 6.6 and the mean site-to-source distance (R) for the 1.0 seconds spectral acceleration is 16.6 kilometers. Note that loose soil at the site (N_{60}<10) would classify as Class S2 soil per Section 6.1.3 of the Caltrans Seismic Design Criteria, Version 2.0.

8.3 Liquefaction and Seismic Settlement

The site is located within an area previously identified as susceptible to liquefaction. Liquefaction involves the sudden loss in strength of a saturated, cohesionless soil (sand and non-plastic silts) caused by the build-up of pore water pressure during cyclic loadings, such as that produced by an earthquake. This increase in pore water pressure can temporarily transform the soil into a fluid mass, resulting in sand boils, settlement, and lateral ground deformations. Typically, liquefaction occurs in areas where there are loose to medium dense sands and silts, and where the depth to groundwater is less than 50 feet from the ground surface. In summary, three simultaneous conditions are required for liquefaction:

- Historic high groundwater within 50 feet of the ground surface
- Liquefiable soils such as loose to medium dense sands
- Strong shaking, such as that caused by an earthquake

The typical groundwater level at the site is approximately 5 feet (MSL). The historic high groundwater associated with flooding is estimated at about 5 feet below the ground surface (see Figure 4B). Although the alluvium at the site is predominately clayey, it does contain frequent beds of loose to medium dense sand and silt and is located in close proximity to several active fault zones. Our analyses indicate that these loose to medium dense beds of sand and silt may liquefy during the design earthquake of 0.6g. The deeper alluvial deposits typically have corrected SPT blow counts above 30, and do not appear to be liquefiable.

The results of our liquefaction analyses are summarized in Appendix E. We performed the liquefaction calculations using the available nearby Cone Penetration Test (CPT) data (Group Delta, 2013). The triggering and settlement evaluations were based on the methods originally developed in the 1998 NCEER Workshops, as implemented in the commercially available computer program CLiq. The calculations were carried to the maximum depth of the available CPT soundings, although the bulk of the associated settlement typically occurred at depths of less than 50 feet below grade. For the analyses, we used a moment magnitude of 6.6, a PGA of 0.6g, and a typical groundwater elevation of 5 feet (MSL) during the earthquake (corresponding to a minimum depth of 7 feet below grade). Based on the results of our analyses, we estimate that the total liquefaction settlement associated with the Design level earthquake at the site should typically vary from about 1 inch to 3 inches.

Liquefaction settlement may result in a downdrag load on the piles, settlement of the approach embankments, and lateral spreading of the abutments. Liquefaction also creates the potential for loss of near-surface soil strength resulting in a reduced lateral pile capacity.

Dissipation of the excess porewater pressure generated in completely liquefied soils, and hence liquefaction-induced downdrag, does not occur until the cessation of ground shaking. Therefore, the effects of liquefaction-induced downdrag on the pile need not be considered in combination with the inertial component that occurs during shaking. Thus, in liquefied soils, a pile foundation needs to be designed to satisfy the seismic axial bearing stability requirements in compression extreme events for two different combinations – a) permanent loads and inertial loads resulting from the ground motion-induced inertia of the superstructure during the shaking, and b) permanent loads and liquefaction induced downdrag after the cessation of the shaking (Caltrans, 2020b).

8.4 Slope Instability and Lateral Spreads

Lateral spreading is the result of liquefaction or plastic deformation occurring on the sloping ground during an earthquake. Lateral spreading is typically characterized by blocks of mostly intact, surficial soil displacing down-slope or towards a free face along a shear zone that has formed within an underlying liquefied sediment. Based on simplified empirical methods, there appears to be a strong potential for lateral spread of the Ballona Creek levees in the site vicinity. Previous analyses suggest that displacements along the levees may vary from roughly 6 inches to 18 inches (Group Delta, 2013).

Note that the precise location, depth, and density of the liquefiable layers at the abutment locations will greatly impact the seismic response and should be better defined through future subsurface investigation.

The presence of the abutment piles helps reduce the displacement at the abutment locations compared to the surrounding levees. Lateral spread analyses including soil-pile interaction may be conducted per Caltrans Geotechnical Manual (Caltrans, 2020c), Memo to Designers 20-15 (Caltrans, 2017b), and Attachment 1 to the memo for lateral spreading analysis. No site-specific subsurface data is available at the abutment locations.

8.5 Tsunamis, Seiches, and Flooding

The Ballona Creek channel drains a large portion of the Los Angeles basin, and seasonal storms are expected to produce floods within the channel beneath the Lincoln Boulevard bridge annually. Available as-built maps suggest that the design flood level within the creek may be on the order of 6 feet (MSL), as shown in Appendix C. The approximate 100-year and 500-year flood zones are shown on the FEMA Flood Maps, Figure 7A. The ultimate 100-year design water surface level should be determined by the bridge designer and shown on the bridge plans.

The site is located about 3 km northeast of a breakwater in the Pacific Ocean, and the Ballona Creek channel bottom is only a few feet above mean sea level. The relatively close proximity to the ocean suggests that the potential may exist for flooding in the event that an earthquake-induced tsunami was to travel up the Ballona Creek channel. However, the existence of the offshore barrier islands and the configuration of the continental shelf in southern California have historically provided relief from such tsunamis. The ten largest tsunamis that occurred within the Pacific Ocean over the last century did not significantly impact the region.

Studies by the Army Corps of Engineers (US Army, 1974) suggest that a 500-year tsunami within the Pacific Ocean may result in a water surface runup of about 14 feet above tidal elevations (U.S. Army, 1974). The California Emergency Management Agency's Tsunami Inundation Map is shown in Figure 7B. This map suggests that a tsunami may travel up the Ballona Creek channel beyond the subject site. Note that the top of the existing bridge is located at an elevation of about 18 feet at the northern abutment location, as shown in Figure 2A. The potential for damage to the bridge from flooding or a tsunami within the Ballona Creek channel should be evaluated by the project design team.

9.0 PRELIMINARY FOUNDATION RECOMMENDATIONS

The remainder of this report presents preliminary recommendations for the design of the proposed bridge foundations. These recommendations are based on empirical and analytical methods typical of the standards of practice in southern California. If these recommendations do not appear to cover a specific feature of the project, please feel free to contact our office for additions or revisions. These recommendations should be considered preliminary and subject to revision based on the findings of the supplemental field investigation.

9.1 Foundation Type

Based on the structural drawings for the planning study, the piers for the new bridge are planned to be supported on either 5½-foot diameter open-ended Cast-In-Steel-Shell (CISS) piles or Type I, or Type II cast-in-drilled-hole (CIDH) piles, and the abutments are supported on either open-eneded CISS or CIDH piles. The cantilever concrete wing walls are supported on the abutment piles.

To resist lateral spreading seismic displacements, large diameter (36-inch or greater) CIDH, or open-ended CISS pile foundation systems are recommended for supporting the bridge structure both at piers and abutments.

Large diameter CIDH piles are feasible at the piers and the abutments, but special construction techniques (slurry, casing, etc.) and integrity testing (gamma-gamma logging) will be required due to shallow groundwater and caving-prone soils.

CISS piles are driven pipe piles that are filled with cast-in-place reinforced concrete no deeper than the shell tip elevation. Since CISS piles are driven, noise issues should be considered in the pile type selection process due to the proximity to the residential development.

Our preliminary liquefaction settlement analyses indicate that the bottom of the liquefiable layers may extend to elevations -25 feet to -30 feet. With proposed pile cut-offs at or around the elevation of 0 to 5 feet, downdrag loads may be experienced along up to 30 to 35 feet of the pile length, negating any pile resistance down to about El. -40 feet within the denser alluvial deposits.

For cost-estimating purposes, we recommend that an average nominal (ultimate) soil skin friction resistance of 1.5 ksf, and 2 ksf be assumed below El. -40 feet for CIDH piles and CISS piles, respectively, for estimation of the pile lengths. This will likely result in pile lengths of about 70 feet to 85 feet, tipping at elevations between -65 feet to -80 feet.

Smaller diameter driven piles are not recommended due to unfavorable subsurface soil conditions as the site is classified as S2 per the SDC V2.0., Section 6.1, and Section 6.2.3. Shallow foundations are not feasible for supporting the bridge structure due to seismic settlement and lateral spreading issues.

9.2 CIDH and CISS Construction Considerations

Type I or Type II CIDH piles may be used to support the bridge structure. Due to high groundwater, a wet method of construction will need to be utilized. Temporary casing will need to be used for the construction of the piles and the temporary casing will need to be left in place near the ground surface to prevent water from flooding into the construction. The casings may be installed by an oscillatory or rotary method.

For wet construction, slurry should be used as drilling fluid per Caltrans Standard Specifications Section 49 (Caltrans, 2022). To maintain the hole sidewall and bottom stability, and to help reduce and potential for anomalies, it is essential that a positive slurry head of no less than 10 feet above the groundwater table be maintained at all times during drilling and concrete placement. The tip resistance of the CIDH piles should be ignored in axial capacity calculations due to the wet method of construction. A permanent casing may also need to be considered within a portion of the pile length in contact with channel water or soft soils near the invert of the Ballona Creek channel.

CISS piles are driven piles that are filled with cast-in-place reinforced concrete no deeper than the shell tip elevation. A soil plug should be left at the bottom of the CISS piles so that the pile is not undermined due to water intrusion. A 20-foot-long soil plug usually provides an adequate seal at the bottom of the pile.

Site-specific issues such as noise and vibration should be considered for this site due to its proximity to residential development. When site-specific subsurface data is available, drivability analysis should also be performed for the CISS piles.

9.3 Approach Fill Settlement and Waiting Period

It appears the existing approach embankment is not wide enough to accommodate the new bridge width, and therefore the approach embankment will be widened as well as raised several feet in profile grades. Due to the presence of soft to stiff saturated clayey/silty layers some long-term consolidation settlement should be anticipated due to grade increase and a waiting period will be required before driving abutment piles. The time required for settlement to take place will be determined based on final embankment geometry and amount of fill placed, soil types and consolidation properties, layer thickness, and single versus double drainage conditions. Waiting periods in general can be reduced by temporary surcharge and/or wick drains.

Our previous settlement analyses indicate that a 10-foot-high abutment fill load over the alluvium may result in roughly 10 to 20 inches of settlement (Group Delta, 2013). Based on settlement monitoring of surcharge fill loads placed at the Playa Vista Development, it appears that such settlement should typically be substantially completed within about 3 months to 6 months of the completion of the fill placement (Group Delta, 1999). Consequently, a waiting period of 90 days to 180 days may be needed for the installation of the piles at the abutment locations, if additional fill loads are proposed. The waiting period should begin after the new abutments are constructed to full height. Construction of the piles, approach slabs and pavement should also be delayed until the waiting period is completed. In accordance with Section 49-2.01C (4) of the standard specifications for driven piles, CISS piles should be driven through predrilled holes where the depth of the new embankment is in excess of 5 feet. Note that if the abutment piles are installed prior to fill placement, a drag load would be imparted on the piles which would result in a reduced axial pile capacity.

Settlement monuments should be installed in all new fill areas. The monuments should be surveyed regularly until the settlement is deemed substantially complete. Settlement monitoring should be performed in general accordance with CT112. Installation of the abutment piles and settlement sensitive surface improvements should be delayed until the settlement is deemed substantially complete based on the survey data. The Geotechnical Engineer should review the settlement data to determine when sufficient settlement is completed for the installation of the piles.

10.0 ADDITIONAL FIELDWORK AND LABORATORY TESTING

Additional field exploration and laboratory testing will be needed in order to provide geotechnical information adequate for final design development. As a minimum, one rotary wash boring and one CPT sounding are proposed at each of the bridge abutment locations, as shown in the Exploration Plan, Figure 3B. Note that additional explorations may be needed at a future date for the support located within Ballona Creek (once the construction trestle is in place and these support locations may be easily accessed with drilling equipment). We recommend that all borings be drilled using the rotary wash method due to the presence of shallow groundwater. In the CPT soundings, shear wave velocities should be measured at 5-foot depth intervals to aid in site-specific seismic hazard analysis. All the borings and CPTs soundings should be extended to a minimum depth of 100 feet below the ground surface or refusal.

Laboratory tests should be conducted on samples collected from the proposed rotary wash borings to supplement the previous testing shown in Appendix B. All tests should be performed in accordance with applicable Caltrans and ASTM standards. The exact scope of testing will depend on the subsurface conditions encountered and will be determined after the completion of the fieldwork. However, as a minimum, additional soil classification, corrosion, and consolidation tests should be conducted on the soils collected within the upper 50 feet of the ground surface to aid in the supplemental geotechnical analyses. Additional shear and unconfined compression tests should also be conducted to aid in pile capacity analyses.

11.0 LIMITATIONS

This report was prepared in accordance with generally accepted Geotechnical Engineering principles and practice. The professional engineering work and judgments presented in this report meet the standard of care of our profession at this time. No other warranty, expressed or implied, is made. This report has been prepared for Psomas and their design consultants. It may not contain sufficient information for other parties or other purposes and should not be used for other projects or other purposes without review and approval by Group Delta.

The recommendations for this project, to a high degree, are dependent upon proper quality control of site grading, fill and backfill placement, and pile foundation installation. The recommendations are made contingent on the opportunity for Group Delta to observe the earthwork operations. This firm should be notified of any pertinent changes in the project, or if conditions are encountered in the field, which differ from those described herein. If parties other than Group Delta are engaged to provide such services, they must be notified that they will be required to assume complete responsibility for the geotechnical phase of the project and must either concur with the recommendations in this report or provide alternate recommendations.

12.0 REFERENCES

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FIGURES

GROUP DELTA CONSULTANTS, INC.
ENGINEERS AND GEOLOGISTS 370
AMAPOLA AVENUE, SUITE 212
TORRANCE, CALIFORNIA

PROJECT NUMBER	LA1590
DOCUMENT NUMBER	
PROJECT NAME	Lincoln Boulevard Bridge Replacement
FIGURE NUMBER	1A

SITE LOCATION MAP

N

NO SCALE

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ENGINEERS AND GEOLOGISTS
370 AMAPOLA AVENUE, SUITE 212
TORRANCE CALIFORNIA

PROJECT NAME
Lincoln Boulevard Bridge Replacement

PROJECT NUMBER
LA1590

DOCUMENT NUMBER

FIGURE NUMBER
1B

SITE VICINITY PLAN

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TORRANCE, CALIFORNIA

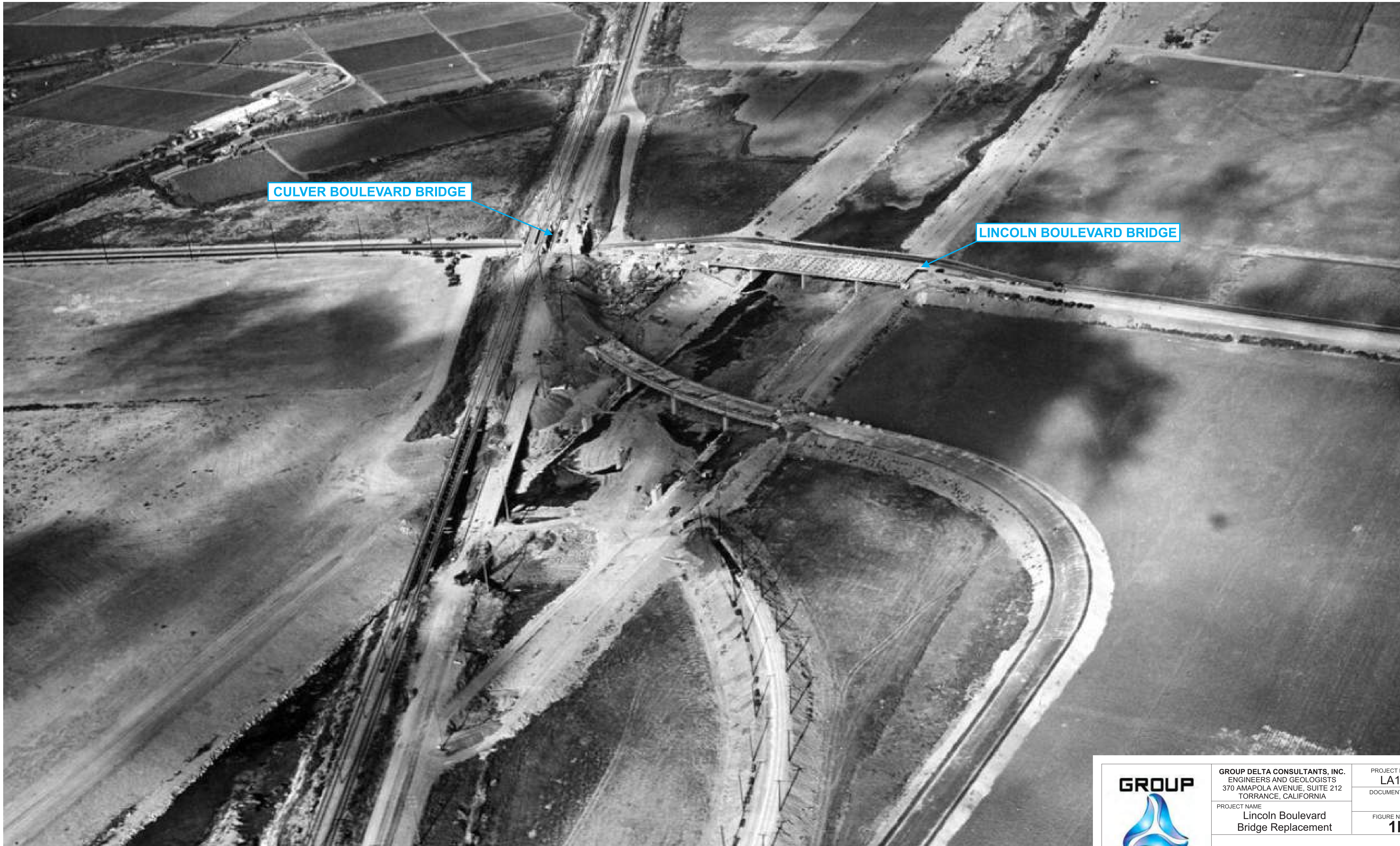
PROJECT NAME
Lincoln Boulevard
Bridge Replacement

PROJECT NUMBER
LA1590

DOCUMENT NUMBER

FIGURE NUMBER
1C

SITE PHOTOGRAPH (2018)



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TORRANCE, CALIFORNIA

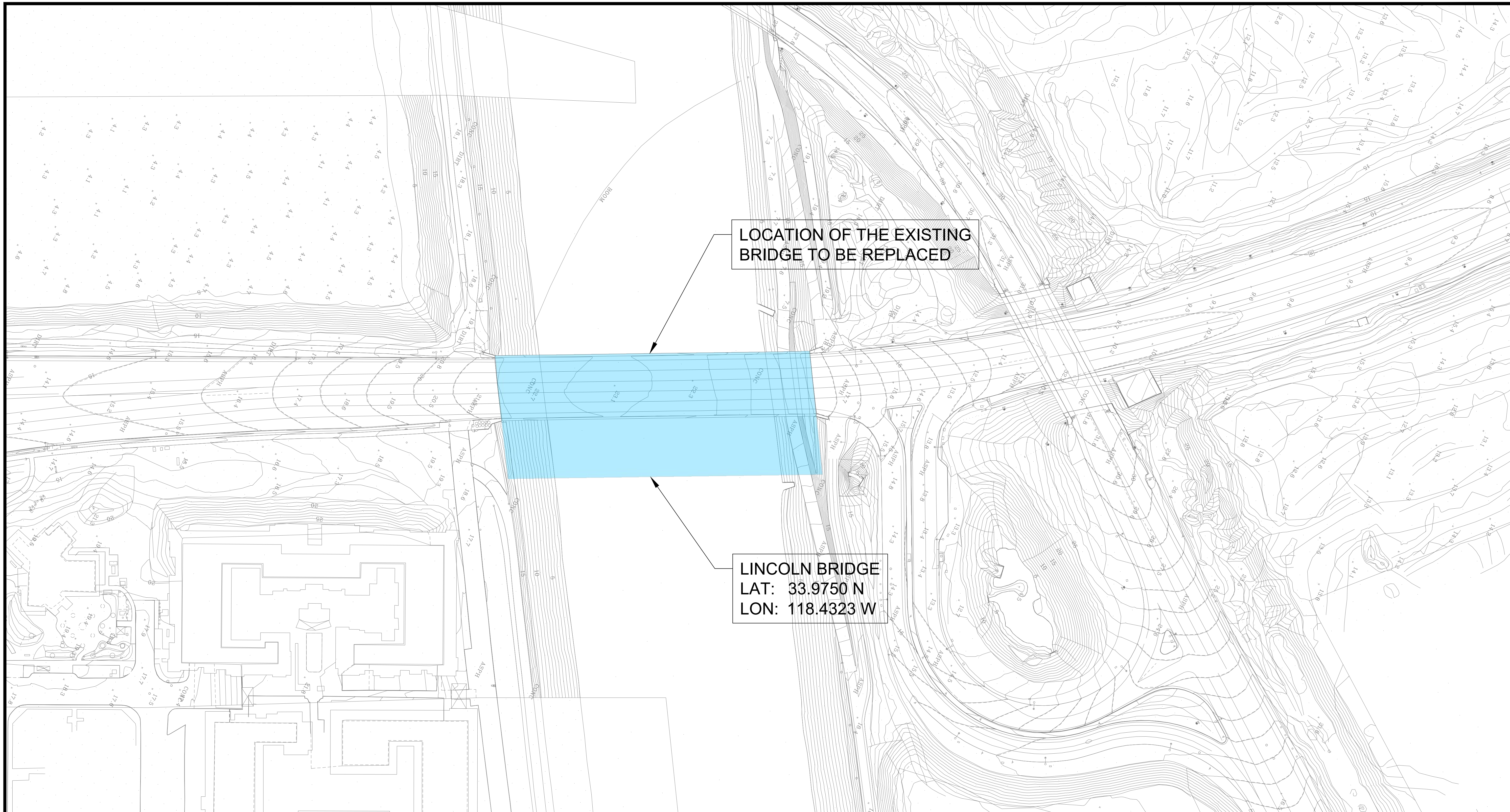
PROJECT NAME
Lincoln Boulevard
Bridge Replacement

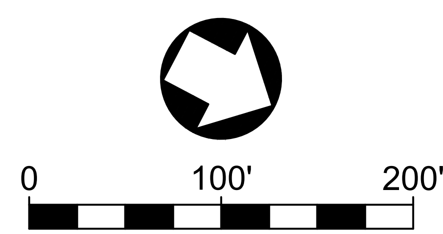
PROJECT NUMBER
LA1590

DOCUMENT NUMBER

FIGURE NUMBER
1D

SITE PHOTOGRAPH (1937)





REFERENCE: PLANNING STUDY, CALTRANS, 2022

GROUP DELTA	GROUP DELTA CONSULTANTS, INC. ENGINEERS AND GEOLOGISTS 370 AMAPOLA AVENUE, SUITE 212 TORRANCE, CALIFORNIA	PROJECT NUMBER: LA1590
	PREPARED BY: JMR — PROJECT NAME: LINCOLN BOULEVARD BRIDGE REPLACEMENT	FIGURE NUMBER: 2A
	REVIEWED BY: AP — PROPOSED DEVELOPMENT	

FILE PATH: N:\Projects\1500-1599\LA1590 Psomas Lincoln Bridge and Culver Bridge SPGR\600 Drafting\LA1590 Figs 2A-2B-Lincoln Bridge.dwg
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DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT
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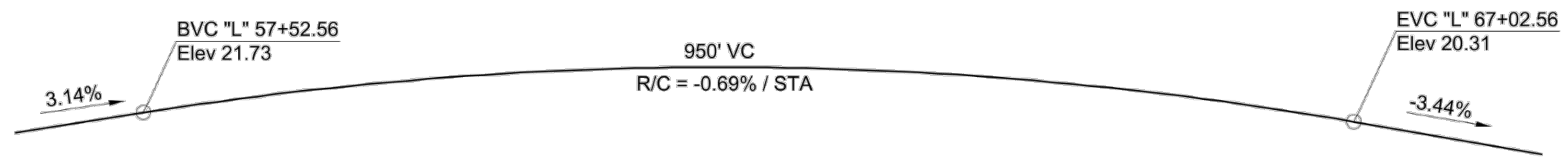
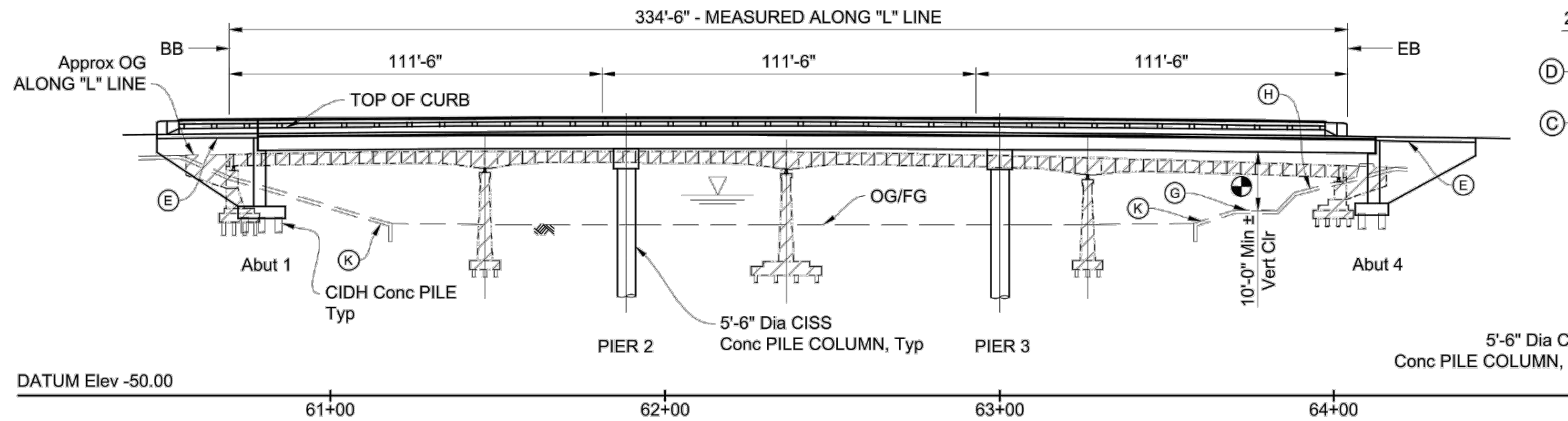
CNS ENGINEERS, INC.
11870 PIERCE ST, STE 265
RIVERSIDE, CA 92505



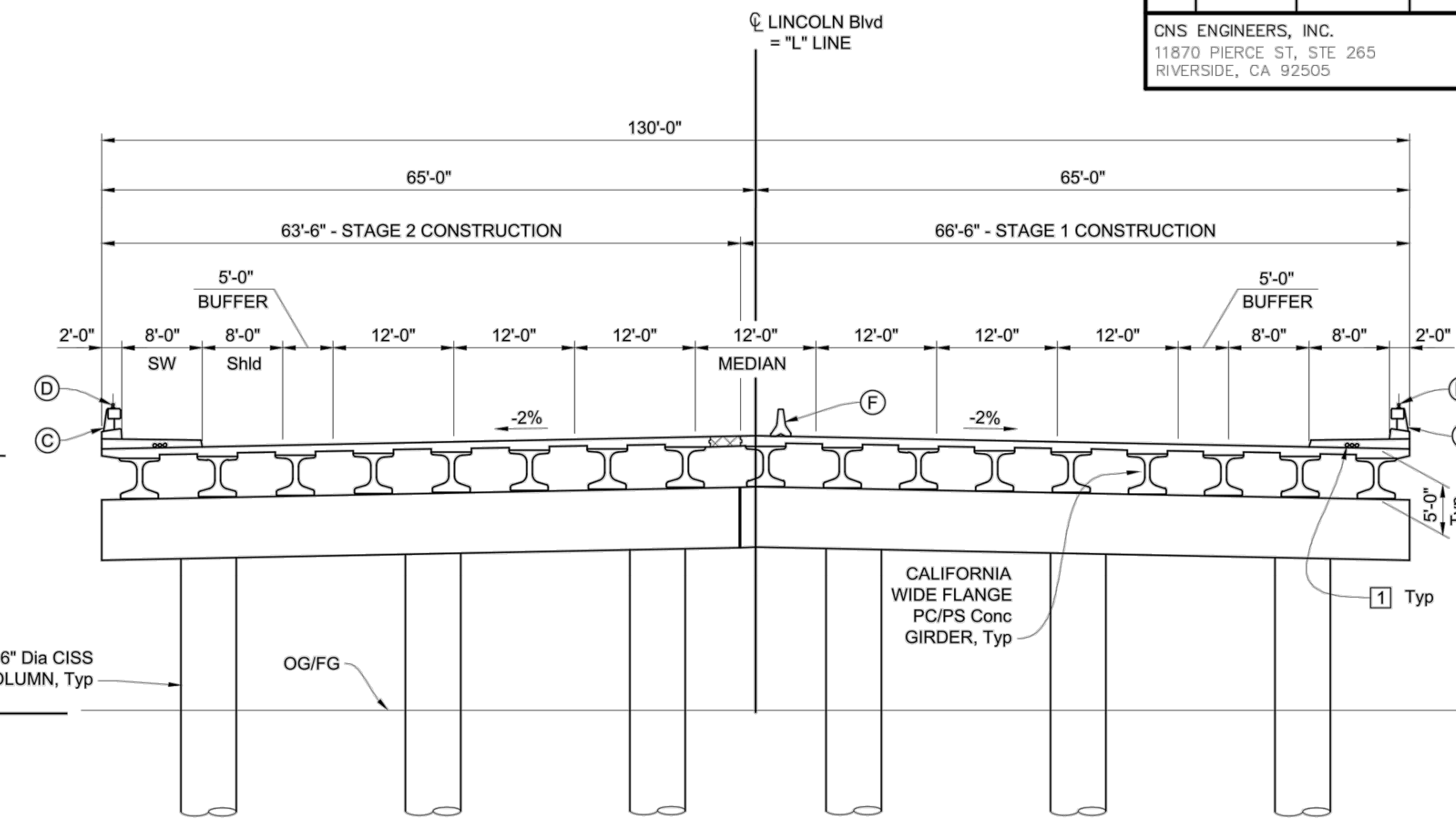
PROFILE GRADE

NO SCALE



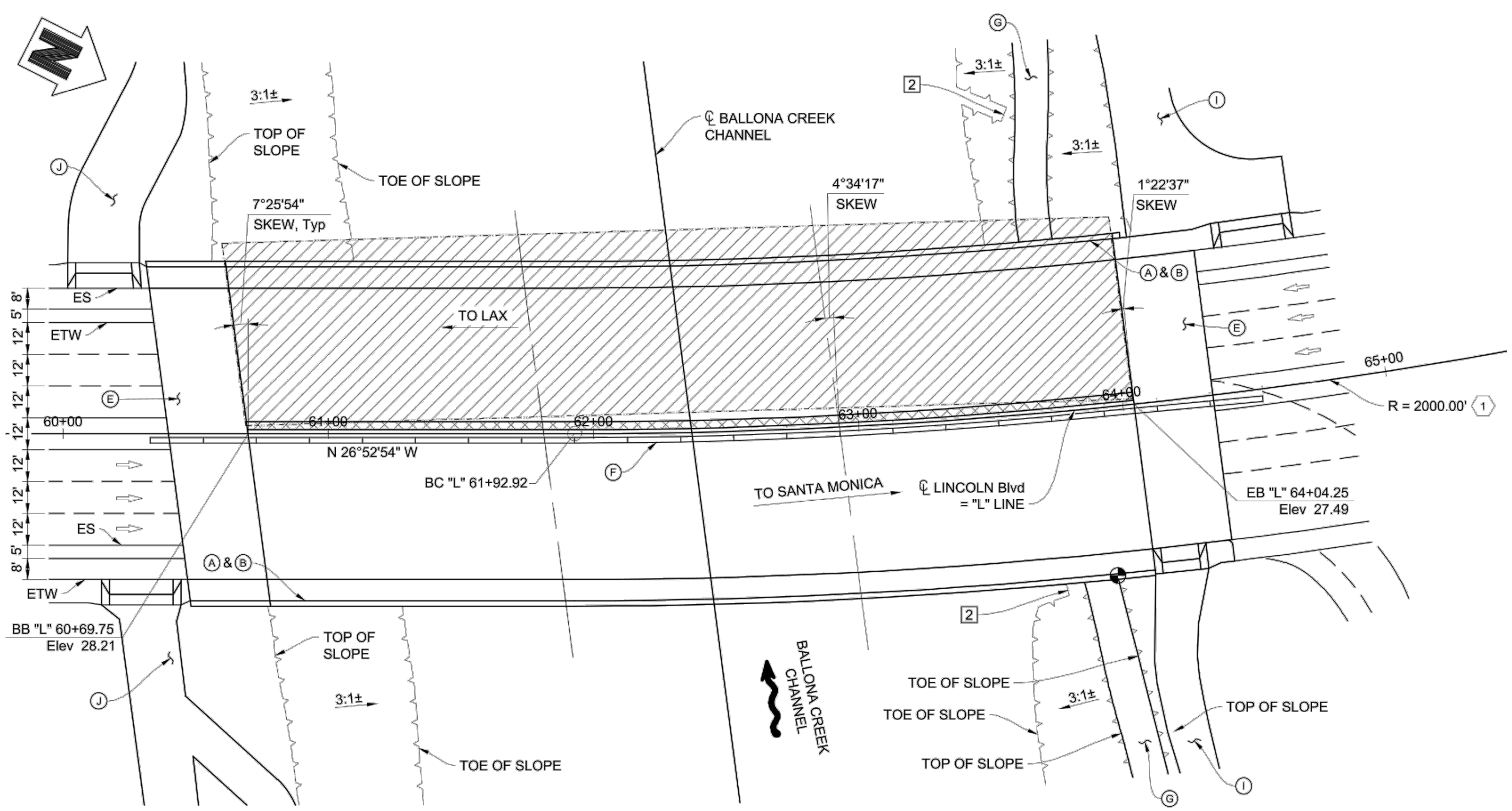
ELEVATION

1" = 30'-0"



TYPICAL SECTION

1" = 10'-0"



PLAN

1" = 30'-0"

LEGEND:

- Exist Structure
- New Construction
- Traffic Direction
- Bridge Removal
- Closure Pour
- Point of Minimum Vertical Clearance
- Water Surface Elevation

KEY NOTES:

- (A) Paint "Br. No. 53-0118"
- (B) Paint "LINCOLN BLVD BRIDGE OVER BALLONA CREEK"
- (C) Conc Barrier, Type 85SW (Mod)
- (D) Tubular Handrailing
- (E) Structure Approach, Type N (30S)
- (F) Temporary K-Rail
- (G) Exist Bike Path
- (H) Exist Bike Path Ramp
- (I) Proposed Bike Path Ramp
- (J) Proposed Maintenance Road Ramp
- (K) Exist Conc Slope Protection

UTILITIES:

- 1 Future Utilities Opening
- 2 Storm Drain

NOTE:

Date of Estimate		10/01/2021
Str Depth	=	5'-0"
Length	=	334'-6"
Width	=	130'-0"
Area	=	43,485 sqft
Avg Cost per Sq Ft Including 10% Mobilization & 25% Contingency	=	$473.00
Total Cost	=	$20,582,000

CURVE DATA TABLE

CURVE No.	R	Δ	T	L
1	2000.00'	25°36'56.00"	886.72'	894.15'

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TORRANCE, CALIFORNIA

PROJECT NUMBER: LA1590

PREPARED BY: JMR

PROJECT NAME: LINCOLN BOULEVARD BRIDGE REPLACEMENT

FIGURE NUMBER: 2B

REVIEWED BY: AP

PROPOSED DEVELOPMENT

REFERENCE: PLANNING STUDY, CALTRANS, 2022

EXPLANATION:

B-HSA051 — Approximate locations of the existing borings in close proximity to the site (A, B or C prefix~ Group Delta, PS~Pacific Soils).

A-CPT-065 — Approximate locations of existing CPT soundings in close proximity to the site (A, B or C ~ Group Delta, PS ~ Pacific Soils).

N

NO SCALE

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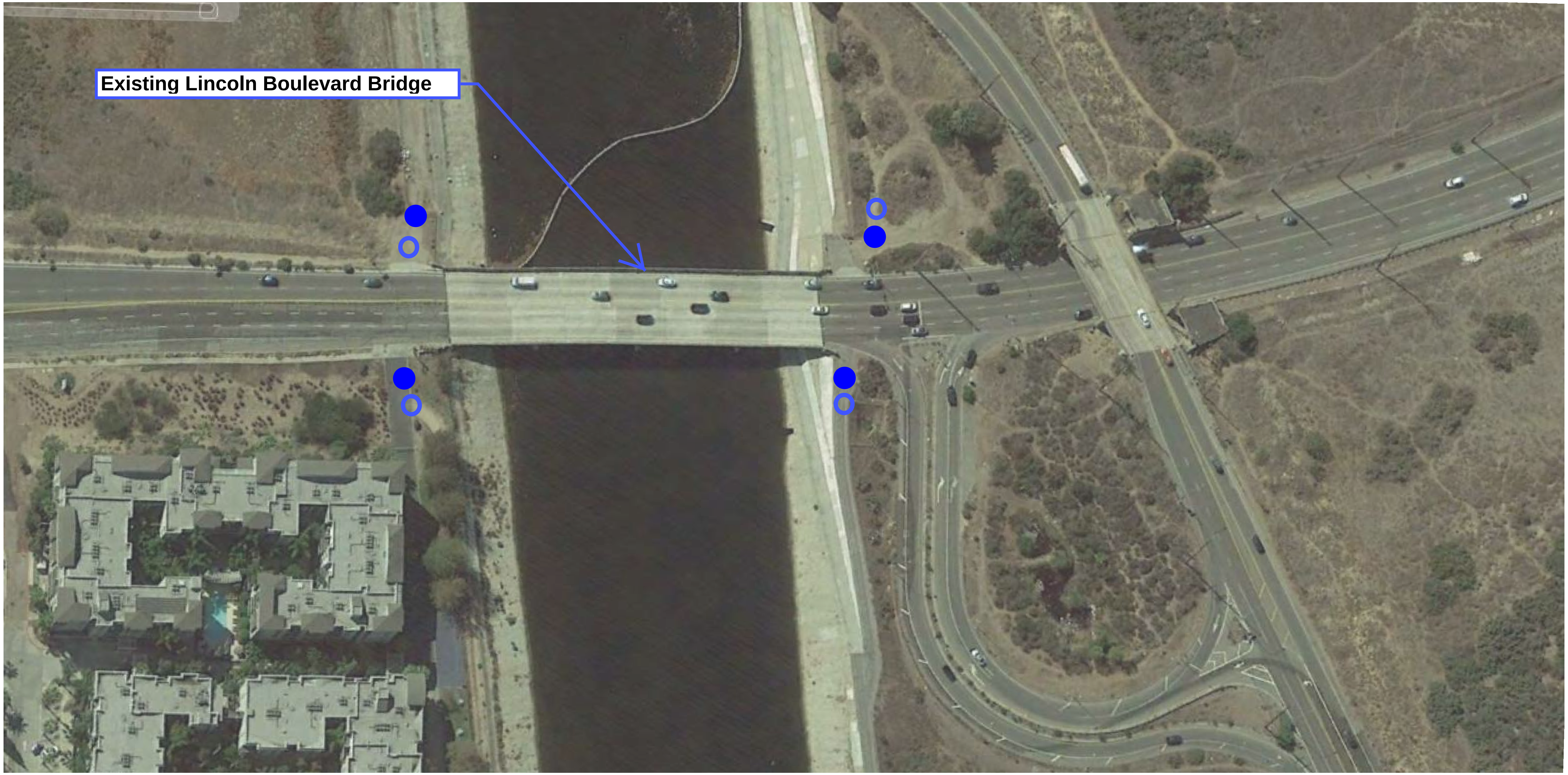
DOCUMENT NUMBER

PROJECT NAME: Lincoln Boulevard Bridge Replacement

FIGURE NUMBER: 3A

EXISTING EXPLORATIONS



EXPLANATION:

- ● Approximate locations of the 4 proposed exploratory borings
- ○ Approximate locations of the 4 proposed exploratory CPT soundings

N

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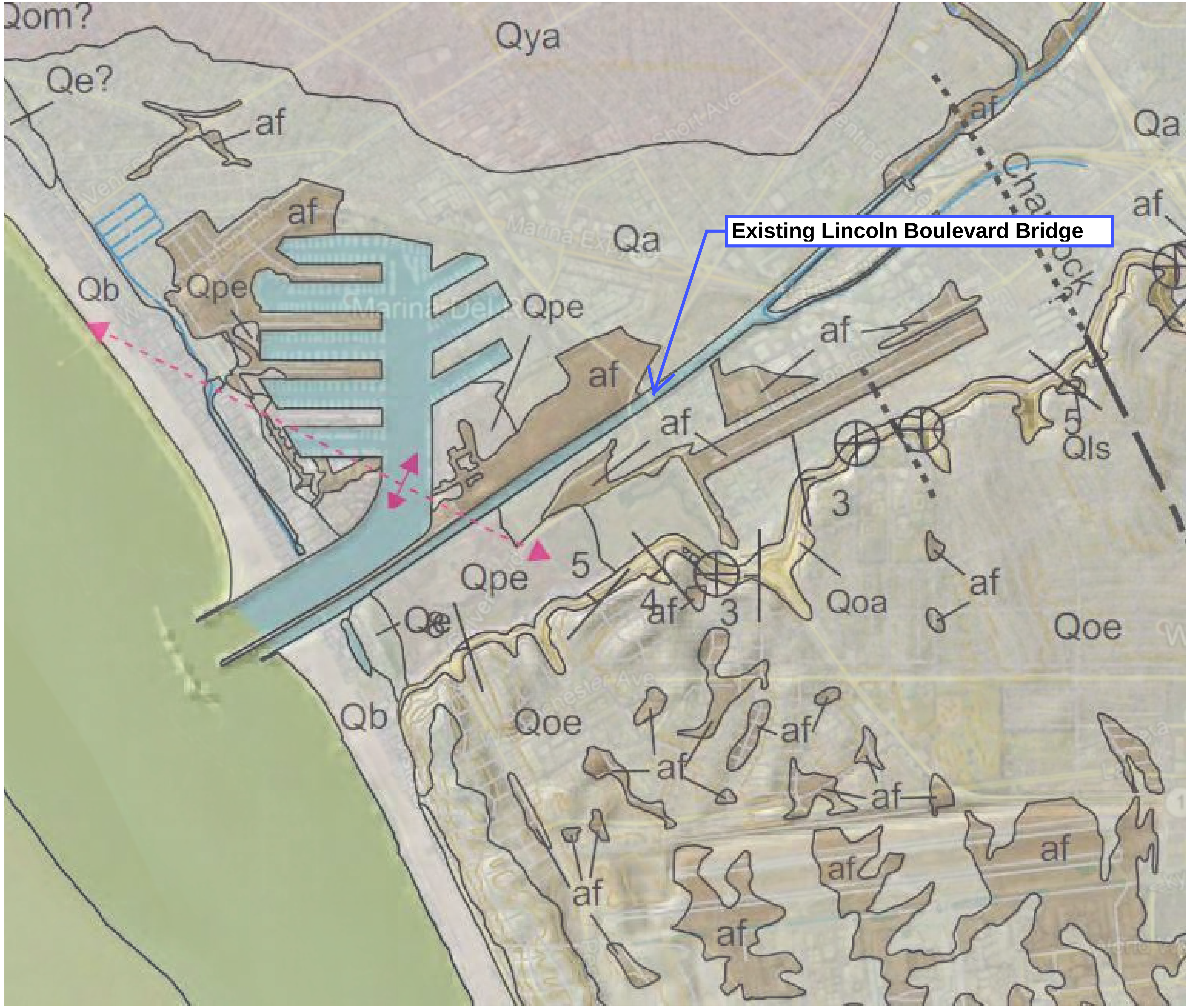
Lincoln Boulevard
Bridge Replacement

PROJECT NUMBER
LA1590

DOCUMENT NUMBER

FIGURE NUMBER
3B

EXPLORATION PLAN



REFERENCE: Saucedo et al. (2003). *Geologic Map of the Long Beach 30'x60' Quadrangle, California*, CGS, Scale 1:100,000.

ABBREVIATED EXPLANATION

HOLOCENE

- af — Artificial fill
- Qw — Active channel and wash deposits
- Qa — Alluvial flood plain deposits
- Qls — Landslide deposits
- Qb — Beach deposits
- Qe — Eolian deposits
- Qpe — Paralic estuarine deposits
- Qyf — Young alluvial fan and valley deposits, undivided a = sand, s = silt, c = clay
- Qyf2 — Young alluvial fan deposits, unit 2
- Qyf1 — Young alluvial fan deposits, unit 1
- Qya — Young alluvial flood plain deposits, unit 1
- Qye — Young eolian deposits
- Qype — Young paralic estuarine deposits
- Qof — Old alluvial fan and valley deposits, undivided a = sand, s = silt, c = clay
- Qoa — Old alluvial flood plain deposits, undivided

PLEISTOCENE

- Qoe — Old eolian deposits
- Qom — Old marine deposits, undivided
- Qop — Old paralic deposits, undivided, a = sand, s = silt, c = clay
- Qlh — La Habra Formation

San Pedro Formation

- Qsp — San Pedro Formation, undivided
- Qspt — Timms Point Silt Member
- Qspl — Lomita Marl Member
- Qi — Inglewood Formation

- Qp — Pleistocene sedimentary deposits, undivided

N

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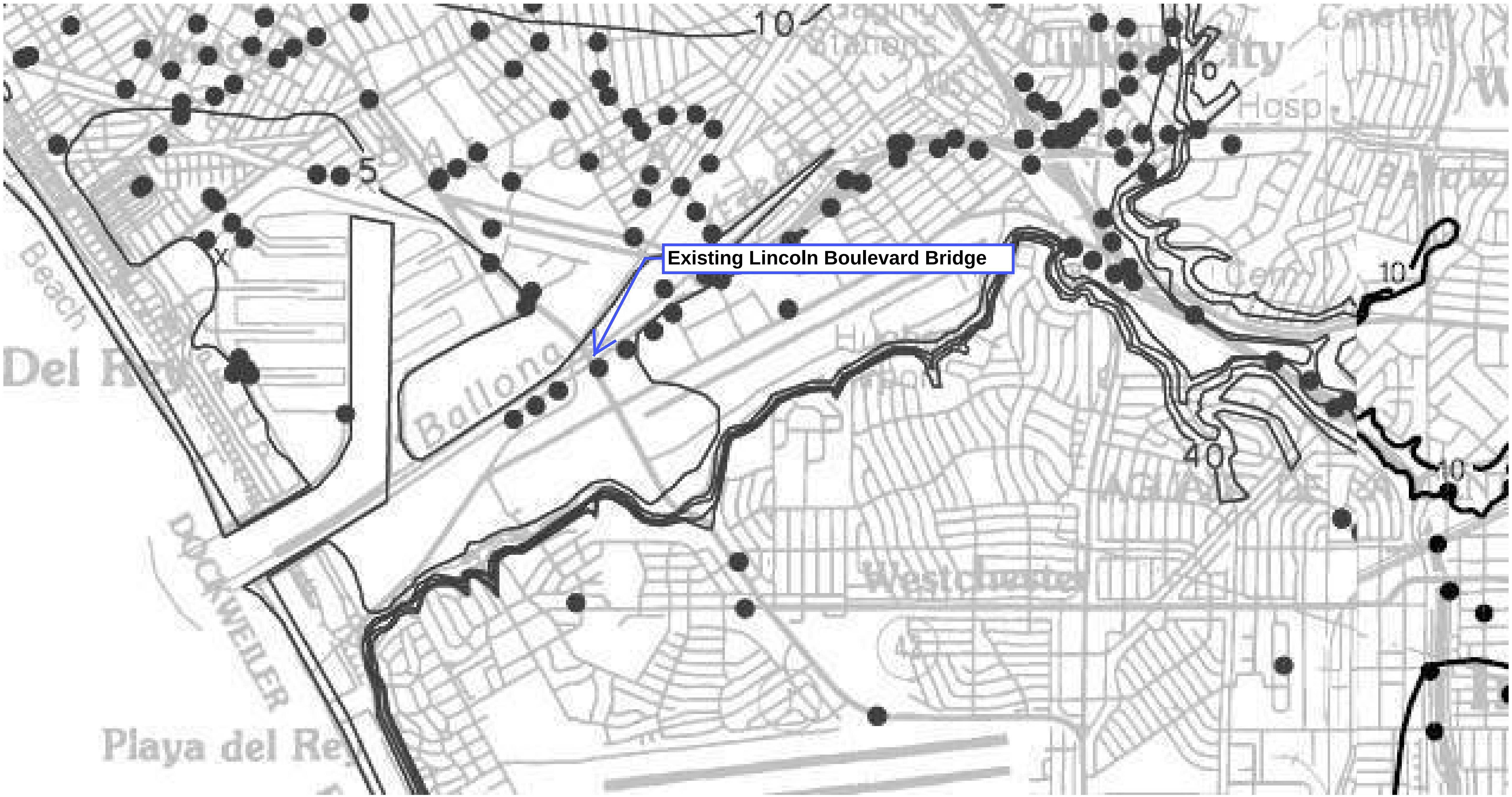
FIGURE NUMBER
4A

LOCAL GEOLOGIC MAP



EXPLANATION:

● Approximate location of borehole used to collect groundwater data.

— 5 — Approximate depth to historic high groundwater in feet.

REFERENCE: California Geologic Survey (1998). Seismic Hazard Zone Report for the Venice & Inglew

N

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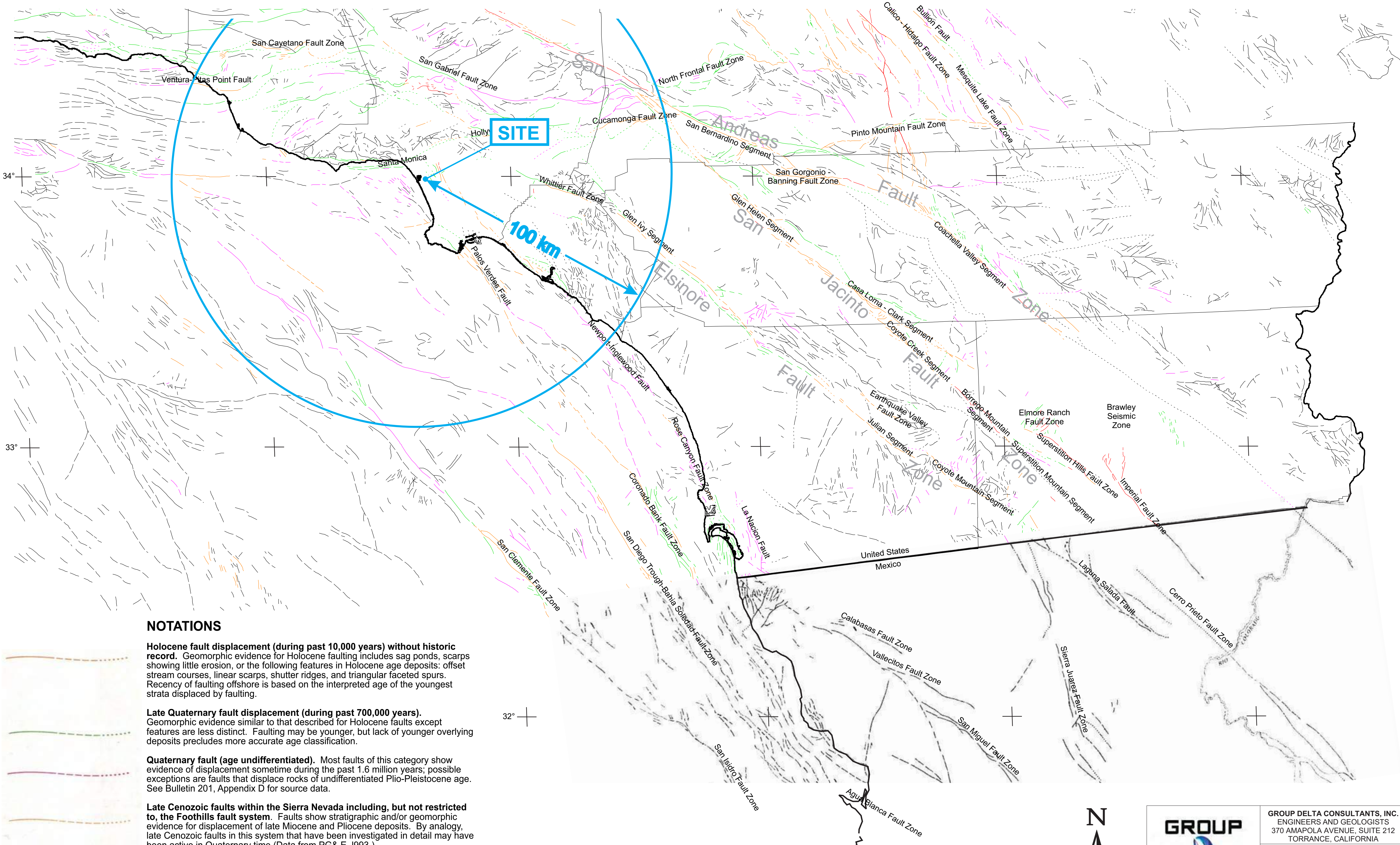
DOCUMENT NUMBER

PROJECT NAME Lincoln Boulevard Bridge Replacement

FIGURE NUMBER 4B

HIGH GROUNDWATER MAP



NOTATIONS

Holocene fault displacement (during past 10,000 years) without historic record. Geomorphic evidence for Holocene faulting includes sag ponds, scarps showing little erosion, or the following features in Holocene age deposits: offset stream courses, linear scarps, shutter ridges, and triangular faceted spurs. Recency of faulting offshore is based on the interpreted age of the youngest strata displaced by faulting.

Late Quaternary fault displacement (during past 700,000 years). Geomorphic evidence similar to that described for Holocene faults except features are less distinct. Faulting may be younger, but lack of younger overlying deposits precludes more accurate age classification.

Quaternary fault (age undifferentiated). Most faults of this category show evidence of displacement sometime during the past 1.6 million years; possible exceptions are faults that displace rocks of undifferentiated Plio-Pleistocene age. See Bulletin 201, Appendix D for source data.

Late Cenozoic faults within the Sierra Nevada including, but not restricted to, the Foothills fault system. Faults show stratigraphic and/or geomorphic evidence for displacement of late Miocene and Pliocene deposits. By analogy, late Cenozoic faults in this system that have been investigated in detail may have been active in Quaternary time (Data from PG&E, I993.)

Pre-Quaternary fault (older than 1.6 million years) or fault without recognized Quaternary displacement. Some faults are shown in this category because the source of mapping used was of reconnaissance nature, or was not done with the object of dating fault displacements. Faults in this category are not necessarily inactive.

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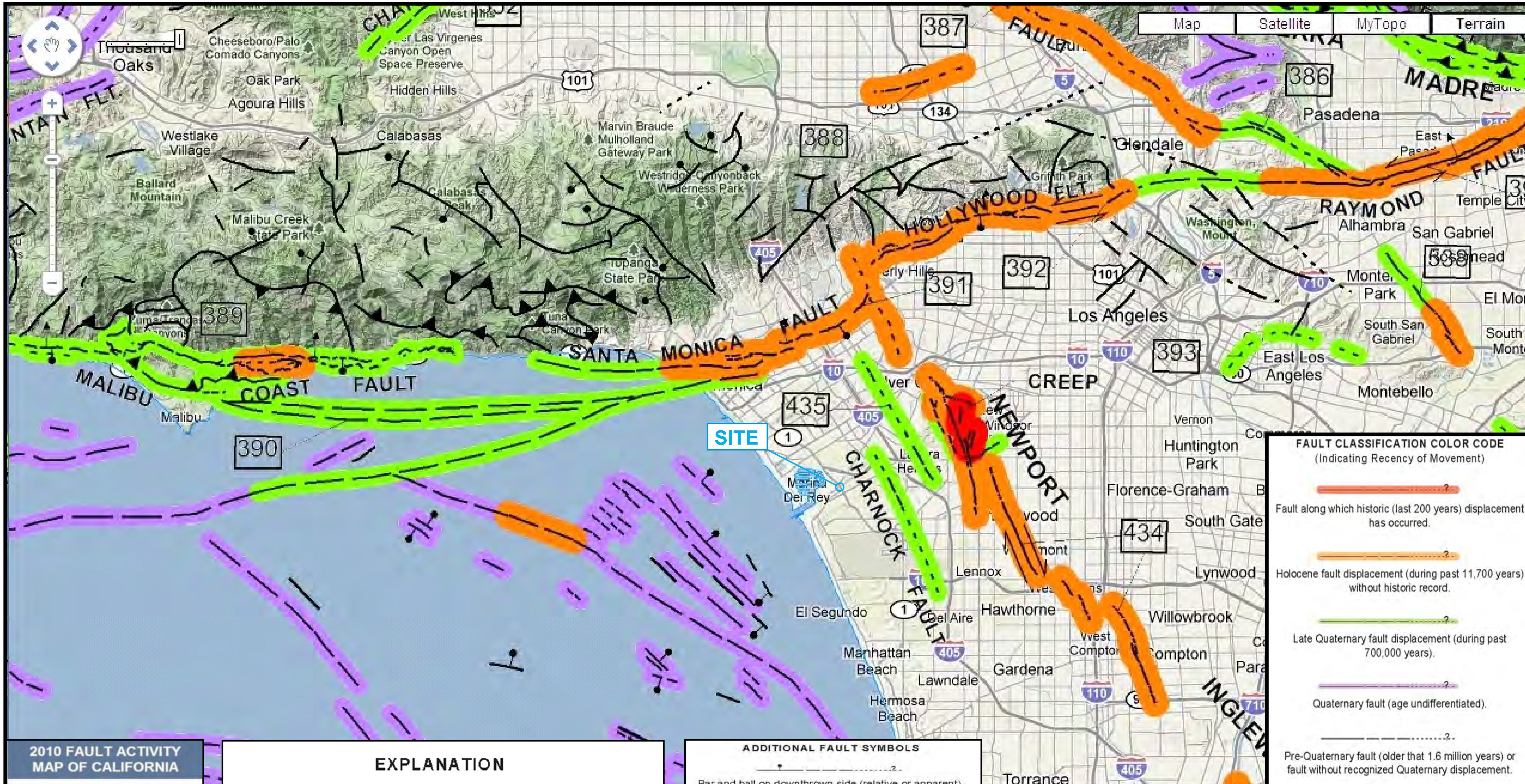
DOCUMENT NUMBER	
PROJECT NAME	Lincoln Boulevard Bridge Replacement
FIGURE NUMBER	5A

REGIONAL FAULT MAP



2010 FAULT ACTIVITY MAP OF CALIFORNIA

California Geological Survey, Geologic Data Map No. 6

Compilation and Interpretation by: Charles W. Jennings and William A. Bryant

Graphics by: Milind Patel, Ellen Sander, Jim Thompson, Barbara Wanish and Milton Fonseca

EXPLANATION

Fault traces on land are indicated by solid lines where well located, by dashed lines where approximately located or inferred, and by dotted lines where concealed by younger rocks or by lakes or bays. Fault traces are queried where continuation or existence is uncertain.

ADDITIONAL FAULT SYMBOLS

Bar and ball on downthrown side (relative or apparent).

Arrows along fault indicate relative or apparent direction of lateral movement.

Arrow on fault indicates direction of dip.

Low angle fault (barbs on upper plate).

N

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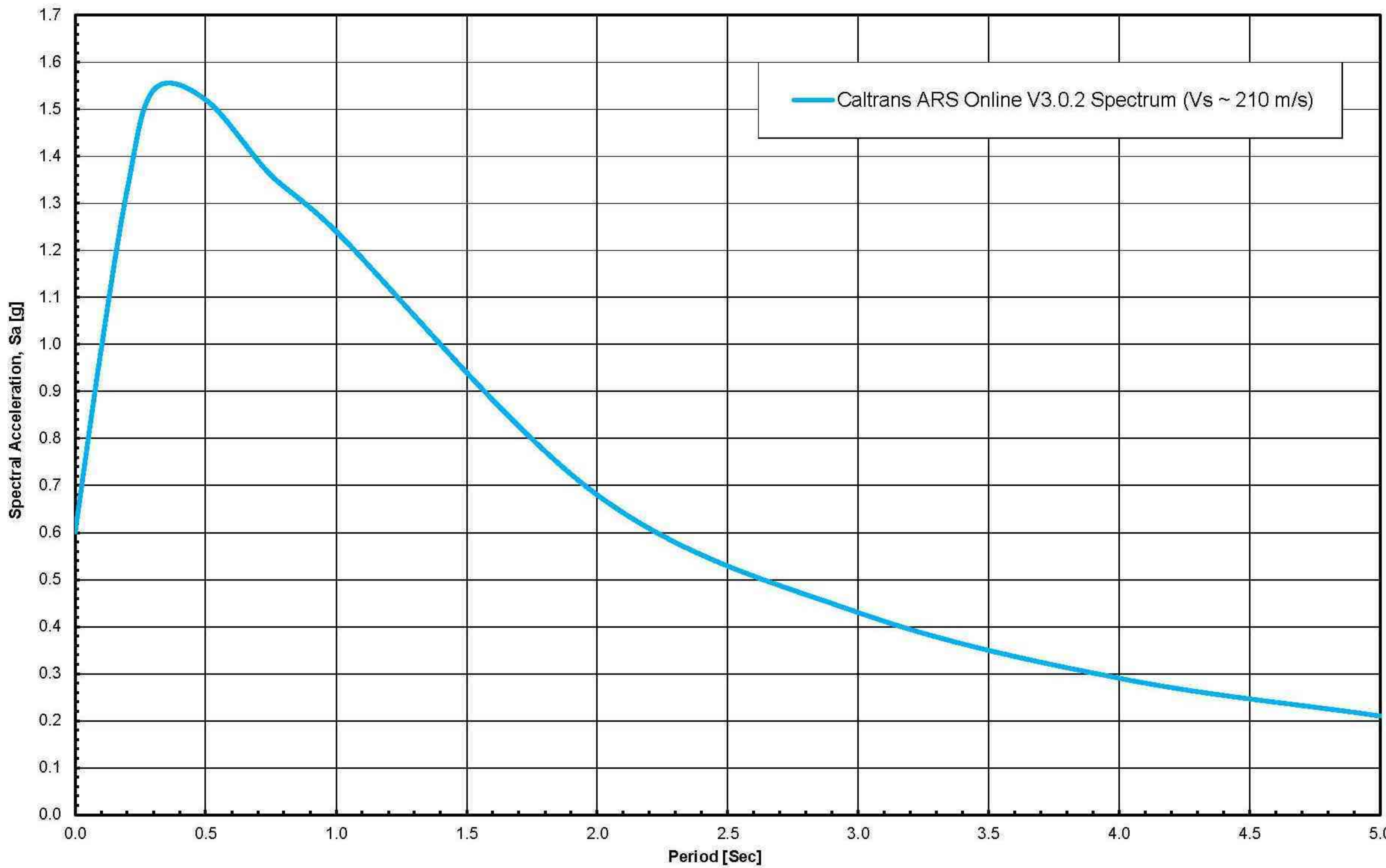
PROJECT NUMBER: LA1590

DOCUMENT NUMBER

PROJECT NAME: Lincoln Boulevard Bridge Replacement

FIGURE NUMBER: 5B

LOCAL FAULT MAP



Caltrans ARS Online Design Spectrum

Period [Sec]	Sa [g]
0	0.6
0.10	0.990
0.20	1.330
0.30	1.540
0.50	1.520
0.75	1.360
1.00	1.240
2.00	0.680
3.00	0.430
4.00	0.290
5.00	0.210

PGA = 0.6g
Mean magnitude (for PGA) = 6.6
Mean site-source distance (for Sa at 1s) = 16.6 km

REFERENCE: CALTRANS (2019). *ARS Online, Version V3.0.2,* http://dap3.dot.ca.gov/ARS_Online/, October 11, 2022.

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DOCUMENT NUMBER
PROJECT NAME Lincoln Boulevard Bridge Replacement
FIGURE NUMBER 6

SITE RESPONSE SPECTRUM

REFERENCE: California Emergency Management Agency (2018). *FEMA Flood Plains and California Specific Flood Areas.*

N

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Lincoln Boulevard Bridge Replacement

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LA1590

DOCUMENT NUMBER

FIGURE NUMBER
7A

FEMA FLOOD MAPS

REFERENCE: California Emergency Management Agency (2018). *Tsunami Emergency Response Planning Zone, Recommended Evacuation Area.*

N

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DOCUMENT NUMBER

FIGURE NUMBER
7B

TSUNAMI INUNDATION ZONE

APPENDIX A
EXISTING FIELD DATA

APPENDIX A
EXISTING FIELD DATA (Group Delta, 2013)

APPENDIX A

EXISTING FIELD DATA

No site-specific subsurface explorations have yet been conducted. The approximate locations of eight explorations we have proposed at the site are shown on the Exploration Plan, Figure 3B. To aid in the preparation of this preliminary report, we reviewed three previous investigations conducted in relatively close proximity to the Lincoln Boulevard Multi-Modal Improvement Project between 1998 and 2013. The approximate locations of these existing explorations located within about 1,500 feet of the subject site are shown on the Existing Explorations, Figure 3A.

The field and laboratory data from our most recent geotechnical investigation for the Ballona Wetlands Restoration Project was still available, and is reproduced in the following Figures A-1 through A-10 (GDC, 2013). Photocopies of the previous subsurface explorations we conducted for the Playa Vista development located southeast of the Lincoln Boulevard bridge are attached as the second Appendix A (GDC, 1999). Photocopies of the previous explorations conducted by others for the Playa Vista development are attached as the third Appendix A (Pacific Soils Engineering, 1998).

The previous field exploration program for the Ballona Wetlands Restoration Project included the advancement of three rotary wash borings, one hollow stem boring, and six cone penetrometer test (CPT) soundings. These 10 explorations were completed between September 14th and October 16th, 2012. Disturbed samples were collected from the borings using a 2-inch diameter Standard Penetration Test (SPT) sampler. Less disturbed samples were also collected using a 3-inch outside diameter ring lined sampler (a modified California sampler). These samples were sealed in plastic bags, labeled, and returned to the laboratory for testing. For each sample, the number of blows needed to drive the sampler 12 inches was recorded on the logs. The drive samples were collected from the borings using an automatic hammer with an Energy Transfer Ratio (ETR) of about 84 percent. The field blow counts (N) were normalized to approximate a standard 60 percent ETR as shown on the logs (N_{60}). Undisturbed Shelby-Tube samples, as well as bulk soil samples were also collected at selected intervals. Logs describing the subsurface conditions encountered in the four previous borings are shown in Figures A-1 to A-4, immediately after the Boring Record Legends.

The cone penetrometer (CPT) soundings were advanced by either Gregg In-Situ or Kehoe Testing and Engineering in general accordance with ASTM D5778. Integrated electronic circuitry was used to measure the tip resistance (Qc) and skin friction (Fs) while the CPT was advanced into the soil with hydraulic down pressure. A piezometer located behind the cone tip also measured transient pore pressure (u). The nearby CPT data from our 2013 Ballona Wetland study is presented in Figures A-5 through A-10. Note that the first figure for each CPT sounding presents the raw data (Figures A-5a through A-10a). The estimated undrained strength (Su) and Soil Behavior Type Index (Ic) is shown in detail in Figures A-5b through A-10b. The Soil Behavior Type (SBT) profiles from the program CPeT-IT v2.0.1.55 are presented along with the raw data in color coded logs at the end of each CPT sounding. Note that the soil interpretations are a function of the normalized cone resistance and friction ratio (Robertson, 2010).

APPENDIX A

EXISTING FIELD DATA (Continued)

The previous exploratory boring and CPT locations were determined by visually estimating, pacing and taping distances from landmarks shown on the available plans. The supplemental borings proposed for the Foundation Report should be surveyed by Psomas. The exploration locations shown in Figures 3A and 3B should not be considered more accurate than is implied by the method of measurement used and the scale of the map. The lines designating the interface between differing soil materials on the logs may be abrupt or gradational. Further, soil conditions at locations between the explorations may be substantially different from those at the specific locations explored. It should be noted that the passage of time may also result in changes in the soil conditions reported in the logs.

SOIL IDENTIFICATION AND DESCRIPTION SEQUENCE

Sequence	Identification Components	Refer to Section: Field	Refer to Section: Lab	Required	Optional
1	Group Name	2.5.2	3.2.2	●	
2	Group Symbol	2.5.2	3.2.2	●	
	Description Components				
3	Consistency of Cohesive Soil	2.5.3	3.2.3	●	
4	Apparent Density of Cohesionless Soil	2.5.4		●	
5	Color	2.5.5		●	
6	Moisture	2.5.6		●	
7	Percent or Proportion of Soil	2.5.7	3.2.4	●	⬭
7	Particle Size	2.5.8	2.5.8	●	⬭
7	Particle Angularity	2.5.9			○
7	Particle Shape	2.5.10			○
8	Plasticity (for fine-grained soil)	2.5.11	3.2.5		○
9	Dry Strength (for fine-grained soil)	2.5.12			○
10	Dilatency (for fine-grained soil)	2.5.13			○
11	Toughness (for fine-grained soil)	2.5.14			○
12	Structure	2.5.15			○
13	Cementation	2.5.16		●	
14	Percent of Cobbles and Boulders	2.5.17		●	
14	Description of Cobbles and Boulders	2.5.18		●	
15	Consistency Field Test Result	2.5.3		●	
16	Additional Comments	2.5.19			○

Describe the soil using descriptive terms in the order shown

Minimum Required Sequence:

USCS Group Name (Group Symbol); Consistency or Density; Color; Moisture; Percent or Proportion of Soil; Particle Size; Plasticity (optional).

⬭ = optional for non-Caltrans projects

Where applicable:

Cementation; % cobbles & boulders; Description of cobbles & boulders; Consistency field test result

REFERENCE: Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010).

HOLE IDENTIFICATION

Holes are identified using the following convention:

H – YY – NNN

Where:

H: Hole Type Code

YY: 2-digit year

NNN: 3-digit number (001-999)

Hole Type Code and Description

Hole Type Code	Description
A	Auger boring (hollow or solid stem, bucket)
R	Rotary drilled boring (conventional)
RC	Rotary core (self-cased wire-line, continuously-sampled)
RW	Rotary core (self-cased wire-line, not continuously sampled)
P	Rotary percussion boring (Air)
HD	Hand driven (1-inch soil tube)
HA	Hand auger
D	Driven (dynamic cone penetrometer)
CPT	Cone Penetration Test
O	Other (note on LOTB)

Description Sequence Examples:

SANDY lean CLAY (CL); very stiff; yellowish brown; moist; mostly fines; some SAND, from fine to medium; few gravels; medium plasticity; PP=2.75.

Well-graded SAND with SILT and GRAVEL and COBBLES (SW-SM); dense; brown; moist; mostly SAND, from fine to coarse; some fine GRAVEL; few fines; weak cementation; 10% GRANITE COBBLES; 3 to 6 inches; hard; subrounded.

Clayey SAND (SC); medium dense, light brown; wet; mostly fine sand,; little fines; low plasticity.

GROUP DELTA

Project No. LA1590

Lincoln Boulevard Bridge Replacement

Psomas

BORING RECORD LEGEND #1

GROUP SYMBOLS AND NAMES

Graphic / Symbol	Group Names	Graphic / Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND	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
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND		
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and 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
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	ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with 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	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
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND		
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL 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
SW	Well-graded SAND Well-graded SAND with GRAVEL		
SP	Poorly graded SAND Poorly graded SAND with GRAVEL	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
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)	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
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)	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
SM	SILTY SAND SILTY SAND with GRAVEL		
SC	CLAYEY SAND CLAYEY SAND with GRAVEL	OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY elastic ELASTIC SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL		
PT	PEAT	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
	COBBLES COBBLES and BOULDERS BOULDERS		

FIELD AND LABORATORY TESTING

C	Consolidation (ASTM D 2435)
CL	Collapse Potential (ASTM D 5333)
CP	Compaction Curve (CTM 216)
CR	Corrosion, Sulfates, Chlorides (CTM 643; CTM 417, CTM 422)
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	Liquid Limit, Plastic Limit, Plasticity Index (AASHTO T 89, AASHTO T 90)
PL	Point Load Index (ASTM D 5731)
PM	Pressure Meter
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)
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)

SAMPLER GRAPHIC SYMBOLS

- Standard Penetration Test (SPT)
- Standard California Sampler
- Modified California Sampler (2.4" ID, 3" OD)
- Shelby Tube
- Piston Sampler
- NX Rock Core
- HQ Rock Core
- Bulk Sample
- Other (see remarks)

DRILLING METHOD SYMBOLS

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

WATER LEVEL SYMBOLS

- ▽ First Water Level Reading (during drilling)
- ▼ Static Water Level Reading (after drilling, date)

Definitions for Change in Material

Term	Definition	Symbol
Material Change	Change in material is observed in the sample or core and the location of change can be accurately located.	solid line
Estimated Material Change	Change in material cannot be accurately located either because the change is gradational or because of limitations of the drilling and sampling methods.	dashed line
Soil / Rock Boundary	Material changes from soil characteristics to rock characteristics.	wavy lines

REFERENCE: Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010).

GROUP DELTA

Project No. LA1590

Lincoln Boulevard Bridge Replacement

Psomas

BORING RECORD LEGEND #2

CONSISTENCY OF COHESIVE SOILS				
Description	Shear Strength (tsf)	Pocket Penetrometer, PP, Measurement (tsf)	Torvane, TV, Measurement (tsf)	Vane Shear, VS, Measurement (tsf)
Very Soft	Less than 0.12	Less than 0.25	Less than 0.12	Less than 0.12
Soft	0.12 - 0.25	0.25 - 0.5	0.12 - 0.25	0.12 - 0.25
Medium Stiff	0.25 - 0.5	0.5 - 1	0.25 - 0.5	0.25 - 0.5
Stiff	0.5 - 1	1 - 2	0.5 - 1	0.5 - 1
Very Stiff	1 - 2	2 - 4	1 - 2	1 - 2
Hard	Greater than 2	Greater than 4	Greater than 2	Greater than 2

APPARENT DENSITY OF COHESIONLESS SOILS	
Description	SPT N_{60} (blows / 12 inches)
Very Loose	0 - 5
Loose	5 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	Greater than 50

MOISTURE	
Description	Criteria
Dry	No discernable moisture
Moist	Moisture present, but no free water
Wet	Visible free water

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

PARTICLE SIZE		
Description		Size (in)
Boulder		Greater than 12
Cobble		3 - 12
Gravel	Coarse	3/4 - 3
	Fine	1/5 - 3/4
Sand	Coarse	1/16 - 1/5
	Medium	1/64 - 1/16
	Fine	1/300 - 1/64
Silt and Clay		Less than 1/300

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.

REFERENCE: Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010), with the exception of consistency of cohesive soils vs. N_{60}.

Plasticity

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

CONSISTENCY OF COHESIVE SOILS	
Description	SPT N_{60} (blows/12 inches)
Very Soft	0 - 2
Soft	2 - 4
Medium Stiff	4 - 8
Stiff	8 - 15
Very Stiff	15 - 30
Hard	Greater than 30

Ref: Peck, Hansen, and Thornburn, 1974, "Foundation Engineering," Second Edition.

Note: Only to be used (with caution) when pocket penetrometer or other data on undrained shear strength are unavailable. Not allowed by Caltrans Soil and Rock Logging and Classification Manual, 2010.

GROUP DELTA

Project No. LA1590

Lincoln Boulevard Bridge Replacement

Psomas

BORING RECORD LEGEND #3

BORING RECORD

PROJECT NAME Lincoln Bridge Multi-Modal Improvement Project	**PROJECT NUMBER** LA1345	**BORING** A-RW013	
SITE LOCATION Ballona Wetlands	**START** 9/26/2012	**FINISH** 9/26/2012	**SHEET NO.** 1 of 3
DRILLING COMPANY Cascade Drilling	**DRILLING METHOD** Rotary Wash	**LOGGED BY** N. Briffa	**CHECKED BY** P. Kashighandi
DRILLING EQUIPMENT CME 85	**BORING DIA. (in)** 3.875	**TOTAL DEPTH (ft)** 56.5	**GROUND ELEV (ft)** 13.8
DEPTH/ELEV. GROUND WATER (ft) ▼ / na			
SAMPLING METHOD Hammer: 140 lbs., Drop: 30 in.	**NOTES** ETR ~ 84%, N_{60} ~ 84/60 * N ~ 1.40 * N		

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	DEPTH (feet)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
0	13.8	Bulk	B-1									**Artificial Fill (af):** Silty Sand (SM), brown, dry, fine to coarse grained sand, fine to coarse gravel, few organics, trace shell fragments, denser than other locations in Area A.
5		Ring	R-2	0 4 3	7	7	20	117		5		-Loose, no organics, few shell fragments.
10		SPT	S-3	3 4 4	8	11			PA	10		**Alluvium (Qa):** Sandy Silt (ML), olive brown, wet, medium stiff, highly micaceous, some oxidation. (0% Gravel; 16% Sand; 84% Fines)
15		Ring	R-4	0 0 2	2	2	48	71	PA PI C	15		Lean Clay (CL), olive brown, wet, soft, medium plasticity, highly micaceous, some oxidation. Vane Shear = 0.3 ksf (0% Gravel; 12% Sand; 88% Fines) (LL~47; PL~27; PI~20)
20		SPT	S-5	0 1 1	2	3			PI	20		Fat Clay (CH), gray, wet, soft, few fine grained sand, high plasticity, trace shell fragments, H2S odor. (LL~56; PL~28; PI~28)

Elevation scale marks: 10, 5, 0, -5, -10

GDC_LOG_BORING_MMX_SOIL_SD L-962_PART 1.GPJ GDCLOG.GDT 2/13/18

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BORING RECORD

PROJECT NAME	PROJECT NUMBER	BORING
Lincoln Bridge Multi-Modal Improvement Project	LA1345	A-RW013

SITE LOCATION	START	FINISH	SHEET NO.
Ballona Wetlands	9/26/2012	9/26/2012	2 of 3

DRILLING COMPANY	DRILLING METHOD	LOGGED BY	CHECKED BY
Cascade Drilling	Rotary Wash	N. Briffa	P. Kashighandi

DRILLING EQUIPMENT	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GROUND WATER (ft)
CME 85	3.875	56.5	13.8	▼ / *na*

SAMPLING METHOD	NOTES
Hammer: 140 lbs., Drop: 30 in.	ETR ~ 84%, N_{60} ~ 84/60 * N ~ 1.40 * N

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	DEPTH (feet)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			SH-6									**<u>Alluvium (Qa):</u>** Fat Clay (CH), gray, wet, soft, few fine grained sand, high plasticity, trace shell fragments, H2S odor.
	-15											Lean Clay (CL), gray, wet, medium stiff, trace coarse grained sand, medium plasticity.
30			R-7	5 5 6	11	10	15	115	PI	30		NOTE: Increase in stiffness at bottom. (LL~34; PL~18; PI~16) Vane Shear = 1.2 ksf
	-20											Silty Sand (SM), gray, wet, loose, fine grained sand, trace fine gravel.
35			S-8	3 3 3	6	8				35		
	-25											Fat Clay (CH), gray, moist, stiff, medium to high plasticity, interbedded with Silt (ML), gray, wet, stiff, trace fine grained sand, medium plasticity.
40			R-9	4 4 6	10	9	57	69		40		
	-30											
45			S-10	3 3 4	7	10				45		Peat (PT), brown, moist, firm, 4" layer of Fat Clay (CH), tree stump or branch >3".
	-35											Poorly Graded Sand with Silt (SP-SM), gray, wet, dense, fine to medium sand, trace organics (wood fibers).

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FIGURE A-1 b

BORING RECORD

PROJECT NAME: Lincoln Bridge Multi-Modal Improvement Project	PROJECT NUMBER: LA1345	BORING: A-RW013	
SITE LOCATION: Ballona Wetlands	START: 9/26/2012	FINISH: 9/26/2012	SHEET NO.: 3 of 3
DRILLING COMPANY: Cascade Drilling	DRILLING METHOD: Rotary Wash	LOGGED BY: N. Briffa	CHECKED BY: P. Kashighandi
DRILLING EQUIPMENT: CME 85	BORING DIA. (in): 3.875	TOTAL DEPTH (ft): 56.5	GROUND ELEV (ft): 13.8
DEPTH/ELEV. GROUND WATER (ft): ▼ / na			
SAMPLING METHOD: Hammer: 140 lbs., Drop: 30 in.	NOTES: ETR ~ 84%, N_{60} ~ 84/60 * N ~ 1.40 * N		

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	DEPTH (feet)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			R-11	22 27 35	62	58	21	104				**<u>Alluvium (Qa):</u>** Poorly Graded Sand with Silt (SP-SM), gray, wet, dense, fine to medium grained sand, trace organics (wood fibers).
	-40											Poorly graded Sand with Gravel (SP), gray, wet, dense, fine to medium grained sand, few coarse grained sand, fine to coarse gravel, trace clay.
55			S-12	15 24 25	49	69				55		
	-45											Boring terminated at 56.5 ft. Groundwater not measured. Boring backfilled with bentonite grout. This boring was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).
60										60		
	-50											
65										65		
	-55											
70										70		
	-60											

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BORING RECORD

PROJECT NAME	Lincoln Bridge Multi-Modal Improvement Project
PROJECT NUMBER	LA1345
BORING	A-RW015
SITE LOCATION	Ballona Wetlands
START	10/2/2012
FINISH	10/2/2012
SHEET NO.	1 of 3
DRILLING COMPANY	Cascade Drilling
DRILLING METHOD	Rotary Wash
LOGGED BY	N. Briffa/JW
CHECKED BY	P. Kashighandi
DRILLING EQUIPMENT	CME 85
BORING DIA. (in)	3.875
TOTAL DEPTH (ft)	61.5
GROUND ELEV (ft)	17.1
DEPTH/*ELEV.* GROUND WATER (ft)	▼ / *na*
SAMPLING METHOD	Hammer: 140 lbs., Drop: 30 in.
NOTES	ETR ~ 84%, N_{60} ~ 84/60 * N ~ 1.40 * N

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	DEPTH (feet)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
0	17.1		B-1									**Artificial Fill (af):** Silty Sand (SM), brown, dry, fine to coarse grained sand, few fine to coarse gravels, trace cobble, little sea shells, little rootlets/branches.
5	15		S-2	1 4 4	8	11				5		-Dark gray to brown, moist, loose, fine to medium grained sand, low to medium plasticity, trace shell fragments, little oxidation.
10	10		R-3	2 4 5	9	8	27		PI	10		**Alluvium (Qa):** Fat Clay (CH), dark gray to brown, moist, stiff, fine grained sand, high plasticity, little medium grained sand. (LL~57; PL~22; PI~35) Vane Shear = 1.1 ksf
	5											Clayey Sand (SC), gray with mottled brown, moist, loose, fine grained sand, some oxidation, micaceous.
15	0		S-4	1 2 3	5	7			PA	15		(0% Gravel; 57% Sand; 43% Fines)
20	-5		R-5	5 4 3	7	7	43	78	DS	20		-Wet, low plasticity, large shell fragments.
												Lean Clay (CL), gray, moist, medium stiff, trace fine grained sand, medium plasticity, H2S odor.

GDC_LOG_BORING_MMX_SOIL_SD L-962_PART 1.GPJ GDCLOG.GDT 2/13/18

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BORING RECORD

PROJECT NAME	PROJECT NUMBER	BORING
Lincoln Bridge Multi-Modal Improvement Project	LA1345	**A-RW015**

SITE LOCATION	START	FINISH	SHEET NO.
Ballona Wetlands	10/2/2012	10/2/2012	2 of 3

DRILLING COMPANY	DRILLING METHOD	LOGGED BY	CHECKED BY
Cascade Drilling	Rotary Wash	N. Briffa/JW	P. Kashighandi

DRILLING EQUIPMENT	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GROUND WATER (ft)
CME 85	3.875	61.5	17.1	▼ / *na*

SAMPLING METHOD	NOTES
Hammer: 140 lbs., Drop: 30 in.	ETR ~ 84%, N_{60} ~ 84/60 * N ~ 1.40 * N

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	DEPTH (feet)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
		Split spoon	S-6	0 1 2	3	4						**Alluvium (Qa):** Lean Clay (CL), gray, moist, medium stiff, trace fine grained sand, medium plasticity, H2S odor.
	-10											
30		Shelby tube	SH-7							30		-Moist, fine to medium grained sand.
	-15	Ring	R-8	13 18 18	36	34	25	107	DS			Poorly graded Sand with Silt (SP-SM), gray, wet, medium dense, fine to coarse grained sand.
35		Split spoon	S-9	4 5 6	11	15			PA	35		Silt (ML), gray, wet, soft, trace fine grained sand, none to low plasticity, ~3" layer of Sand with Silt (SM). (0% Gravel; 37% Sand; 63% Fines)
	-20											
40		Ring	R-10	3 4 4	8	7	25			40		Sandy Silt (ML), gray, wet, firm, fine grained sand, trace coarse grained sand, low plasticity.
	-25											Fat Clay (CH), gray, moist, medium stiff, high plasticity, some organics. (LL~57; PL~28; PI~29)
45		Split spoon	S-11	1 4 5	9	13			PI	45		
	-30											Silty Sand (SM), gray, moist to wet, medium dense, fine grained sand, trace organics.

BORING RECORD

PROJECT NAME	PROJECT NUMBER	BORING
Lincoln Bridge Multi-Modal Improvement Project	LA1345	A-RW015

SITE LOCATION	START	FINISH	SHEET NO.
Ballona Wetlands	10/2/2012	10/2/2012	3 of 3

DRILLING COMPANY	DRILLING METHOD	LOGGED BY	CHECKED BY
Cascade Drilling	Rotary Wash	N. Briffa/JW	P. Kashighandi

DRILLING EQUIPMENT	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GROUND WATER (ft)
CME 85	3.875	61.5	17.1	▼ / *na*

SAMPLING METHOD	NOTES
Hammer: 140 lbs., Drop: 30 in.	ETR ~ 84%, N_{60} ~ 84/60 * N ~ 1.40 * N

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	DEPTH (feet)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			R-12	9 15 15	30	28	25	100	PA			**Alluvium (Qa):** Silty Sand (SM), gray, moist to wet, medium dense, fine grained sand, trace organics. (0% Gravel; 56% Sand; 44% Fines)
	-35											Poorly Graded Sand (SP), gray, wet, very dense, fine to coarse grained sand, few fine subangular gravel.
55			S-13	12 27 27	44	62				55		
	-40											
60			S-14	48 40 46	86	120				60		-Few fine to coarse gravel.
	-45											Boring terminated at 61.5 ft. Groundwater not measured. Boring backfilled with bentonite grout. This boring was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).
65										65		
	-50											
70										70		
	-55											

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FIGURE

A-2 c

BORING RECORD

PROJECT NAME	PROJECT NUMBER	BORING
Lincoln Bridge Multi-Modal Improvement Project	LA1345	**B-RW049**

SITE LOCATION	START	FINISH	SHEET NO.
Ballona Wetlands	10/1/2012	10/1/2012	1 of 3

DRILLING COMPANY	DRILLING METHOD	LOGGED BY	CHECKED BY
Cascade Drilling	Rotary Wash	N. Briffa	P. Kashighandi

DRILLING EQUIPMENT	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GROUND WATER (ft)
CME 85	3.875	69	17.6	▼ / *na*

SAMPLING METHOD	NOTES
Hammer: 140 lbs., Drop: 30 in.	ETR ~ 84%, N_{60} ~ 84/60 * N ~ 1.40 * N

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS
0			B-1						
5			S-2	3 4 4	8	11			
10			R-3	2 4 8	12	11	31	81	
15			SH-4				37	74	PA PI C
20			S-5	2 1 2	3	4			PI

DEPTH (feet)	DESCRIPTION AND CLASSIFICATION
0	**Artificial Fill (af):** Silty Sand with Gravel (SM), brown, dry, fine to coarse grained sand, fine to coarse gravel.
4	Silt (ML), brown, moist, medium stiff, low plasticity, trace roots.
10	-Olive brown, low to medium plasticity, trace dark brown clay seams. Vane Shear = 0.7 ksf
15	-None to low plasticity, increase in roots, highly micaceous, no clay seams. Vane Shear = 0.5 ksf
16	Elastic Silt (MH), dark brown with orange spots of Silt, high plasticity, trace hair or fiber, trace shell fragments. (0% Gravel; 45% Sand; 55% Fines) (LL~84; PL~41; PI~43)
18.5	**Alluvium (Qa)**Lean Clay (CL), gray, wet, soft, low to medium plasticity, some laminations and pinholes of oxidation, micaceous. (LL~27; PL~20; PI~7)
23.5	Fat Clay (CH), gray, wet, medium stiff, trace fine grained sand, high plasticity, micaceous, H2S odor.

BORING RECORD

PROJECT NAME	PROJECT NUMBER	BORING
Lincoln Bridge Multi-Modal Improvement Project	LA1345	**B-RW049**

SITE LOCATION	START	FINISH	SHEET NO.
Ballona Wetlands	10/1/2012	10/1/2012	2 of 3

DRILLING COMPANY	DRILLING METHOD	LOGGED BY	CHECKED BY
Cascade Drilling	Rotary Wash	N. Briffa	P. Kashighandi

DRILLING EQUIPMENT	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GROUND WATER (ft)
CME 85	3.875	69	17.6	▼ / *na*

SAMPLING METHOD	NOTES
Hammer: 140 lbs., Drop: 30 in.	ETR ~ 84%, N_{60} ~ 84/60 * N ~ 1.40 * N

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	DEPTH (feet)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
		Shelby tube	SH-6				63	62	PI C			**Alluvium (Qa):** Fat Clay (CH), gray, wet, medium stiff, trace fine grained sand, high plasticity, micaceous, H2S odor. (LL~67; PL~33; PI~234) Vane Shear = 1.0 ksf
	-10											
												Lean Clay (CL), gray, wet, medium stiff, few fine grained sand, low to medium plasticity, trace shell fragments, slight H2S odor.
30		Ring	R-7	3 4 5	9	8	32	89		30		
	-15											
35		Shelby tube	SH-8				28	96	PI	35		-Moist, stiff, trace fine grained sand, medium plasticity, trace rootlets. (LL~40; PL~23; PI~17) Vane Shear = 1.1 ksf
	-20											
												Silty Sand (SM), gray, wet, medium dense, fine to coarse grained sand.
40		Ring	R-9	10 10 13	23	21	22	105	DS	40		
	-25											
45		SPT	S-10	9 9 12	21	29				45		-Fine grained sand, trace seams of Elastic Silt.
	-30											

BORING RECORD

PROJECT NAME	PROJECT NUMBER	BORING
Lincoln Bridge Multi-Modal Improvement Project	LA1345	B-RW049

SITE LOCATION	START	FINISH	SHEET NO.
Ballona Wetlands	10/1/2012	10/1/2012	3 of 3

DRILLING COMPANY	DRILLING METHOD	LOGGED BY	CHECKED BY
Cascade Drilling	Rotary Wash	N. Briffa	P. Kashighandi

DRILLING EQUIPMENT	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GROUND WATER (ft)
CME 85	3.875	69	17.6	▼ / *na*

SAMPLING METHOD	NOTES
Hammer: 140 lbs., Drop: 30 in.	ETR ~ 84%, N_{60} ~ 84/60 * N ~ 1.40 * N

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS
			R-11	14 20 28	48	45	18	106	
	-35								
55			S-12	16 14 15	29	41			
	-40								
60			R-13	4 5 8	13	12	31	85	PI
	-45								
65			SH-14						
	-50		S-15	3 14 23	37	52	21		
70									
	-55								

DESCRIPTION AND CLASSIFICATION

Alluvium (Qa): Silty Sand (SM), gray, wet, medium dense, fine to coarse grained sand.

Dense, fine to medium grained sand, trace fine gravel.

Poorly Graded Sand with Silt (SP-SM), gray, wet, medium dense, fine to medium grained sand, few coarse grained sand.

Lean Clay (CL), gray, moist, stiff, few fine grained sand, medium plasticity, trace organics.

Vane Shear = 1.0 ksf
(LL~39; PL~23; PI~16)

No recovery.

Poorly Graded Sand (SP), gray, wet, dense, fine to medium grained sand, trace fines.

Boring terminated at 69 ft.
Groundwater not measured.
Boring backfilled with bentonite grout.

This boring was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).

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BORING RECORD

PROJECT NAME	Lincoln Bridge Multi-Modal Improvement Project
PROJECT NUMBER	LA1345
BORING	B-HSA051
SITE LOCATION	Ballona Wetlands
START	10/16/2012
FINISH	10/16/2012
SHEET NO.	1 of 1
DRILLING COMPANY	Cascade Drilling
DRILLING METHOD	Hollow Stem Auger
LOGGED BY	N. Briffa
CHECKED BY	P. Kashighandi
DRILLING EQUIPMENT	CME 85 All Terrain
BORING DIA. (in)	8
TOTAL DEPTH (ft)	21.5
GROUND ELEV (ft)	6.3
DEPTH/*ELEV.* GROUND WATER (ft)	▼ / *na*
SAMPLING METHOD	Hammer: 140 lbs., Drop: 30 in.
NOTES	ETR ~ 84%, N_{60} ~ 84/60 * N ~ 1.40 * N

DEPTH (feet)	ELEVATION (feet)	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	DESCRIPTION AND CLASSIFICATION
	5	B-1							**Artificial Fill (af):** Lean Clay (CL), brown, dry, low to medium plasticity, trace organics, trace sea shells, few fine roots, trace white residue. -Moist
		S-2	0 2 4	6	8	17			-Firm, no snail shells.
5									-Soft, light brown and gray, moist, medium plasticity.
	0	R-3	1 2 3	5	5	42	76	C	
		S-4	1 2 2	4	6				**Alluvium (Qa):** Interbedded layers of Lean Clay (CL) and Silt (ML), gray, wet, soft, fine grained sand, few oxidation, trace fine rootlets, micaceous.
10									Silt (ML), gray, wet, very soft, low plasticity, trace oxidation, some small to large shell fragments, H2S odor.
	-5	R-5	0 0 2	2	2	49	68	C	
		S-6	0 0 0	0	0			PI	Elastic Silt (MH), gray, wet, very soft, few fine grained sand, medium plasticity, few shell fragments, few tan color blebs of organics or CH, strong H2S odor. (LL~87; PL~43; PI~44)
15									-Trace fine rootlets.
	-10	R-7	0 0 1	1	1	103	43		
		S-8	0 5 7	12	17				-Increase in shell fragments.
									Sandy Lean Clay (CL), gray, wet, stiff, some fine grained sand, trace sea shells, H2S odor.
20									Strong H2S odor occurred at ~20' (H2S >150 ppm).
	-15	R-9	0 2 4	6	6	17	111		
									Boring terminated at 21.5 ft. Groundwater not encountered. Boring backfilled with tamped cuttings. This boring was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).

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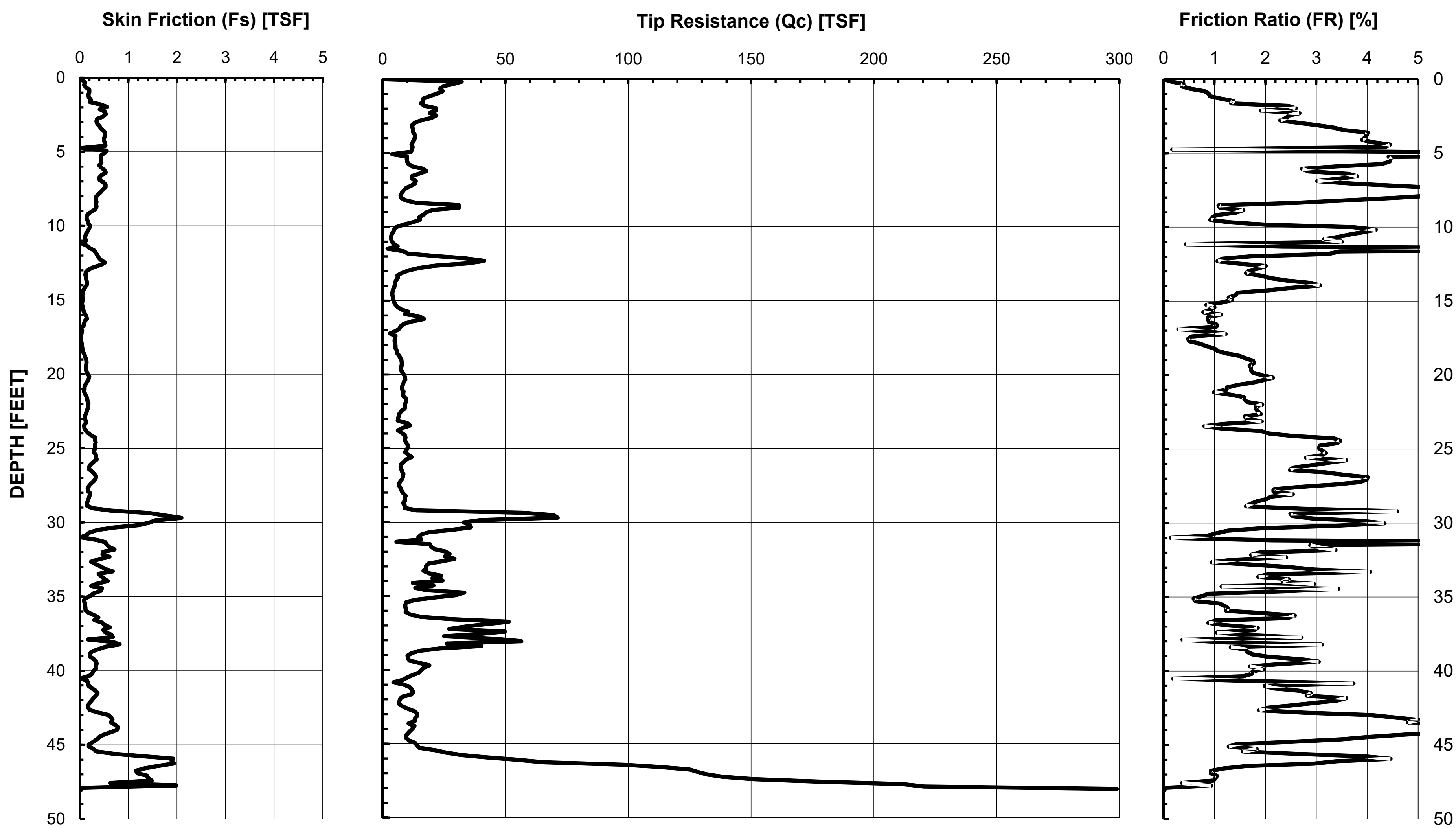
THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

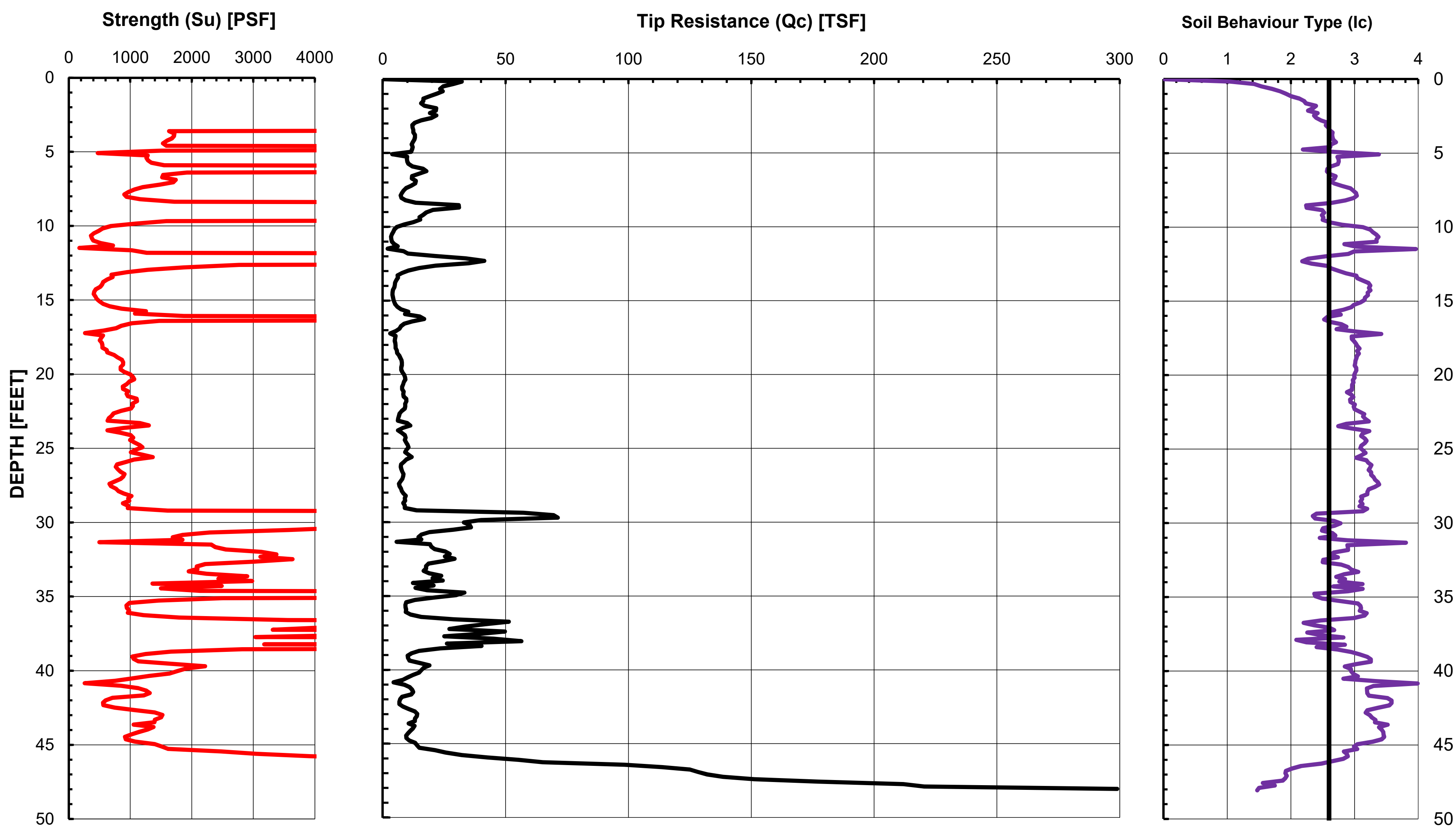
FIGURE A-4



GROUP DELTA

CONE PENETOMETER DATA (A-CPT-012)

Document No. 18-0018
Project No. LA1345
FIGURE A-5a



GROUP DELTA

INTERPRETED SOIL DATA (A-CPT-012)

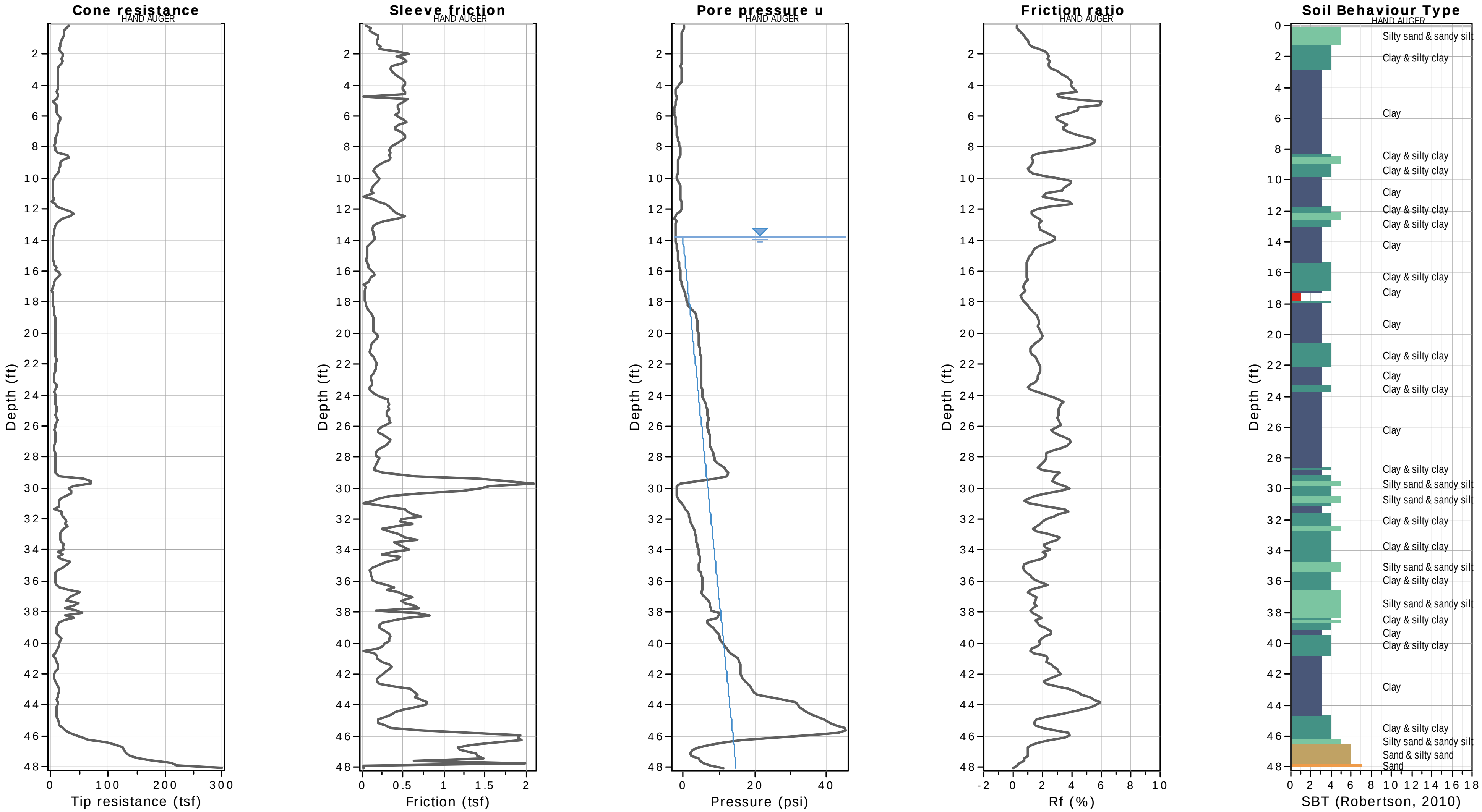
Document No. 18-0018
Project No. LA1345
FIGURE A-5b

Group Delta Consultants, Inc.
Project No. LA1345

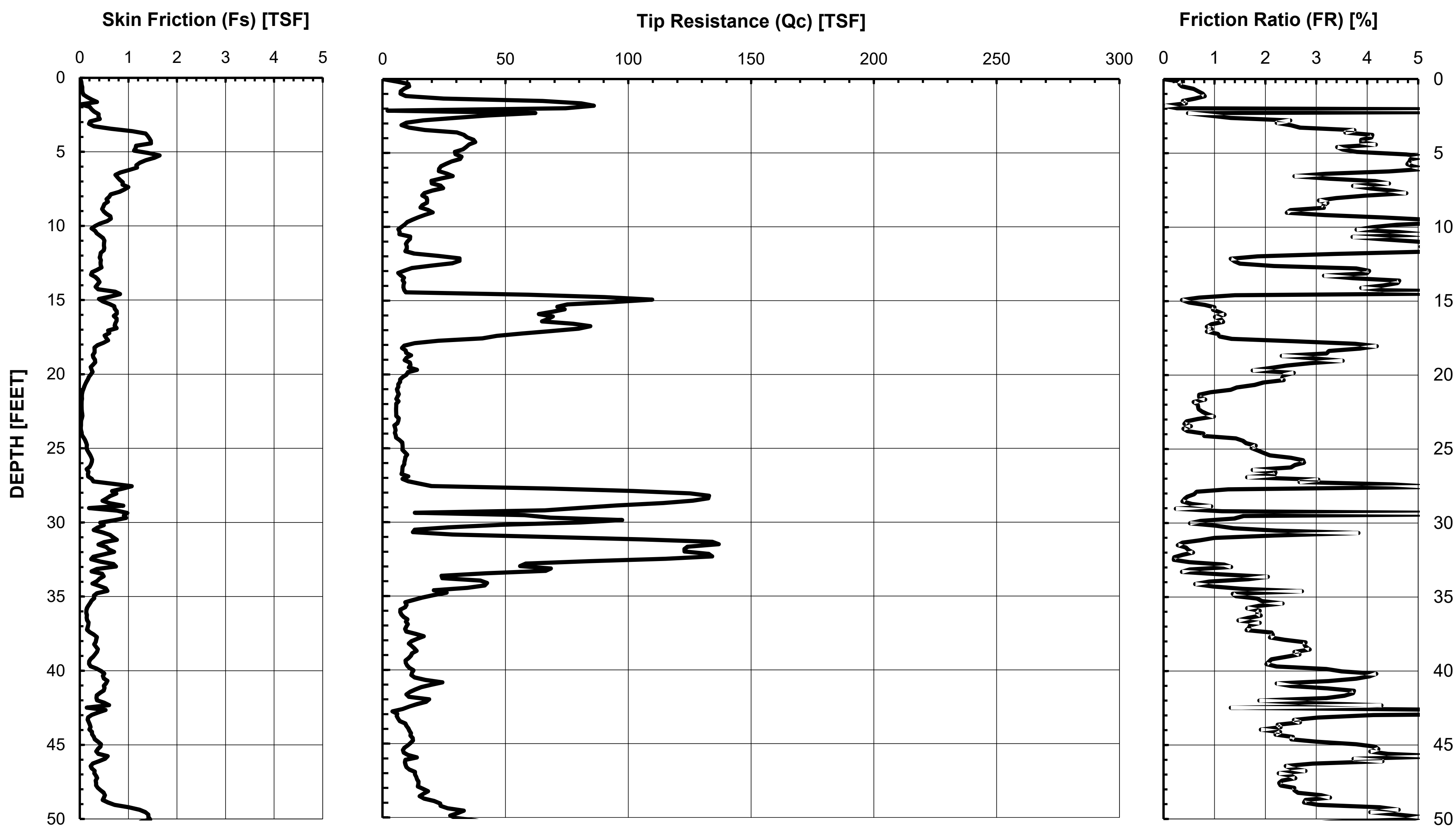
CPT: A-CPT-012

Project: Lincoln Bridge Multi-Modal Improvement Project
Location: Los Angeles, California

Total depth: 48.06 ft, Date: 9/24/2012
Surface Elevation: 13.80 ft



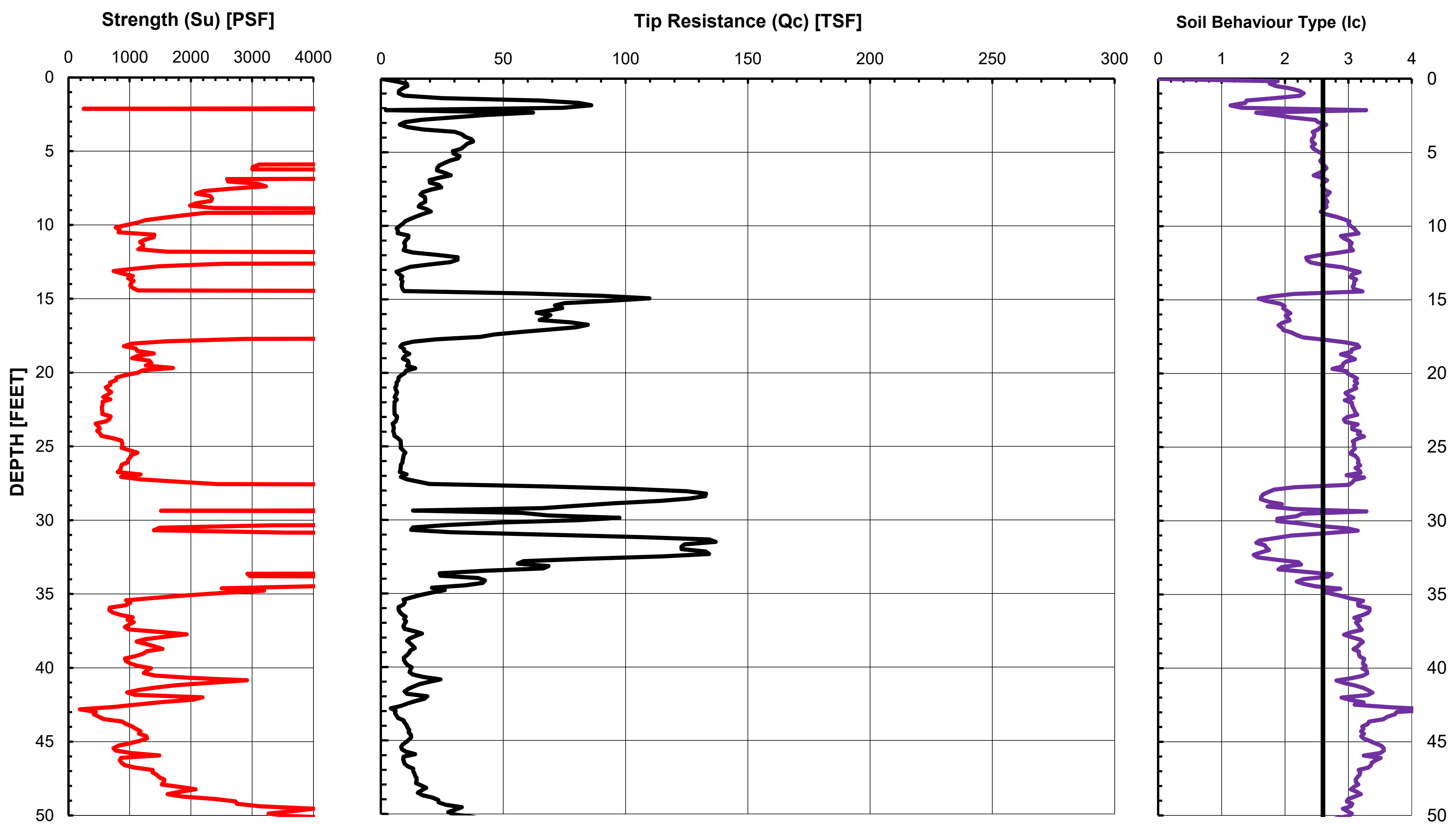
CPeT-IT v.2.0.1.55 - CPTU data presentation & interpretation software - Report created on: 2/15/2018, 8:27:59 AM
Project file: N:\Projects\LA\LA1345 Lincoln Bridge Widening\18-0018 Lincoln PFR\Appendix A\CPT\CPT Data.cpt



GROUP DELTA

CONE PENETOMETER DATA (A-CPT-014)

Document No. 18-0018
Project No. LA1345
FIGURE A-6a



GROUP DELTA

INTERPRETED SOIL DATA (A-CPT-014)

Document No. 18-0018
Project No. LA1345
FIGURE A-6b

Group Delta Consultants, Inc.
Project No. LA1345

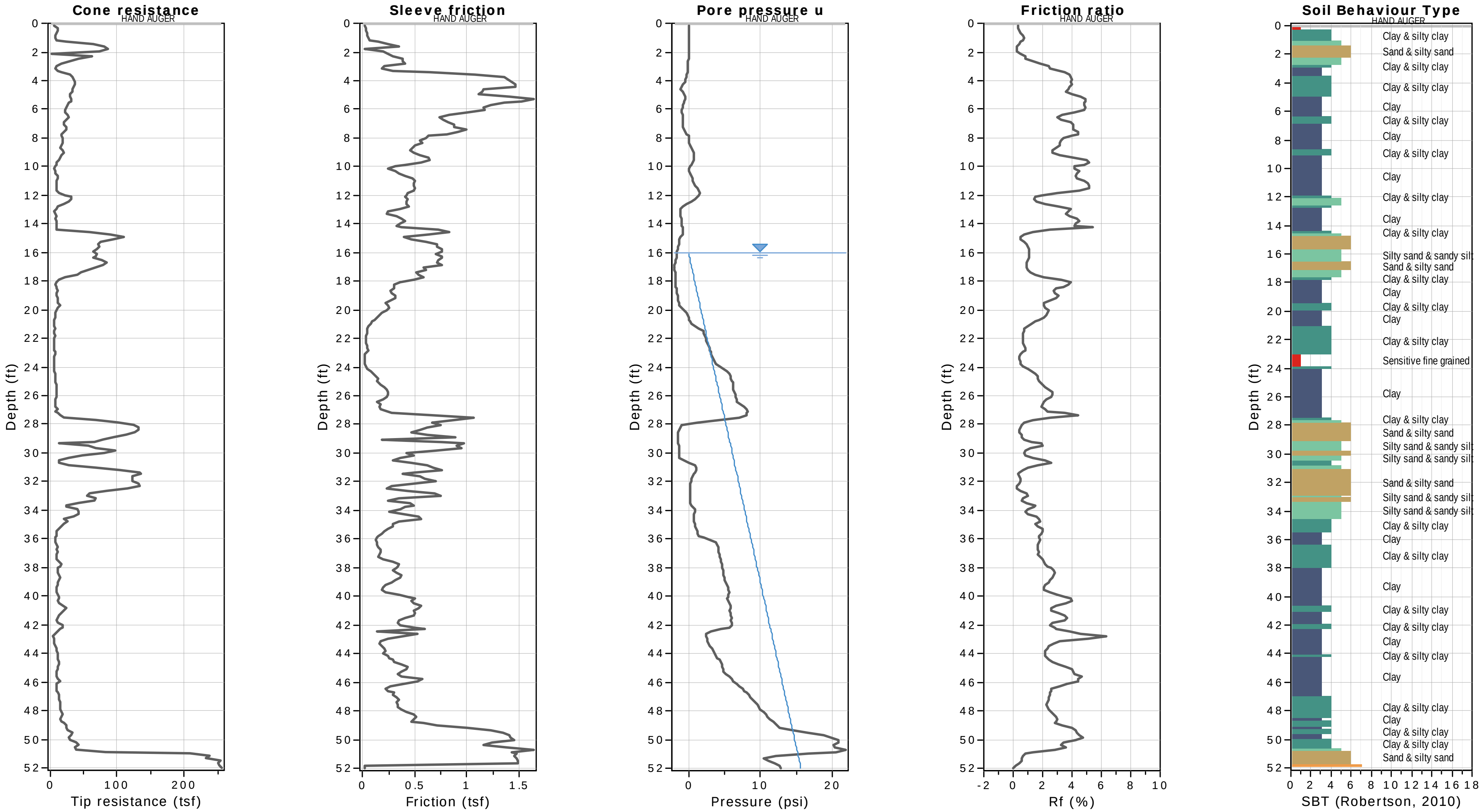
CPT: A-CPT-014

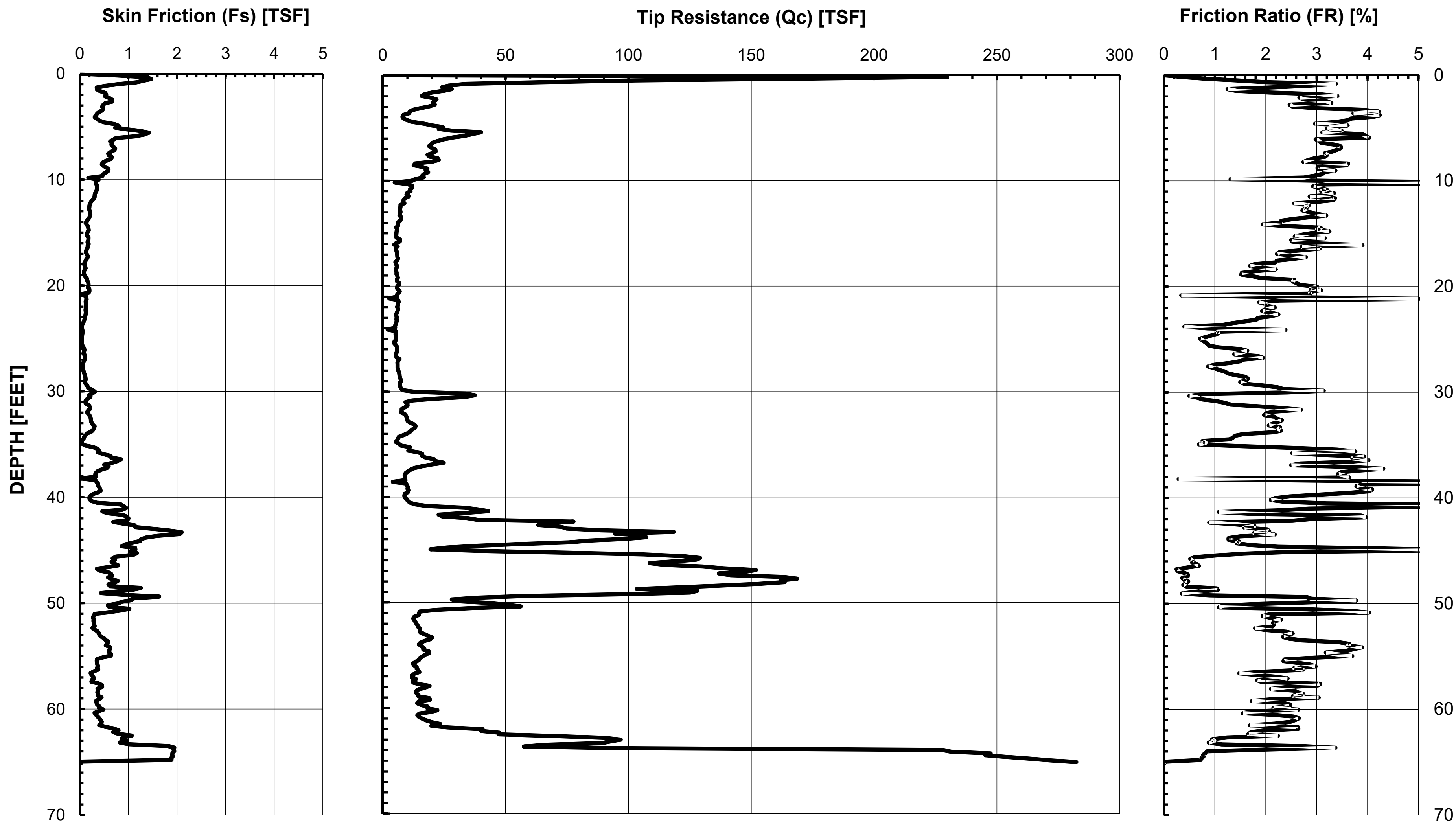
Project: Lincoln Bridge Multi-Modal Improvement Project

Location: Los Angeles, California

Total depth: 52.00 ft, Date: 9/24/2012

Surface Elevation: 16.00 ft

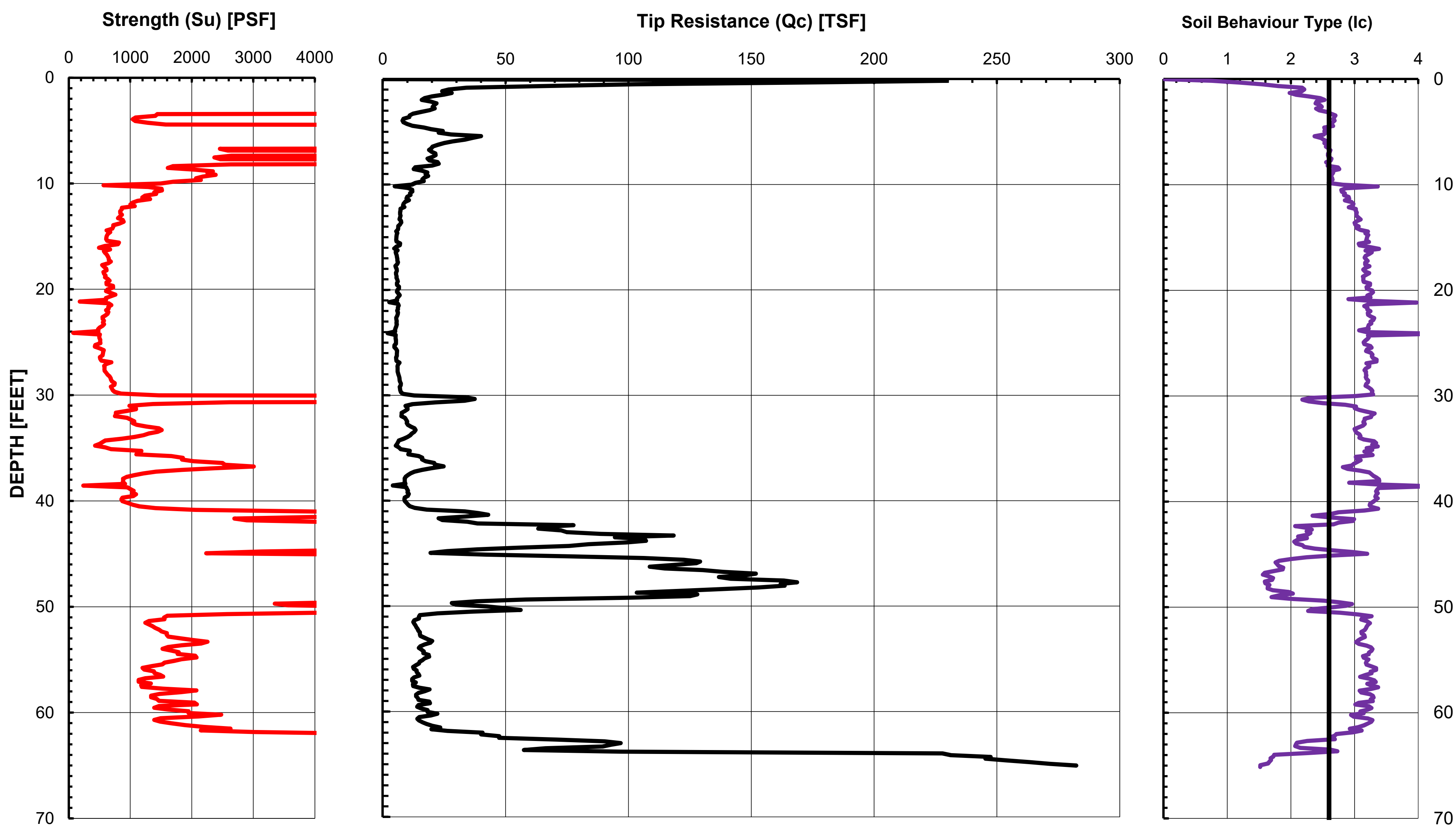




GROUP DELTA

CONE PENETOMETER DATA (A-CPT-025)

Document No. 18-0018
Project No. LA1345
FIGURE A-7a



GROUP DELTA

INTERPRETED SOIL DATA (A-CPT-025)

Document No. 18-0018
Project No. LA1345
FIGURE A-7b

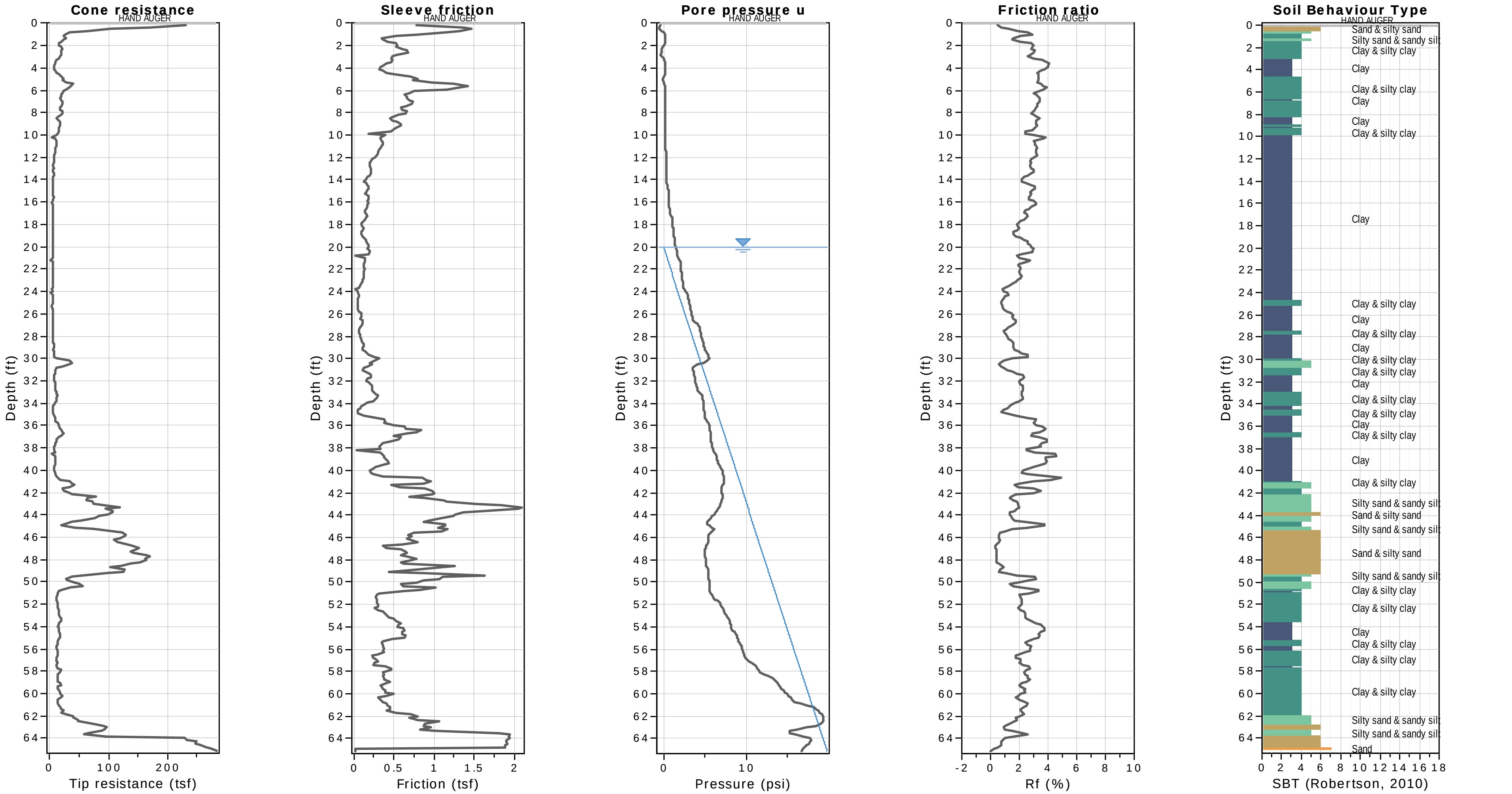
CPT: A-CPT-025

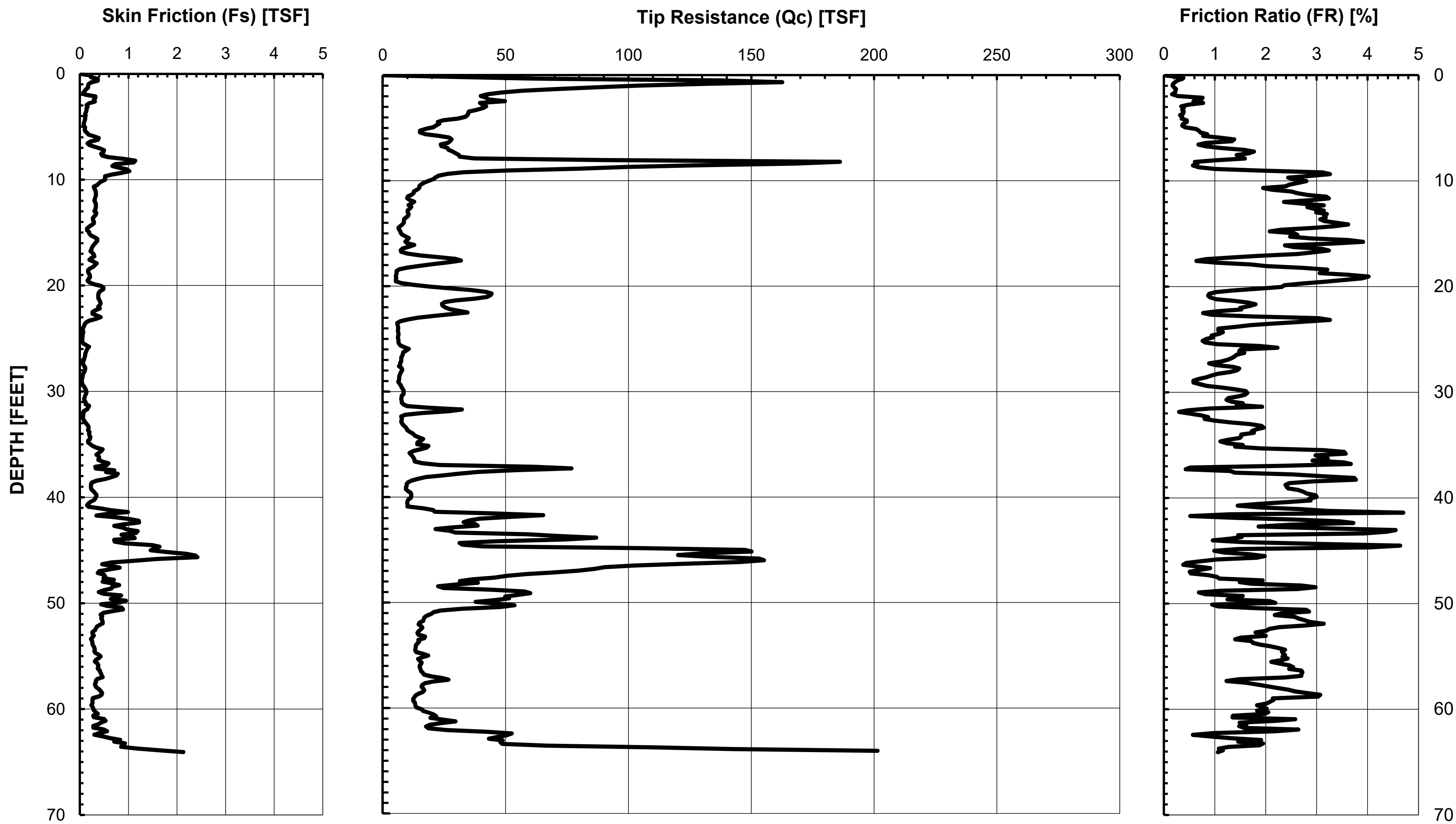
Project: Lincoln Bridge Multi-Modal Improvement Project

Location: Los Angeles, California

Total depth: 65.13 ft, Date: 9/26/2012

Surface Elevation: 20.00 ft

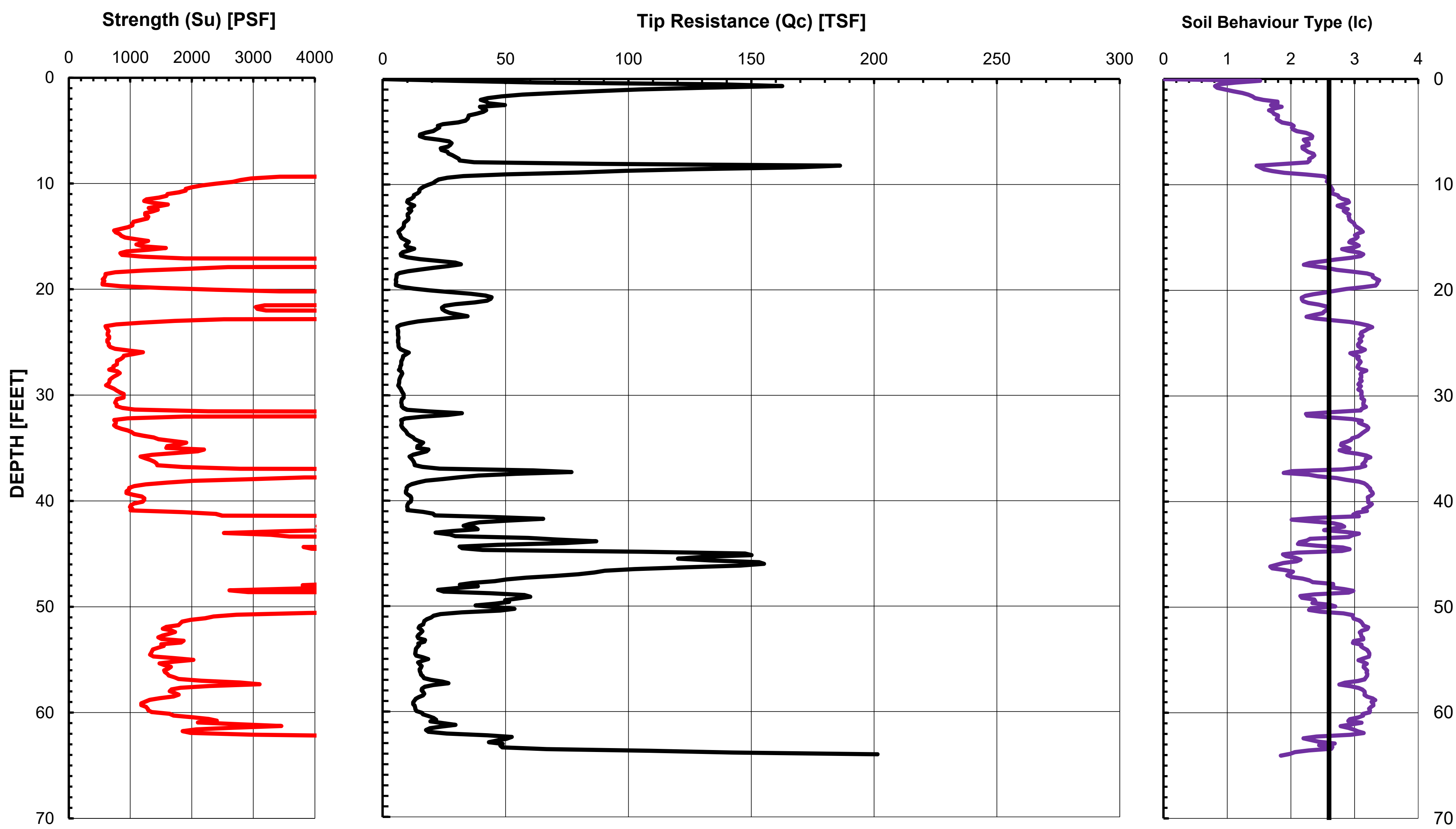




GROUP DELTA

CONE PENETOMETER DATA (B-CPT-050)

Document No. 18-0018
Project No. LA1345
FIGURE A-8a



GROUP DELTA

INTERPRETED SOIL DATA (B-CPT-050)

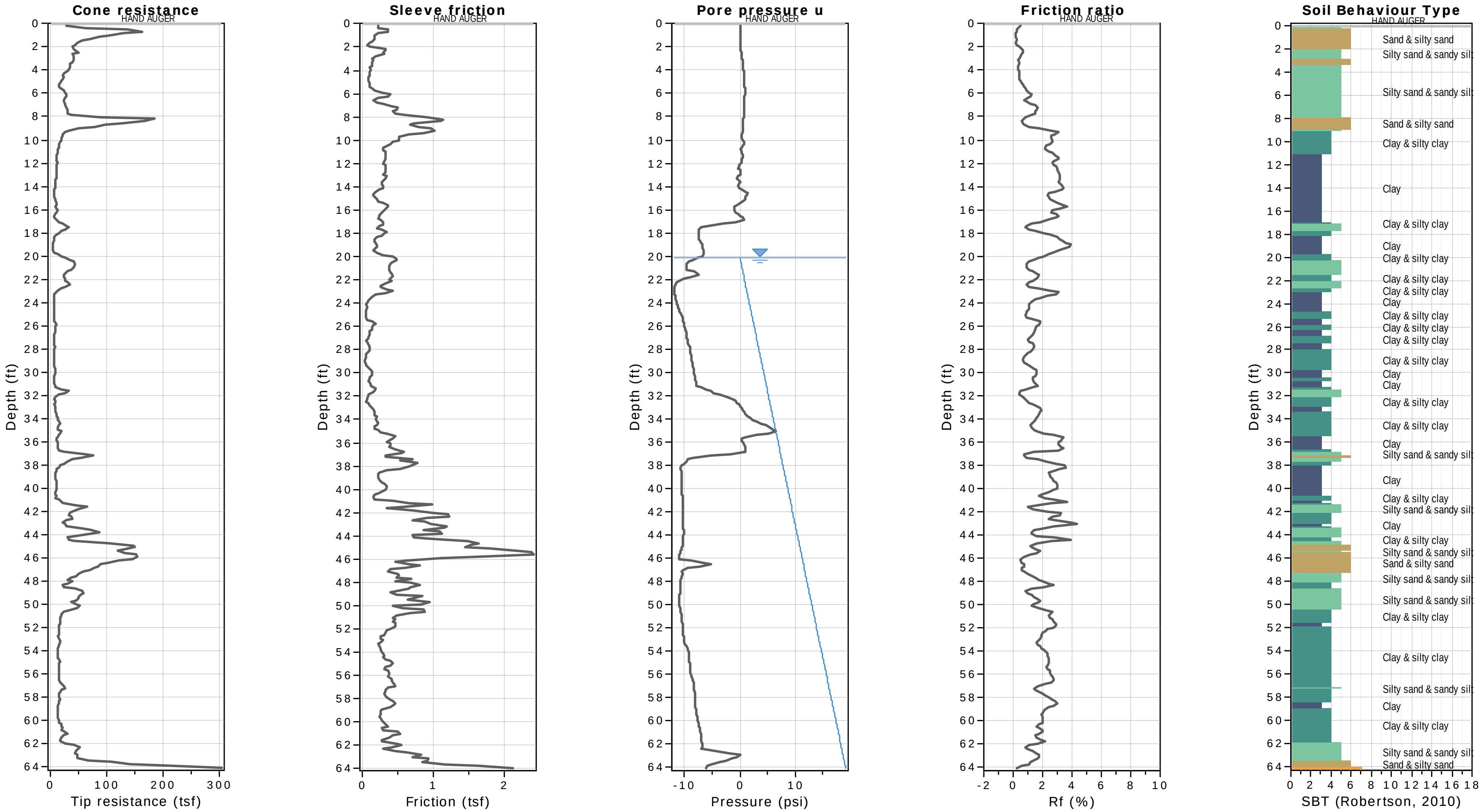
Document No. 18-0018
Project No. LA1345
FIGURE A-8b

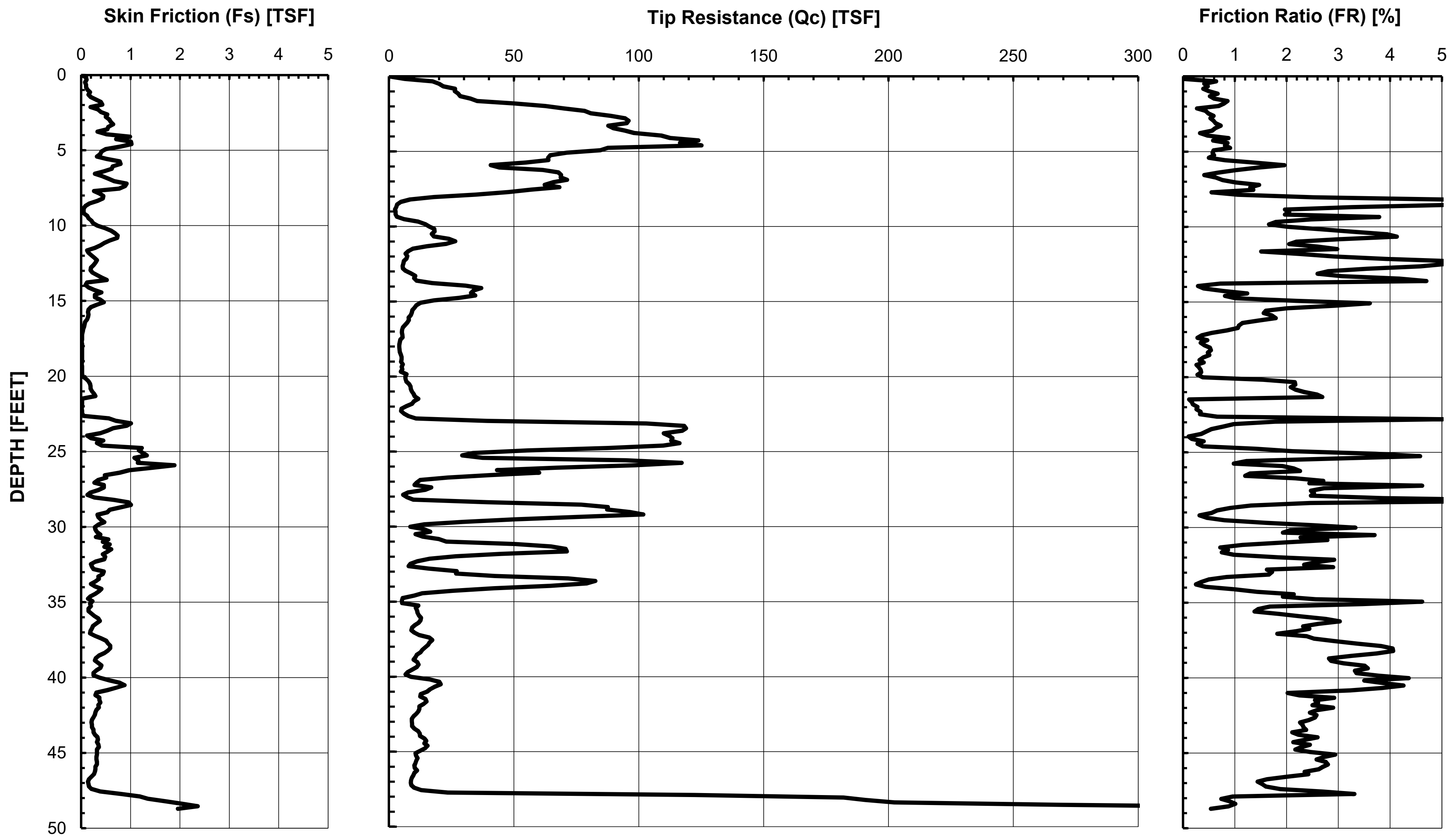
Group Delta Consultants, Inc.
Project No. LA1345

CPT: B-CPT-050

Project: Lincoln Bridge Multi-Modal Improvement Project
Location: Los Angeles, California

Total depth: 64.12 ft, Date: 9/14/2012
Surface Elevation: 20.20 ft

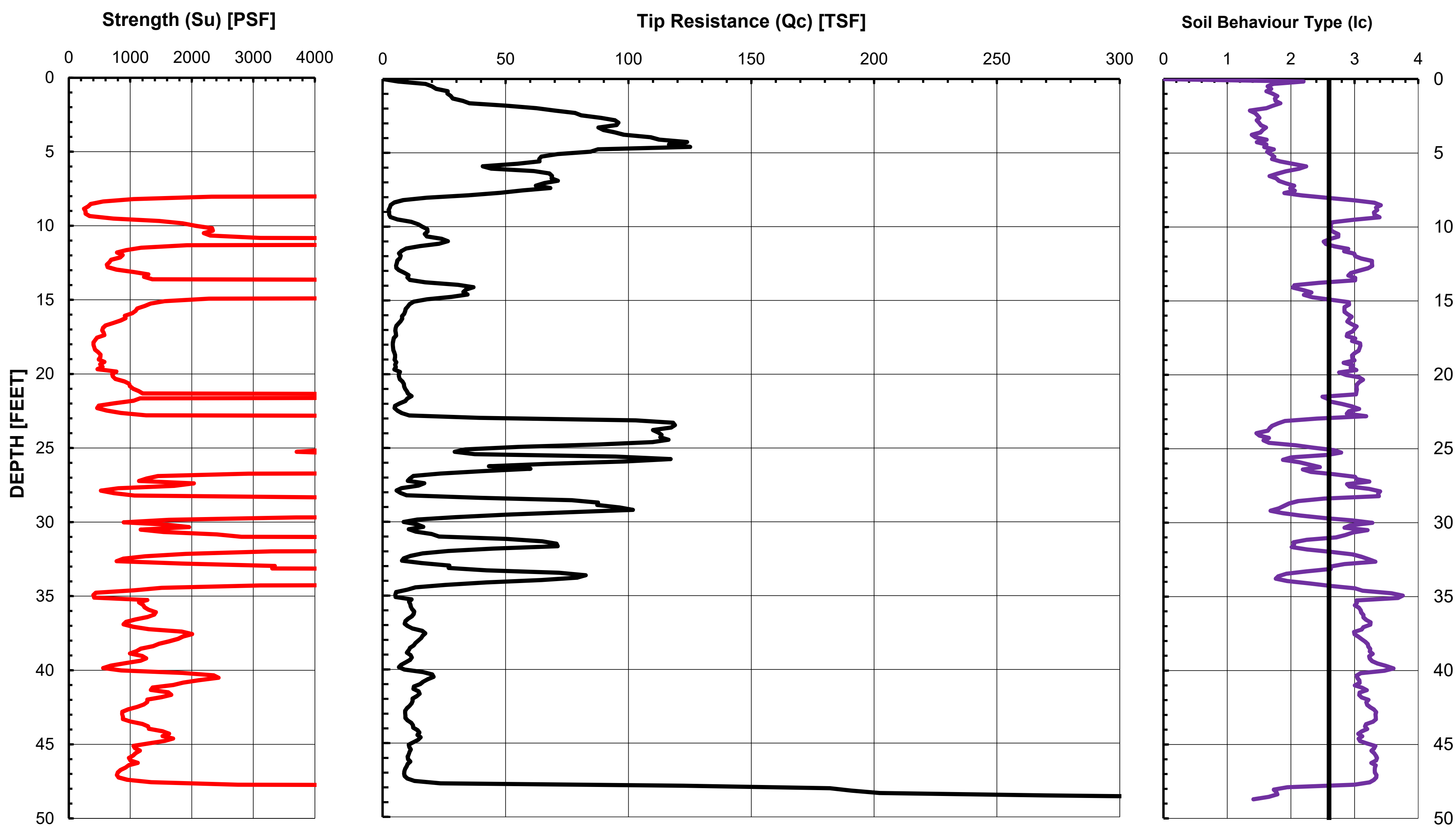




GROUP DELTA

CONE PENETOMETER DATA (C-CPT-060)

Document No. 18-0018
Project No. LA1345
FIGURE A-9a



GROUP DELTA

INTERPRETED SOIL DATA (C-CPT-060)

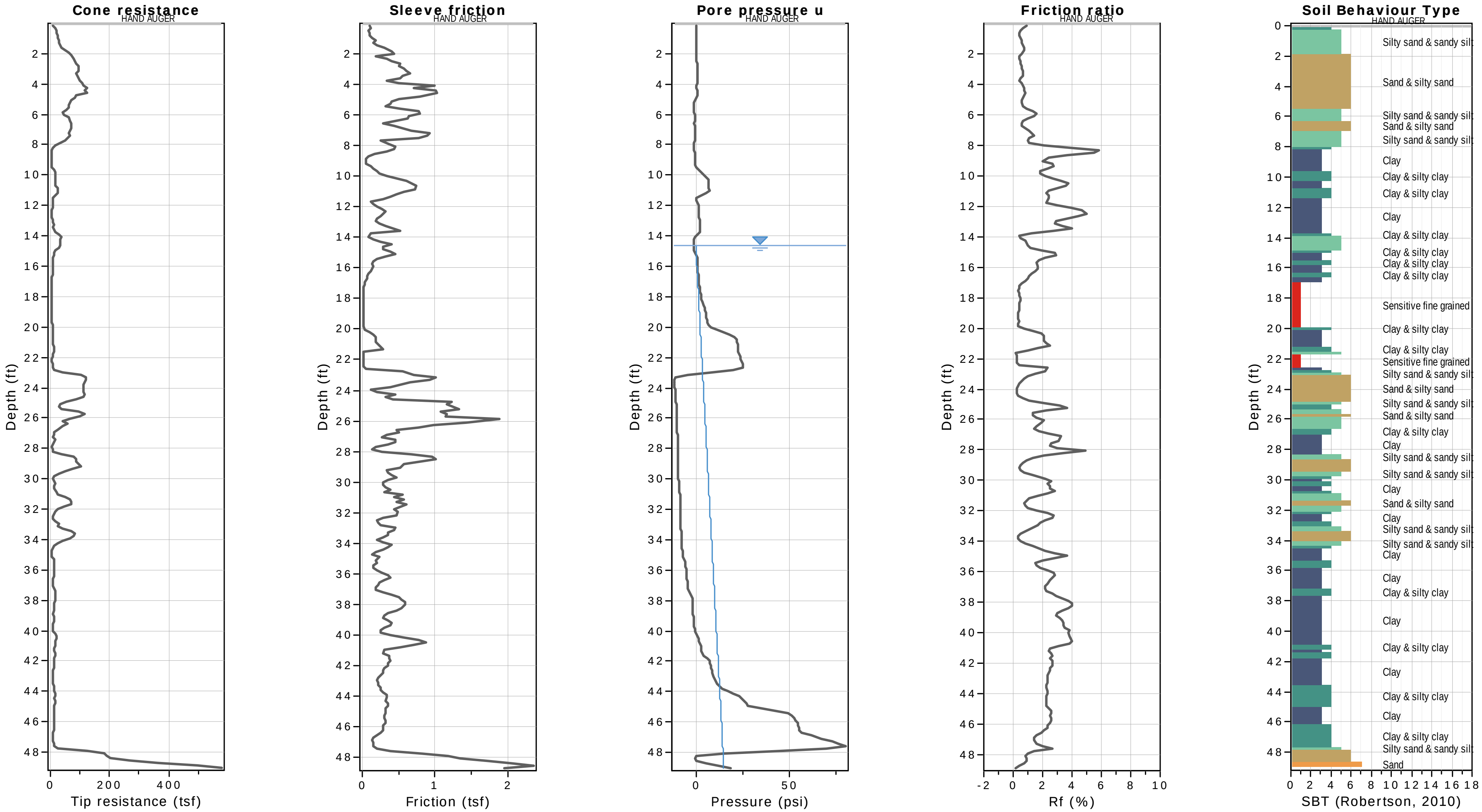
Document No. 18-0018
Project No. LA1345
FIGURE A-9b

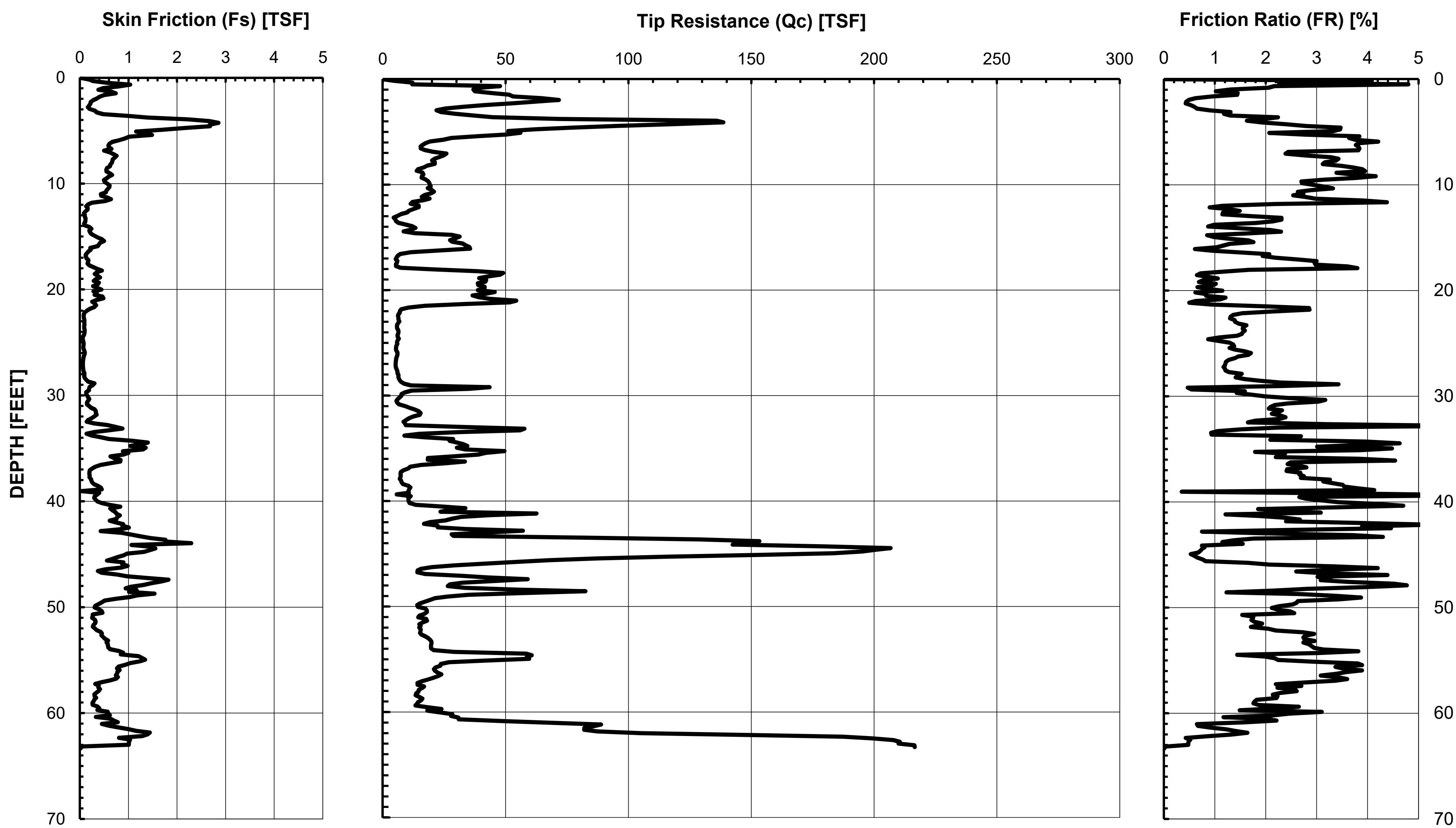
Group Delta Consultants, Inc.
Project No. LA1345

CPT: C-CPT-060

Project: **Lincoln Bridge Multi-Modal Improvement Project**
Location: **Los Angeles, California**

Total depth: 49.04 ft, Date: 10/10/2012
Surface Elevation: 14.60 ft

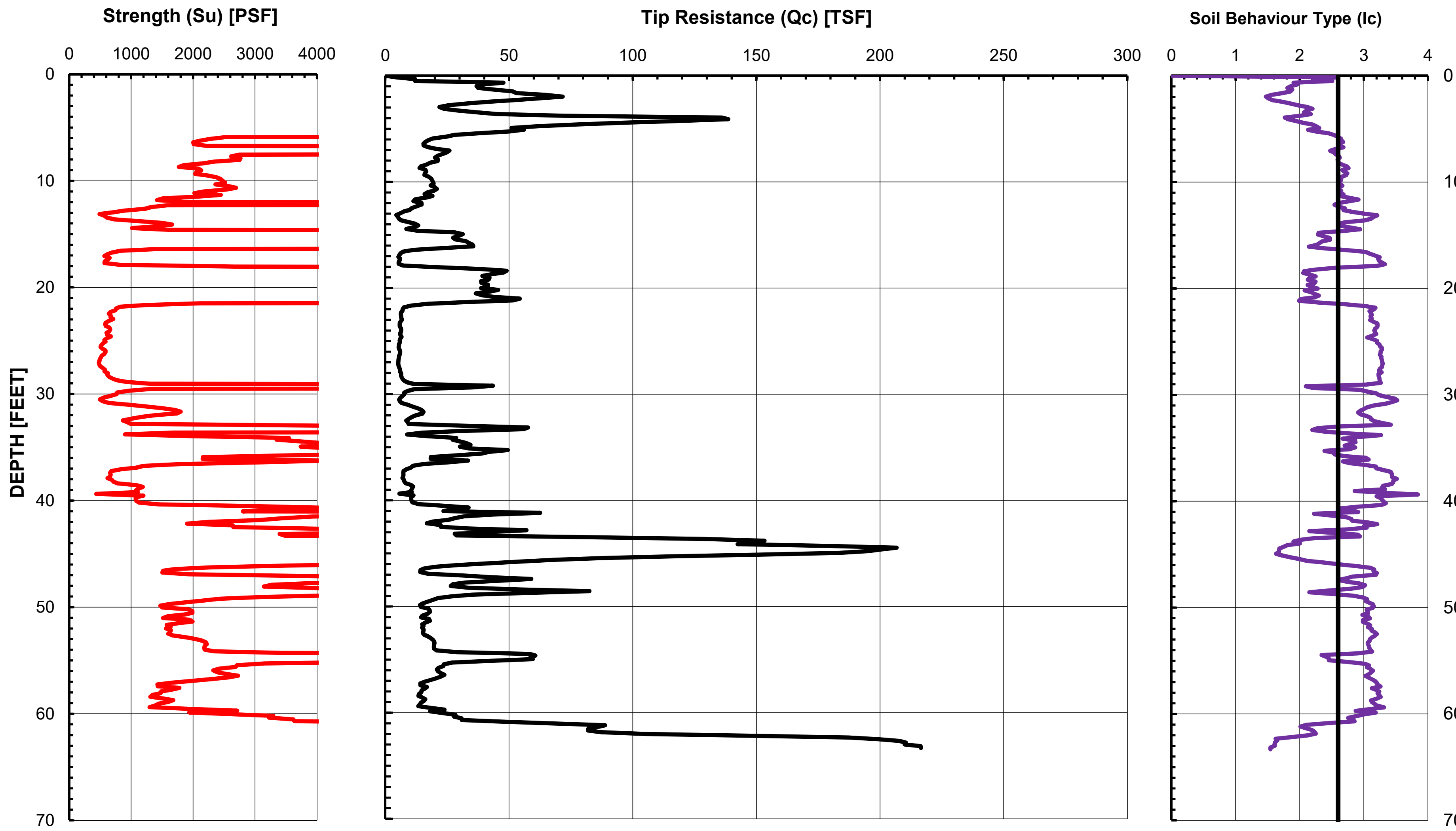




GROUP DELTA

CONE PENETOMETER DATA (A-CPT-065)

Document No. 18-0018
Project No. LA1345
FIGURE A-10a



GROUP DELTA

INTERPRETED SOIL DATA (A-CPT-065)

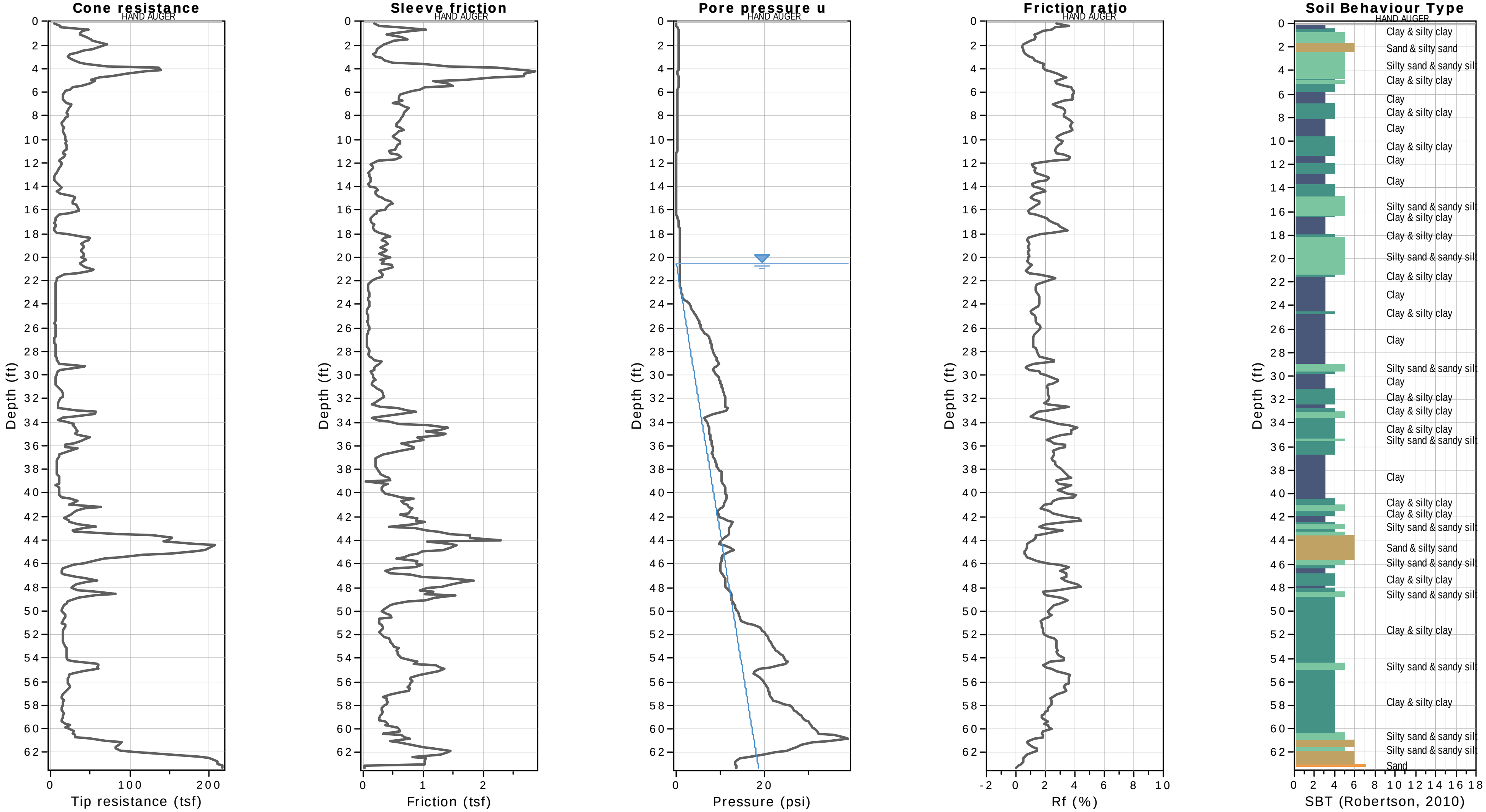
Document No. 18-0018
Project No. LA1345
FIGURE A-10b

Group Delta Consultants, Inc.
Project No. LA1345

CPT: A-CPT-065

Project: **Lincoln Bridge Multi-Modal Improvement Project**
Location: **Los Angeles, California**

Total depth: 63.32 ft, Date: 9/26/2012
Surface Elevation: 20.50 ft



APPENDIX A
EXISTING FIELD DATA (Group Delta, 1999)

APPENDIX C
GDC FIELD INVESTIGATION

C.1 Introduction

The subsurface conditions at the project site were investigated by Group Delta Consultants during the period of October 29, 1998 to December 11, 1998 by performing the following activities:

- 11 soil borings to depths ranging from 26 ft to 66.3 ft below ground surface (bgs), as shown in Figure 3 of this report including the construction of a four temporary observation wells; and
- A total of eight CPTs to depths ranging from 38 ft to 69 ft bgs, also as shown in Figure 3.

C.2 Soil Drilling, Excavation, and Sampling

The borings were advanced utilizing both rotary wash and hollow-stem auger drill rig systems. The rotary wash borings had a hole diameter ranging from 4.5 inches to 6 inches; the hollow stem auger borings had a hole diameter of 10 inches. The borings were performed by both C&L Drilling (rotary) and THF Drilling (rotary and hollow-stem). This exploration program was supervised by the GDC Field Engineer, who visually inspected the soil samples, maintained detailed logs of the borings, interpreted stratigraphy, classified the soils, and obtained drive samples as well as Standard Penetration Test (SPT) samples and bulk samples at maximum vertical spacing of approximately 5-foot intervals. The soils were classified in the field and further examined in the laboratory in accordance with the Unified Soil Classification System (Figure C-1). Field classifications were modified, where necessary, on the basis of laboratory test results.

Relatively undisturbed soil samples were obtained using a 3.25-inch outside diameter sampler lined with brass rings, each 1-inch high and 2.42-inch inside diameter. The ring and tube samplers were driven with a 140-pound hammer dropping 30 inches. In addition, Standard Penetration Tests (SPT) were performed in accordance with ASTM D1586 using a 2-inch outside diameter and 1.375-inch inside diameter split-spoon barrel sampler. The SPT sampler was driven with a 140-pound safety hammer dropping 30-inches.

The Standard Penetration Test consists of counting the number of hammer blows it takes to drive the sampler approximately 1 foot into the ground. SPT blowcounts are often used as an index of the relative density and resistance of the sampled materials. The blowcounts obtained by driving the ring sampler can be converted to an approximate equivalent SPT blowcount using a multiplication factor of 0.65.

Detailed logs of the soil borings including blowcount data and in-situ moisture content and soil density are presented in Figures C-2 through C-20. Laboratory tests performed on the samples, such as moisture content and dry density, are shown in the "Other Tests" columns of the log. Descriptions and further result summaries of laboratory tests performed are provided in Appendix D.

In addition, four temporary observation wells were placed in Boring B-304H, B-305H, B-313H, and B-315H to evaluate groundwater conditions. Groundwater level measurements in these wells and other existing wells were recorded and are provided in Table C-2

C.3 Cone Penetration Test (CPT)

A total of eight CPT soundings were conducted for the Site to depths ranging from 38 ft to 69 ft bgs. This was performed in general accordance with ASTM D3441-86, using an electric cone penetrometer. The CPT soundings were performed by Gregg In-Situ, Inc. at the locations shown in Figure 3 and are presented as Figures C-21 to C-43.

CPTs are advanced from the ground surface with a truck-mounted hydraulic ram which pushes a steel rod with a conical tip and cylindrical friction-sleeve into the ground. The conical tip has a 60-degree apex angle and a projected cross-sectional area of 1.55 square inches. The cylindrical friction sleeve has a surface area of 23.25 square inches. Both the tip and the sleeve have outside diameters of 1.4 inches.

As the rod is advanced, electronic instruments measure and record both the tip resistance and the frictional resistance on the sleeve. The tip and frictional resistance are then analyzed, using available correlations, to estimate soil classification, density, strength, and compressibility of the subsurface materials. Unlike soil borings, in which drive samples are typically taken at discrete intervals, the CPT provides a continuous record of soil properties with depth. Hence, the CPT can evaluate the subsurface soil profile with much higher resolution than a soil boring, more precisely identifying the actual thickness of soft/compressible layers (to the nearest foot), and often detecting thin layers that may not be observed with conventional drilling and sampling techniques.

C.4 List of Attached Tables and Figures

The following tables and figures are attached and complete this appendix:

Table C-1	Field Exploration Summary
Table C-2	Summary of Water Level Measurements
Figure C-1	Key for Soil Classification
Figures C-2 through C-20	Boring Logs
Figures C-21 through C-43	CPT Logs

TABLE C-1
SUMMARY OF SOIL BORINGS

Expl. No.	Date Drilled	Ground Surface Elevation (feet, MSL)	Ground water Depth (feet)	Final Groundwater Elevation at Time of Exploration (feet, MSL)	Total Depth (ft)	Remarks
B-302R	12-11-98	17.5	20.0	-2.5	66.5	--
B-304H	10-29-98	14.6	12.2	+2.4	31.0	Installed 4" well
B-305H	10-29-98	15.3	12.0	+3.3	31.0	Installed 4" well
B-306R	11-04-98	16.8	--	--	51.5	--
B-307R	11-06-98	11.4	--	--	61.0	--
B-309R	11-04-98	12.8	--	--	61.0	--
B-313H	10-29-98	12.6	8.4	+4.2	26.0	Installed 4" well
B-315H	10-30-98	13.3	8.0	+5.3	26.0	Installed 4" well
B-316R	11-03-98	14.1	--	--	57.5	--
B-317R	11-05-98	9.5	--	--	61.0	--
B-319R	11-05-98	11.7	--	--	61.0	--

TABLE C-2
SUMMARY OF WATER LEVEL MEASUREMENTS

Well I.D.	Date Recorded	Time Recorded	Well Diameter Size (in)	Casing Elevation (ft, MSL)	Ground water Depth (ft)	Groundwater Elevation (ft, MSL)
Well by SE gate	11-11-98	0835	2	13.5	5.1	8.4
Well 315H	11-11-98	0902	4	15.4	9.6	5.8
Well central area	11-11-98	0906	2	14.8	10.5	4.3
Well B-305H	11-11-98	0912	4	17.4	14.6	2.8
Well B-304H	11-11-98	0921	4	16.7	14.1	2.6
Well B-313H	11-11-98	0930	4	14.6	10.1	4.5
Well by SE gate	12-04-98	1551	2	13.5	5.2	8.3
Well 315H	12-04-98	1556	4	15.4	9.5	5.9
Well central area	12-04-98	1612	2	14.8	10.4	4.4
Well B-305H	12-04-98	1600	4	17.4	14.6	2.8
Well B-304H	12-04-98	1606	4	16.7	14.1	2.6
Well B-313H	12-04-98	0615	4	14.6	10.2	4.4
Well by SE gate	12-23-98	1350	2	13.5	6.1	7.4
Well 315H	12-23-98	1240	4	15.4	10.0	5.4
Well central area	12-23-98	1330	2	14.8	10.8	4.0
Well B-305H	12-23-98	1315	4	17.4	14.9	2.5
Well B-304H	12-23-98	1300	4	16.7	14.4	2.3
Well B-313H	12-23-98	1250	4	14.6	10.5	4.1

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

PRIMARY DIVISIONS			GROUP SYMBOL	SECONDARY DIVISIONS
COARSE GRAINED SOILS MORE THAN HALF OF MATERIALS IS LARGER THAN # 200 SIEVE SIZE	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN # 4 SIEVE	CLEAN GRAVELS (LESS THAN 5% FINES)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES.
			GP	POORLY GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES.
		GRAVEL WITH FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURE, NON PLASTIC FINES.
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, PLASTIC FINES.
	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN # 4 SIEVE	CLEAN SANDS (LESS THAN 5% FINES)	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES.
			SP	POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES.
		SANDS WITH FINES	SM	SILTY SANDS, SAND-SILT MIXTURES, NON-PLASTIC FINES.
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES, PLASTIC FINES.
FINE GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN # 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT IS LESS THAN 50	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.
	SILTS AND CLAYS	LIQUID LIMIT IS GREATER THAN 50	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.
	HIGHLY ORGANIC SOILS		PT	PEAT AND OTHER HIGHLY ORGANIC SOILS.

CLASSIFICATION CRITERIA BASED ON FIELD TESTS

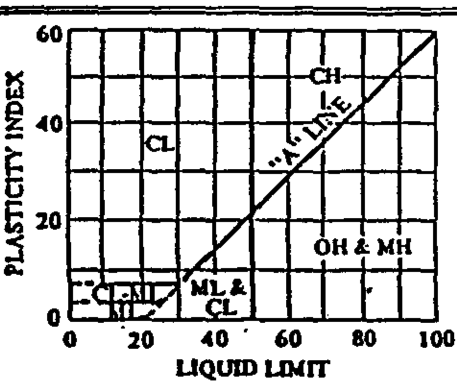
PENETRATION RESISTANCE (PR)	
SANDS AND GRAVELS	
RELATIVE DENSITY	BLOWS/FOOT*
VERY LOOSE	0 - 4
LOOSE	4 - 10
MEDIUM DENSE	10 - 30
DENSE	30 - 50
VERY DENSE	OVER 50

CLAYS AND SILTS		
CONSISTANCY	BLOWS/FOOT*	STRENGTH**
VERY SOFT	0 - 2	0 - ¼
SOFT	2 - 4	¼ - ½
FIRM	4 - 8	½ - 1
STIFF	8 - 15	1 - 2
VERY STIFF	15 - 30	2 - 4
HARD	OVER 30	OVER 4

* NUMBER OF BLOWS OF 140 POUND HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1 3/8 INCH I.D.) SPLIT BARREL SAMPLER (ASTM-1586 STANDARD PENETRATION TEST)

** UNCONFINED COMPRESSIVE STRENGTH IN TONS/SQ. FT. READ FROM POCKET PENETROMETER

CLASSIFICATION CRITERIA BASED ON LAB TESTS



GW AND SW – $C_u = \frac{D_{60}}{D_{10}}$ GREATER THAN 4 FOR GW AND 6 FOR SW; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ BETWEEN 1 AND 3

GP AND SP – CLEAN GRAVEL OR SAND NOT MEETING REQUIREMENT FOR GW AND SW

GM AND SM – ATTERBERG LIMIT BELOW "A" LINE OR P.I. LESS THAN 4

GC AND SC – ATTERBERG LIMIT ABOVE "A" LINE P.I. GREATER THAN 7

FINES (SILT OR CLAY)	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	COARSE GRAVEL	COBBLES	BOULDERS
SIEVE SIZES 200	40	10	4	3/4"	3"	10"	

CLASSIFICATION OF EARTH MATERIALS IS BASED ON FIELD INSPECTION AND SHOULD NOT BE CONSTRUED TO IMPLY LABORATORY ANALYSIS UNLESS SO STATED.

KEY FOR SOIL EXPLORATION LOGS

Figure C-1

LOG OF TEST BORING

PROJECT	PROJECT NUMBER	HOLE NUMBER
PLAYA VISTA - Site DE & Ballona Creek	L-196	LEGEND

SITE	BEGUN	COMPLETED	SHEET NO.
Playa del Rey, California			1 of 1

DRILLER	DRILL METHOD	LOGGED BY	CHECKED BY

DRILL EQUIPMENT	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	DEPTH/*ELEV.* GROUND WATER
		45.0 ft.		▼

SAMPLING METHOD	NOTES
	LOCATIONS: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
						5			FILL - Soil material not native to the location.
									NATIVE - Soil material naturally deposited at the location.
						10			
									BULK 1, R-2, S-3 - Refers to the type and sequence in which the sample was taken.
						15			
									GRAB, MC, SPT - Refers to the method in which the sample was obtained.
						20			
Bulk 1 GRAB									GRAB - Refers to collecting sample by method of placing loose soil material into a plastic bag.
						25			
R-2 MC									MC (CALIFORNIA MODIFIED) - Refers to collecting the sample by method of a 2.4" inside diameter by 12" long cylindrical sampler driven into the soil by a downward force, usually provided by a free falling hammer.
S-3 SPT						30			SPT (STANDARD PENETRATING TEST) - Refers to collecting the sample by method of a 1.4" inside diameter by 18" long cylindrical sampler driven into the soil by a downward force, usually provided by a free falling hammer.
						35			THE FOLLOWING SUBSURFACE SUMMARIES APPLY ONLY AT THE LOCATION OF THESE BORINGS AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THESE LOCATIONS WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.
						40			
						45			

LOG OF TEST BORING

PROJECT	PROJECT NUMBER	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	**B-302R**

SITE	BEGUN	COMPLETED	SHEET NO.
Playa del Rey, California	12/11/98	12/11/98	1 of 2

DRILLER	DRILL METHOD	LOGGED BY	CHECKED BY
C & L	ROTARY WASH	SHK	MDR

DRILL EQUIPMENT	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	DEPTH/*ELEV.* GROUND WATER
MAYHEW ROTARY	6"	66.5 ft.	17.50	▼ 20.0 / *-2.5*

SAMPLING METHOD	NOTES
R: 400-lb downhole hammer S:140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
									FILL (SM) Olive gray fine SAND
S-1 SPT	4	27.4			13	5			Very loose, with SILT
R-2 MC	5	31.8	86.2		8	10			No change
S-3 SPT	2	48.5		AL	3	15			NATIVE (CH) Dark gray, very soft, Silty CLAY
R-4 MC	5	32.3	91.0	DS	-3	20			Micaceous
S-5 SPT	1	56.4		WA	-8	25			(ML) Dark gray, very loose, medium to fine, Sandy SILT, with CLAY, some sea shells (ML) Light gray, very soft, Clayey SILT, carbonaceous
R-6 MC	5	27.1	98.1	DS	-13	30			(CL) Dark gray Silty CLAY, some plant particles
S-7 SPT	15	18.8		WA	-18	35			(ML) Dark gray, stiff, coarse to fine, Sandy SILT, some GRAVEL Stiff, no SAND and GRAVEL, some sea shells
R-8 MC	8	41.7	82.6		-23	40			(CL) Blue to olive gray, Silty CLAY

LOG OF TEST BORING

PROJECT	PROJECT NUMBER	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	B-302R

SITE	BEGUN	COMPLETED	SHEET NO.
Playa del Rey, California	12/11/98	12/11/98	2 of 2

DRILLER	DRILL METHOD	LOGGED BY	CHECKED BY
C & L	ROTARY WASH	SHK	MDR

DRILL EQUIPMENT	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	DEPTH/ELEV. GROUND WATER
MAYHEW ROTARY	6"	66.5 ft.	17.50	▼ 20.0 / -2.5

SAMPLING METHOD	NOTES
R: 400-lb downhole hammer S:140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
S-9 SPT	8	43.9		AL	-28	45			(ML) Greenish gray, soft, Clayey SILT
S-10 SPT	Pushed				-33	50			Sample pushed (CL) dark greenish gray, soft, Silty CLAY
S-11 SPT	14	48.2		AL	-38	55			(CL) Dark gray, stiff, Silty CLAY, with trace of fine SAND
S-12 SPT	22	25.8			-43	60			(SP) Dark gray, compact, SAND, with GRAVEL
S-13 SPT	73	9.2			-48	65			Very dense
									Bottom of B-302R @ 66.5 feet *Ground water was observed at 20 feet below the top surface.* *The boring was backfilled with grout.* *The boring cuttings were placed into DOT drums.*
					-53	70			
					-58	75			
					-63	80			

GDC_LOG_BORING L196PV.GPJ GDC_WLOG.GDT 1/4/99

GROUP DELTA CONSULTANTS, INC.

BORING/WELL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	1 of 1	**B-304H**

SITE	LOGGED BY	CHECKED BY	BEGUN	COMPLETED
Playa del Rey, California	SHK	MDR	10/29/98	10/29/98

DRILLER	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	TOP OF CASING ELEV.	DEPTH/ELEV. GROUND WATER
THF	10"	31.0 ft.	14.55	16.69	▼ 12.2 / 2.3

DRILL METHOD	CASING TYPE/DIA.	SCREEN TYPE/SLOT	GRAVEL PACK TYPE	GROUT TYPE/QUANTITY
HOLLOW STEM	4" PVC Casing	0.010" Slotted Casing	12 bgs, 2/12 Sand	2 bgs, Bentonite Chips

SAMPLING METHOD	NOTES
140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	DESCRIPTION AND CLASSIFICATION
BULK1 GRAB		9.8		CO			FILL (SM) Dark brown, coarse to fine, Silty SAND, damp
R-1 MC	20	18.7	98.0	AL CS	10	5	(SC) Dark gray Clayey SAND, with SILT
R-2 MC	71	11.5	95.4		5	10	(CL) Gray, medium to fine Sandy CLAY, with white cemented SAND
R-3 MC	15	30.9	90.1	WA	0	15	NATIVE (ML) Gray to olive gray, Sandy SILT, micaceous
R-4 MC	10	37.2	76.4	AL CS	-5	20	(CH) Medium gray, Silty CLAY, fossil worm holes present.
R-5 MC	10				-10	25	NO SAMPLE RECOVERED
R-6 MC	17				-15	30	
					-20	35	
					-25	40	

Bottom of B-304H @ 31 feet
Ground water was observed at 12.22 feet below ground surface on 12/23/98.
The boring cuttings and water were placed into DOT drums.

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BORING/WELL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	1 of 1	B-305H

SITE	LOGGED BY	CHECKED BY	BEGUN	COMPLETED
Playa del Rey, California	SHK	MDR	10/29/98	10/29/98

DRILLER	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	TOP OF CASING ELEV.	DEPTH/ELEV. GROUND WATER
THF	10"	31.0 ft.	15.29	17.43	▼ 12.0 / 3.3

DRILL METHOD	CASING TYPE/DIA.	SCREEN TYPE/SLOT	GRAVEL PACK TYPE	GROUT TYPE/QUANTITY
HOLLOW STEM	4" PVC Casing	0.010" Slotted Casing	12 bgs, 2/12 Sand	2 bgs, Bentonite Chips

SAMPLING METHOD	NOTES
140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	WELL GRAPHICS	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
BULK1 GRAB										FILL (SM) Brown to dark brown, coarse to fine, Silty SAND, with CLAY, GRAVEL
		9.0		CO						
R-1 MC	20	18.6	109.0	AL CS	10	5				(CL) Dark brown, fine Sandy CLAY
R-2 MC	20	15.2			5	10				Increse in SILT, less SAND, Silty CLAY, with GRAVEL
R-3 MC	10	34.9	87.6	AL CS	0	15				NATIVE (SM) Olive gray to gray, coarse Silty SAND, with sea shell fragments, micaceous
R-4 MC	6	65.1	58.4	AL CS	-5	20				(CH) Olive to dark gray, Silty CLAY
R-5 MC	11	22.4	100.4		-10	25				Color change: Dark gray
R-6 MC	16				-15	30				NSR
										Bottom of B-305H @ 31 feet *Ground water was observed at 12.77 feet below ground surface on 12/23/98.* *The boring cuttings and water were placed into DOT drums.*
					-20	35				
					-25	40				

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FIGURE C-6

LOG OF TEST BORING

Field	Value
PROJECT	Playa Vista - Site DE & Ballona Creek
PROJECT NUMBER	L-196
HOLE NUMBER	**B-306R**
SITE	Playa del Rey, California
BEGUN	11/04/98
COMPLETED	11/04/98
SHEET NO.	1 of 2
DRILLER	THF
DRILL METHOD	ROTARY WASH
LOGGED BY	SHK
CHECKED BY	MDR
DRILL EQUIPMENT	MOBILE 61 ROTARY
BORING DIA.	4.5"
TOTAL DEPTH	51.5 ft.
GROUND ELEV.	16.78
DEPTH/*ELEV.* GROUND WATER	▼ N/T / *na*
SAMPLING METHOD	140-lb 30-inch Free Falling Hammer
NOTES	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE I.D.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	DESCRIPTION AND CLASSIFICATION
							FILL (SC/SM) Olive gray, Silty to Clayey SAND
R-1 MC	73@11"	16.8	112.1		12	5	With GRAVEL
S-2 SPT	82				7	10	Very dense, less GRAVEL
							NATIVE
R-3 MC	33	40.8		WA	2	15	(CL) Light gray, Silty CLAY, with fine SAND, carbonaceous
S-4 SPT	18	55.9	63.9	AL	-3	20	(CH) Black to dark gray, stiff, CLAY, carbonaceous
R-5 MC	50				-8	25	No change
S-6 SPT	36				-13	30	Hard, GRAVELS up to 1/2"
R-7 MC	84	10.6	129.1	SE			(SP) Dark gray, coarse to medium, Gravelly SAND, up to 2"
S-8 SPT	19	32.7			-18	35	(CL) Dark gray, stiff, Silty CLAY
R-9 MC	72				-23	40	medium to fine SAND present

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LOG OF TEST BORING

PROJECT	PROJECT NUMBER	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	**B-306R**

SITE	BEGUN	COMPLETED	SHEET NO.
Playa del Rey, California	11/04/98	11/04/98	2 of 2

DRILLER	DRILL METHOD	LOGGED BY	CHECKED BY
THF	ROTARY WASH	SHK	MDR

DRILL EQUIPMENT	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	DEPTH/*ELEV.* GROUND WATER
MOBILE 61 ROTARY	4.5"	51.5 ft.	16.78	⊻ N/T / *na*

SAMPLING METHOD	NOTES
140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
S-10 SPT	68	37.6			-28	45			Dense
S-11 SPT	66	41.1			-33	50			(CH) Dark gray, hard, CLAY, with fine SAND
									Bottom of B-306R @ 51.5 feet *Ground water measurement was not taken.* *The boring was backfilled with grout.* *The boring cuttings were placed into DOT drums.*
					-38	55			
					-43	60			
					-48	65			
					-53	70			
					-58	75			
					-63	80			

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FIGURE C-8

LOG OF TEST BORING

PROJECT	PROJECT NUMBER	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	B-307R

SITE	BEGUN	COMPLETED	SHEET NO.
Playa del Rey, California	11/06/98	11/06/98	1 of 2

DRILLER	DRILL METHOD	LOGGED BY	CHECKED BY
THF	ROTARY WASH	SHK	MDR

DRILL EQUIPMENT	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	DEPTH/*ELEV.* GROUND WATER
MOBILE 61 ROTARY	4.5"	61.0 ft.	11.38	⊻ N/T / *na*

SAMPLING METHOD	NOTES
140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
									FILL (CL) Olive gray Sandy CLAY
S-1 SPT	12	16.2			6	5			Gradation change: Stiff, coarse to fine Sandy CLAY, some GRAVEL
									NATIVE
R-2 MC	26				1	10			(CL) Medium gray to gray, CLAY
R-3 MC	26	40.0	81.5						
									(CH) Olive gray, fine Sandy CLAY, micaceous
R-4 MC	43				-4	15			No Recovery
R-5 MC	6	82.0	51.3	WA AL CS	-9	20			(CH/OH) Dark gray, Sandy CLAY / Organic Sandy CLAY
S-6 SPT	16	23.5		WA	-14	25			Gradation change: Stiff, fine Sandy / Organic Sandy CLAY
R-7 MC	49	29.5	94.8	DS	-19	30			(ML) Dark gray, fine Sandy SILT, trace of CLAY
S-8 SPT	59	28.2			-24	35			(CL) Dark gray, hard, Silty CLAY (SP) Dark gray, dense, coarse to medium, SAND, with some GRAVEL
S-9 SPT	22	36.9			-29	40			(CL) Dark gray, very stiff, Silty CLAY

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FIGURE C-9

LOG OF TEST BORING

PROJECT	PROJECT NUMBER	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	B-307R

SITE	BEGUN	COMPLETED	SHEET NO.
Playa del Rey, California	11/06/98	11/06/98	2 of 2

DRILLER	DRILL METHOD	LOGGED BY	CHECKED BY
THF	ROTARY WASH	SHK	MDR

DRILL EQUIPMENT	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	DEPTH/*ELEV.* GROUND WATER
MOBILE 61 ROTARY	4.5"	61.0 ft.	11.38	▼ N/T / *na*

SAMPLING METHOD	NOTES
140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
S-10 SPT	25	33.6			-34	45			Very stiff
S-11 SPT	39	22.8			-39	50			(SP) Dark gray, dense, coarse to medium, SAND, with fine GRAVEL (CL) Dark gray Silty CLAY
S-12 SPT	112@15"	28.6			-44	55			(ML) Dark gray, very hard, fine Sandy SILT
S-13 SPT	120	21.0			-49	60			(SP) Gray, very dense, coarse to medium, SAND *Bottom of B-307R @ 61 feet* *Ground water measurement was not taken.* *The boring was backfilled with grout.* *The boring cuttings were placed into DOT drums.*
					-54	65			
					-59	70			
					-64	75			
					-69	80			

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FIGURE **C-10**

LOG OF TEST BORING

PROJECT	PROJECT NUMBER	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	**B-309R**

SITE	BEGUN	COMPLETED	SHEET NO.
Playa del Rey, California	11/04/98	11/04/98	1 of 2

DRILLER	DRILL METHOD	LOGGED BY	CHECKED BY
THF	ROTARY WASH	SHK	MDR

DRILL EQUIPMENT	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	DEPTH/*ELEV.* GROUND WATER
MOBILE 61 ROTARY	4.5"	61.0 ft.	12.76	▼ N/T / *na*

SAMPLING METHOD	NOTES
140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
									FILL (SC) Olive gray, Clayey SILT, with GRAVEL
S-1 SPT	26	18.4			8	5			Compact
R-2 MC	23	27.5	91.0		3	10			NATIVE (CL) Gray to medium gray, Silty CLAY
S-3 SPT	17			AL	-2	15			Color change: Gray to olive gray, stiff
R-4 MC	24	29.2		AL	-7	20			(CL/OL) Dark gray, Silty / Organic CLAY, with sea shells and decaying plants
S-5 SPT	8			WA	-12	25			Gradation change: Soft, coarse to fine Silty / Organic Clay, with GRAVEL
R-6 MC	32	37.5	89.6		-17	30			With sections of Silty SAND
S-7 SPT	16	36.9		AL	-22	35			(CH) Dark gray, stiff, CLAY, porous
R-8 MC	32				-27	40			With some SILT

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LOG OF TEST BORING

PROJECT	PROJECT NUMBER	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	B-309R

SITE	BEGUN	COMPLETED	SHEET NO.
Playa del Rey, California	11/04/98	11/04/98	2 of 2

DRILLER	DRILL METHOD	LOGGED BY	CHECKED BY
THF	ROTARY WASH	SHK	MDR

DRILL EQUIPMENT	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	DEPTH/*ELEV.* GROUND WATER
MOBILE 61 ROTARY	4.5"	61.0 ft.	12.76	▼ N/T / *na*

SAMPLING METHOD	NOTES
140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
S-9 SPT	22	37.9			-32	45			Very stiff,
S-10 SPT	50				-37	50			Hard, SILT lenses are present
S-11 SPT	48	31.5			-42	55			Hard
S-12 SPT	70@3"	4.5			-47	60			(GP) Dark gray, very dense, well graded GRAVEL
									Bottom of B-309R @ 61 feet *Ground water measurement was not taken.* *The boring was backfilled with grout.* *The boirng cuttings were placed into DOT drums.*
					-52	65			
					-57	70			
					-62	75			
					-67	80			

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BORING/WELL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	1 of 1	**B-313H**

SITE	LOGGED BY	CHECKED BY	BEGUN	COMPLETED
Playa del Rey, California	SHK	MDR	10/29/98	10/29/98

DRILLER	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	TOP OF CASING ELEV.	DEPTH/*ELEV.* GROUND WATER
THF	10"	26.0 ft.	12.58	14.62	▼ 8.4 / *4.1*

DRILL METHOD	CASING TYPE/DIA.	SCREEN TYPE/SLOT	GRAVEL PACK TYPE	GROUT TYPE/QUANTITY
HOLLOW STEM	4" PVC Casing	0.010" Slotted Casing	12 bgs, 2/12 Sand	2 bgs, Bentonite Chips

SAMPLING METHOD	NOTES
140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	DESCRIPTION AND CLASSIFICATION
BULK1 GRAB				CO			FILL (SM) Dark brown, coarse to medium, Silty SAND, with GRAVEL
R-1 MC	18	19.1	105.9	GS	8	5	(CL) Olive gray with black streaks, Silty CLAY
R-2 MC	11	29.8	89.4		3	10	NATIVE (ML) Olive gray, Clayey SILLT, micaceous, wet
R-3 MC	6	39.5	81.3		-2	15	Saturated, thin 1/8" stringers of organic material
R-4 MC	4	86.4	51.4	AL CS	-7	20	(CH) Dark gray, CLAY / Organic CLAY, fossilierous
R-5 MC	9	42.1	83.5		-12	25	No change
					-17	30	
					-22	35	
					-27	40	

Bottom of B-313H @ 26 feet
Ground water was observed at 8.45 feet below ground surface on 12/23/98.
The boring cuttings and well water were placed into DOT drums.

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BORING/WELL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	1 of 1	**B-315H**

SITE	LOGGED BY	CHECKED BY	BEGUN	COMPLETED
Playa del Rey, California	SHK	MDR	10/30/98	10/30/98

DRILLER	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	TOP OF CASING ELEV.	DEPTH/*ELEV.* GROUND WATER
THF	10"	26.0 ft.	13.34	15.36	▼ 8.0 / *5.3*

DRILL METHOD	CASING TYPE/DIA.	SCREEN TYPE/SLOT	GRAVEL PACK TYPE	GROUT TYPE/QUANTITY
HOLLOW STEM	4" PVC Casing	0.010" Slotted Casing	12 bgs, 2/12 Sand	2 bgs, Bentonite Chips

SAMPLING METHOD	NOTES
140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	DESCRIPTION AND CLASSIFICATION
BULK1 GRAB				RV			FILL (SM) Dark brown, Silty SAND, with CLAY, GRAVEL, and some brick fragments
R-1 MC	21	10.2	120.7		8	5	Slight increase in GRAVEL
R-2 MC	6	48.7	68.7		3	10	NATIVE (CL) Medium gray, Silty CLAY, with some sea shells, micaceous
R-3 MC	9	42.7	80.6	WA	-2	15	(ML) Olive gray, Clayey SILT, micaceous, very wet
R-4 MC	10	65.1	59.8	AL CS	-7	20	(MH) Dark gray, Clayey SILT, organic content, saturated
R-5 MC	13	50.5	84.6		-12	25	No change *Bottom of B-315H @ 26 feet* *Ground water was observed at 8.0 feet below ground surface on 12/23/98.* *The boring cuttings and well water were placed into DOT drums.*
					-17	30	
					-22	35	
					-27	40	

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FIGURE **C-14**

LOG OF TEST BORING

PROJECT	Playa Vista - Site DE & Ballona Creek
PROJECT NUMBER	L-196
HOLE NUMBER	B-316R
SITE	Playa del Rey, California
BEGUN	11/03/98
COMPLETED	11/03/98
SHEET NO.	1 of 2
DRILLER	THF
DRILL METHOD	ROTARY WASH
LOGGED BY	SHK
CHECKED BY	MDR
DRILL EQUIPMENT	MOBILE 61 ROTARY
BORING DIA.	4.5"
TOTAL DEPTH	57.5 ft.
GROUND ELEV.	14.08
DEPTH/*ELEV.* GROUND WATER	▼ N/T / *na*
SAMPLING METHOD	140-lb 30-inch Free Falling Hammer
NOTES	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
									FILL (SC) Olive gray, Clayey SAND, with GRAVEL
R-1 MC	29				9	5			Some SILT and brick fragments
S-2 SPT	37	34.5		WA AL	4	10			NATIVE (CL) Dark gray to olive gray, hard, Silty CLAY
R-3 MC	19				-1	15			No Sample Recovered
S-4 SPT	11	60.1			-6	20			Color change: Gray, stiff, some medium grain SAND lenses to 1/4"
R-5 MC	21				-11	25			No change
R-6 MC	22	18.6	109.4	WA					(ML) Dark gray, fine to medium Sandy SILT, slightly porous
S-7 SPT	9	30.4			-16	30			(CL) Dark gray, soft, Silty CLAY
S-8 SPT	15	31.8			-21	35			(CL/OL) Dark gray, stiff, Silty / Organic CLAY
S-9 SPT	12	33.9			-26	40			Stiff

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LOG OF TEST BORING

PROJECT	PROJECT NUMBER	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	B-316R

SITE	BEGUN	COMPLETED	SHEET NO.
Playa del Rey, California	11/03/98	11/03/98	2 of 2

DRILLER	DRILL METHOD	LOGGED BY	CHECKED BY
THF	ROTARY WASH	SHK	MDR

DRILL EQUIPMENT	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	DEPTH/*ELEV.* GROUND WATER
MOBILE 61 ROTARY	4.5"	57.5 ft.	14.08	▼ N/T / *na*

SAMPLING METHOD	NOTES
140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
S-10 SPT	33	27.9			-31	45		X	(CL) Dark gray, very stiff, CLAY, with 1" thick SAND lenses
S-11 SPT	62	35.0			-36	50		X	(SM) Dark gray, dense, fine Silty SAND
S-12 SPT	71	26.4			-41	55		X	Gradation change: Very dense, coarse to fine Silty SAND, with GRAVEL
									Bottom of B-316R @ 57.5 feet *Ground water measurement was not taken.* *The boring was backfilled with grout and capped with concrete.* *The boring cuttings were placed into DOT drums.*
					-46	60			
					-51	65			
					-56	70			
					-61	75			
					-66	80			

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LOG OF TEST BORING

PROJECT	PROJECT NUMBER	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	B-317R

SITE	BEGUN	COMPLETED	SHEET NO.
Playa del Rey, California	11/05/98	11/05/98	1 of 2

DRILLER	DRILL METHOD	LOGGED BY	CHECKED BY
THF	ROTARY WASH	SHK	MDR

DRILL EQUIPMENT	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	DEPTH/*ELEV.* GROUND WATER
MOBILE 61 ROTARY	4.5"	61.0 ft.	9.53	⊻ N/T / *na*

SAMPLING METHOD	NOTES
140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
									FILL (SC) Brown to olive gray, Clayey SAND, with GRAVEL
S-1 SPT	49				5	5			Dense, some glass and plastic present
R-2 MC	6	49.9	73.3		0	10			NATIVE (CL) Dark gray to light gray, Silty CLAY, carbonaceous
S-3 SPT	4	35.8	87.4	WA	-5	15			(ML) Olive gray, very soft, Clayey SILT, with medium to fine SAND, sea shells, micaceous
R-4 MC	12	93.7	47.2		-10	20			(CL) Gray, fine Sandy CLAY, fossiliferous
S-5 SPT	19	26.9			-15	25			Stiff, with SILT, carbonates present
R-6 MC	22	42.0	81.1		-20	30			Friable / cottage cheese texture when broken
S-7 SPT	21	25.5			-25	35			(ML) Dark gray, very stiff, Clayey SILT
R-8 MC	90	22.7	102.3		-30	40			(SM) Dark gray, coarse to fine, Silty SAND

LOG OF TEST BORING

PROJECT: Playa Vista - Site DE & Ballona Creek		PROJECT NUMBER: L-196	HOLE NUMBER: **B-317R**
SITE: Playa del Rey, California	BEGUN: 11/05/98	COMPLETED: 11/05/98	SHEET NO.: 2 of 2
DRILLER: THF	DRILL METHOD: ROTARY WASH	LOGGED BY: SHK	CHECKED BY: MDR
DRILL EQUIPMENT: MOBILE 61 ROTARY	BORING DIA.: 4.5"	TOTAL DEPTH: 61.0 ft.	GROUND ELEV.: 9.53
DEPTH/*ELEV.* GROUND WATER: ▼ N/T / *na*			
SAMPLING METHOD: 140-lb 30-inch Free Falling Hammer	NOTES: LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP		

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
S-9 SPT	49	36.0			-35	45			(CL) Dark gray, hard, Silty CLAY, 1/2" thick organic deposit
S-10 SPT	37	31.4			-40	50			Hard, no organics
S-11 SPT	89	23.6			-45	55			(SM) Dark gray, very dense, medium to fine, Silty SAND
S-12 SPT	70@1"	10.1			-50	60			(SP) Gray, very dense, coarse to medium, SAND, with GRAVEL up to 1"
					-55	65			
					-60	70			
					-65	75			
					-70	80			

Bottom of B-317R @ 61 feet
Ground water measurement was not taken.
The boring was backfilled with grout.
The boring cuttings were placed into DOT drums.

GDC LOG BORING L196PV.GPJ GDC WLOG.GDT 1/4/99

GROUP DELTA CONSULTANTS, INC.

FIGURE **C-18**

LOG OF TEST BORING

PROJECT	Playa Vista - Site DE & Ballona Creek
PROJECT NUMBER	L-196
HOLE NUMBER	B-319R
SITE	Playa del Rey, California
BEGUN	11/05/98
COMPLETED	11/05/98
SHEET NO.	1 of 2
DRILLER	THF
DRILL METHOD	ROTARY WASH
LOGGED BY	SHK
CHECKED BY	MDR
DRILL EQUIPMENT	MOBILE 61 ROTARY
BORING DIA.	4.5"
TOTAL DEPTH	61.0 ft.
GROUND ELEV.	11.67
DEPTH/*ELEV.* GROUND WATER	▼ N/T / *na*
SAMPLING METHOD	140-lb 30-inch Free Falling Hammer
NOTES	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
									FILL (CL) Olive gray Sandy CLAY
S-1 SPT	26	18.1			7	5			Very stiff, medium to fine Sandy CLAY, with some GRAVEL, soome brick fragments
R-2 MC	20				2	10			NATIVE (CL) Dark gray, Silty CLAY
R-3 MC	21	43.3	79.5						
S-4 SPT	19	39.6			-3	15			(ML) Light gray, fine Sandy SILT, micaaceous
R-5 MC	8	66.8	60.0	AL CS	-8	20			(MH) Dark gray, Clayey SILT, fossiliferous
S-6 SPT	9	31.2			-13	25			Soft, with fine grain SAND, some sea shells
R-7 MC	24	33.0	91.4	DS	-18	30			(CL) Greenish gray, mottled dark yellow-orange, Silty CLAY, trace of fine SAND
S-8 SPT	N/R	28.8			-23	35			Color change: Dark gray, fine SAND grading to SILT and Silty CLAY
S-9 SPT	36	24.7			-28	40			(SM) Dary gray, dense, fine Silty SAND

GDC_LOG_BORING_L196PV.GPJ_GDC_WLOG.GDT_1/4/99

LOG OF TEST BORING

PROJECT	PROJECT NUMBER	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	B-319R

SITE	BEGUN	COMPLETED	SHEET NO.
Playa del Rey, California	11/05/98	11/05/98	2 of 2

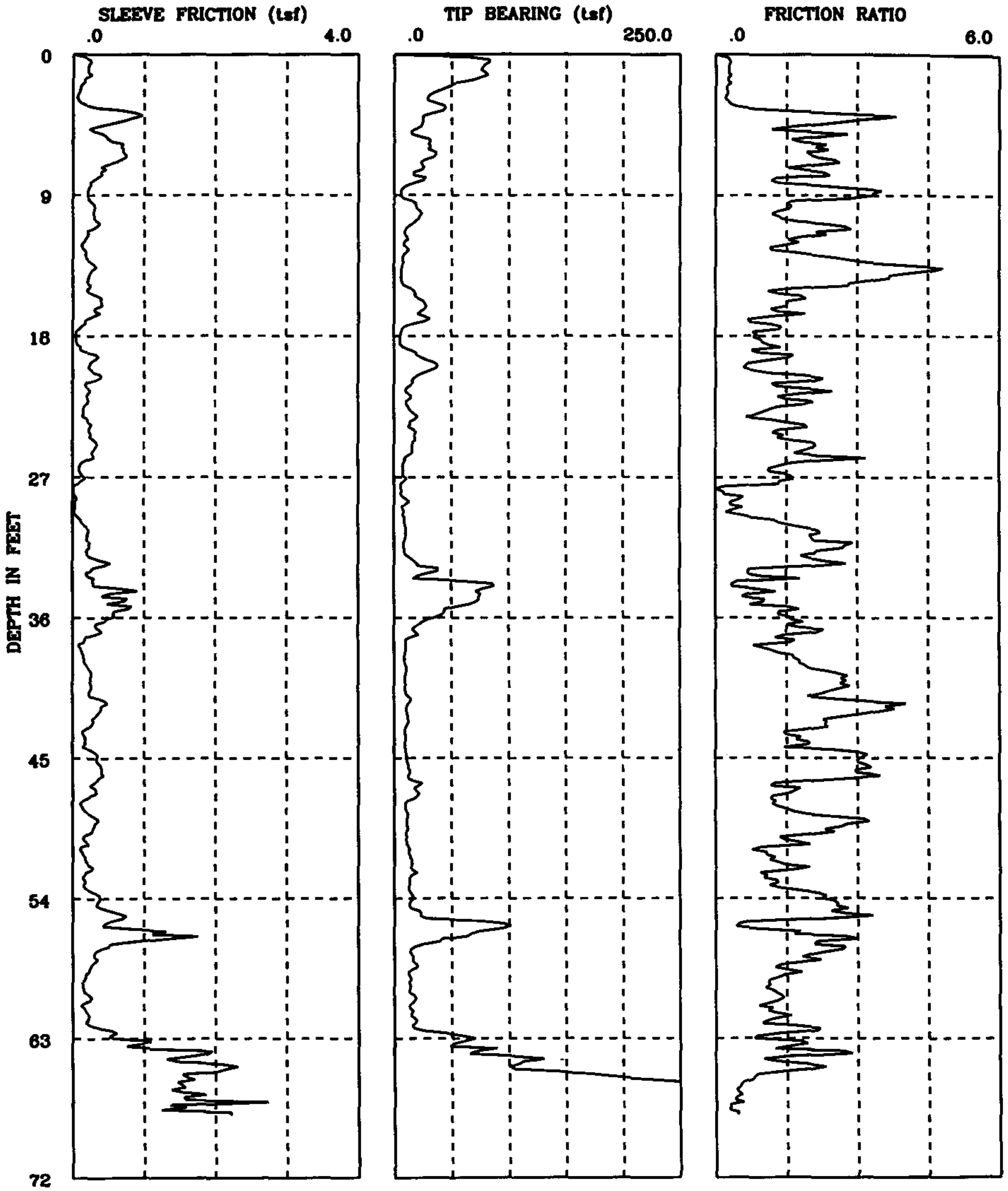
DRILLER	DRILL METHOD	LOGGED BY	CHECKED BY
THF	ROTARY WASH	SHK	MDR

DRILL EQUIPMENT	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	DEPTH/*ELEV.* GROUND WATER
MOBILE 61 ROTARY	4.5"	61.0 ft.	11.67	▼ N/T / *na*

SAMPLING METHOD	NOTES
140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
S-10 SPT	23	38.0			-33	45			(CL) Dark gray, compact, Silty CLAY
S-11 SPT	61	30.3			-38	50			Dense
S-12 SPT	98	25.4			-43	55			(ML) Dark gray, very hard, fine Sandy SILT
S-13 SPT	100@9"	15.0			-48	60			(SP) Gray, very dense, coarse to medium, SAND, with GRAVEL up to 1"
									Bottom of B-319R @ 61 feet *Ground water measurement was not taken.* *The boring was backfilled with grout.* *The boring cuttings were placed into DOT drums.*
					-53	65			
					-58	70			
					-63	75			
					-68	80			

GDC_LOG_BORING L196PV.GPJ GDC_WLOG.GDT 1/4/99



CPT 301C	Playa Vista Site
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

GROUP DELTA CONSULTANTS

CPT Date :12-07-98
Cone Used :**CPT B-301C**
Depth to water table (ft) : 14

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.20	1	53.89	0.15	0.28	0.02	sand to silty sand	>90	>48	13	UNDEFINED
0.50	2	74.67	0.21	0.29	0.07	sand to silty sand	>90	>48	18	UNDEFINED
0.80	3	40.45	0.10	0.24	0.12	sand to silty sand	70-80	46-48	10	UNDEFINED
1.10	4	38.62	0.32	0.84	0.18	silty sand to sandy silt	60-70	44-46	12	UNDEFINED
1.40	5	24.75	0.68	2.76	0.24	clayey silt to silty clay	UNDFND	UNDFD	12	1.6
1.70	6	22.30	0.43	1.94	0.29	sandy silt to clayey silt	UNDFND	UNDFD	9	1.4
2.00	7	34.35	0.71	2.07	0.35	sandy silt to clayey silt	UNDFND	UNDFD	13	2.2
2.30	8	22.07	0.47	2.11	0.41	sandy silt to clayey silt	UNDFND	UNDFD	8	1.4
2.70	9	14.80	0.25	1.71	0.47	clayey silt to silty clay	UNDFND	UNDFD	7	.9
3.00	10	15.40	0.27	1.73	0.54	clayey silt to silty clay	UNDFND	UNDFD	7	.9
3.30	11	20.56	0.32	1.57	0.59	sandy silt to clayey silt	UNDFND	UNDFD	8	1.3
3.60	12	10.45	0.23	2.20	0.65	clayey silt to silty clay	UNDFND	UNDFD	5	.6
3.90	13	9.67	0.15	1.52	0.71	clayey silt to silty clay	UNDFND	UNDFD	5	.5
4.20	14	6.86	0.26	3.79	0.76	clay	UNDFND	UNDFD	7	.4
4.50	15	7.20	0.23	3.19	0.81	clay	UNDFND	UNDFD	7	.4
4.80	16	20.35	0.30	1.49	0.84	sandy silt to clayey silt	UNDFND	UNDFD	8	1.2
5.10	17	25.68	0.33	1.30	0.86	sandy silt to clayey silt	UNDFND	UNDFD	10	1.6
5.40	18	13.94	0.12	0.86	0.89	sandy silt to clayey silt	UNDFND	UNDFD	5	.8
5.70	19	6.05	0.07	1.10	0.92	sensitive fine grained	UNDFND	UNDFD	3	.3
6.00	20	25.92	0.26	1.00	0.94	sandy silt to clayey silt	UNDFND	UNDFD	10	1.6
6.30	21	26.72	0.30	1.12	0.97	sandy silt to clayey silt	UNDFND	UNDFD	10	1.7
6.60	22	13.17	0.21	1.57	0.99	clayey silt to silty clay	UNDFND	UNDFD	6	.7
6.90	23	12.68	0.19	1.47	1.02	clayey silt to silty clay	UNDFND	UNDFD	6	.7
7.20	24	16.72	0.21	1.24	1.04	sandy silt to clayey silt	UNDFND	UNDFD	6	1.0
7.50	25	17.53	0.25	1.45	1.07	sandy silt to clayey silt	UNDFND	UNDFD	7	1.0
7.80	26	15.10	0.31	2.03	1.10	clayey silt to silty clay	UNDFND	UNDFD	7	.9
8.10	27	8.37	0.13	1.55	1.12	clayey silt to silty clay	UNDFND	UNDFD	4	.4
8.40	28	7.56	0.09	1.15	1.15	undefined	UNDFND	UNDFD	UDF	UNDEFINED
8.70	29	8.73	0.03	0.34	1.17	sensitive fine grained	UNDFND	UNDFD	4	.4
9.10	30	8.59	0.06	0.73	1.20	clayey silt to silty clay	UNDFND	UNDFD	4	.4
9.40	31	10.01	0.20	2.03	1.23	clayey silt to silty clay	UNDFND	UNDFD	5	.5
9.70	32	8.66	0.22	2.54	1.26	silty clay to clay	UNDFND	UNDFD	6	.4
10.00	33	24.02	0.36	1.51	1.29	sandy silt to clayey silt	UNDFND	UNDFD	9	1.4
10.30	34	43.40	0.26	0.60	1.31	silty sand to sandy silt	<40	34-36	14	UNDEFINED
10.60	35	75.37	0.65	0.86	1.34	sand to silty sand	50-60	38-40	18	UNDEFINED
10.90	36	50.75	0.60	1.19	1.36	silty sand to sandy silt	40-50	36-38	16	UNDEFINED
11.20	37	22.39	0.39	1.73	1.39	sandy silt to clayey silt	UNDFND	UNDFD	9	1.3
11.50	38	13.87	0.19	1.37	1.42	sandy silt to clayey silt	UNDFND	UNDFD	5	.7

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

GROUP DELTA CONSULTANTS

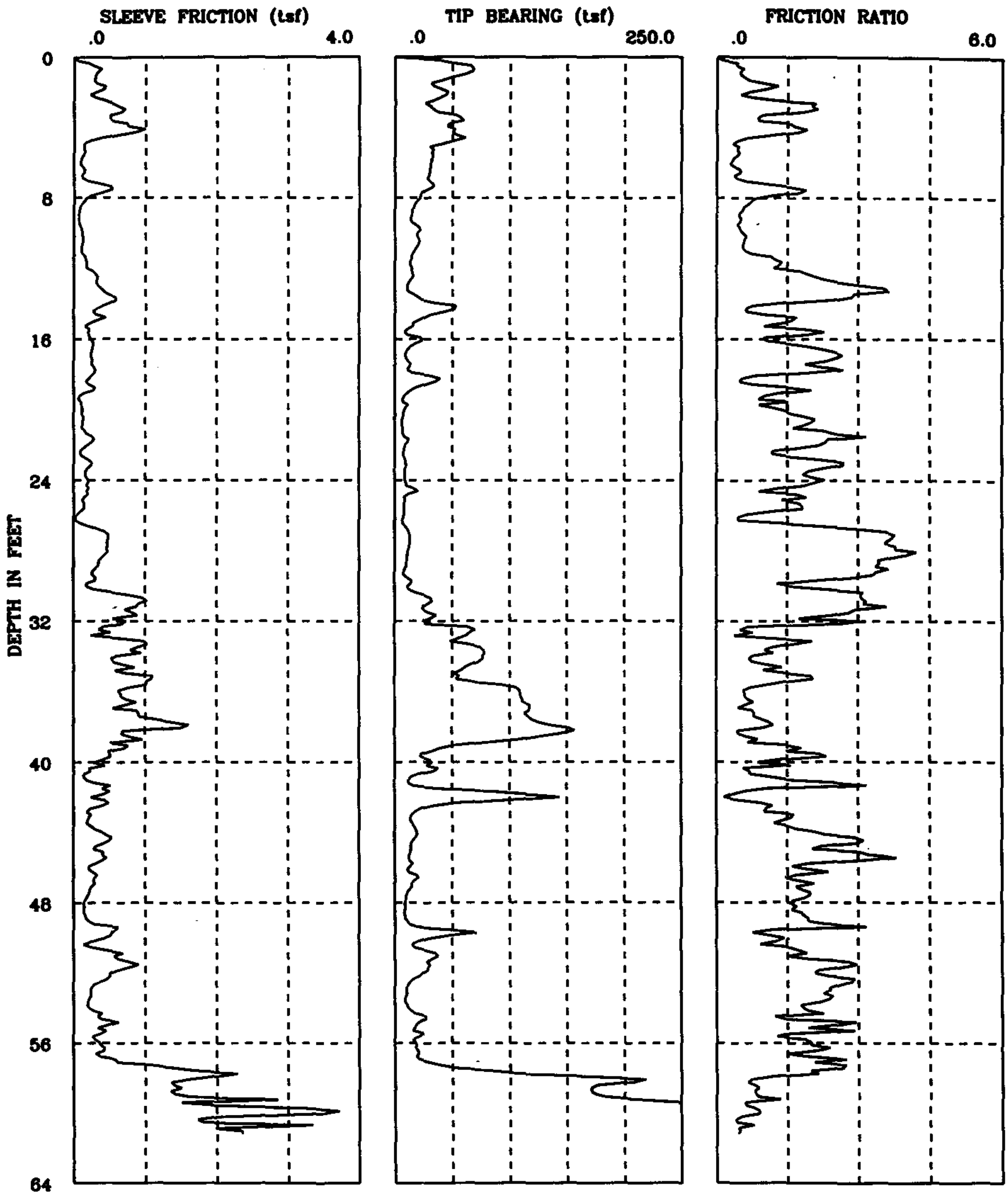
CPT Date :12-07-98
Cone Used :CPT B-301C
Depth to water table (ft) : 14

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.80	39	9.43	0.14	1.52	1.44	clayey silt to silty clay	UNDFND	UNDFD	5	.4
12.10	40	9.94	0.23	2.31	1.47	silty clay to clay	UNDFND	UNDFD	6	.5
12.40	41	9.56	0.25	2.65	1.49	silty clay to clay	UNDFND	UNDFD	6	.4
12.70	42	12.60	0.36	2.88	1.52	silty clay to clay	UNDFND	UNDFD	8	.6
13.00	43	11.74	0.33	2.81	1.54	silty clay to clay	UNDFND	UNDFD	7	.6
13.30	44	9.56	0.18	1.88	1.57	clayey silt to silty clay	UNDFND	UNDFD	5	.4
13.60	45	9.75	0.21	2.15	1.60	clayey silt to silty clay	UNDFND	UNDFD	5	.4
13.90	46	11.58	0.36	3.14	1.62	silty clay to clay	UNDFND	UNDFD	7	.5
14.20	47	16.57	0.36	2.15	1.65	clayey silt to silty clay	UNDFND	UNDFD	8	.9
14.50	48	18.67	0.28	1.50	1.67	sandy silt to clayey silt	UNDFND	UNDFD	7	1.0
14.80	49	10.51	0.16	1.55	1.70	clayey silt to silty clay	UNDFND	UNDFD	5	.5
15.10	50	11.47	0.31	2.73	1.73	silty clay to clay	UNDFND	UNDFD	7	.5
15.50	51	11.20	0.17	1.50	1.76	clayey silt to silty clay	UNDFND	UNDFD	5	.5
15.80	52	14.40	0.18	1.23	1.79	sandy silt to clayey silt	UNDFND	UNDFD	6	.7
16.10	53	15.02	0.20	1.33	1.81	sandy silt to clayey silt	UNDFND	UNDFD	6	.8
16.40	54	14.06	0.25	1.78	1.84	clayey silt to silty clay	UNDFND	UNDFD	7	.7
16.70	55	16.36	0.41	2.49	1.86	clayey silt to silty clay	UNDFND	UNDFD	8	.8
17.00	56	66.15	0.57	0.86	1.89	sand to silty sand	40-50	34-36	16	UNDEFINED
17.30	57	59.16	1.30	2.20	1.92	sandy silt to clayey silt	UNDFND	UNDFD	23	3.7
17.60	58	16.14	0.37	2.31	1.94	clayey silt to silty clay	UNDFND	UNDFD	8	.8
17.90	59	16.25	0.26	1.60	1.97	sandy silt to clayey silt	UNDFND	UNDFD	6	.8
18.20	60	13.61	0.16	1.15	1.99	sandy silt to clayey silt	UNDFND	UNDFD	5	.6
18.50	61	16.00	0.21	1.29	2.02	sandy silt to clayey silt	UNDFND	UNDFD	6	.8
18.80	62	15.31	0.19	1.26	2.04	sandy silt to clayey silt	UNDFND	UNDFD	6	.7
19.10	63	27.02	0.39	1.44	2.07	sandy silt to clayey silt	UNDFND	UNDFD	10	1.5
19.40	64	70.35	0.89	1.27	2.10	silty sand to sandy silt	40-50	34-36	22	UNDEFINED
19.70	65	101.69	1.77	1.74	2.12	silty sand to sandy silt	50-60	36-38	32	UNDEFINED
20.00	66	166.43	1.79	1.08	2.15	sand to silty sand	70-80	38-40	40	UNDEFINED
20.30	67	315.87	1.59	0.50	2.17	gravelly sand to sand	80-90	42-44	>50	UNDEFINED
20.60	68	448.42	1.40	0.31	2.20	gravelly sand to sand	>90	44-46	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



CPT 303C	Playa Vista Site
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

GROUP DELTA CONSULTANTS

CPT Date :12-07-98
Cone Used :**CPT B-303C**
Depth to water table (ft) : 14

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.20	1	39.17	0.20	0.50	0.02	silty sand to sandy silt	>90	>48	13	UNDEFINED
0.50	2	45.01	0.34	0.75	0.07	silty sand to sandy silt	80-90	>48	14	UNDEFINED
0.80	3	36.92	0.39	1.05	0.12	silty sand to sandy silt	60-70	44-46	12	UNDEFINED
1.10	4	48.52	0.58	1.20	0.18	silty sand to sandy silt	70-80	44-46	15	UNDEFINED
1.40	5	52.30	0.67	1.28	0.24	silty sand to sandy silt	60-70	44-46	17	UNDEFINED
1.70	6	35.67	0.14	0.39	0.29	silty sand to sandy silt	50-60	40-42	11	UNDEFINED
2.00	7	31.14	0.12	0.40	0.35	silty sand to sandy silt	40-50	40-42	10	UNDEFINED
2.30	8	29.74	0.33	1.12	0.41	silty sand to sandy silt	40-50	38-40	9	UNDEFINED
2.70	9	18.03	0.14	0.76	0.47	sandy silt to clayey silt	UNDFND	UNDFD	7	1.1
3.00	10	17.76	0.09	0.49	0.54	sandy silt to clayey silt	UNDFND	UNDFD	7	1.1
3.30	11	19.54	0.11	0.58	0.59	sandy silt to clayey silt	UNDFND	UNDFD	7	1.2
3.60	12	14.23	0.15	1.08	0.65	sandy silt to clayey silt	UNDFND	UNDFD	5	.9
3.90	13	14.12	0.30	2.12	0.71	clayey silt to silty clay	UNDFND	UNDFD	7	.8
4.20	14	16.52	0.47	2.84	0.76	clayey silt to silty clay	UNDFND	UNDFD	8	1.0
4.50	15	40.76	0.37	0.91	0.81	silty sand to sandy silt	40-50	36-38	13	UNDEFINED
4.80	16	12.62	0.21	1.69	0.84	clayey silt to silty clay	UNDFND	UNDFD	6	.7
5.10	17	15.70	0.25	1.59	0.86	sandy silt to clayey silt	UNDFND	UNDFD	6	.9
5.40	18	11.37	0.26	2.32	0.89	clayey silt to silty clay	UNDFND	UNDFD	5	.6
5.70	19	28.23	0.24	0.84	0.92	silty sand to sandy silt	<40	34-36	9	UNDEFINED
6.00	20	9.56	0.10	1.05	0.94	clayey silt to silty clay	UNDFND	UNDFD	5	.5
6.30	21	6.90	0.12	1.74	0.97	silty clay to clay	UNDFND	UNDFD	4	.3
6.60	22	8.50	0.19	2.20	0.99	silty clay to clay	UNDFND	UNDFD	5	.4
6.90	23	8.01	0.13	1.67	1.02	clayey silt to silty clay	UNDFND	UNDFD	4	.4
7.20	24	8.88	0.20	2.25	1.04	silty clay to clay	UNDFND	UNDFD	6	.5
7.50	25	12.87	0.19	1.45	1.07	clayey silt to silty clay	UNDFND	UNDFD	6	.7
7.80	26	7.88	0.14	1.82	1.10	silty clay to clay	UNDFND	UNDFD	5	.4
8.10	27	7.80	0.09	1.15	1.12	clayey silt to silty clay	UNDFND	UNDFD	4	.4
8.40	28	12.62	0.46	3.62	1.15	silty clay to clay	UNDFND	UNDFD	8	.7
8.70	29	10.96	0.41	3.74	1.17	clay	UNDFND	UNDFD	11	.6
9.10	30	10.63	0.27	2.54	1.20	silty clay to clay	UNDFND	UNDFD	7	.5
9.40	31	23.26	0.69	2.98	1.23	clayey silt to silty clay	UNDFND	UNDFD	11	1.4
9.70	32	28.00	0.74	2.64	1.26	clayey silt to silty clay	UNDFND	UNDFD	13	1.7
10.00	33	53.06	0.42	0.80	1.29	silty sand to sandy silt	40-50	36-38	17	UNDEFINED
10.30	34	67.04	0.94	1.40	1.31	silty sand to sandy silt	50-60	36-38	21	UNDEFINED
10.60	35	66.70	0.59	0.88	1.34	sand to silty sand	50-60	36-38	16	UNDEFINED
10.90	36	76.58	0.96	1.25	1.36	silty sand to sandy silt	50-60	38-40	24	UNDEFINED
11.20	37	112.48	0.70	0.62	1.39	sand to silty sand	60-70	40-42	27	UNDEFINED
11.50	38	119.14	1.05	0.88	1.42	sand to silty sand	60-70	40-42	29	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

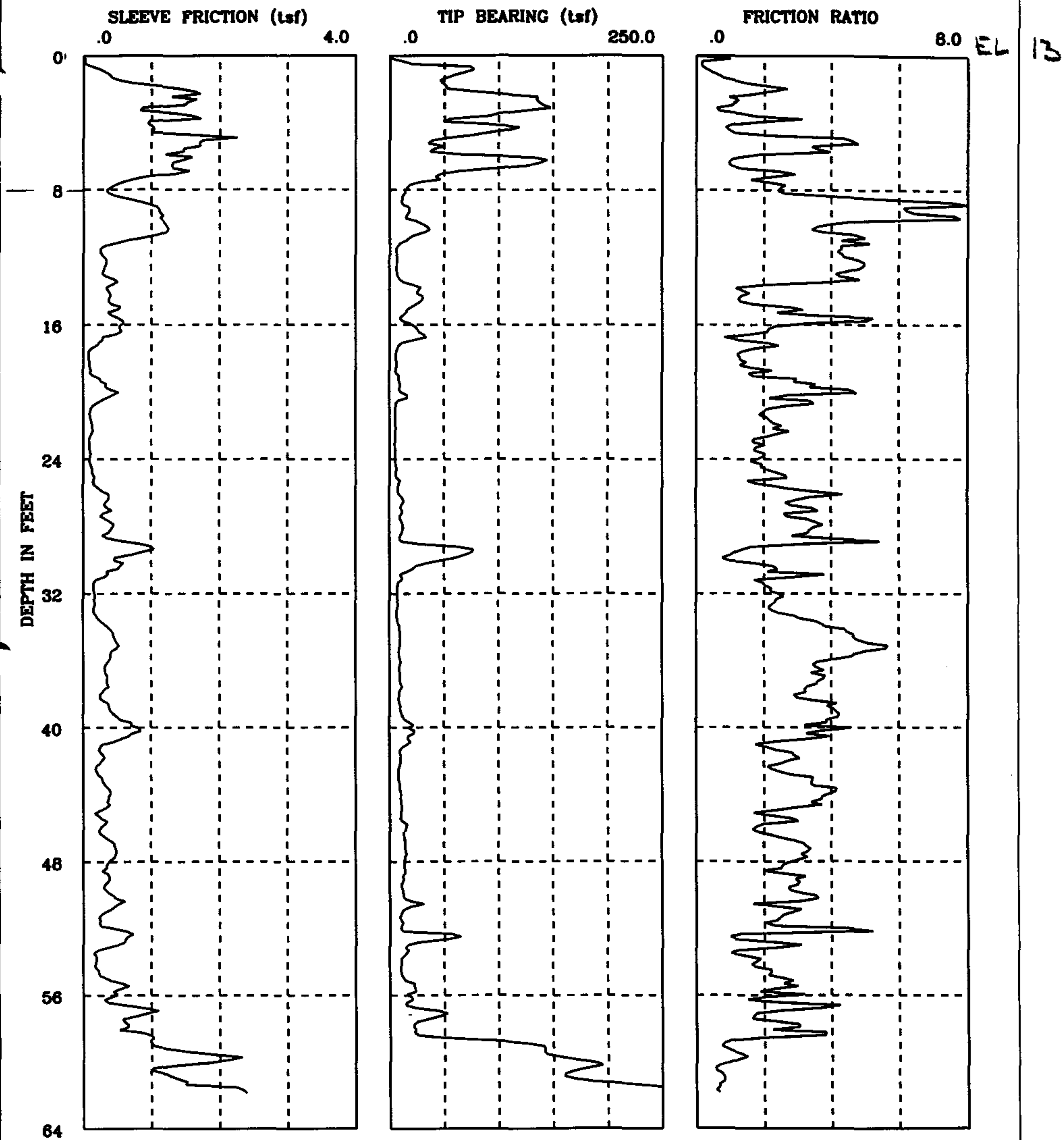
C. Date :12-07-98
Cone Used :CPT B-303C
Depth to water table (ft) : 14

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.80	39	134.72	1.04	0.77	1.44	sand	60-70	40-42	26	UNDEFINED
12.10	40	35.16	0.58	1.66	1.47	sandy silt to clayey silt	UNDFND	UNDFD	13	2.1
12.40	41	29.83	0.21	0.70	1.49	silty sand to sandy silt	<40	30-32	10	UNDEFINED
12.70	42	37.56	0.40	1.06	1.52	silty sand to sandy silt	<40	32-34	12	UNDEFINED
13.00	43	72.46	0.32	0.44	1.54	sand to silty sand	50-60	36-38	17	UNDEFINED
13.30	44	14.70	0.22	1.52	1.57	clayey silt to silty clay	UNDFND	UNDFD	7	.8
13.60	45	17.04	0.45	2.62	1.60	clayey silt to silty clay	UNDFND	UNDFD	8	.9
13.90	46	12.96	0.36	2.75	1.62	clayey silt to silty clay	UNDFND	UNDFD	6	.6
14.20	47	14.87	0.26	1.73	1.65	clayey silt to silty clay	UNDFND	UNDFD	7	.8
14.50	48	12.55	0.24	1.94	1.67	clayey silt to silty clay	UNDFND	UNDFD	6	.6
14.80	49	8.69	0.15	1.69	1.70	clayey silt to silty clay	UNDFND	UNDFD	4	.3
15.10	50	23.07	0.34	1.47	1.73	sandy silt to clayey silt	UNDFND	UNDFD	9	1.3
15.50	51	29.24	0.43	1.45	1.76	sandy silt to clayey silt	UNDFND	UNDFD	11	1.7
15.80	52	30.23	0.71	2.34	1.79	sandy silt to clayey silt	UNDFND	UNDFD	12	1.8
16.10	53	14.87	0.37	2.51	1.81	clayey silt to silty clay	UNDFND	UNDFD	7	.7
16.40	54	10.00	0.21	2.13	1.84	clayey silt to silty clay	UNDFND	UNDFD	5	.4
16.70	55	20.60	0.41	1.97	1.86	sandy silt to clayey silt	UNDFND	UNDFD	8	1.1
17.00	56	19.20	0.34	1.75	1.89	sandy silt to clayey silt	UNDFND	UNDFD	7	1.0
17.30	57	19.31	0.39	2.02	1.92	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
17.60	58	62.81	1.43	2.28	1.94	sandy silt to clayey silt	UNDFND	UNDFD	24	3.9
17.90	59	188.35	1.46	0.77	1.97	sand	70-80	40-42	36	UNDEFINED
18.20	60	278.74	2.12	0.76	1.99	sand	80-90	42-44	>50	UNDEFINED
18.50	61	414.60	2.84	0.69	2.02	gravelly sand to sand	>90	44-46	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



CPT B-308C	Playa Vista Site De
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

GROUP DELTA CONSULTANTS

CPT Date :11-03-98
Cone Used :CPT B-308
Depth to water table (ft) : 10

Job No. L196 Playa Vista Site De
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.20	1	28.78	0.05	0.19	0.02	silty sand to sandy silt	80-90	>48	9	UNDEFINED
0.50	2	56.78	0.49	0.86	0.07	silty sand to sandy silt	80-90	>48	18	UNDEFINED
0.80	3	96.95	1.59	1.64	0.12	silty sand to sandy silt	>90	>48	31	UNDEFINED
1.10	4	118.64	1.30	1.10	0.18	sand to silty sand	>90	>48	28	UNDEFINED
1.40	5	86.58	0.99	1.15	0.24	sand to silty sand	80-90	46-48	21	UNDEFINED
1.70	6	42.89	1.81	4.23	0.29	silty clay to clay	UNDFND	UNDFD	27	2.8
2.00	7	112.58	1.33	1.18	0.35	sand to silty sand	80-90	44-46	27	UNDEFINED
2.30	8	44.48	1.03	2.32	0.41	sandy silt to clayey silt	UNDFND	UNDFD	17	2.9
2.70	9	13.43	0.59	4.41	0.47	clay	UNDFND	UNDFD	13	.8
3.00	10	19.18	1.15	6.01	0.54	clay	UNDFND	UNDFD	18	1.2
3.30	11	28.17	1.12	3.96	0.58	silty clay to clay	UNDFND	UNDFD	18	1.8
3.60	12	7.20	0.34	4.67	0.61	clay	UNDFND	UNDFD	7	.4
3.90	13	6.78	0.32	4.77	0.64	clay	UNDFND	UNDFD	6	.4
4.20	14	16.48	0.39	2.39	0.66	clayey silt to silty clay	UNDFND	UNDFD	8	1.0
4.50	15	26.55	0.39	1.48	0.69	sandy silt to clayey silt	UNDFND	UNDFD	10	1.7
4.80	16	13.19	0.50	3.76	0.71	silty clay to clay	UNDFND	UNDFD	8	.8
5.10	17	27.60	0.46	1.65	0.74	sandy silt to clayey silt	UNDFND	UNDFD	11	1.7
5.40	18	7.92	0.14	1.77	0.76	clayey silt to silty clay	UNDFND	UNDFD	4	.4
5.70	19	5.70	0.09	1.58	0.79	sensitive fine grained	UNDFND	UNDFD	3	.3
6.00	20	9.12	0.24	2.67	0.82	silty clay to clay	UNDFND	UNDFD	6	.5
6.30	21	10.96	0.36	3.25	0.84	silty clay to clay	UNDFND	UNDFD	7	.6
6.60	22	5.08	0.10	2.04	0.87	silty clay to clay	UNDFND	UNDFD	3	.2
6.90	23	5.01	0.12	2.46	0.89	clay	UNDFND	UNDFD	5	.2
7.20	24	4.82	0.09	1.80	0.92	silty clay to clay	UNDFND	UNDFD	3	.2
7.50	25	5.44	0.11	1.96	0.95	silty clay to clay	UNDFND	UNDFD	3	.2
7.80	26	7.50	0.15	2.05	0.97	silty clay to clay	UNDFND	UNDFD	5	.4
8.10	27	10.56	0.33	3.13	1.00	silty clay to clay	UNDFND	UNDFD	7	.6
8.40	28	10.47	0.32	3.09	1.02	silty clay to clay	UNDFND	UNDFD	7	.5
8.70	29	11.26	0.38	3.35	1.05	silty clay to clay	UNDFND	UNDFD	7	.6
9.10	30	51.93	0.72	1.39	1.08	silty sand to sandy silt	40-50	36-38	17	UNDEFINED
9.40	31	21.41	0.49	2.27	1.11	clayey silt to silty clay	UNDFND	UNDFD	10	1.3
9.70	32	8.33	0.16	1.92	1.14	silty clay to clay	UNDFND	UNDFD	5	.4
10.00	33	7.16	0.17	2.33	1.16	silty clay to clay	UNDFND	UNDFD	5	.3
10.30	34	7.18	0.22	3.11	1.19	clay	UNDFND	UNDFD	7	.3
10.60	35	9.35	0.43	4.64	1.21	clay	UNDFND	UNDFD	9	.4
10.90	36	8.82	0.45	5.10	1.24	clay	UNDFND	UNDFD	8	.4
11.20	37	9.39	0.33	3.51	1.26	clay	UNDFND	UNDFD	9	.4
11.50	38	9.62	0.34	3.50	1.29	clay	UNDFND	UNDFD	9	.4

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

GROUP DELTA CONSULTANTS

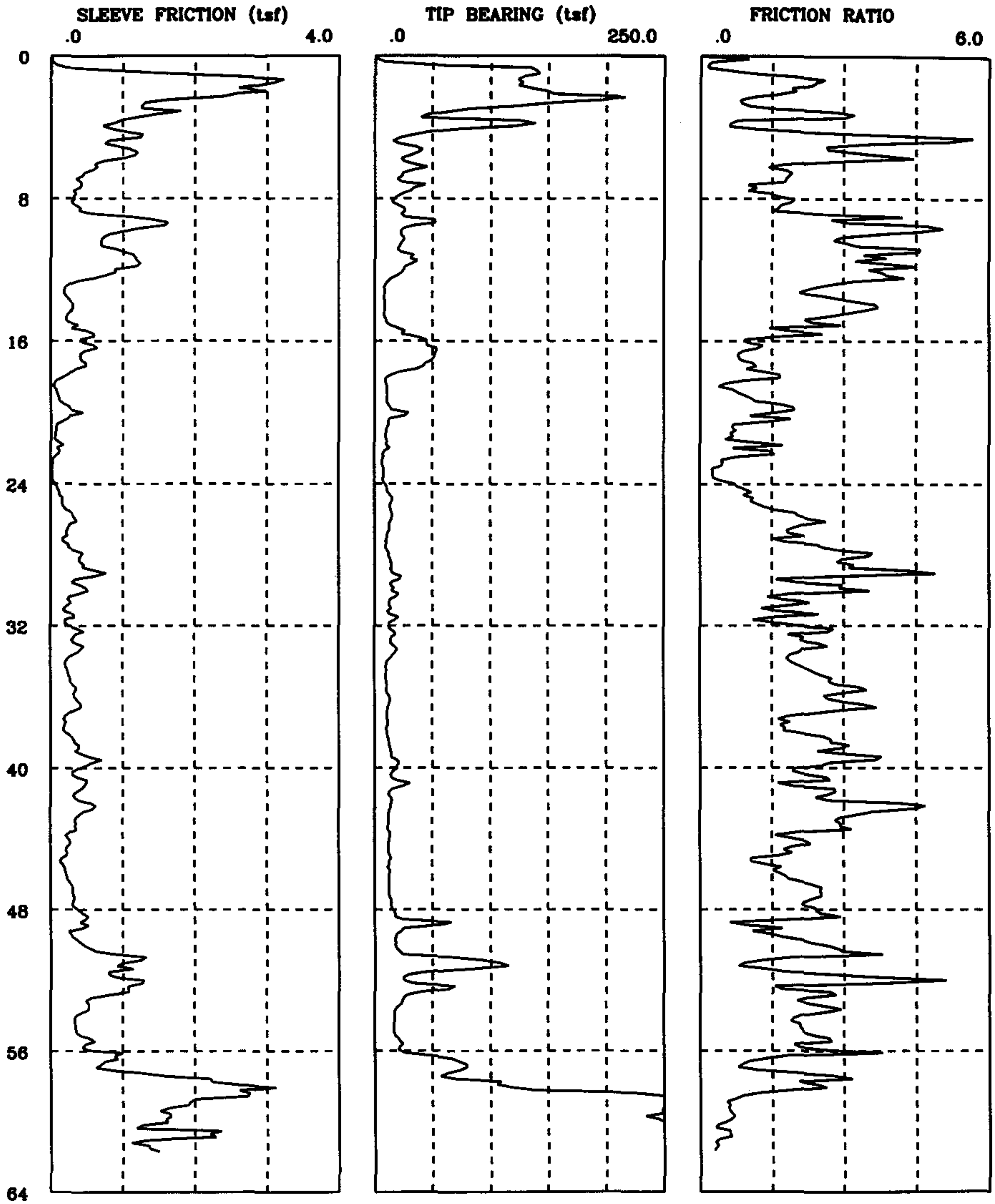
CPT Date :11-03-98
Cone Used :**CPT B-308**
Depth to water table (ft) : 10

Job No. L196 Playa Vista Site De
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.80	39	8.67	0.30	3.42	1.32	clay	UNDFND	UNDFD	8	.4
12.10	40	13.45	0.54	4.01	1.34	clay	UNDFND	UNDFD	13	.7
12.40	41	18.91	0.70	3.70	1.37	silty clay to clay	UNDFND	UNDFD	12	1.1
12.70	42	12.09	0.27	2.23	1.39	clayey silt to silty clay	UNDFND	UNDFD	6	.6
13.00	43	9.03	0.22	2.44	1.42	silty clay to clay	UNDFND	UNDFD	6	.4
13.30	44	8.54	0.31	3.67	1.45	clay	UNDFND	UNDFD	8	.4
13.60	45	10.22	0.39	3.78	1.47	clay	UNDFND	UNDFD	10	.5
13.90	46	10.85	0.28	2.55	1.50	silty clay to clay	UNDFND	UNDFD	7	.5
14.20	47	13.76	0.28	2.03	1.52	clayey silt to silty clay	UNDFND	UNDFD	7	.7
14.50	48	14.72	0.47	3.22	1.55	silty clay to clay	UNDFND	UNDFD	9	.8
14.80	49	13.76	0.34	2.49	1.58	clayey silt to silty clay	UNDFND	UNDFD	7	.7
15.10	50	11.53	0.35	3.01	1.60	silty clay to clay	UNDFND	UNDFD	7	.5
15.50	51	17.42	0.44	2.56	1.63	clayey silt to silty clay	UNDFND	UNDFD	8	.9
15.80	52	10.43	0.25	2.43	1.66	silty clay to clay	UNDFND	UNDFD	7	.4
16.10	53	34.54	0.63	1.82	1.69	sandy silt to clayey silt	UNDFND	UNDFD	13	2.1
16.40	54	13.58	0.24	1.74	1.71	clayey silt to silty clay	UNDFND	UNDFD	7	.7
16.70	55	10.73	0.21	1.99	1.74	clayey silt to silty clay	UNDFND	UNDFD	5	.5
17.00	56	20.07	0.51	2.52	1.76	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
17.30	57	19.99	0.56	2.80	1.79	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
17.60	58	36.51	0.72	1.98	1.82	sandy silt to clayey silt	UNDFND	UNDFD	14	2.2
17.90	59	48.79	0.84	1.71	1.84	silty sand to sandy silt	<40	32-34	16	UNDEFINED
18.20	60	146.80	1.64	1.12	1.87	sand to silty sand	60-70	38-40	35	UNDEFINED
18.50	61	177.58	1.37	0.77	1.89	sand	70-80	40-42	34	UNDEFINED
18.80	62	264.91	1.76	0.66	1.92	sand	80-90	42-44	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



CPT B-310C	Playa Vista Site De
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

GROUP DELTA CONSULTANTS

CPT Date :11-03-98
Cone Used :CPT B-310C
Depth to water table (ft) : 8

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.20	1	47.69	0.08	0.16	0.02	sand to silty sand	>90	>48	11	UNDEFINED
0.50	2	130.15	2.57	1.97	0.07	silty sand to sandy silt	>90	>48	42	UNDEFINED
0.80	3	173.17	2.23	1.29	0.12	sand to silty sand	>90	>48	41	UNDEFINED
1.10	4	84.37	1.24	1.47	0.18	silty sand to sandy silt	80-90	46-48	27	UNDEFINED
1.40	5	62.07	1.00	1.61	0.24	silty sand to sandy silt	70-80	44-46	20	UNDEFINED
1.70	6	31.08	1.01	3.24	0.29	clayey silt to silty clay	UNDFND	UNDFD	15	2.0
2.00	7	31.50	0.61	1.94	0.35	sandy silt to clayey silt	UNDFND	UNDFD	12	2.0
2.30	8	31.33	0.36	1.16	0.41	silty sand to sandy silt	40-50	38-40	10	UNDEFINED
2.70	9	20.41	0.39	1.94	0.47	sandy silt to clayey silt	UNDFND	UNDFD	8	1.3
3.00	10	35.79	1.34	3.73	0.50	clayey silt to silty clay	UNDFND	UNDFD	17	2.3
3.30	11	22.26	0.77	3.46	0.52	clayey silt to silty clay	UNDFND	UNDFD	11	1.4
3.60	12	32.33	1.18	3.64	0.55	clayey silt to silty clay	UNDFND	UNDFD	15	2.1
3.90	13	16.00	0.60	3.73	0.57	silty clay to clay	UNDFND	UNDFD	10	1.0
4.20	14	8.47	0.23	2.68	0.60	silty clay to clay	UNDFND	UNDFD	5	.5
4.50	15	8.73	0.26	2.94	0.62	silty clay to clay	UNDFND	UNDFD	6	.5
4.80	16	24.94	0.49	1.96	0.65	sandy silt to clayey silt	UNDFND	UNDFD	10	1.6
5.10	17	50.17	0.50	0.99	0.68	silty sand to sandy silt	50-60	38-40	16	UNDEFINED
5.40	18	37.73	0.40	1.06	0.70	silty sand to sandy silt	40-50	36-38	12	UNDEFINED
5.70	19	9.99	0.09	0.93	0.73	clayey silt to silty clay	UNDFND	UNDFD	5	.5
6.00	20	11.43	0.16	1.37	0.75	clayey silt to silty clay	UNDFND	UNDFD	5	.6
6.30	21	17.89	0.25	1.42	0.78	sandy silt to clayey silt	UNDFND	UNDFD	7	1.1
6.60	22	9.56	0.08	0.84	0.81	clayey silt to silty clay	UNDFND	UNDFD	5	.5
6.90	23	8.92	0.08	0.86	0.83	clayey silt to silty clay	UNDFND	UNDFD	4	.5
7.20	24	7.20	0.02	0.32	0.86	sensitive fine grained	UNDFND	UNDFD	3	.3
7.50	25	10.77	0.09	0.87	0.88	sandy silt to clayey silt	UNDFND	UNDFD	4	.6
7.80	26	14.38	0.21	1.46	0.91	clayey silt to silty clay	UNDFND	UNDFD	7	.8
8.10	27	13.19	0.28	2.10	0.94	clayey silt to silty clay	UNDFND	UNDFD	6	.7
8.40	28	9.86	0.21	2.16	0.96	clayey silt to silty clay	UNDFND	UNDFD	5	.5
8.70	29	13.24	0.43	3.25	0.99	silty clay to clay	UNDFND	UNDFD	8	.7
9.10	30	16.91	0.50	2.93	1.02	clayey silt to silty clay	UNDFND	UNDFD	8	1.0
9.40	31	15.36	0.28	1.85	1.05	clayey silt to silty clay	UNDFND	UNDFD	7	.9
9.70	32	14.46	0.23	1.59	1.07	clayey silt to silty clay	UNDFND	UNDFD	7	.8
10.00	33	15.19	0.33	2.19	1.10	clayey silt to silty clay	UNDFND	UNDFD	7	.8
10.30	34	16.44	0.36	2.21	1.12	clayey silt to silty clay	UNDFND	UNDFD	8	.9
10.60	35	10.00	0.23	2.27	1.15	silty clay to clay	UNDFND	UNDFD	6	.5
10.90	36	10.45	0.31	3.00	1.18	silty clay to clay	UNDFND	UNDFD	7	.5
11.20	37	12.22	0.37	3.00	1.20	silty clay to clay	UNDFND	UNDFD	8	.6
11.50	38	10.73	0.20	1.83	1.23	clayey silt to silty clay	UNDFND	UNDFD	5	.5

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

GROUP DELTA CONSULTANTS

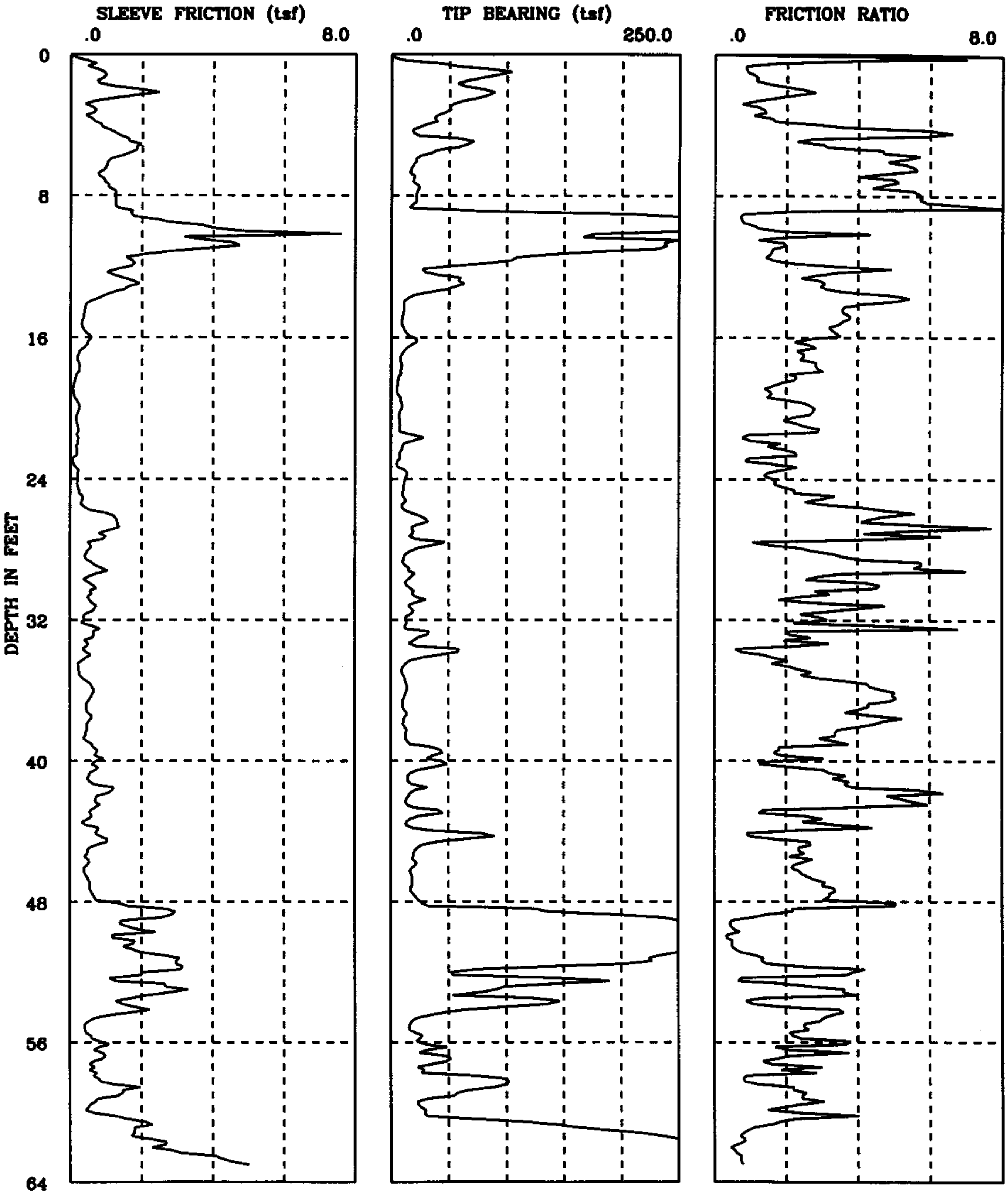
CPT Date :11-03-98
Cone Used :CPT B-310C
Depth to water table (ft) : 8

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.80	39	11.66	0.31	2.69	1.25	silty clay to clay	UNDFND	UNDFD	7	.6
12.10	40	16.42	0.48	2.94	1.28	clayey silt to silty clay	UNDFND	UNDFD	8	.9
12.40	41	17.12	0.39	2.30	1.31	clayey silt to silty clay	UNDFND	UNDFD	8	.9
12.70	42	16.74	0.38	2.27	1.33	clayey silt to silty clay	UNDFND	UNDFD	8	.9
13.00	43	13.00	0.51	3.95	1.36	clay	UNDFND	UNDFD	12	.7
13.30	44	12.23	0.32	2.59	1.38	clayey silt to silty clay	UNDFND	UNDFD	6	.6
13.60	45	12.15	0.24	1.98	1.41	clayey silt to silty clay	UNDFND	UNDFD	6	.6
13.90	46	12.28	0.18	1.47	1.43	clayey silt to silty clay	UNDFND	UNDFD	6	.6
14.20	47	12.53	0.24	1.94	1.46	clayey silt to silty clay	UNDFND	UNDFD	6	.6
14.50	48	13.10	0.31	2.39	1.49	clayey silt to silty clay	UNDFND	UNDFD	6	.6
14.80	49	18.88	0.43	2.26	1.51	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
15.10	50	31.44	0.36	1.15	1.54	silty sand to sandy silt	<40	30-32	10	UNDEFINED
15.50	51	38.92	0.79	2.02	1.57	sandy silt to clayey silt	UNDFND	UNDFD	15	2.4
15.80	52	61.75	0.88	1.43	1.60	silty sand to sandy silt	40-50	36-38	20	UNDEFINED
16.10	53	41.31	1.05	2.53	1.62	sandy silt to clayey silt	UNDFND	UNDFD	16	2.5
16.40	54	20.46	0.49	2.38	1.65	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
16.70	55	16.59	0.34	2.05	1.68	clayey silt to silty clay	UNDFND	UNDFD	8	.8
17.00	56	20.43	0.49	2.40	1.70	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
17.30	57	57.69	0.88	1.52	1.73	silty sand to sandy silt	40-50	34-36	18	UNDEFINED
17.60	58	79.74	1.57	1.97	1.75	silty sand to sandy silt	50-60	36-38	25	UNDEFINED
17.90	59	204.96	2.63	1.28	1.78	sand	70-80	40-42	39	UNDEFINED
18.20	60	263.30	1.70	0.65	1.81	sand	80-90	42-44	>50	UNDEFINED
18.50	61	346.18	1.67	0.48	1.83	gravelly sand to sand	>90	42-44	>50	UNDEFINED
18.80	62	418.30	1.42	0.34	1.86	gravelly sand to sand	>90	44-46	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



CPT B-311C	Playa Vista Site De
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

GROUP DELTA CONSULTANTS

CPT Date :11-03-98
Cone Used :**CPT B-311C**
Depth to water table (ft) : 8

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.20	1	22.80	0.31	1.37	0.02	sandy silt to clayey silt	UNDFND	UNDFD	9	1.5
0.50	2	79.48	0.89	1.12	0.07	sand to silty sand	>90	>48	19	UNDEFINED
0.80	3	74.85	1.49	1.99	0.12	silty sand to sandy silt	80-90	>48	24	UNDEFINED
1.10	4	44.56	0.61	1.37	0.18	silty sand to sandy silt	60-70	44-46	14	UNDEFINED
1.40	5	23.99	1.10	4.58	0.24	clay	UNDFND	UNDFD	23	1.5
1.70	6	54.71	1.70	3.11	0.29	sandy silt to clayey silt	UNDFND	UNDFD	21	3.6
2.00	7	18.94	1.03	5.42	0.35	clay	UNDFND	UNDFD	18	1.2
2.30	8	20.98	0.94	4.50	0.41	clay	UNDFND	UNDFD	20	1.3
2.70	9	34.15	1.37	4.00	0.47	silty clay to clay	UNDFND	UNDFD	22	2.2
3.00	10	310.10	2.85	0.92	0.50	sand	>90	>48	>50	UNDEFINED
3.30	11	241.32	5.36	2.22	0.52	silty sand to sandy silt	>90	46-48	>50	UNDEFINED
3.60	12	122.35	2.05	1.68	0.55	silty sand to sandy silt	80-90	44-46	39	UNDEFINED
3.90	13	42.05	1.41	3.35	0.57	clayey silt to silty clay	UNDFND	UNDFD	20	2.7
4.20	14	34.02	1.21	3.56	0.60	clayey silt to silty clay	UNDFND	UNDFD	16	2.2
4.50	15	10.74	0.41	3.82	0.62	clay	UNDFND	UNDFD	10	.6
4.80	16	11.06	0.37	3.38	0.65	silty clay to clay	UNDFND	UNDFD	7	.6
5.10	17	17.15	0.44	2.57	0.68	clayey silt to silty clay	UNDFND	UNDFD	8	1.0
5.40	18	8.42	0.23	2.73	0.70	silty clay to clay	UNDFND	UNDFD	5	.4
5.70	19	6.66	0.13	2.00	0.73	silty clay to clay	UNDFND	UNDFD	4	.3
6.00	20	7.38	0.14	1.90	0.75	silty clay to clay	UNDFND	UNDFD	5	.4
6.30	21	7.96	0.20	2.47	0.78	silty clay to clay	UNDFND	UNDFD	5	.4
6.60	22	14.65	0.21	1.46	0.81	sandy silt to clayey silt	UNDFND	UNDFD	6	.8
6.90	23	9.34	0.19	2.00	0.83	clayey silt to silty clay	UNDFND	UNDFD	4	.5
7.20	24	8.53	0.13	1.52	0.86	clayey silt to silty clay	UNDFND	UNDFD	4	.4
7.50	25	11.53	0.21	1.82	0.88	clayey silt to silty clay	UNDFND	UNDFD	6	.6
7.80	26	10.82	0.35	3.27	0.91	silty clay to clay	UNDFND	UNDFD	7	.6
8.10	27	23.63	1.21	5.11	0.94	clay	UNDFND	UNDFD	23	1.4
8.40	28	27.27	0.86	3.14	0.96	clayey silt to silty clay	UNDFND	UNDFD	13	1.7
8.70	29	16.17	0.49	3.03	0.99	clayey silt to silty clay	UNDFND	UNDFD	8	.9
9.10	30	14.27	0.69	4.85	1.02	clay	UNDFND	UNDFD	14	.8
9.40	31	21.76	0.63	2.88	1.05	clayey silt to silty clay	UNDFND	UNDFD	10	1.3
9.70	32	15.84	0.57	3.62	1.07	silty clay to clay	UNDFND	UNDFD	10	.9
10.00	33	19.28	0.60	3.11	1.10	clayey silt to silty clay	UNDFND	UNDFD	9	1.1
10.30	34	33.39	0.43	1.30	1.12	silty sand to sandy silt	<40	34-36	11	UNDEFINED
10.60	35	16.48	0.29	1.76	1.15	clayey silt to silty clay	UNDFND	UNDFD	8	.9
10.90	36	12.46	0.44	3.53	1.18	silty clay to clay	UNDFND	UNDFD	8	.6
11.20	37	11.70	0.56	4.82	1.20	clay	UNDFND	UNDFD	11	.6
11.50	38	11.95	0.52	4.38	1.23	clay	UNDFND	UNDFD	11	.6

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

GROUP DELTA CONSULTANTS

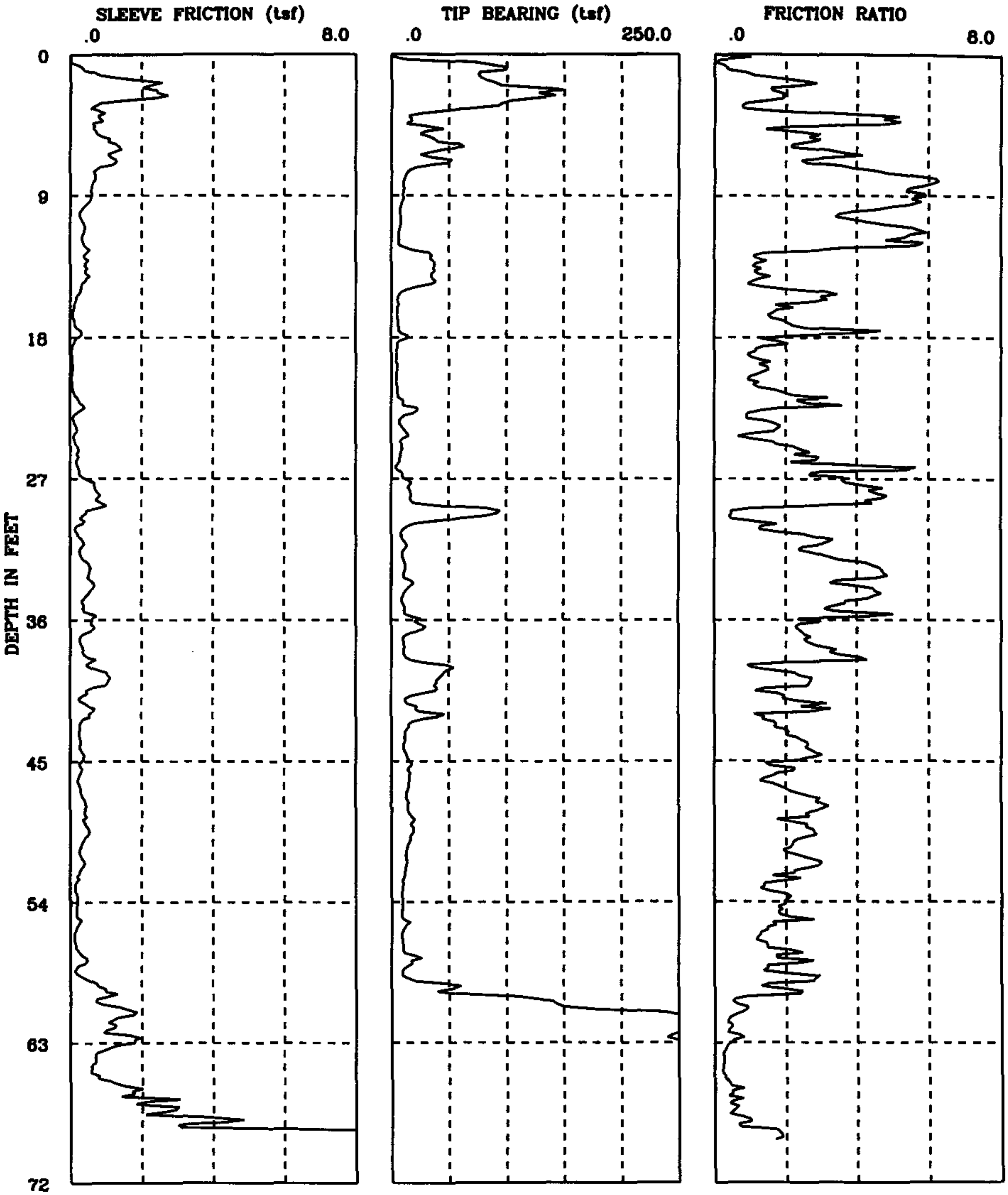
CPT Date :11-03-98
Cone Used :**CPT B-311C**
Depth to water table (ft) : 8

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.80	39	12.42	0.42	3.41	1.25	silty clay to clay	UNDFND	UNDFD	8	.6
12.10	40	32.00	0.69	2.16	1.28	sandy silt to clayey silt	UNDFND	UNDFD	12	1.9
12.40	41	32.89	0.69	2.09	1.31	sandy silt to clayey silt	UNDFND	UNDFD	13	2.0
12.70	42	18.20	0.79	4.32	1.33	clay	UNDFND	UNDFD	17	1.0
13.00	43	15.73	0.72	4.60	1.36	clay	UNDFND	UNDFD	15	.8
13.30	44	24.84	0.50	2.00	1.38	sandy silt to clayey silt	UNDFND	UNDFD	10	1.4
13.60	45	54.03	0.89	1.64	1.41	silty sand to sandy silt	40-50	36-38	17	UNDEFINED
13.90	46	20.55	0.52	2.51	1.43	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
14.20	47	18.88	0.45	2.38	1.46	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
14.50	48	18.34	0.59	3.20	1.49	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
14.80	49	63.91	1.76	2.75	1.51	sandy silt to clayey silt	UNDFND	UNDFD	24	4.0
15.10	50	296.81	1.93	0.65	1.54	sand	>90	42-44	>50	UNDEFINED
15.50	51	314.91	1.61	0.51	1.57	gravelly sand to sand	>90	44-46	>50	UNDEFINED
15.80	52	167.80	3.04	1.81	1.60	sand to silty sand	70-80	40-42	40	UNDEFINED
16.10	53	114.21	1.99	1.74	1.62	silty sand to sandy silt	60-70	38-40	36	UNDEFINED
16.40	54	112.47	1.98	1.76	1.65	silty sand to sandy silt	60-70	38-40	36	UNDEFINED
16.70	55	38.14	1.27	3.33	1.68	clayey silt to silty clay	UNDFND	UNDFD	18	2.3
17.00	56	20.89	0.49	2.33	1.70	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
17.30	57	36.40	0.92	2.54	1.73	sandy silt to clayey silt	UNDFND	UNDFD	14	2.2
17.60	58	32.75	0.70	2.15	1.75	sandy silt to clayey silt	UNDFND	UNDFD	13	1.9
17.90	59	89.12	1.17	1.32	1.78	sand to silty sand	50-60	36-38	21	UNDEFINED
18.20	60	34.70	0.86	2.47	1.81	sandy silt to clayey silt	UNDFND	UNDFD	13	2.0
18.50	61	80.33	1.53	1.91	1.83	silty sand to sandy silt	50-60	36-38	26	UNDEFINED
18.80	62	248.12	2.07	0.83	1.86	sand	80-90	42-44	48	UNDEFINED
19.10	63	531.60	3.23	0.61	1.88	gravelly sand to sand	>90	44-46	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



CPT B-312C	Playa Vista Site De
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

GROUP DELTA CONSULTANTS

CPT Date :11-03-98
Cone Used :CPT B-312C
Depth to water table (ft) : 8

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.20	1	33.18	0.08	0.25	0.02	silty sand to sandy silt	>90	>48	11	UNDEFINED
0.50	2	85.69	1.04	1.21	0.07	sand to silty sand	>90	>48	21	UNDEFINED
0.80	3	128.64	2.46	1.91	0.12	silty sand to sandy silt	>90	>48	41	UNDEFINED
1.10	4	81.53	1.00	1.22	0.18	sand to silty sand	80-90	46-48	20	UNDEFINED
1.40	5	21.07	0.78	3.72	0.24	silty clay to clay	UNDFND	UNDFD	13	1.3
1.70	6	34.36	0.88	2.55	0.29	sandy silt to clayey silt	UNDFND	UNDFD	13	2.2
2.00	7	44.44	1.25	2.81	0.35	sandy silt to clayey silt	UNDFND	UNDFD	17	2.9
2.30	8	28.31	0.92	3.26	0.41	clayey silt to silty clay	UNDFND	UNDFD	14	1.8
2.70	9	10.60	0.62	5.90	0.47	clay	UNDFND	UNDFD	10	.6
3.00	10	8.85	0.47	5.27	0.50	clay	UNDFND	UNDFD	8	.5
3.30	11	7.81	0.32	4.05	0.52	clay	UNDFND	UNDFD	7	.4
3.60	12	6.84	0.36	5.31	0.55	clay	UNDFND	UNDFD	7	.4
3.90	13	20.37	0.44	2.14	0.57	clayey silt to silty clay	UNDFND	UNDFD	10	1.3
4.20	14	36.81	0.44	1.20	0.60	silty sand to sandy silt	40-50	38-40	12	UNDEFINED
4.50	15	32.13	0.41	1.29	0.62	silty sand to sandy silt	40-50	36-38	10	UNDEFINED
4.80	16	6.71	0.20	2.93	0.65	clay	UNDFND	UNDFD	6	.3
5.10	17	4.97	0.09	1.81	0.68	silty clay to clay	UNDFND	UNDFD	3	.2
5.40	18	7.13	0.21	2.94	0.70	clay	UNDFND	UNDFD	7	.4
5.70	19	8.15	0.12	1.43	0.73	clayey silt to silty clay	UNDFND	UNDFD	4	.4
6.00	20	4.44	0.05	1.13	0.75	sensitive fine grained	UNDFND	UNDFD	2	.2
6.30	21	4.39	0.05	1.21	0.78	sensitive fine grained	UNDFND	UNDFD	2	.2
6.60	22	4.95	0.08	1.68	0.81	sensitive fine grained	UNDFND	UNDFD	2	.2
6.90	23	14.23	0.29	2.06	0.83	clayey silt to silty clay	UNDFND	UNDFD	7	.8
7.20	24	8.90	0.12	1.35	0.86	clayey silt to silty clay	UNDFND	UNDFD	4	.5
7.50	25	11.72	0.14	1.22	0.88	clayey silt to silty clay	UNDFND	UNDFD	6	.6
7.80	26	8.24	0.21	2.59	0.91	silty clay to clay	UNDFND	UNDFD	5	.4
8.10	27	6.52	0.20	3.07	0.94	clay	UNDFND	UNDFD	6	.3
8.40	28	13.89	0.56	4.03	0.96	clay	UNDFND	UNDFD	13	.8
8.70	29	17.52	0.80	4.55	0.99	clay	UNDFND	UNDFD	17	1.0
9.10	30	63.86	0.48	0.75	1.02	sand to silty sand	50-60	38-40	15	UNDEFINED
9.40	31	9.60	0.22	2.29	1.05	silty clay to clay	UNDFND	UNDFD	6	.5
9.70	32	11.04	0.31	2.78	1.07	silty clay to clay	UNDFND	UNDFD	7	.6
10.00	33	11.40	0.48	4.24	1.10	clay	UNDFND	UNDFD	11	.6
10.30	34	14.67	0.58	3.98	1.12	clay	UNDFND	UNDFD	14	.8
10.60	35	10.49	0.45	4.26	1.15	clay	UNDFND	UNDFD	10	.5
10.90	36	13.36	0.50	3.74	1.18	silty clay to clay	UNDFND	UNDFD	9	.7
11.20	37	23.55	0.59	2.52	1.20	clayey silt to silty clay	UNDFND	UNDFD	11	1.4
11.50	38	10.68	0.30	2.78	1.23	silty clay to clay	UNDFND	UNDFD	7	.5

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

GROUP DELTA CONSULTANTS

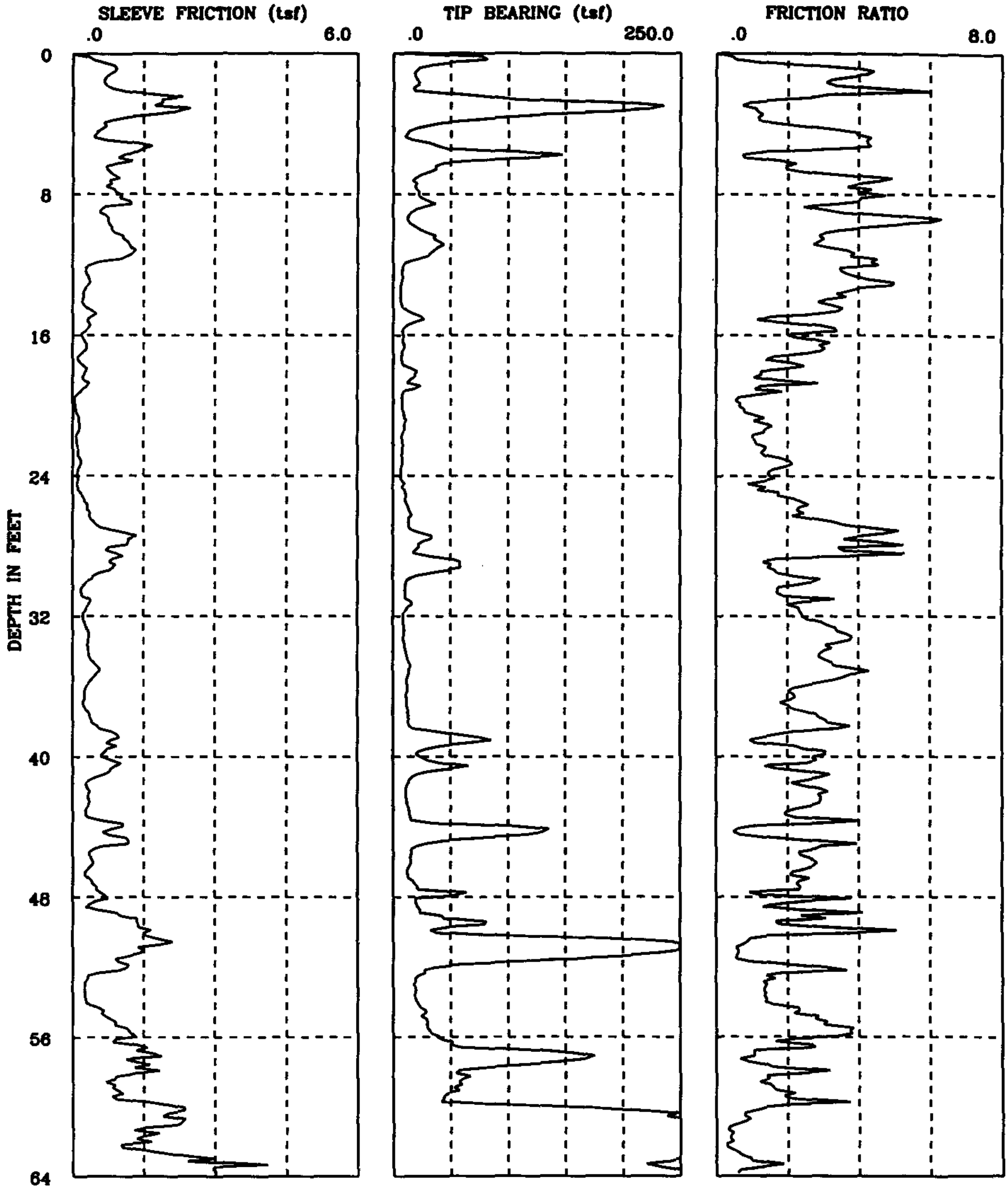
CPT Date :11-03-98
Cone Used :CPT B-312C
Depth to water table (ft) : 8

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.80	39	16.78	0.46	2.74	1.25	clayey silt to silty clay	UNDFND	UNDFD	8	.9
12.10	40	47.07	0.91	1.93	1.28	sandy silt to clayey silt	UNDFND	UNDFD	18	2.9
12.40	41	35.43	0.69	1.96	1.31	sandy silt to clayey silt	UNDFND	UNDFD	14	2.2
12.70	42	15.53	0.45	2.88	1.33	clayey silt to silty clay	UNDFND	UNDFD	7	.8
13.00	43	29.01	0.37	1.28	1.36	sandy silt to clayey silt	UNDFND	UNDFD	11	1.7
13.30	44	12.02	0.26	2.14	1.38	clayey silt to silty clay	UNDFND	UNDFD	6	.6
13.60	45	11.44	0.32	2.80	1.41	silty clay to clay	UNDFND	UNDFD	7	.5
13.90	46	15.74	0.32	2.01	1.43	clayey silt to silty clay	UNDFND	UNDFD	8	.8
14.20	47	15.31	0.24	1.57	1.46	clayey silt to silty clay	UNDFND	UNDFD	7	.8
14.50	48	13.80	0.35	2.54	1.49	clayey silt to silty clay	UNDFND	UNDFD	7	.7
14.80	49	15.29	0.43	2.83	1.51	clayey silt to silty clay	UNDFND	UNDFD	7	.8
15.10	50	18.71	0.47	2.51	1.54	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
15.50	51	14.51	0.32	2.24	1.57	clayey silt to silty clay	UNDFND	UNDFD	7	.7
15.80	52	12.80	0.35	2.73	1.60	silty clay to clay	UNDFND	UNDFD	8	.6
16.10	53	11.06	0.22	2.02	1.62	clayey silt to silty clay	UNDFND	UNDFD	5	.5
16.40	54	9.72	0.17	1.78	1.65	clayey silt to silty clay	UNDFND	UNDFD	5	.4
16.70	55	8.96	0.17	1.90	1.68	clayey silt to silty clay	UNDFND	UNDFD	4	.3
17.00	56	11.36	0.23	2.00	1.70	clayey silt to silty clay	UNDFND	UNDFD	5	.5
17.30	57	9.41	0.12	1.31	1.73	clayey silt to silty clay	UNDFND	UNDFD	5	.4
17.60	58	15.65	0.34	2.19	1.75	clayey silt to silty clay	UNDFND	UNDFD	7	.8
17.90	59	11.51	0.22	1.88	1.78	clayey silt to silty clay	UNDFND	UNDFD	6	.5
18.20	60	40.31	0.78	1.93	1.81	sandy silt to clayey silt	UNDFND	UNDFD	15	2.4
18.50	61	133.78	1.03	0.77	1.83	sand	60-70	38-40	26	UNDEFINED
18.80	62	278.01	1.42	0.51	1.86	sand	80-90	42-44	>50	UNDEFINED
19.10	63	249.34	1.37	0.55	1.88	sand	80-90	42-44	48	UNDEFINED
19.40	64	338.62	1.21	0.36	1.91	gravelly sand to sand	>90	42-44	>50	UNDEFINED
19.70	65	261.66	0.67	0.25	1.93	gravelly sand to sand	80-90	42-44	42	UNDEFINED
20.00	66	284.85	0.90	0.31	1.96	gravelly sand to sand	80-90	42-44	45	UNDEFINED
20.30	67	336.77	2.28	0.68	1.99	sand	>90	42-44	>50	UNDEFINED
20.60	68	487.00	2.29	0.47	2.01	gravelly sand to sand	>90	44-46	>50	UNDEFINED
20.90	69	473.95	5.33	1.13	2.04	sand	>90	44-46	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



CPT B-314C	Playa Vista Site De
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

GROUP DELTA CONSULTANTS

CPT Date :11-03-98
Cone Used :**CPT B-314C**
Depth to water table (ft) : 8

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.20	1	38.72	0.44	1.14	0.02	silty sand to sandy silt	>90	>48	12	UNDEFINED
0.50	2	20.37	0.76	3.71	0.07	silty clay to clay	UNDFND	UNDFD	13	1.3
0.80	3	58.54	1.44	2.46	0.12	sandy silt to clayey silt	UNDFND	UNDFD	22	3.8
1.10	4	175.53	1.71	0.97	0.18	sand	>90	>48	34	UNDEFINED
1.40	5	24.92	0.59	2.37	0.24	sandy silt to clayey silt	UNDFND	UNDFD	10	1.6
1.70	6	55.14	1.25	2.27	0.29	sandy silt to clayey silt	UNDFND	UNDFD	21	3.6
2.00	7	67.81	0.89	1.31	0.35	silty sand to sandy silt	70-80	42-44	22	UNDEFINED
2.30	8	19.94	0.78	3.91	0.41	silty clay to clay	UNDFND	UNDFD	13	1.3
2.70	9	25.92	0.94	3.62	0.47	clayey silt to silty clay	UNDFND	UNDFD	12	1.6
3.00	10	15.27	0.76	4.98	0.50	clay	UNDFND	UNDFD	15	.9
3.30	11	35.92	1.05	2.91	0.52	sandy silt to clayey silt	UNDFND	UNDFD	14	2.3
3.60	12	26.60	1.02	3.84	0.55	silty clay to clay	UNDFND	UNDFD	17	1.7
3.90	13	7.92	0.30	3.79	0.57	clay	UNDFND	UNDFD	8	.4
4.20	14	6.48	0.27	4.12	0.60	clay	UNDFND	UNDFD	6	.3
4.50	15	10.86	0.33	3.04	0.62	silty clay to clay	UNDFND	UNDFD	7	.6
4.80	16	15.72	0.31	1.99	0.65	clayey silt to silty clay	UNDFND	UNDFD	8	.9
5.10	17	9.35	0.26	2.78	0.68	silty clay to clay	UNDFND	UNDFD	6	.5
5.40	18	8.07	0.17	2.06	0.70	silty clay to clay	UNDFND	UNDFD	5	.4
5.70	19	17.32	0.27	1.56	0.73	sandy silt to clayey silt	UNDFND	UNDFD	7	1.0
6.00	20	11.56	0.11	0.98	0.75	sandy silt to clayey silt	UNDFND	UNDFD	4	.6
6.30	21	8.77	0.08	0.95	0.78	clayey silt to silty clay	UNDFND	UNDFD	4	.5
6.60	22	9.35	0.12	1.28	0.81	clayey silt to silty clay	UNDFND	UNDFD	4	.5
6.90	23	8.07	0.10	1.24	0.83	clayey silt to silty clay	UNDFND	UNDFD	4	.4
7.20	24	7.56	0.14	1.85	0.86	silty clay to clay	UNDFND	UNDFD	5	.4
7.50	25	7.69	0.11	1.39	0.88	clayey silt to silty clay	UNDFND	UNDFD	4	.4
7.80	26	10.81	0.24	2.19	0.91	clayey silt to silty clay	UNDFND	UNDFD	5	.6
8.10	27	14.44	0.37	2.54	0.94	clayey silt to silty clay	UNDFND	UNDFD	7	.8
8.40	28	23.62	0.97	4.11	0.96	silty clay to clay	UNDFND	UNDFD	15	1.4
8.70	29	23.75	0.96	4.06	0.99	silty clay to clay	UNDFND	UNDFD	15	1.4
9.10	30	40.95	0.64	1.58	1.02	silty sand to sandy silt	40-50	36-38	13	UNDEFINED
9.40	31	10.39	0.20	1.96	1.05	clayey silt to silty clay	UNDFND	UNDFD	5	.5
9.70	32	12.34	0.29	2.38	1.07	clayey silt to silty clay	UNDFND	UNDFD	6	.7
10.00	33	9.20	0.28	3.01	1.10	silty clay to clay	UNDFND	UNDFD	6	.4
10.30	34	9.47	0.33	3.48	1.12	clay	UNDFND	UNDFD	9	.5
10.60	35	13.04	0.40	3.09	1.15	silty clay to clay	UNDFND	UNDFD	8	.7
10.90	36	12.47	0.45	3.61	1.18	silty clay to clay	UNDFND	UNDFD	8	.6
11.20	37	12.02	0.26	2.14	1.20	clayey silt to silty clay	UNDFND	UNDFD	6	.6
11.50	38	12.58	0.31	2.46	1.23	clayey silt to silty clay	UNDFND	UNDFD	6	.6

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

GROUP DELTA CONSULTANTS

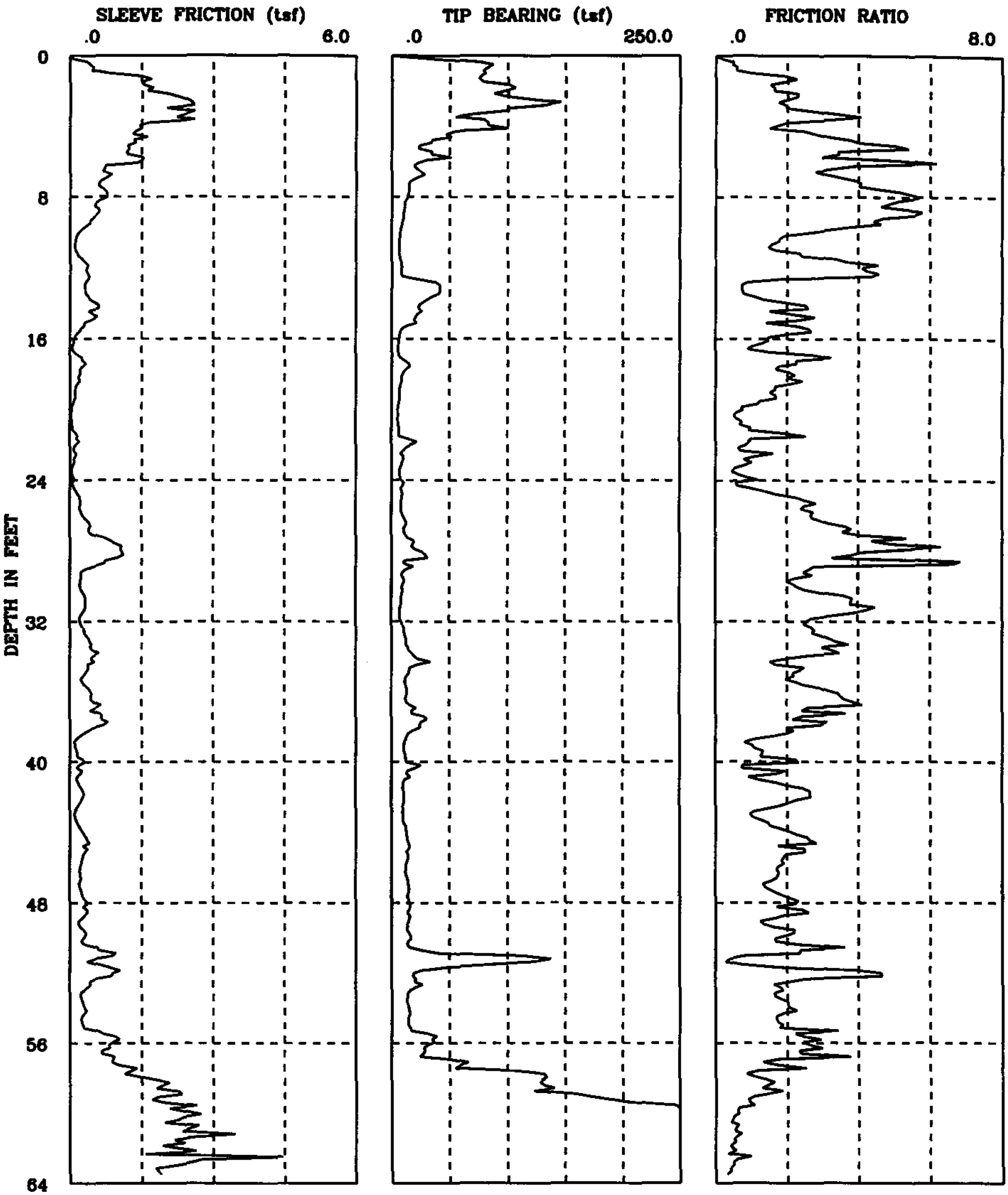
CPT Date :11-03-98
Cone Used :**CPT B-314C**
Depth to water table (ft) : 8

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.80	39	27.38	0.63	2.30	1.25	sandy silt to clayey silt	UNDFND	UNDFD	10	1.6
12.10	40	50.22	0.81	1.61	1.28	silty sand to sandy silt	40-50	36-38	16	UNDEFINED
12.40	41	38.47	0.83	2.17	1.31	sandy silt to clayey silt	UNDFND	UNDFD	15	2.4
12.70	42	15.38	0.43	2.80	1.33	clayey silt to silty clay	UNDFND	UNDFD	7	.8
13.00	43	11.64	0.35	2.98	1.36	silty clay to clay	UNDFND	UNDFD	7	.6
13.30	44	14.10	0.39	2.74	1.38	clayey silt to silty clay	UNDFND	UNDFD	7	.7
13.60	45	105.49	0.94	0.89	1.41	sand to silty sand	60-70	38-40	25	UNDEFINED
13.90	46	20.44	0.66	3.23	1.43	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
14.20	47	13.78	0.35	2.54	1.46	clayey silt to silty clay	UNDFND	UNDFD	7	.7
14.50	48	17.61	0.42	2.37	1.49	clayey silt to silty clay	UNDFND	UNDFD	8	.9
14.80	49	31.18	0.48	1.54	1.51	sandy silt to clayey silt	UNDFND	UNDFD	12	1.8
15.10	50	48.79	1.22	2.50	1.54	sandy silt to clayey silt	UNDFND	UNDFD	19	3.0
15.50	51	157.56	1.67	1.06	1.57	sand to silty sand	70-80	40-42	38	UNDEFINED
15.80	52	150.63	1.17	0.77	1.60	sand	70-80	40-42	29	UNDEFINED
16.10	53	22.90	0.52	2.27	1.62	sandy silt to clayey silt	UNDFND	UNDFD	9	1.3
16.40	54	19.12	0.26	1.38	1.65	sandy silt to clayey silt	UNDFND	UNDFD	7	1.0
16.70	55	24.96	0.57	2.28	1.68	sandy silt to clayey silt	UNDFND	UNDFD	10	1.4
17.00	56	30.80	1.10	3.58	1.70	clayey silt to silty clay	UNDFND	UNDFD	15	1.8
17.30	57	72.63	1.20	1.65	1.73	silty sand to sandy silt	40-50	36-38	23	UNDEFINED
17.60	58	134.04	1.50	1.12	1.75	sand to silty sand	60-70	38-40	32	UNDEFINED
17.90	59	58.25	1.03	1.77	1.78	silty sand to sandy silt	40-50	34-36	19	UNDEFINED
18.20	60	47.84	1.12	2.34	1.81	sandy silt to clayey silt	UNDFND	UNDFD	18	2.9
18.50	61	222.47	2.26	1.01	1.83	sand	80-90	40-42	43	UNDEFINED
18.80	62	386.29	1.69	0.44	1.86	gravelly sand to sand	>90	44-46	>50	UNDEFINED
19.10	63	337.19	1.54	0.46	1.88	gravelly sand to sand	>90	42-44	>50	UNDEFINED
19.40	64	327.25	3.35	1.02	1.91	sand	>90	42-44	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



CPT B-318C	Playa Vista Site De
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

GROUP DELTA CONSULTANTS

CPT Date :11-03-98
Cone Used :**CPT B-318C**
Depth to water table (ft) : 8

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.20	1	52.66	0.29	0.54	0.02	sand to silty sand	>90	>48	13	UNDEFINED
0.50	2	85.88	1.35	1.57	0.07	silty sand to sandy silt	>90	>48	27	UNDEFINED
0.80	3	114.75	2.14	1.87	0.12	silty sand to sandy silt	>90	>48	37	UNDEFINED
1.10	4	84.76	2.35	2.77	0.18	sandy silt to clayey silt	UNDFND	UNDFD	32	5.6
1.40	5	63.30	1.48	2.34	0.24	sandy silt to clayey silt	UNDFND	UNDFD	24	4.2
1.70	6	30.44	1.27	4.16	0.29	silty clay to clay	UNDFND	UNDFD	19	2.0
2.00	7	24.73	0.99	3.99	0.35	silty clay to clay	UNDFND	UNDFD	16	1.6
2.30	8	17.23	0.68	3.97	0.41	silty clay to clay	UNDFND	UNDFD	11	1.1
2.70	9	11.85	0.63	5.27	0.47	clay	UNDFND	UNDFD	11	.7
3.00	10	8.88	0.38	4.24	0.50	clay	UNDFND	UNDFD	9	.5
3.30	11	6.76	0.12	1.73	0.52	silty clay to clay	UNDFND	UNDFD	4	.4
3.60	12	7.33	0.26	3.50	0.55	clay	UNDFND	UNDFD	7	.4
3.90	13	18.14	0.35	1.93	0.57	clayey silt to silty clay	UNDFND	UNDFD	9	1.1
4.20	14	37.58	0.35	0.92	0.60	silty sand to sandy silt	40-50	38-40	12	UNDEFINED
4.50	15	23.32	0.52	2.22	0.62	sandy silt to clayey silt	UNDFND	UNDFD	9	1.5
4.80	16	12.60	0.23	1.80	0.65	clayey silt to silty clay	UNDFND	UNDFD	6	.7
5.10	17	5.80	0.08	1.32	0.68	sensitive fine grained	UNDFND	UNDFD	3	.3
5.40	18	11.56	0.26	2.25	0.70	clayey silt to silty clay	UNDFND	UNDFD	6	.7
5.70	19	8.33	0.18	2.12	0.73	silty clay to clay	UNDFND	UNDFD	5	.4
6.00	20	6.39	0.09	1.46	0.75	sensitive fine grained	UNDFND	UNDFD	3	.3
6.30	21	5.48	0.04	0.67	0.78	sensitive fine grained	UNDFND	UNDFD	3	.2
6.60	22	8.88	0.11	1.20	0.81	clayey silt to silty clay	UNDFND	UNDFD	4	.5
6.90	23	12.15	0.11	0.88	0.83	sandy silt to clayey silt	UNDFND	UNDFD	5	.7
7.20	24	7.67	0.06	0.74	0.86	sensitive fine grained	UNDFND	UNDFD	4	.4
7.50	25	8.79	0.09	1.02	0.88	clayey silt to silty clay	UNDFND	UNDFD	4	.4
7.80	26	8.35	0.21	2.48	0.91	silty clay to clay	UNDFND	UNDFD	5	.4
8.10	27	11.05	0.34	3.11	0.94	silty clay to clay	UNDFND	UNDFD	7	.6
8.40	28	14.36	0.67	4.69	0.96	clay	UNDFND	UNDFD	14	.8
8.70	29	20.03	0.97	4.83	0.99	clay	UNDFND	UNDFD	19	1.2
9.10	30	12.01	0.30	2.46	1.02	clayey silt to silty clay	UNDFND	UNDFD	6	.6
9.40	31	8.77	0.29	3.27	1.05	clay	UNDFND	UNDFD	8	.4
9.70	32	7.27	0.27	3.67	1.07	clay	UNDFND	UNDFD	7	.3
10.00	33	10.45	0.29	2.74	1.10	silty clay to clay	UNDFND	UNDFD	7	.5
10.30	34	14.57	0.48	3.27	1.12	silty clay to clay	UNDFND	UNDFD	9	.8
10.60	35	19.95	0.39	1.96	1.15	sandy silt to clayey silt	UNDFND	UNDFD	8	1.1
10.90	36	12.49	0.31	2.46	1.18	clayey silt to silty clay	UNDFND	UNDFD	6	.6
11.20	37	13.78	0.52	3.75	1.20	silty clay to clay	UNDFND	UNDFD	9	.7
11.50	38	23.66	0.63	2.66	1.23	clayey silt to silty clay	UNDFND	UNDFD	11	1.4

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

GROUP DELTA CONSULTANTS

CPT Date :11-03-98
Cone Used :**CPT B-318C**
Depth to water table (ft) : 8

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.80	39	16.87	0.30	1.76	1.25	clayey silt to silty clay	UNDFND	UNDFD	8	.9
12.10	40	11.11	0.13	1.20	1.28	clayey silt to silty clay	UNDFND	UNDFD	5	.5
12.40	41	15.42	0.22	1.45	1.31	sandy silt to clayey silt	UNDFND	UNDFD	6	.8
12.70	42	10.81	0.21	1.91	1.33	clayey silt to silty clay	UNDFND	UNDFD	5	.5
13.00	43	10.26	0.21	2.08	1.36	clayey silt to silty clay	UNDFND	UNDFD	5	.5
13.30	44	10.28	0.13	1.26	1.38	clayey silt to silty clay	UNDFND	UNDFD	5	.5
13.60	45	13.51	0.34	2.49	1.41	clayey silt to silty clay	UNDFND	UNDFD	6	.7
13.90	46	14.29	0.30	2.10	1.43	clayey silt to silty clay	UNDFND	UNDFD	7	.7
14.20	47	12.64	0.22	1.74	1.46	clayey silt to silty clay	UNDFND	UNDFD	6	.6
14.50	48	14.53	0.23	1.56	1.49	clayey silt to silty clay	UNDFND	UNDFD	7	.7
14.80	49	14.72	0.32	2.17	1.51	clayey silt to silty clay	UNDFND	UNDFD	7	.7
15.10	50	13.96	0.24	1.72	1.54	clayey silt to silty clay	UNDFND	UNDFD	7	.7
15.50	51	21.79	0.52	2.40	1.57	clayey silt to silty clay	UNDFND	UNDFD	10	1.2
15.80	52	82.67	0.74	0.89	1.60	sand to silty sand	50-60	36-38	20	UNDEFINED
16.10	53	19.69	0.55	2.79	1.62	clayey silt to silty clay	UNDFND	UNDFD	9	1.1
16.40	54	13.53	0.25	1.82	1.65	clayey silt to silty clay	UNDFND	UNDFD	6	.6
16.70	55	14.70	0.28	1.90	1.68	clayey silt to silty clay	UNDFND	UNDFD	7	.7
17.00	56	27.61	0.67	2.44	1.70	sandy silt to clayey silt	UNDFND	UNDFD	11	1.6
17.30	57	28.17	0.81	2.86	1.73	clayey silt to silty clay	UNDFND	UNDFD	13	1.6
17.60	58	84.48	1.14	1.35	1.75	silty sand to sandy silt	50-60	36-38	27	UNDEFINED
17.90	59	128.56	2.01	1.57	1.78	sand to silty sand	60-70	38-40	31	UNDEFINED
18.20	60	235.45	1.98	0.84	1.81	sand	80-90	42-44	45	UNDEFINED
18.50	61	444.03	2.56	0.58	1.83	gravelly sand to sand	>90	44-46	>50	UNDEFINED
18.80	62	435.12	2.46	0.56	1.86	gravelly sand to sand	>90	44-46	>50	UNDEFINED
19.10	63	469.12	2.23	0.47	1.88	gravelly sand to sand	>90	44-46	>50	UNDEFINED
19.40	64	501.82	1.99	0.40	1.91	gravelly sand to sand	>90	44-46	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

APPENDIX A
EXISTING FIELD DATA (Pacific Soils Engineering, 1998)

GEOTECHNICAL BORING LOG

PROJECT NO.	500464	PROJECT NAME	Playa Vista	BORING DESIG.	B-01
DATE STARTED	12/5/97	GROUND ELEV.	16 +	LOGGED BY	DO
DATE FINISHED	12/5/97	GW DEPTH (FT)	14.00	NOTE	
DRILLER	2R DRILLING	DRIVE WT.	140 lbs.		
TYPE OF DRILL RIG	8" HOLLOWSTEM	DROP	30"		

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
0							**FILL (Af):** SILTY CLAY, dark brown and CLAYEY SILT, medium brown, damp, medium stiff				
5		R		6/18/25				19.9	103	85	
							ALLUVIUM (Qal): SILTY CLAY, trace very fine sand, damp to moist, plastic at in situ moisture, medium stiff				
10		R		9/13/19			SILTY SAND, orange brown, fine to coarse, traces fine to coarse gravel, damp, medium dense	17.1	108	82	
							SILTY CLAY, black, damp to moist, medium stiff	17.9	112	96	
15		R		3/5/7		SM/ML	Fine-grained SANDY SILT to SILTY SAND, light gray, moist, medium dense, slightly micaceous	30.8	88	90	DS HY
							SILTY CLAY, dark gray, moist to wet, medium stiff				
20		R		2/3/4				49.2	73	98	
25		R		3/4/10		ML	SANDY SILT, dark gray-brown, moist, medium stiff, trace old rootlets and pin size pores, aqua coloring	19.9	106	91	CON HY
30		R		6/9/17			CLAYEY Fine to Coarse-Grained SAND, and fine to coarse gravel, wet, medium dense to dense, trace cobbles	10.2	95	36	
35		R		6/8/12			SILT, with traces of CLAY, dark gray-brown, moist to wet, medium stiff to stiff, traces of mica	30.0	93	99	

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

▼ GROUNDWATER
► SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-1

GEOTECHNICAL BORING LOG

PROJECT NO. 500464
DATE STARTED 12/5/97
DATE FINISHED 12/5/97
DRILLER 2R DRILLING
TYPE OF DRILL RIG 8" HOLLOWSTEM

PROJECT NAME Playa Vista
GROUND ELEV. 16+
GW DEPTH (FT) 14.00
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. B-01
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		R		3/5/7		ML	CLAYEY SILT, dark gray, moist to wet, medium stiff to stiff, plastic with dark brown mottling, interbedded with fine-grained SANDY SILT, wet	33.4	89	99	CON HY
45		R		6/7/7				47.0	77	98	
							CLAYEY SILT, dark gray, wet, medium stiff to stiff, micaceous				
50		R		6/8/12				33.7	88	100	
							gravel				
55		R		17/ 50 for 4"			**PLEISTOCENE SAND (Ps):** Fine to Medium-Grained SAND, gray, wet, dense, with some coarse SAND, fine gravel	13.9	120	93	
60		R		51 for 6"			Becomes coarser with depth, fine to coarse-grained SAND and fine to coarse GRAVEL.	13.0	117	81	
65		R		20/33 50 for 4"			Encountered piece of cobble	26.3	97	97	
70		R		20/ 50 for 4"				24.5	100	96	
							Total Depth 71 feet Groundwater encountered at about 14 feet				

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-1

GEOTECHNICAL BORING LOG

PROJECT NO.	500464	PROJECT NAME	Playa Vista		
DATE STARTED	12/9/97	GROUND ELEV.	16+	BORING DESIG.	B-02
DATE FINISHED	12/9/97	GW DEPTH (FT)	15.00	LOGGED BY	DO
DRILLER	2R DRILLING	DRIVE WT.	140 lbs.	NOTE	
TYPE OF DRILL RIG	8" HOLLOWSTEM	DROP	30"		

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		B				SC	**FILL (Af):** Fine-Grained SANDY CLAY, brown, damp, medium stiff, with some coarse SAND and fine gravel				MAX DSR EI HY
5		R		4/7/14			@5' cobble encountered	14.3	118	91	
							SILTY Fine-Grained SAND, orange brown, damp, medium dense				
10		R		8/9/13			**ALLUVIUM (Qal):** SILTY CLAY, black, damp, medium stiff	19.7	107	93	
15		R		3/4/6			Fine-Grained SANDY SILT, damp to moist, medium dense, micaceous	42.5	79	99	
							SILTY CLAY, aqua blue, moist, medium stiff, plastic				
20		R		1/2/4		CL	@ 20' wet sample	33.5	90	100	DS
							Coarse to Fine-Grained SAND, black gray, moist to wet, medium dense				
25		R		4/5/7			SILTY CLAY, dark brown, moist to wet, stiff, plastic	24.7	100	98	
							Water measured at 27 feet and 3 inches during drilling				
30		R		2/4/7		ML	SILTY CLAY to CLAYEY SILT, black brown	29.9	94	99	CON HY
35		R		6/6/11							

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-2

GEOTECHNICAL BORING LOG

PROJECT NO. 500464
DATE STARTED 12/9/97
DATE FINISHED 12/9/97
DRILLER 2R DRILLING
TYPE OF DRILL RIG 8" HOLLOWSTEM

PROJECT NAME Playa Vista
GROUND ELEV. 16 +
GW DEPTH (FT) 15.00
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. B-02
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		R		3/7/8			CLAYEY SILT with some fine-grained SAND, dark brown, wet, micaceous	27.7	98	99	
45		R		5/9/16			CLAYEY Coarse-Grained SAND with gravel, black brown, wet, medium dense	27.8	95	97	
50		R		6/7/15			Fine to Medium-Grained SAND, black brown, wet, medium dense	26.6	97	98	
55		R		7/13/30			**PLEISTOCENE SAND (Ps):** Fine-Grained SILTY SAND, with fine to coarse gravel, dark gray, wet, medium dense to dense, gravel encountered 55 to 60 feet	26.0	102	89	
60		R		11/15/40			Fine to Coarse-Grained SAND, with fine to coarse gravel, gray, wet, dense	12.0	129	99	
65		R		16/50 for 6"			Same as 60' with fine cobbles	8.0	133	80	
70		R		40/50 for				10.5	131	98	
							Total Depth 71 feet Groundwater encountered at about 15 feet				

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-2

GEOTECHNICAL BORING LOG

PROJECT NO. 500464
DATE STARTED 12/9/97
DATE FINISHED 12/9/97
DRILLER 2R DRILLING
TYPE OF DRILL RIG 8" HOLLOWSTEM

PROJECT NAME Playa Vista
GROUND ELEV. 16 +
GW DEPTH (FT) 15.00
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. B-03
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
							FILL (Af): Medium to Coarse-Grained SANDY CLAY, brown, damp, medium stiff, also fine gravel				
5		R		20/19/20			Occasional cobbles	7.3	123	54	
10		R		9/11/17			**ALLUVIUM (Qal):** SILTY CLAY, black, damp, medium stiff	21.7	106	98	
15		R		6/6/8		ML	CLAYEY SAND, gray-brown, damp, medium dense	32.8	90	99	HY
20		R		1/1/2		CL	Water on sampler	48.5	73	100	CON HY
							SILTY CLAY, gray-brown, wet, stiff, roots				
25		R		2/2/4			SILTY CLAY, black, moist to wet, stiff	38.5	81	97	CHEM
30		R		3/6/7			CLAYEY SILT, black, moist to wet, moderately firm	27.1	98	98	
35		R		7/7/7		ML	Medium-Grained SANDY SILT, gray-brown, wet, medium dense	25.0	101	99	DS

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-3

GEOTECHNICAL BORING LOG

PROJECT NO.	500464	PROJECT NAME	Playa Vista
DATE STARTED	12/9/97	GROUND ELEV.	16 +
DATE FINISHED	12/9/97	GW DEPTH (FT)	15.00
DRILLER	2R DRILLING	DRIVE WT.	140 lbs.
TYPE OF DRILL RIG	8" HOLLOWSTEM	DROP	30"

BORING DESIG. B-03
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		R		3/4/7		SP	CLAYEY Coarse-Grained SAND, with gravel, black brown, wet, medium dense	11.9	101	49	CON HY
45		R		4/9/11			CLAYEY SILT with sand, black brown, wet, medium dense	34.5	87	99	
50		R		5/7/10			SILTY Medium to Fine-Grained SAND, gray-black, wet, medium dense	28.9	95	100	
55		R		4/9/12			CLAYEY SILT, gray-brown, moist to wet, firm, micaceous	22.0	106	100	
60		R		11/31/50 for 5"			**PLEISTOCENE SAND (Ps):** Medium to Coarse-Grained GRAVELLY SAND, gray-brown, wet, medium dense	20.6	103	87	
65		R		14/50 for 3"		SP	Increase in gravel size with occasional cobbles	16.5	117	99	CON HY
70		R		16/50 for 5"			Medium to Fine-Grained SAND, gray-brown, wet, medium dense, micaceous	23.7	104	99	
							Total Depth 71 feet Groundwater encountered at about 15 feet				

SAMPLE TYPES:
[R] RING (DRIVE) SAMPLE
[S] SPT (SPLIT SPOON) SAMPLE
[B] BULK SAMPLE [T] TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-3

GEOTECHNICAL BORING LOG

PROJECT NO.	500464	PROJECT NAME	Playa Vista		
DATE STARTED	12/9/97	GROUND ELEV.	16 +	BORING DESIG.	B-04
DATE FINISHED	12/9/97	GW DEPTH (FT)	10.00	LOGGED BY	DO
DRILLER	2R DRILLING	DRIVE WT.	140 lbs.	NOTE	
TYPE OF DRILL RIG	8"HOLLOWSTEM	DROP	30"		

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
							ALLUVIUM (Qal): CLAYEY SAND, medium to coarse, dark brown, moist, medium dense, some gravel to 3/4" subrounded				
5		R		12/12/7			CLAYEY SAND, medium to coarse with gravel, brown, damp, medium dense, occasional cobble	9.9	120	66	
10		R		15/7/8		CL	SANDY CLAY, medium grained, gray-brown, damp, medium stiff	27.8	95	97	DS HY
15		R		4/5/8			SILTY SAND, medium to fine grained, gray-brown, damp, medium dense	33.3	89	98	
20		R		3/4/6			SANDY SILT, fine grained, gray-brown, damp to moist, firm	40.4	80	98	
25		R		2/1/2		ML	CLAYEY SILT, black-brown, moist, stiff, some shells	32.3	93	99	CON HY
30		R		5/4/12			No Recovery				
35		R		4/7/7			SILTY CLAY, gray-brown, moist, moderately firm	37.3	84	100	

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

▼ GROUNDWATER

► SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-4

GEOTECHNICAL BORING LOG

PROJECT NO. 500464
DATE STARTED 12/9/97
DATE FINISHED 12/9/97
DRILLER 2R DRILLING
TYPE OF DRILL RIG 8"HOLLOWSTEM

PROJECT NAME Playa Vista
GROUND ELEV. 16+
GW DEPTH (FT) 10.00
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. B-04
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		R		3/3/4			SILTY CLAY, bluish gray-brown, moist, firm	35.2	88	98	CHEM
45		R		3/5/7		CL	same as above	38.0	83	99	DS
50		R		5/8/6			SILTY CLAY,with fine grained sand, blue gray-brown, moist to wet, firm	32.5	90	99	
55		R		4/4/6		ML	SILTY CLAY, black-brown, moist, firm with some fine SAND	41.8	81	99	CON HY
60		R		1/2/7			<u>PLEISTOCENE SAND (Ps):</u> SAND, medium grained, gray-brown, wet, medium dense	12.0	119	79	
65		R		50 for 3"		SP	same as above	23.1	103	99	DS HY
70		R		30/50			Coarse Grained SAND, gray-brown, wet, dense with gravel up to 1/2" subrounded	9.4	122	67	
							Total Depth 71 feet Groundwater encountered at about 10 feet				

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-4

GEOTECHNICAL BORING LOG

PROJECT NO. 500464
DATE STARTED 12/10/97
DATE FINISHED 12/10/97
DRILLER 2R DRILLING
TYPE OF DRILL RIG 8" HOLLOWSTEM

PROJECT NAME Playa Vista
GROUND ELEV. 16 +
GW DEPTH (FT)
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. B-05
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
							FILL (Af): SANDY CLAY, gravel, moist to wet, stiff				
5		R		6/14/12			CLAYEY SAND, coarse up to 1/4", black-brown, damp, stiff	9.9	119	65	
10		R		3/4/4			**ALLUVIUM (Qal):** SANDY CLAY, gray-brown, wet, soft	37.9	82	97	
15		R		3/3/4			SILTY SAND, fine grained, gray-brown, moist, soft	38.2	84	99	
20		R		1/1/1		CL	SILTY CLAY, gray-brown, wet, soft, odiferous, peat (?), micaceous	70.8	58	98	CON HY
25		R		2/1/2			SANDY CLAY, black brown, moist to wet, soft	26.6	87	77	
30		R		3/5/6			CLAYEY SILT, with fine sand, gray-brown, wet, firm	28.7	96	98	CHEM
35		R		3/3/4			SILTY fine SAND, with CLAY, blue-gray, wet, soft, micaceous	27.8	96	99	

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

GEOTECHNICAL BORING LOG

PROJECT NO. 500464
DATE STARTED 12/10/97
DATE FINISHED 12/10/97
DRILLER 2R DRILLING
TYPE OF DRILL RIG 8" HOLLOWSTEM

PROJECT NAME Playa Vista
GROUND ELEV. 16 +
GW DEPTH (FT)
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. B-05
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		R		4/4/8			CLAYEY SILT, blue-gray, moist to wet, firm, micaceous	32.0	92	99	
45		R		4/5/8			SILTY CLAY, blue-gray, wet, very firm, micaceous	36.5	85	99	
50		R		8/12/13			CLAY, blue-gray, wet, soft	33.3	89	100	
							1 foot layer of medium to fine SAND				
							CLAY, blue-gray, wet, soft				
55		R		3/4/6		ML	same with 1/8" root encountered	29.7	93	99	CON HY
60		R		5/19/30			**PLEISTOCENE SAND (Ps):** Fine to Coarse SAND, gray, wet, medium dense to dense, trace of silt, cobble fragments in tip 2 1/2"	19.6	116	99	
65		R		27/53			same with increase in grain size	9.0	139	98	
							Total Depth 66 feet Seepage at about 1 foot Possibly locally shallow perched groundwater				

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-5

GEOTECHNICAL BORING LOG

PROJECT NO. 500464
DATE STARTED 12/10/97
DATE FINISHED 12/10/97
DRILLER 2R DRILLING
TYPE OF DRILL RIG 8" HOLLOWSTEM

PROJECT NAME Playa Vista
GROUND ELEV. 16+
GW DEPTH (FT) 10.00
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. B-06
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
							FILL (Af): Medium SANDY CLAY, brown, damp, firm				
5		R		4/7/13			CLAYEY medium SAND, brown, damp, medium dense				
10		R		7/10/15			**ALLUVIUM (Qal):** SILTY CLAY with fine SAND, gray-brown, damp, firm	27.0	97	99	
15		R		3/6/10			SILTY fine SAND, brown, wet, loose to medium dense	30.7	95	98	
20		R		2/3/3			SANDY CLAY, gray-brown, moist to wet, soft	66.3	61	98	
25		R		3/4/7			same as above	20.7	106	95	
30		R		3/6/6		ML	SANDY SILT, gray-brown, moist to wet, soft	31.4	93	99	CON HY
							SILTY SAND, medium to coarse, gray-brown, moist to wet, dense				
35		R		3/9/15			same as above	23.4	103	99	
							SANDY CLAY, gray-brown, moist to wet, firm				

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

GEOTECHNICAL BORING LOG

PROJECT NO. 500464
DATE STARTED 12/10/97
DATE FINISHED 12/10/97
DRILLER 2R DRILLING
TYPE OF DRILL RIG 8" HOLLOWSTEM

PROJECT NAME Playa Vista
GROUND ELEV. 16 +
GW DEPTH (FT) 10.00
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. B-06
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		R		3/5/8			SILTY CLAY, gray-brown, moist to wet, soft to firm, micaceous	29.4	97	99	
45		R		2/4/6		ML	CLAYEY SILT, black-brown, moist to wet, firm	33.6	79	80	CON HY
50		R		3/6/8			CLAYEY SAND, black-brown, wet, dense	28.3	96	98	
							SANDY CLAY, black-brown, moist to wet, firm				
55		R		4/5/12			Fine SANDY SILT, blue-gray, moist, firm, micaceous, 1/8" root	31.2	92	99	
60		R		3/7/10			CLAYEY Medium SAND, gray-brown, wet, dense, root 1/8", micaceous, occasional coarse sizes to 1/4"	25.2	100	99	
65		R		14/50			**PLEISTOCENE SAND (Ps):** Coarse SAND, gray-brown, wet, dense	15.0	119	98	
70		R		15/50 for 5"		SP	same	17.9	109	89	DS HY
							Total Depth 71 feet Groundwater encountered at about 10 feet				

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-6

GEOTECHNICAL BORING LOG

PROJECT NO.	500464	PROJECT NAME	Playa Vista
DATE STARTED	12/10/97	GROUND ELEV.	16 +
DATE FINISHED	12/10/97	GW DEPTH (FT)	17.00
DRILLER	2R DRILLING	DRIVE WT.	140 lbs.
TYPE OF DRILL RIG	8" HOLLOWSTEM	DROP	30"

BORING DESIG. B-07
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
						SC	**FILL (Af):** CLAYEY SAND, brown, damp, medium dense				MAX RV HY
5		R		6/8/13			SANDY CLAY, brown, damp, moderately firm, with gravel	15.1	111	78	
10		R		7/12/13			CLAY, some fine SAND, black, damp to moist, hard, micaceous, roots	24.3	100	96	
15		R		3/4/5			**ALLUVIUM (Qal):** SANDY SILT, black-brown, damp to moist, firm, micaceous	32.4	90	99	
							water				
20		R		2/3/3			SILT with CLAY and SAND, greenish-gray, wet, firm	26.6	90	82	CHEM
25		R		2/5/4		ML	SANDY SILT, greenish gray, wet, firm	20.5	107	97	CON HY
30		R		3/5/5		ML	SANDY SILT, gray-brown, wet, firm	26.4	98	99	DS
35		R		1/2/4			No Recovery				

SAMPLE TYPES:
- [R] RING (DRIVE) SAMPLE
- [S] SPT (SPLIT SPOON) SAMPLE
- [B] BULK SAMPLE
- [T] TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-7

GEOTECHNICAL BORING LOG

PROJECT NO. 500464
DATE STARTED 12/10/97
DATE FINISHED 12/10/97
DRILLER 2R DRILLING
TYPE OF DRILL RIG 8" HOLLOWSTEM
PROJECT NAME Playa Vista
GROUND ELEV. 16 +
GW DEPTH (FT) 17.00
DRIVE WT. 140 lbs.
DROP 30"
BORING DESIG. B-07
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		R		6/7/12			SILTY medium to coarse SAND, gray-brown, wet, medium dense	19.8	110	99	
45		R		6/8/8			SILTY CLAY, blue-gray, moist to wet, soft to firm	23.5	99	90	
50		R		7/10/15			same as above	28.9	94	97	
55		R		6/8/10			CLAYEY SILT, blue-gray, moist to wet, firm, with roots	32.3	90	99	
60		R		12/20/30			**PLEISTOCENE SAND (Ps):** Coarse Grained SAND, blue-gray, wet, dense	17.7	112	95	
65		R		12/30/50 for 4"			same, 1 1/2" gravel in tip	15.5	116	93	
70		R		7/20/48			same	10.3	127	84	
							Total Depth 71 feet Groundwater encountered at about 17 feet				

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-7

GEOTECHNICAL BORING LOG

PROJECT NO. 500464
DATE STARTED 12/11/97
DATE FINISHED 12/11/97
DRILLER 2R DRILLING
TYPE OF DRILL RIG 8" HOLLOWSTEM

PROJECT NAME Playa Vista
GROUND ELEV. 16 +
GW DEPTH (FT) 15.00
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. B-08
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
							FILL (Af): CLAYEY fine to coarse SAND, brown, damp, loose				
5		R		11/15/6			same but damp to moist, with cobble fragments	5.6	114	32	
10		R		6/9/19			SANDY CLAY, coarse, black-brown, damp, firm, micaceous 6 inch layer of SILTY SAND	15.5	116	92	
							water				
15		R		4/6/9			**ALLUVIUM (Qal):** CLAYEY SILT, with medium SAND, gray-blue, moist to wet, firm	35.2	88	99	
20		R		2/3/4		ML	same with roots and shells	41.5	71	82	CON HY
25		R		4/6/9			CLAYEY SILT with medium SAND, blue-gray, moist to wet, firm, micaceous	20.0	106	92	
							Coarse SAND, gray, wet				
30		R		5/5/8			SILTY CLAY, gray-brown, moist to wet, soft	28.5	95	100	CHEM
35		R		2/5/7			Fine SANDY CLAY, gray-brown, moist to wet, firm, roots	35.6	89	99	

SAMPLE TYPES:
[R] RING (DRIVE) SAMPLE
[S] SPT (SPLIT SPOON) SAMPLE
[B] BULK SAMPLE [T] TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-8

A-80

GEOTECHNICAL BORING LOG

PROJECT NO.	500464	PROJECT NAME	Playa Vista
DATE STARTED	12/11/97	GROUND ELEV.	18 +
DATE FINISHED	12/11/97	GW DEPTH (FT)	15.00
DRILLER	2R DRILLING	DRIVE WT.	140 lbs.
TYPE OF DRILL RIG	8" HOLLOWSTEM	DROP	30"

BORING DESIG. B-08
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		R		3/5/7		ML	CLAYEY SILT, aqua, moist to wet, firm, micaceous, roots	35.8	87	99	CON HY
45		R		5/8/7			CLAYEY SILT, gray-black, moist to wet, firm, micaceous	31.8	92	100	
50		R		4/7/11			CLAYEY SILT, gray, moist to wet, firm, roots	24.5	97	89	
55		R		4/5/8		ML		34.2	88	99	CON HY
60		R		6/8/12			CLAYEY SAND, coarse with subrounded gravel up to 1", moist to wet, dense	28.2	95	99	
65		R		10/50		SP	**PLEISTOCENE SAND (Ps):** Coarse SAND, gray, wet, dense	17.5	110	88	DS HY
70		R		11/50 for 5"			same with increase in grain size	23.7	101	97	
							Total Depth 71 feet Groundwater encountered at about 15 feet				

SAMPLE TYPES:
- [R] RING (DRIVE) SAMPLE
- [S] SPT (SPLIT SPOON) SAMPLE
- [B] BULK SAMPLE [T] TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

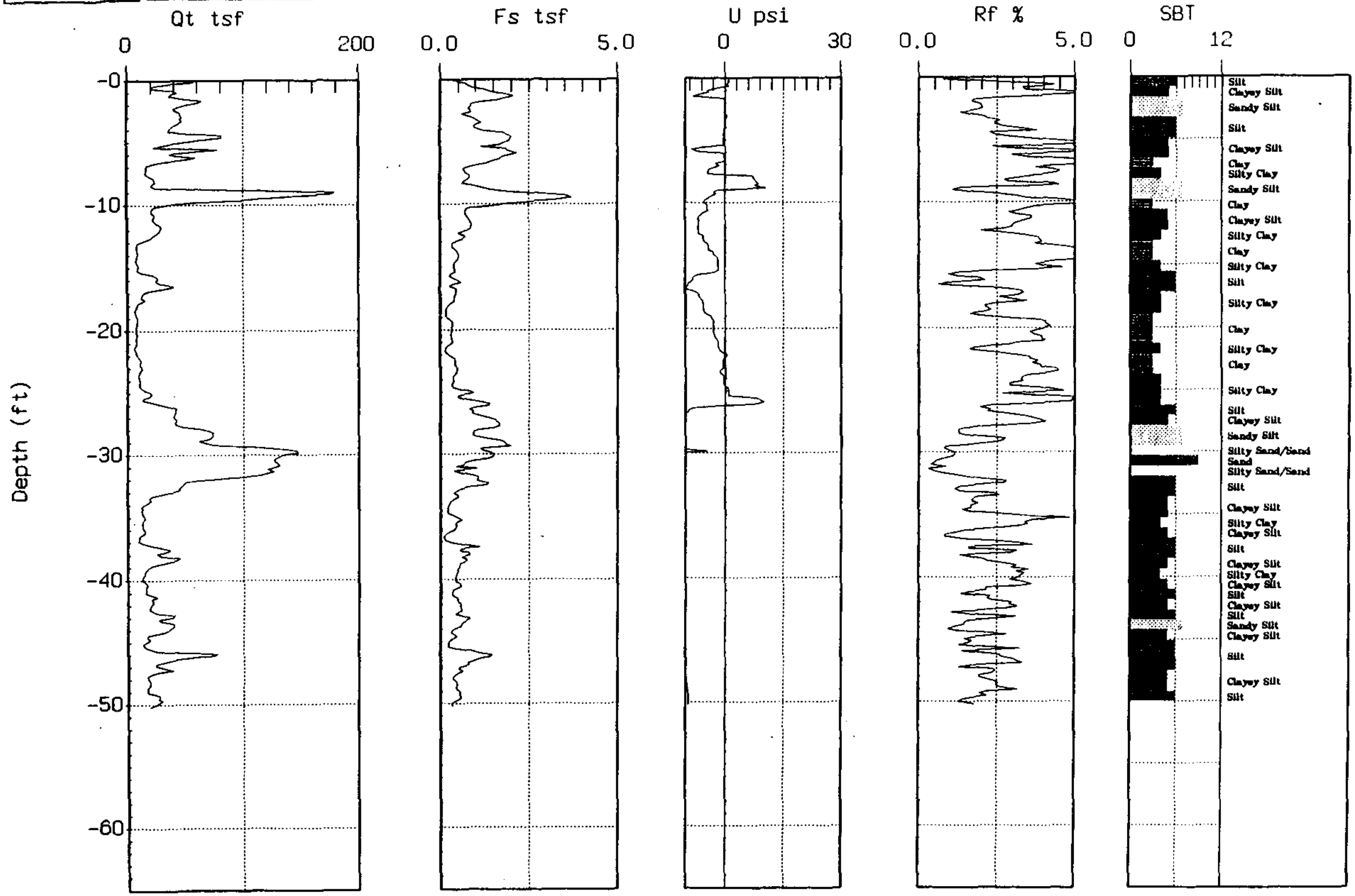
PLATE A-8

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-1

Engineer : C. KROLL
Date : 12:10:97 06:48



Max. Depth: 50.20 (ft)

Depth Inc.: 0.164 (ft)

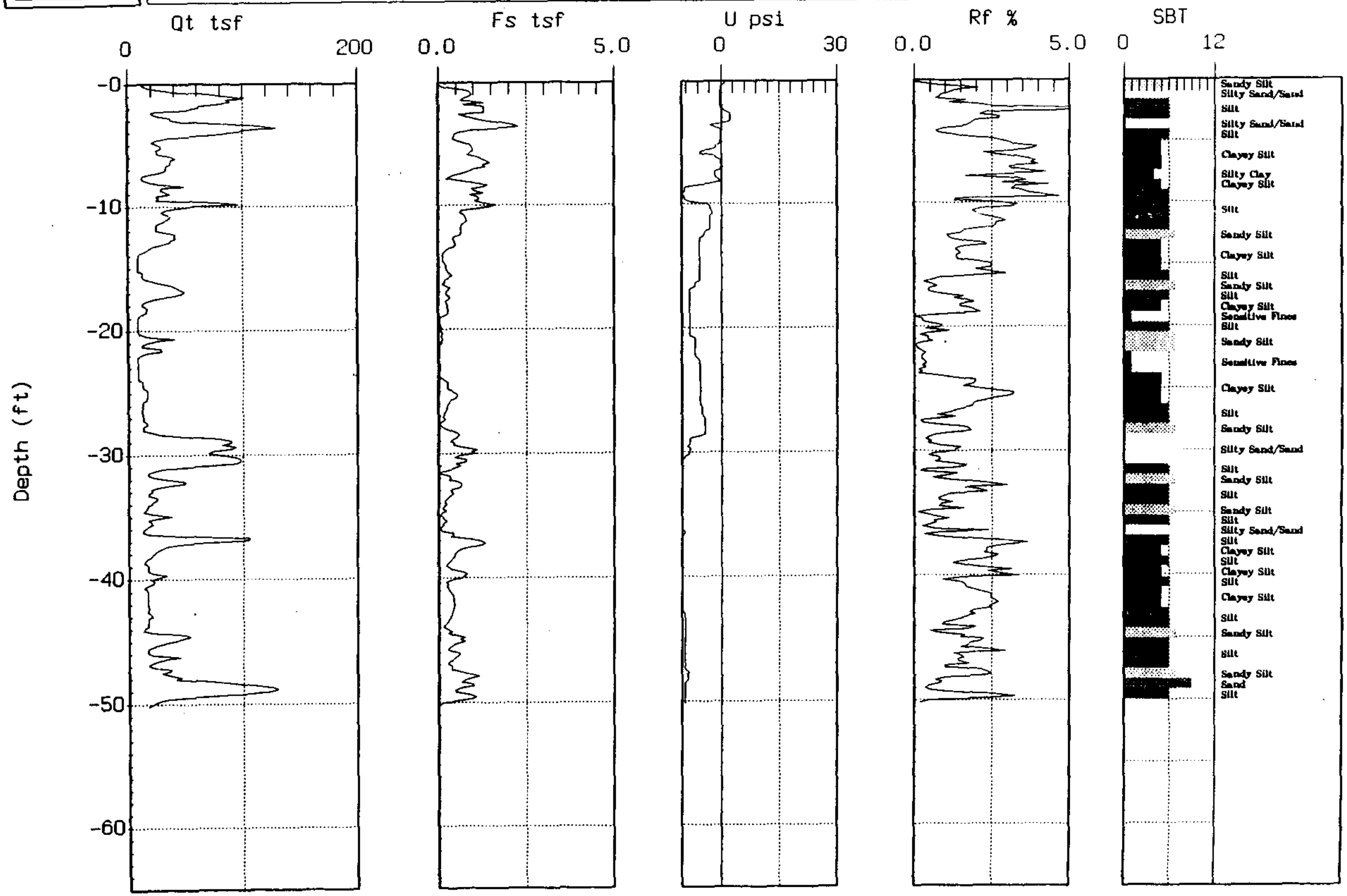
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-2

Engineer : S. KROLL
Date : 12:10:97 09:11



Max. Depth: 50.20 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

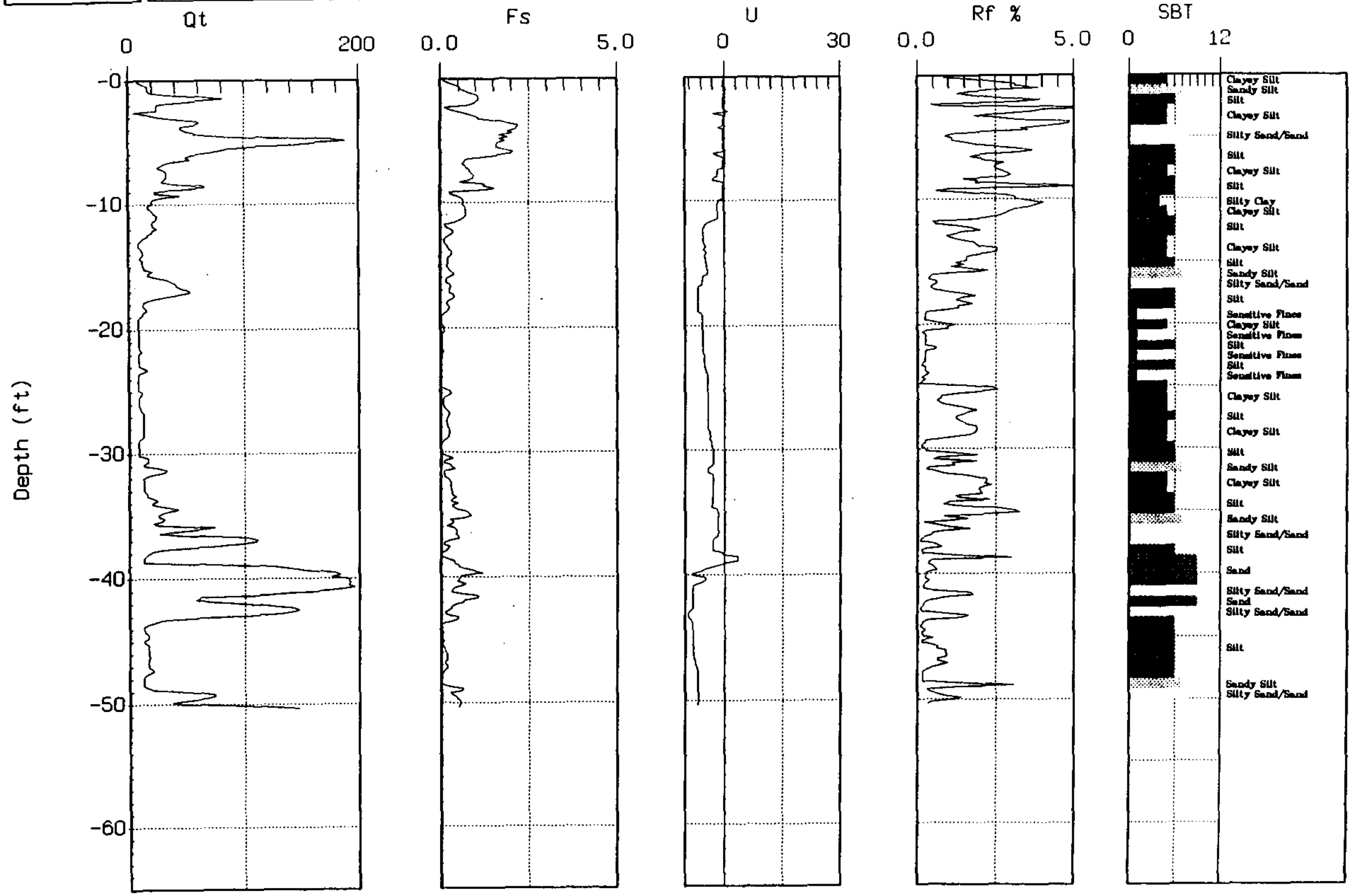
A-108

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-3

Engineer : S.KROLL
Date : 12:10:97 09:52



Max. Depth: 50.36 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

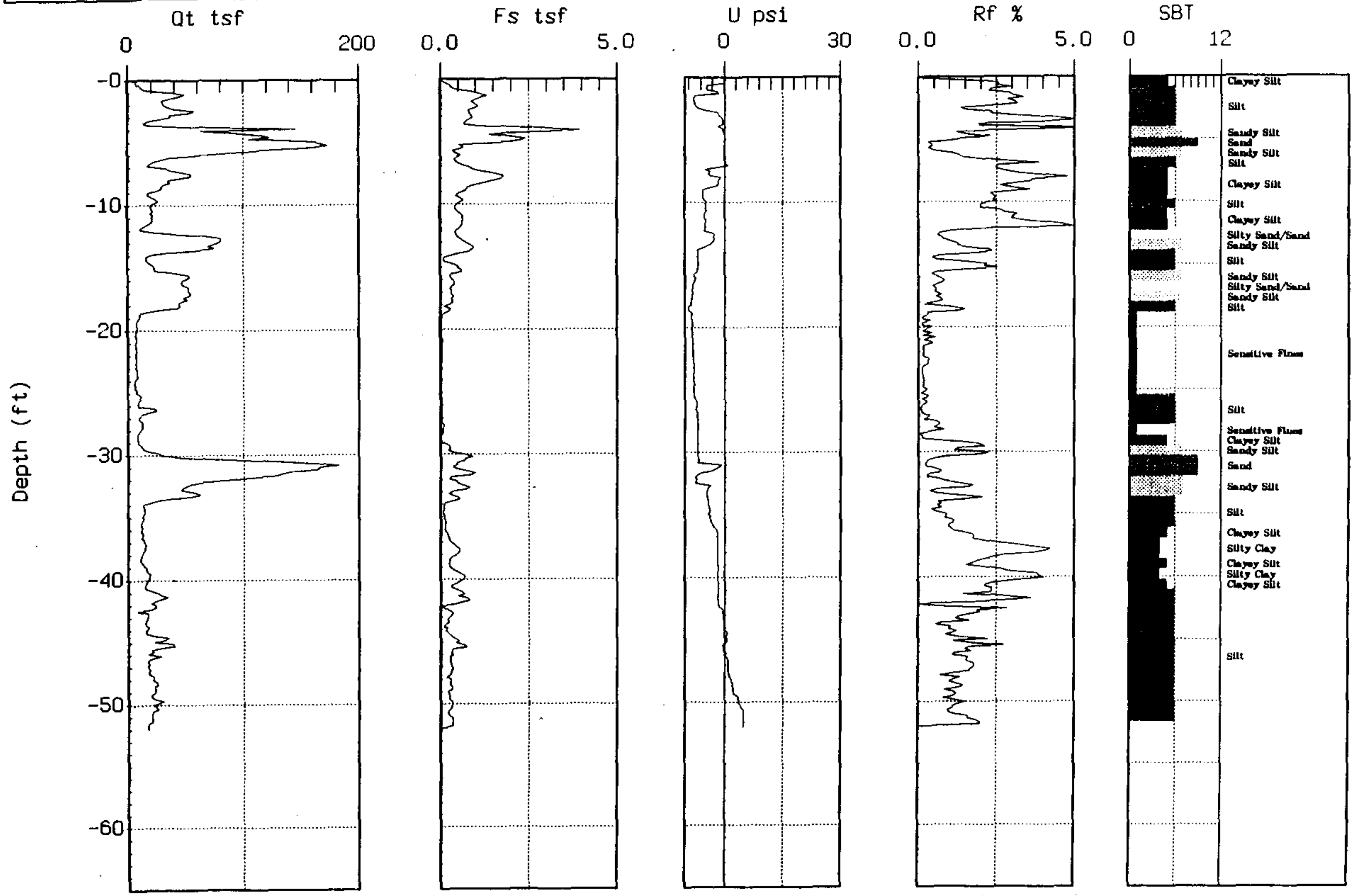
A-109

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-4

Engineer : S. KROLL
Date : 12:10:97 10:48



Max. Depth: 52.00 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

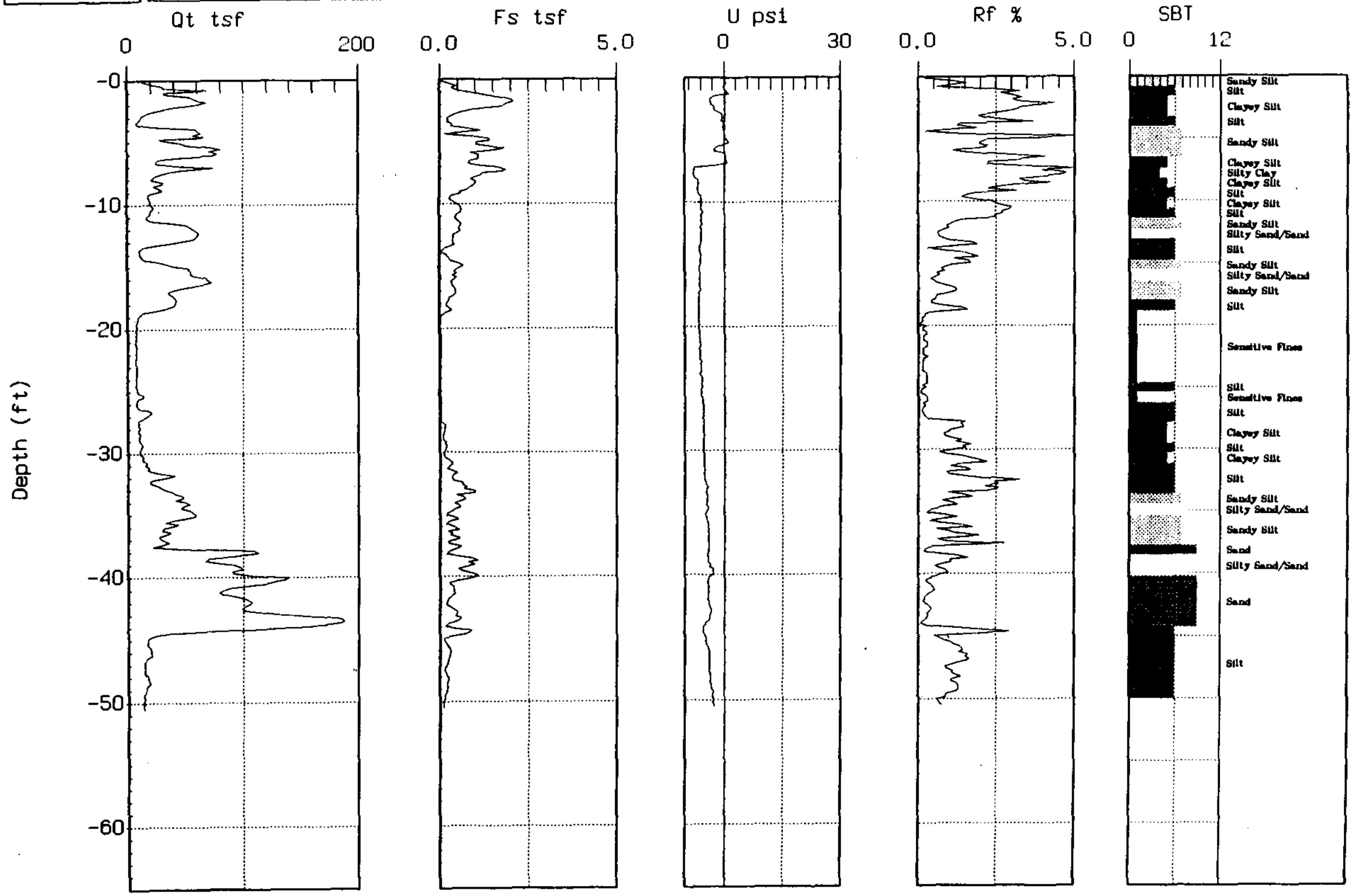
A-110

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-5

Engineer : S. KROLL
Date : 12:10:97 12:09



Max. Depth: 50.52 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

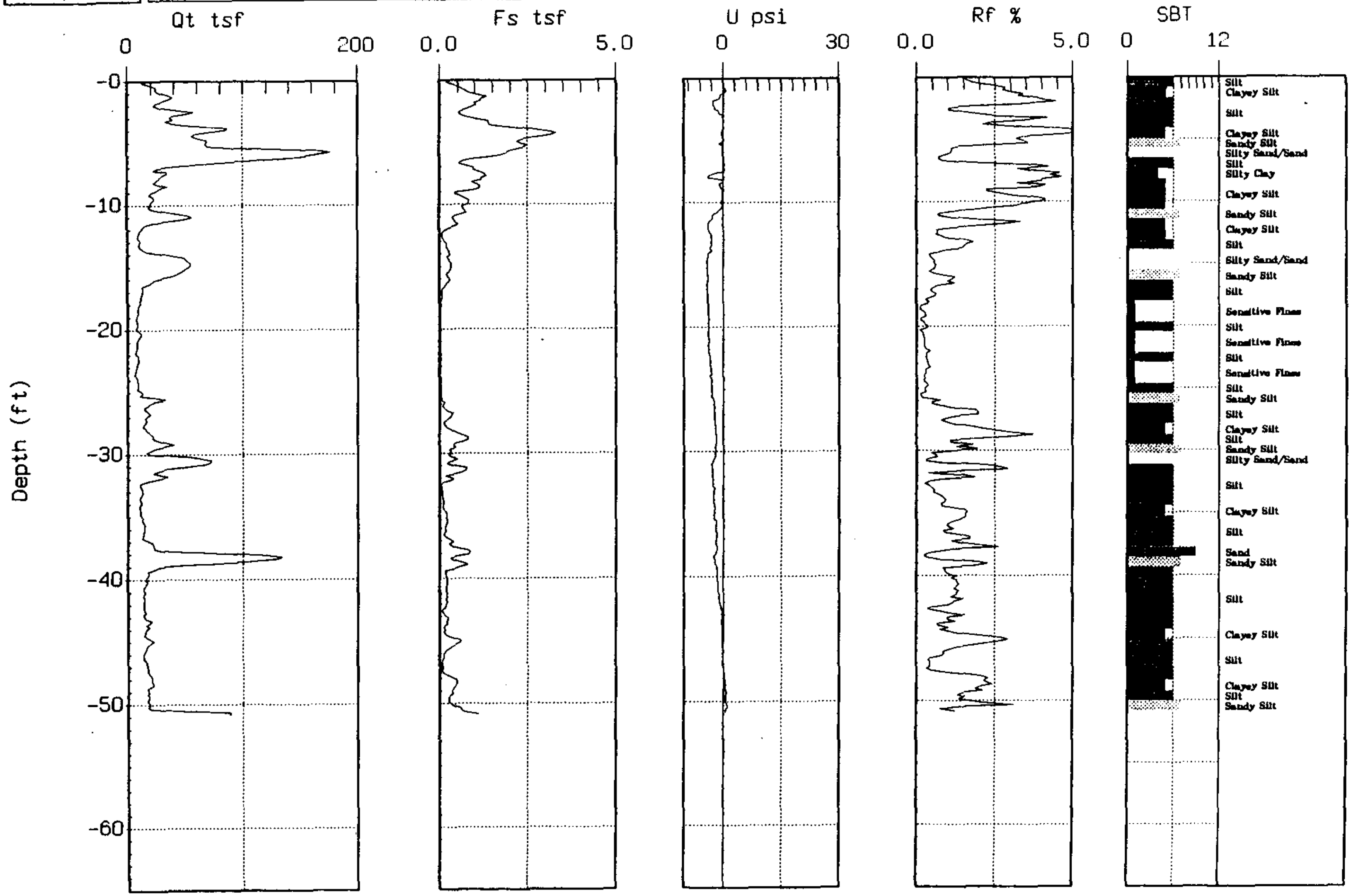
A-111

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-6

Engineer : S. KROLL
Date : 12:10:97 12:37



Max. Depth: 50.85 (ft)
Depth Inc.: 0.164 (ft)

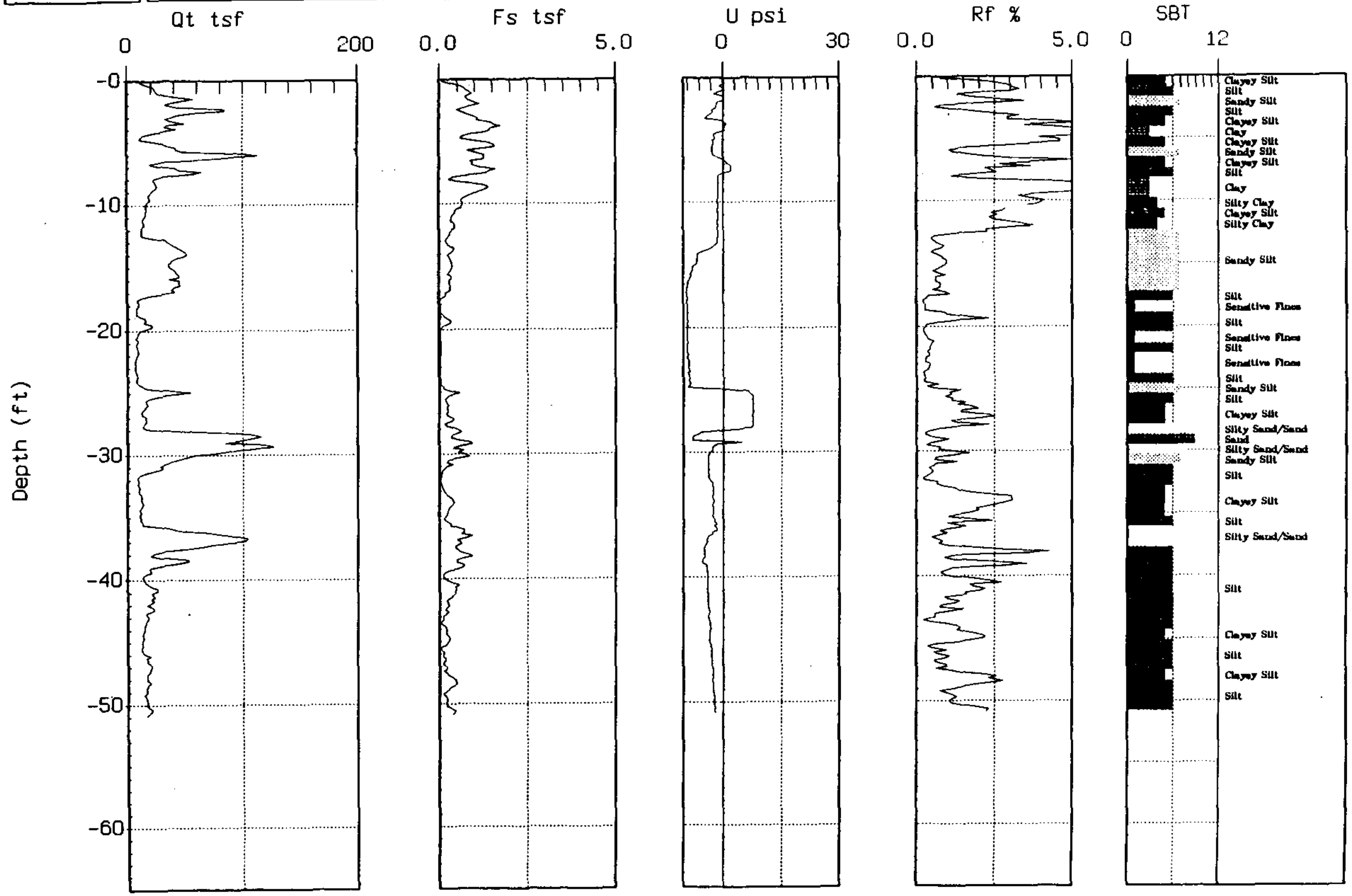
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-7

Engineer : S. KROLL
Date : 12:10:97 13:04



Max. Depth: 50.85 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

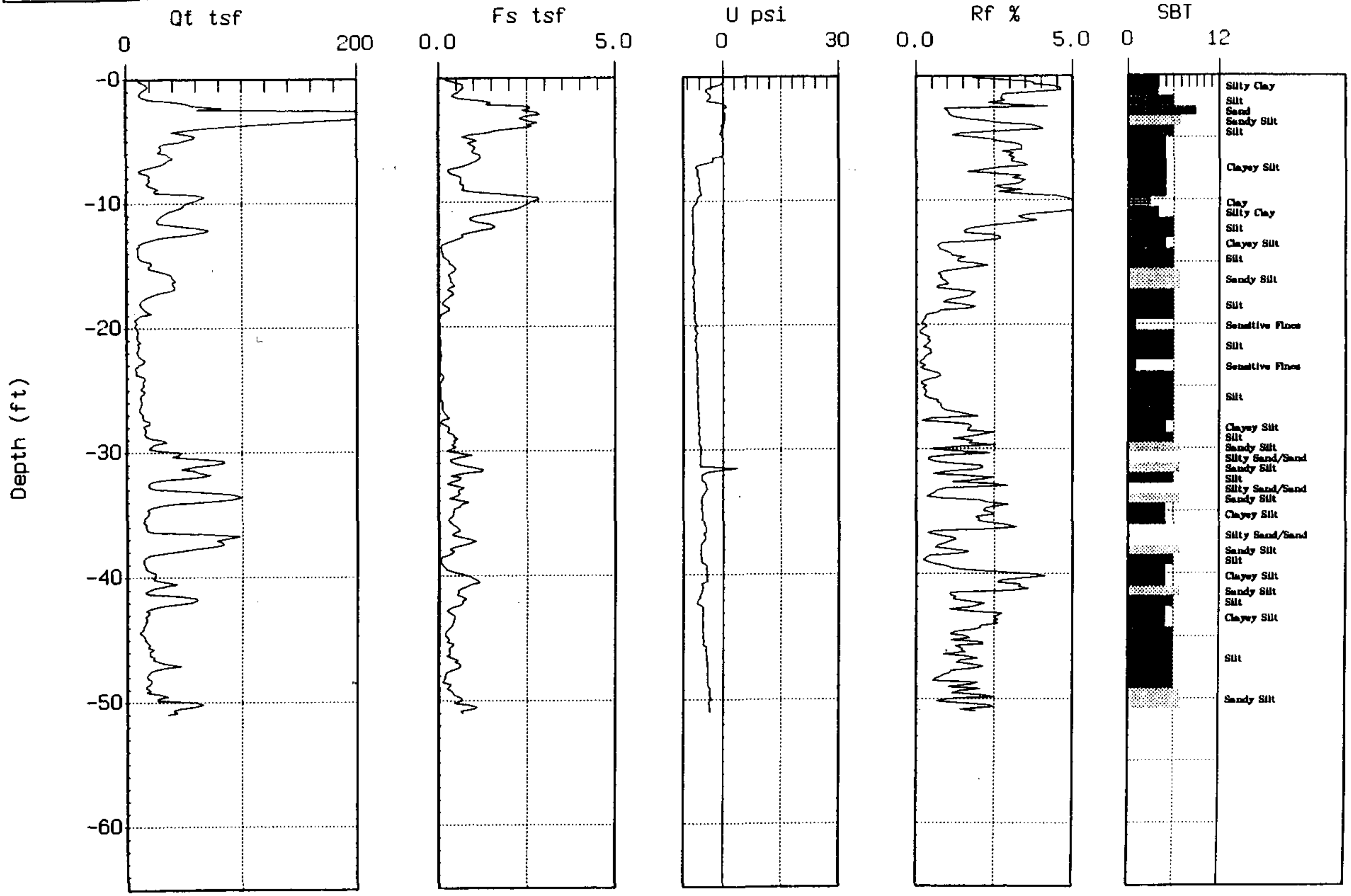
A-113

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-8

Engineer : S. KROLL
Date : 12:10:97 13:59



Max. Depth: 51.02 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

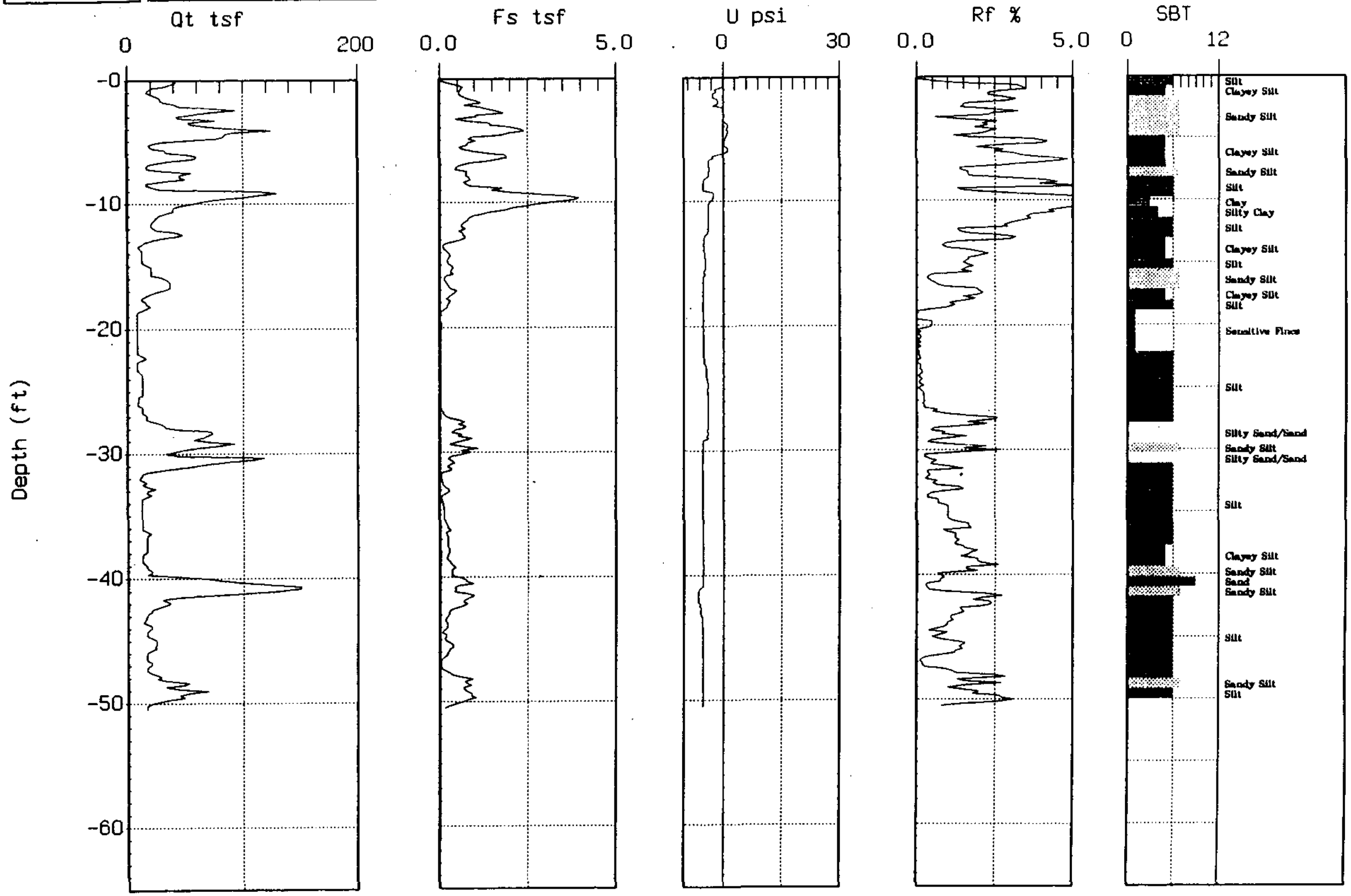
A-114

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-9

Engineer : S. KROLL
Date : 12:10:97 14:57



Max. Depth: 50.52 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

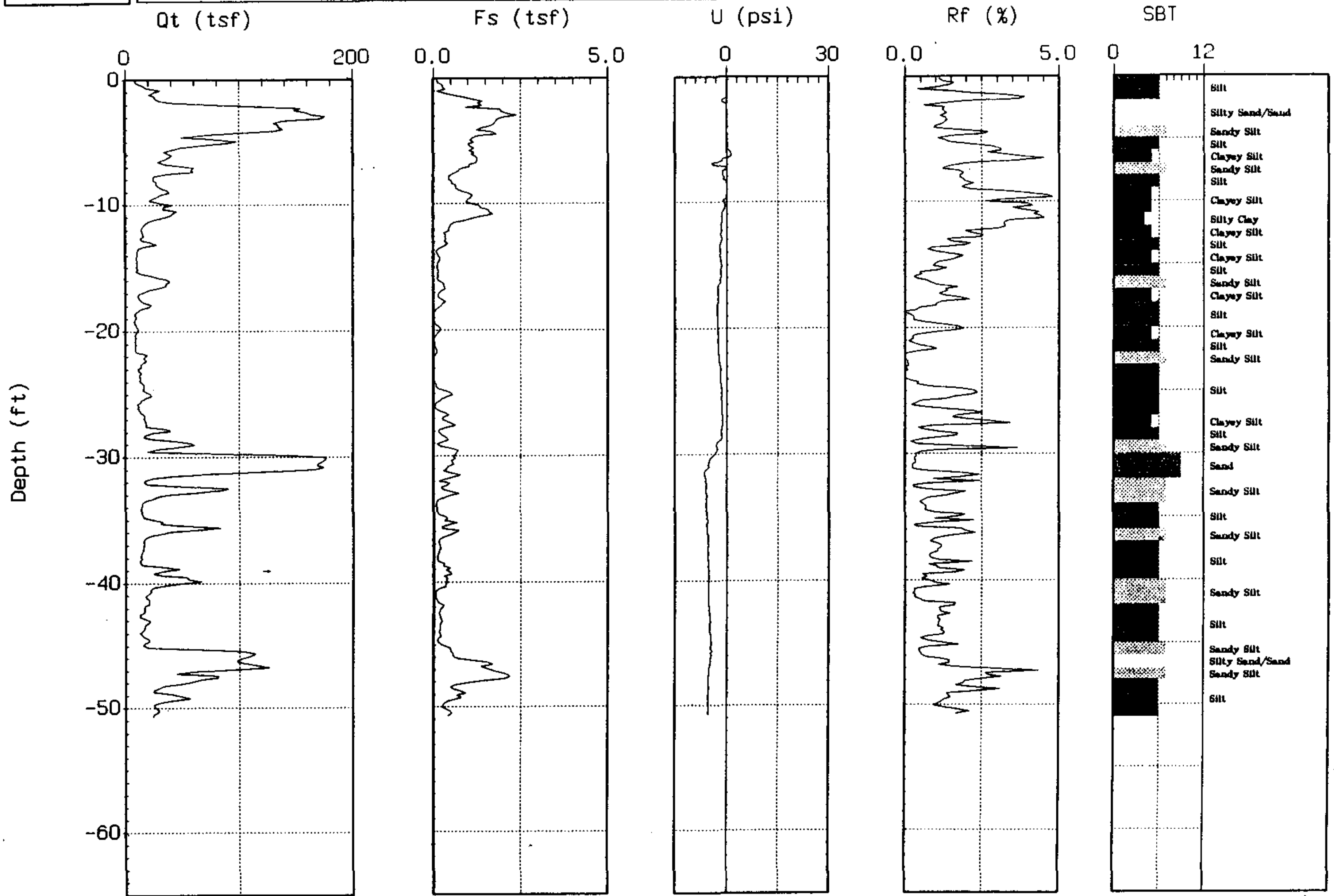
A-115

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-10

Engineer : S. KROLL
Date : 12:10:97 15:25



Max. Depth: 50.69 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

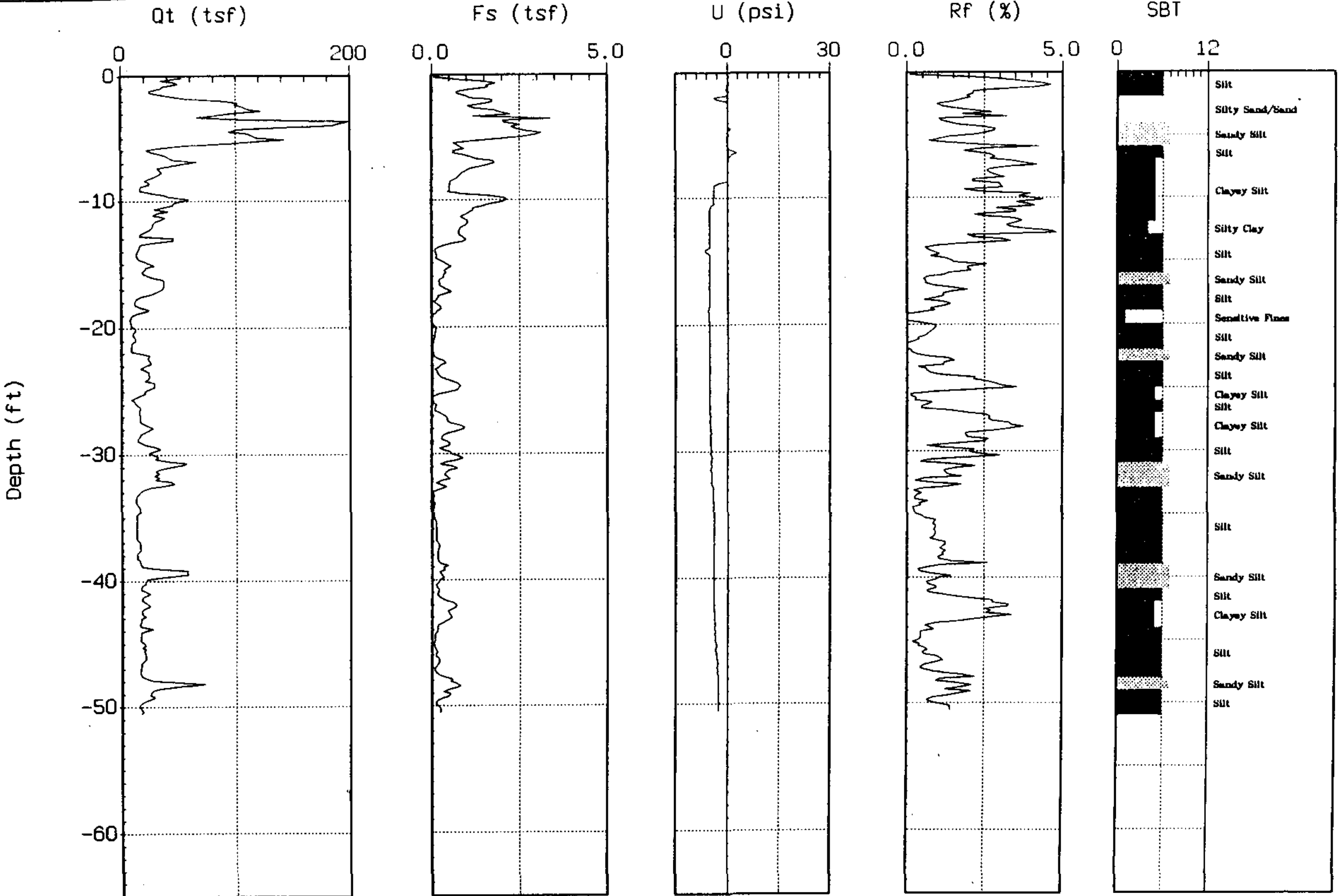
A-116

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-11

Engineer : S. KROLL
Date : 12:10:97 15:57



Max. Depth: 50.52 (ft)

Depth Inc.: 0.164 (ft)

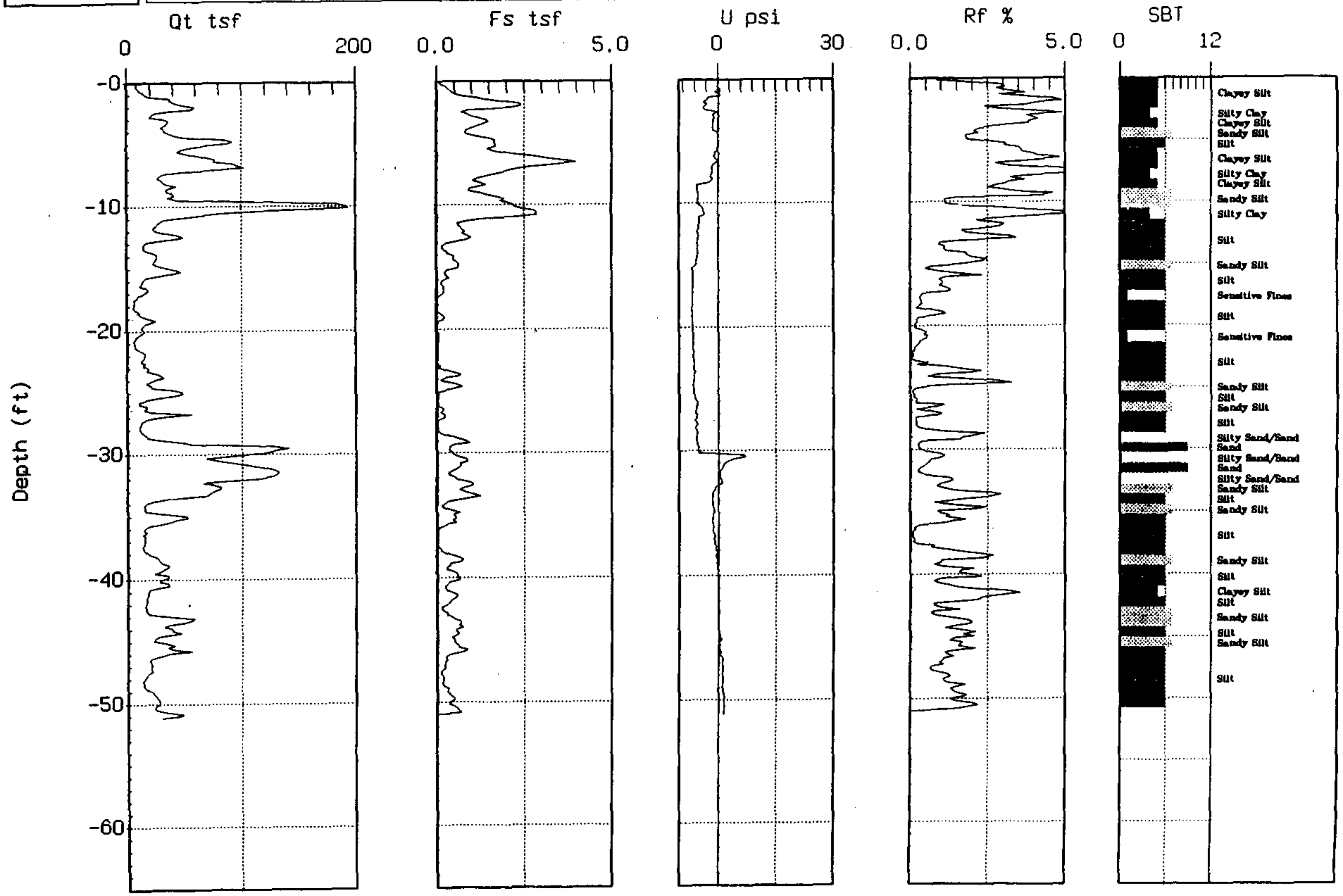
SBT: Soil Behavior Type (Robertson and Campanella 1988)

A-117

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-12

Engineer : S. KROLL
Date : 12:10:97 16:23



Max. Depth: 51.18 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

A-118

APPENDIX B
EXISTING LABORATORY DATA

APPENDIX B
EXISTING LABORATORY DATA (Group Delta, 2013)

APPENDIX B

EXISTING LABORATORY DATA

Laboratory testing was conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions and in the same locality. No warranty, express or implied, is made as to the correctness or serviceability of the test results, or the conclusions derived from these tests. Where a specific laboratory test method has been referenced, such as ASTM or Caltrans, the reference only applies to the specified laboratory test method, which has been used only as a guidance document for the general performance of the test and not as a "Test Standard". A brief description of the various tests performed for the previous investigations in the site vicinity follows (GDC, 1999, 2013).

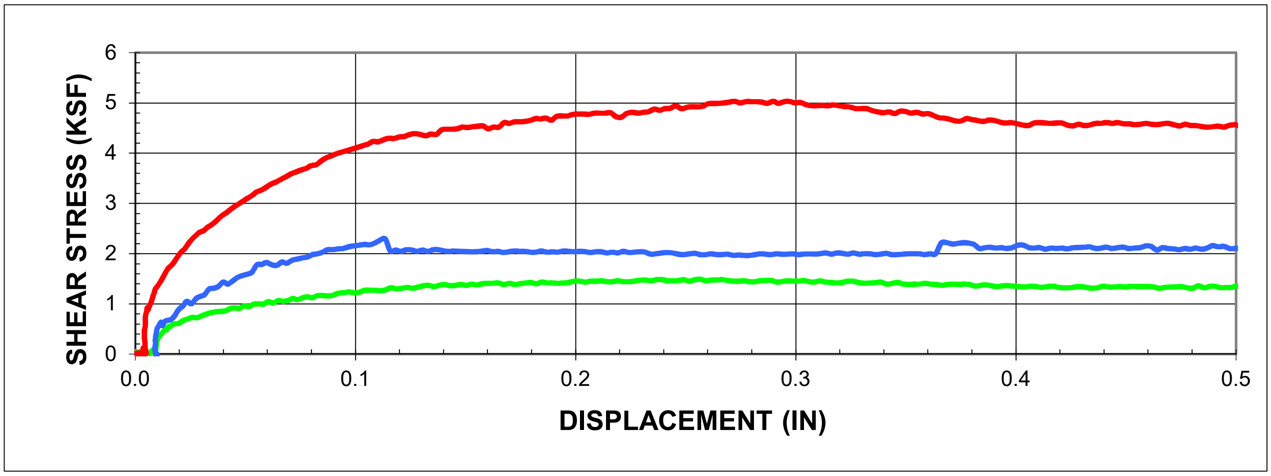
Classification: Soils were classified visually according to the Unified Soil Classification System as established by the American Society of Civil Engineers. Visual classification was supplemented by laboratory testing and classification using ASTM D2487. The soil classifications are summarized on the Boring Records in Appendix A.

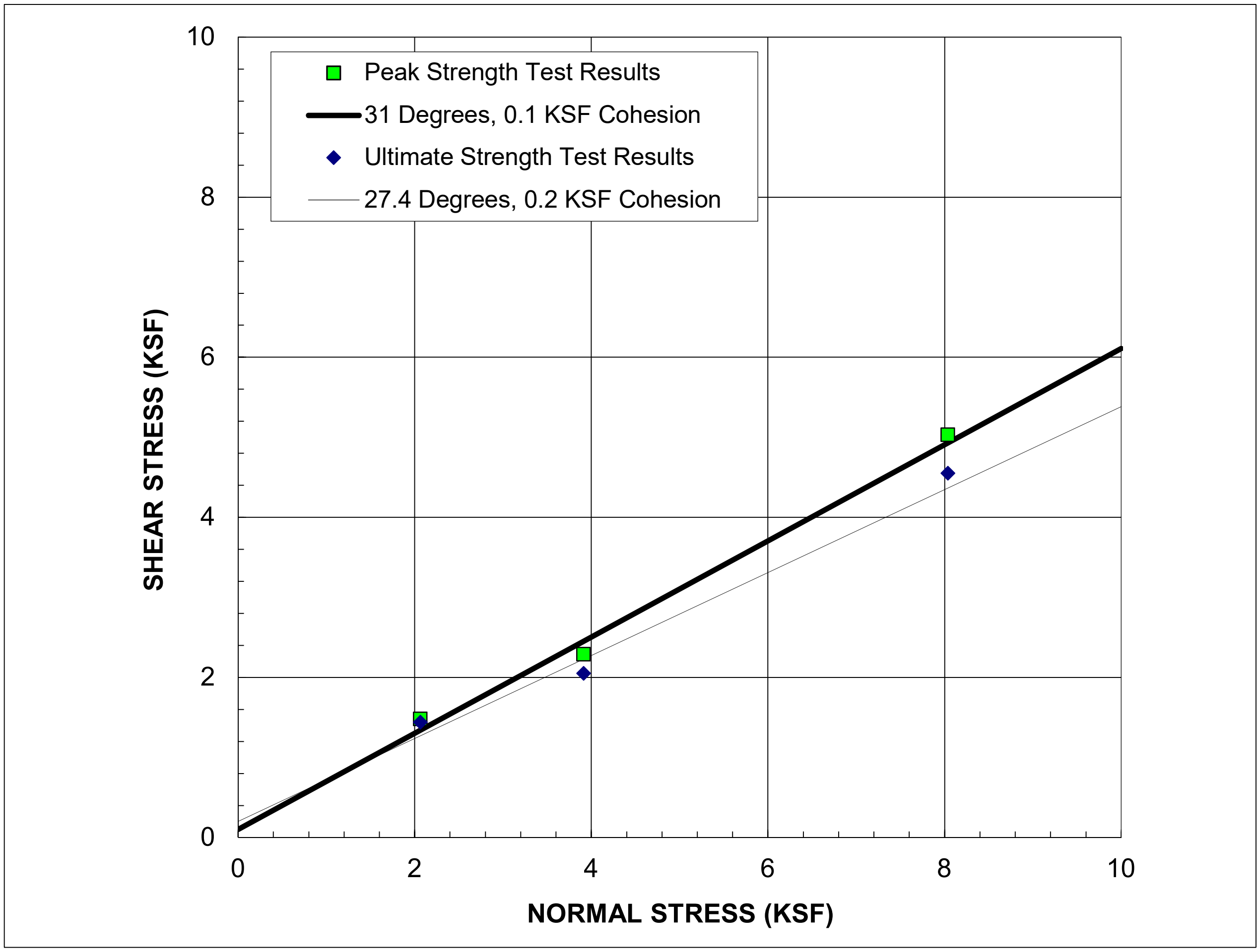
Particle Size Analysis: Particle size analyses were performed in general accordance with ASTM D422, and were used to supplement visual soil classifications. The test results are summarized on the Boring Records in Appendix A.

Atterberg Limits: ASTM D4318 was used to determine the liquid and plastic limits, and plasticity index of selected soil samples. The test results are shown on the Boring Records in Appendix A.

Direct Shear: The shear strengths of selected materials were assessed using direct shear testing conducted on relatively undisturbed soil samples in general accordance with ASTM D3080. The shear test results are shown in Figures B-1.1 through B-1.3.

Consolidation: The one-dimensional consolidation properties of selected samples were evaluated in general accordance with ASTM D2435. The samples were inundated with water under an 800 PSF load, and then subjected to controlled stress increments while restrained laterally and drained axially. The test results are presented in Figures B-2.1 through B-2.5.





SAMPLE: A-RW015 R5@20'

Description: Very Dark greenish Gray Silty Sand with Shells

	PEAK	ULTIMATE
ϕ'	31 °	27 °
c'	0.10 KSF	0.20 KSF

STRAIN RATE: 0.0050 IN/MIN

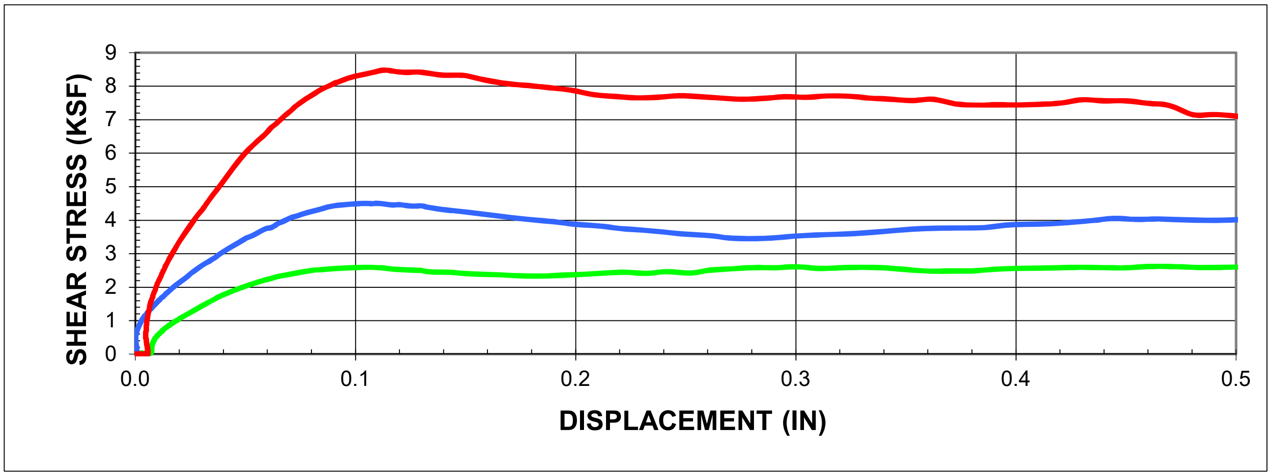
(Sample was consolidated and drained)

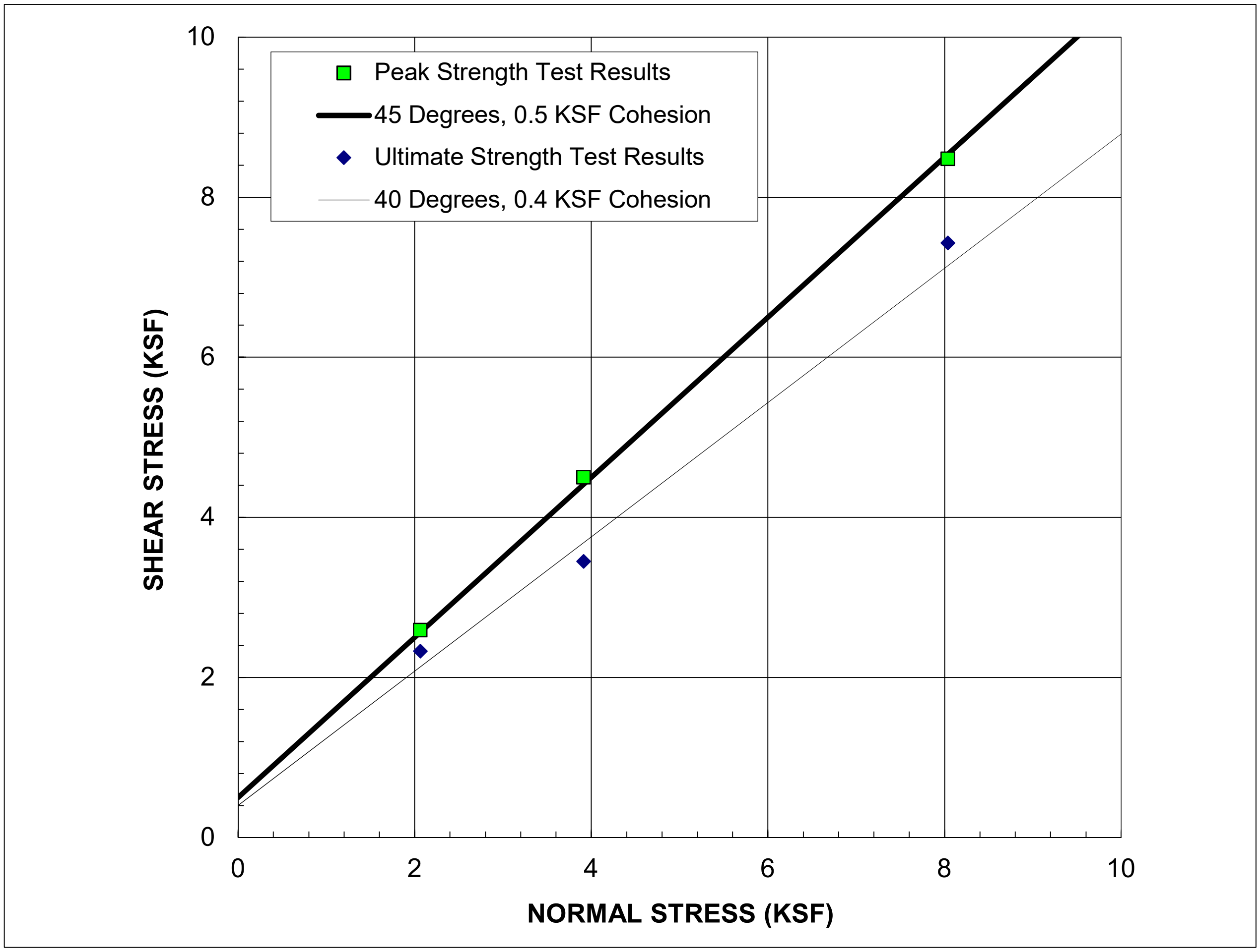
	IN-SITU	AS-TESTED
γ_d	79.8 PCF	79.8 PCF
w_c	17.5 %	17.8 %

GROUP DELTA

DIRECT SHEAR TEST RESULTS

Document No. 18-0018
Project No. LA1345
FIGURE B-1.1





SAMPLE: A-RW015 R8@32.5

Description: Very Dark Greenish Gray Coarse Sand

	PEAK	ULTIMATE
ϕ'	45 °	40 °
c'	0.50 KSF	0.40 KSF

STRAIN RATE: 0.0250 IN/MIN

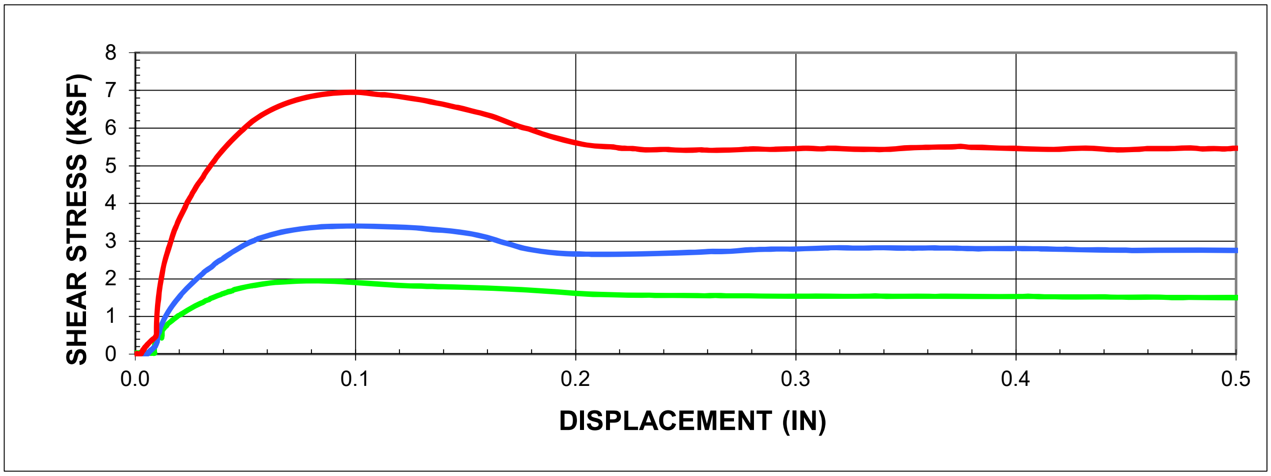
(Sample was consolidated and drained)

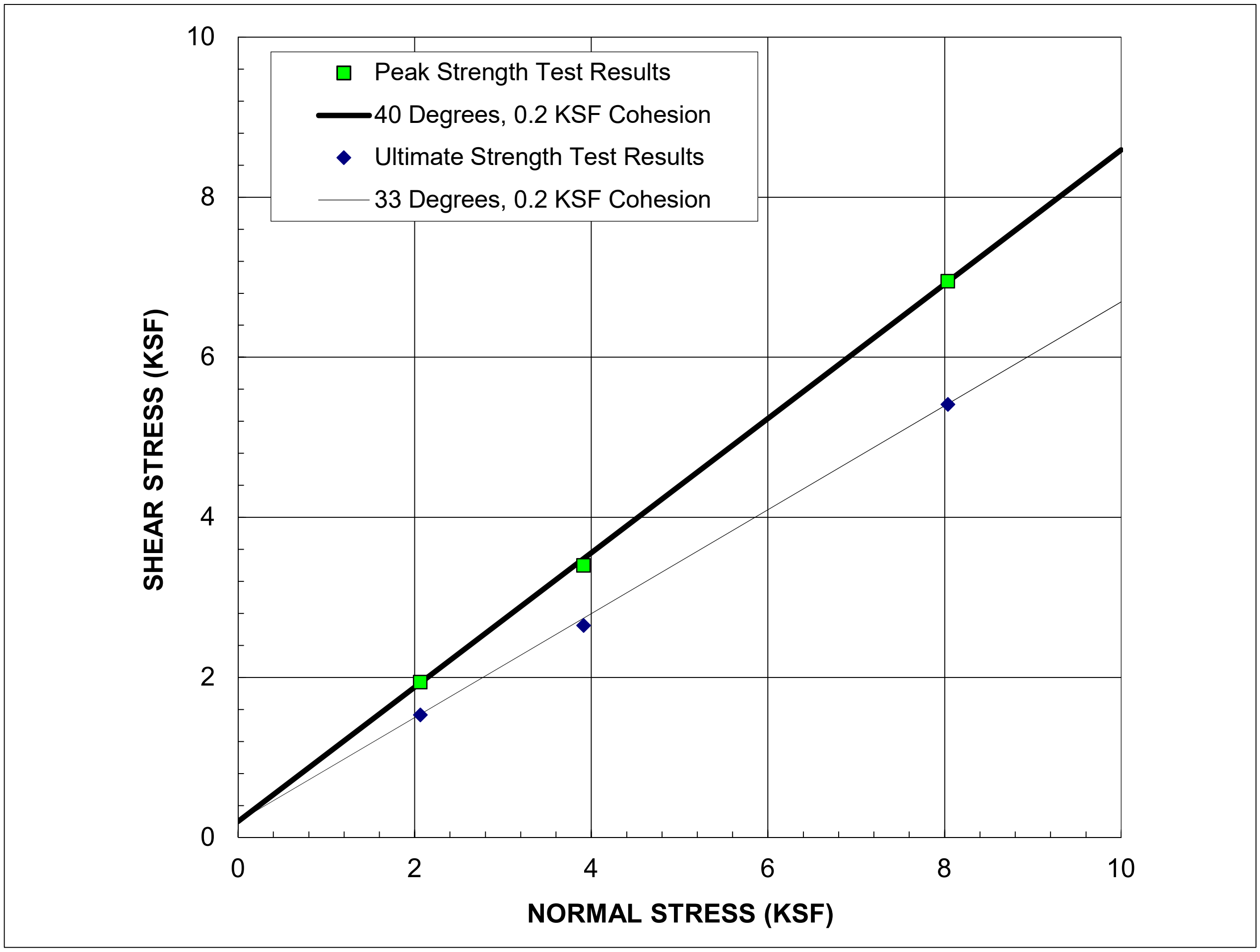
	IN-SITU	AS-TESTED
γ_d	112.5 PCF	112.5 PCF
w_c	20.8 %	19.1 %

GROUP DELTA

DIRECT SHEAR TEST RESULTS

Document No. 18-0018
Project No. LA1345
FIGURE B-1.2





SAMPLE: B-RW049 R9@40'

Description: Dark Greenish Gray Sand

	PEAK	ULTIMATE
ϕ'	40 °	33 °
c'	0.20 KSF	0.20 KSF

	IN-SITU	AS-TESTED
γ_d	102.6 PCF	102.6 PCF
w_c	20.0 %	23.0 %

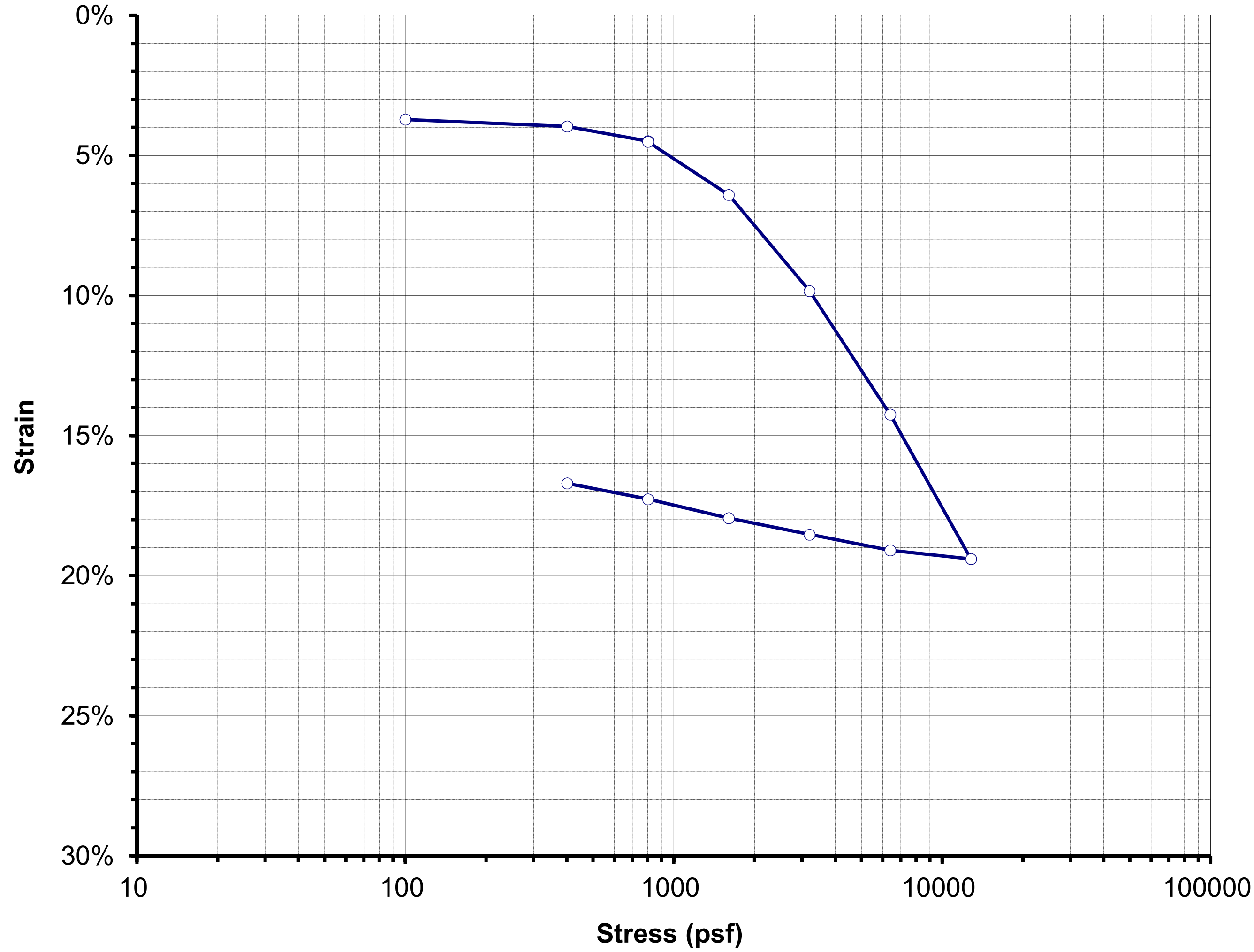
STRAIN RATE: 0.0250 IN/MIN

(Sample was consolidated and drained)

GROUP DELTA

DIRECT SHEAR TEST RESULTS

Document No. 18-0018
Project No. LA1345
FIGURE B-1.3



Boring No.	A-RW013	Sample Depth	15
Sample No.	R4	USCS	0

BEFORE TEST

Initial Moisture Content:	50.9%	
Initial Dry Unit Wt:	73.3	pcf
Initial Total Unit Wt.:	110.6	pcf
Initial Void Ratio:	1.3750	
Initial Degree of Saturation:	103.3%	

AFTER TEST

Final Moisture Content:	38.6%	
Final Dry Unit Wt:	86.7	pcf
Final Total Unit Wt.:	123.5	pcf
Final Void Ratio:	1.0076	
Final Degree of Saturation:	106.9%	

Water Added at: 800 psf

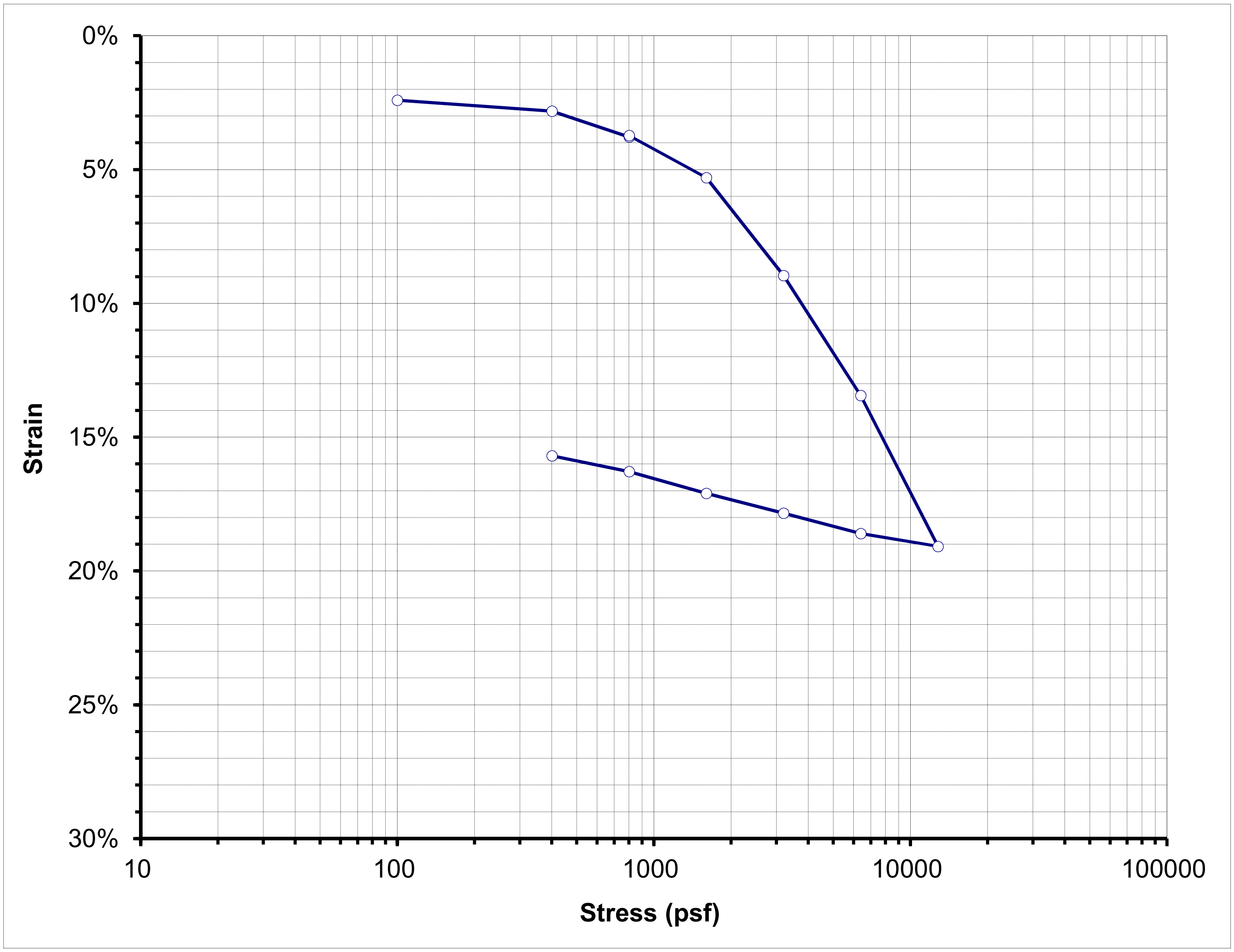
ATTERBERG LIMITS					
LL=		PL=		PI=	

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
100	3.71%	1.2868
400	3.97%	1.2807
800	4.49%	1.2684
800	4.51%	1.2679
1600	6.41%	1.2228
3200	9.84%	1.1414
6400	14.24%	1.0367
12800	19.41%	0.9141
6400	19.09%	0.9216
3200	18.53%	0.9349
1600	17.95%	0.9487
800	17.27%	0.9650
400	16.70%	0.9783

GROUP DELTA

CONSOLIDATION RESULTS

Document No. 18-0018
Project No. LA1345
FIGURE B-2.1



Boring No.	B-RW049	**Sample Depth**	15
Sample No.	R4A	**USCS**	0

BEFORE TEST

Initial Moisture Content:	72.7%	
Initial Dry Unit Wt:	56.2	pcf
Initial Total Unit Wt.:	97.1	pcf
Initial Void Ratio:	2.0975	
Initial Degree of Saturation:	96.7%	

AFTER TEST

Final Moisture Content:	59.5%	
Final Dry Unit Wt:	65.9	pcf
Final Total Unit Wt.:	120.1	pcf
Final Void Ratio:	1.6422	
Final Degree of Saturation:	101.0%	

Water Added at: 800 psf

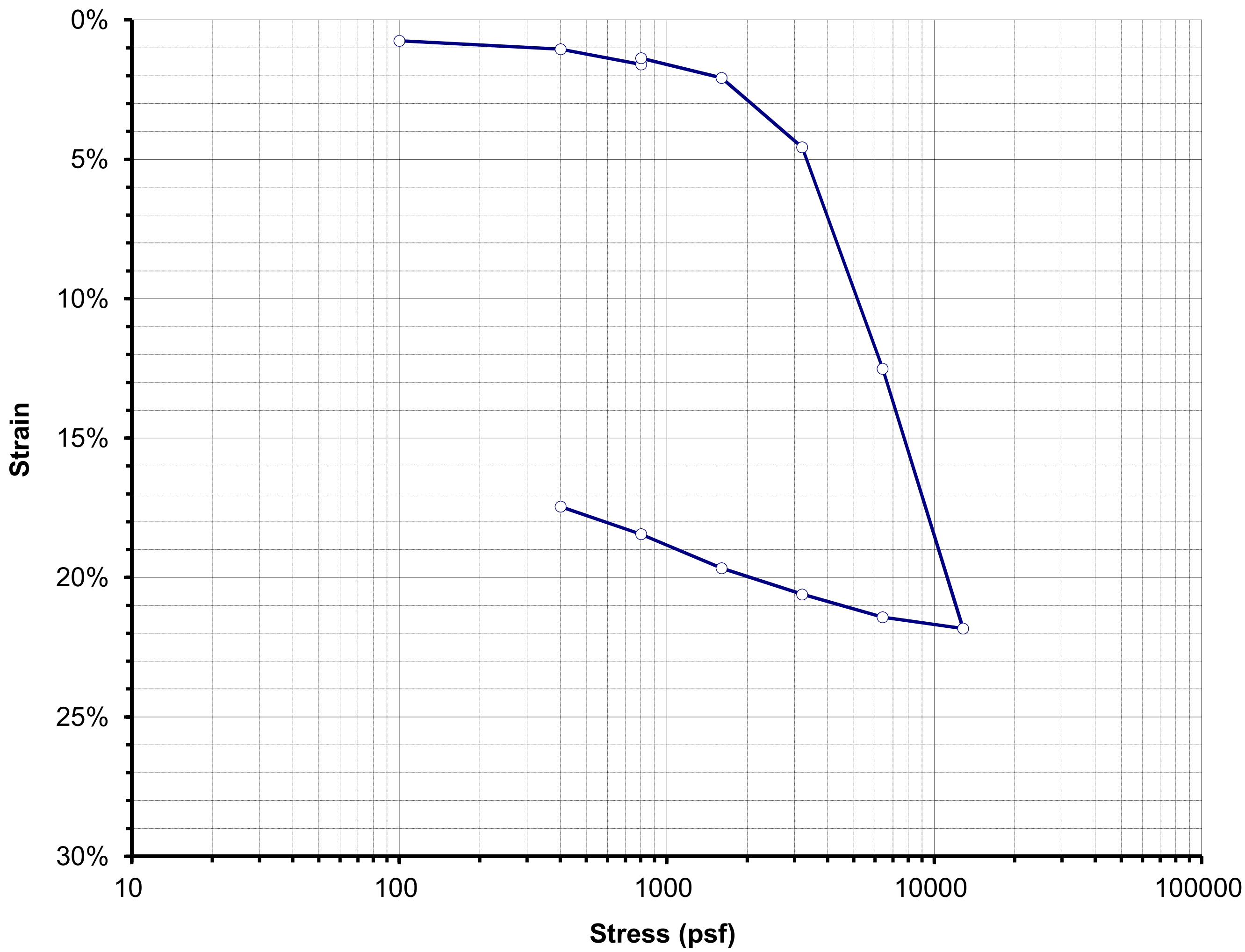
ATTERBERG LIMITS					
LL=		**PL=**		**PI=**	

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
100	2.40%	2.0230
400	2.82%	2.0103
800	3.78%	1.9805
800	3.73%	1.9820
1600	5.30%	1.9333
3200	8.96%	1.8200
6400	13.45%	1.6810
12800	19.08%	1.5065
6400	18.60%	1.5214
3200	17.84%	1.5450
1600	17.10%	1.5677
800	16.28%	1.5931
400	15.69%	1.6114

GROUP DELTA

CONSOLIDATION RESULTS

Document No. 18-0018
Project No. LA1345
FIGURE B-2.2



Boring No.	B-RW049	**Sample Depth**	25 ft
Sample No.	R6A	**USCS**	0

BEFORE TEST

Initial Moisture Content:	64.3%	
Initial Dry Unit Wt:	60.4	pcf
Initial Total Unit Wt.:	99.2	pcf
Initial Void Ratio:	1.8822	
Initial Degree of Saturation:	95.2%	

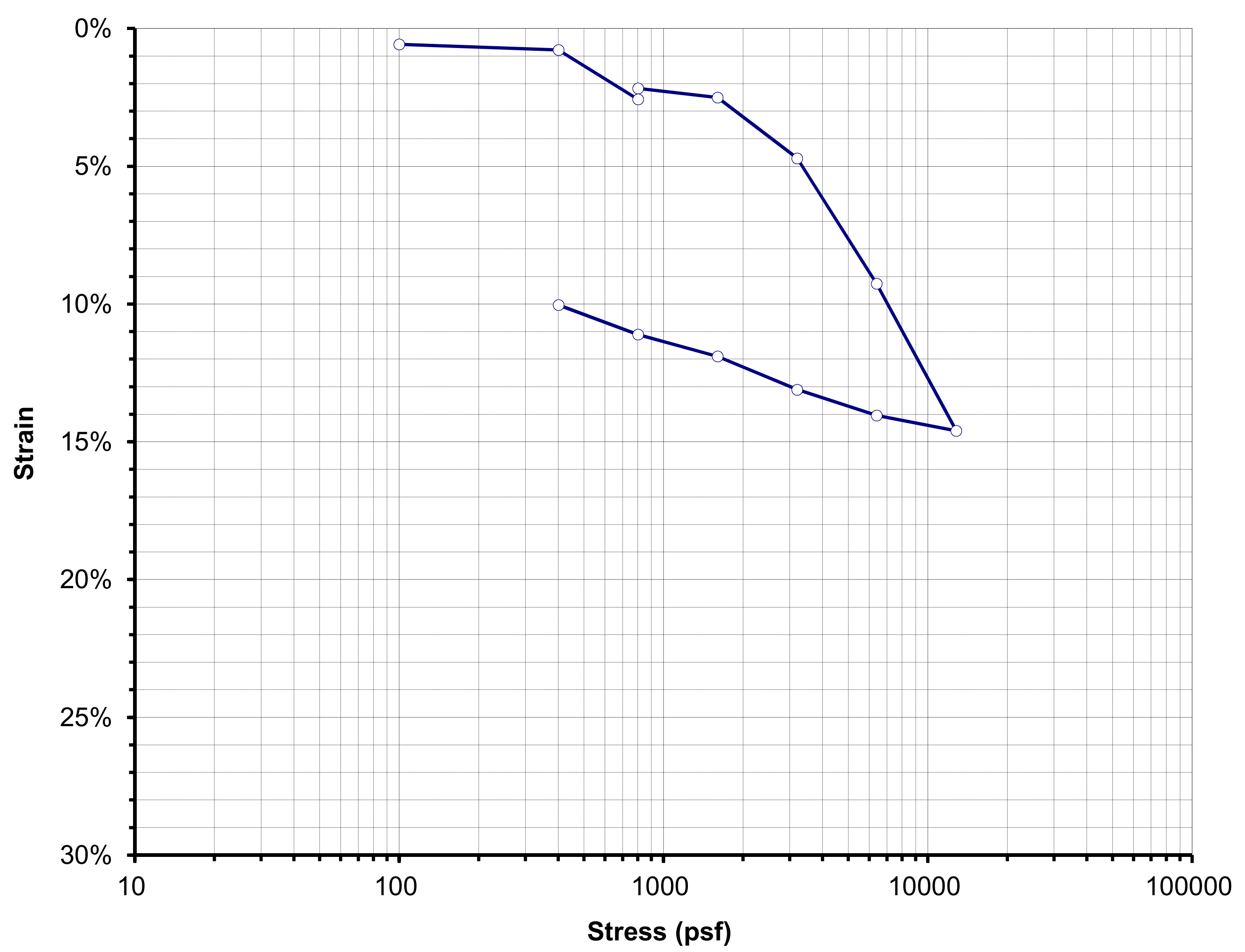
AFTER TEST

Final Moisture Content:	50.8%	
Final Dry Unit Wt:	72.4	pcf
Final Total Unit Wt.:	122.8	pcf
Final Void Ratio:	1.4048	
Final Degree of Saturation:	100.8%	

Water Added at: 800 psf

ATTERBERG LIMITS					
LL=		**PL=**		**PI=**	

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
100	0.75%	1.8605
400	1.05%	1.8518
800	1.59%	1.8362
800	1.37%	1.8426
1600	2.07%	1.8224
3200	4.57%	1.7505
6400	12.51%	1.5217
12800	21.82%	1.2532
6400	21.42%	1.2647
3200	20.60%	1.2884
1600	19.66%	1.3155
800	18.44%	1.3508
400	17.45%	1.3791



Boring No.	B-HSA051	Sample Depth	5 ft
Sample No.	R3	USCS	0

BEFORE TEST

Initial Moisture Content:	45.1%	
Initial Dry Unit Wt:	75.7	pcf
Initial Total Unit Wt.:	109.9	pcf
Initial Void Ratio:	1.2998	
Initial Degree of Saturation:	96.9%	

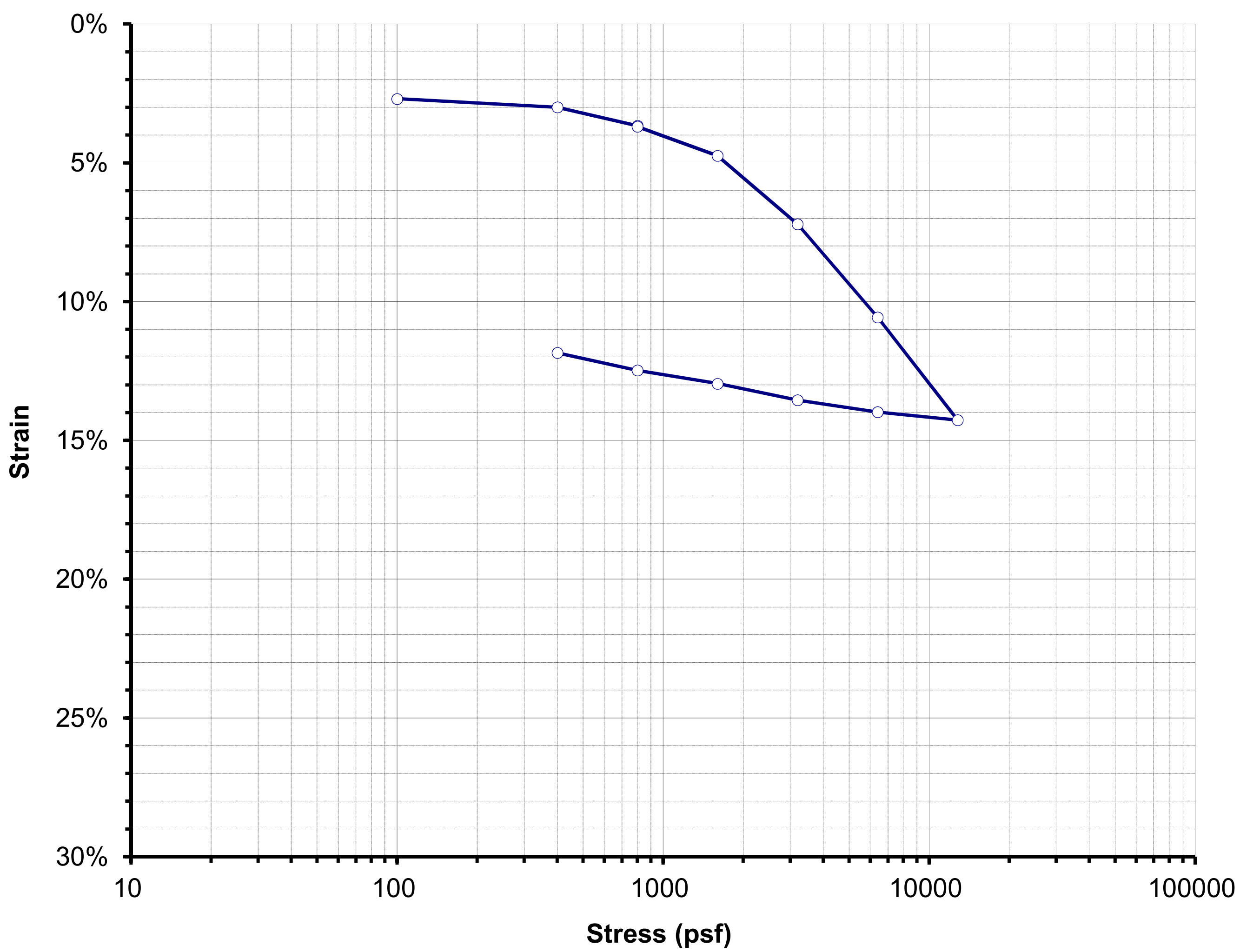
AFTER TEST

Final Moisture Content:	40.9%	
Final Dry Unit Wt:	82.5	pcf
Final Total Unit Wt.:	111.6	pcf
Final Void Ratio:	1.1111	
Final Degree of Saturation:	102.6%	

Water Added at: 800 psf

ATTERBERG LIMITS					
LL=		PL=		PI=	

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
100	0.57%	1.2867
400	0.78%	1.2819
800	2.58%	1.2406
800	2.17%	1.2498
1600	2.51%	1.2422
3200	4.71%	1.1915
6400	9.26%	1.0869
12800	14.60%	0.9641
6400	14.05%	0.9768
3200	13.11%	0.9984
1600	11.90%	1.0261
800	11.10%	1.0445
400	10.03%	1.0692



Boring No.	B-HSA051	Sample Depth	10 ft
Sample No.	R5	USCS	0

BEFORE TEST

Initial Moisture Content:	43.6%	
Initial Dry Unit Wt:	77.5	pcf
Initial Total Unit Wt.:	111.3	pcf
Initial Void Ratio:	1.2466	
Initial Degree of Saturation:	97.5%	

AFTER TEST

Final Moisture Content:	36.8%	
Final Dry Unit Wt:	86.3	pcf
Final Total Unit Wt.:	114.5	pcf
Final Void Ratio:	1.0165	
Final Degree of Saturation:	100.9%	

Water Added at: 800 psf

ATTERBERG LIMITS					
LL=		PL=		PI=	

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
100	2.69%	1.1861
400	2.99%	1.1793
800	3.67%	1.1642
800	3.70%	1.1635
1600	4.74%	1.1401
3200	7.22%	1.0845
6400	10.57%	1.0091
12800	14.27%	0.9260
6400	13.98%	0.9326
3200	13.55%	0.9423
1600	12.95%	0.9556
800	12.48%	0.9662
400	11.85%	0.9804

APPENDIX B
EXISTING LABORATORY DATA (Group Delta, 1999)

APPENDIX D
GDC LABORATORY TESTING

D.1 Introduction

Relatively undisturbed Standard Penetration Test (SPT) samples and Shelby tube samples were collected and carefully sealed in the field to prevent moisture loss. All the samples were then transported to our in-house geotechnical laboratory for examination and testing. Tests were performed on selected samples as an aid in classifying the soils, and to evaluate their physical properties and engineering characteristics that may be present in the soil samples. Details of the laboratory testing program and test results are discussed in the following sections. All tests were performed in general accordance with appropriate American Society for Testing and Materials (ASTM) Test Methods. Brief descriptions of the laboratory testing program and test results are presented below.

D.2 Soil Classification

The subsurface materials were classified using the Unified Soil Classification System, in accordance with ASTM Test Methods D2487-85 and D2488-84. The soil classifications are presented on the boring logs in Appendix C.

D.3 Moisture Content

Moisture content was determined for selected samples. The samples were dried in accordance with ASTM D2937. After drying, the weight of each sample was measured and moisture content was calculated. Moisture content values are summarized in Table D-1 and presented on the boring logs in Appendix C.

D.4 Grain Size Distribution and Fines Content

Representative samples were dried, weighed, soaked in water until individual soil particles were separated, and then washed on the No. 200 sieve. The portion of the material retained on the No. 200 sieve was oven-dried and then run through a standard set of sieves in accordance with ASTM D422. In addition, silt and clay content was evaluated by performance of hydrometer tests on selected samples. The results of grain size distribution tests performed are summarized in Table D-1 and graphically shown in Figure D-1. The percentage of fines (i.e., soil passing #200 sieve) is an important factor for evaluating the liquefaction potential of sandy soils.

D.5 Atterberg Limits Tests

Liquid and plastic limits were determined for selected samples showing plasticity properties in accordance with ASTM D4318. The test results are summarized in Figures D-2 through D-4.

D.6 Direct Shear Tests

To determine the shear strength parameters of the on-site soils, direct shear tests were performed on selected undisturbed drive samples in accordance with ASTM D 3080. After the initial weight and volume measurements were made, the sample was placed in a calibrated shear machine and a selected normal load was applied. The samples were submerged, allowed to consolidate, and then were sheared to failure. Shear stress and sample deformation were monitored throughout the test. The process was repeated under two additional normal loads. The test results are summarized in Table D-3 and graphically presented in Figure D-5.

D.7 Consolidation Tests

One dimensional tests were performed on disturbed samples in accordance with ASTM D 2435-90. The tests were performed on 1-inch high samples having a diameter of 2.42 inches. After trimming the ends, the sample was placed in the consolidometer and initial reading was recorded. The sample was saturated under loading and thereafter; the sample was incrementally loaded to 16 ksf. The results of the consolidation tests are shown graphically in Figures D-6 to D-14. In addition, time rates for selected consolidation tests were performed and are presented in Figures D-15 through D-19

D.8 Resistance Value Test

A resistance or R-Value test was performed on a selected bulk sample of subgrade soils. The result of the R-Value test is presented in Table D-2.

D.9 Corrosivity Tests

Corrosivity tests were performed on selected samples. Corrosivity testing included analyses for minimum resistivity, pH, electrical conductivity, and chemical analyses such as chlorides and sulfates. The results of the tests are presented in Table D-3.

D.10 List of Attached Tables and Figures

The following figures are attached and complete this appendix:

TABLE D-1
SUMMARY OF MOISTURE CONTENT AND GRAIN SIZE DISTRIBUTION

Boring No.	Sample Depth (ft)	USCS Soil Type	Blow Counts per ft	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)
B-302R	5.0	SM	4	27.4	--	--	--	--
B-302R	10.0	SM	5	31.8	86.2	--	--	--
B-302R	15.0	CH	2	48.5	--	--	--	--
B-302R	20.0	CH	5	32.3	91.0	--	--	--
B-302R	25.0	ML	1	56.4	--	--	--	56
B-302R	30.0	CL	5	27.1	98.1	--	--	--
B-302R	35.0	ML	15	18.8	--	--	--	62
B-302R	40.0	CL	8	41.7	82.6	--	--	--
B-302R	45.0	ML	8	43.9	--	--	--	--
B-302R	55.0	CL	14	48.2	--	--	--	--
B-302R	60.0	SP	22	25.8	--	--	--	--
B-302R	65.0	SP	73	9.2	--	--	--	--
B-304H	0.0	SM	--	9.8	--	--	--	--
B-304H	5.0	SC	20	18.7	98.0	--	--	--
B-304H	10.0	CL	71	11.5	95.4	--	--	--
B-304H	15.0	ML	15	30.9	90.1	--	--	64
B-304H	20.0	CH	10	37.2	76.4	--	--	--
B-305H	0.0	SM	--	9.0	--	--	--	--
B-305H	5.0	CL	20	18.6	109.0	--	--	--
B-305H	10.0	CL	20	15.2	--	--	--	--
B-305H	15.0	SM	10	34.9	87.6	--	--	--
B-305H	20.0	CH	6	65.1	58.4	--	--	--
B-305H	25.0	CH	11	22.4	100.4	--	--	--
B-306R	5.0	SC/SM	73/11"	16.8	112.1	--	--	--
B-306R	15.0	CL	33	40.8	--	--	--	--
B-306R	20.	CH	18	55.9	63.9	--	--	--
B-306R	32.0	SP	84	10.6	129.1	34	52	14
B-306R	35.0	CL	19	32.7	--	--	--	--
B-306R	45.0	CL	68	37.6	--	--	--	--
B-306R	50.0	CH	66	41.1	--	--	--	--
B-307R	5.0	CL	12	16.2	--	--	--	--
B-307R	12.0	CL	26	40.0	81.5	--	--	--
B-307R	20.0	CH/OH	6	82.0	51.3	--	--	71
B-307R	25.0	CH/OH	16	23.5	--	--	--	65
B-307R	30.0	ML	49	29.5	94.8	--	--	--
B-307R	35.0	CL/SP	59	28.2	--	--	--	--
B-307R	40.0	CL	22	36.9	--	--	--	--
B-307R	45.0	CL	25	33.6	--	--	--	--
B-307R	50.0	SP/CL	39	22.8	--	--	--	--
B-307R	55.0	ML	112/5"	28.6	--	--	--	--
B-307R	60.0	SP	120	21.0	--	--	--	--

TABLE D-1 (continued)
SUMMARY OF MOISTURE CONTENT AND GRAIN SIZE DISTRIBUTION

Boring No.	Sample Depth (ft)	USCS Soil Type	Blow Counts per ft	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)
B-309R	5.0	SC	26	18.4	--	--	--	--
B-309R	10.0	SC	23	27.5	91.0	--	--	--
B-309R	20.0	CL/OL	24	29.2	--	--	--	--
B-309R	30.0	CL/OL	32	37.5	89.6	--	--	--
B-309R	35.0	CH	16	36.9	--	--	--	--
B-309R	45.0	CH	22	37.9	--	--	--	--
B-309R	55.0	CH	48	31.5	--	--	--	--
B-309R	60.0	GP	70/3"	4.5	--	--	--	--
B-313H	5.0	CL	18	19.1	105.9	0	27	73
B-313H	10.0	ML	11	29.8	89.4	--	--	--
B-313H	15.0	ML	6	39.5	81.3	--	--	--
B-313H	20.0	CH	4	86.4	51.4	--	--	--
B-313H	25.0	CH	9	42.1	83.5	--	--	--
B-315H	5.0	SM/SC	21	10.2	120.7	--	--	--
B-315H	10.0	CL	6	48.7	68.7	--	--	--
B-315H	15.0	CL	9	42.7	80.6	--	--	82
B-315H	20.0	MH	10	65.1	59.8	--	--	--
B-315H	25.0	MH	13	50.5	84.6	--	--	--
B-316R	10.0	CL	37	34.5	--	--	--	--
B-316R	20.0	CL	11	60.1	--	--	--	--
B-316R	27.0	ML	22	18.6	109.4	--	--	55
B-316R	30.0	CL	9	30.4	--	--	--	--
B-316R	35.0	CL/OL	15	31.8	--	--	--	--
B-316R	40.0	CL/OL	12	33.9	--	--	--	--
B-316R	45.0	CL	33	27.9	--	--	--	--
B-316R	50.0	SM	62	35.0	--	--	--	--
B-316R	55.0	SM	71	26.4	--	--	--	--
B-317R	10.0	CL	6	49.9	73.3	--	--	--
B-317R	15.0	ML	4	35.8	87.4	--	--	62
B-317R	20.0	CL	12	93.7	47.2	--	--	--
B-317R	25.0	CL	19	26.9	--	--	--	--
B-317R	30.0	CL	22	42.0	81.1	--	--	--
B-317R	35.0	ML	21	25.5	--	--	--	--
B-317R	40.0	SP	90	22.7	--	--	--	9
B-317R	45.0	CL	49	36.0	--	--	--	--
B-317R	50.0	CL	37	31.4	--	--	--	--
B-317R	55.0	SM	89	23.6	--	--	--	24
B-317R	60.0	SP	70/1"	10.1	--	--	--	9

TABLE D-1 (continued)
SUMMARY OF MOISTURE CONTENT AND GRAIN SIZE DISTRIBUTION

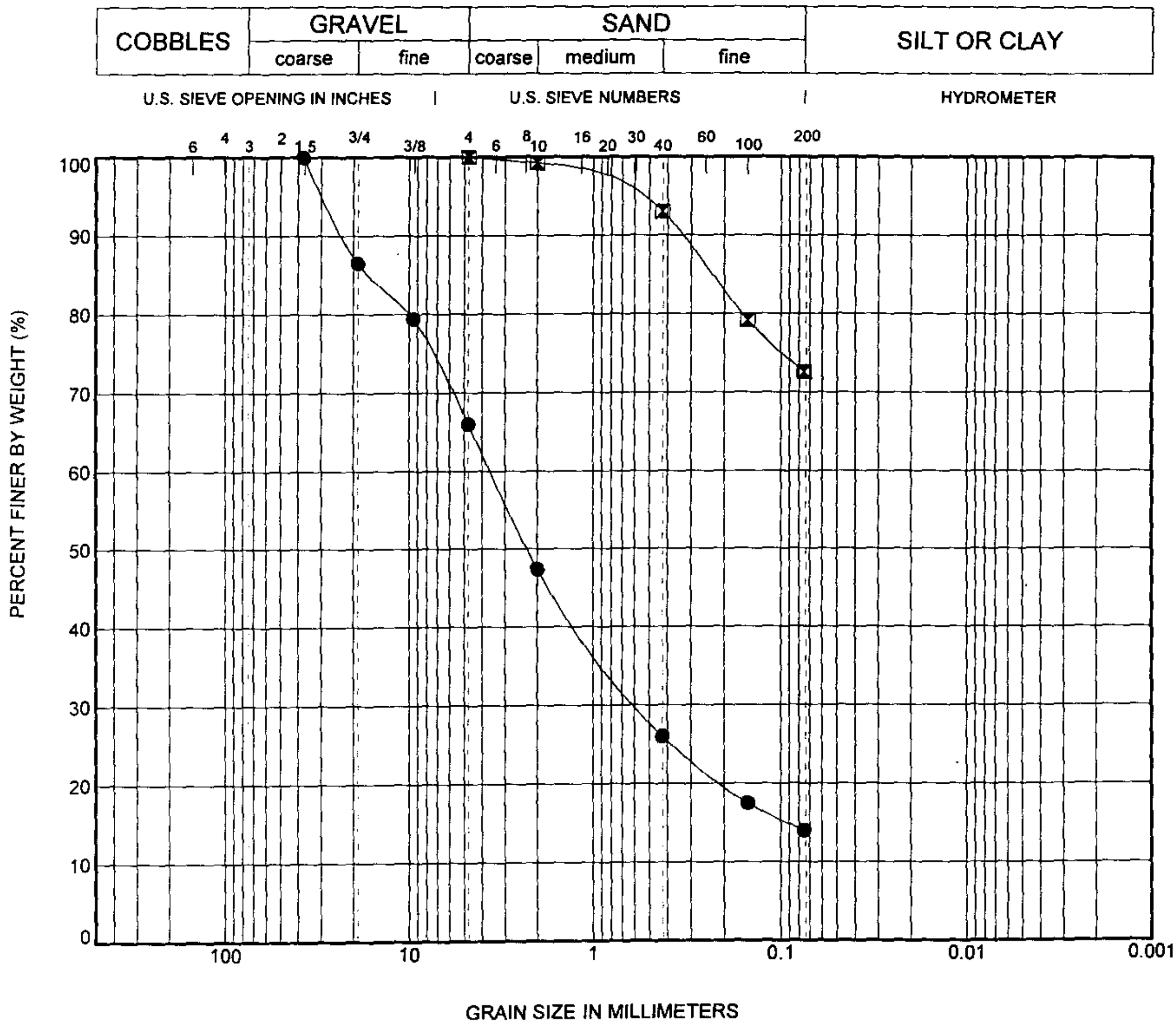
Boring No.	Sample Depth (ft)	USCS Soil Type	Blow Counts per ft	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)
B-319R	5.0	CL	26	18.1	--	--	--	--
B-319R	11.0	CL	21	43.3	79.5	--	--	--
B-319R	15.0	ML	19	39.6	--	--	--	--
B-319R	20.0	MH	8	66.8	60.0	--	--	--
B-319R	25.0	MH	9	31.2	--	--	--	--
B-319R	30.0	CL	24	33.0	91.4	--	--	--
B-319R	35.0	CL	--	28.8	--	--	--	--
B-319R	40.0	SM	36	24.7	--	--	--	38
B-319R	45.0	CL	23	38.0	--	--	--	--
B-319R	50.0	CL	61	30.3	--	--	--	--
B-319R	55.0	ML	98	25.4	--	--	--	--
B-319R	60.0	SP	100/9"	15.0	--	--	--	--

TABLE D-2
SUMMARY OF R-VALUE TEST RESULTS

Boring No.	Sample Depth (ft)	Soil Type	R-Value
B-315H	0.0-5.0	SC/CL	10

TABLE D-3
SUMMARY OF CORROSIVITY TEST RESULTS

Boring No.	Sample Depth (ft)	Soil Type	Soluble Sulfate (ppm)	Soluble Chloride (ppm)	Minimum Resistivity (ohm-cm)	pH
B-304H	0.0-5.0	SM	130	<10	250	8.1
B-305H	0.0-5.0	SM	120	<10	240	8.2
B-313H	0.0-5.0	SM/SC	260	30	130	7.8



SYMBOL	BORING	DEPTH (ft)	DESCRIPTION
●	B-306R	32.0	(SP) Dark Gray Gravelly SAND
⊠	B-313H	5.0	(CL) Olive Gray Silty CLAY

SYMBOL	BORING	DEPTH (ft)	D100	D60	D30	D10	LL	PL	PI	Cc	Cu
●	B-306R	32.0	37.5	3.593	0.568						
⊠	B-313H	5.0	4.75								

GDC GRAIN SIZE L196PV.GPJ GDC WLOG.GDT 12/23/98

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GRAIN SIZE DISTRIBUTION

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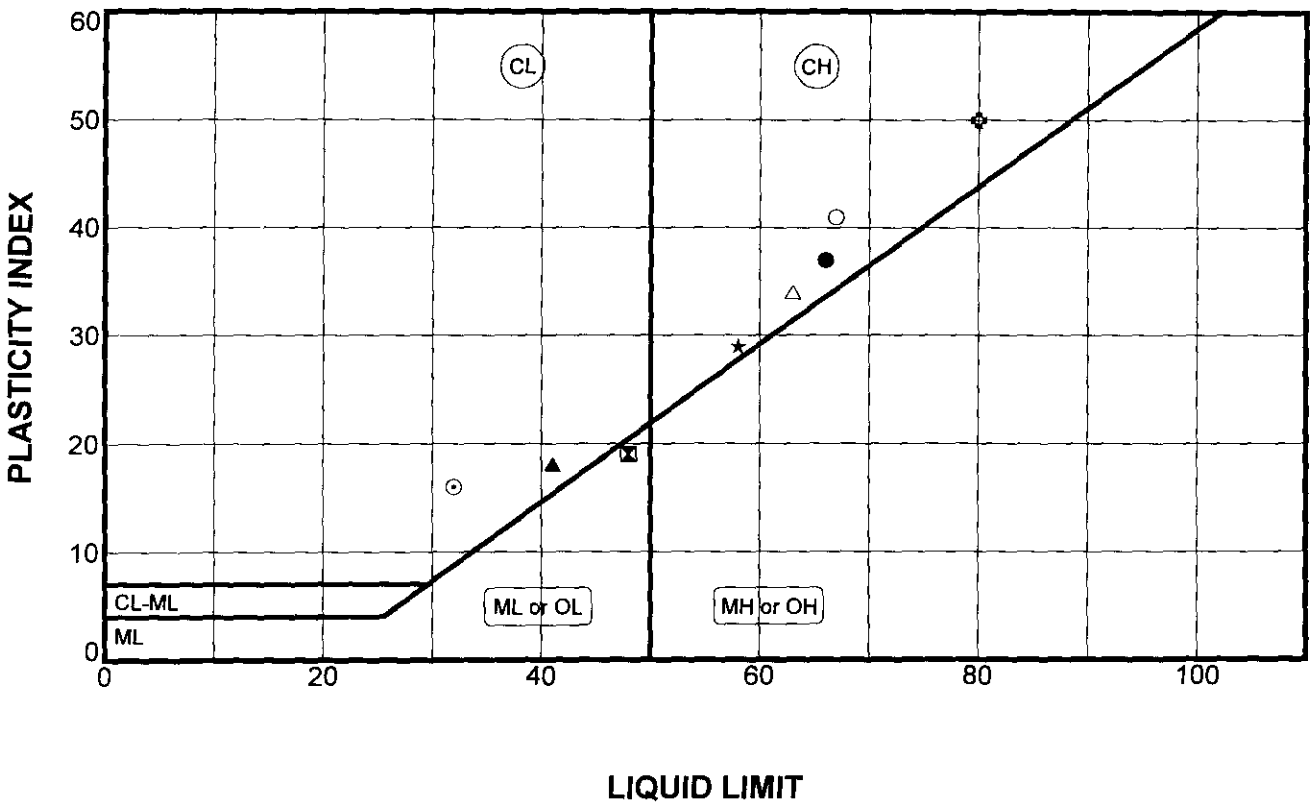
Project: Playa Vista - Site DE & Ballona Creek
Location: Playa del Rey, California
Number: L-196

FIGURE **D-1**



Sym	BORING	Depth (ft)	LL	PL	PI	Description
●	B-302R	15.0	66	29	37	(CH) Dark Gray Silty CLAY
⊠	B-302R	45.0	48	29	19	(ML) Greenish Gray Clayey SILT
▲	B-302R	55.0	41	23	18	(CL) Dark Gray Silty CLAY
★	B-304H	20.0	58	29	29	(CH) Medium Gray Silty CLAY
⊙	B-305H	5.0	32	16	16	(CL) Dark Brown Sandy CLAY
✪	B-305H	20.0	80	30	50	(CH) Black to Dark Gray CLAY
○	B-306R	20.0	67	26	41	(CH) Dark Gray Silty CLAY
△	B-307R	12.0	63	29	34	(CH) Medium Gray CLAY

GDC ATTERBERG L196PV.GPJ GDC WLOG.GDT 1/4/99

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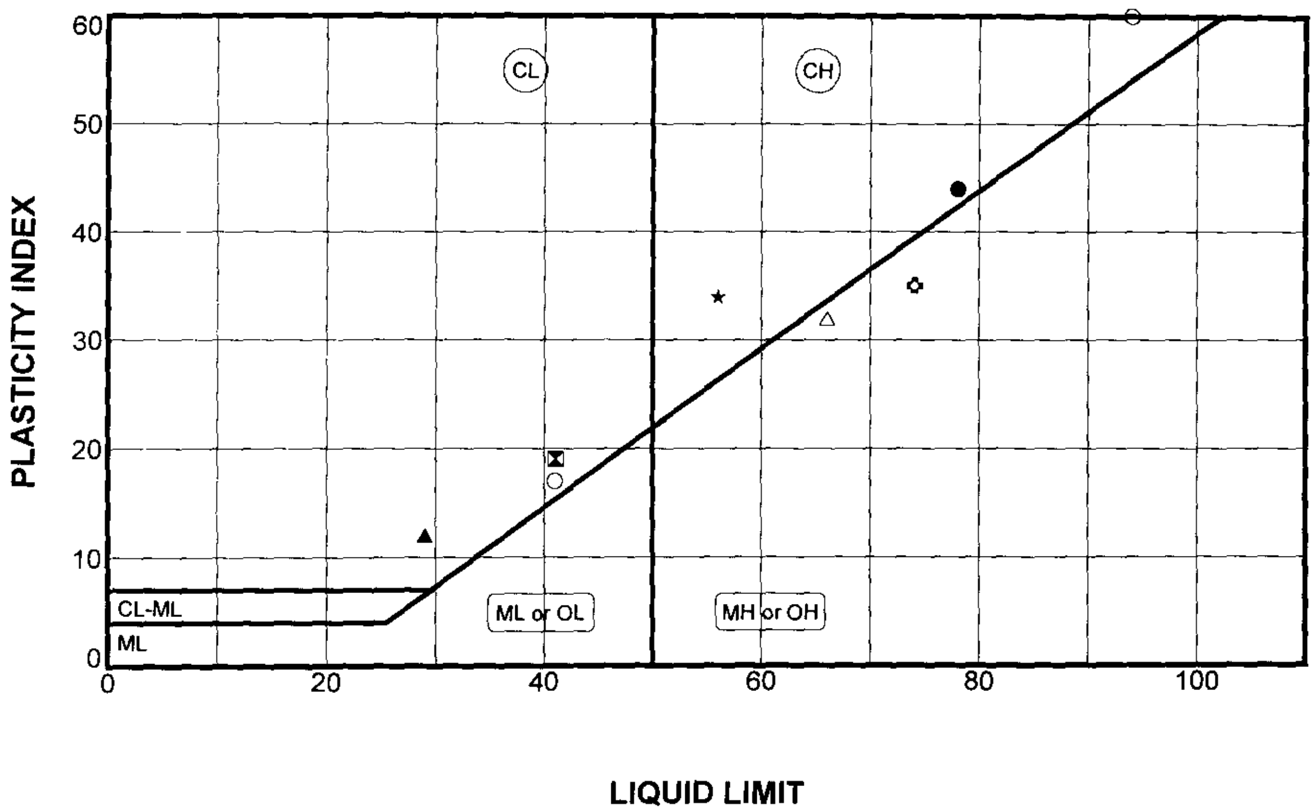
ATTERBERG LIMITS

GROUP DELTA CONSULTANTS, INC.

Project: Playa Vista - Site DE & Ballona Creek
Location: Playa del Rey, California
Number: L-196

FIGURE **D-2**



Sym	BORING	Depth (ft)	LL	PL	PI	Description
●	**B-307R**	**20.0**	**78**	**34**	**44**	**(CH) Dark Gray Sandy CLAY**
⧗	**B-309R**	**15.0**	**41**	**22**	**19**	**(CL) Olive Gray Silty CLAY**
▲	**B-309R**	**20.0**	**29**	**17**	**12**	**(CL/OL) Dark Gray Silty Organic CLAY**
★	**B-309R**	**35.0**	**56**	**22**	**34**	**(CH) Dark Gray CLAY**
⊙	**B-313H**	**20.0**	**94**	**34**	**60**	**(CH) Dark Gray CLAY**
✿	**B-315H**	**20.0**	**74**	**39**	**35**	**(MH) Dark Gray Clayey SILT**
○	**B-316R**	**10.0**	**41**	**24**	**17**	**(CL) Dark Gray Silty CLAY**
△	**B-319R**	**20.0**	**66**	**34**	**32**	**(MH) Dark Gray Clayey SILT**

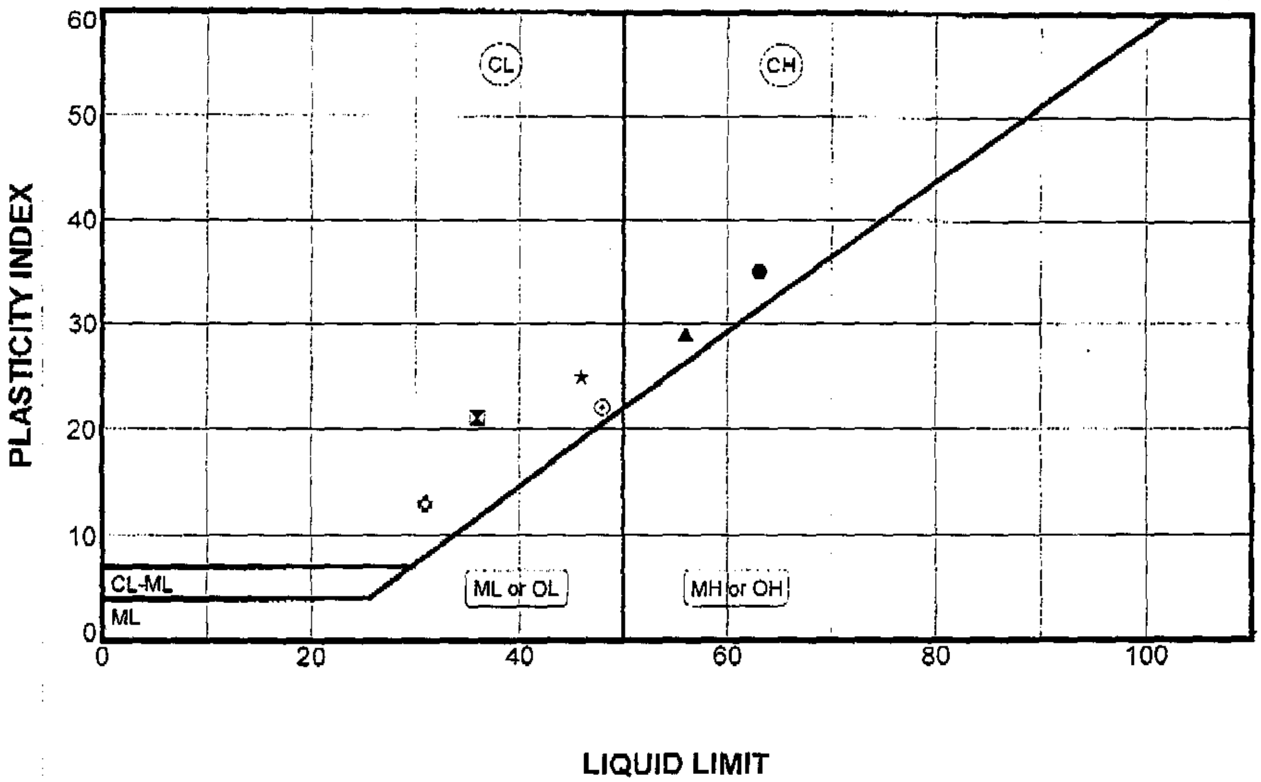
GROUP DELTA CONSULTANTS

ATTERBERG LIMITS

GROUP DELTA CONSULTANTS, INC.

Project: Playa Vista - Site DE & Ballona Creek
Location: Playa del Rey, California
Number: L-196

FIGURE **D-3**



Sym	BORING	Depth (ft)	LL	PL	PI	Description
●	B-317R	10.0	63	28	35	(CH) Dark Gray CLAY
⊠	B-317R	25.0	36	15	21	(CL) Dark Gray CLAY
▲	B-317R	30.0	56	27	29	(CH) Dark Gray CLAY
★	B-317R	35.0	46	21	25	(CL) Dark Gray CLAY
⊙	B-317R	45.0	48	26	22	(CL) Dark Gray CLAY
✧	B-317R	50.0	31	18	13	(CL) Dark Gray CLAY

GDC ATTERBERG L196IV.GPJ GDC WLOG.GDT 1/8/99

GROUP DELTA CONSULTANTS

ATTERBERG LIMITS

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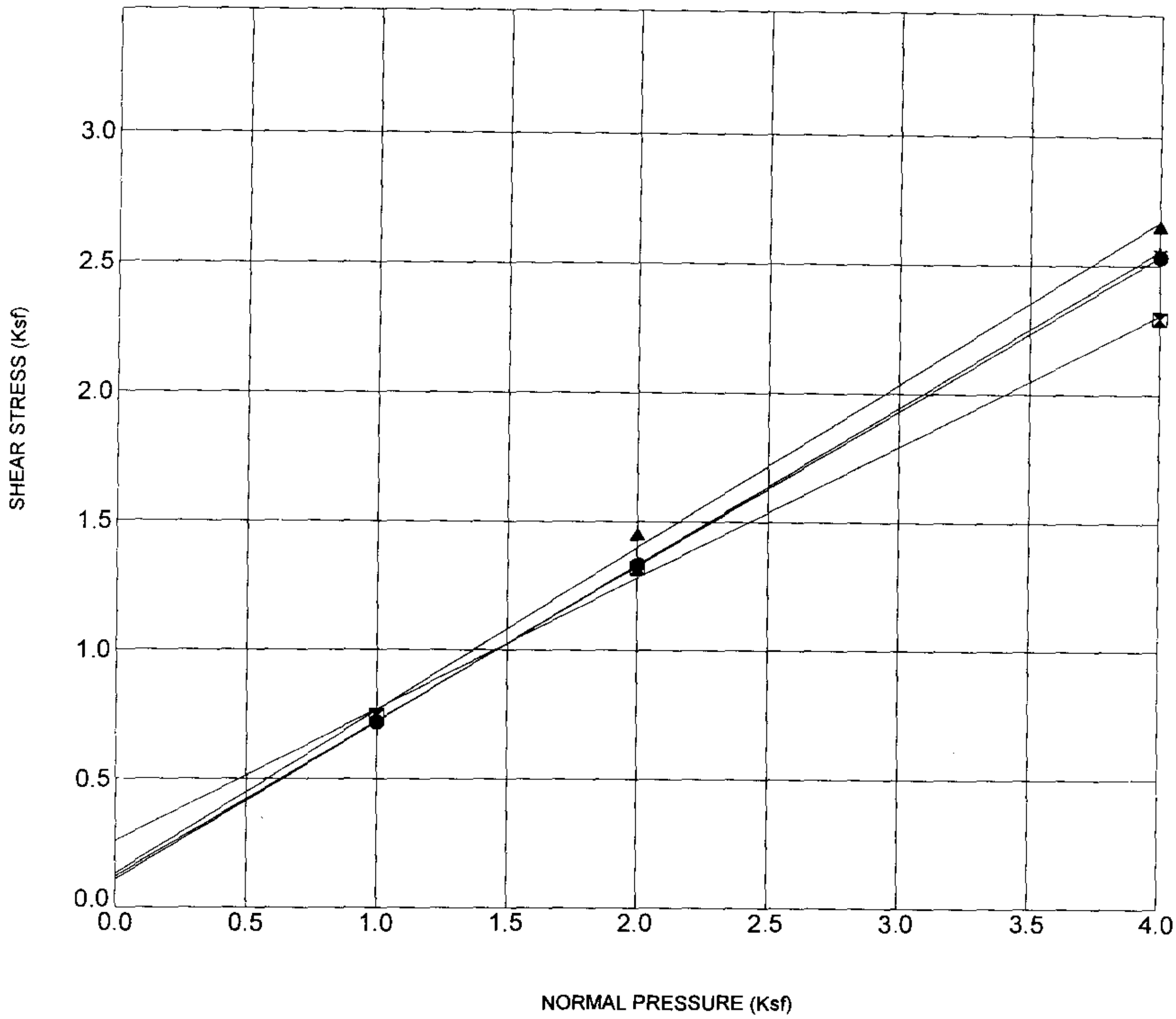
Project: Playa Vista - Site DE & Ballona Creek
Location: Playa del Rey, California
Number: L-196

FIGURE **D-4**



SYM	BORING	Depth(ft)	DESCRIPTION	γ_d lb/ft^3	MC % Before	MC % After	c KSF	ϕ deg
●	**B-302R**	**20.0**	**(ML) Dark Gray Clayey SILT**	**90.2**	**32.3**	**32.7**	**0.12**	**31.1**
⧗	**B-302R**	**30.0**	**(CL) Dark Gray Silty CLAY**	**98.7**	**27.1**	**40.4**	**0.26**	**27.1**
▲	**B-307R**	**30.0**	**(ML) Dark Gray Sandy SILT**	**95.0**	**29.5**	**29.8**	**0.13**	**32.4**
★	**B-319R**	**30.0**	**(CL) Greenish Gray Silty CLAY**	**91.5**	**33.0**	**30.1**	**0.11**	**31.5**

NOTE: All samples submerged unless otherwise noted
Shear Strength are Ultimate with less than 0.25 inch deflection

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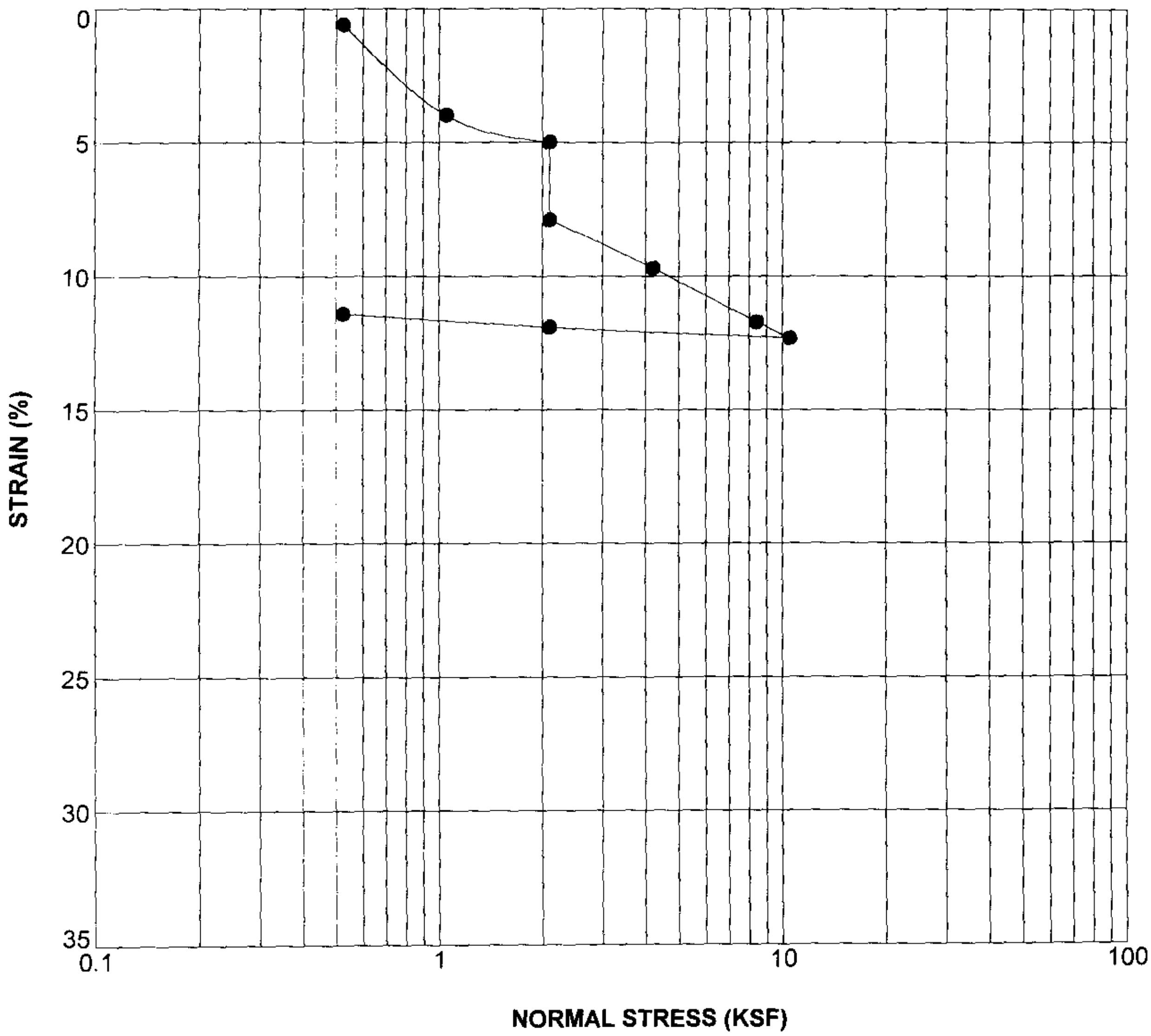
DIRECT SHEAR TEST

GROUP DELTA CONSULTANTS, INC.

Project: Playa Vista - Site DE & Ballona Creek
Location: Playa del Rey, California
Number: L-196

FIGURE **D-5**

GDC DIRECT SHEAR L196PV.GPJ GDC WLOG.GDT 1/4/99



SYMBOL	BORING	DEPTH (ft)	DESCRIPTION	Liquid Limit	Plastic Limit
●	B-304H	5.0	**(SC) Dark Gray Clayey SAND w/Silt**	NON PLASTIC	

	Moisture Content (%)	Dry Density (pcf)	Percent Saturation (%)	Void Ratio
INITIAL	**18.7**	**96.7**	**68.0**	**0.742**
FINAL	**15.1**	**120.6**	**100.0**	**0.397**

Specific Gravity: 2.7

Remark: SAMPLE SATURATED AT 2.1 KSF

GDC_CON_STRNVSSTRS_L196PV.GPJ_GDC_WLOG.GDT 1/4/99

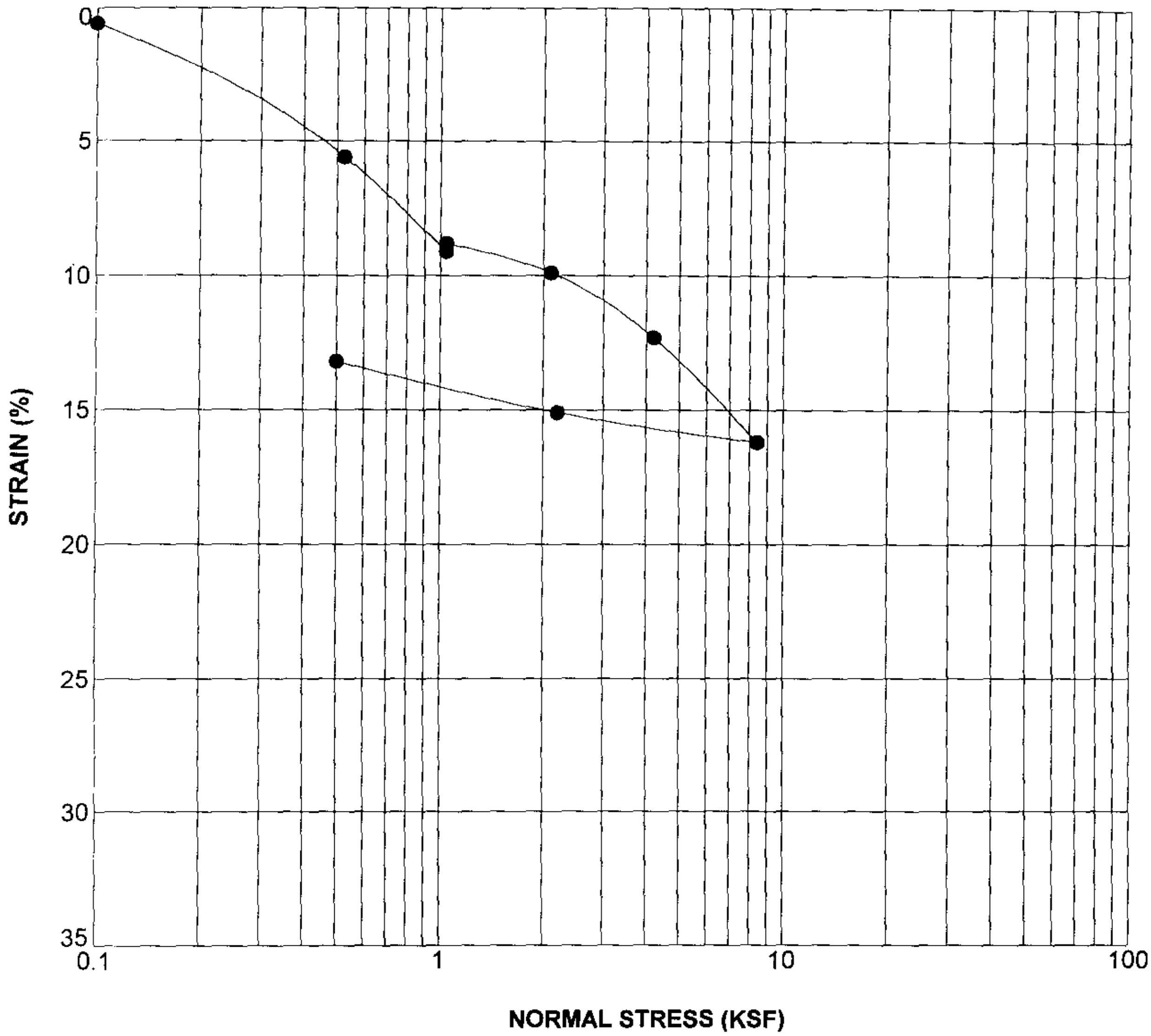
GROUP DELTA CONSULTANTS

CONSOLIDATION TEST

GROUP DELTA CONSULTANTS, INC.

Project: Playa Vista - Site DE & Ballona Creek
Location: Playa del Rey, California
Number: L-196

FIGURE **D-6**



SYMBOL	BORING	DEPTH (ft)	DESCRIPTION	Liquid Limit	Plastic Limit
●	**B-304H**	**20.0**	**(CH) Medium Gray Silty CLAY**	**58**	**29**

	Moisture Content (%)	Dry Density (pcf)	Percent Saturation (%)	Void Ratio
INITIAL	**37.2**	**77.7**	**86.0**	**1.168**
FINAL	**40.8**	**83.7**	**100.0**	**1.013**

Specific Gravity: 2.7

Remark: SAMPLE SATURATED AT 1.1 KSF

GROUP DELTA CONSULTANTS

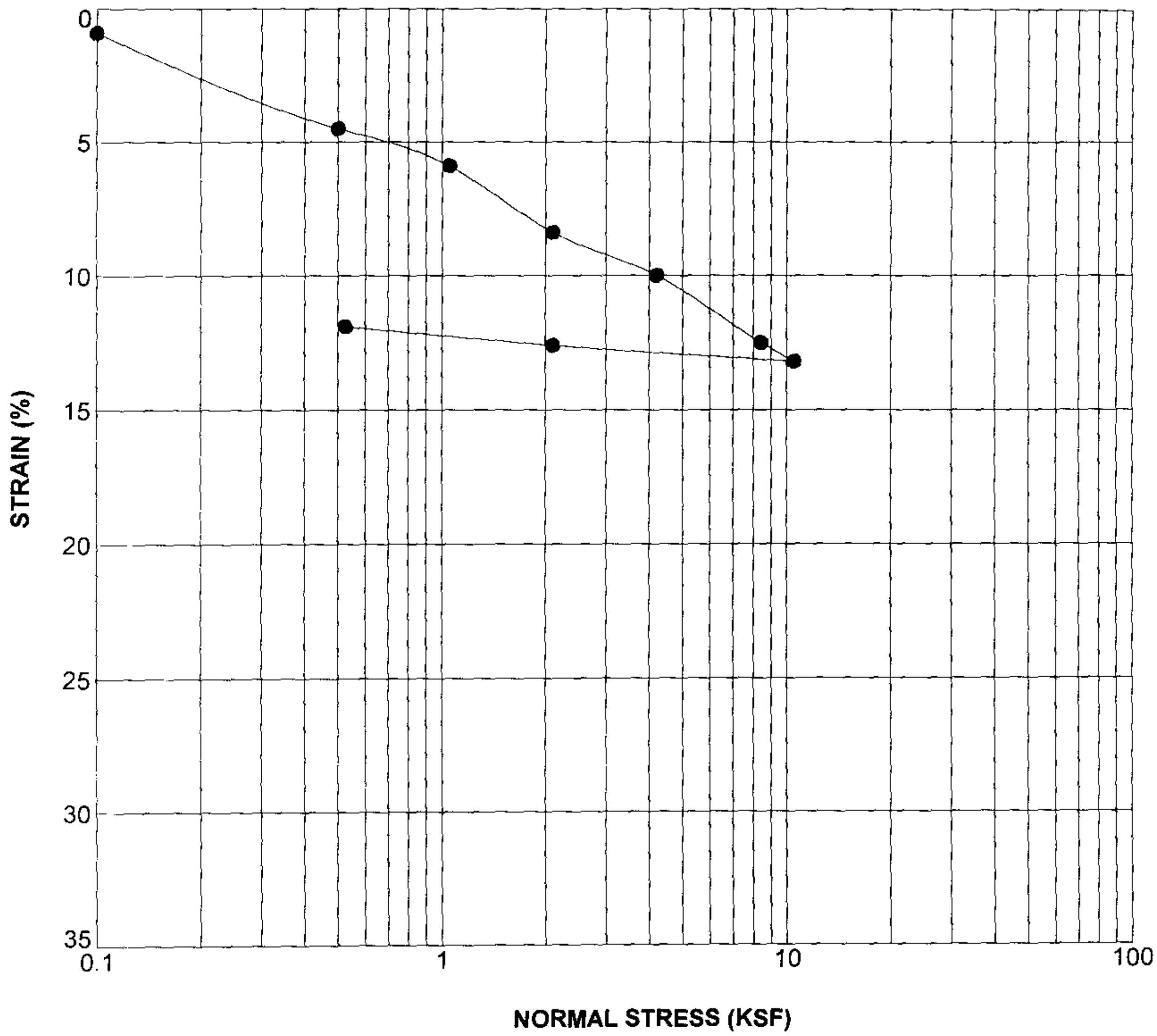
CONSOLIDATION TEST

GROUP DELTA CONSULTANTS, INC.

Project: Playa Vista - Site DE & Ballona Creek
Location: Playa del Rey, California
Number: L-196

FIGURE **D-7**

GDC CON STRNVSSTRS L196PV.GPJ GDC WLOG.GDT 1/4/99



SYMBOL	BORING	DEPTH (ft)	DESCRIPTION	Liquid Limit	Plastic Limit
●	B-305H	5.0	(CL) Dark Brown Sandy CLAY	32	16

	Moisture Content (%)	Dry Density (pcf)	Percent Saturation (%)	Void Ratio
INITIAL	18.6	108.9	91.8	0.547
FINAL	17.1	123.7	100.0	0.362

Specific Gravity: 2.7

Remark: SAMPLE SATURATED AT 1.05 KSF

GROUP DELTA CONSULTANTS

CONSOLIDATION TEST

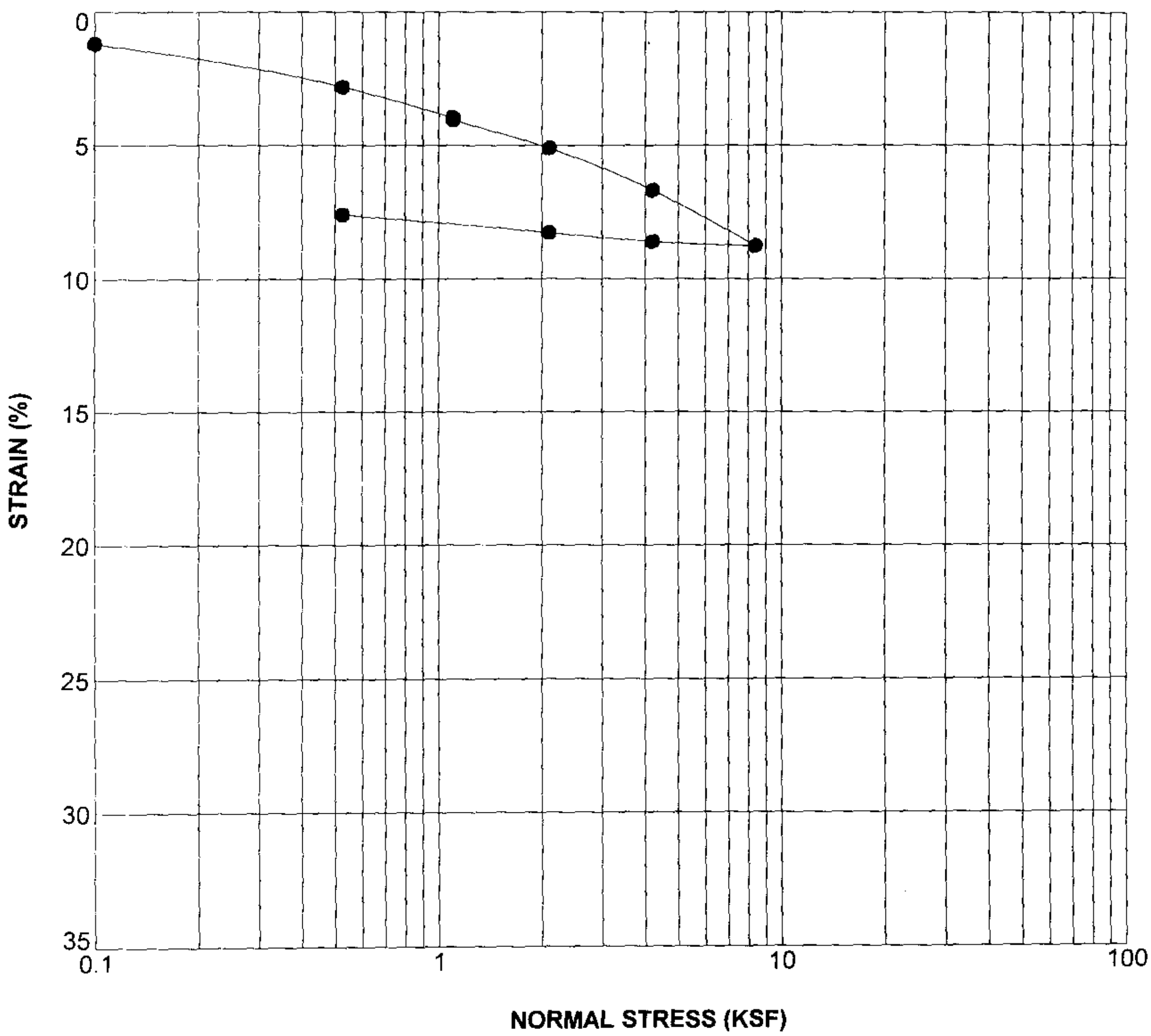
GROUP DELTA CONSULTANTS, INC.

Project: Playa Vista - Site DE & Ballona Creek

Location: Playa del Rey, California

Number: L-196

FIGURE **D-8**



SYMBOL	BORING	DEPTH (ft)	DESCRIPTION	Liquid Limit	Plastic Limit
●	B-305H	15.0	(ML) Olive Gray Sandy SILT	NON PLASTIC	

	Moisture Content (%)	Dry Density (pcf)	Percent Saturation (%)	Void Ratio
INITIAL	34.9	87.3	100.0	0.930
FINAL	29.8	106.1	100.0	0.588

Specific Gravity: 2.7

Remark: SAMPLE SATURATED AT 1.1 KSF

GROUP DELTA CONSULTANTS

CONSOLIDATION TEST

GROUP DELTA CONSULTANTS, INC.

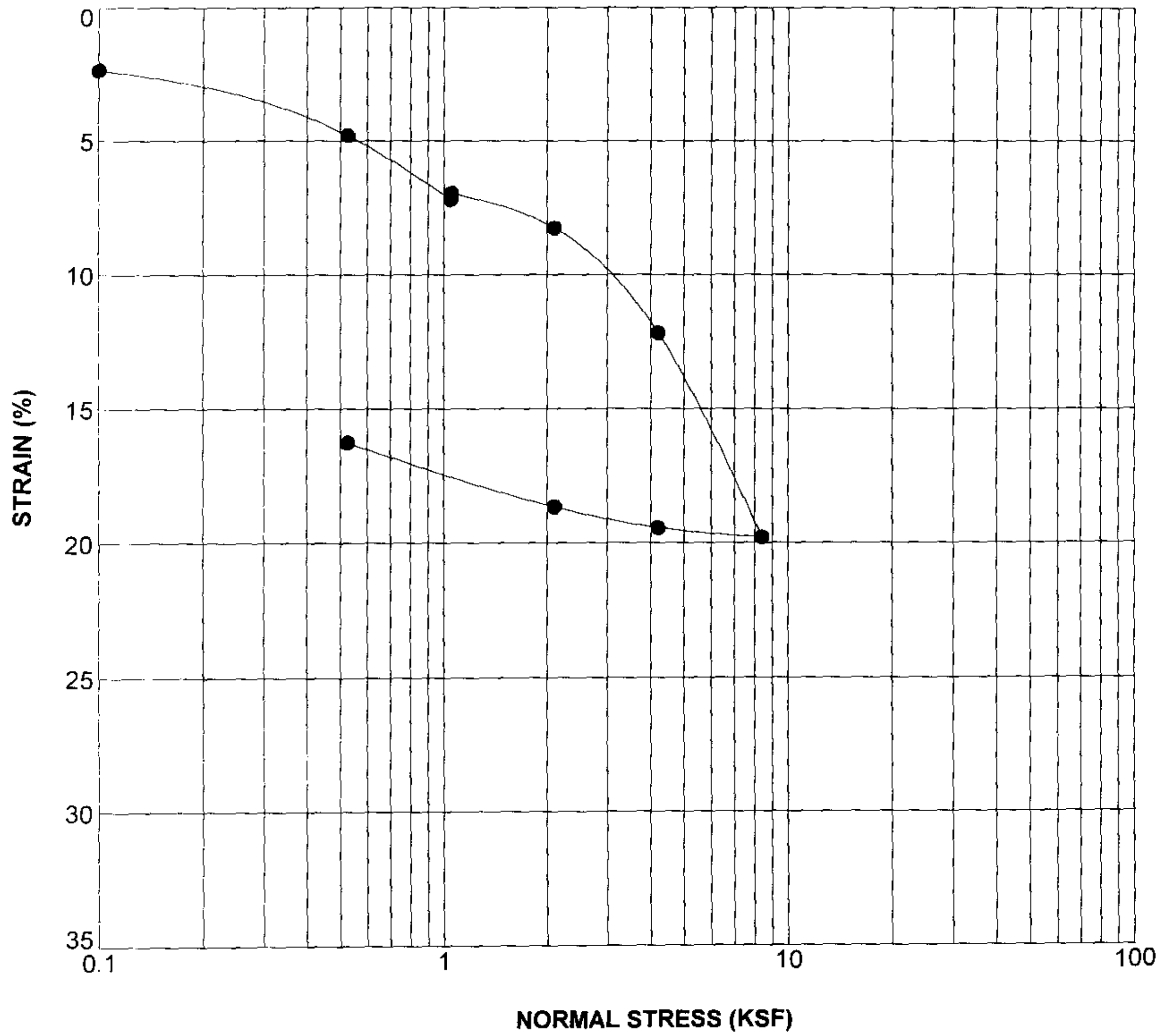
Project: Playa Vista - Site DE & Ballona Creek

Location: Playa del Rey, California

Number: L-196

FIGURE **D-9**

GDC CON STRNVSSTRS L196PV.GPJ GDC WLOG.GDT 1/4/99



SYMBOL	BORING	DEPTH (ft)	DESCRIPTION	Liquid Limit	Plastic Limit
●	**B-305H**	**20.0**	**(CH) Black to Dark Gray CLAY**	**80**	**30**

	Moisture Content (%)	Dry Density (pcf)	Percent Saturation (%)	Void Ratio
INITIAL	**65.1**	**60.7**	**99.0**	**1.776**
FINAL	**32.8**	**83.4**	**86.8**	**1.020**

Specific Gravity: 2.7

Remark: SAMPLE SATURATED AT 1.05 KSF

GROUP DELTA CONSULTANTS

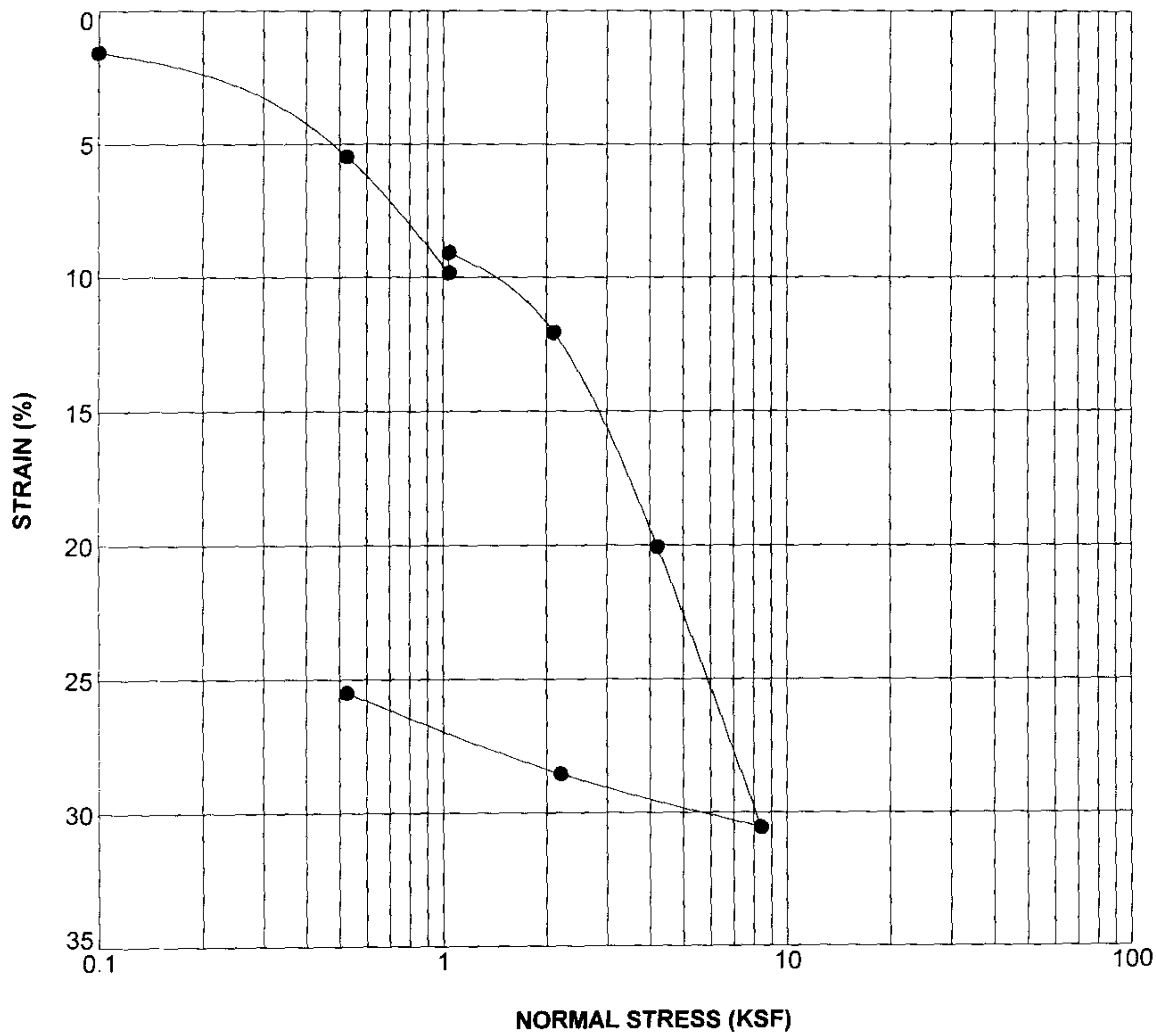
CONSOLIDATION TEST

GROUP DELTA CONSULTANTS, INC.

Project: Playa Vista - Site DE & Ballona Creek
Location: Playa del Rey, California
Number: L-196

FIGURE **D-10**

GDC_CON_STRNVSSTRS L196PV.GPJ GDC_WLOG.GDT 1/4/99



SYMBOL	BORING	DEPTH (ft)	DESCRIPTION	Liquid Limit	Plastic Limit
●	**B-307R**	**20.0**	**(CH) Dark Gray Sandy CLAY**	**78**	**34**

	Moisture Content (%)	Dry Density (pcf)	Percent Saturation (%)	Void Ratio
INITIAL	**82**	**50.1**	**93.7**	**2.362**
FINAL	**68.6**	**63.0**	**100.0**	**1.674**

Specific Gravity: 2.7

Remark: SAMPLE SATURATED AT 1.05 KSF

GROUP DELTA CONSULTANTS

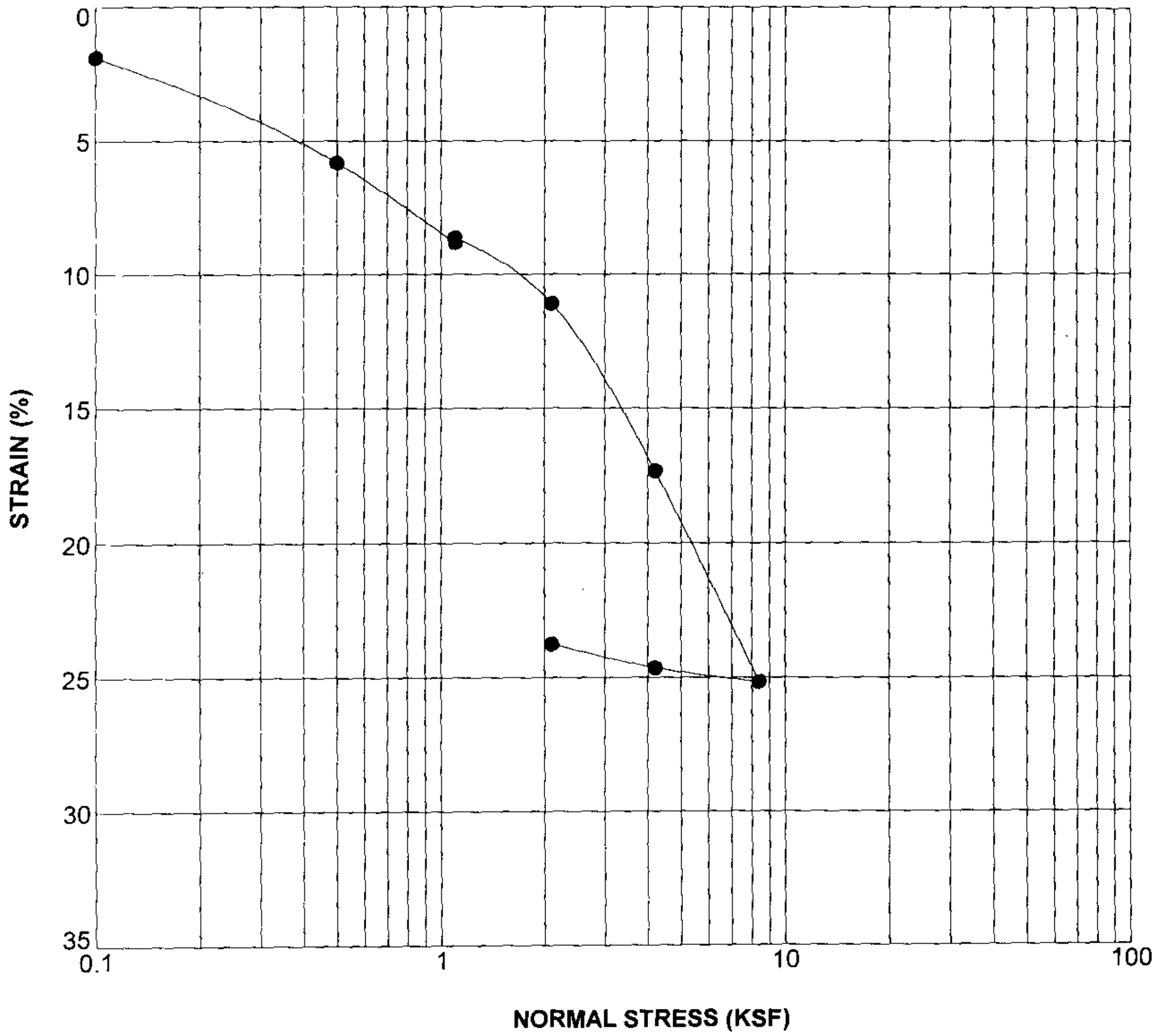
CONSOLIDATION TEST

GROUP DELTA CONSULTANTS, INC.

Project: Playa Vista - Site DE & Ballona Creek
Location: Playa del Rey, California
Number: L-196

FIGURE **D-11**

GDC_CON_STRNVSSTRS L196PV.GPJ GDC_WLOG.GDT 1/4/99



SYMBOL	BORING	DEPTH (ft)	DESCRIPTION	Liquid Limit	Plastic Limit
●	**B-313H**	**20.0**	**(CH) Dark Gray CLAY**	**94**	**34**

	Moisture Content (%)	Dry Density (pcf)	Percent Saturation (%)	Void Ratio
INITIAL	**86.4**	**52.9**	**100.0**	**2.185**
FINAL	**34.8**	**85.7**	**97.3**	**0.966**

Specific Gravity: 2.7

Remark: SAMPLE SATURATED AT 1.1 KSF

GROUP DELTA CONSULTANTS

CONSOLIDATION TEST

GROUP DELTA CONSULTANTS, INC.

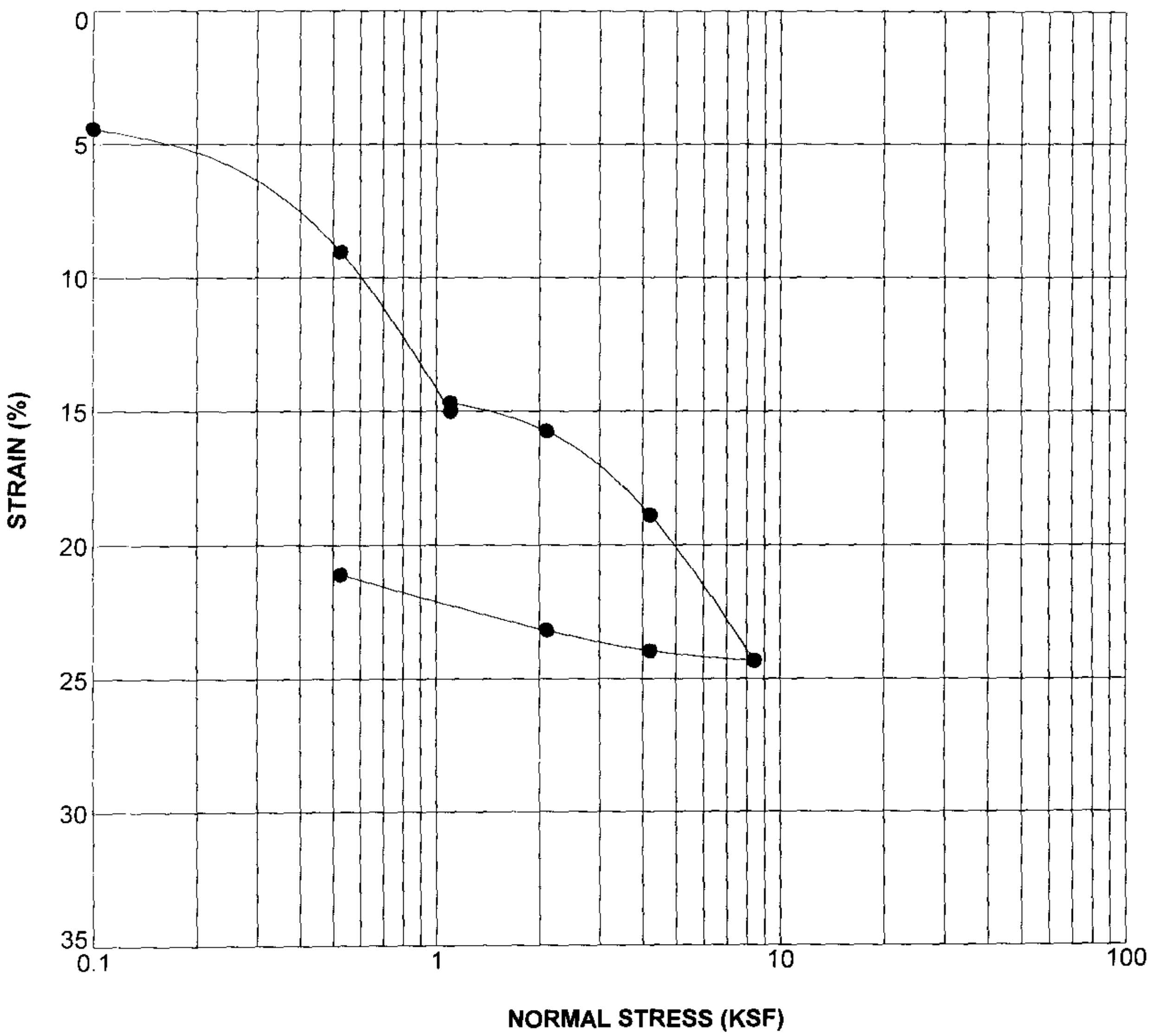
Project: Playa Vista - Site DE & Ballona Creek

Location: Playa del Rey, California

Number: L-196

FIGURE **D-12**

GDC_CON_STRNVSSTRS L196PV.GPJ GDC_WLOG.GDT 1/4/99



SYMBOL	BORING	DEPTH (ft)	DESCRIPTION	Liquid Limit	Plastic Limit
●	B-315H	20.0	(MH) Dark Gray Clayey SILT	74	39

	Moisture Content (%)	Dry Density (pcf)	Percent Saturation (%)	Void Ratio
INITIAL	65.1	61.1	100.0	1.757
FINAL	30.0	88.0	88.6	0.915

Specific Gravity: 2.7

Remark: SAMPLE SATURATED AT 1.1 KSF

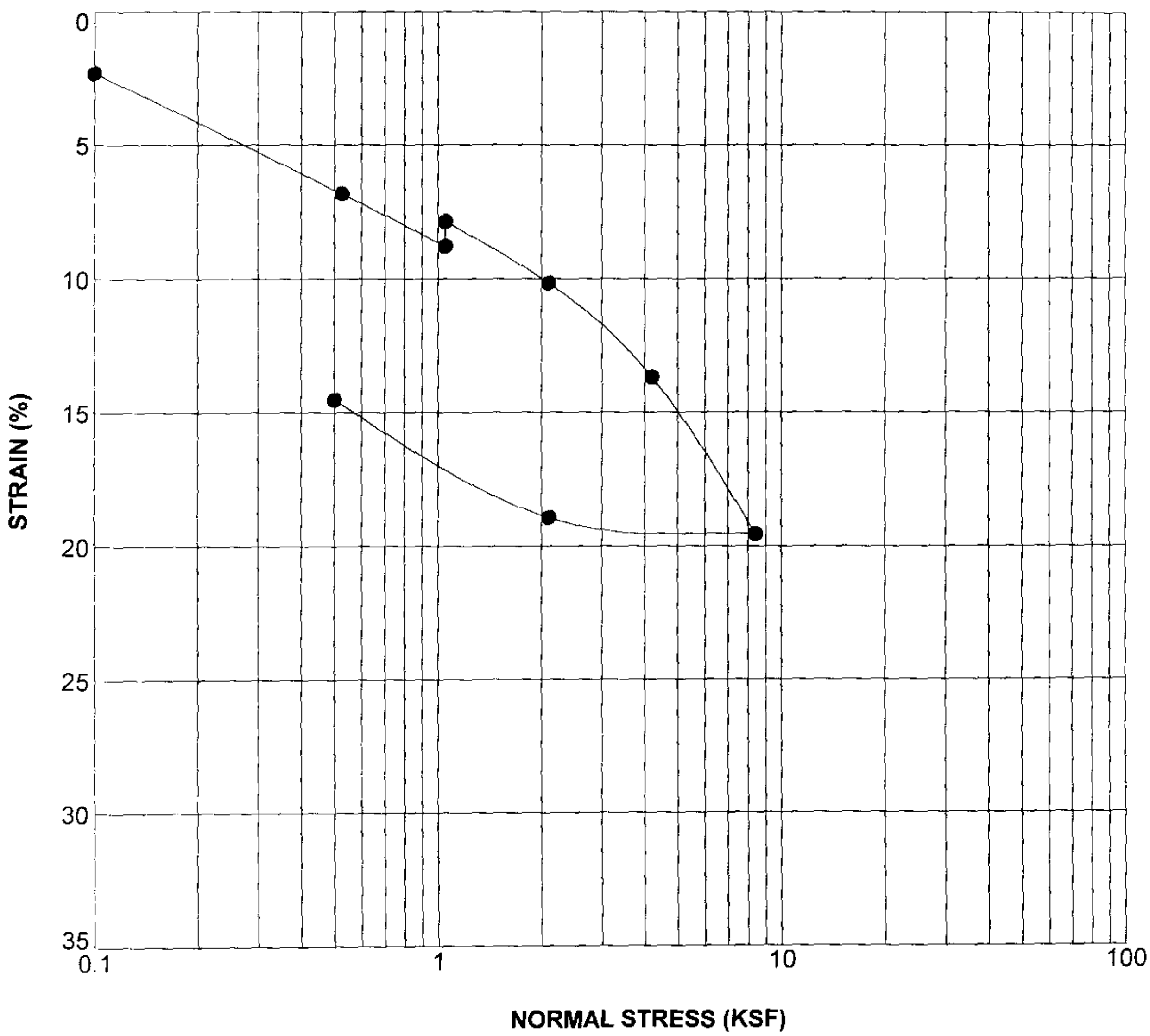
GROUP DELTA CONSULTANTS

CONSOLIDATION TEST

GROUP DELTA CONSULTANTS, INC.

Project: Playa Vista - Site DE & Ballona Creek
Location: Playa del Rey, California
Number: L-196

FIGURE **D-13**



SYMBOL	BORING	DEPTH (ft)	DESCRIPTION	Liquid Limit	Plastic Limit
●	B-319R	20.0	(MH) Dark Gray Clayey SILT	66	34

	Moisture Content (%)	Dry Density (pcf)	Percent Saturation (%)	Void Ratio
INITIAL	66.8	72.5	100.0	1.324
FINAL	57.0	70.0	100.0	1.407

Specific Gravity: 2.7

Remark: SAMPLE SATURATED AT 1.05 KSF

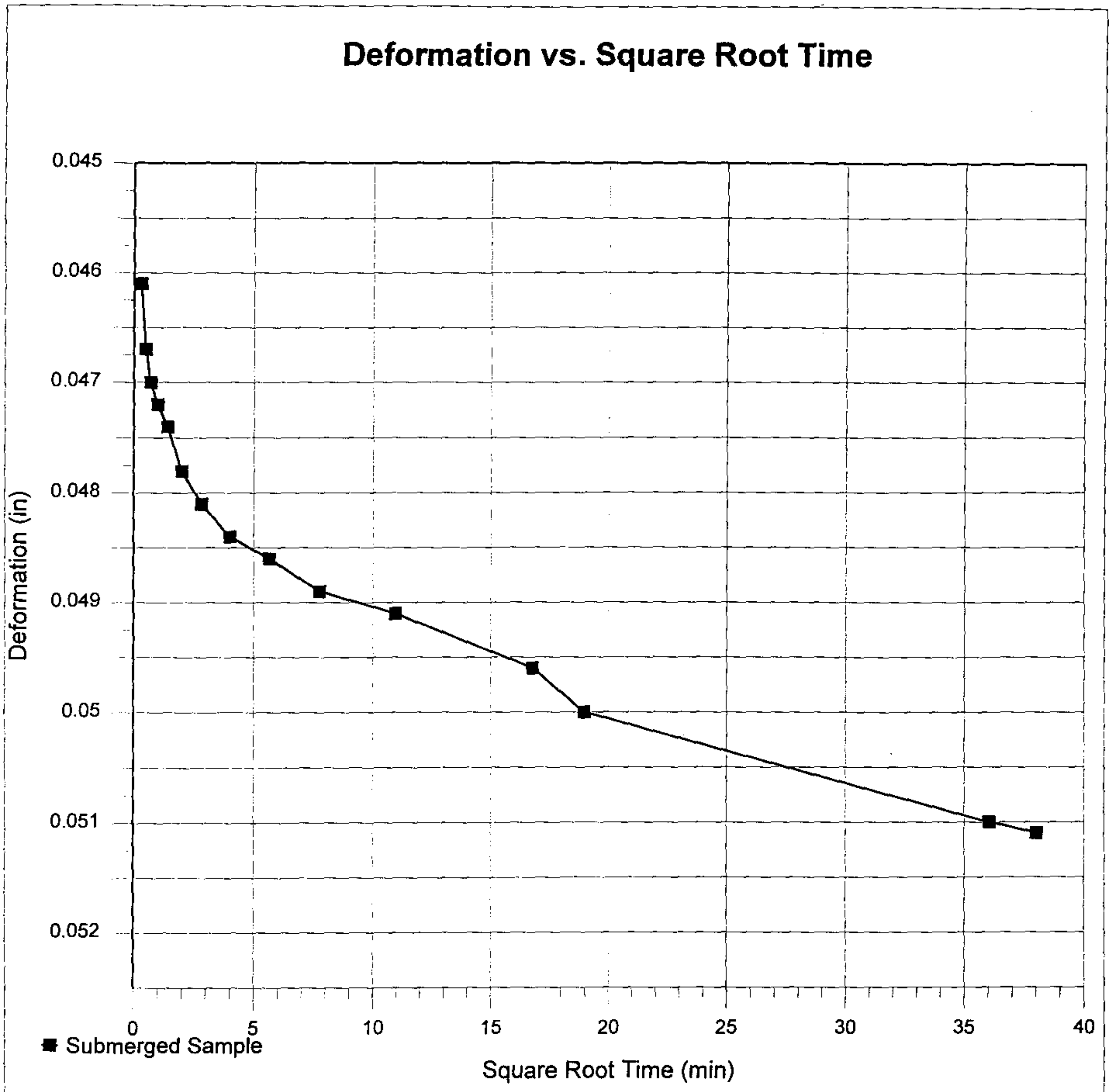
GROUP DELTA CONSULTANTS

CONSOLIDATION TEST

GROUP DELTA CONSULTANTS, INC.

Project: Playa Vista - Site DE & Ballona Creek
Location: Playa del Rey, California
Number: L-196

FIGURE **D-14**



Sample Location: B-305H

Confining Pressure: 2.1 KSF

Sample Depth: 15 feet

Soil Description: (SM) Olive Gray Silty SAND

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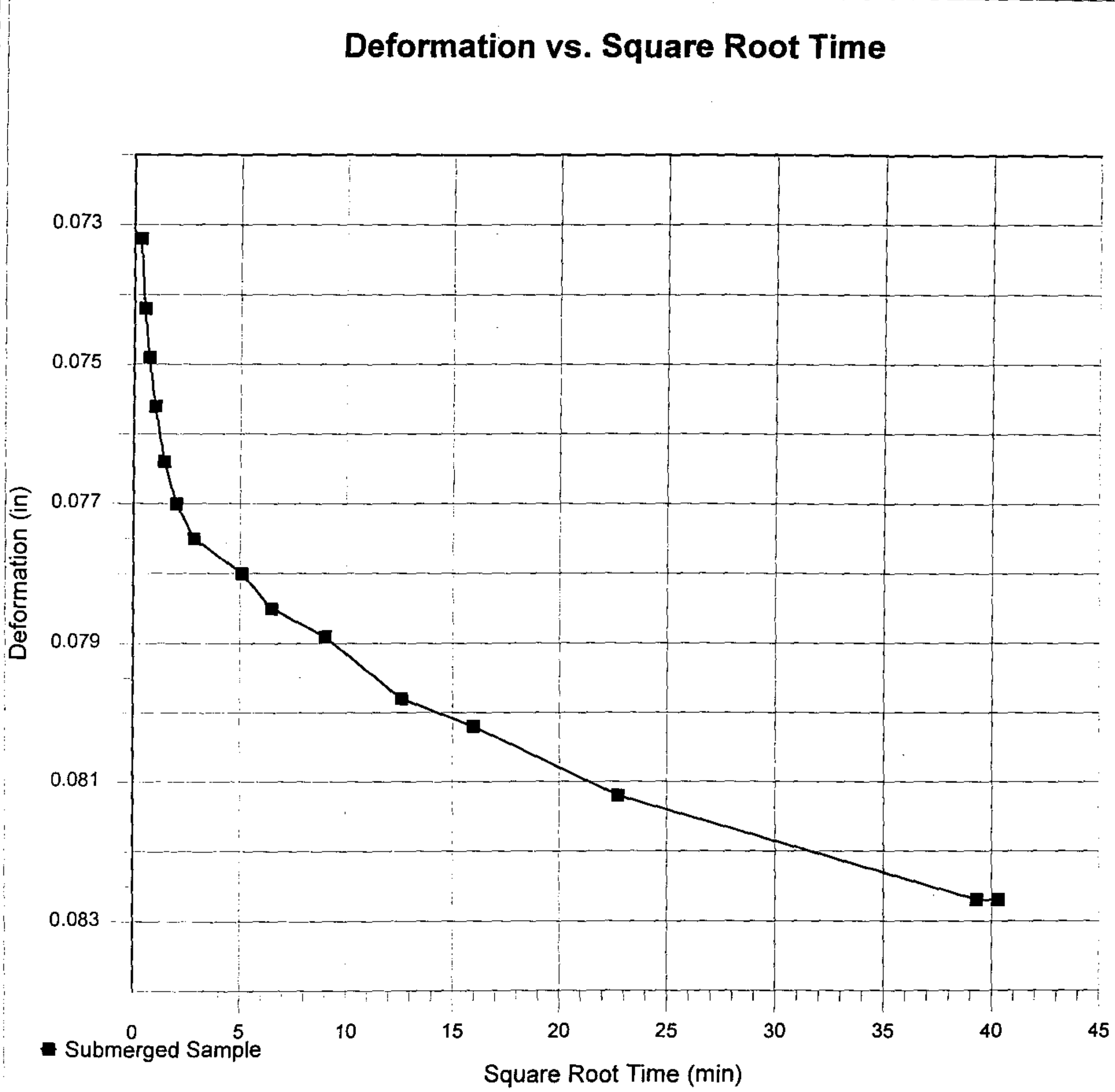
TIME RATE CONSOLIDATION

GROUP DELTA CONSULTANTS, INC.

Project: Playa Vista

Location: Site DE & Bollona Creek Channel

Number: L-196 Figure: **D-15**



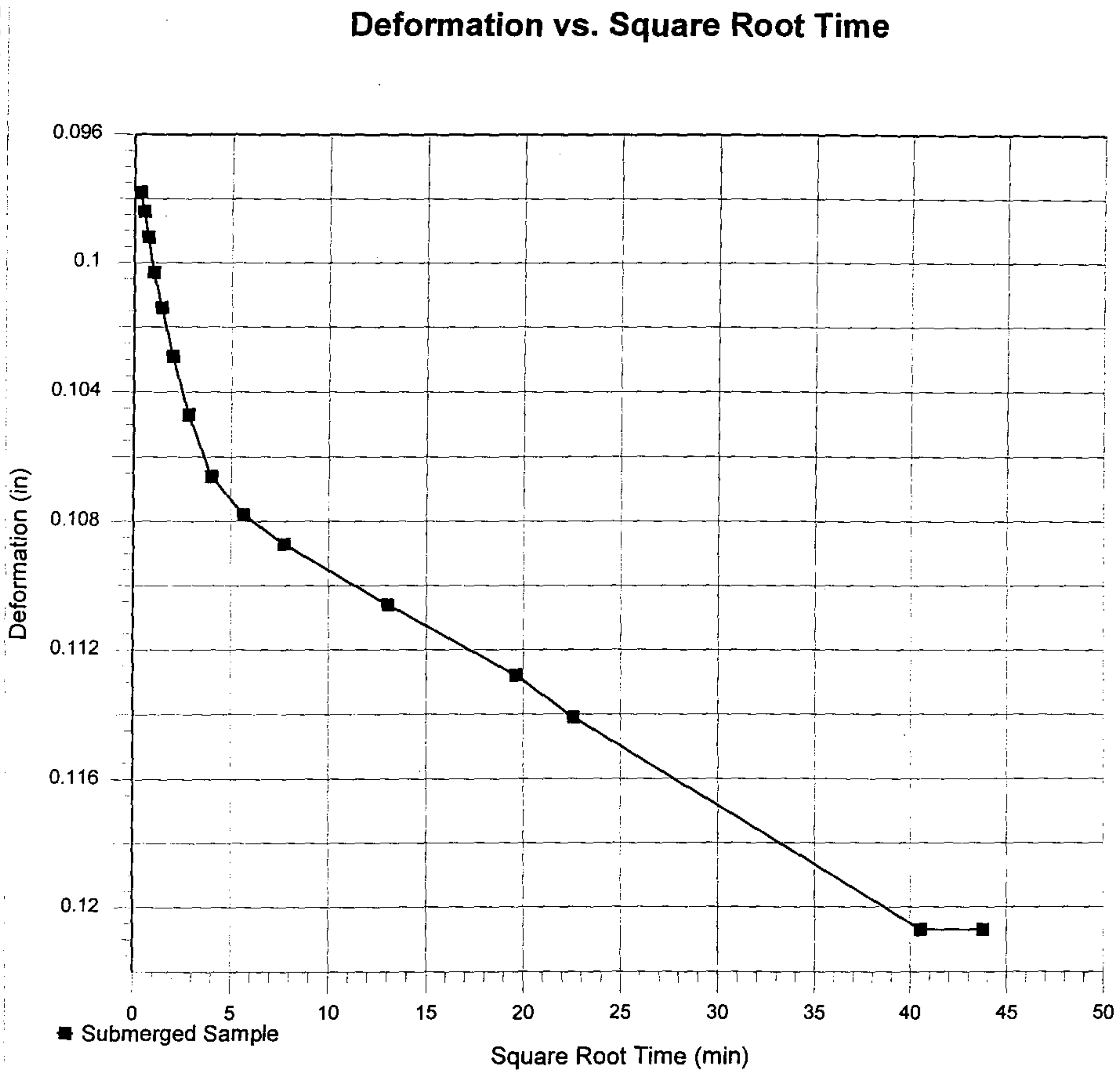
Sample Location: B-305H

Confining Pressure: 2.1 KSF

Sample Depth: 20 feet

Soil Description: (CL) Dark Gray Silty CLAY

GROUP DELTA CONSULTANTS	**TIME RATE CONSOLIDATION**	Project: Playa Vista
		Location: Site DE & Bollona Creek Channel
	GROUP DELTA CONSULTANTS, INC.	Number: L-196 Figure: **D-16**



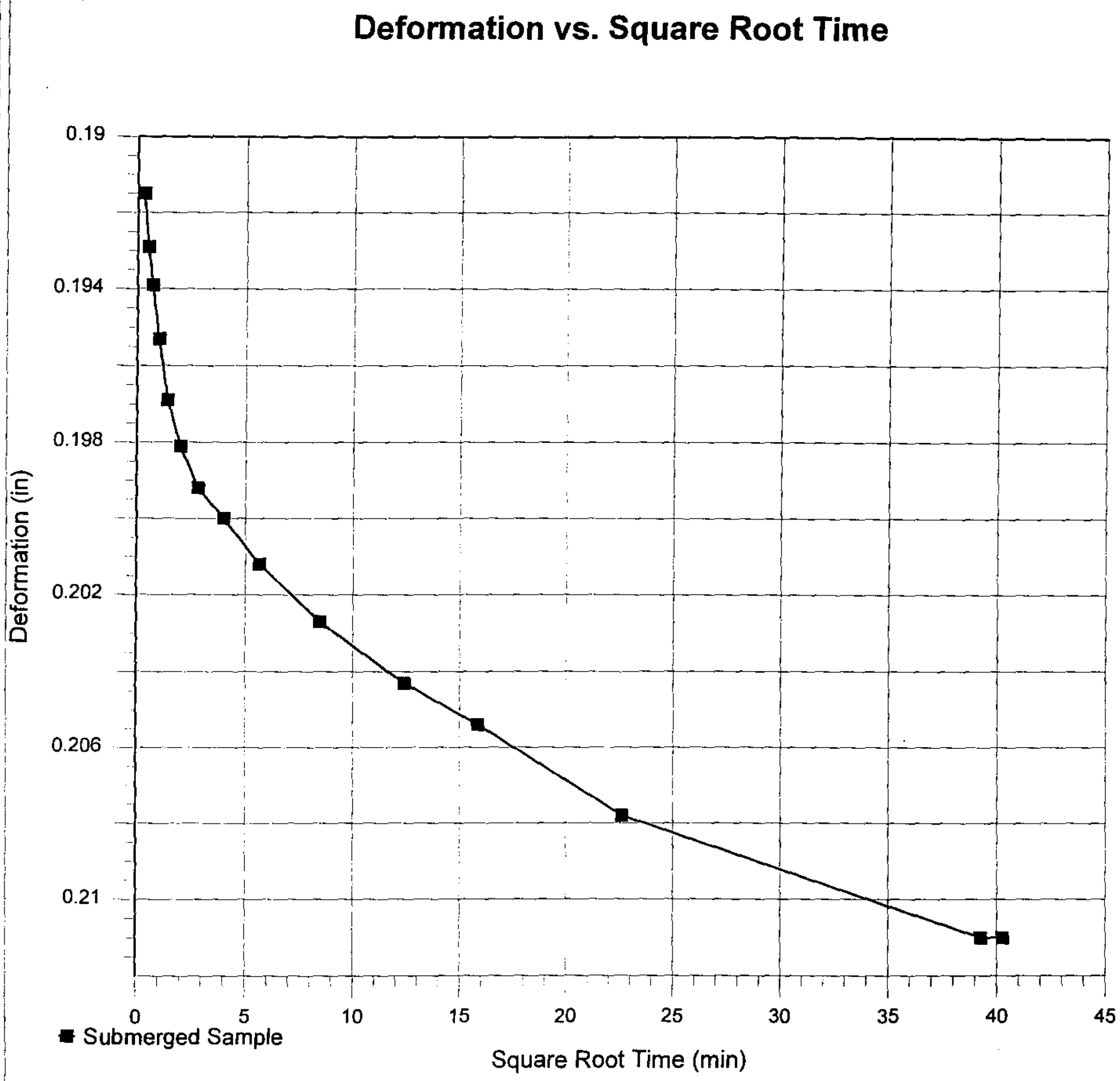
Sample Location: B-307R

Confining Pressure: 2.1 KSF

Sample Depth: 20 feet

Soil Description: (CH) Dark Gray Sandy CLAY

GROUP DELTA CONSULTANTS	**TIME RATE CONSOLIDATION**	Project: Playa Vista
		Location: Site DE & Bollona Creek Channel
	GROUP DELTA CONSULTANTS, INC.	Number: L-196 Figure: **D-17**



Sample Location: B-313H

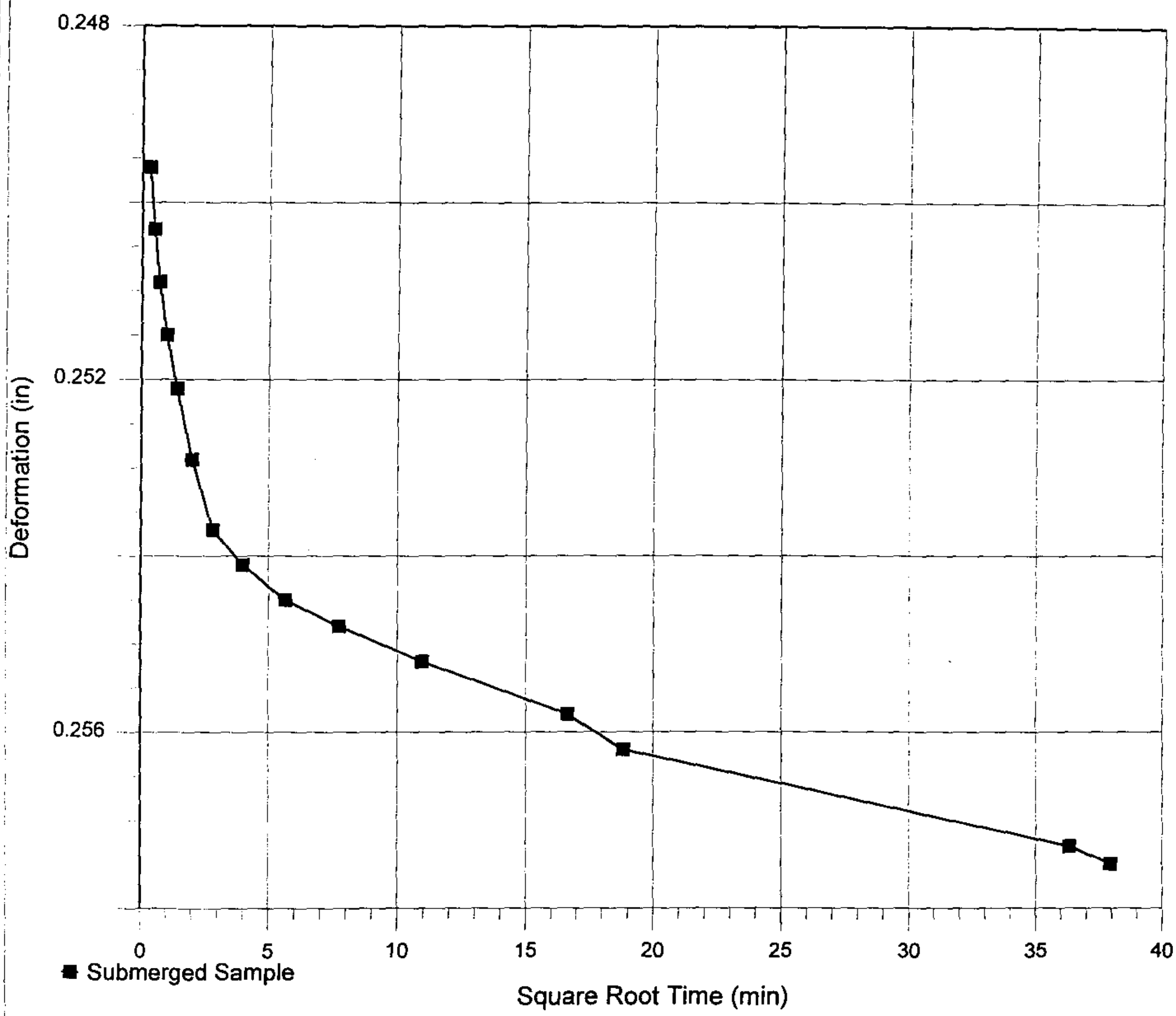
Confining Pressure: 2.1 KSF

Sample Depth: 20 feet

Soil Description: (CH/OH) Dark Gray Organic CLAY

GROUP DELTA CONSULTANTS	**TIME RATE CONSOLIDATION**	Project: Playa Vista
		Location: Site DE & Bollona Creek Channel
	GROUP DELTA CONSULTANTS, INC.	Number: L-196 Figure: **D-18**

Deformation vs. Square Root Time



Sample Location: B-315H

Confining Pressure: 2.1 KSF

Sample Depth: 20 feet

Soil Description: (MH) Dark Gray Silty CLAY

GROUP DELTA CONSULTANTS	**TIME RATE CONSOLIDATION**	Project: Playa Vista
		Location: Site DE & Bollona Creek Channel
	GROUP DELTA CONSULTANTS, INC.	Number: L-196 Figure: **D-19**

APPENDIX B
EXISTING LABORATORY DATA (Pacific Soils Engineering, 1998)

APPENDIX B

Laboratory Testing

The results of laboratory testing performed during this study (for the subject site and the northerly neighboring site) are enclosed within this appendix. Table B-1 presents a summary of laboratory test results.

The following laboratory tests were performed on representative samples in accordance with the applicable latest standards or methods from the ASTM, Uniform Building Code (UBC) and California Department of Transportation.

Moisture and In-Place Density

The field moisture content and in-situ dry density were established on relatively undisturbed ring samples obtained from the borings. The moisture content was obtained in accordance with ASTM Test Method: D-2216. The in-situ dry density was computed using the net weight of the entire sample. The results of these tests are presented on the boring logs.

Classification

Soils were classified with respect to the Unified Soil Classification System (USCS) in accordance with ASTM Test Methods: D-2487 and D-2488.

Direct Shear Tests

Direct shear tests were performed on two remolded samples that were saturated under a surcharge equal to the applied normal force during testing. The apparatus used is in conformance with the requirements outlined in ASTM Test Method D-3080. The test specimens, 2.5-inches in diameter and 1-inch in height, were subjected to simple shear along a plane at mid-height.

The samples were sheared under various normal loads, a different specimen being used for each normal load. A strain of 0.050-inches per minute was used to evaluate shear strength values. The specimens were sheared until the shear stress reached a constant value or until the sample deformation had reached approximately 10 percent of the original diameter.

The shear stress values obtained from the tests were plotted versus applied normal pressures. The best-fitting straight lines were drawn through the plotted points to obtain the shear strength envelopes. The cohesion and angle of internal friction of the soil materials were evaluated from the shear strength envelopes. The direct shear test results are shown on Plates _________.

Consolidation Tests

Consolidation tests were performed on undisturbed soils samples in accordance with procedures outlined in ASTM Test Method D-2435. Samples were placed in a consolidometer and loads were applied incrementally in geometric progression. The sample (2.5-inches in diameter and 1-inch in height) was permitted to consolidate under each load increment until the slope of the characteristics linear secondary compression portion of the thickness versus log of time plot was apparent.

The percent consolidation for each load cycle was recorded as the ratio of the amount of vertical compression to the original 1-inch height. Hydroconsolidation (collapse) and expansion characteristics were also evaluated by monitoring the change in volume with saturation while the specimen was confined under constant normal street. The consolidation test results are shown on Plates B-17 through B-21.

Maximum Density/Optimum Moisture

The maximum dry density and optimum moisture content of two representative bulk samples was evaluated in accordance with ASTM Test Method D 1557-91/Method A. The results of this test are summarized in Table B-1.

Particle Size Analysis

Modified hydrometer portion ASTM Test Method D-2422-72 were conducted to aid in classification of the soils. The results of the particle size analysis are presented in Table B-1.

Expansion Index Tests

An expansion index test was performed to evaluate the expansion potential of typical onsite soils. Testing was carried out according to UBC Method 29-2. The results are presented in Table B-1.

TABLE B-1

Playa Vista W.O. 500464

SUMMARY OF LABORATORY TEST DATA

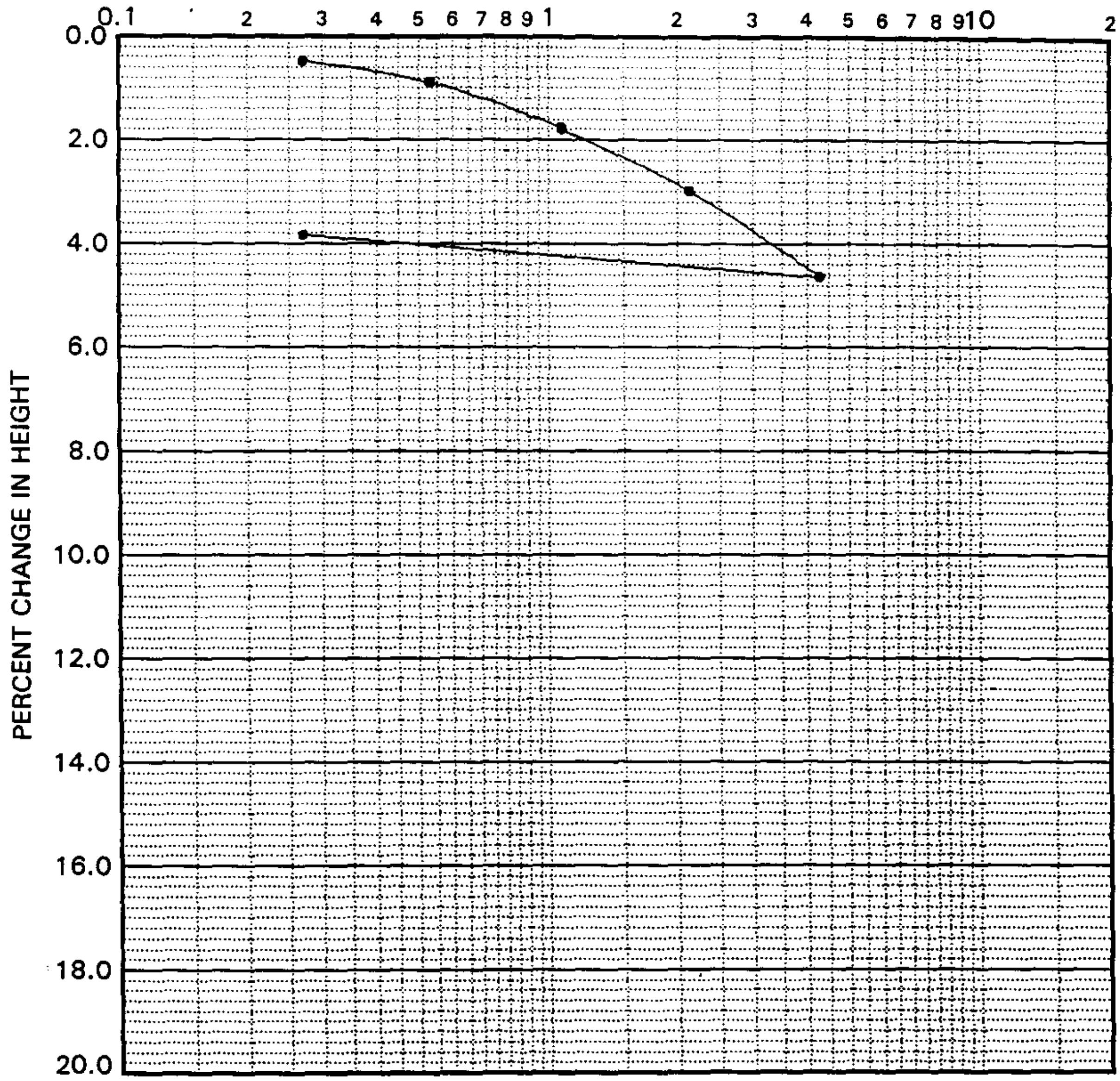
Boring	Depth (feet)	Soil Description	Group Classification	% Gravel	% Sand	% Silt	% Clay	Max. Dry Density (pcf)	Opt. Moist. (%)	EI	RV
B-01	15.0	Silty Sand/Sandy Si⁻	SM/ML	0	50	40	10				
B-01	25.0	Sandy Silt	ML	0	40	38	22				
B-01	40.0	Clayey Silt	ML	0	2	58	40				
B-02	0.0	Clayey Sand	SC	7	50	21	22	127.5	8.9	17	
B-02	20.0	Silty Clay	CL	0	27	31	42				
B-02	30.0	Clayey Silt	ML	0	7	63	30				
B-03	15.0	Sandy Clayey Silt	ML	0	23	59	18				
B-03	20.0	Silty Clay	CL	0	0	47	53				
B-03	35.0	Sandy Silt	ML	0	35	50	15				
B-03	40.0	Sand	SP	32	65	1	2				
B-03	65.0	Sand	SP	7	85	5	3				
B-04	10.0	Clay	CL	0	17	13	70				
B-04	25.0	Clayey Silt	ML	0	20	55	25				
B-04	45.0	Silty Clay	CL	0	0	37	63				
B-04	55.0	Clayey Silt	ML	0	0	52	48				
B-04	65.0	Sand	SP	0	90	7	3				
B-05	20.0	Silty Clay	CL	0	10	43	47				
B-05	55.0	Clayey Silt	ML	0	2	63	35				
B-06	30.0	Sandy Silt	ML	0	32	51	17				
B-06	45.0	Clayey Silt	ML	0	2	51	47				
B-06	70.0	Sand	SP	7	88	2	3				
B-07	0.0	Clayey Sand	SC	11	45	20	24	125.8	9.4		32
B-07	25.0	Clayey Sandy Silt	ML	0	38	37	25				
B-07	30.0	Sandy Silt	ML	0	47	43	10				
B-08	20.0	Clayey Silt	ML	0	2	71	27				
B-08	40.0	Clayey Silt	ML	0	0	53	47				
B-08	55.0	Clayey Silt	ML	0	5	57	38				
B-08	65.0	Sand	SP	0	97	1	2				

TABLE B-1

Playa Vista W.O.500464

SUMMARY OF LABORATORY TEST DATA

Boring	Depth (feet)	Soil Description	Group Classif-ication	% Gravel	% Sand	% Silt	% Clay	Max.Dry Density (pcf)	Opt. Moist. (%)	EI	RV
B-09	20.0	Clayey Silt	ML	0	12	50	38				
B-09	45.0	Clayey Silt	ML	0	15	58	27				
B-10	0.0	Sandy Clay	CL	4	44	24	28	123.3	10.0		
B-10	40.0	Clayey Silt	ML	0	0	68	32				
B-10	60.0	Sand	SP	20	78	0	3				
B-11	0.0	Sandy Clay	CL	5	38	27	30	121.4	10.1	34	
B-11	15.0	Silty Clay	CL	0	12	36	52				
B-11	25.0	Clayey Silt	ML	0	18	45	37				
B-11	35.0	Sandy Silt	ML	0	32	53	15				
B-11	60.0	Sand	SP	0	92	5	3				



boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-01	25.0	106.0	19.9	60	ML	Sandy Silt

REMARKS: WATER ADDED AT 1.07 TSF

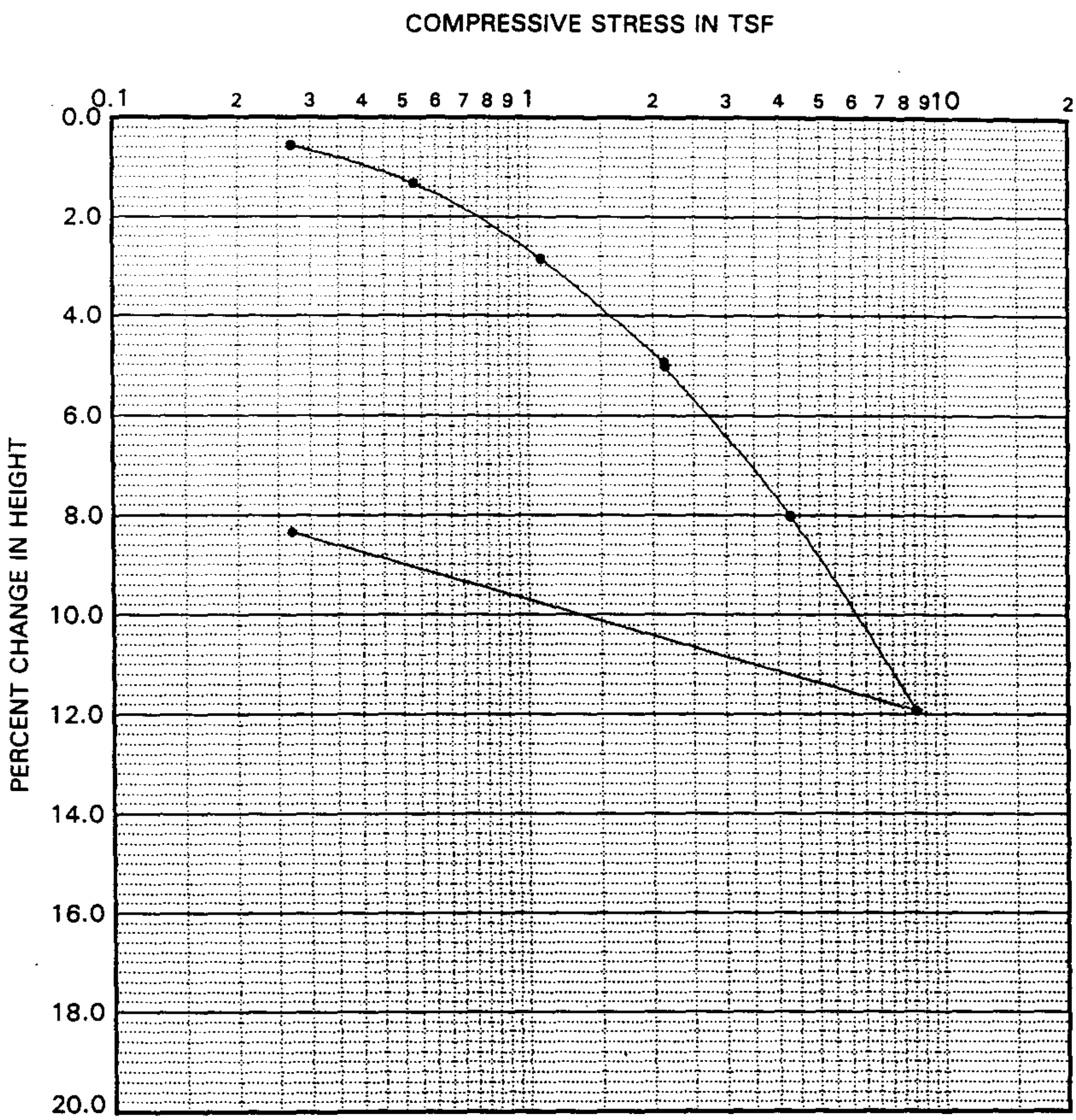
CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.

3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 **PLATE B-1**

A-86



boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-01	40.0	89.0	33.4	98	ML	Clayey Silt

REMARKS: WATER ADDED AT 2.13 TSF

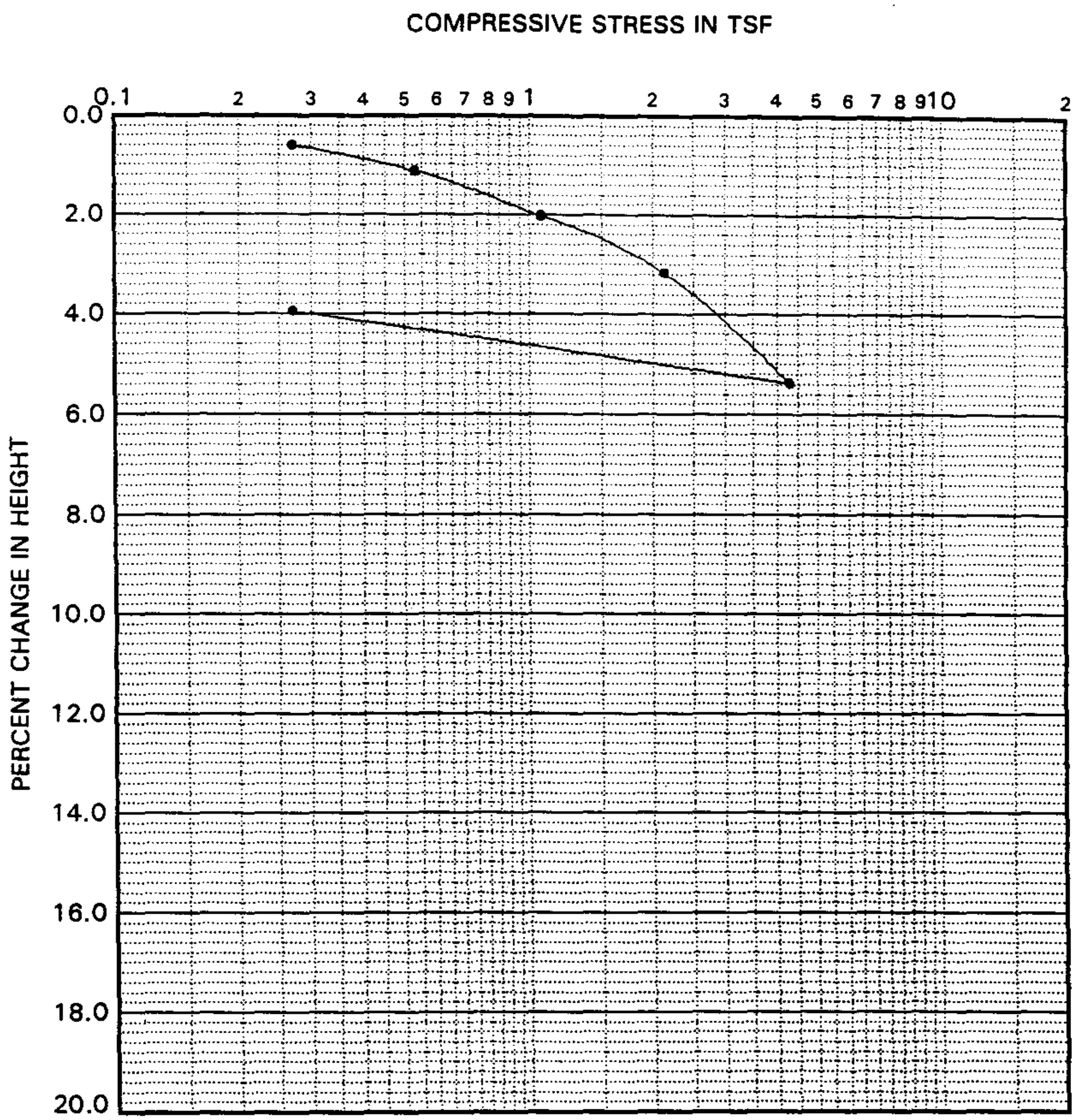
CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.

3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 **PLATE B-2**

A-87



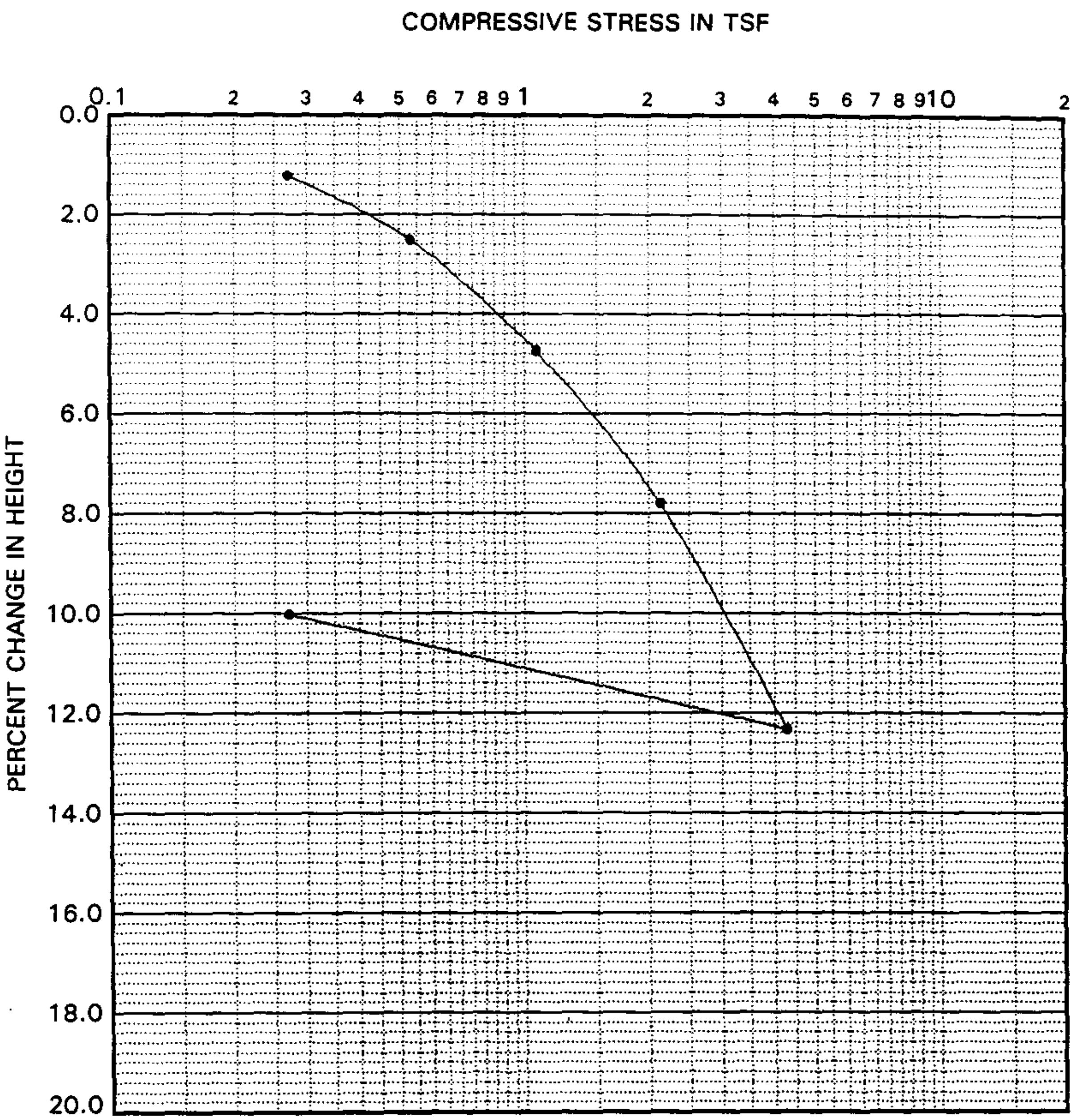
boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-02	30.0	94.1	29.9	93	ML	Clayey Silt

REMARKS: WATER ADDED AT 1.07 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 PLATE B-3

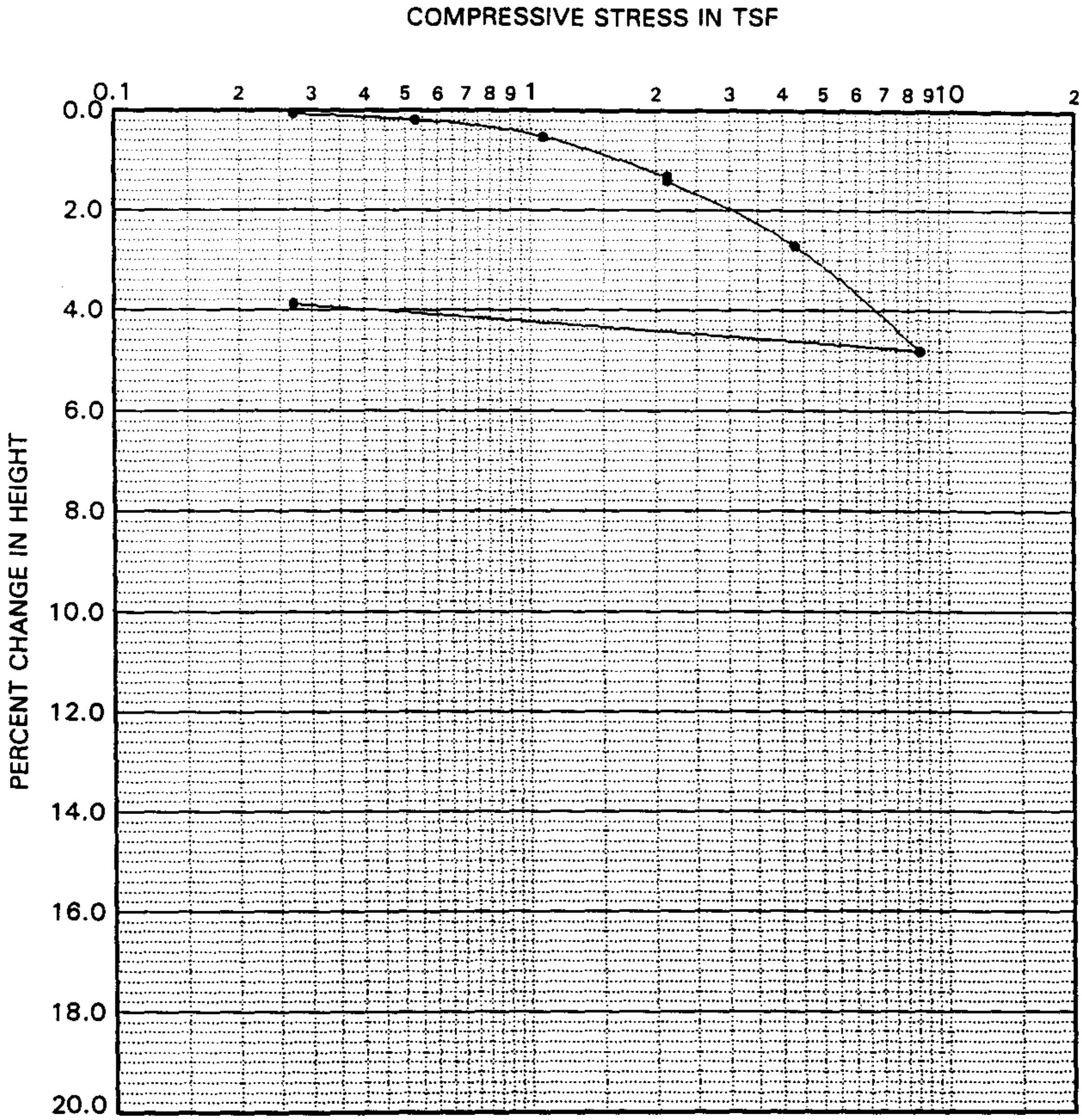


boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-03	20.0	73.4	48.5	100	CL	Silty Clay

REMARKS: WATER ADDED AT 1.07 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122
W.O. 500464 PLATE B-4

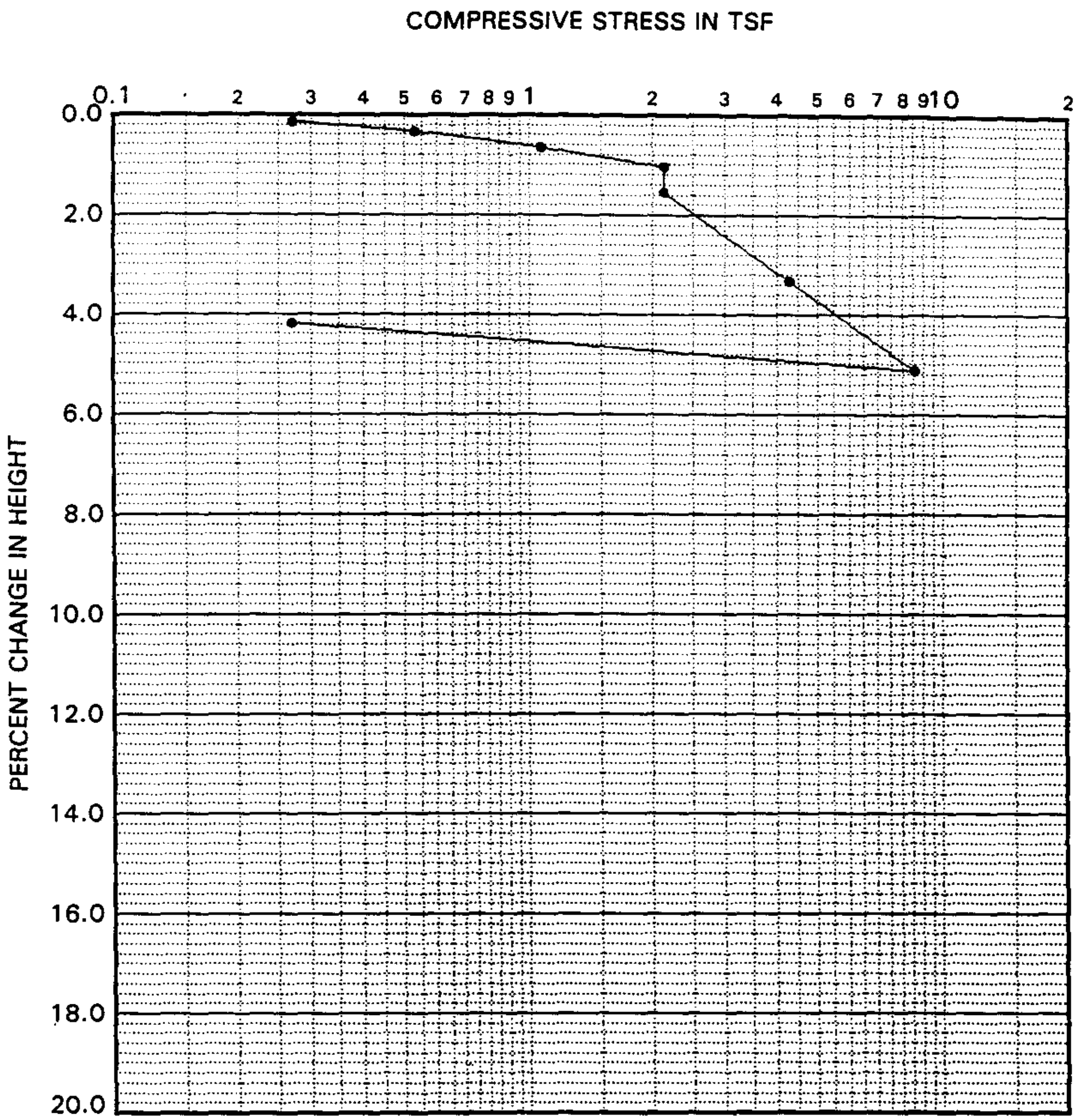


boring	depth (ft.)	dry density	in situ moist.	-200 sieve,	group symbol	typical names
B-03	40.0	101.4	11.9	3	SP	Sand

REMARKS: WATER ADDED AT 2.13 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122
W.O. 500464 PLATE B-5



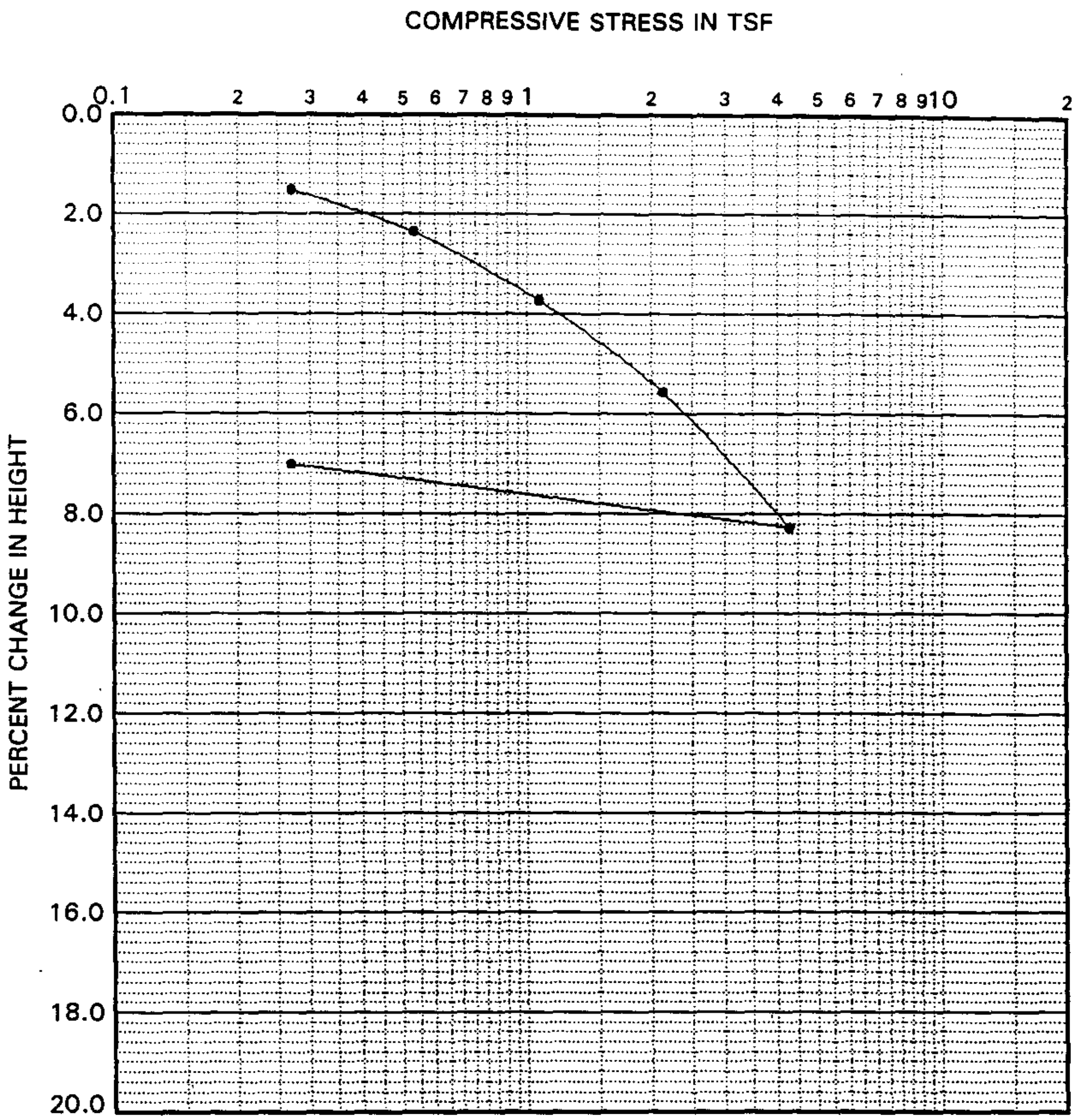
boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-03	65.0	117.5	16.5	8	SP	Sand

REMARKS: WATER ADDED AT 2.13 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122
W.O. 500464 **PLATE B-6**

A-91



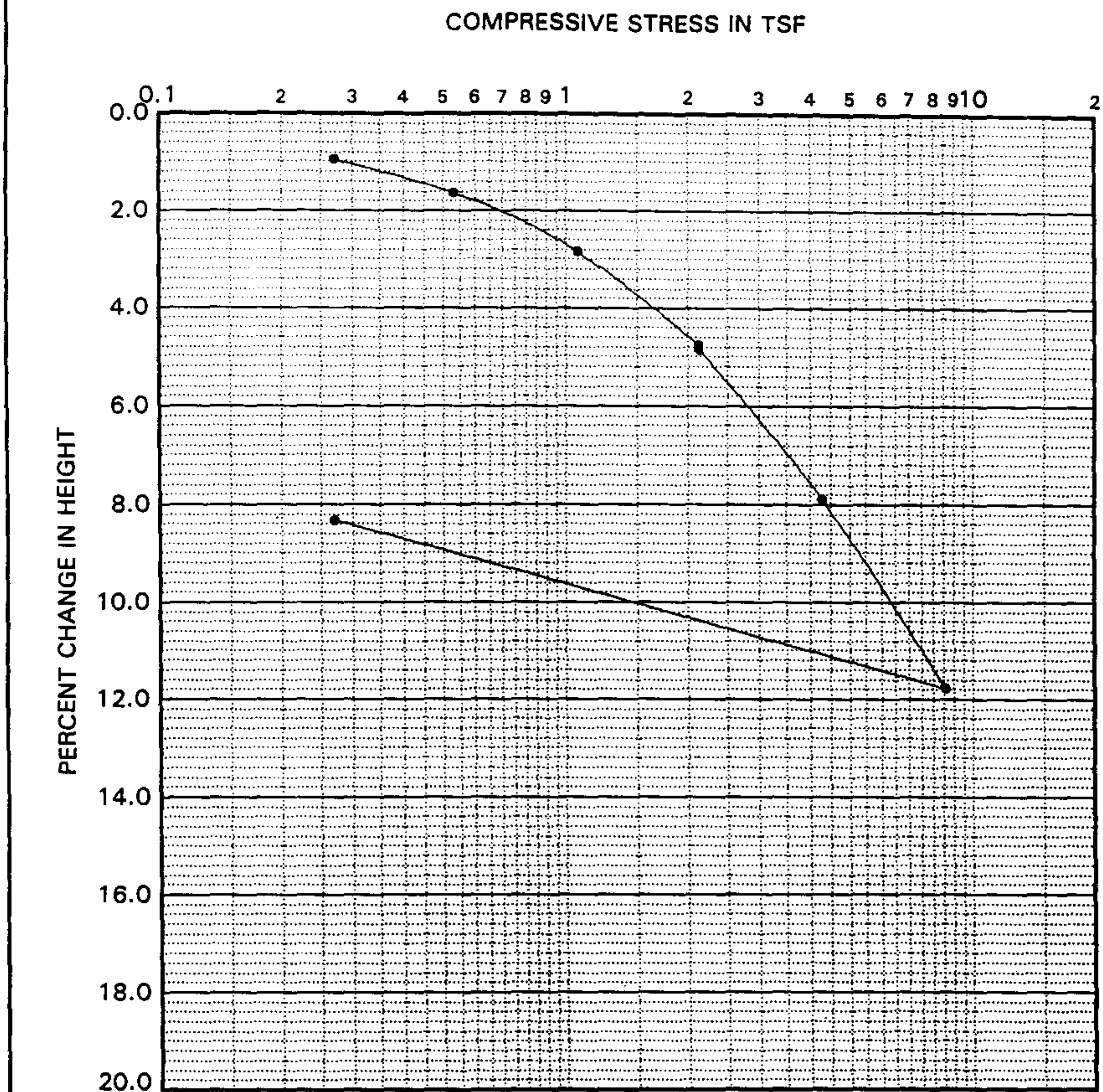
boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-04	25.0	93.2	32.3	80	ML	Clayey Silt

REMARKS: WATER ADDED AT 1.07 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 PLATE B-7



boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-04	55.0	81.1	41.8	100	ML	Clayey Silt

REMARKS: WATER ADDED AT 2.13 TSF

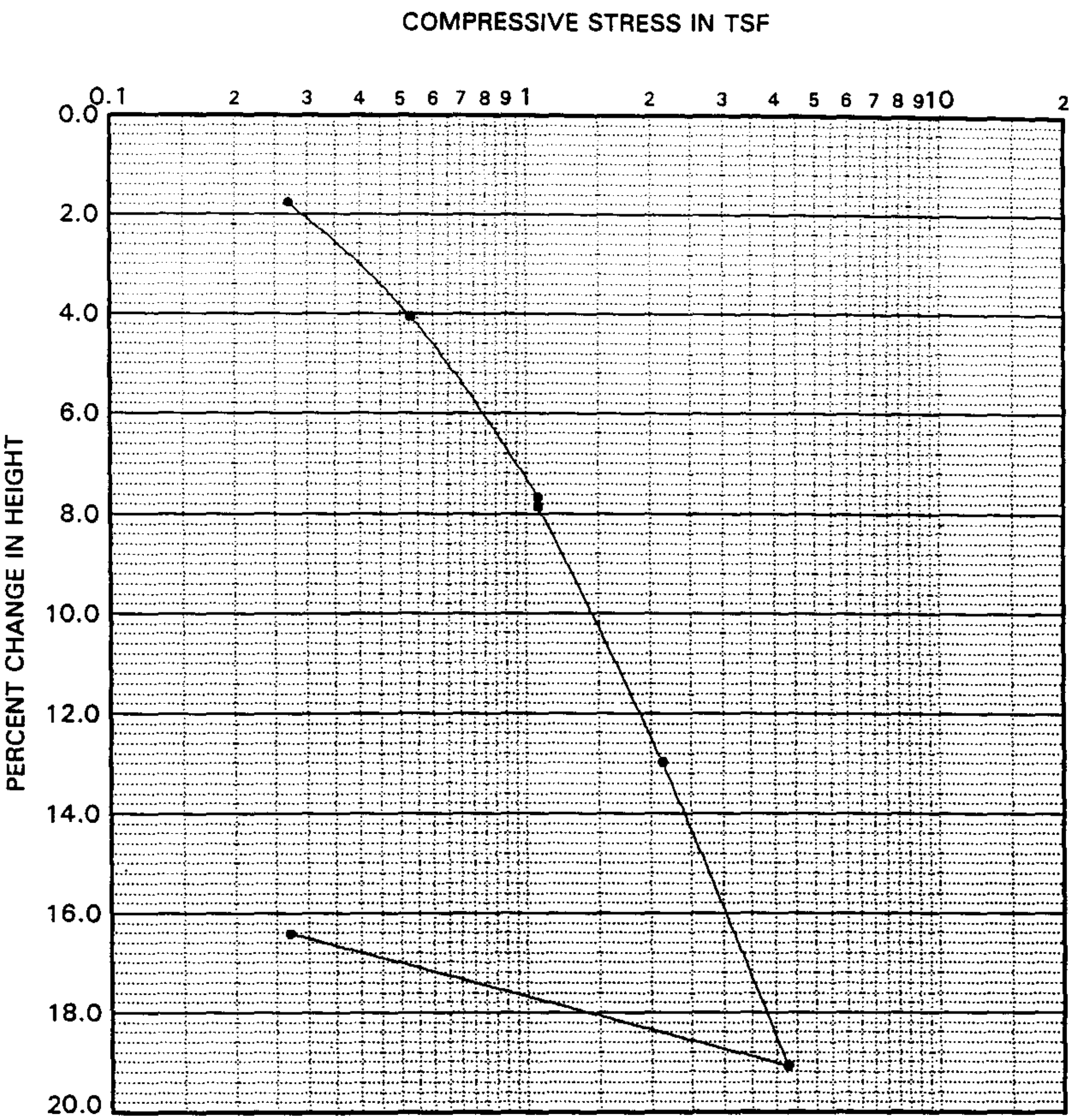
CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.

3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 PLATE B-8

A-93



boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-05	20.0	57.7	70.8	90	CL	Silty Clay

REMARKS: WATER ADDED AT 1.07 TSF

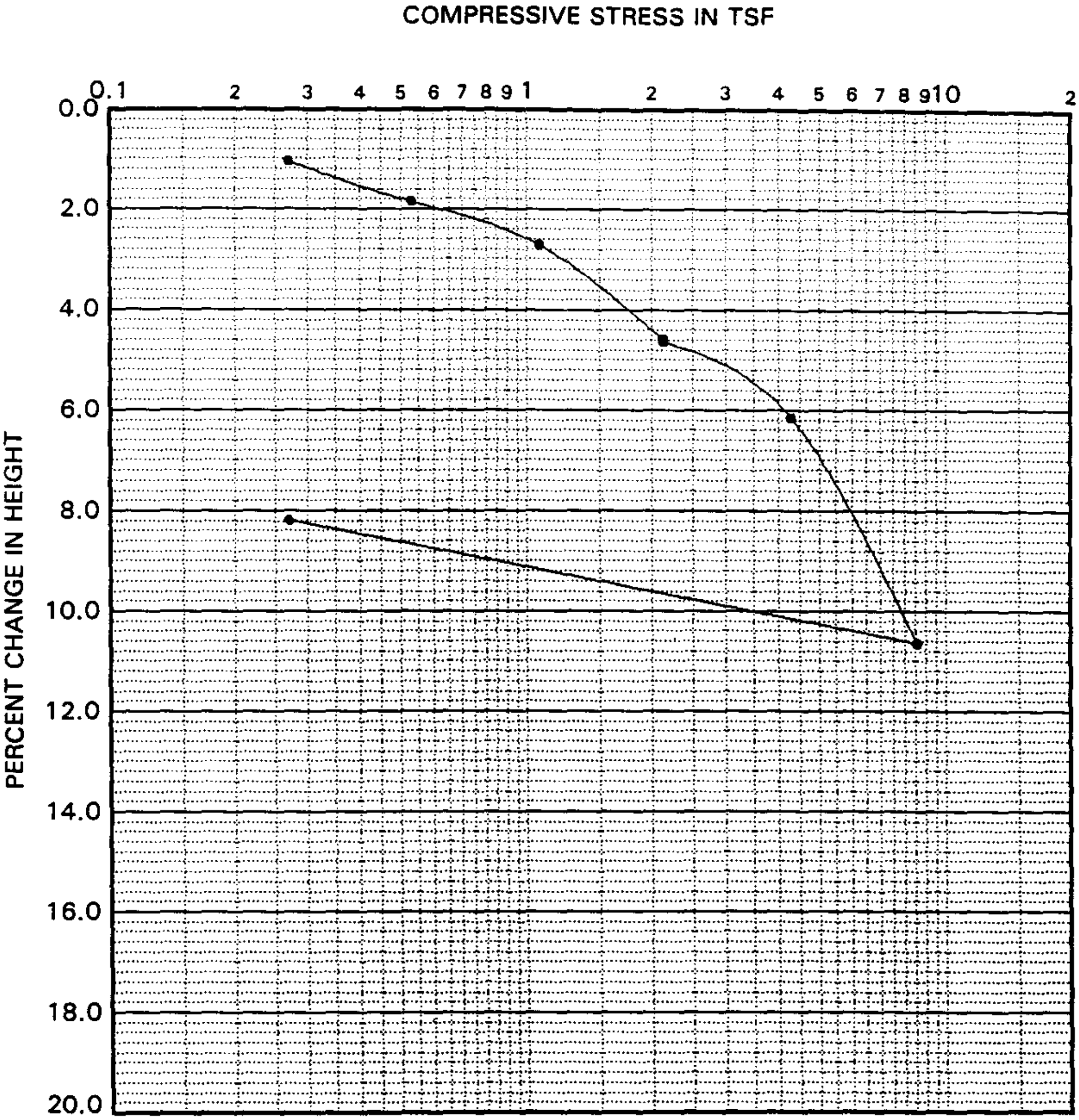
CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.

3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 **PLATE B-9**

A-94



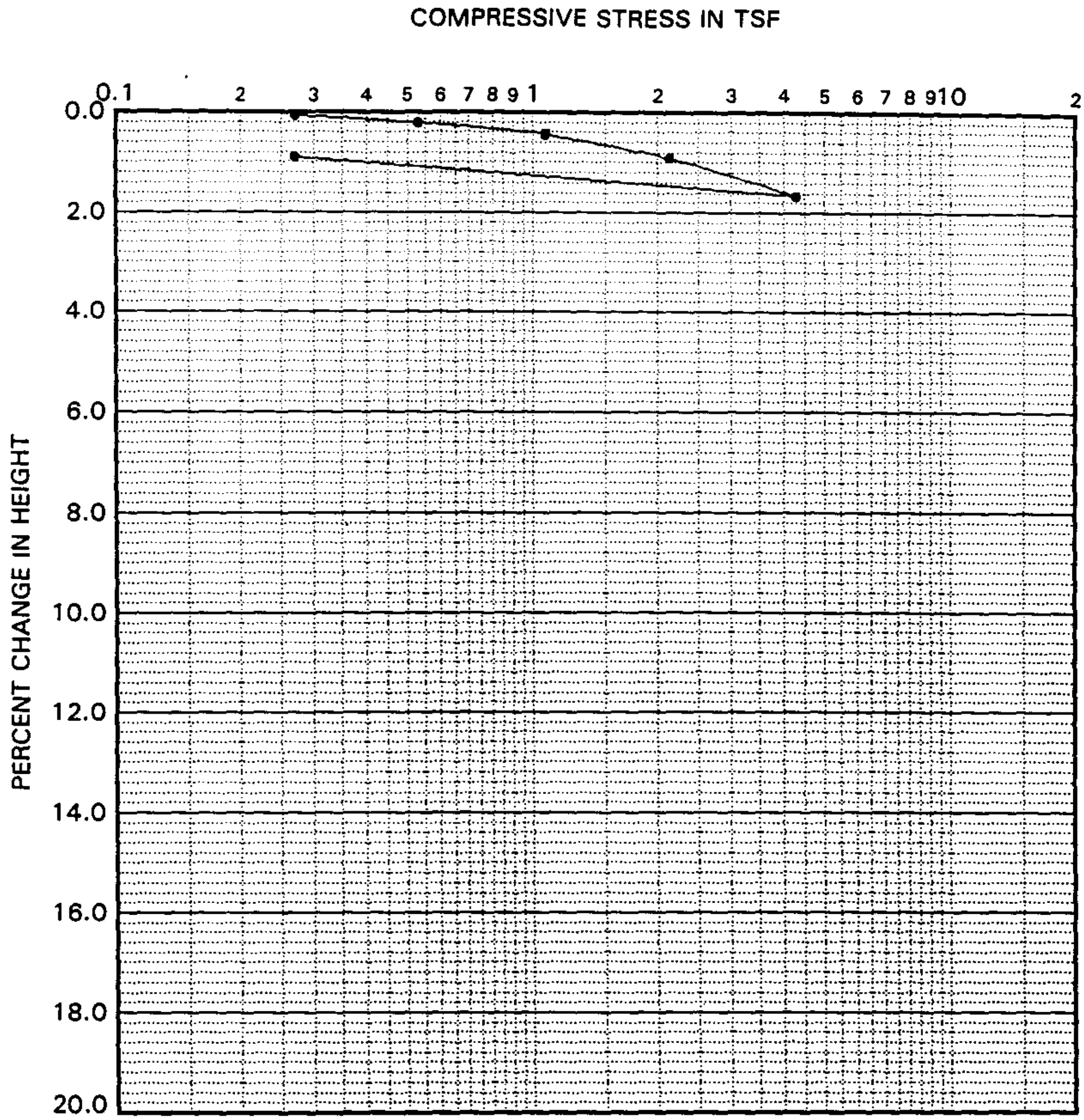
boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-05	55.0	93.1	29.7	98	ML	Clayey Silt

REMARKS: WATER ADDED AT 2.13 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122
W.O. 500464 PLATE B-10

A-95



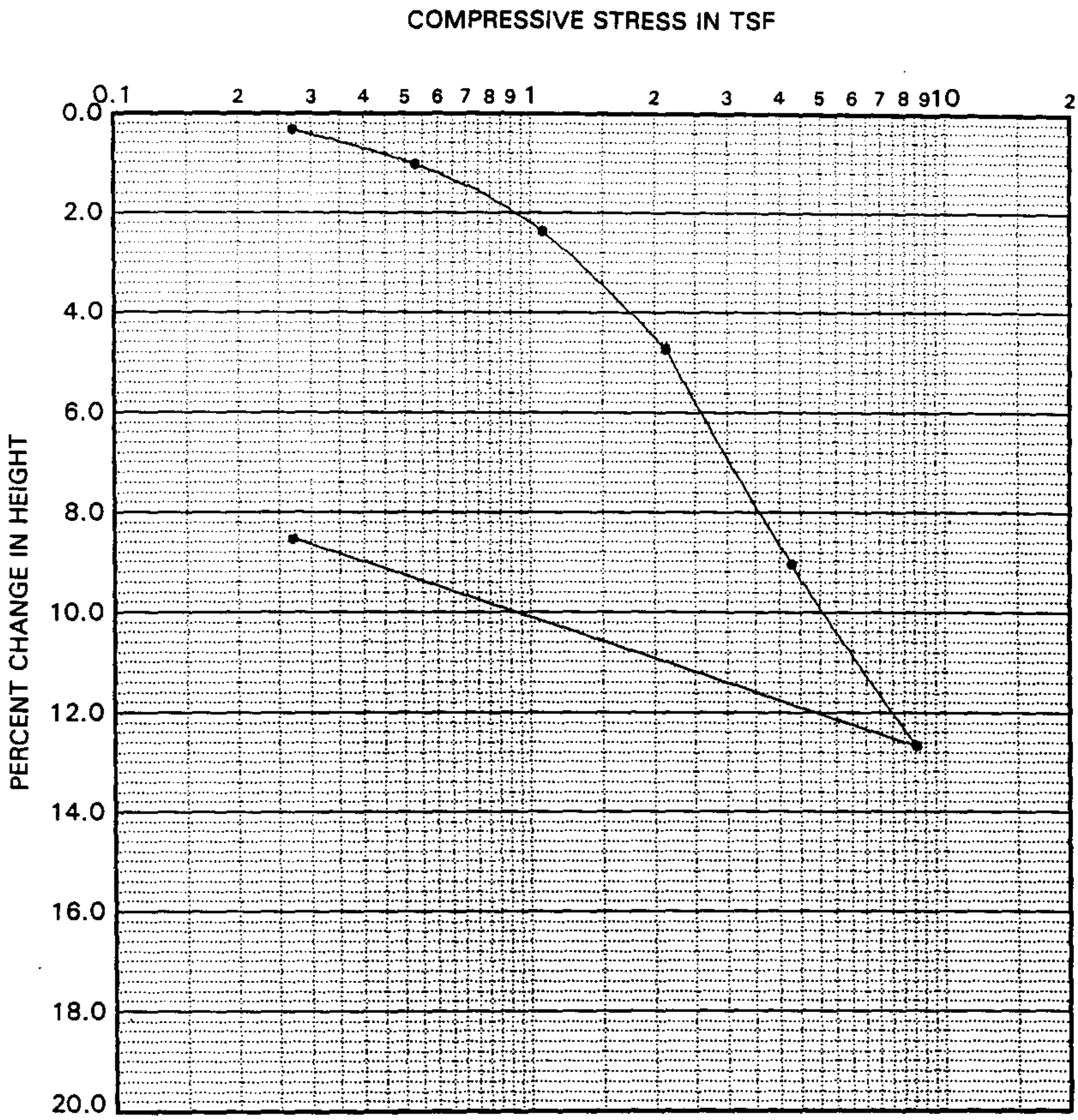
boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-06	30.0	93.2	31.4	68	ML	Sandy Silt

REMARKS: WATER ADDED AT 1.07 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122
W.O. 500464 PLATE B-11

A-96



boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-06	45.0	79.1	33.6	98	ML	Clayey Silt

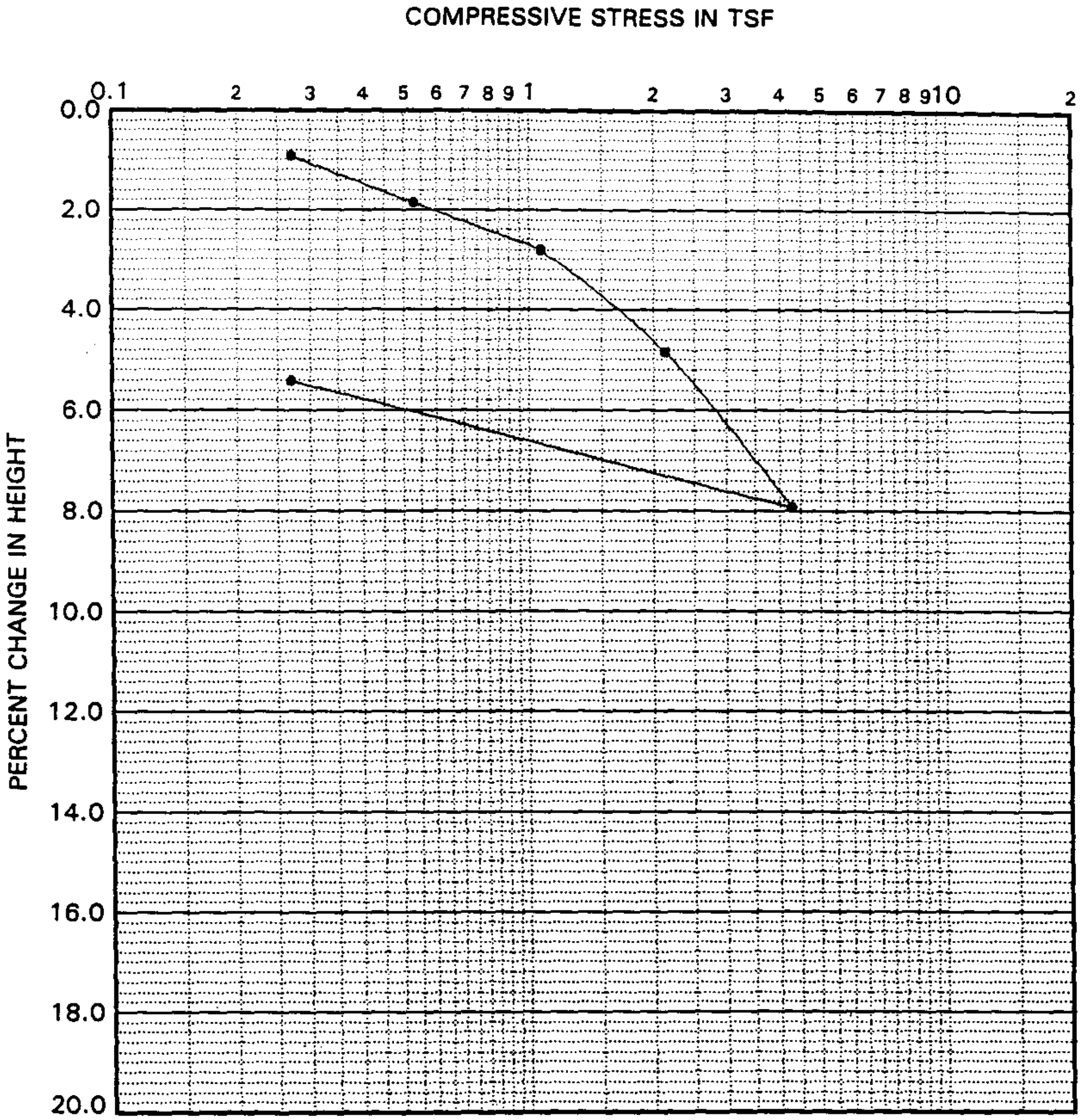
REMARKS: WATER ADDED AT 2.13 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.

3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 **PLATE B-12**



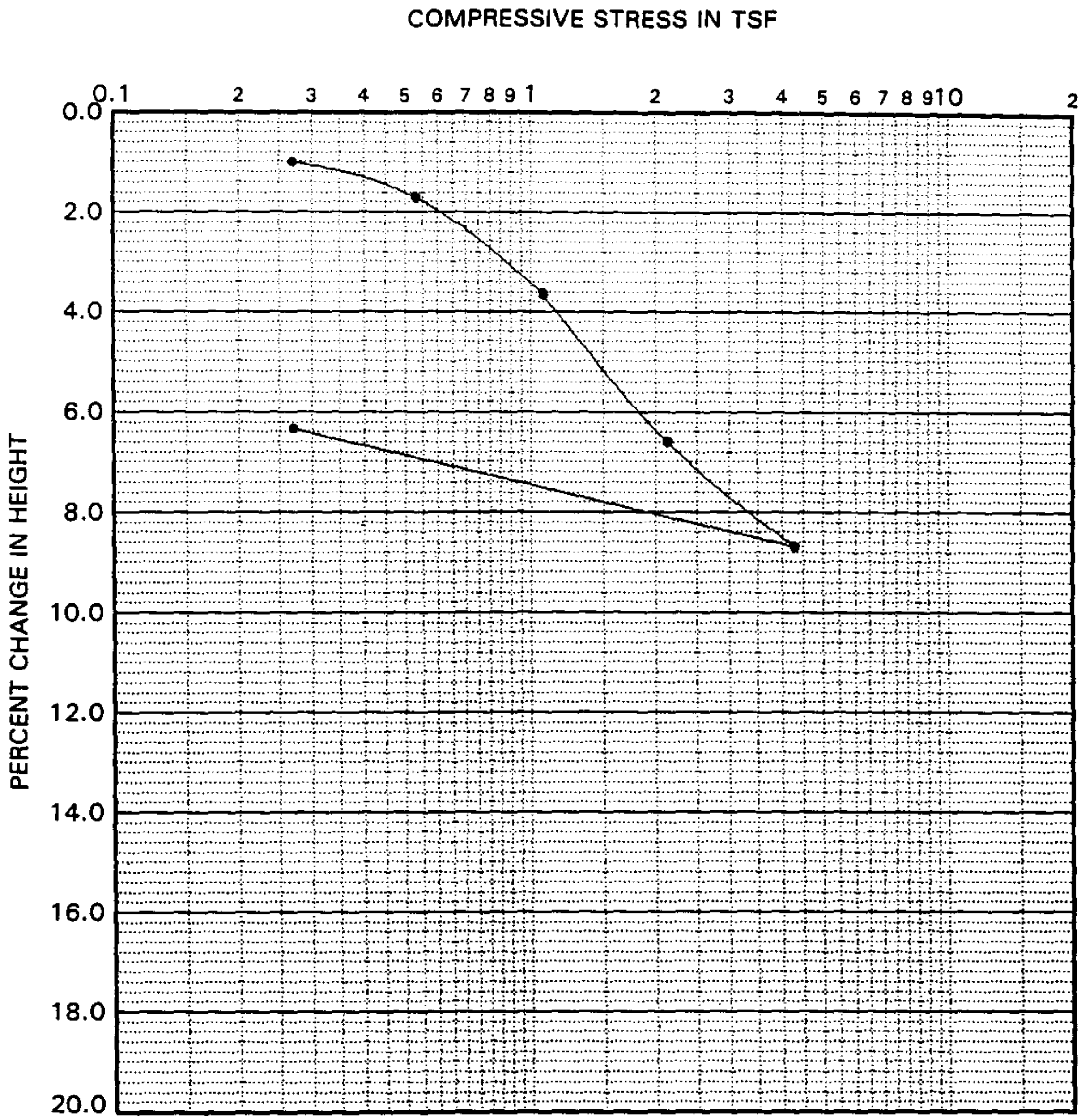
boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-07	25.0	107.3	20.5	62	ML	Clayey Sandy Silt

REMARKS: WATER ADDED AT 1.07 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 PLATE B-13



boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-08	20.0	71.3	41.5	98	ML	Clayey Silt

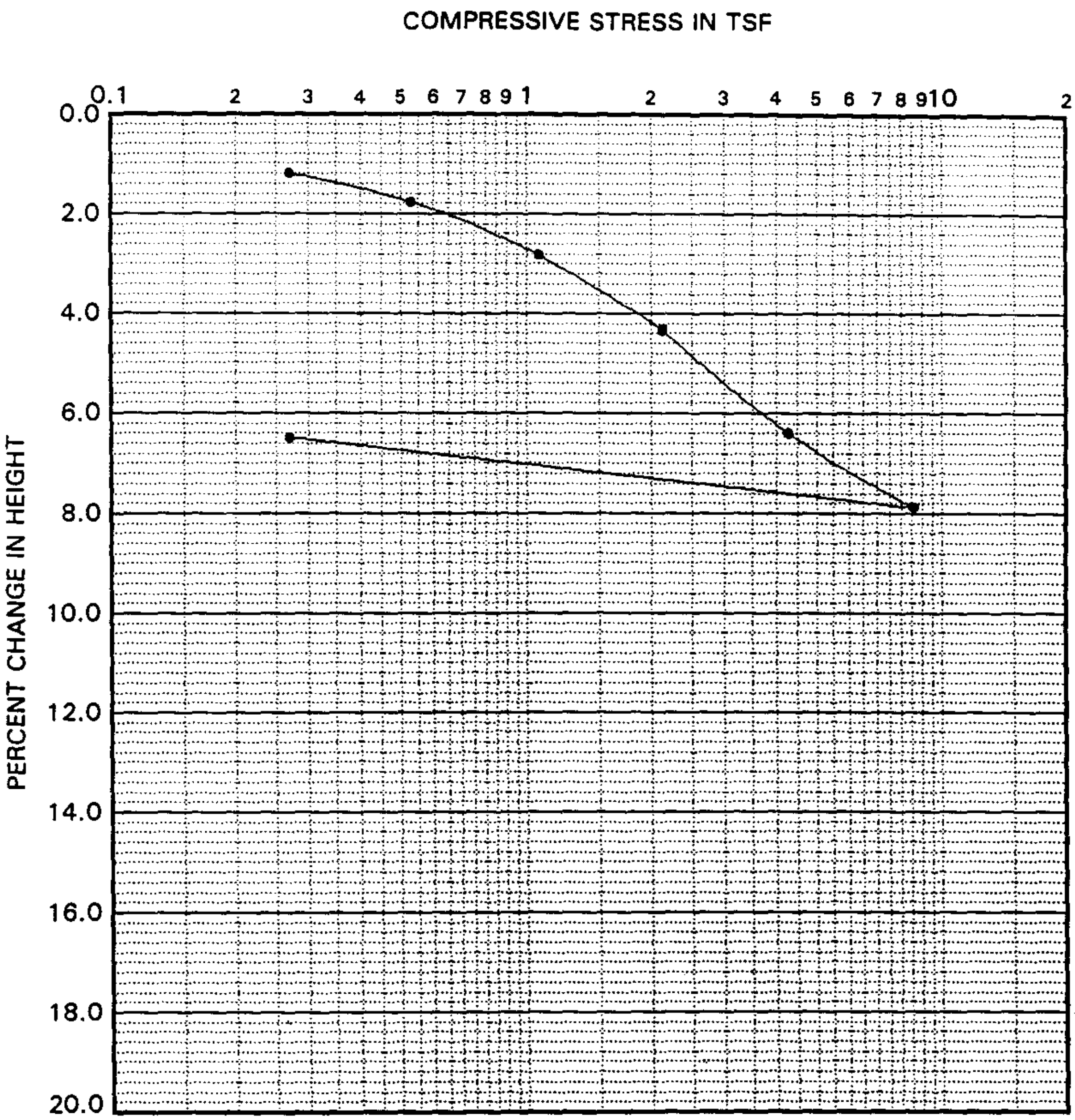
REMARKS: WATER ADDED AT 1.07 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 PLATE B-14

A-99



boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-08	40.0	87.2	35.8	100	ML	Clayey Silt

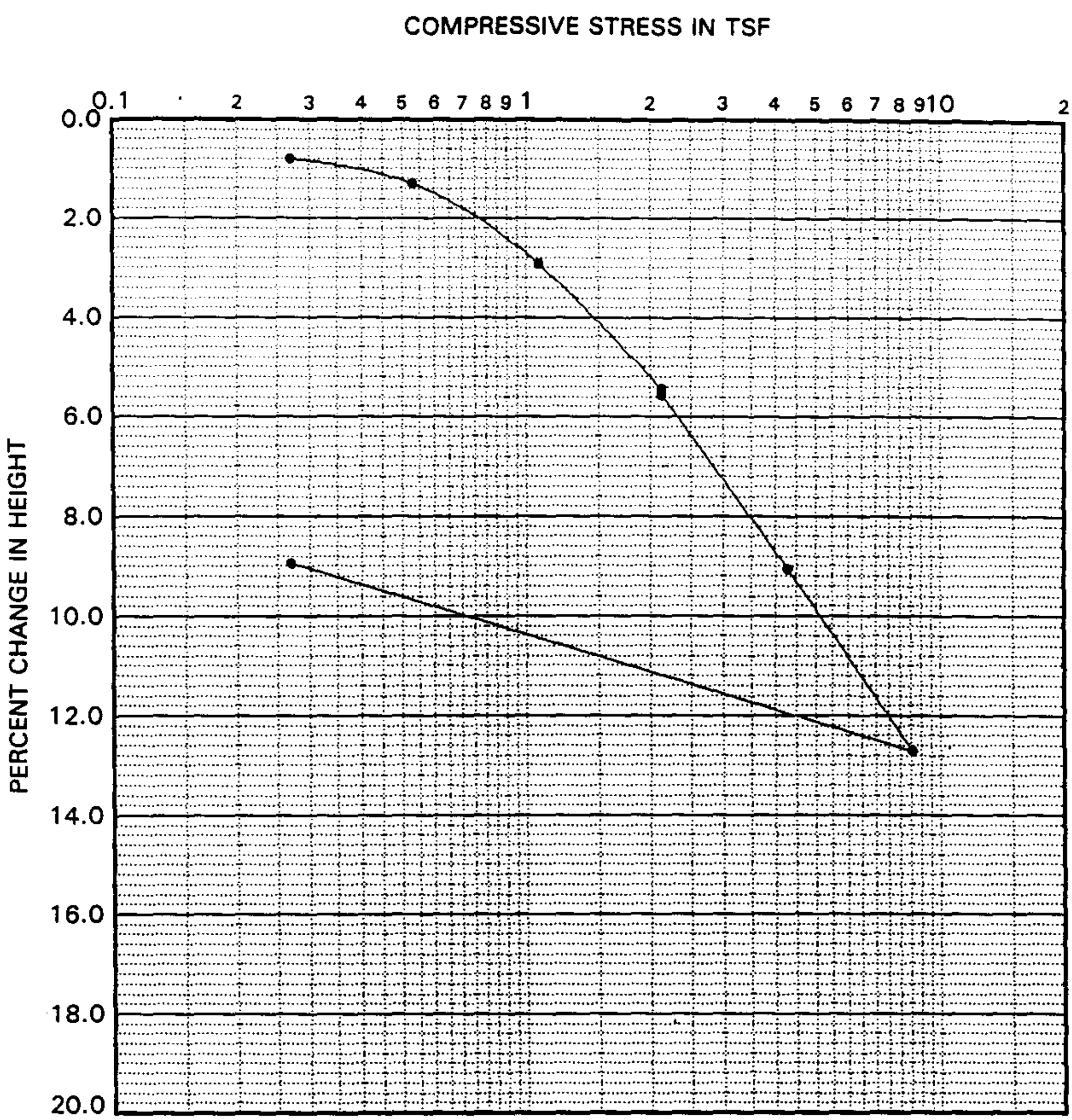
REMARKS: WATER ADDED AT 2.13 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 PLATE B-15

A-100



boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-08	55.0	87.9	34.2	95	ML	Clayey Silt

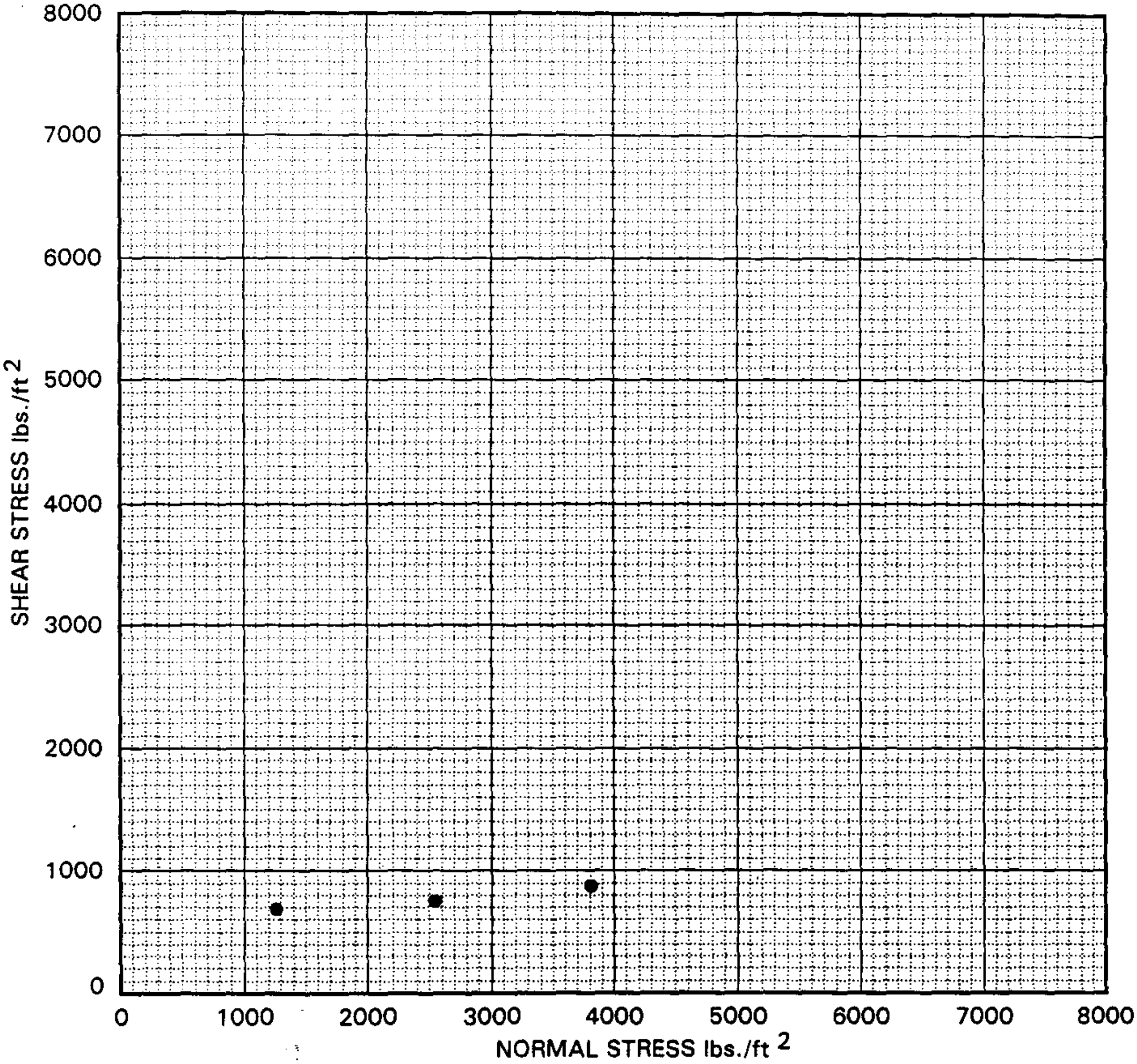
REMARKS: WATER ADDED AT 2.13 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122
W.O. 500464 PLATE B-16

A-101

DIRECT SHEAR TEST
Undisturbed



Silty Sand/Sandy Silt	COHESION 600 psf.
SM/ML	FRICTION ANGLE 5.0 degrees

symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	B-01	15.00			

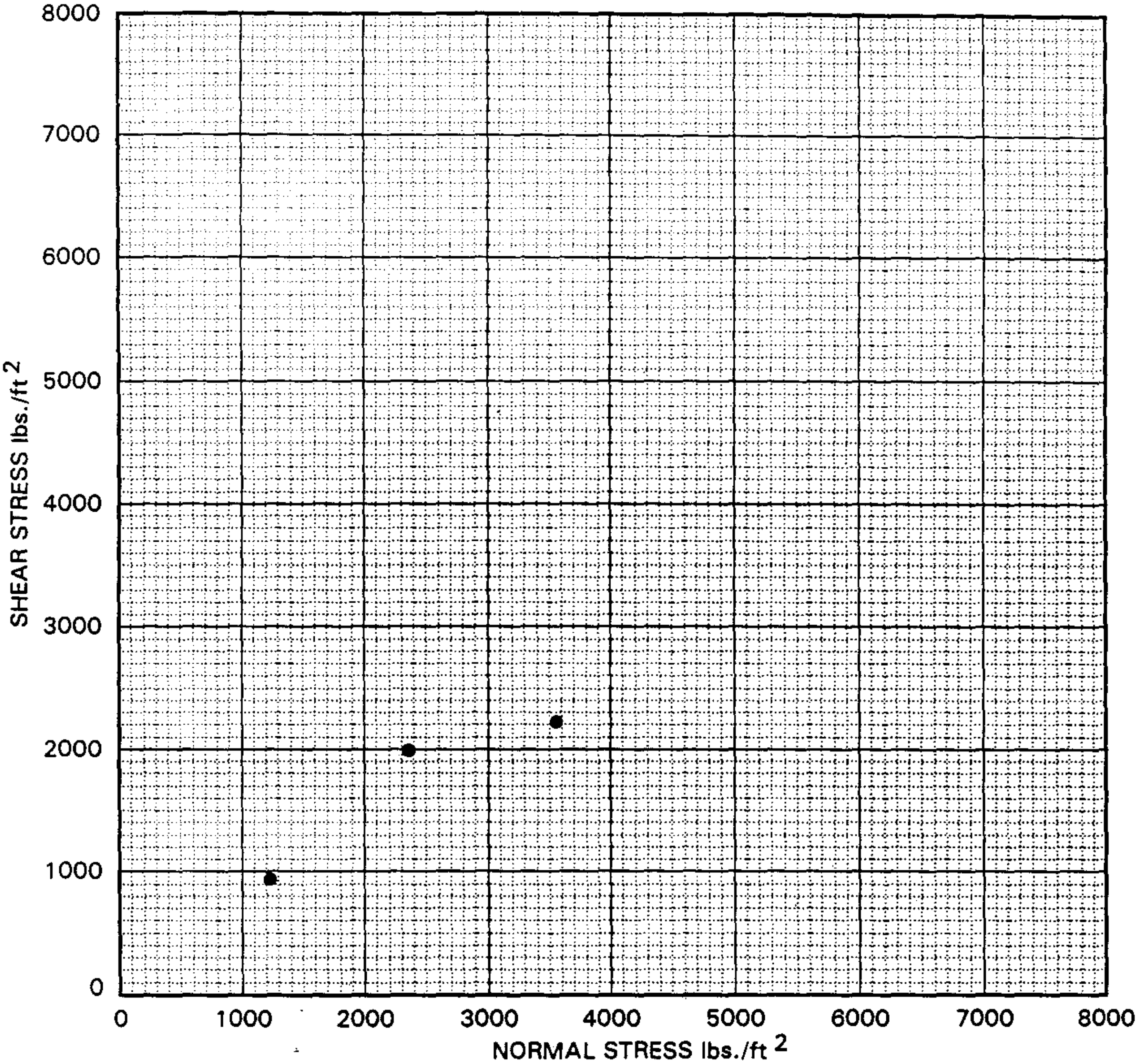
DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 **PLATE B-22**

A-102

DIRECT SHEAR TEST
Remolded



	COHESION	450	psf.
	FRICTION ANGLE	28.0	degrees

symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	B-02	5.00			

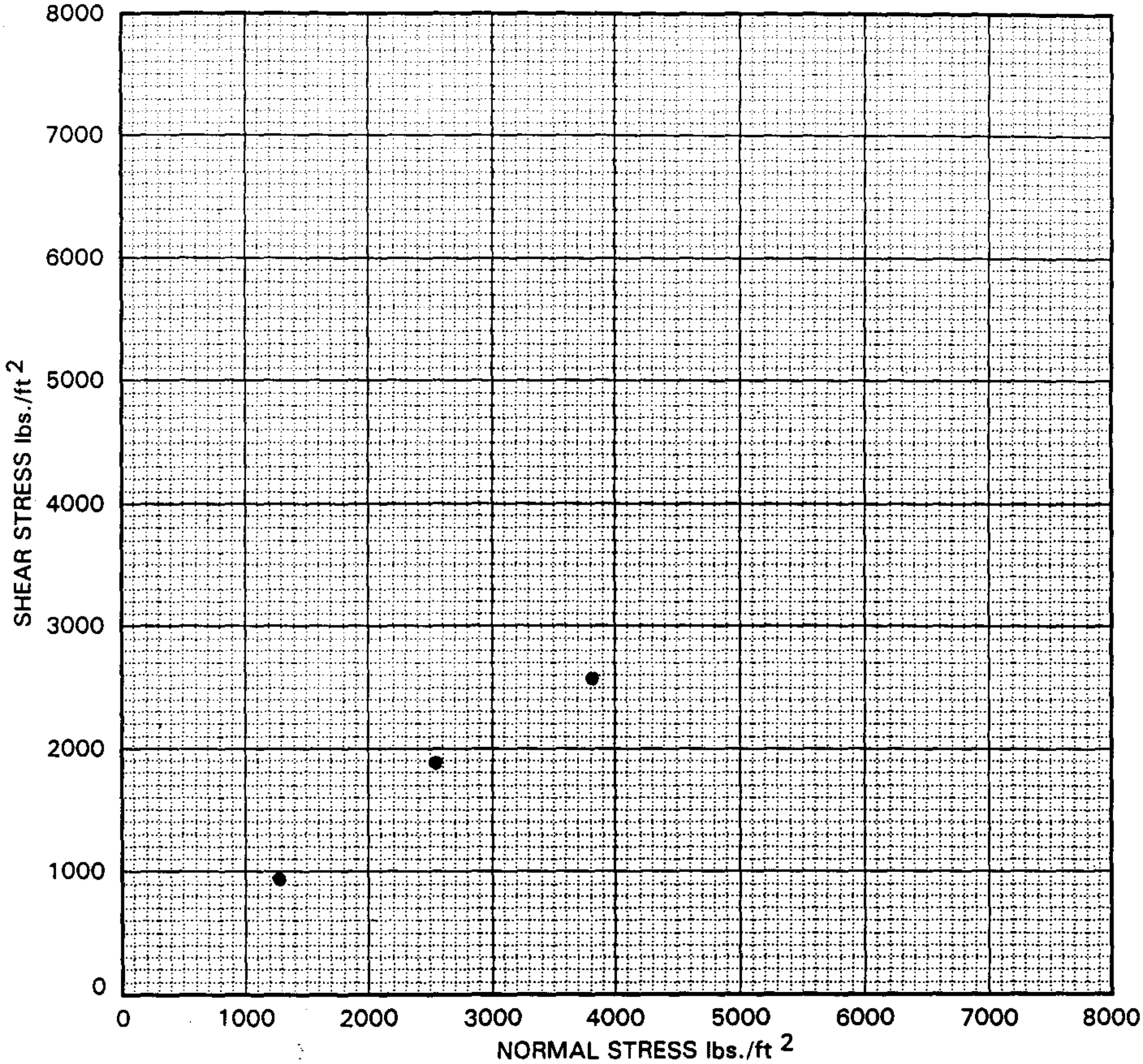
DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 **PLATE B-23**

A-103

DIRECT SHEAR TEST
Undisturbed



Sand	COHESION 200 psf.
SP	FRICTION ANGLE 32.0 degrees

symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	B-04	65.00			

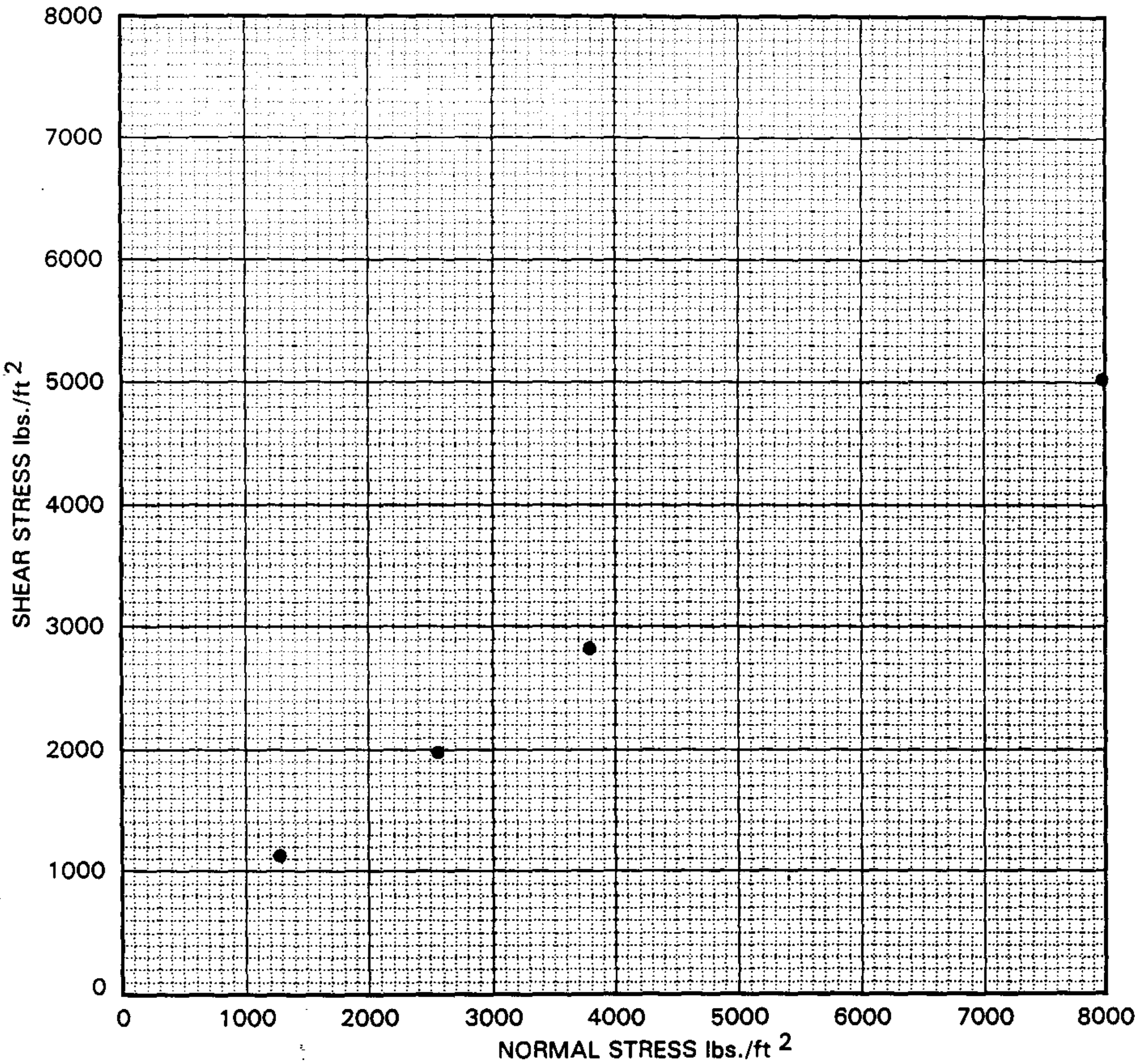
DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 **PLATE B-24**

A-104

DIRECT SHEAR TEST
Undisturbed



Sand		COHESION	psf.
SP		FRICTION ANGLE	degrees

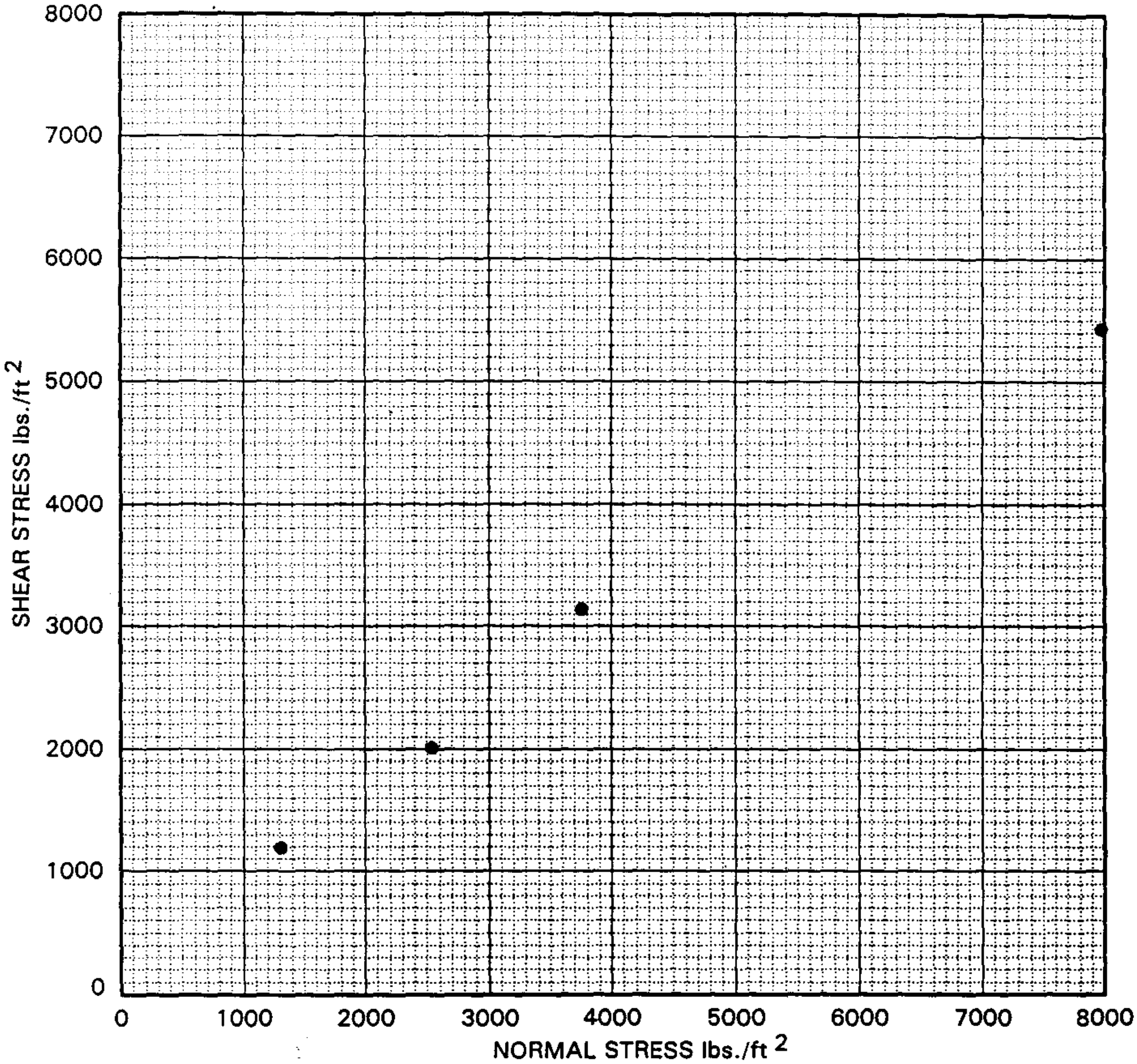
symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	B-06	70.00			

DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122
W.O. 500464 **PLATE B-25**

A-105

DIRECT SHEAR TEST
undisturbed



Sand	COHESION 400 psf.
SP	FRICTION ANGLE 33.0 degrees

symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	8-08	65.00			

DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 **PLATE B-26**

A-106

APPENDIX C
RELEVANT AS-BUILT DRAWINGS

APPENDIX C
RELEVANT AS-BUILT DRAWINGS

DIST	COUNTY	ROUTE	POST MILE TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	LA	1, 90, 405	Var	1	167

ACBHI-405-3(944)142E
ACBHNH-3041(134)E

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

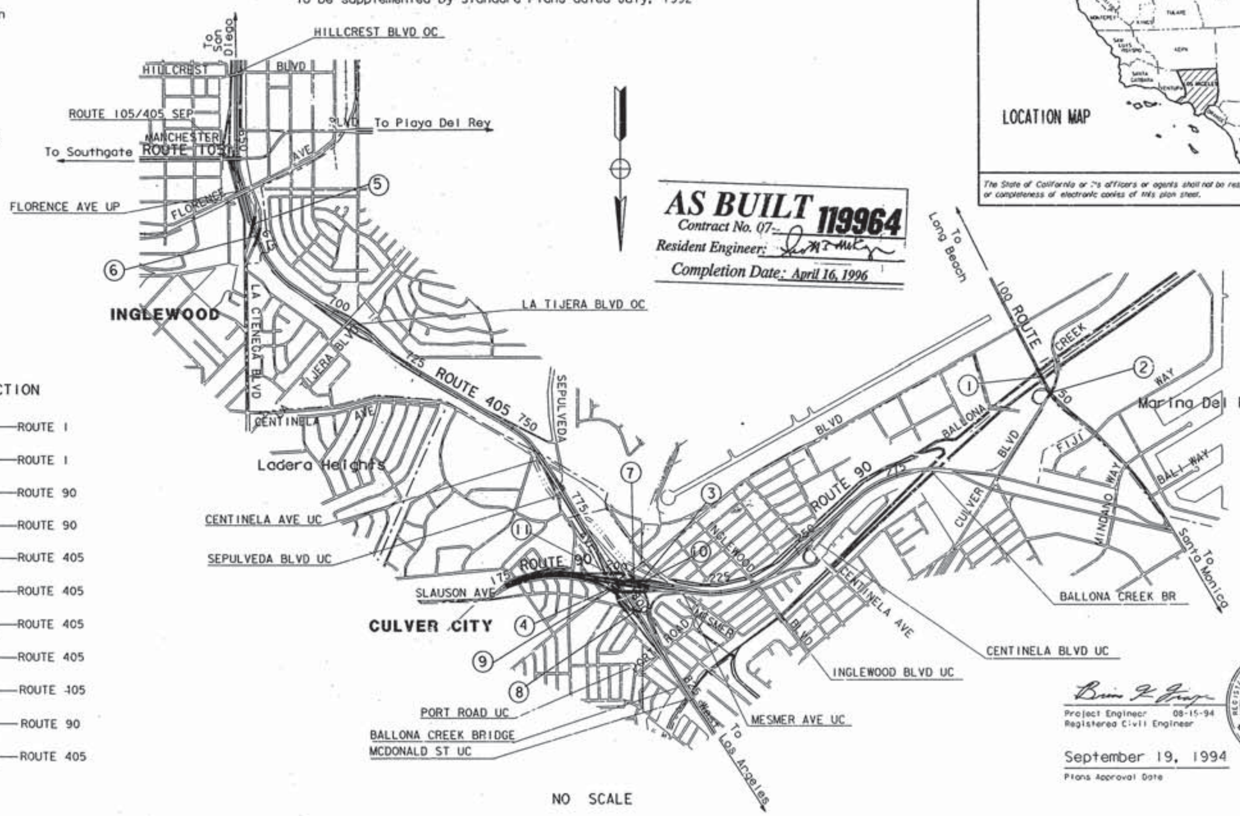
PROJECT PLANS FOR CONSTRUCTION ON
STATE HIGHWAY
IN LOS ANGELES COUNTY
AT VARIOUS LOCATIONS

To be supplemented by Standard Plans dated July, 1992

INDEX OF SHEETS

LOCATIONS OF CONSTRUCTION

No.	Location	Route
1	BALLONA CREEK BR BR NO 53-0118 PM 30.36	ROUTE 1
2	CULVER BLVD OC BR NO 53-0089 PM 30.47	ROUTE 1
3	ROUTE 90/405 SEP BR NO 53-1851 PM 2.54	ROUTE 90
4	JEFFERSON BLVD UC BR NO 53-1855F PM 2.73	ROUTE 90
5	LA CIENEGA BLVD N/B OC BR NO 53-1249 PM 23.64	ROUTE 405
6	LA CIENEGA BLVD S/B OC BR NO 53-1250 PM 23.71	ROUTE 405
7	NORTH CONNECTOR OC BR NO 53-1838G PM 25.99	ROUTE 405
8	SLAUSON AVE UC BR NO 53-1401 PM 26.08	ROUTE 405
9	JEFFERSON BLVD UC BR NO 53-1255 PM 25.93	ROUTE 405
10	NORTHWEST CONNECTOR OC BR NO 53-1854G PM 2.55	ROUTE 90
11	SOUTH CONNECTOR OC BR NO 53-1852F PM 25.91	ROUTE 405



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.

AS BUILT
Contract No. 07- 119964
Resident Engineer: [signature]
Completion Date: April 16, 1996

NO SCALE

Project Engineer 08-15-94
Registered Civil Engineer

B.K. FRAZER
No. 49071
Exp. 9-30-96
CIVIL
REGISTERED PROFESSIONAL ENGINEER — STATE OF CALIFORNIA

September 19, 1994
Plans Approval Date

The Contractor shall possess the Class (or classes) of license as specified in the "Notice to Contractors".

PROJECT ENGINEER: B.K. FRAZER | PROJECT MANAGER: T.A. PYLE

Contract No. **07-119964**

TIME PLOTTED => 28-SEP-1994 08:51

00-00-00

FORM DC-OE-93-PF (REV. 3/88)

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3

USERNAME => tome
DGN FILE => /usr/tome/PO/7119960D1.dgn

CU 07200

EA 119961

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	LA	1	43.9/50.0	1	277

STATE OF CALIFORNIA

DEPARTMENT OF TRANSPORTATION

PROJECT PLANS FOR CONSTRUCTION ON

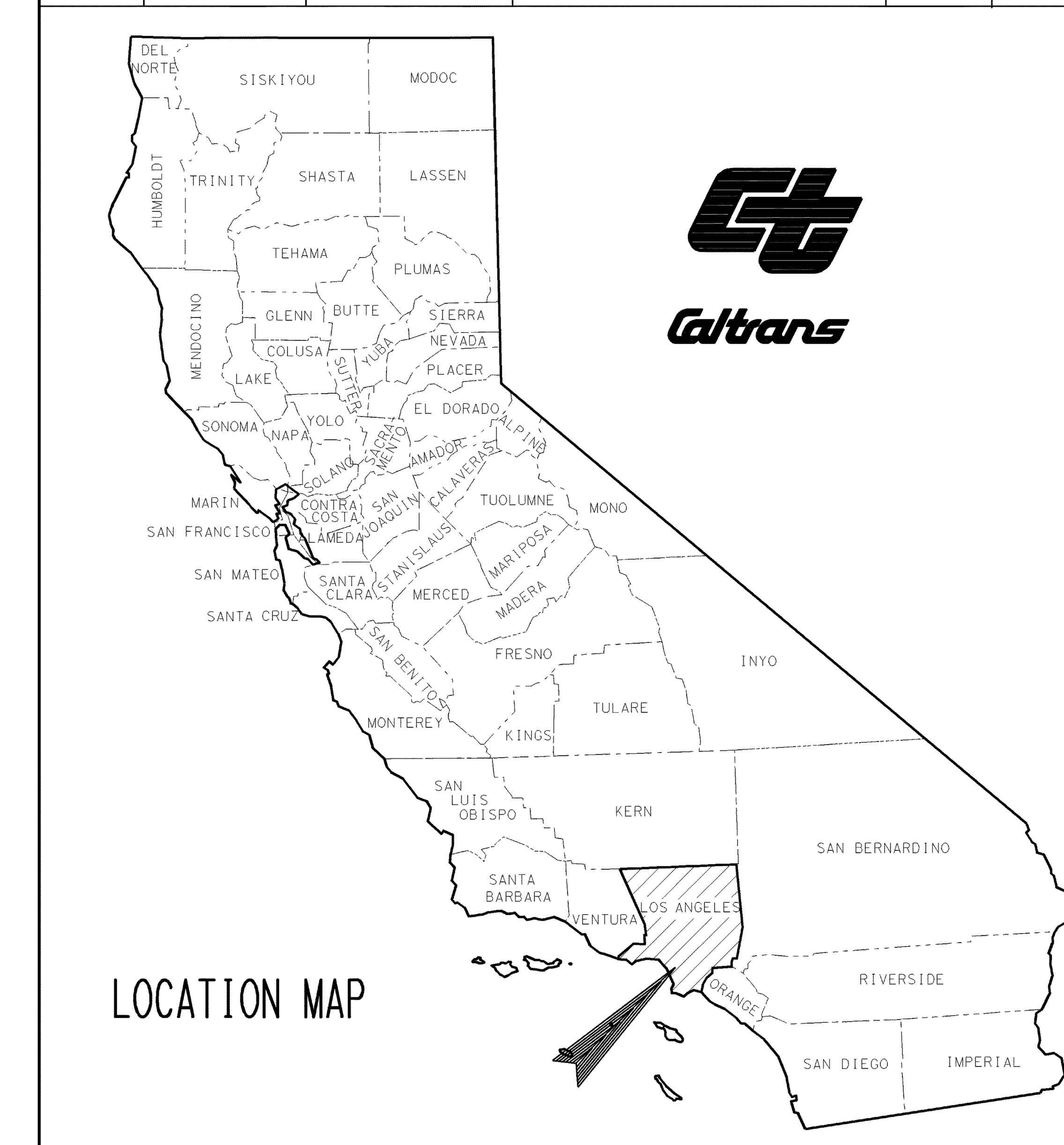
STATE HIGHWAY

IN LOS ANGELES COUNTY
IN LOS ANGELES
AT VARIOUS LOCATIONS FROM 0.4 KM NORTH OF 96TH STREET TO 0.1 KM SOUTH OF BALI WAY

To be supplemented by Standard Plans dated July, 1999

INDEX OF SHEETS

THE STANDARD PLANS LIST APPLICABLE TO THIS CONTRACT IS INCLUDED IN THE NOTICE TO CONTRACTORS AND SPECIAL PROVISIONS BOOK.



AS-BUILT

Contract No. 07- 1660U4

Resident Engineer: [signature]

Completion Date: 08/31/10

Caltrans Metric

[signature] 10-22-03
Project Engineer Date
Registered Civil Engineer

M Crehan No. 48944 Exp. 9-30-06 CIVIL
REGISTERED PROFESSIONAL ENGINEER STATE OF CALIFORNIA

December 6, 2004
Plans Approval Date

Approved as to impact on State facilities and conformance with applicable State standard and practices and that technical oversight was performed as described in the California Department of Transportation A & E Consultant Service Manual

PROJECT ENGINEER	DESIGN OVERSIGHT PRINTED NAME	APPROVAL SIGNATURE	REGISTRATION NO.	DATE
Michael Crehan	Fekade S. Mesfin	[signature]	C 39775	12/31/05

The Contractor shall possess the Class (or classes) of license as specified in the ''Notice to Contractors''.

CITY OF LOS ANGELES

DEPARTMENT OF TRANSPORTATION — ACCEPTED: 01/07 20 04 — SR. TRANS. ENGR.

BUREAU OF STREET LIGHTING — ST. LTG. DES. ENGR. — SR. ST. LTG. ENGR. — APPROVED: 01/06 20 04 — DIV. ENGR. ST. LTG.

PSOMAS
11444 West Olympic Boulevard
West Los Angeles, CA 90064-1549

Contract No. **07-1660U4**

LAST REVISION 10/22/03 DATE PLOTTED => 07-JUN-2011 TIME PLOTTED => 09:59

NOTE: EXACT SIGN LOCATIONS TO DETERMINED BY THE ENGINEER.

DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	LA	1, 90, 405	Var	34	167

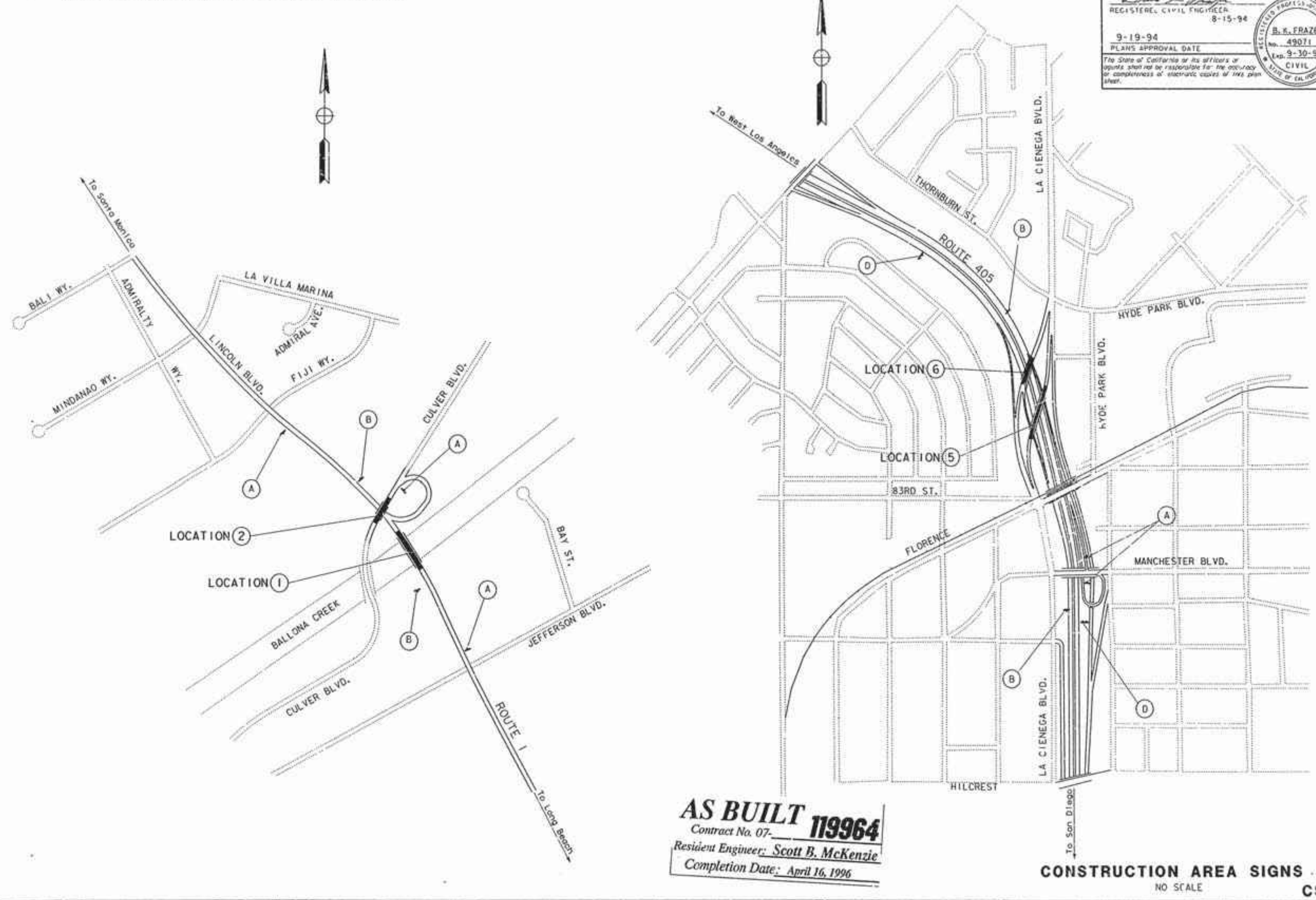
REGISTERED CIVIL ENGINEER 8-15-94

9-19-94

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 B. K. FRAZER No. 49071 Exp. 9-30-96 CIVIL STATE OF CALIFORNIA



AS BUILT

Contract No. 07- 119964

Resident Engineer: Scott B. McKenzie

Completion Date: April 16, 1996

CONSTRUCTION AREA SIGNS

NO SCALE

CS-1

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION	PROJECT ENGINEER	CALCULATED/DESIGNED BY	DATE	REVISED BY
Caltrans OFFICE OF DESIGN STATEWIDE	B. K. FRAZER	CHECKED BY		DATE REVISED

FORM DC-DE-F2-PF (REV. 3/88)

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3

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DGN FILE => /usr/tomo/PO/7I199Fm01.dgn

CU 07200

EA 119961

TIME PLOTTED => 29-SEP-1994 16:15

LAST REVISION 00-00-00

< 24

< 24

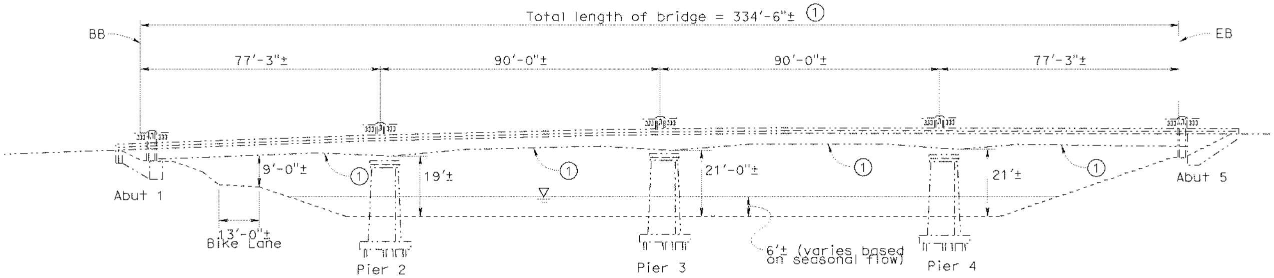
DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
07	LA	1,90,405	Var	22	40

REGISTERED CIVIL ENGINEER 11/30/11 DATE

3-19-12
PLANS APPROVAL DATE

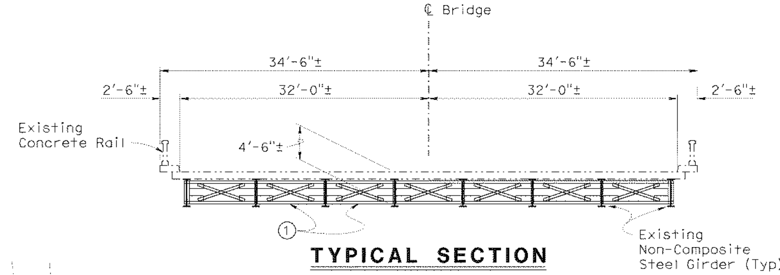
The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.

REGISTERED PROFESSIONAL ENGINEER VINH DUC L. DANG No. C65096 Exp. 09/30/13 CIVIL STATE OF CALIFORNIA



ELEVATION

1" = 20'



TYPICAL SECTION

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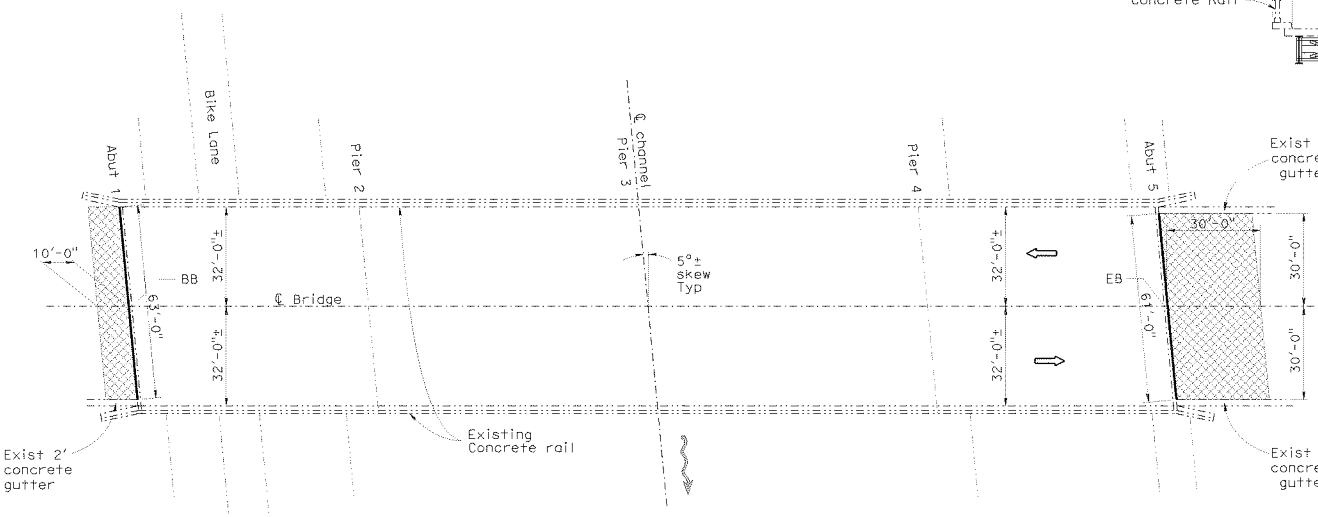


PLAN

1" = 20'

LEGEND:

- - - - Indicates existing.
⇨ Indicates direction of traffic.
① Clean and spot blast cleaning of existing paint system on steel members (including steel rocker bearings) and apply undercoats and finish coats of the specified paint system to the entire bridge.
▨ Indicates limits of remove existing approach and place new Structure Approach Type R. For details see "STRUCTURE APPROACH TYPE R, DETAILS NO.2" sheet.
— Indicates limits of existing joint seal removal and placement of new joint seal. Prior to placement of new joint, remove unsound concrete and patch with rapid setting concrete.

BALLONA CREEK — BRIDGE NO. 53-0118

QUANTITIES

REMOVE UNSOUND CONCRETE	2	CF
AGGREGATE BASE (APPROACH SLAB)	9	CY
STRUCTURAL CONCRETE, APPROACH SLAB (TYPE R)	85	CY
RAPID SETTING CONCRETE (PATCH)	2	CF
JOINT SEAL (MR 1/2")	124	LF
CLEAN STRUCTURAL STEEL (EXISTING BRIDGE)	LUMP	SUM
PAINT STRUCTURAL STEEL (EXISTING BRIDGE)	LUMP	SUM
SPOT BLAST CLEAN AND PAINT UNDERCOAT	2,500	SQFT
WORK AREA MONITORING	LUMP	SUM

BALLONA CREEK

Br No. 53-0118, Rte 1, PM 30.36
1" = 20'

NOTE:
THE CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIAL. EXISTING UTILITY FACILITIES HAVE NOT BEEN PLOTTED ON THESE PLANS.

TONY D. BRAKE
DESIGN ENGINEER

	BY	CHECKED			
DESIGN	Vinh Dang	Ramesh Patel	LOAD FACTOR DESIGN	LIVE LOADING: HS20-44 AND ALTERNATIVE AND PERMIT DESIGN LOAD	
DETAILS	Tom Dang	Ramesh Patel	LAYOUT	BY Tom Dang	CHECKED Vinh Dang
QUANTITIES	Vinh Dang	Ramesh Patel	SPECIFICATIONS	BY Rebecca Franti	PLANS AND SPECS COMPARED Rebecca Franti

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF MAINTENANCE
STRUCTURE MAINTENANCE DESIGN

BRIDGE NO. Various
POST MILE Various

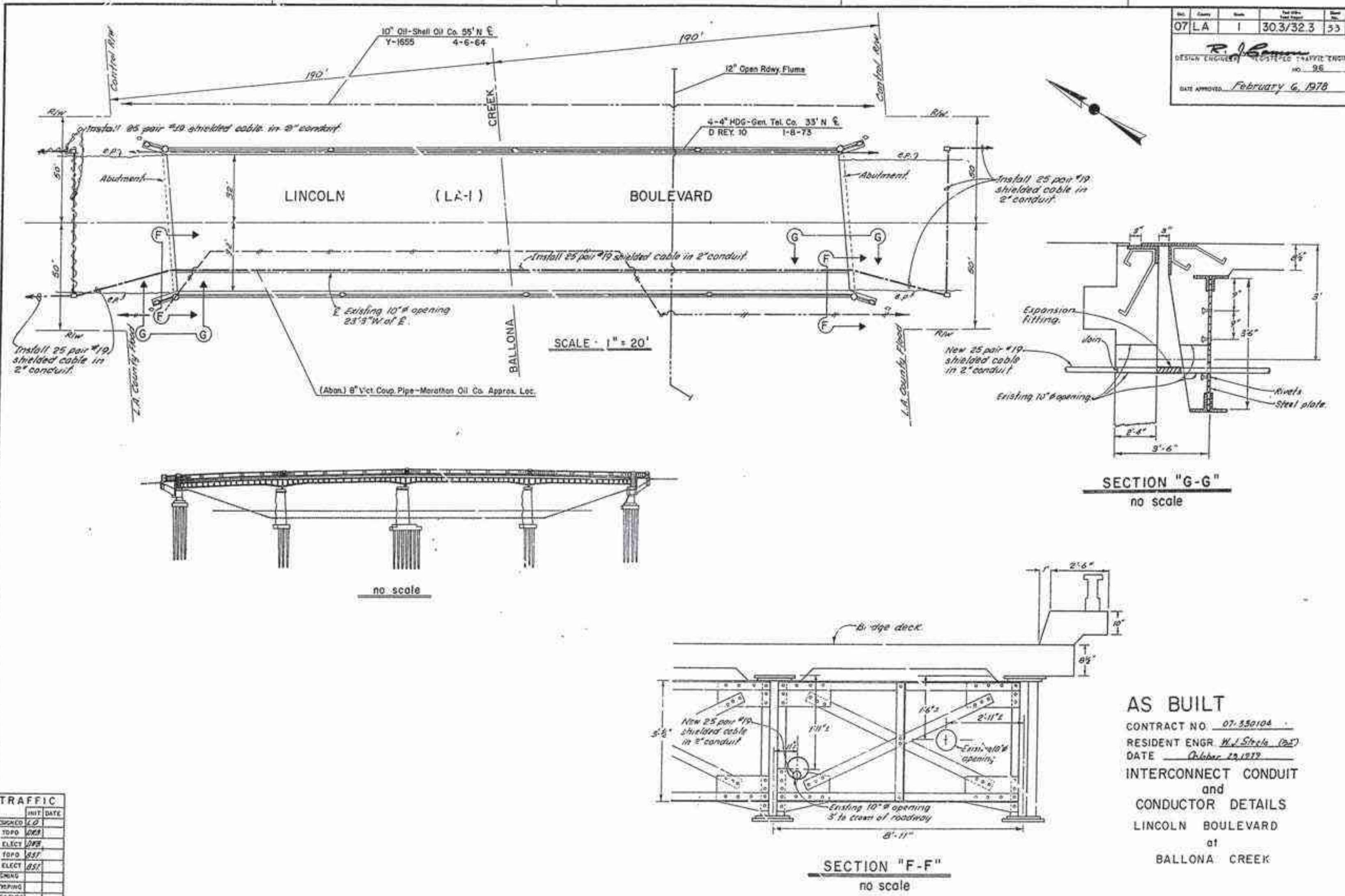
ROUTE 1, 90, 405 BRIDGES
GENERAL PLAN NO. 4

STRUCTURES MAINTENANCE GENERAL PLAN SHEET (ENGLISH) (REV. 09-01-10)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: 3489
PROJECT NUMBER & PHASE: 07000010941
CONTRACT NO.: 4Y1501
DISREGARD PRINTS BEARING EARLIER REVISION DATES
04 | 22

FILE => 07-4y1501-a-gp04.dgn



AS BUILT
CONTRACT NO. 07-330104
RESIDENT ENGR. W.J. Strela
DATE October 29, 1979

INTERCONNECT CONDUIT and CONDUCTOR DETAILS
LINCOLN BOULEVARD at BALLONA CREEK

TRAFFIC	INIT	DATE
DESIGNED	LO	
TOPO	DEB	
ELECT	DEB	
TOPO	BST	
ELECT	BST	
SIGNING		
STRIPING		
AREA ENGR		

33

Ben Takeuchi 5/77

07-351 - 330101

1927

AS BUILT PLANS
Contract No. 07-330104
Date Completed 10-15-79
Document No. 7000 8368

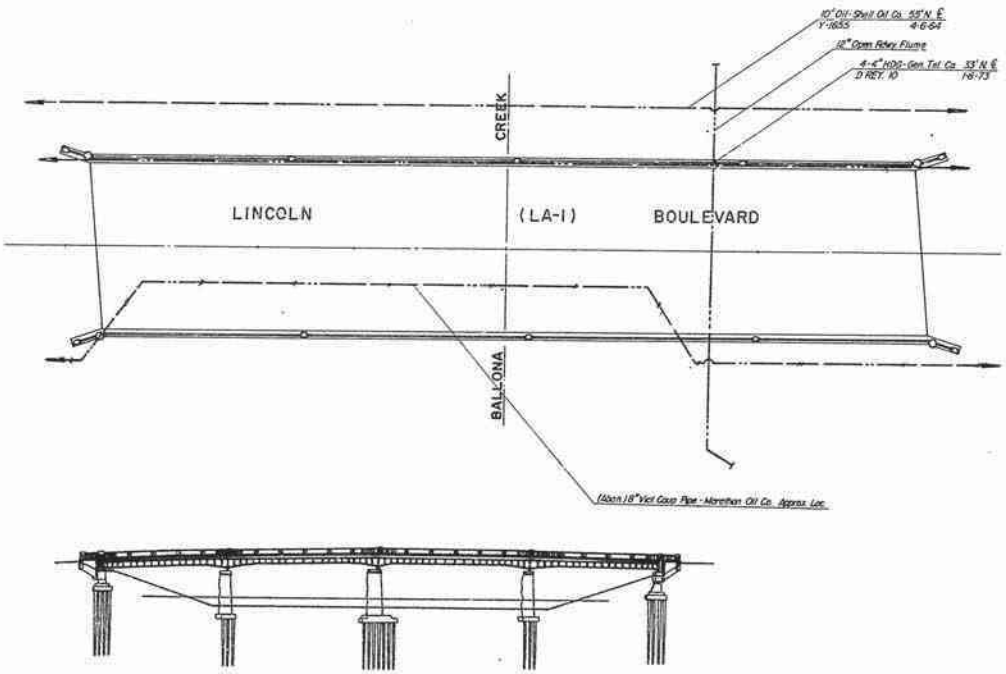
I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION
2-14-80 Joseph M. Costa

MICROFILM - STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION - MICROFILM

Dist.	County	Route	Post Miles	Sheet No.	Total Sheets
07	LA	1	30.3/32.3	11	36

R. J. [signature]
REGISTERED TRAFFIC ENGINEER
NO. 96

DATE APPROVED February 6, 1978



AS BUILT

CONTRACT NO. 07-330104
RESIDENT ENGR. W.J.Shee?e (BT)
DATE October 15, 1979

UTILITY PLAN

LINCOLN BOULEVARD
at
BALLONA CREEK

1927

11

07351 330101

AS BUILT PLANS
Contract No. 07-330104
Date Completed 10-15-79
Document No. 7000 8368

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2-14-80 Joseph M [signature]

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	LA	1	43.9/50.0	18	277

Caltrans Metric

REGISTERED CIVIL ENGINEER 11-10-04

12-6-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER
BG Wright
No. C59331
Exp. 6-30-07
CIVIL
STATE OF CALIFORNIA

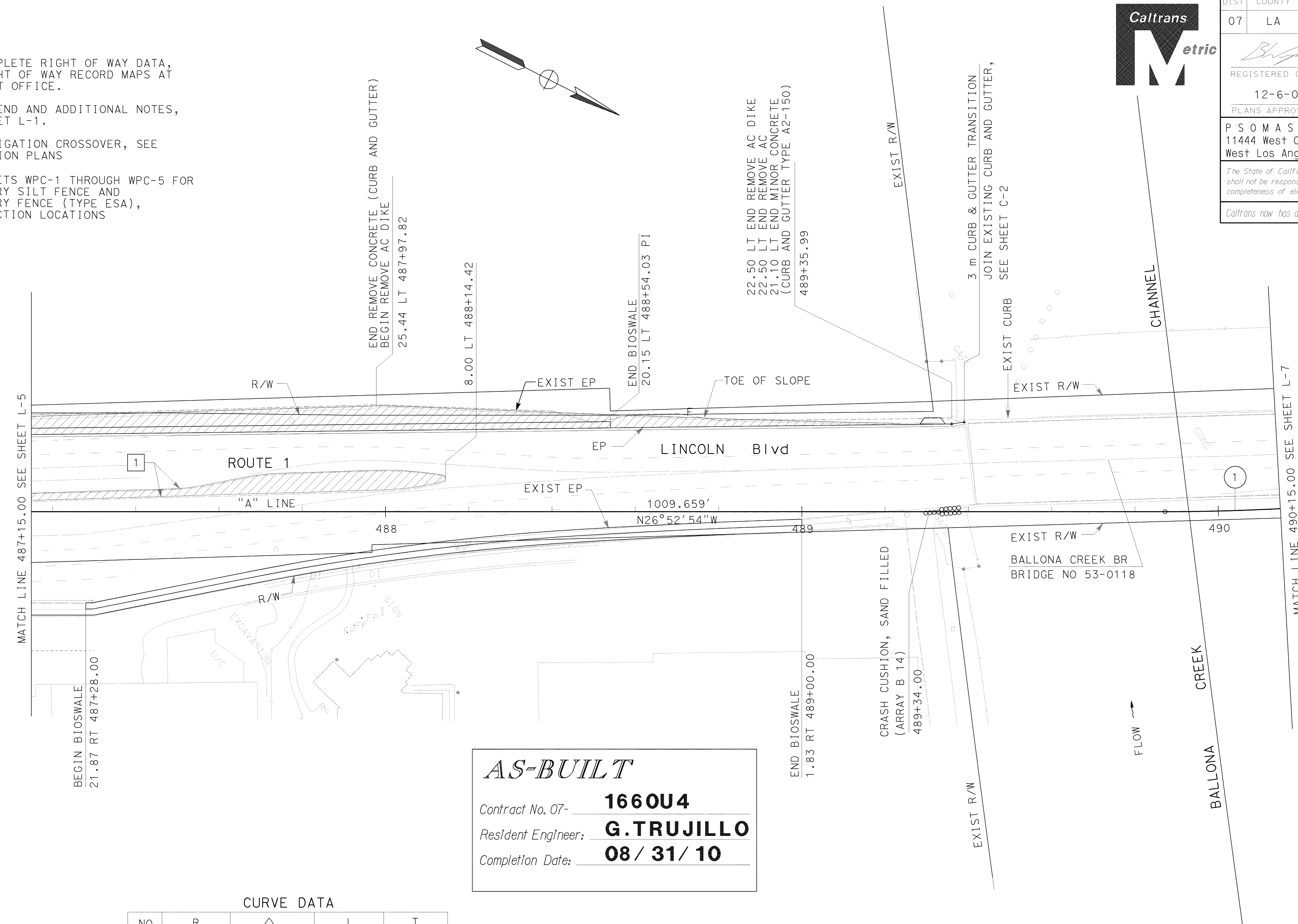
PSOMAS
11444 West Olympic Boulevard
West Los Angeles, CA 90064-1549

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.

Caltrans now has a web site! To get to the web site, go to: http://www.dot.ca.gov

NOTES:

1. FOR COMPLETE RIGHT OF WAY DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.
2. FOR LEGEND AND ADDITIONAL NOTES, SEE SHEET L-1.
3. FOR IRRIGATION CROSSOVER, SEE IRRIGATION PLANS
4. SEE SHEETS WPC-1 THROUGH WPC-5 FOR TEMPORARY SILT FENCE AND TEMPORARY FENCE (TYPE ESA), CONSTRUCTION LOCATIONS



AS-BUILT

Contract No. 07- **1660U4**

Resident Engineer: **G.TRUJILLO**

Completion Date: **08/31/10**

CURVE DATA

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SEE REVISION SHEET #18A

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

LAYOUT
LOCATION 2
SCALE 1:500

L-6

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

DESIGN OVERSIGHT: FEKADE S. MESFIN

CALCULATED/DESIGNED BY	GM	8/02
CHECKED BY	BW	8/02

REVISED BY / DATE REVISED

LAST REVISION 11-10-04
DATE PLOTTED => 07-JUN-2011
TIME PLOTTED => 10:01

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

USERNAME => s129112
DGN FILE => 71660Ueq006.dgn

CU 07279

EA 1660U1

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	LA	1	43.9/50.0	184	277

REGISTERED CIVIL ENGINEER 11-10-04

12-6-04
PLANS APPROVAL DATE

PSOMAS
11444 West Olympic Boulevard
West Los Angeles, CA 90064-1549

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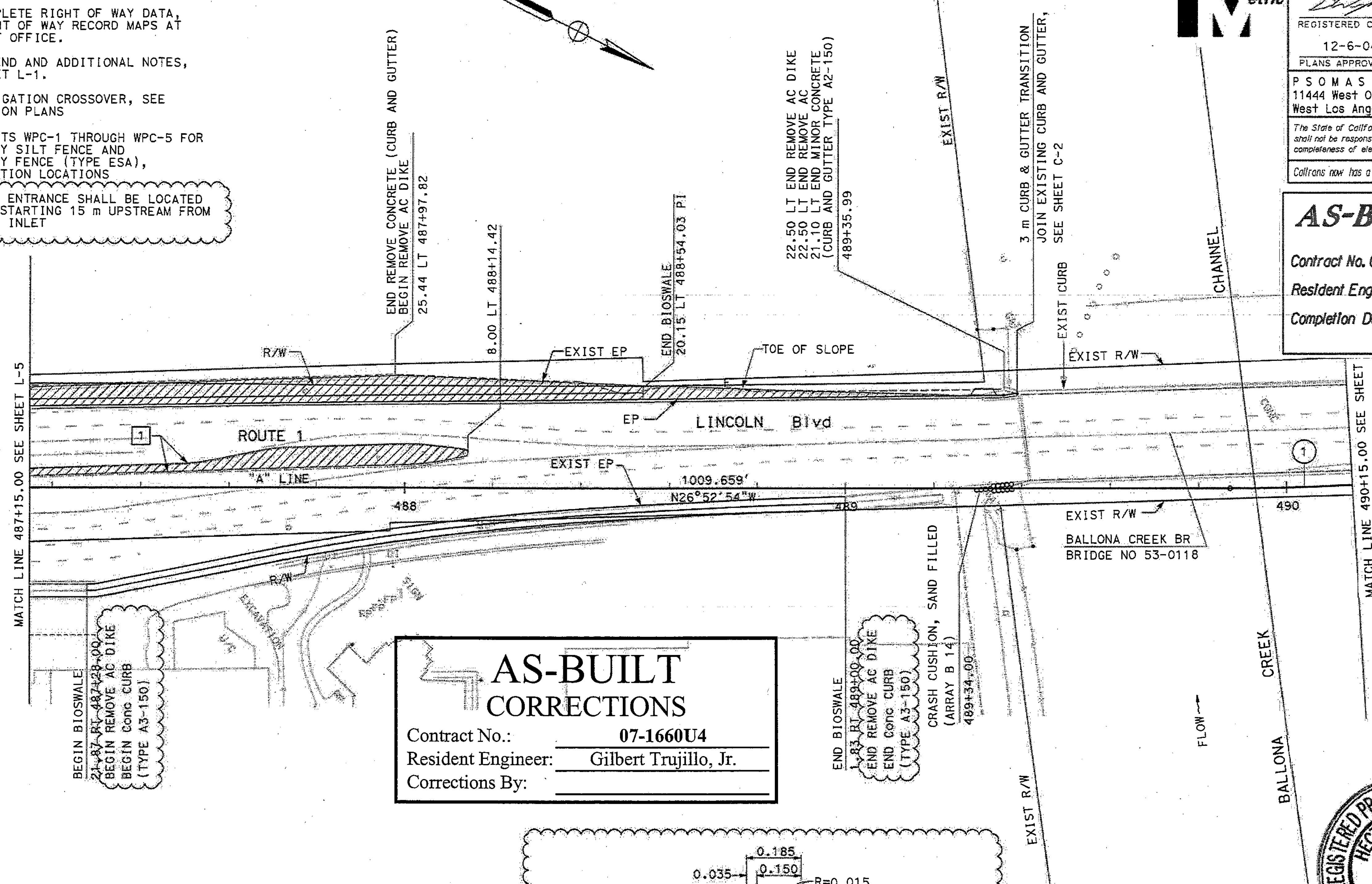
AS-BUILT

Contract No. 07- 1660U4
Resident Engineer: G.TRUJILLO
Completion Date: 08/31/10

NOTES:

1. FOR COMPLETE RIGHT OF WAY DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.
2. FOR LEGEND AND ADDITIONAL NOTES, SEE SHEET L-1.
3. FOR IRRIGATION CROSSOVER, SEE IRRIGATION PLANS
4. SEE SHEETS WPC-1 THROUGH WPC-5 FOR TEMPORARY SILT FENCE AND TEMPORARY FENCE (TYPE ESA), CONSTRUCTION LOCATIONS
5. BIOSWALE ENTRANCE SHALL BE LOCATED 15 m OC STARTING 15 m UPSTREAM FROM DRAINAGE INLET



AS-BUILT CORRECTIONS
Contract No.: 07-1660U4
Resident Engineer: Gilbert Trujillo, Jr.
Corrections By:

CURVE DATA

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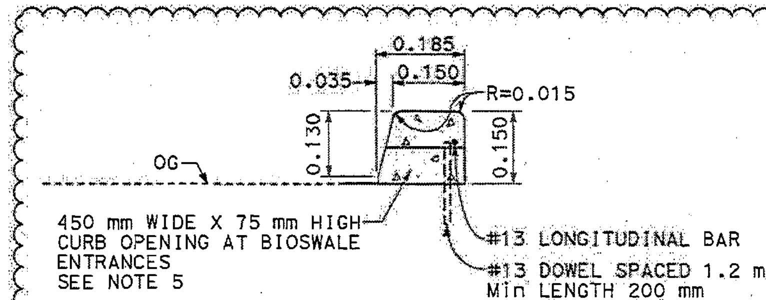

TYPE A3-150 CURB
NO SCALE

CONTRACT No. 07-1660U4
Contract Change Order No. 34
Sheet 2 of 2

(CCO34)

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

LAYOUT LOCATION 2

SCALE 1:500

L-6

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
DESIGN OVERSIGHT FEKADE S. MESFIN
CALCULATED/DESIGNED BY GM | CHECKED BY BW | DATE 8/02 | 8/02 | REVISED BY | DATE REVISED

FOR REDUCED PLANS ORIGINAL SCALE IS IN MILLIMETERS. 0 20 40 60 80
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DGN FILE => 71660Uea006.dgn
CU 07279 | EA 1660U1
LAST REVISION 4-9-08 | DATE PLOTTED => 09-APR-2008 | TIME PLOTTED => 11:00

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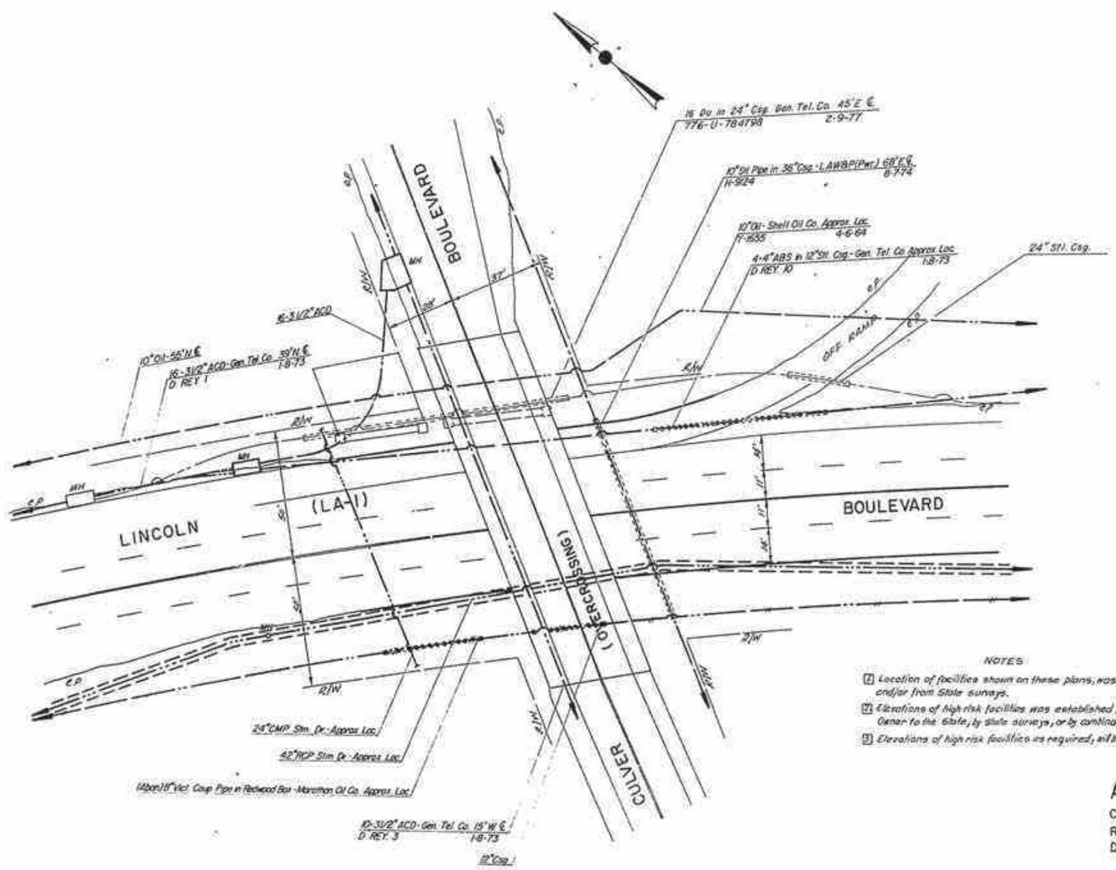
UTILITY ENGINEER — REGISTERED CIVIL ENGINEER NO. C-24421

DATE APPROVED February 6, 1978



NOTES

[1] Location of facilities shown on these plans, was obtained either from Owner's records and/or from State surveys.

[2] Elevations of high risk facilities was established from information furnished from by the Owner to the State, by State surveys, or by combination ob both.

[3] Elevations of high risk facilities as required, will be determined at time of construction.

AS BUILT
CONTRACT NO. 07-330104
RESIDENT ENGR. W.J. Steele (ET)
DATE October 15 1979

LOCATION "2"
UTILITY PLAN
LINCOLN BOULEVARD
at
CULVER BOULEVARD

0 20 40 60 80 100
FEET

1927

4

FORM HD 82 PF

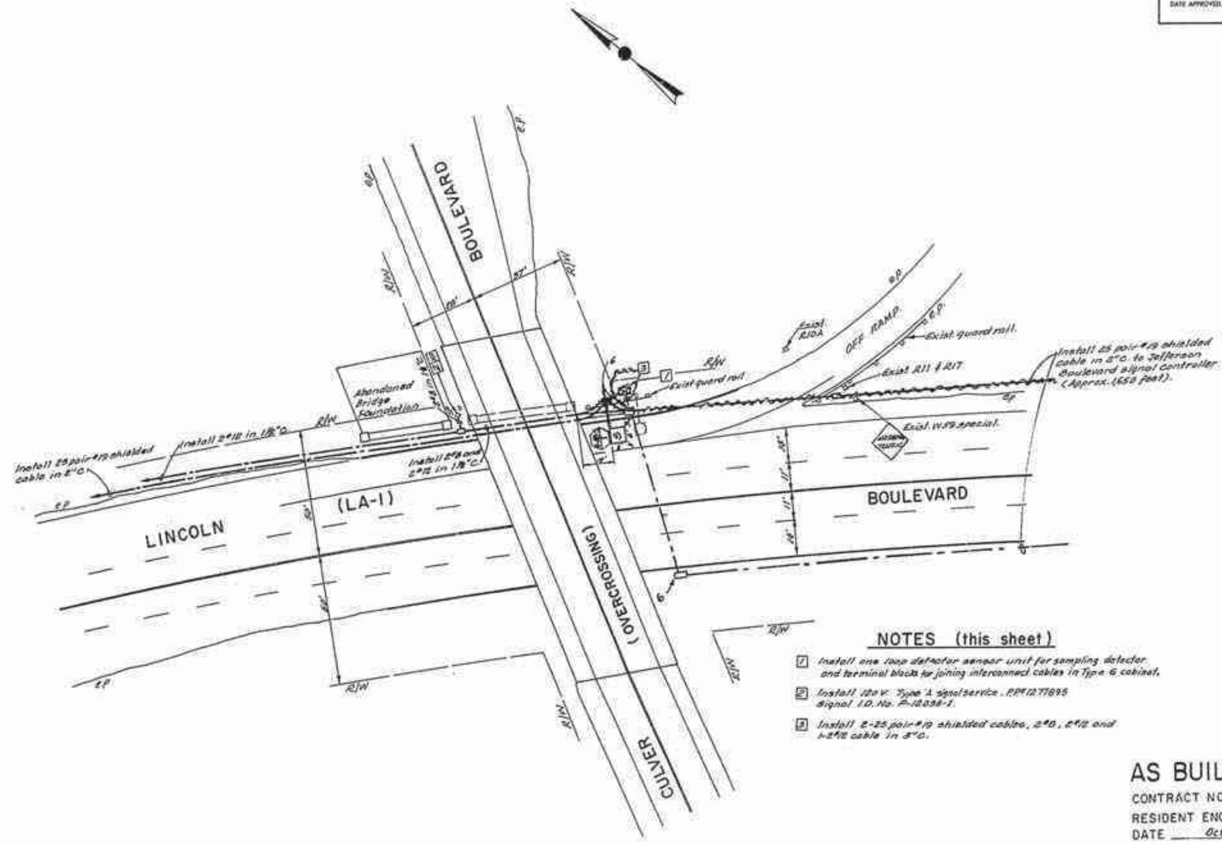
07351 330101

AS BUILT PLANS
Contract No. 07-330104
Date Completed 10-15-79
Document No. 7000 8368

Dist	County	Route	Post Miles Total Project	Sheet No.	Total Sheets
07	LA	1	30.3/323	15	36

REGISTERED TRAFFIC ENGINEER NO. 96

DATE APPROVED February 6, 1978



NOTES (this sheet)

1. Install one loop detector sensor unit for sampling detector and terminal blocks for joining interconnect cables in Type 6 cabinet.
2. Install 120 V. Type 'A' signal service. PP#1277895 Signal I.D. No. P-12038-1.
3. Install 2-25 pair #19 shielded cables, 2#8, 2#12 and 1-2#12 cable in 3"C.

AS BUILT

CONTRACT NO 07-330104
RESIDENT ENGR W.J.Steele (BJ)
DATE October 15,1979

LOCATION "2"
TRAFFIC SIGNAL PLAN
LINCOLN BOULEVARD at CULVER BOULEVARD

0 20 40 60 80 100 FEET

TRAFFIC	INIT	DATE
DESIGNED	LQ	
TOPO	DB	
ELECT	LQ	
TOPO	LQ	
ELECT	BS7	
SIGNING	DR	
STRIPING		
AREA CHKR		

NOTE THIS PLAN ACCURATE FOR SIGNALS, LIGHTING, SIGNING, STRIPING AND PAVEMENT MARKINGS

15

1927

0735I 330101

FORM HD 63 PF

AS BUILT PLANS
Contract No. 07-330104
Date Completed 10-15-79
Document No. 7000 8368

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF TRANSPORTATION.

2-14-80

MICROFILM - STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION - MICROFILM

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	LA	1	43.9/50.0	19	277

Caltrans Metric

REGISTERED CIVIL ENGINEER 11-26-03

12-6-04
PLANS APPROVAL DATE

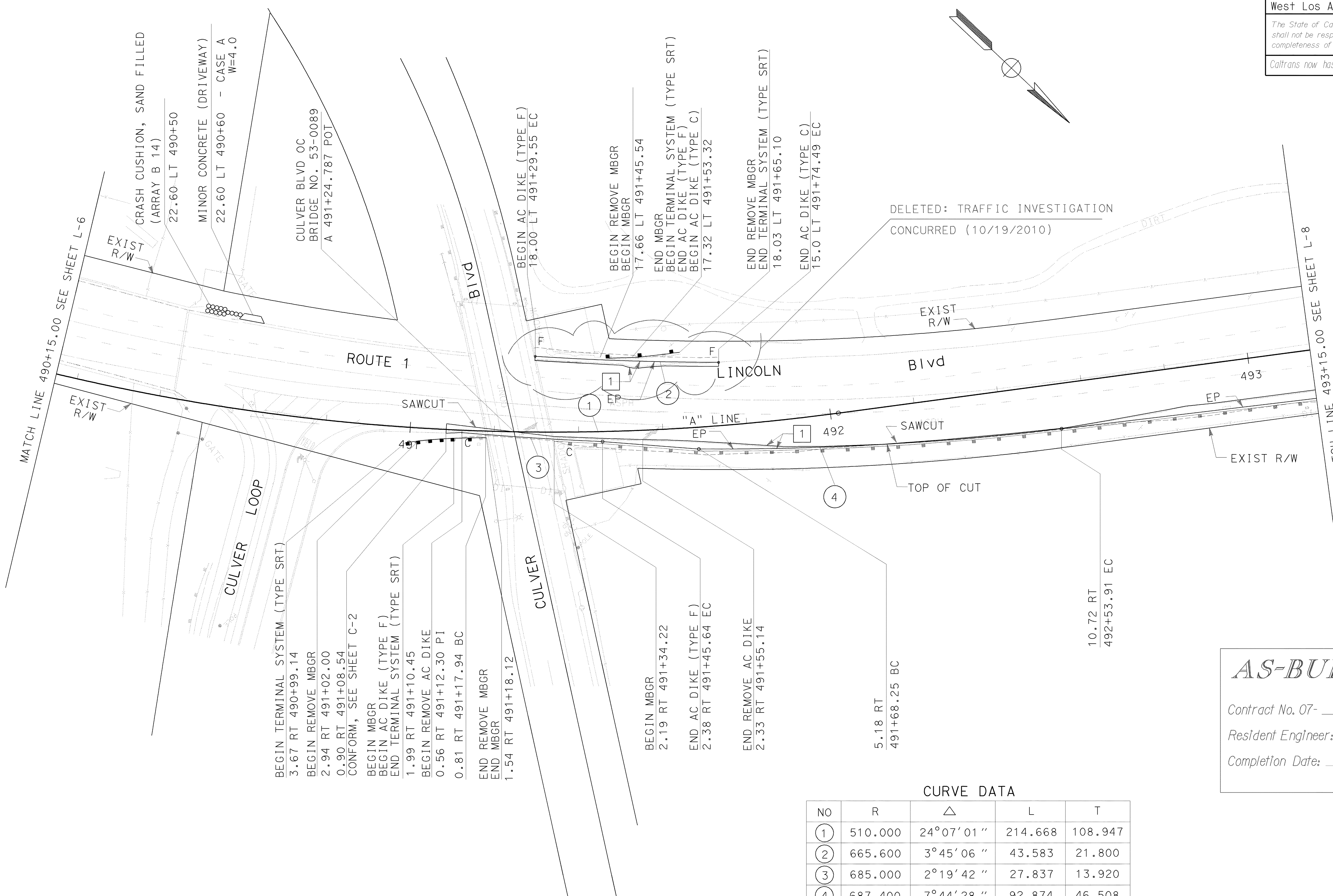
REGISTERED PROFESSIONAL ENGINEER BG Wright No. C59331 Exp. 6-30-07 CIVIL STATE OF CALIFORNIA

P S O M A S
11444 West Olympic Boulevard
West Los Angeles, CA 90064-1549

NOTES:

1. FOR COMPLETE RIGHT OF WAY DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.

2. FOR LEGEND AND ADDITIONAL NOTES, SEE SHEET L-1.



CURVE DATA

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3	685.000	2°19′42″	27.837	13.920
4	687.400	7°44′28″	92.874	46.508

AS-BUILT

Contract No. 07- 166OU4

Resident Engineer: G.TRUJILLO

Completion Date: 08/31/10

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

LAYOUT LOCATION 2

SCALE 1:500

L-7

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

DESIGN OVERSIGHT FEKADE S. MESFIN

CALCULATED/DESIGNED BY GM 8/02 | CHECKED BY BW 8/02 | REVISED BY | DATE REVISED

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

USERNAME => s129112
DGN FILE => 71660Uea007.dgn

CU 07279 EA 1660U1

LAST REVISION 10-22-03 DATE PLOTTED => 07-JUN-2011 TIME PLOTTED => 10:01

APPENDIX D
SCOUR EVALUATION REPORT

Lincoln Bridge Multi-Modal Bridge Improvements Hydraulics Study

Los Angeles County, California

Prepared for:

Psomas
555 South Flower Street, Suite 4300
Los Angeles, CA 90071
213.223.1400

Prepared by:

Michael Baker International
5 Hutton Centre Drive, Suite 500
Santa Ana, CA 92707

Michael Baker
INTERNATIONAL

Contact Persons:

Mujahid Chandoo, P.E.

October 2022

JN 173324

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Table of Contents

Figures

Tables

Appendices

1 Introduction

This report summarizes an update to HEC-RAS numerical modeling and sediment transport analysis associated with Lincoln Bridge Multi-Modal Improvement Project (City of Los Angeles Department of Transportation [LADOT] TOS 27). Previously, Psomas completed sea level rise (SLR) analysis and HEC-RAS modeling of lower Ballona Creek and Lincoln Boulevard Bridge for the existing conditions for pre-2018 Caltrans and California Coastal Commission (CCC) SLR. Since the project started, new SLR criteria for California has been enacted (State of California Sea-Level Rise Guidance 2018 Update) (California 2018). Additionally, discussions between Psomas, CCC, Caltrans, LADOT and the US Army Corps of Engineers (USACE) have refined the regulatory requirements concerning hydraulic analysis and SLR related to the project.

The project is located along Ballona Creek bounded by Marina Del Rey to the north and the Ballona Wetlands to the south. The project includes the widening and other multimodal improvements of Lincoln Boulevard over the Creek south of Culver Boulevard (Figure 1). The project is approximately 8,700 feet upstream of the Pacific Ocean and approximately 3,200 feet downstream of the Marina Freeway crossing of the Creek.

1.1 Purpose

The purpose of the project is to create a new multi-modal corridor along SR-1/Lincoln Boulevard between Fiji Way and Jefferson Boulevard to improve traffic operations and to serve transit, bicyclists, and pedestrians while minimizing impacts to Ballona Wetlands Reserve, Ballona Creek, and other environmental resources. The purpose of this study is to assess the hydraulic impacts of the proposed bridge in order to minimize environmental impacts to Marina Del Rey and the Ballona Wetlands.

1.2 Need

Lincoln Boulevard serves as a critical north-south connection on the Westside. There are few arterial connections that provide continuous access through the Westside, which results in Lincoln Boulevard being oversaturated during peak commute periods. Lincoln Boulevard narrows from three to two lanes in the southbound direction, approximately 1,050 feet north of the existing Lincoln Bridge over Ballona Creek, and from four to three lanes in the northbound direction, approximately 320 feet north of the intersection with Jefferson Blvd, to the intersection with Fiji Way. These lane reductions create a major bottleneck.

The average vehicle travel speeds along Lincoln Boulevard are 15 mph during peak periods when measured between Ozone Ave in the City of Santa Monica and Sepulveda Boulevard while the design speed is 50 mph. Travel times are greatly impacted by bottlenecks resulting in slower speeds along much of the corridor.

In addition, access for pedestrians along Lincoln Boulevard is disjointed north and south of the Ballona Creek bridge which does not have sidewalks. Lincoln Boulevard also lacks bicycle facilities across the bridge. Pedestrian and bicycle facilities are also deficient along Culver Boulevard.

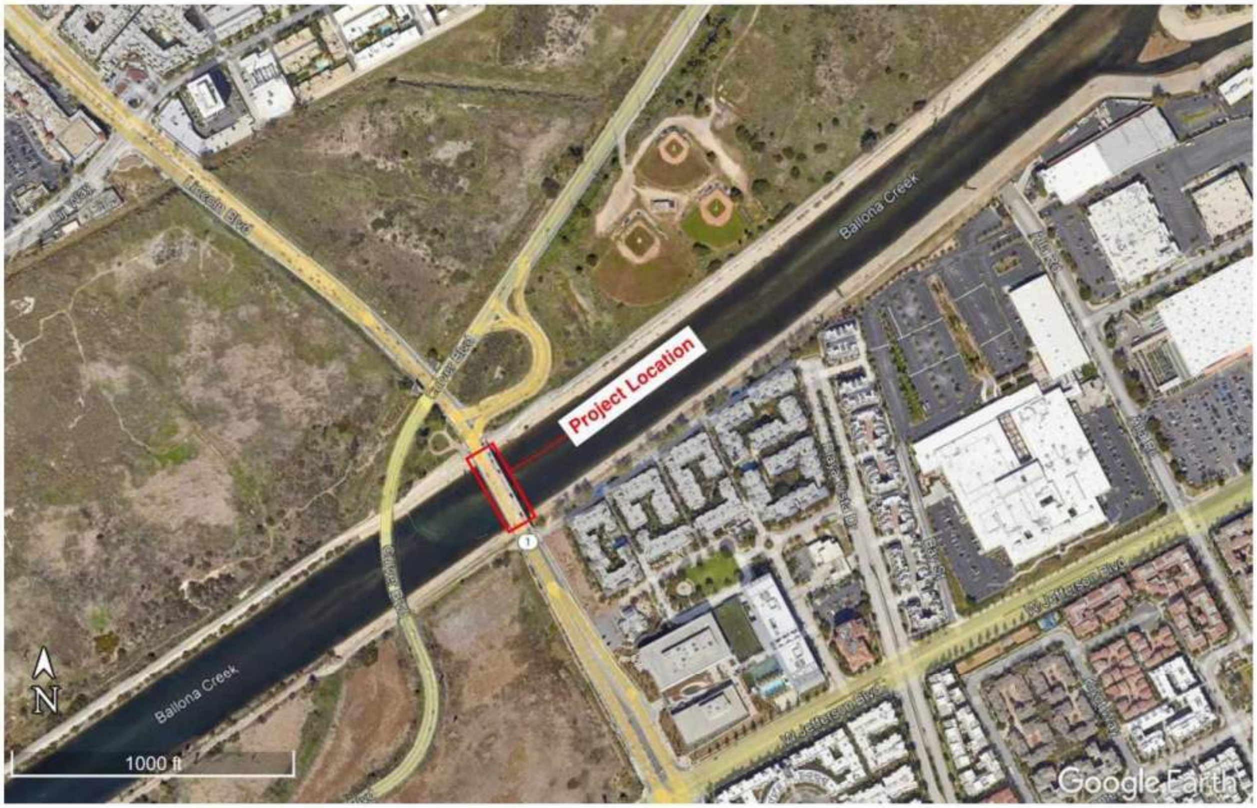

Figure 1: Project Location and Vicinity Map

1.3 Study Goals

The study has the following goals:

1. Two design discharges will be analyzed using the HEC-RAS hydraulics models of lower Ballona Creek: Los Angeles County Department of Public Works (LACDPW) Capital Storm discharge (QCAP) and USACE 100-year discharge (USACE).
2. Two sea level change criteria will be used for the downstream boundary conditions in HEC-RAS modeling: USACE and California (2018). No tsunami, wave run-up or other oceanographic factors are included as part of the SLR analysis because Lincoln Bridge is located approximately 2.5 miles inland of the coast. In addition, the Creek is leveed from its downstream terminus at the Pacific Ocean to upstream of the Lincoln Bridge crossing. The change in bottom elevation between the terminus and the Lincoln Bridge crossing is approximately 7 feet and the opening of the channel is approximately 300 feet. While some open ocean waves may diffract, refract, or reflect through the levee mouth and propagate upstream, it is highly unlikely that open ocean waves will impact Lincoln Bridge. Geotechnical subsidence or uplift is also not included in SLR analysis.
   USACE SLR values will be taken from USACE Sea-Level Change Curve Calculator Monica Gage intermediate value, and California (2018) SLR values will be taken from Table 25. Three values will be utilized from Table 25: Low, Medium-High and Extreme Risk Aversion (H++) for High Emissions. The basis for SLR will include two different starting water surface elevation datums: mean higher high water (MHHW) at the request of California Coastal Commission and Caltrans, and mean sea level (MSL), as per USACE ER 1100-2-8162 (local MSL) and ETL 1100-2-1 (non-ecosystem). Per the Santa Monica Gage, all elevations will be in NAVD88; bridge elevations will be adjusted accordingly.
3. All hydraulic modeling will be conducted using the HEC-RAS model developed by ESA in conjunction with USACE and modified by Michael Baker. The Michael Baker-modified model will be updated to incorporate:
   a. two design discharges (USACE and QCAP),
   b. two starting water surface elevations (MSL and MHHW),
   c. four SLR criteria (USACE Intermediate, and California 2018 Low, Medium-High, and H++),
   d. two bridge conditions (existing and proposed).
4. A scour analysis will be developed for Lincoln Bridge. Bridge scour for the existing and proposed bridge conditions will be developed in the HEC-RAS models using the software's hydraulic design function following HEC-18, Evaluating Scour at Bridges. Bridge scour will be calculated for the USACE and QCAP discharges assuming a MSL downstream boundary condition. The MSL boundary condition is expected to be the most conservative in that a lower water surface elevation for a given discharge will have a higher velocity in subcritical flow regimes. Only changes to Lincoln Bridge will be analyzed in the proposed condition bridge scour analysis.

2 Hydrologic and Bridge Design Conditions

2.1 Hydrologic Conditions

There are three design discharges available for the project reach of Ballona Creek: US Army Corps of Engineers (USACE) 100-year discharge; Federal Emergency Management Agency (FEMA) 100-year discharge; and the Los Angeles County Department of Public Works (LACDPW) 50-year burned-and-bulked, or Capital, (QCAP) discharge. For the purposes of the present study only the USACE and QCAP discharges are considered and are summarized in Table 1. No changes to the channel or watershed are proposed as part of the project, and the project will not alter the hydrology in the proposed condition.

Table 1: Design Discharges (cfs) for Ballona Creek at Lincoln Boulevard

FEMA	USACE	QCAP
44,270	46,000	51,240

2.2 Existing and Proposed Bridge Conditions

In the existing condition, the bridge is a four-bent structure with three pier walls. The piers are 90.0 feet apart with a width ranging from 3.25 to 4.50 feet (average 3.875 feet) without debris and a 7.75-foot debris width (double the average width). The bridge deck is approximately 69.0 feet wide and 334.5 feet long. The deck is vertically curved with the low chord ranging from 17.9 to 21.3 feet NAVD88, and a high chord ranging from 21.4 to 25.8 feet NAVD88. The deck is not super-elevated. The representation of the existing bridge in HEC-RAS is shown in Figure 2.

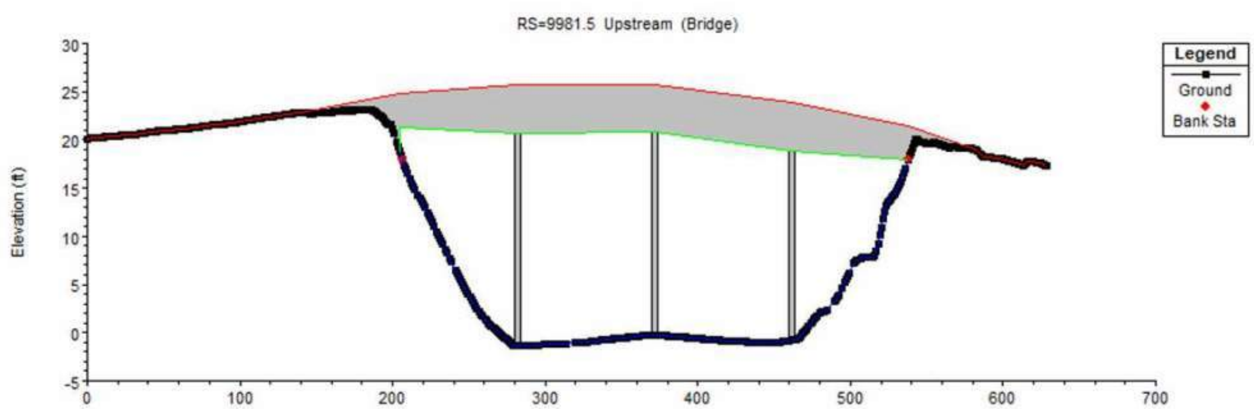

Figure 2: Existing Bridge (upstream section looking downstream)

In the proposed condition, the bridge is a three-bent structure with two pier groups. The circular pier groups are approximately 111.5 feet apart. Each pier is 5.5 feet wide without debris and has an 11.0-foot debris width. The bridge deck is approximately 130.0 feet wide and 334.5 feet long. The deck is vertically curved with the low chord ranging from 23.6 to 25.1 feet, and a high chord ranging from 28.6 to 30.2 feet. The representation of the proposed bridge in HEC-RAS is shown in Figure 3. All bridge design details of the existing and proposed conditions were provided by Psomas' (D. Fredricks, personal communication, 2021) and can be found in Appendix A. Deck elevations were provided in NGVD29 and were adjusted to NAVD88 to be consistent with the datums of the Santa Monica Gage.

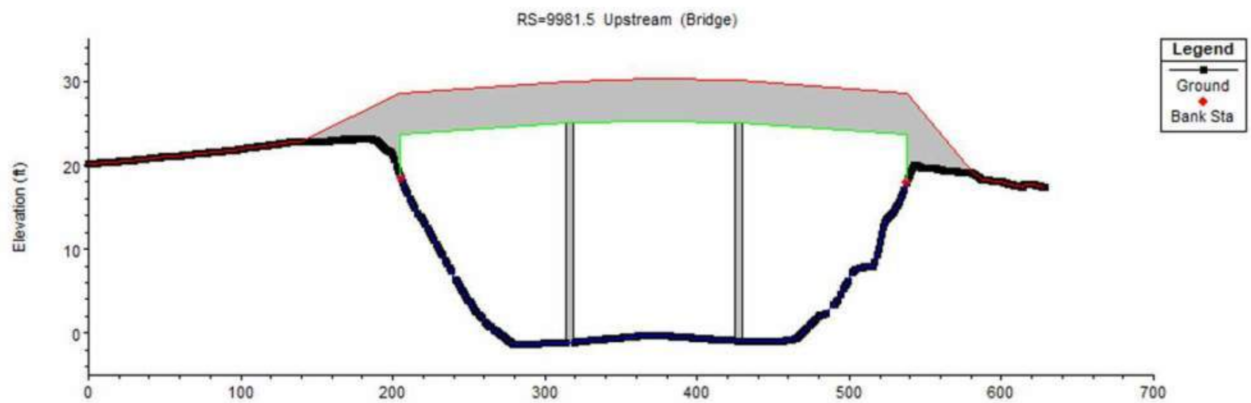

Figure 3: Proposed Bridge (upstream section looking downstream)

3 Sea Level Rise Design Considerations

All hydraulic analysis in the present study employs sea level rise design considerations based on two design parameters USACE (2019) and California (2018). USACE (2019) analysis is expected to be required to comply with future Clean Water Act (CWA) Section 408 permitting requirements. California (2018) analysis is expected to be required for State-related permitting (i.e. Caltrans, CCC, etc.).

Previous iterations (2018 and earlier) of this study included older Caltrans/CCC SLR values, and the present version of the report is intended to update the design to meet current SLR design guidelines within the State.

The USACE Sea-Level Change Curve Calculator is an online sea-level change calculator (at the time of writing, Version 2022.60: https://cwbi-app.sec.usace.army.mil/rccslc/slcc_calc.html). The present study utilizes the USACE 2013 dataset as well as the Santa Monica, CA Gage 9410840 for the year 2100, which is the furthest out in time for which the projections are valid. A copy of the USACE calculator output data is included in the Appendix B. The calculator indicates that relative sea-level change (SLC) for the intermediate projection is 4.15 feet relative to the NAVD88 datum. This value is used for all modeling with the USACE SLR boundary condition. It is important to note that the USACE projections include the local rate of vertical land movement. The estimated USACE relative SLC projections for the Santa Monica Gage are shown in Figure 4.

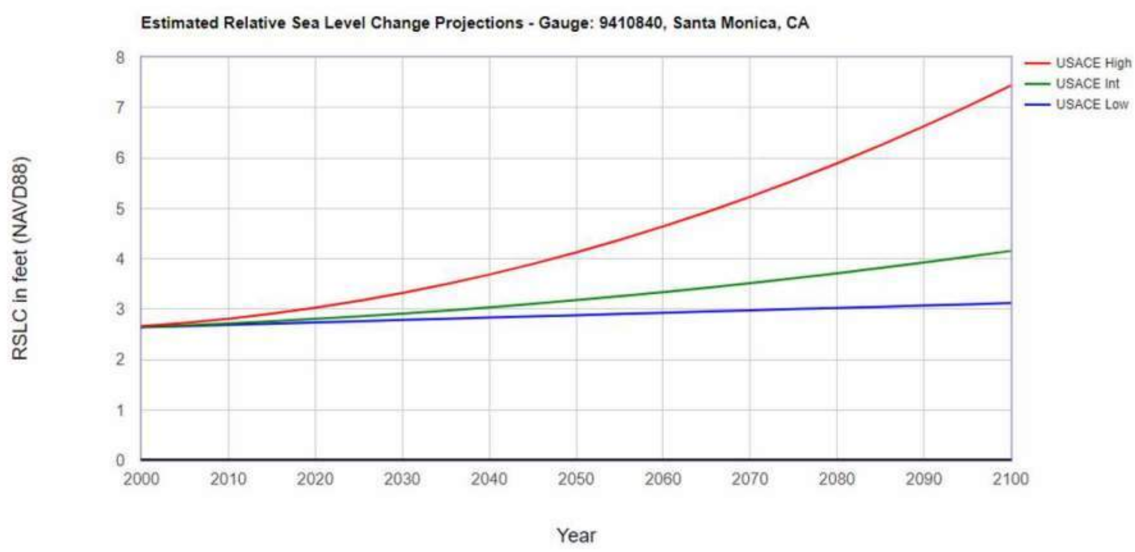

Figure 4: USACE Seal Level Change Projections for Santa Monica, CA

USACE has several guidance documents addressing SLC considerations for Corps-related projects. Both ER 1100-2-8162 (USACE 2013) and ETL 1100-2-1 (USACE 2014) address starting water surface elevations for analysis in SLC in coastal projects. While the documents appear to give latitude to local Corps Districts for final selection of starting water surface elevations, the documents give weight to MSL as local MSL, and non-ecosystem analyses, respectively. The present study uses both MSL (2.60 feet NAVD88) and MHHW (5.24 feet NAVD88) for USACE-related analyses of SLC to be consistent with analyses under California (2018) (see below, Section 4). Previous discussions with USACE staff (C. Mesa, personal communication, 2019) failed to produce additional guidance since no 408 permit application documentation had been provided to the Los Angeles District at the time of the communication.

State SLR criteria utilizes data from Table 25 in California (2018), Santa Monica gage. In the present study only the high emissions values for the low, medium-high and extreme risk aversion are used for modeling. These values are 3.3, 6.8 and 10.0 feet, respectively, for year 2010, which was chosen to be consistent with USACE analysis. It is important to note that California (2018) does not specify a starting sea surface elevation from which to conduct analysis. Additionally, multiple meetings with CCC and Caltrans staff in 2018 and 2019 failed to produce documentation specifying a starting sea surface elevation. For calculations herein both mean sea level (MSL) and mean higher high water (MHHW) for Santa Monica gage 9410840, 2.60 and 5.24 feet NAVD88, respectively, were employed. Datums are shown in the Appendix.

The values used for SLC/SLR for present study are summarized in Table 2.

Table 2: Sea Level Change/Rise Values by Agency for Santa Monica, CA

AGENCY	USACE	CALIFORNIA		
CRITERIA	INTERMEDIATE	LOW	MEDIUM-HIGH	EXTREME
VALUE	4.15	3.30	6.80	10.0

Several other design considerations may be included in SLC/SLR analyses. These considerations include local sedimentation/erosion, channel/levee overtopping, tsunamis, geotechnical uplift/subsidence, local inundation, and coastal erosion. While these topics are generally beyond the scope of the present study a discussion of them can be found in the Ballona Wetlands Restoration Project Draft EIS/EIR, Appendix F (ESA 2017). ESA (2017) notes that some bed aggradation has occurred in the area of Lincoln Bridge in the period on the order of 1 to 2 feet over the period 1961 to 2012. Between the Bridge and the end of the South Jetty, the bed aggradation has ranged from approximately 0 to greater than 3 feet during the same period. A discussion of aggradation in the proposed condition is included in Section 4.

4 Hydraulic Analysis of Existing and Proposed Conditions

4.1 HEC-RAS Model

All hydraulic modeling is conducted using the HEC-RAS numerical model developed initially by ESA (2017). The model is run in steady state, sub-critical mode, with downstream boundary conditions as described previously. All model geometry information remains unchanged, and only the proposed bridge geometry is included in proposed conditions modeling.

In the present study, HEC-RAS modeling consists of two discharges (USACE and QCAP), two starting water surface elevations (MSL and MHHW), four SLR criteria (USACE Intermediate, and California [2018] Low, Medium-High, and H++), and two bridge conditions (existing and proposed). The combination of modeling scenarios results in 32 discrete model plans. All HEC-RAS model files can be found in Appendix C. For readability, this report focuses on the design limits of Lincoln Bridge, and a discussion of all simulations is not included.

Part of the reason for not discussing all of the simulation results is because some simulations are not expected alter the critical basis of design values since they produce less conservative results than other simulations (i.e. simulations utilizing MSL produce lower changes in velocity, water surface elevation and/or greater freeboard than simulations utilizing MHHW). Other simulations are not discussed because the Ballona Creek Levees are overtopped in the model results. For overtopping cases, the results are both not valid (that is, the cross sections do not contain the discharge), and the model results raise the larger issue of coastal retreat. Coastal retreat becomes important for the purposes of the present project as rising SL inundates the areas adjacent to the project including Ballona Wetlands, Marina Del Rey and the roads which cross them. For example, there is no need to consider the design elements of Lincoln Bridge as sea levels rise and inundate portions of Ballona Wetlands where Lincoln Boulevard drops under Culver Boulevard to the north of the project site: the road to and from the Bridge would be impassable. Therefore, the discussions that follow focus on simulations that are valid. Table 3 summarizes the inputs and validity of all HEC-RAS model runs.

Table 3: Validity of HEC-RAS model runs

	Plan #	Plan Name in HEC-RAS	Discharge	Initial Elevation	Sea Level Rise	Change in WSE (ft) [NAVD88]	Is the analysis valid?
Existing	1	EX-USACE-MHHW-USACE	USACE	MHHW	USACE - Int	9.39	YES
	2	EX-USACE-MHHW-Low	USACE	MHHW	CA - Low	8.54	YES
	3	EX-USACE-MHHW-MH	USACE	MHHW	CA - M-H	12.04	NO
	4	EX-USACE-MHHW-HH	USACE	MHHW	CA - H++	15.24	NO
	5	EX-USACE-MSL-USACE	USACE	MSL	USACE - Int	6.75	YES
	6	EX-USACE-MSL-Low	USACE	MSL	CA - Low	5.90	YES
	7	EX-USACE-MSL-MH	USACE	MSL	CA - M-H	9.40	YES
	8	EX-USACE-MSL-HH	USACE	MSL	CA - H++	12.6	NO
	9	EX-QCAP-MHHW-USACE	QCAP	MHHW	USACE - Int	9.39	YES
	10	EX-QCAP-MHHW-Low	QCAP	MHHW	CA - Low	8.54	YES
	11	EX-QCAP-MHHW-MH	QCAP	MHHW	CA - M-H	12.04	NO
	12	EX-QCAP-MHHW-HH	QCAP	MHHW	CA - H++	15.24	NO
	13	EX-QCAP-MSL-USACE	QCAP	MSL	USACE - Int	6.75	YES
	14	EX-QCAP-MSL-Low	QCAP	MSL	CA - Low	5.90	YES
	15	EX-QCAP-MSL-MH	QCAP	MSL	CA - M-H	9.40	YES
	16	EX-QCAP-MSL-HH	QCAP	MSL	CA - H++	12.60	NO
Proposed	17	PR-USACE-MHHW-USACE	USACE	MHHW	USACE - Int	9.39	YES
	18	PR-USACE-MHHW-Low	USACE	MHHW	CA - Low	8.54	YES
	19	PR-USACE-MHHW-MH	USACE	MHHW	CA - M-H	12.04	NO
	20	PR-USACE-MHHW-HH	USACE	MHHW	CA - H++	15.24	NO
	21	PR-USACE-MSL-USACE	USACE	MSL	USACE - Int	6.75	YES
	22	PR-USACE-MSL-Low	USACE	MSL	CA - Low	5.90	YES
	23	PR-USACE-MSL-MH	USACE	MSL	CA - M-H	9.40	YES
	24	PR-USACE-MSL-HH	USACE	MSL	CA - H++	12.60	NO
	25	PR-QCAP-MHHW-USACE	QCAP	MHHW	USACE - Int	9.39	YES
	26	PR-QCAP-MHHW-Low	QCAP	MHHW	CA - Low	8.54	YES
	27	PR-QCAP-MHHW-MH	QCAP	MHHW	CA - M-H	12.04	NO
	28	PR-QCAP-MHHW-HH	QCAP	MHHW	CA - H++	15.24	NO
	29	PR-QCAP-MSL-USACE	QCAP	MSL	USACE - Int	6.75	YES
	30	PR-QCAP-MSL-Low	QCAP	MSL	CA - Low	5.90	YES
	31	PR-QCAP-MSL-MH	QCAP	MSL	CA - M-H	9.40	YES
	32	PR-QCAP-MSL-HH	QCAP	MSL	CA - H++	12.60	NO

4.2 Bridge Hydraulics

The impacts of the proposed bridge on channel hydraulics are summarized in Table 4 by comparing the existing and proposed velocity and water surface elevations (WSE) for different events. These events considered a combination of hydrologic conditions and sea level rise scenarios as necessary to maintain validity of the hydraulic analysis as described in Section 4.1.

Table 4 shows the changes in velocity from existing to proposed for the cross sections (XS) in the vicinity of Lincoln Bridge (located at XS 9981.5). For all scenarios examined, the average difference in velocity is approximately +0.01 foot per second (fps). That is, all valid hydraulic analyses show that the proposed bridge condition has a negligible impact on velocity compared to the existing bridge condition.

Table 4 also shows the changes in water surface elevation in NAVD88 from existing to proposed for the cross sections in the vicinity of the bridge. For all scenarios examined, the difference in WSE ranges from zero to a decrease in 0.02 ft. Therefore, all valid hydraulic analyses show that the proposed project has a negligible impact on depth compared to the existing bridge condition.

4.3 Sea-Level Rise Impact on Channel Hydraulics

As noted in Section 4.1, the magnitude of SLR plays a significant role on flow containment within the Ballona Creek channel and the validity of this analysis. However, for cases in which the analysis is valid, the impacts of different SLR scenarios are significantly low with regards to velocity and depth. Per Table 4, increasing the SLR while maintaining the same discharge and initial elevation yields no more than an increase in 0.1 fps in velocity or 0.3 ft in WSE. Because of these insignificant differences observed in both the existing and proposed conditions, no additional analysis of future aggradation/degradation impacts to channel hydraulics are described here. This approach is further supported by the findings of ESA (2017) which indicate that long-term aggradation of the channel bed has occurred since 1961 (see Section 3, above). That is, for the purposes of design of the Lincoln Bridge, additional or accelerated aggradation is expected to decrease the capacity of Ballona Creek channel fostering overtopping of the levees at lower SLR magnitudes and/or at less frequent discharge events than the USACE design discharge. In any case, the primary driver of the design of Lincoln Bridge improvements is not the local hydraulics within the Ballona Creek channel, but the ability of the levees and surrounding area to contain and resist the local relative increase in sea surface elevation. It is recommended that future analyses of proposed Lincoln Bridge improvements proceed under the most conservative hydrologic conditions that yielded valid hydraulic analyses—that is, scenarios considering the QCAP design discharge of 51,240 cubic feet per second, the MSL initial elevation of 2.6 feet, and the California Medium-High SLR scenario of 6.8 feet.

Table 4: Impacts of the Proposed Bridge on Channel Hydraulics

Discharge	Initial Elevation	SLR Scenario	Existing		Proposed		Change in Velocity	Existing		Proposed		Change in WSE
			XS	Velocity (fps)	XS	Velocity (fps)	(fps)	XS	WSE (ft)	XS	WSE (ft)	(ft)
USACE	MHHW	USACE - Intermediate	12520	10.53	12520	10.54	0.01	12520	17.66	12520	17.65	-0.01
			12121	10.74	12121	10.75	0.01	12121	17.35	12121	17.34	-0.01
			11613	10.67	11613	10.68	0.01	11613	17.08	11613	17.06	-0.02
			11028	10.63	11028	10.64	0.01	11028	16.76	11028	16.74	-0.02
			10424	10.64	10424	10.65	0.01	10424	16.41	10424	16.39	-0.02
			10037	10.09	10037	10.10	0.01	10037	16.29	10037	16.27	-0.02
			9886	10.85	9886	10.85	0	9886	15.61	9886	15.61	0
		CA - Low	12520	10.57	12520	10.58	0.01	12520	17.60	12520	17.58	-0.02
			12121	10.79	12121	10.80	0.01	12121	17.29	12121	17.27	-0.02
			11613	10.73	11613	10.74	0.01	11613	17.01	11613	16.99	-0.02
			11028	10.69	11028	10.70	0.01	11028	16.68	11028	16.66	-0.02
			10424	10.71	10424	10.72	0.01	10424	16.32	10424	16.30	-0.02
			10037	10.16	10037	10.17	0.01	10037	16.20	10037	16.18	-0.02
			9886	10.94	9886	10.94	0	9886	15.49	9886	15.49	0
	MSL	USACE - Intermediate	12520	10.63	12520	10.65	0.02	12520	17.52	12520	17.51	-0.01
			12121	10.86	12121	10.87	0.01	12121	17.20	12121	17.19	-0.01
			11613	10.80	11613	10.81	0.01	11613	16.92	11613	16.9	-0.02
			11028	10.77	11028	10.78	0.01	11028	16.58	11028	16.56	-0.02
			10424	10.80	10424	10.81	0.01	10424	16.21	10424	16.19	-0.02
			10037	10.24	10037	10.26	0.02	10037	16.08	10037	16.06	-0.02
			9886	11.06	9886	11.06	0	9886	15.35	9886	15.35	0
		CA - Low	12520	10.65	12520	10.66	0.01	12520	17.50	12520	17.49	-0.01
			12121	10.87	12121	10.88	0.01	12121	17.18	12121	17.17	-0.01
			11613	10.82	11613	10.83	0.01	11613	16.89	11613	16.88	-0.01
			11028	10.78	11028	10.80	0.02	11028	16.56	11028	16.54	-0.02
			10424	10.82	10424	10.84	0.02	10424	16.18	10424	16.16	-0.02
			10037	10.26	10037	10.28	0.02	10037	16.05	10037	16.03	-0.02
			9886	11.09	9886	11.09	0	9886	15.31	9886	15.31	0
		CA - M-H	12520	10.53	12520	10.54	0.01	12520	17.66	12520	17.65	-0.01
			12121	10.74	12121	10.75	0.01	12121	17.35	12121	17.34	-0.01
			11613	10.67	11613	10.68	0.01	11613	17.08	11613	17.07	-0.01
			11028	10.63	11028	10.64	0.01	11028	16.76	11028	16.74	-0.02
			10424	10.64	10424	10.65	0.01	10424	16.41	10424	16.39	-0.02
			10037	10.09	10037	10.10	0.01	10037	16.29	10037	16.27	-0.02
			9886	10.85	9886	10.85	0	9886	15.61	9886	15.61	0

Discharge	Initial Elevation	SLR Scenario	Existing		Proposed		Change in Velocity	Existing		Proposed		Change in WSE
			XS	Velocity (fps)	XS	Velocity (fps)	(fps)	XS	WSE (ft)	XS	WSE (ft)	(ft)
QCAP	MHHW	USACE - Intermediate	12520	10.53	12520	10.54	0.01	12520	17.66	12520	17.65	-0.01
			12121	10.74	12121	10.75	0.01	12121	17.35	12121	17.34	-0.01
			11613	10.67	11613	10.68	0.01	11613	17.08	11613	17.06	-0.02
			11028	10.63	11028	10.64	0.01	11028	16.76	11028	16.74	-0.02
			10424	10.64	10424	10.65	0.01	10424	16.41	10424	16.39	-0.02
			10037	10.09	10037	10.1	0.01	10037	16.29	10037	16.27	-0.02
			9886	10.85	9886	10.85	0	9886	15.61	9886	15.61	0
		CA - Low	12520	10.57	12520	10.58	0.01	12520	17.6	12520	17.58	-0.02
			12121	10.79	12121	10.8	0.01	12121	17.29	12121	17.27	-0.02
			11613	10.73	11613	10.74	0.01	11613	17.01	11613	16.99	-0.02
			11028	10.69	11028	10.7	0.01	11028	16.68	11028	16.66	-0.02
			10424	10.71	10424	10.72	0.01	10424	16.32	10424	16.3	-0.02
			10037	10.16	10037	10.17	0.01	10037	16.2	10037	16.18	-0.02
			9886	10.94	9886	10.94	0	9886	15.49	9886	15.49	0
	MSL	USACE - Intermediate	12520	10.63	12520	10.65	0.02	12520	17.52	12520	17.51	-0.01
			12121	10.86	12121	10.87	0.01	12121	17.2	12121	17.19	-0.01
			11613	10.8	11613	10.81	0.01	11613	16.92	11613	16.9	-0.02
			11028	10.77	11028	10.78	0.01	11028	16.58	11028	16.56	-0.02
			10424	10.8	10424	10.81	0.01	10424	16.21	10424	16.19	-0.02
			10037	10.24	10037	10.26	0.02	10037	16.08	10037	16.06	-0.02
			9886	11.06	9886	11.06	0	9886	15.35	9886	15.35	0
		CA - Low	12520	10.65	12520	10.66	0.01	12520	17.5	12520	17.49	-0.01
			12121	10.87	12121	10.88	0.01	12121	17.18	12121	17.17	-0.01
			11613	10.82	11613	10.83	0.01	11613	16.89	11613	16.88	-0.01
			11028	10.78	11028	10.8	0.02	11028	16.56	11028	16.54	-0.02
			10424	10.82	10424	10.84	0.02	10424	16.18	10424	16.16	-0.02
			10037	10.26	10037	10.28	0.02	10037	16.05	10037	16.03	-0.02
			9886	11.09	9886	11.09	0	9886	15.31	9886	15.31	0
		CA - M-H	12520	10.53	12520	10.54	0.01	12520	17.66	12520	17.65	-0.01
			12121	10.74	12121	10.75	0.01	12121	17.35	12121	17.34	-0.01
			11613	10.67	11613	10.68	0.01	11613	17.08	11613	17.07	-0.01
			11028	10.63	11028	10.64	0.01	11028	16.76	11028	16.74	-0.02
			10424	10.64	10424	10.65	0.01	10424	16.41	10424	16.39	-0.02
			10037	10.09	10037	10.1	0.01	10037	16.29	10037	16.27	-0.02
			9886	10.85	9886	10.85	0	9886	15.61	9886	15.61	0

4.4 Scour Analysis

Two approaches to scour analysis are utilized to understand the impacts to sediment transport and channel bed response resulting from the proposed Lincoln Bridge improvements. The first approach follows the guidelines of LACDWP (2006) and the second employs bridge scour calculations using the hydraulic design package in HEC-RAS based on HEC-18 (FHWA 2012). The benefit of the former is that it considers the total bed response, including general and long-term bed adjustment, and local scour. The benefit of the latter is that considers the different elements of bridge scour directly in the HEC-RAS model. Generally, both approaches follow all or part, respectively, of Federal Highways guidelines for scour analysis for stream crossings. The methods and analysis results are described below.

4.4.1 LACDPW Scour Analysis

LACDPW (2006) requires that the sum of several design parameters be used to develop the scour-depth toe-down. These parameters include long-term bed change (degradation component only), general bed change (degradation component only), and several elements of local scour (general local scour, bend scour, low flow incitement and bed form height). In the present study, the long-term bed change is set to 0.0 feet following the findings of (ESA 2017) that indicates long-term aggradation has occurred historically at the site. General adjustment is calculated using Appendix C of the Manual, which is represented with a second-order polynomial. No bends are present in the project reach of the channel so bend scour is set to 0.0 feet. Low flow incisement is set to 2.0 feet as a conservative estimate of the thalweg depth, which is a typical approach for channels in Los Angeles County. Bed form height is calculated following Appendix C of the Manual, which relies upon academic literature (Kennedy's equation). Local scour is based on the impacts of piers (Neill's equation) and abutments (Lin's equation), and generally follows the approach of FHWA (2012). The maximum scour is then compared to the design scour depth in the legacy County Design Manual (LACFCD 1982) and the greater of the two values is used for design toe-down. The LACDPW scour calculations for all modeled scenarios are presented in Appendix D. Table 5 summarizes the total scour results for the total design scour after LACDPW (2006) comparing the existing and proposed condition bridges for all valid analyses. The proposed bridge condition results in an additional 0.01 feet of bridge scour compared to the existing condition for all valid analyses.

Table 5: LACDPW Scour Results (feet) at Lincoln Bridge

Discharge	Initial Elevation	SLR Scenario	Existing	Proposed
USACE	MHHW	USACE - Int	24.22	24.23
		CA - Low	22.48	22.49
	MSL	USACE - Int	22.56	22.57
		CA - Low	22.57	22.58
		CA - M-H	22.42	22.43
QCAP	MHHW	USACE - Int	23.11	23.12
		CA - Low	23.15	23.16
	MSL	USACE - Int	23.21	23.22
		CA - Low	23.22	23.23
		CA - M-H	23.11	23.12

4.4.2 HEC-18 Scour Analysis

HEC-18 analysis is conducted in the HEC-RAS model using the software's hydraulic design function. The function utilizes hydraulic information from the model to perform the scour calculations. The calculations are limited to contraction, pier and abutment components of local scour. Table 6 summarizes the HEC-18 scour results after FHWA (2012) comparing the existing and proposed condition bridges for all valid simulations examined. The analyses show that on average, the proposed bridge condition results in an increase of 2.5 feet of pier scour and a decrease in 0.1 feet of contraction score when compared to the existing condition.

Table 6: HEC-18 Scour Results (feet) at Lincoln Bridge

Discharge	Initial Elevation	SLR Scenario	Existing				Proposed			
			Contraction	Pier	Abutment	**Total**	Contraction	Pier	Abutment	**Total**
USACE	MHHW	USACE - Int	0.94	9.72	0.0	10.66	0.87	12.21	0.0	13.08
		CA - Low	0.97	9.74	0.0	10.71	0.88	12.23	0.0	13.11
	MSL	USACE - Int	0.99	9.76	0.0	10.75	0.92	12.26	0.0	13.18
		CA - Low	1.00	9.77	0.0	10.77	0.91	12.27	0.0	13.18
		CA - M-H	0.94	9.72	0.0	10.66	0.87	12.20	0.0	13.07
QCAP	MHHW	USACE - Int	1.00	9.97	0.0	10.97	0.92	12.51	0.0	13.43
		CA - Low	1.02	9.98	0.0	11.00	0.93	12.52	0.0	13.45
	MSL	USACE - Int	1.02	10.00	0.0	11.02	0.94	12.55	0.0	13.49
		CA - Low	1.03	10.00	0.0	11.03	0.95	12.56	0.0	13.51
		CA - M-H	0.99	9.97	0.0	10.96	0.92	12.51	0.0	13.43

Because there is no abutment scour observed, the pier and abutment scour cones are not expected to overlap at Lincoln Bridge in either the existing or proposed condition. Therefore, when using HEC-18 guidelines for determining scour under Lincoln Bridge, the pier and abutment scour should not be summed; the contraction scour should instead be summed with either the pier or abutment scour for an appropriate analysis. HEC-18 analysis results for all valid simulations are included in the Appendix D.

5 Conclusion and Final Recommendations

The purpose of the Lincoln Bridge Multi-Modal Bridge Improvement Project is to create a new multi-modal corridor along SR-1/Lincoln Boulevard in order to improve traffic operations and services while minimizing impacts to Ballona Creek and Ballona Wetlands Reserve. The purpose of this hydraulic study is to update the HEC-RAS model provided by Psomas with revised SLR criteria and up-to-date design plans in an effort to analyze the hydraulic impacts of the proposed bridge design. It is worth noting that using updated SLR criteria yielded overtopping of the modeled channel for certain proposed runs; runs in which the channel could not contain the full flow are invalid analyses for which conclusions cannot be drawn.

Results of the hydraulic analysis show that the proposed bridge design has minimal impacts on channel water surface elevation and velocity in the vicinity of the bridge. For all valid model runs, the proposed bridge design yields a channel velocity increase of 0.01 feet per second on average. Additionally, the proposed design yields an average decrease in water surface elevation (NAVD88) of 0.02 feet when compared to the hydraulic results of the existing bridge design. The LACDPW scour analysis of the Lincoln Bridge show that the proposed bridge design results in an additional 0.01 feet of bridge scour compared to the existing condition for all valid analyses. Results of the HEC-18 scour analysis show an average increase of 2.4 feet of total scour for the proposed design in comparison to the existing bridge.

It is recommended that all future analyses of proposed bridge designs use the most hydrologically conservative scenario that yielded valid hydraulic analyses. That is, scenarios considering the QCAP design discharge of 51,240 cubic feet per second, the MSL initial elevation of 2.6 feet, and the California Medium-High SLR scenario of 6.8 feet. If future models require using hydrologic conditions that resulted in channel overtopping for more conservative analyses, it is recommended that Psomas obtain additional terrain data to expand the area of analysis to include the Ballona Wetlands Reserve. Additional terrain data would make it possible to extend the HEC-RAS cross sections to contain the full flow or to add a 2D area to capture surface flow if needed.

6 References

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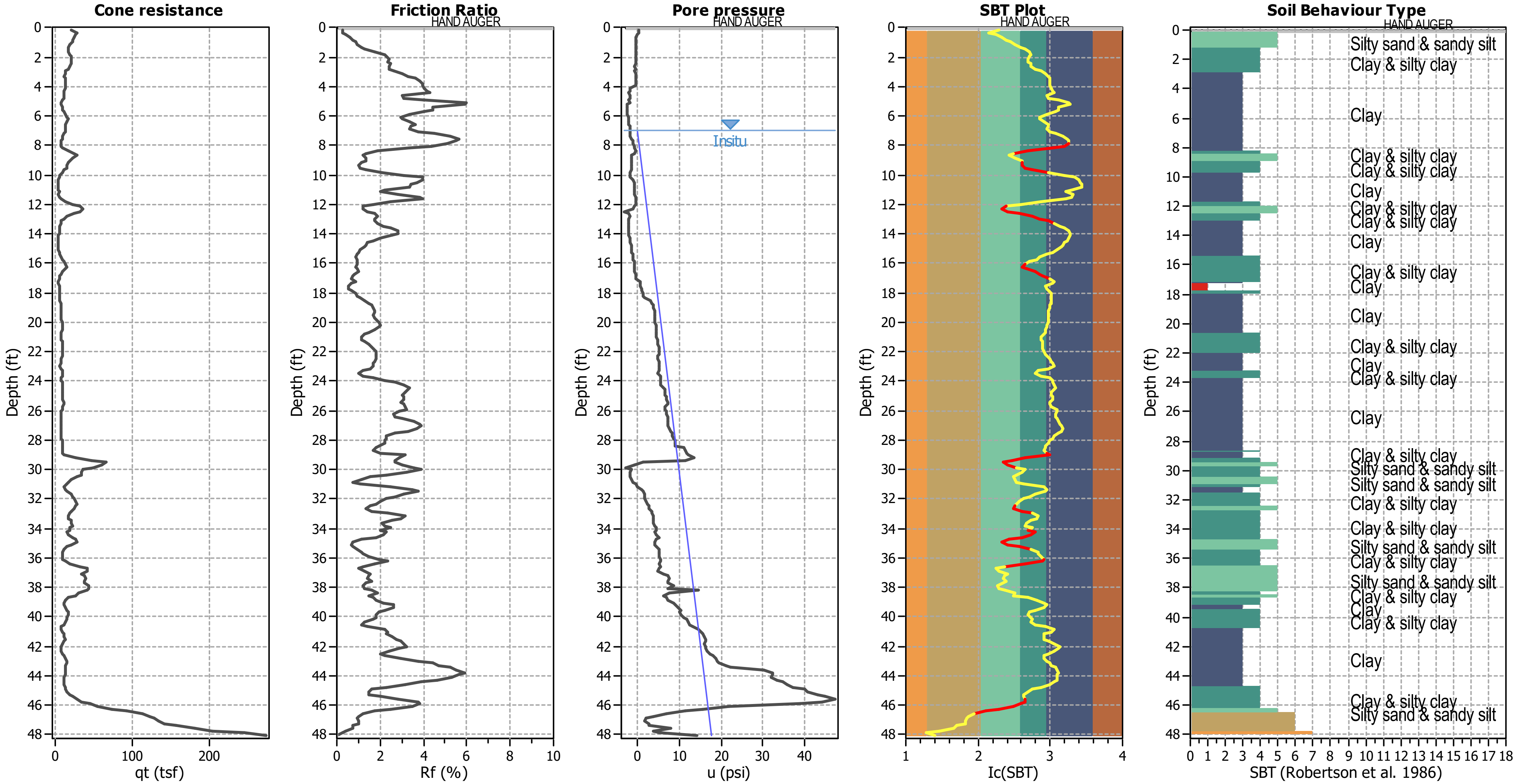
7 Appendices

Please refer to digitally submitted appendices.

APPENDIX E
LIQUEFACTION ANALYSIS

CPT basic interpretation plots



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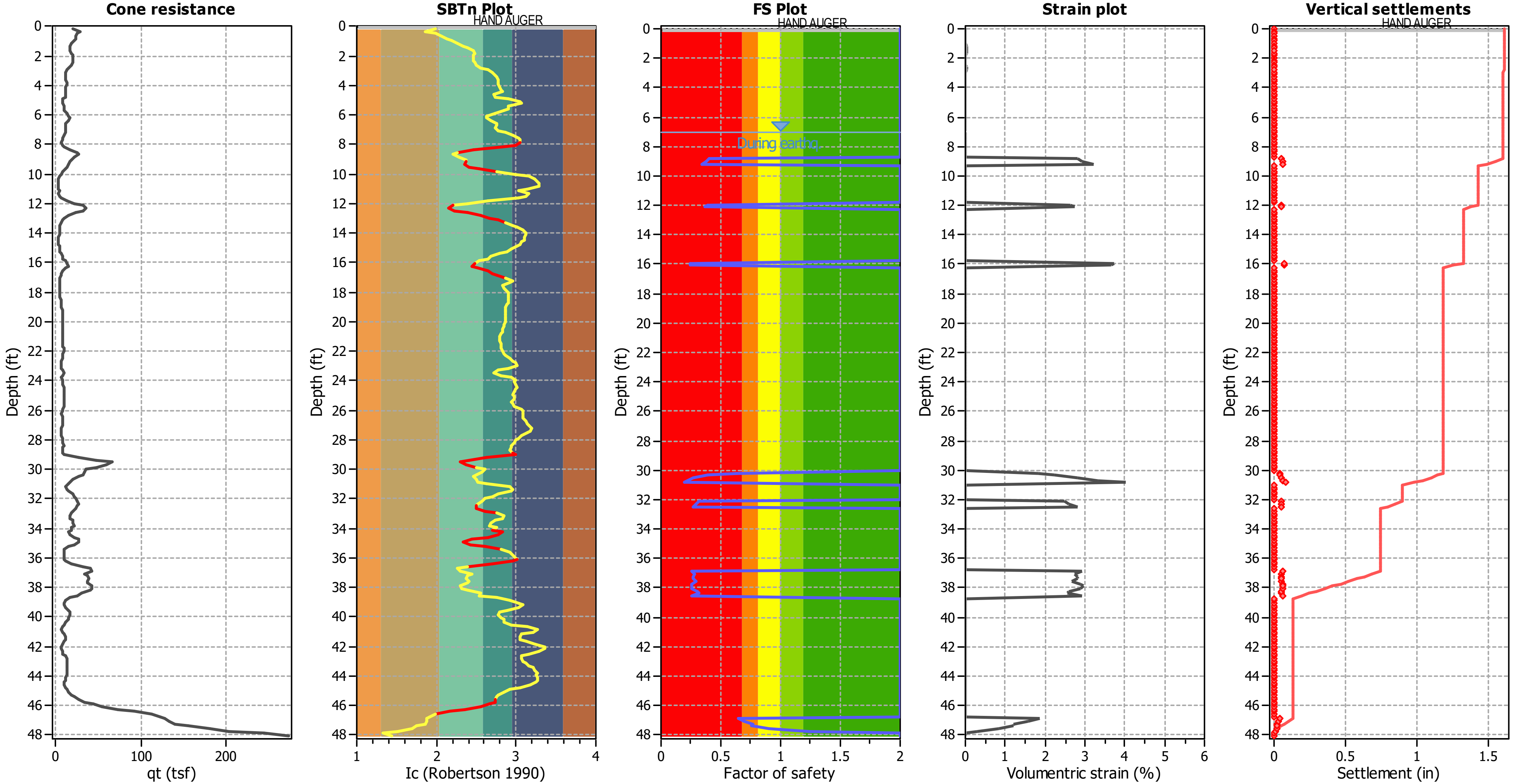
Depth to water table (insitu):	7.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Estimation of post-earthquake settlements



Abbreviations

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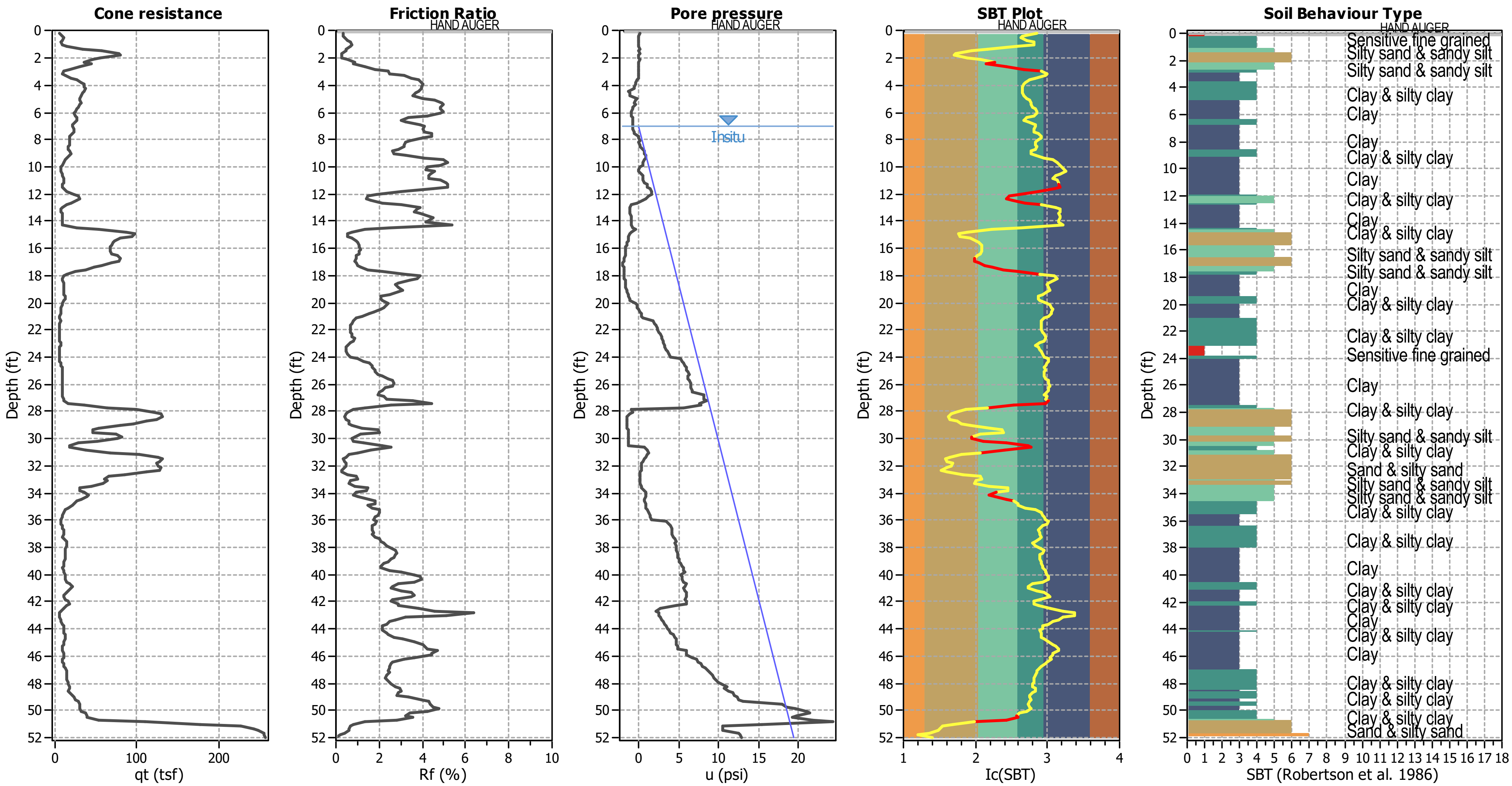
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

CPT basic interpretation plots



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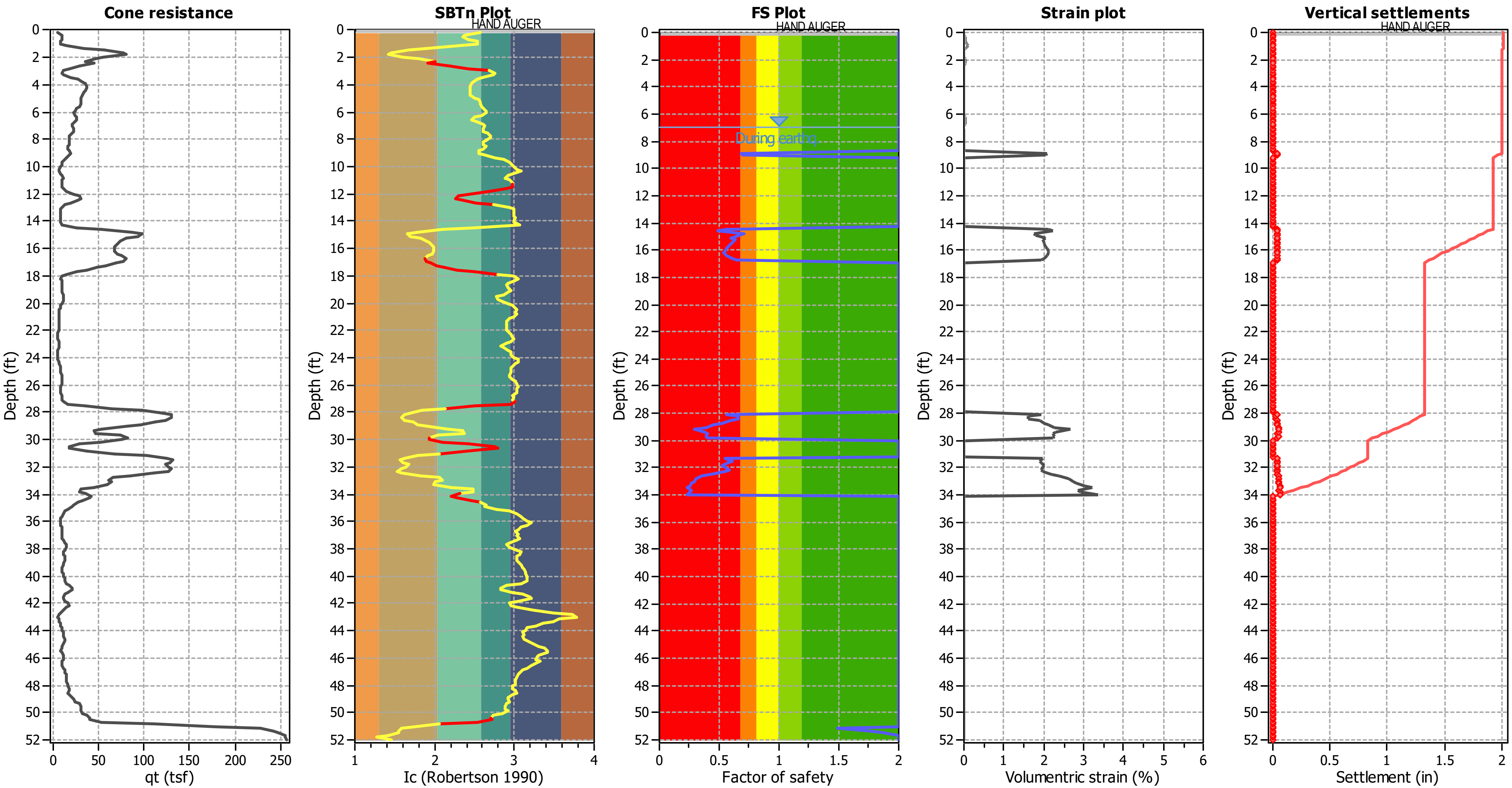

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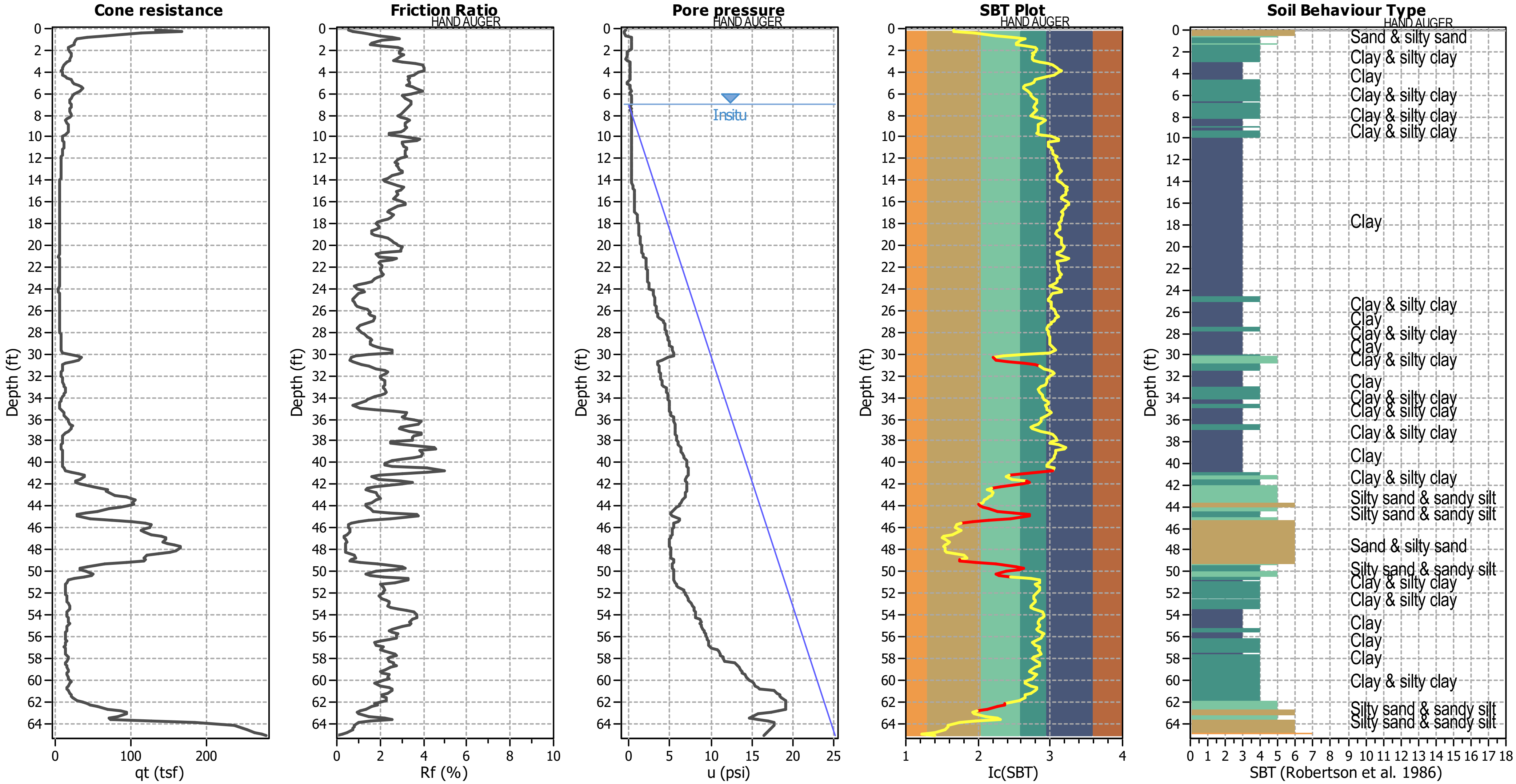

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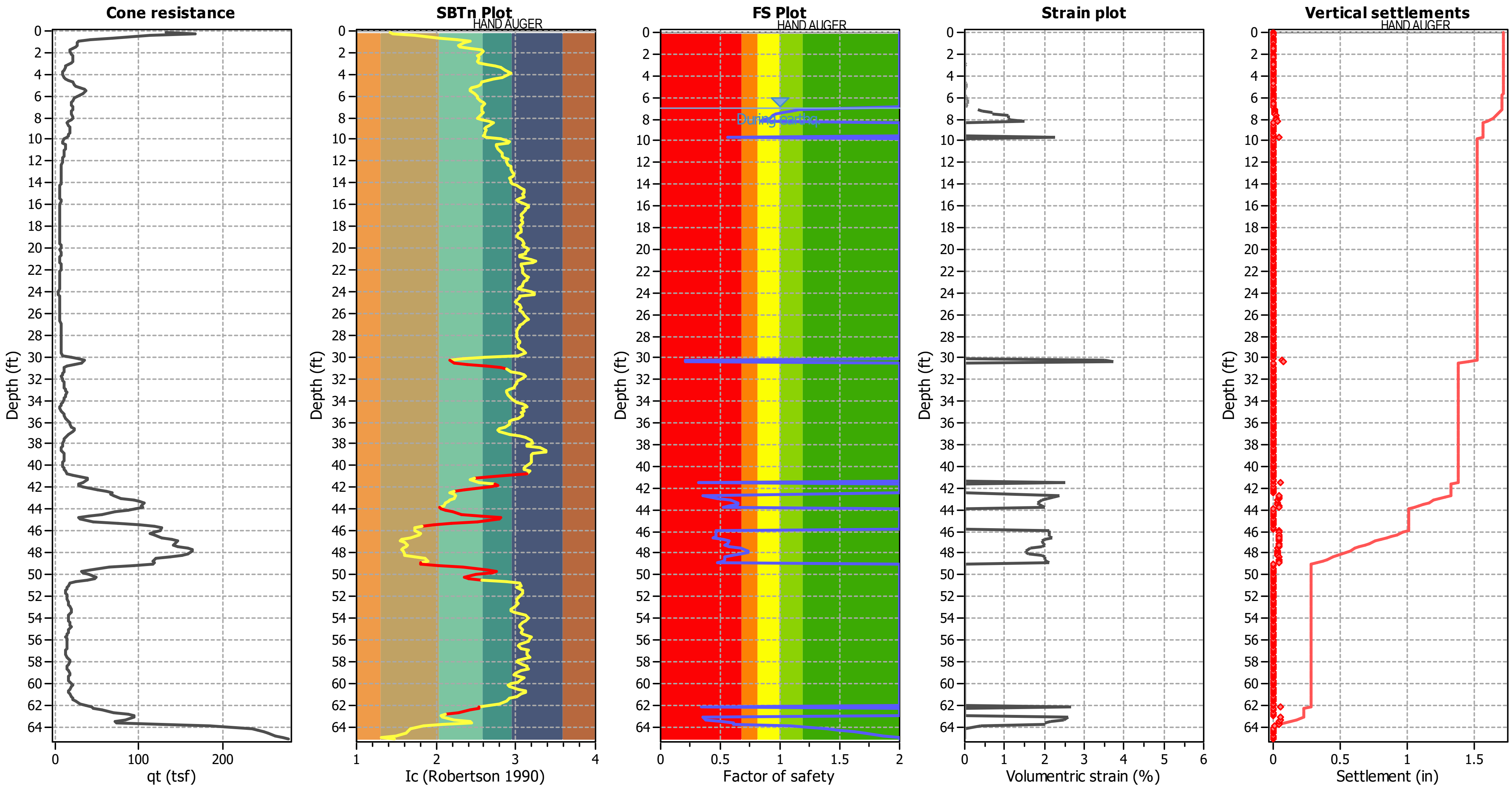

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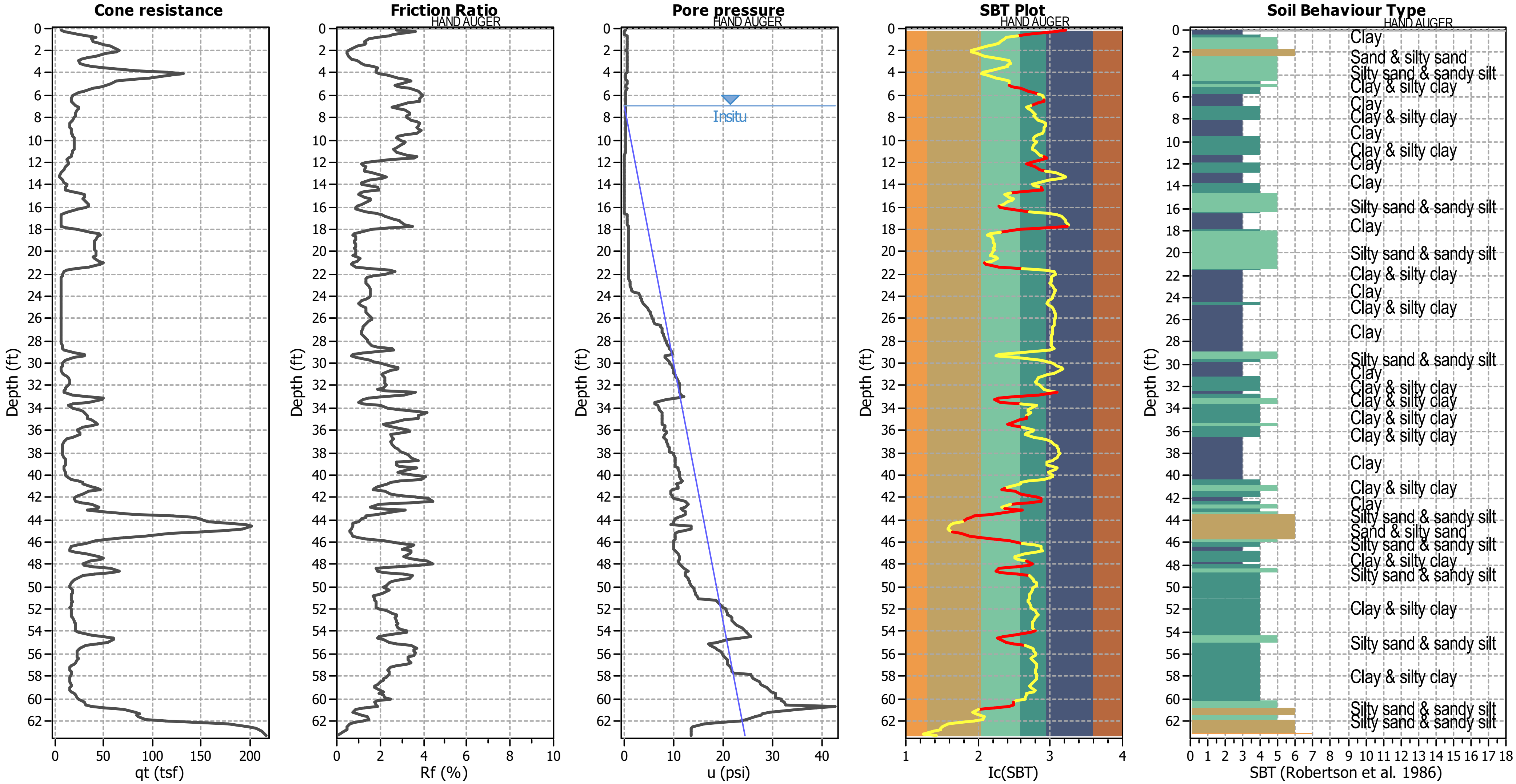

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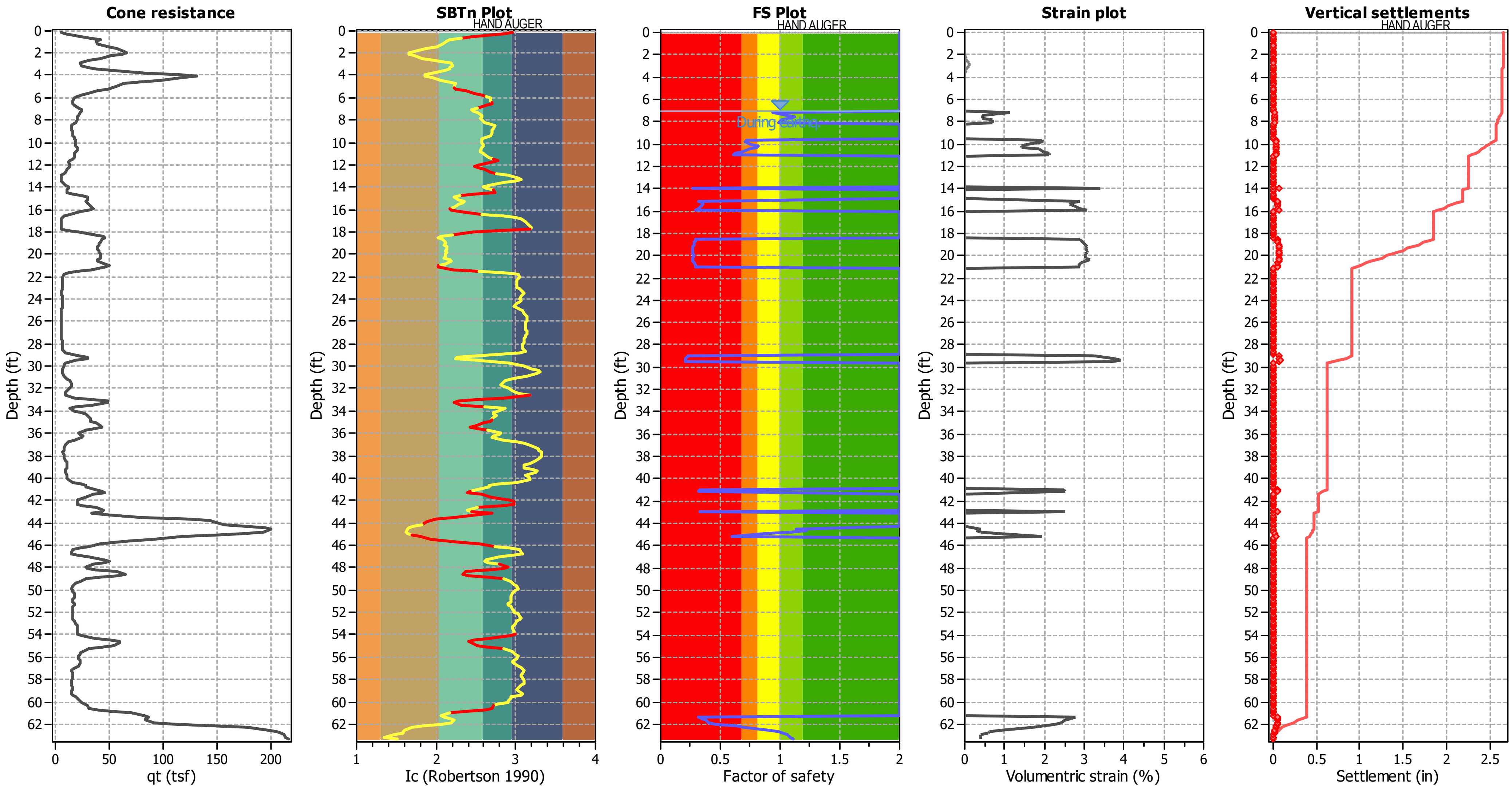

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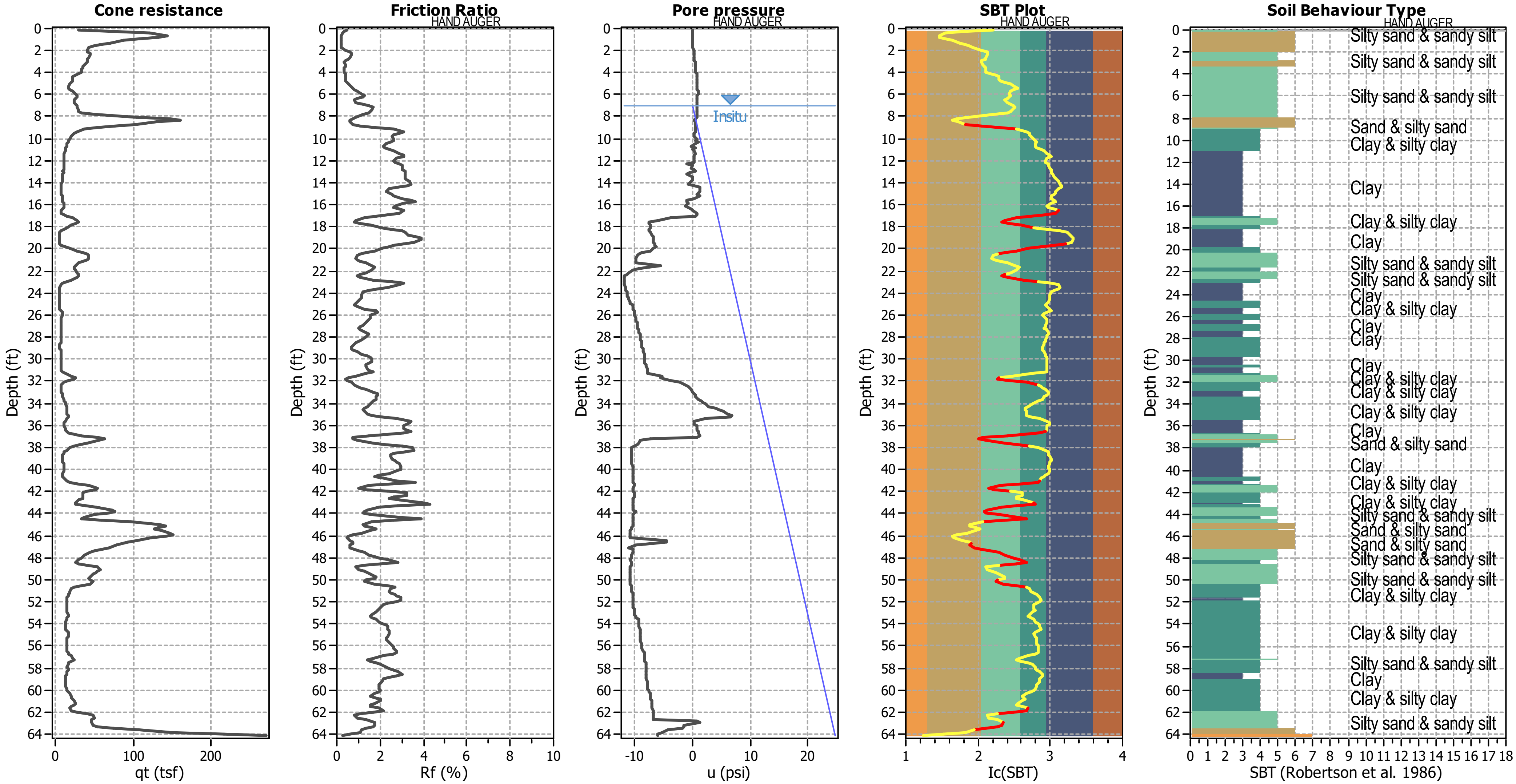

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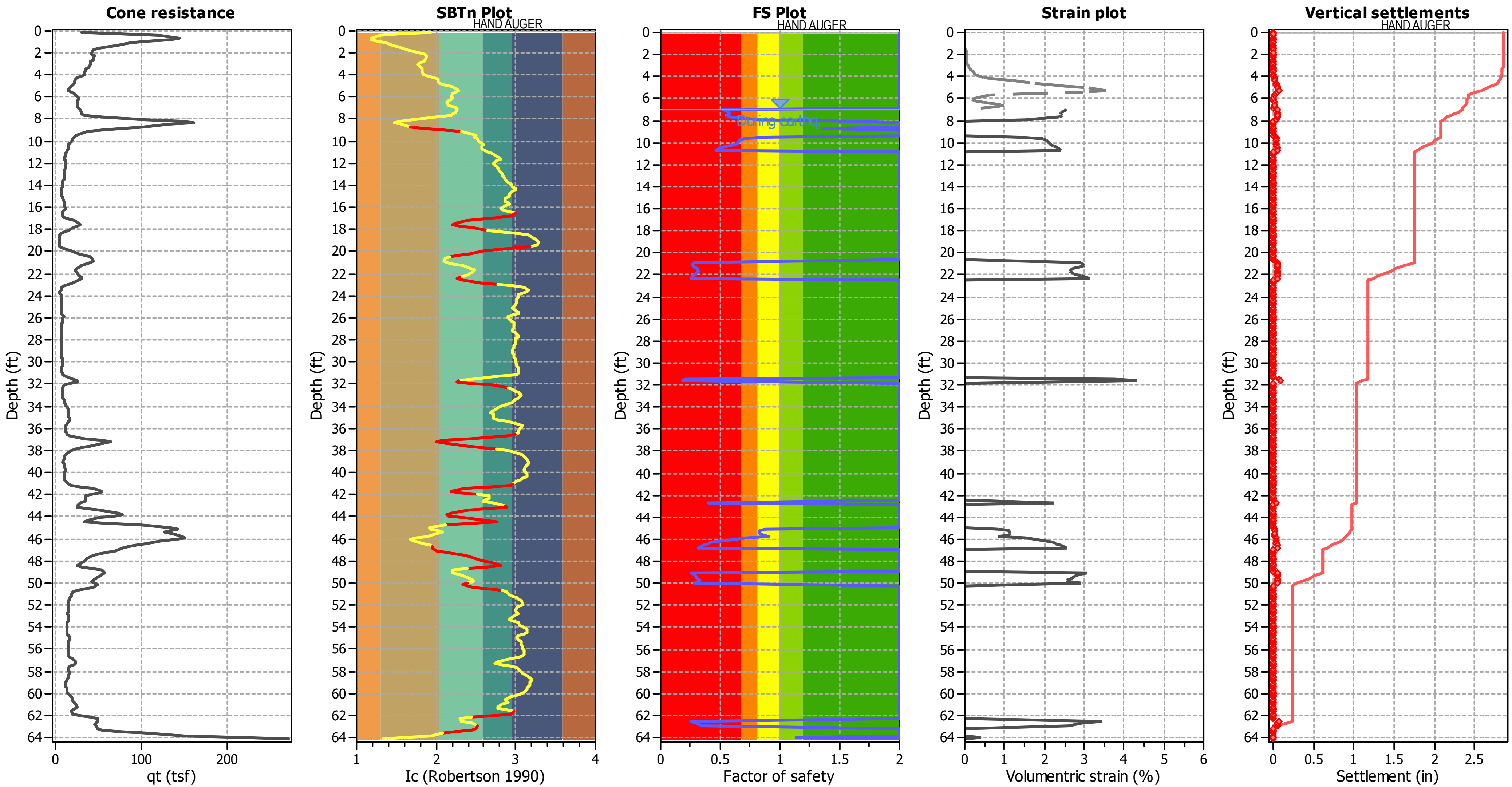

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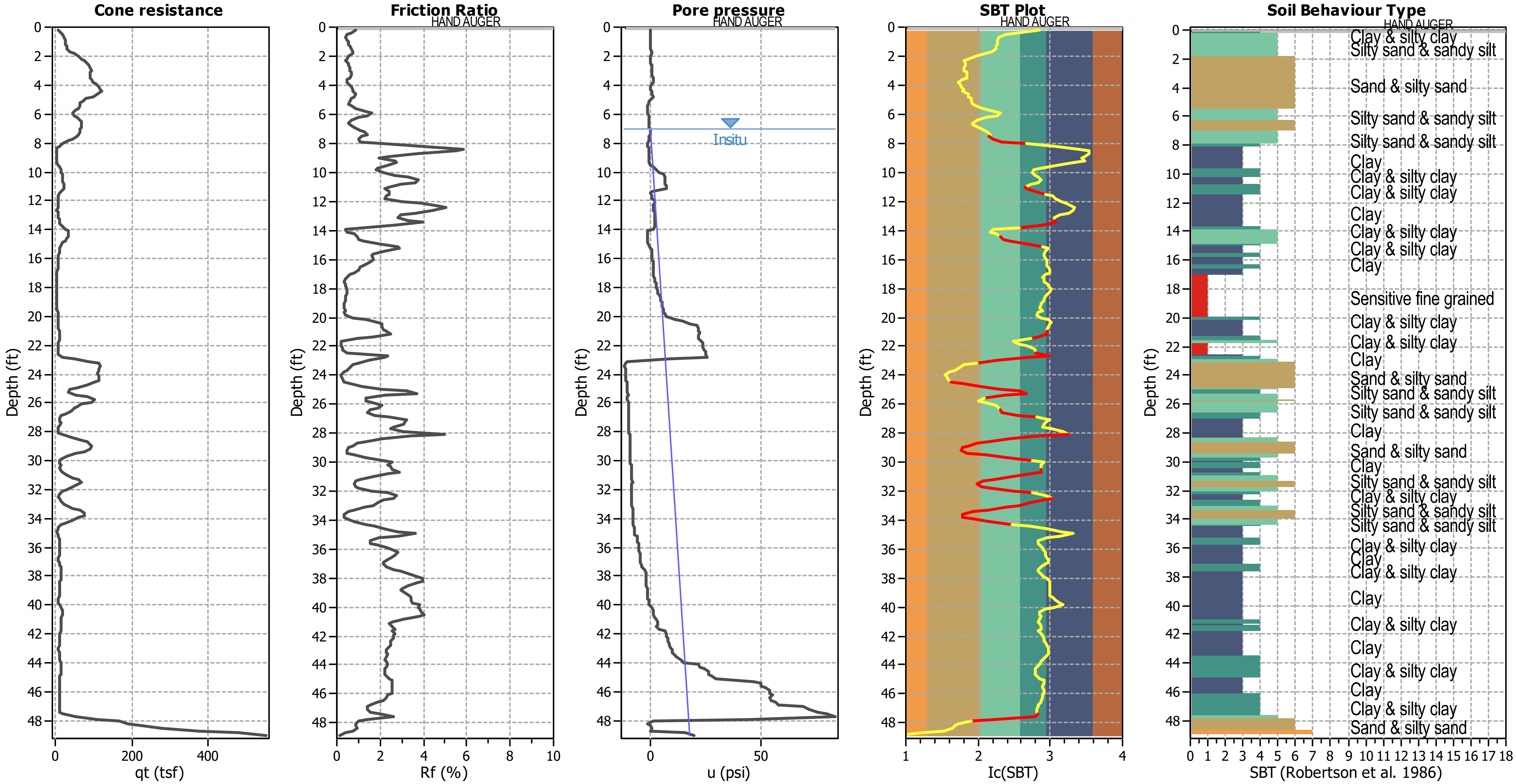

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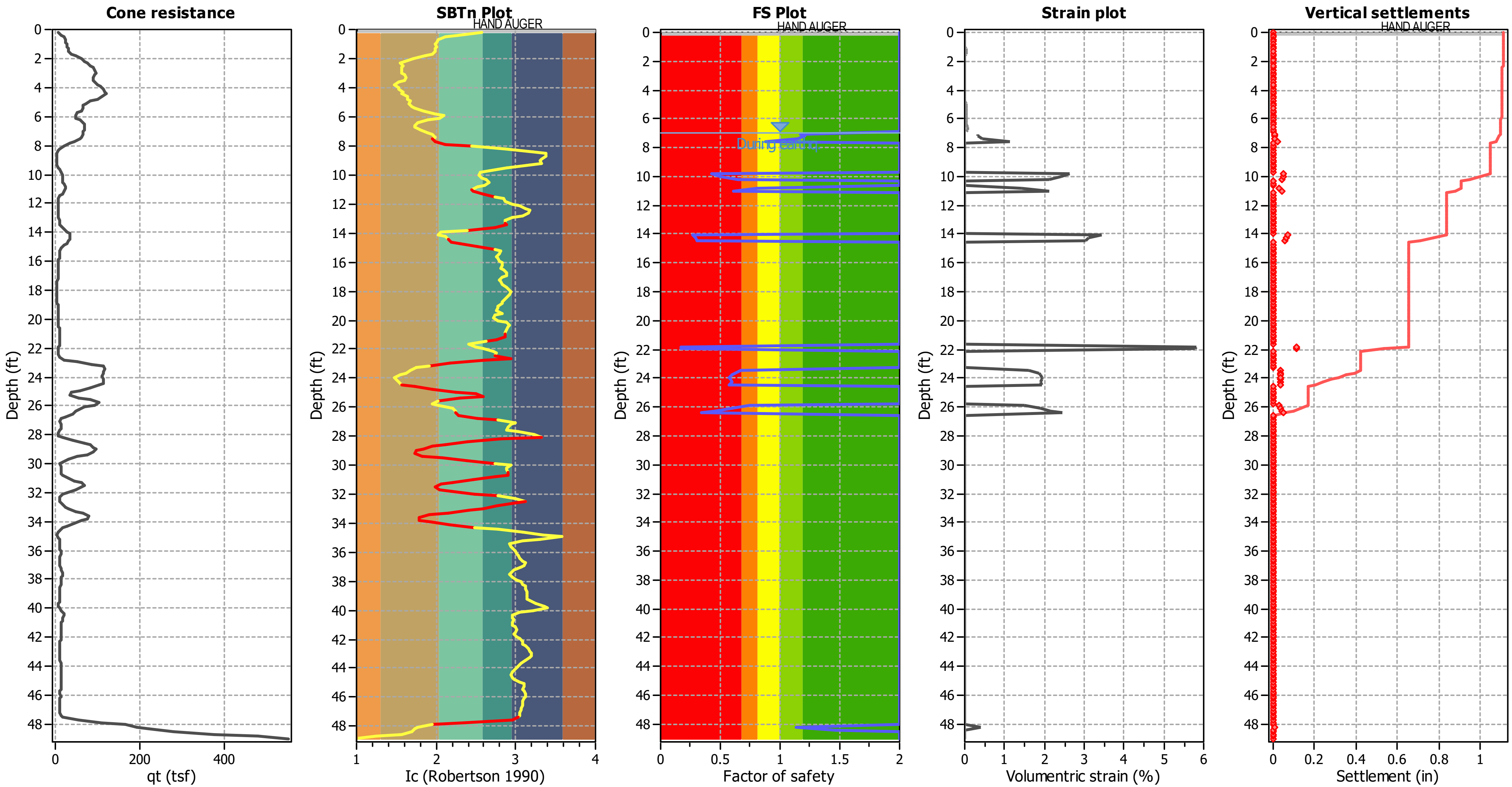

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APPENDIX G

PRELIMINARY HYDROLOGY, HYDRAULICS AND SCOUR STUDY

Lincoln Bridge Multi-Modal Bridge Improvements Hydraulics Study

Los Angeles County, California

Prepared for:

Psomas
555 South Flower Street, Suite 4300
Los Angeles, CA 90071
213.223.1400

Prepared by:

Michael Baker International
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Santa Ana, CA 92707

Contact Persons:

Mujahid Chandoo, P.E.

October 2022

JN 173324

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Appendices

1 Introduction

This report summarizes an update to HEC-RAS numerical modeling and sediment transport analysis associated with Lincoln Bridge Multi-Modal Improvement Project (City of Los Angeles Department of Transportation [LADOT] TOS 27). Previously, Psomas completed sea level rise (SLR) analysis and HEC-RAS modeling of lower Ballona Creek and Lincoln Boulevard Bridge for the existing conditions for pre-2018 Caltrans and California Coastal Commission (CCC) SLR. Since the project started, new SLR criteria for California has been enacted (State of California Sea-Level Rise Guidance 2018 Update) (California 2018). Additionally, discussions between Psomas, CCC, Caltrans, LADOT and the US Army Corps of Engineers (USACE) have refined the regulatory requirements concerning hydraulic analysis and SLR related to the project.

The project is located along Ballona Creek bounded by Marina Del Rey to the north and the Ballona Wetlands to the south. The project includes the widening and other multimodal improvements of Lincoln Boulevard over the Creek south of Culver Boulevard (Figure 1). The project is approximately 8,700 feet upstream of the Pacific Ocean and approximately 3,200 feet downstream of the Marina Freeway crossing of the Creek.

1.1 Purpose

The purpose of the project is to create a new multi-modal corridor along SR-1/Lincoln Boulevard between Fiji Way and Jefferson Boulevard to improve traffic operations and to serve transit, bicyclists, and pedestrians while minimizing impacts to Ballona Wetlands Reserve, Ballona Creek, and other environmental resources. The purpose of this study is to assess the hydraulic impacts of the proposed bridge in order to minimize environmental impacts to Marina Del Rey and the Ballona Wetlands.

1.2 Need

Lincoln Boulevard serves as a critical north-south connection on the Westside. There are few arterial connections that provide continuous access through the Westside, which results in Lincoln Boulevard being oversaturated during peak commute periods. Lincoln Boulevard narrows from three to two lanes in the southbound direction, approximately 1,050 feet north of the existing Lincoln Bridge over Ballona Creek, and from four to three lanes in the northbound direction, approximately 320 feet north of the intersection with Jefferson Blvd, to the intersection with Fiji Way. These lane reductions create a major bottleneck.

The average vehicle travel speeds along Lincoln Boulevard are 15 mph during peak periods when measured between Ozone Ave in the City of Santa Monica and Sepulveda Boulevard while the design speed is 50 mph. Travel times are greatly impacted by bottlenecks resulting in slower speeds along much of the corridor.

In addition, access for pedestrians along Lincoln Boulevard is disjointed north and south of the Ballona Creek bridge which does not have sidewalks. Lincoln Boulevard also lacks bicycle facilities across the bridge. Pedestrian and bicycle facilities are also deficient along Culver Boulevard.

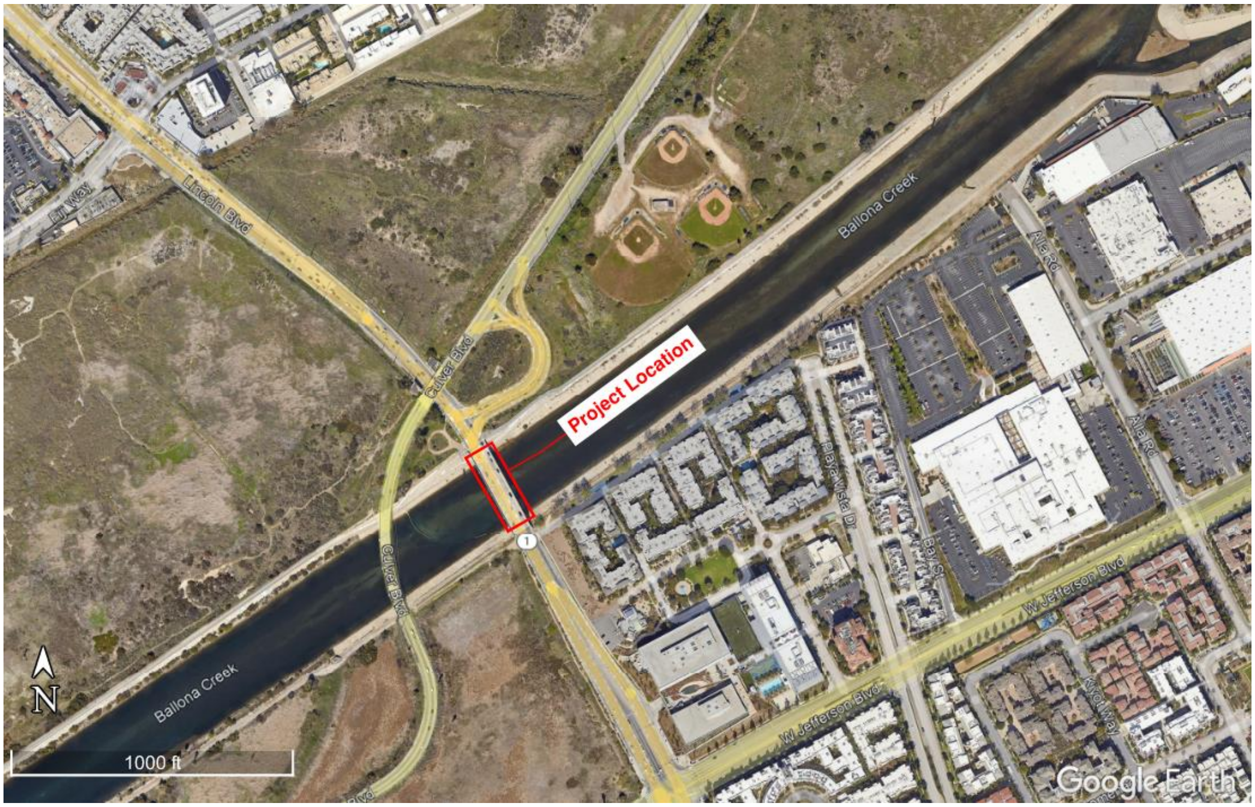

Figure 1: Project Location and Vicinity Map

1.3 Study Goals

The study has the following goals:

1. Two design discharges will be analyzed using the HEC-RAS hydraulics models of lower Ballona Creek: Los Angeles County Department of Public Works (LACDPW) Capital Storm discharge (QCAP) and USACE 100-year discharge (USACE).
2. Two sea level change criteria will be used for the downstream boundary conditions in HEC-RAS modeling: USACE and California (2018). No tsunami, wave run-up or other oceanographic factors are included as part of the SLR analysis because Lincoln Bridge is located approximately 2.5 miles inland of the coast. In addition, the Creek is leveed from its downstream terminus at the Pacific Ocean to upstream of the Lincoln Bridge crossing. The change in bottom elevation between the terminus and the Lincoln Bridge crossing is approximately 7 feet and the opening of the channel is approximately 300 feet. While some open ocean waves may diffract, refract, or reflect through the levee mouth and propagate upstream, it is highly unlikely that open ocean waves will impact Lincoln Bridge. Geotechnical subsidence or uplift is also not included in SLR analysis.
   USACE SLR values will be taken from USACE Sea-Level Change Curve Calculator Monica Gage intermediate value, and California (2018) SLR values will be taken from Table 25. Three values will be utilized from Table 25: Low, Medium-High and Extreme Risk Aversion (H++) for High Emissions. The basis for SLR will include two different starting water surface elevation datums: mean higher high water (MHHW) at the request of California Coastal Commission and Caltrans, and mean sea level (MSL), as per USACE ER 1100-2-8162 (local MSL) and ETL 1100-2-1 (non-ecosystem). Per the Santa Monica Gage, all elevations will be in NAVD88; bridge elevations will be adjusted accordingly.
3. All hydraulic modeling will be conducted using the HEC-RAS model developed by ESA in conjunction with USACE and modified by Michael Baker. The Michael Baker-modified model will be updated to incorporate:
   a. two design discharges (USACE and QCAP),
   b. two starting water surface elevations (MSL and MHHW),
   c. four SLR criteria (USACE Intermediate, and California 2018 Low, Medium-High, and H++),
   d. two bridge conditions (existing and proposed).
4. A scour analysis will be developed for Lincoln Bridge. Bridge scour for the existing and proposed bridge conditions will be developed in the HEC-RAS models using the software's hydraulic design function following HEC-18, Evaluating Scour at Bridges. Bridge scour will be calculated for the USACE and QCAP discharges assuming a MSL downstream boundary condition. The MSL boundary condition is expected to be the most conservative in that a lower water surface elevation for a given discharge will have a higher velocity in subcritical flow regimes. Only changes to Lincoln Bridge will be analyzed in the proposed condition bridge scour analysis.

2 Hydrologic and Bridge Design Conditions

2.1 Hydrologic Conditions

There are three design discharges available for the project reach of Ballona Creek: US Army Corps of Engineers (USACE) 100-year discharge; Federal Emergency Management Agency (FEMA) 100-year discharge; and the Los Angeles County Department of Public Works (LACDPW) 50-year burned-and-bulked, or Capital, (QCAP) discharge. For the purposes of the present study only the USACE and QCAP discharges are considered and are summarized in Table 1. No changes to the channel or watershed are proposed as part of the project, and the project will not alter the hydrology in the proposed condition.

Table 1: Design Discharges (cfs) for Ballona Creek at Lincoln Boulevard

FEMA	USACE	QCAP
44,270	46,000	51,240

2.2 Existing and Proposed Bridge Conditions

In the existing condition, the bridge is a four-bent structure with three pier walls. The piers are 90.0 feet apart with a width ranging from 3.25 to 4.50 feet (average 3.875 feet) without debris and a 7.75-foot debris width (double the average width). The bridge deck is approximately 69.0 feet wide and 334.5 feet long. The deck is vertically curved with the low chord ranging from 17.9 to 21.3 feet NAVD88, and a high chord ranging from 21.4 to 25.8 feet NAVD88. The deck is not super-elevated. The representation of the existing bridge in HEC-RAS is shown in Figure 2.

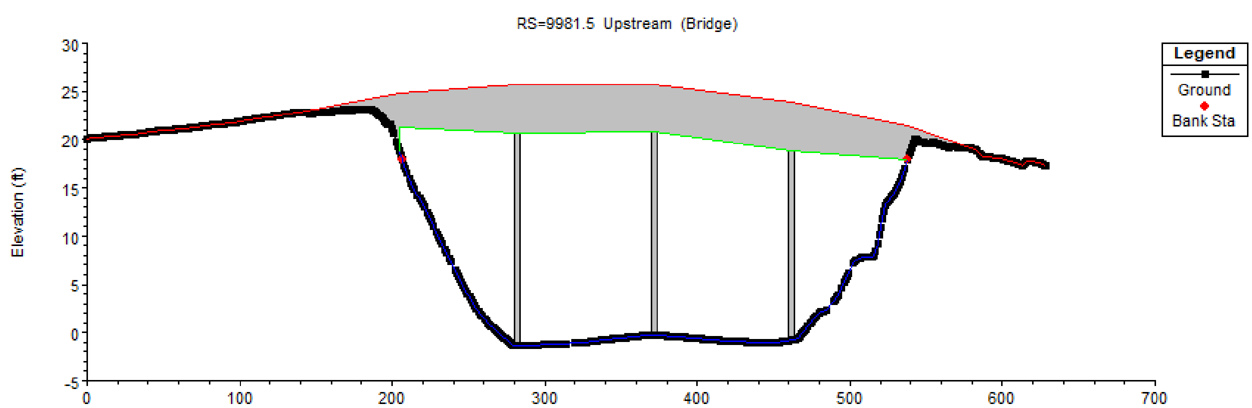

Figure 2: Existing Bridge (upstream section looking downstream)

In the proposed condition, the bridge is a three-bent structure with two pier groups. The circular pier groups are approximately 111.5 feet apart. Each pier is 5.5 feet wide without debris and has an 11.0-foot debris width. The bridge deck is approximately 130.0 feet wide and 334.5 feet long. The deck is vertically curved with the low chord ranging from 23.6 to 25.1 feet, and a high chord ranging from 28.6 to 30.2 feet. The representation of the proposed bridge in HEC-RAS is shown in Figure 3. All bridge design details of the existing and proposed conditions were provided by Psomas' (D. Fredricks, personal communication, 2021) and can be found in Appendix A. Deck elevations were provided in NGVD29 and were adjusted to NAVD88 to be consistent with the datums of the Santa Monica Gage.

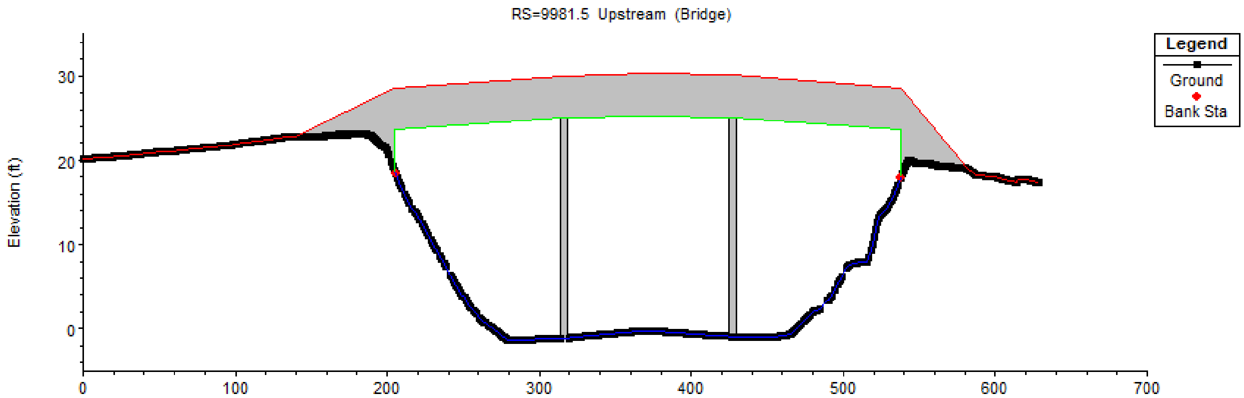

Figure 3: Proposed Bridge (upstream section looking downstream)

3 Sea Level Rise Design Considerations

All hydraulic analysis in the present study employs sea level rise design considerations based on two design parameters USACE (2019) and California (2018). USACE (2019) analysis is expected to be required to comply with future Clean Water Act (CWA) Section 408 permitting requirements. California (2018) analysis is expected to be required for State-related permitting (i.e. Caltrans, CCC, etc.).

Previous iterations (2018 and earlier) of this study included older Caltrans/CCC SLR values, and the present version of the report is intended to update the design to meet current SLR design guidelines within the State.

The USACE Sea-Level Change Curve Calculator is an online sea-level change calculator (at the time of writing, Version 2022.60: https://cwbi-app.sec.usace.army.mil/rccslc/slcc_calc.html). The present study utilizes the USACE 2013 dataset as well as the Santa Monica, CA Gage 9410840 for the year 2100, which is the furthest out in time for which the projections are valid. A copy of the USACE calculator output data is included in the Appendix B. The calculator indicates that relative sea-level change (SLC) for the intermediate projection is 4.15 feet relative to the NAVD88 datum. This value is used for all modeling with the USACE SLR boundary condition. It is important to note that the USACE projections include the local rate of vertical land movement. The estimated USACE relative SLC projections for the Santa Monica Gage are shown in Figure 4.

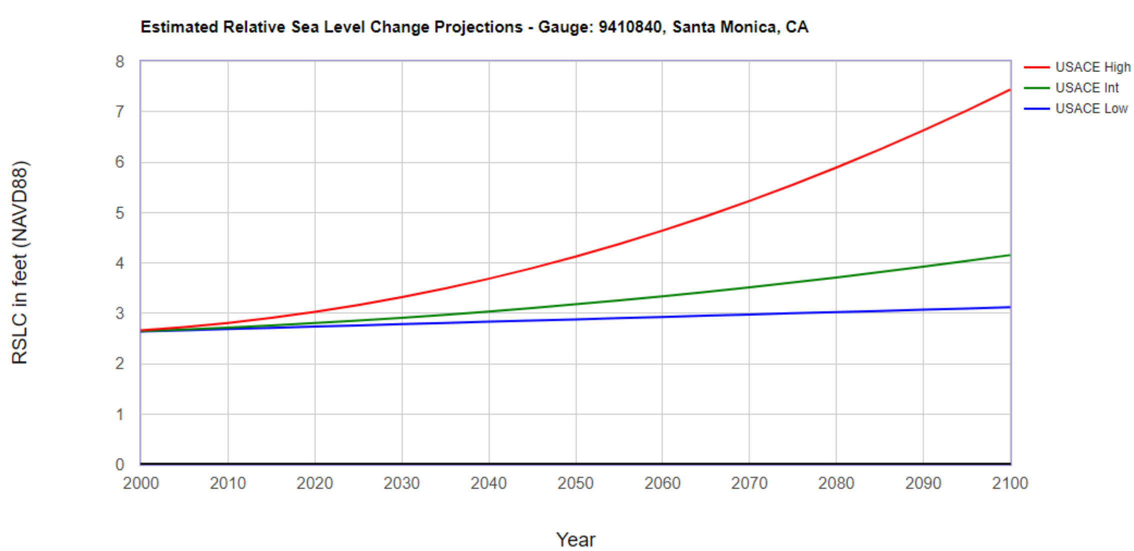

Figure 4: USACE Seal Level Change Projections for Santa Monica, CA

USACE has several guidance documents addressing SLC considerations for Corps-related projects. Both ER 1100-2-8162 (USACE 2013) and ETL 1100-2-1 (USACE 2014) address starting water surface elevations for analysis in SLC in coastal projects. While the documents appear to give latitude to local Corps Districts for final selection of starting water surface elevations, the documents give weight to MSL as local MSL, and non-ecosystem analyses, respectively. The present study uses both MSL (2.60 feet NAVD88) and MHHW (5.24 feet NAVD88) for USACE-related analyses of SLC to be consistent with analyses under California (2018) (see below, Section 4). Previous discussions with USACE staff (C. Mesa, personal communication, 2019) failed to produce additional guidance since no 408 permit application documentation had been provided to the Los Angeles District at the time of the communication.

State SLR criteria utilizes data from Table 25 in California (2018), Santa Monica gage. In the present study only the high emissions values for the low, medium-high and extreme risk aversion are used for modeling. These values are 3.3, 6.8 and 10.0 feet, respectively, for year 2010, which was chosen to be consistent with USACE analysis. It is important to note that California (2018) does not specify a starting sea surface elevation from which to conduct analysis. Additionally, multiple meetings with CCC and Caltrans staff in 2018 and 2019 failed to produce documentation specifying a starting sea surface elevation. For calculations herein both mean sea level (MSL) and mean higher high water (MHHW) for Santa Monica gage 9410840, 2.60 and 5.24 feet NAVD88, respectively, were employed. Datums are shown in the Appendix.

The values used for SLC/SLR for present study are summarized in Table 2.

Table 2: Sea Level Change/Rise Values by Agency for Santa Monica, CA

AGENCY	USACE	CALIFORNIA		
CRITERIA	INTERMEDIATE	LOW	MEDIUM-HIGH	EXTREME
VALUE	4.15	3.30	6.80	10.0

Several other design considerations may be included in SLC/SLR analyses. These considerations include local sedimentation/erosion, channel/levee overtopping, tsunamis, geotechnical uplift/subsidence, local inundation, and coastal erosion. While these topics are generally beyond the scope of the present study a discussion of them can be found in the Ballona Wetlands Restoration Project Draft EIS/EIR, Appendix F (ESA 2017). ESA (2017) notes that some bed aggradation has occurred in the area of Lincoln Bridge in the period on the order of 1 to 2 feet over the period 1961 to 2012. Between the Bridge and the end of the South Jetty, the bed aggradation has ranged from approximately 0 to greater than 3 feet during the same period. A discussion of aggradation in the proposed condition is included in Section 4.

4 Hydraulic Analysis of Existing and Proposed Conditions

4.1 HEC-RAS Model

All hydraulic modeling is conducted using the HEC-RAS numerical model developed initially by ESA (2017). The model is run in steady state, sub-critical mode, with downstream boundary conditions as described previously. All model geometry information remains unchanged, and only the proposed bridge geometry is included in proposed conditions modeling.

In the present study, HEC-RAS modeling consists of two discharges (USACE and QCAP), two starting water surface elevations (MSL and MHHW), four SLR criteria (USACE Intermediate, and California [2018] Low, Medium-High, and H++), and two bridge conditions (existing and proposed). The combination of modeling scenarios results in 32 discrete model plans. All HEC-RAS model files can be found in Appendix C. For readability, this report focuses on the design limits of Lincoln Bridge, and a discussion of all simulations is not included.

Part of the reason for not discussing all of the simulation results is because some simulations are not expected alter the critical basis of design values since they produce less conservative results than other simulations (i.e. simulations utilizing MSL produce lower changes in velocity, water surface elevation and/or greater freeboard than simulations utilizing MHHW). Other simulations are not discussed because the Ballona Creek Levees are overtopped in the model results. For overtopping cases, the results are both not valid (that is, the cross sections do not contain the discharge), and the model results raise the larger issue of coastal retreat. Coastal retreat becomes important for the purposes of the present project as rising SL inundates the areas adjacent to the project including Ballona Wetlands, Marina Del Rey and the roads which cross them. For example, there is no need to consider the design elements of Lincoln Bridge as sea levels rise and inundate portions of Ballona Wetlands where Lincoln Boulevard drops under Culver Boulevard to the north of the project site: the road to and from the Bridge would be impassable. Therefore, the discussions that follow focus on simulations that are valid. Table 3 summarizes the inputs and validity of all HEC-RAS model runs.

Table 3: Validity of HEC-RAS model runs

	Plan #	Plan Name in HEC-RAS	Discharge	Initial Elevation	Sea Level Rise	Change in WSE (ft) [NAVD88]	Is the analysis valid?
Existing	1	EX-USACE-MHHW-USACE	USACE	MHHW	USACE - Int	9.39	YES
	2	EX-USACE-MHHW-Low	USACE	MHHW	CA - Low	8.54	YES
	3	EX-USACE-MHHW-MH	USACE	MHHW	CA - M-H	12.04	NO
	4	EX-USACE-MHHW-HH	USACE	MHHW	CA - H++	15.24	NO
	5	EX-USACE-MSL-USACE	USACE	MSL	USACE - Int	6.75	YES
	6	EX-USACE-MSL-Low	USACE	MSL	CA - Low	5.90	YES
	7	EX-USACE-MSL-MH	USACE	MSL	CA - M-H	9.40	YES
	8	EX-USACE-MSL-HH	USACE	MSL	CA - H++	12.6	NO
	9	EX-QCAP-MHHW-USACE	QCAP	MHHW	USACE - Int	9.39	YES
	10	EX-QCAP-MHHW-Low	QCAP	MHHW	CA - Low	8.54	YES
	11	EX-QCAP-MHHW-MH	QCAP	MHHW	CA - M-H	12.04	NO
	12	EX-QCAP-MHHW-HH	QCAP	MHHW	CA - H++	15.24	NO
	13	EX-QCAP-MSL-USACE	QCAP	MSL	USACE - Int	6.75	YES
	14	EX-QCAP-MSL-Low	QCAP	MSL	CA - Low	5.90	YES
	15	EX-QCAP-MSL-MH	QCAP	MSL	CA - M-H	9.40	YES
	16	EX-QCAP-MSL-HH	QCAP	MSL	CA - H++	12.60	NO
Proposed	17	PR-USACE-MHHW-USACE	USACE	MHHW	USACE - Int	9.39	YES
	18	PR-USACE-MHHW-Low	USACE	MHHW	CA - Low	8.54	YES
	19	PR-USACE-MHHW-MH	USACE	MHHW	CA - M-H	12.04	NO
	20	PR-USACE-MHHW-HH	USACE	MHHW	CA - H++	15.24	NO
	21	PR-USACE-MSL-USACE	USACE	MSL	USACE - Int	6.75	YES
	22	PR-USACE-MSL-Low	USACE	MSL	CA - Low	5.90	YES
	23	PR-USACE-MSL-MH	USACE	MSL	CA - M-H	9.40	YES
	24	PR-USACE-MSL-HH	USACE	MSL	CA - H++	12.60	NO
	25	PR-QCAP-MHHW-USACE	QCAP	MHHW	USACE - Int	9.39	YES
	26	PR-QCAP-MHHW-Low	QCAP	MHHW	CA - Low	8.54	YES
	27	PR-QCAP-MHHW-MH	QCAP	MHHW	CA - M-H	12.04	NO
	28	PR-QCAP-MHHW-HH	QCAP	MHHW	CA - H++	15.24	NO
	29	PR-QCAP-MSL-USACE	QCAP	MSL	USACE - Int	6.75	YES
	30	PR-QCAP-MSL-Low	QCAP	MSL	CA - Low	5.90	YES
	31	PR-QCAP-MSL-MH	QCAP	MSL	CA - M-H	9.40	YES
	32	PR-QCAP-MSL-HH	QCAP	MSL	CA - H++	12.60	NO

4.2 Bridge Hydraulics

The impacts of the proposed bridge on channel hydraulics are summarized in Table 4 by comparing the existing and proposed velocity and water surface elevations (WSE) for different events. These events considered a combination of hydrologic conditions and sea level rise scenarios as necessary to maintain validity of the hydraulic analysis as described in Section 4.1.

Table 4 shows the changes in velocity from existing to proposed for the cross sections (XS) in the vicinity of Lincoln Bridge (located at XS 9981.5). For all scenarios examined, the average difference in velocity is approximately +0.01 foot per second (fps). That is, all valid hydraulic analyses show that the proposed bridge condition has a negligible impact on velocity compared to the existing bridge condition.

Table 4 also shows the changes in water surface elevation in NAVD88 from existing to proposed for the cross sections in the vicinity of the bridge. For all scenarios examined, the difference in WSE ranges from zero to a decrease in 0.02 ft. Therefore, all valid hydraulic analyses show that the proposed project has a negligible impact on depth compared to the existing bridge condition.

4.3 Sea-Level Rise Impact on Channel Hydraulics

As noted in Section 4.1, the magnitude of SLR plays a significant role on flow containment within the Ballona Creek channel and the validity of this analysis. However, for cases in which the analysis is valid, the impacts of different SLR scenarios are significantly low with regards to velocity and depth. Per Table 4, increasing the SLR while maintaining the same discharge and initial elevation yields no more than an increase in 0.1 fps in velocity or 0.3 ft in WSE. Because of these insignificant differences observed in both the existing and proposed conditions, no additional analysis of future aggradation/degradation impacts to channel hydraulics are described here. This approach is further supported by the findings of ESA (2017) which indicate that long-term aggradation of the channel bed has occurred since 1961 (see Section 3, above). That is, for the purposes of design of the Lincoln Bridge, additional or accelerated aggradation is expected to decrease the capacity of Ballona Creek channel fostering overtopping of the levees at lower SLR magnitudes and/or at less frequent discharge events than the USACE design discharge. In any case, the primary driver of the design of Lincoln Bridge improvements is not the local hydraulics within the Ballona Creek channel, but the ability of the levees and surrounding area to contain and resist the local relative increase in sea surface elevation. It is recommended that future analyses of proposed Lincoln Bridge improvements proceed under the most conservative hydrologic conditions that yielded valid hydraulic analyses—that is, scenarios considering the QCAP design discharge of 51,240 cubic feet per second, the MSL initial elevation of 2.6 feet, and the California Medium-High SLR scenario of 6.8 feet.

Table 4: Impacts of the Proposed Bridge on Channel Hydraulics

Discharge	Initial Elevation	SLR Scenario	Existing		Proposed		Change in Velocity	Existing		Proposed		Change in WSE
			XS	Velocity (fps)	XS	Velocity (fps)	(fps)	XS	WSE (ft)	XS	WSE (ft)	(ft)
USACE	MHHW	USACE - Intermediate	12520	10.53	12520	10.54	0.01	12520	17.66	12520	17.65	-0.01
			12121	10.74	12121	10.75	0.01	12121	17.35	12121	17.34	-0.01
			11613	10.67	11613	10.68	0.01	11613	17.08	11613	17.06	-0.02
			11028	10.63	11028	10.64	0.01	11028	16.76	11028	16.74	-0.02
			10424	10.64	10424	10.65	0.01	10424	16.41	10424	16.39	-0.02
			10037	10.09	10037	10.10	0.01	10037	16.29	10037	16.27	-0.02
			9886	10.85	9886	10.85	0	9886	15.61	9886	15.61	0
		CA - Low	12520	10.57	12520	10.58	0.01	12520	17.60	12520	17.58	-0.02
			12121	10.79	12121	10.80	0.01	12121	17.29	12121	17.27	-0.02
			11613	10.73	11613	10.74	0.01	11613	17.01	11613	16.99	-0.02
			11028	10.69	11028	10.70	0.01	11028	16.68	11028	16.66	-0.02
			10424	10.71	10424	10.72	0.01	10424	16.32	10424	16.30	-0.02
			10037	10.16	10037	10.17	0.01	10037	16.20	10037	16.18	-0.02
			9886	10.94	9886	10.94	0	9886	15.49	9886	15.49	0
	MSL	USACE - Intermediate	12520	10.63	12520	10.65	0.02	12520	17.52	12520	17.51	-0.01
			12121	10.86	12121	10.87	0.01	12121	17.20	12121	17.19	-0.01
			11613	10.80	11613	10.81	0.01	11613	16.92	11613	16.9	-0.02
			11028	10.77	11028	10.78	0.01	11028	16.58	11028	16.56	-0.02
			10424	10.80	10424	10.81	0.01	10424	16.21	10424	16.19	-0.02
			10037	10.24	10037	10.26	0.02	10037	16.08	10037	16.06	-0.02
			9886	11.06	9886	11.06	0	9886	15.35	9886	15.35	0
		CA - Low	12520	10.65	12520	10.66	0.01	12520	17.50	12520	17.49	-0.01
			12121	10.87	12121	10.88	0.01	12121	17.18	12121	17.17	-0.01
			11613	10.82	11613	10.83	0.01	11613	16.89	11613	16.88	-0.01
			11028	10.78	11028	10.80	0.02	11028	16.56	11028	16.54	-0.02
			10424	10.82	10424	10.84	0.02	10424	16.18	10424	16.16	-0.02
			10037	10.26	10037	10.28	0.02	10037	16.05	10037	16.03	-0.02
			9886	11.09	9886	11.09	0	9886	15.31	9886	15.31	0
		CA - M-H	12520	10.53	12520	10.54	0.01	12520	17.66	12520	17.65	-0.01
			12121	10.74	12121	10.75	0.01	12121	17.35	12121	17.34	-0.01
			11613	10.67	11613	10.68	0.01	11613	17.08	11613	17.07	-0.01
			11028	10.63	11028	10.64	0.01	11028	16.76	11028	16.74	-0.02
			10424	10.64	10424	10.65	0.01	10424	16.41	10424	16.39	-0.02
			10037	10.09	10037	10.10	0.01	10037	16.29	10037	16.27	-0.02
			9886	10.85	9886	10.85	0	9886	15.61	9886	15.61	0

Discharge	Initial Elevation	SLR Scenario	Existing		Proposed		Change in Velocity	Existing		Proposed		Change in WSE
			XS	Velocity (fps)	XS	Velocity (fps)	(fps)	XS	WSE (ft)	XS	WSE (ft)	(ft)
QCAP	MHHW	USACE - Intermediate	12520	10.53	12520	10.54	0.01	12520	17.66	12520	17.65	-0.01
			12121	10.74	12121	10.75	0.01	12121	17.35	12121	17.34	-0.01
			11613	10.67	11613	10.68	0.01	11613	17.08	11613	17.06	-0.02
			11028	10.63	11028	10.64	0.01	11028	16.76	11028	16.74	-0.02
			10424	10.64	10424	10.65	0.01	10424	16.41	10424	16.39	-0.02
			10037	10.09	10037	10.1	0.01	10037	16.29	10037	16.27	-0.02
			9886	10.85	9886	10.85	0	9886	15.61	9886	15.61	0
		CA - Low	12520	10.57	12520	10.58	0.01	12520	17.6	12520	17.58	-0.02
			12121	10.79	12121	10.8	0.01	12121	17.29	12121	17.27	-0.02
			11613	10.73	11613	10.74	0.01	11613	17.01	11613	16.99	-0.02
			11028	10.69	11028	10.7	0.01	11028	16.68	11028	16.66	-0.02
			10424	10.71	10424	10.72	0.01	10424	16.32	10424	16.3	-0.02
			10037	10.16	10037	10.17	0.01	10037	16.2	10037	16.18	-0.02
			9886	10.94	9886	10.94	0	9886	15.49	9886	15.49	0
	MSL	USACE - Intermediate	12520	10.63	12520	10.65	0.02	12520	17.52	12520	17.51	-0.01
			12121	10.86	12121	10.87	0.01	12121	17.2	12121	17.19	-0.01
			11613	10.8	11613	10.81	0.01	11613	16.92	11613	16.9	-0.02
			11028	10.77	11028	10.78	0.01	11028	16.58	11028	16.56	-0.02
			10424	10.8	10424	10.81	0.01	10424	16.21	10424	16.19	-0.02
			10037	10.24	10037	10.26	0.02	10037	16.08	10037	16.06	-0.02
			9886	11.06	9886	11.06	0	9886	15.35	9886	15.35	0
		CA - Low	12520	10.65	12520	10.66	0.01	12520	17.5	12520	17.49	-0.01
			12121	10.87	12121	10.88	0.01	12121	17.18	12121	17.17	-0.01
			11613	10.82	11613	10.83	0.01	11613	16.89	11613	16.88	-0.01
			11028	10.78	11028	10.8	0.02	11028	16.56	11028	16.54	-0.02
			10424	10.82	10424	10.84	0.02	10424	16.18	10424	16.16	-0.02
			10037	10.26	10037	10.28	0.02	10037	16.05	10037	16.03	-0.02
			9886	11.09	9886	11.09	0	9886	15.31	9886	15.31	0
		CA - M-H	12520	10.53	12520	10.54	0.01	12520	17.66	12520	17.65	-0.01
			12121	10.74	12121	10.75	0.01	12121	17.35	12121	17.34	-0.01
			11613	10.67	11613	10.68	0.01	11613	17.08	11613	17.07	-0.01
			11028	10.63	11028	10.64	0.01	11028	16.76	11028	16.74	-0.02
			10424	10.64	10424	10.65	0.01	10424	16.41	10424	16.39	-0.02
			10037	10.09	10037	10.1	0.01	10037	16.29	10037	16.27	-0.02
			9886	10.85	9886	10.85	0	9886	15.61	9886	15.61	0

4.4 Scour Analysis

Two approaches to scour analysis are utilized to understand the impacts to sediment transport and channel bed response resulting from the proposed Lincoln Bridge improvements. The first approach follows the guidelines of LACDWP (2006) and the second employs bridge scour calculations using the hydraulic design package in HEC-RAS based on HEC-18 (FHWA 2012). The benefit of the former is that it considers the total bed response, including general and long-term bed adjustment, and local scour. The benefit of the latter is that considers the different elements of bridge scour directly in the HEC-RAS model. Generally, both approaches follow all or part, respectively, of Federal Highways guidelines for scour analysis for stream crossings. The methods and analysis results are described below.

4.4.1 LACDPW Scour Analysis

LACDPW (2006) requires that the sum of several design parameters be used to develop the scour-depth toe-down. These parameters include long-term bed change (degradation component only), general bed change (degradation component only), and several elements of local scour (general local scour, bend scour, low flow incitement and bed form height). In the present study, the long-term bed change is set to 0.0 feet following the findings of (ESA 2017) that indicates long-term aggradation has occurred historically at the site. General adjustment is calculated using Appendix C of the Manual, which is represented with a second-order polynomial. No bends are present in the project reach of the channel so bend scour is set to 0.0 feet. Low flow incisement is set to 2.0 feet as a conservative estimate of the thalweg depth, which is a typical approach for channels in Los Angeles County. Bed form height is calculated following Appendix C of the Manual, which relies upon academic literature (Kennedy's equation). Local scour is based on the impacts of piers (Neill's equation) and abutments (Lin's equation), and generally follows the approach of FHWA (2012). The maximum scour is then compared to the design scour depth in the legacy County Design Manual (LACFCD 1982) and the greater of the two values is used for design toe-down. The LACDPW scour calculations for all modeled scenarios are presented in Appendix D. Table 5 summarizes the total scour results for the total design scour after LACDPW (2006) comparing the existing and proposed condition bridges for all valid analyses. The proposed bridge condition results in an additional 0.01 feet of bridge scour compared to the existing condition for all valid analyses.

Table 5: LACDPW Scour Results (feet) at Lincoln Bridge

Discharge	Initial Elevation	SLR Scenario	Existing	Proposed
USACE	MHHW	USACE - Int	24.22	24.23
		CA - Low	22.48	22.49
	MSL	USACE - Int	22.56	22.57
		CA - Low	22.57	22.58
		CA - M-H	22.42	22.43
QCAP	MHHW	USACE - Int	23.11	23.12
		CA - Low	23.15	23.16
	MSL	USACE - Int	23.21	23.22
		CA - Low	23.22	23.23
		CA - M-H	23.11	23.12

4.4.2 HEC-18 Scour Analysis

HEC-18 analysis is conducted in the HEC-RAS model using the software's hydraulic design function. The function utilizes hydraulic information from the model to perform the scour calculations. The calculations are limited to contraction, pier and abutment components of local scour. Table 6 summarizes the HEC-18 scour results after FHWA (2012) comparing the existing and proposed condition bridges for all valid simulations examined. The analyses show that on average, the proposed bridge condition results in an increase of 2.5 feet of pier scour and a decrease in 0.1 feet of contraction score when compared to the existing condition.

Table 6: HEC-18 Scour Results (feet) at Lincoln Bridge

Discharge	Initial Elevation	SLR Scenario	Existing				Proposed			
			Contraction	Pier	Abutment	**Total**	Contraction	Pier	Abutment	**Total**
USACE	MHHW	USACE - Int	0.94	9.72	0.0	10.66	0.87	12.21	0.0	13.08
		CA - Low	0.97	9.74	0.0	10.71	0.88	12.23	0.0	13.11
	MSL	USACE - Int	0.99	9.76	0.0	10.75	0.92	12.26	0.0	13.18
		CA - Low	1.00	9.77	0.0	10.77	0.91	12.27	0.0	13.18
		CA - M-H	0.94	9.72	0.0	10.66	0.87	12.20	0.0	13.07
QCAP	MHHW	USACE - Int	1.00	9.97	0.0	10.97	0.92	12.51	0.0	13.43
		CA - Low	1.02	9.98	0.0	11.00	0.93	12.52	0.0	13.45
	MSL	USACE - Int	1.02	10.00	0.0	11.02	0.94	12.55	0.0	13.49
		CA - Low	1.03	10.00	0.0	11.03	0.95	12.56	0.0	13.51
		CA - M-H	0.99	9.97	0.0	10.96	0.92	12.51	0.0	13.43

Because there is no abutment scour observed, the pier and abutment scour cones are not expected to overlap at Lincoln Bridge in either the existing or proposed condition. Therefore, when using HEC-18 guidelines for determining scour under Lincoln Bridge, the pier and abutment scour should not be summed; the contraction scour should instead be summed with either the pier or abutment scour for an appropriate analysis. HEC-18 analysis results for all valid simulations are included in the Appendix D.

5 Conclusion and Final Recommendations

The purpose of the Lincoln Bridge Multi-Modal Bridge Improvement Project is to create a new multi-modal corridor along SR-1/Lincoln Boulevard in order to improve traffic operations and services while minimizing impacts to Ballona Creek and Ballona Wetlands Reserve. The purpose of this hydraulic study is to update the HEC-RAS model provided by Psomas with revised SLR criteria and up-to-date design plans in an effort to analyze the hydraulic impacts of the proposed bridge design. It is worth noting that using updated SLR criteria yielded overtopping of the modeled channel for certain proposed runs; runs in which the channel could not contain the full flow are invalid analyses for which conclusions cannot be drawn.

Results of the hydraulic analysis show that the proposed bridge design has minimal impacts on channel water surface elevation and velocity in the vicinity of the bridge. For all valid model runs, the proposed bridge design yields a channel velocity increase of 0.01 feet per second on average. Additionally, the proposed design yields an average decrease in water surface elevation (NAVD88) of 0.02 feet when compared to the hydraulic results of the existing bridge design. The LACDPW scour analysis of the Lincoln Bridge show that the proposed bridge design results in an additional 0.01 feet of bridge scour compared to the existing condition for all valid analyses. Results of the HEC-18 scour analysis show an average increase of 2.4 feet of total scour for the proposed design in comparison to the existing bridge.

It is recommended that all future analyses of proposed bridge designs use the most hydrologically conservative scenario that yielded valid hydraulic analyses. That is, scenarios considering the QCAP design discharge of 51,240 cubic feet per second, the MSL initial elevation of 2.6 feet, and the California Medium-High SLR scenario of 6.8 feet. If future models require using hydrologic conditions that resulted in channel overtopping for more conservative analyses, it is recommended that Psomas obtain additional terrain data to expand the area of analysis to include the Ballona Wetlands Reserve. Additional terrain data would make it possible to extend the HEC-RAS cross sections to contain the full flow or to add a 2D area to capture surface flow if needed.

6 References

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7 Appendices

Please refer to digitally submitted appendices.

P. Culver Boulevard Advanced Planning Study

LINCOLN BOULEVARD (SR-01) MULTI-MODAL IMPROVEMENT PROJECT
From Jefferson Boulevard to Fiji Way
PM 30.16 to PM 30.74
EA 33880 PROJECT ID 0717000061

ADVANCE PLANNING STUDY
DESIGN MEMO

CULVER BOULEVARD OVERCROSSING BRIDGE REPLACEMENT
BRIDGE No. 53-0118

Prepared for:

Los Angeles Department of Transportation
&
California Department of Transportation

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1.0 PROJECT DESCRIPTION

Lincoln Boulevard is a major route traveling northwest to southeast on the Westside of Los Angeles County, connecting major destinations including the City of Santa Monica to the north, and Loyola Marymount University, Otis College of Art and Design and Los Angeles International Airport to the south. The Project segment provides a critical and heavily traveled connection between and amongst the communities of Playa Del Rey, Playa Vista, Westchester, and El Segundo in the south and Marina Del Rey, Del Rey, Venice, Culver City, Mar Vista, and Santa Monica in the north.

Lincoln Boulevard is classified in the City of Los Angeles General Plan as a Boulevard I (Major Highway Class I) and is comprised of three to four lanes in the northbound direction and two to three lanes in the southbound direction within the Project limits. Culver Boulevard is classified as an Avenue I (Major Highway Class II) and Avenue III (Modified Scenic) and is comprised of one lane in each direction in the vicinity of Lincoln Boulevard. Jefferson Boulevard is a Boulevard II (Major Highway Class I) and is comprised of two lanes in each direction, and Fiji Way is a Local street, comprised of one lane in each direction near the Project.

The Project's build alternative includes: realignment of the Lincoln Boulevard centerline approximately 50 feet to the east; addition of one southbound lane along Lincoln Boulevard for a length of approximately 1,800 feet; demolition, replacement, and widening of the Lincoln Boulevard Bridge over Ballona Creek; demolition, replacement, and widening of the Culver Boulevard Bridge over Lincoln Boulevard; demolition, replacement, and realignment of the connector ramps between Lincoln Boulevard and Culver Boulevard; construction of active transportation improvements including sidewalks and Class IV protected bicycle lanes on both sides of Lincoln Boulevard. The Project would also include utility relocation, landscaping, low-intensity street lighting, striping, signage, drainage, and water quality improvements. The Project would install a striped center median that would allow space to accommodate a future center-running transit facility within the Project limits, which is not included as part of the Project. Construction of the Project build alternative would result in three through lanes in the northbound and southbound directions of Lincoln Boulevard between Fiji Way and Jefferson Boulevard, with additional turning lanes at intersections.

2.0 PROJECT LOCATION

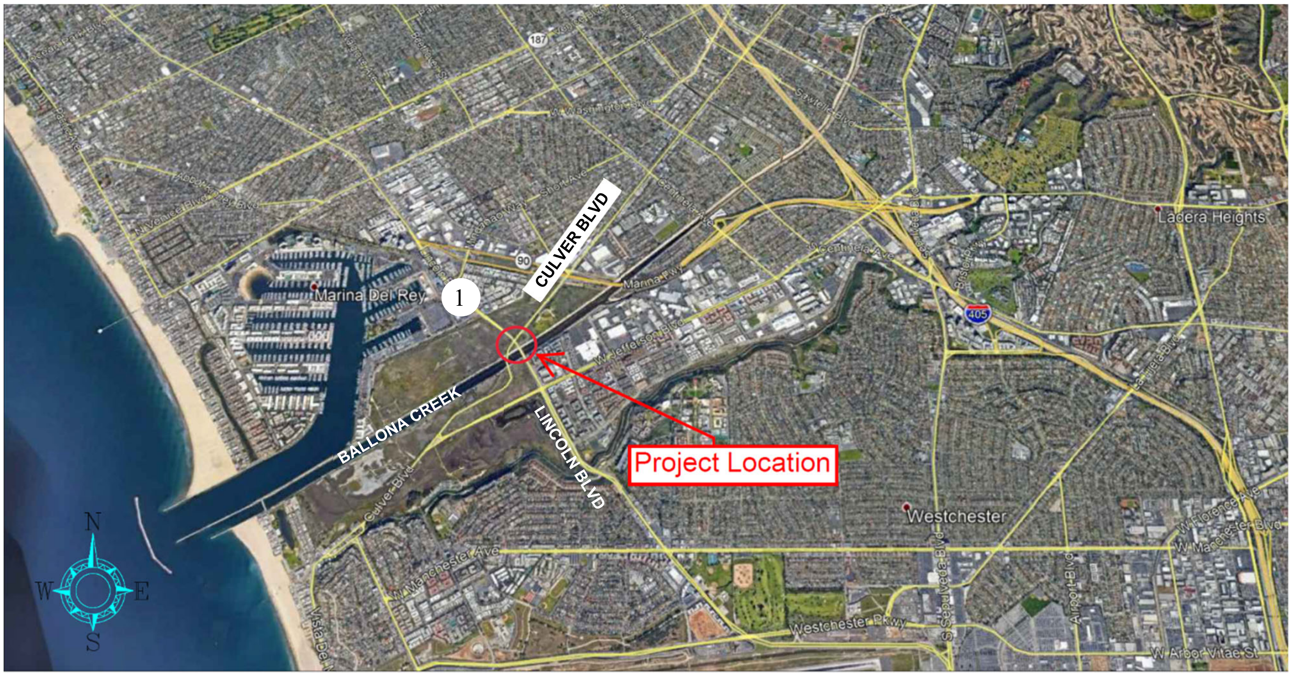


Figure 1: Project Regional Map

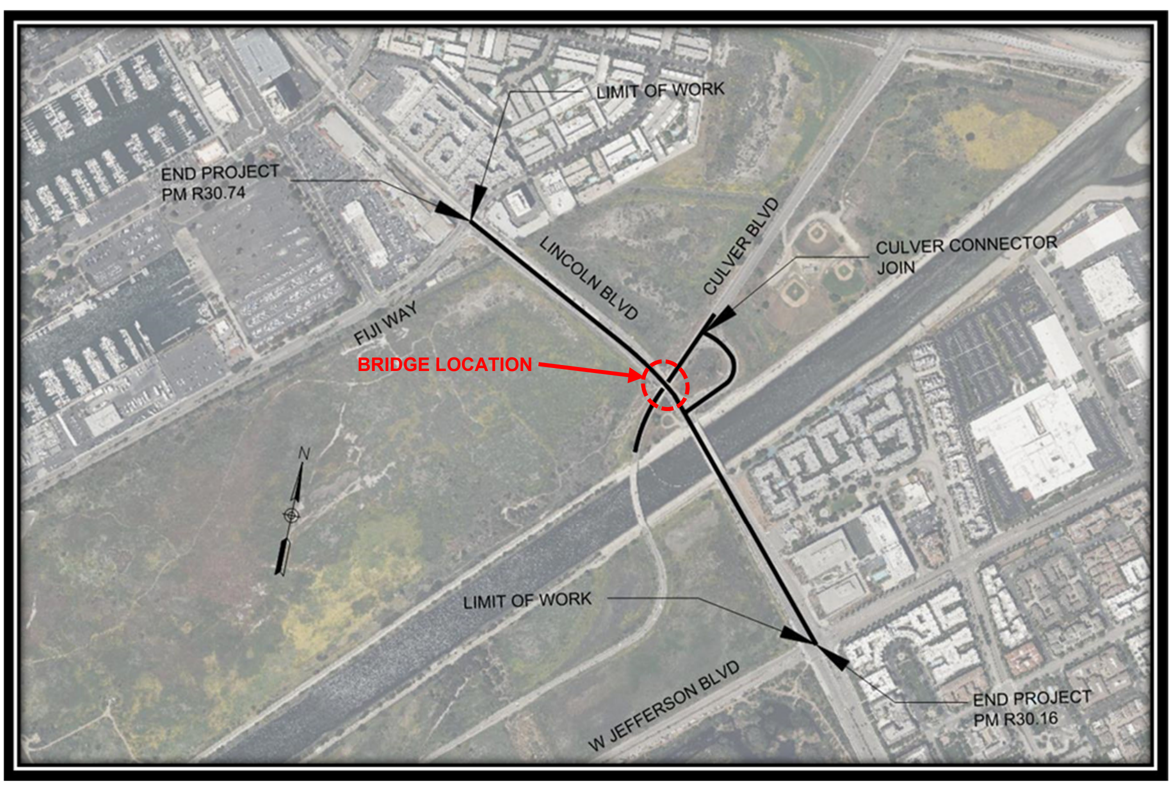


Figure 2: Project Vicinity Map

3.0 PURPOSE AND NEED

Purpose

The Project purpose is to create a new multi-modal corridor along SR-1/ Lincoln Boulevard between Fiji way and Jefferson Boulevard to serve transit, bicyclists and pedestrians while minimizing impacts to Ballona Wetlands Reserve and Ballona Creek and other environmental resources.

Need

Lincoln Boulevard serves as a critical north-south connection on the Westside. There are few arterial connections that provide continuous access through the Westside, which results in Lincoln Boulevard being oversaturated during peak commute periods. Lincoln Boulevard narrows from three to two lanes in the southbound direction, approximately 1,050 feet north of the existing Lincoln Bridge over Ballona Creek, and from four to three lanes in the northbound direction, approximately 320 feet north of the intersection with Jefferson Blvd, to the intersection with Fiji Way. These lane reductions create a major bottleneck.

The average vehicle travel speeds along Lincoln Boulevard are 15 mph during peak periods when measured between Ozone Ave in the City of Santa Monica and Sepulveda Boulevard while the design speed is 50 mph. Travel times are greatly impacted by bottlenecks resulting in slower speeds along much of the corridor.

In addition, access for pedestrians along Lincoln Boulevard is disjointed north and south of the Ballona Creek bridge which does not have sidewalks. Lincoln Boulevard also lacks bicycle facilities across the bridge. Pedestrian and bicycle facilities are also deficient along Culver Boulevard.

4.0 EXISTING STRUCTURES

The existing 3-span Culver Boulevard Overcrossing Bridge was constructed in 1937 (Bridge No. 53-0089). The bridge spans approximately 147'-1" along centerline of Culver Boulevard over Lincoln Boulevard and is 50 feet wide. It was constructed to accommodate a 40-foot curb-to-curb roadway, which is currently striped with one traffic lane in each direction, and two shoulders. There is a 4-foot-wide sidewalk along with a 1-foot-wide concrete open railing on each side of the structure. The existing superstructure consists of two spans (Spans 1 and 3) of Reinforced Concrete "T-Beam" girders and one span (Span 2) of riveted steel plate girders supporting a cast-in-place concrete deck. Expansion joints are provided at Bent 2 and Bent 3. The structure is skewed at approximately 17 degrees with the centerline of Lincoln Blvd. The bridge superstructure is supported on reinforced concrete bents and strutted abutments founded on vertical driven treated timber piles. Abutment and bent foundation are laterally braced by reinforced concrete struts. There is an abandoned railroad bridge on the northeast side of the bridge. The existing superstructure of the abandoned bridge has been removed while the existing abutments and piers remain in place. The remaining abutments and piers will be removed to 3 feet below the finished grade of the proposed bridge abutment embankment slopes.

5.0 PROPOSED STRUCTURE

5.1 General Description

The proposed improvements to the Lincoln Boulevard entail to construct a wider multi-modal corridor to meet the ultimate roadway needs for the project. The proposed project will require replacing and lengthening the existing bridge with a new overcrossing to accommodate the widened Lincoln Boulevard.

The proposed bridge will be a single-span wide flange concrete girder bridge, 150’-0” long and 54’-4” wide. The proposed bridge is approximately 4” wider than the existing structure to accommodate the existing 40-foot-wide roadway and a modified Type 732SW concrete barrier, which includes a 6’-2” wide standard sidewalk and a 1’-0” thick concrete parapet wall with Type 7 chain link railing, on each side of the structure. The concrete parapet walls will receive aesthetic treatments while the aesthetics of the bridge will be addressed through future design efforts. Since the posted speed will be only 35 MPH on Culver Boulevard, a traffic barrier separating the sidewalk and the shoulder is not required.

The Lincoln Boulevard will receive transit facilities along the center median in the future, which disallows placing a supporting bent at the centerline of the Lincoln Boulevard, hence a single-span bridge is considered. A single-span bridge will reduce the roadway improvement limits and construction cost while maintaining a proper horizontal clearance of the proposed Lincoln Boulevard. The span length is minimized to reduce the structure depth to reduce the raise of the profile grade.

5.2 Design Alternatives Evaluated

5.2a California Wide Flange Precast Prestressed (PC/PS) Concrete Girder (Option 1)

The new bridge will have California Wide Flange PC/PS Girder superstructure with a depth of 7’-0”, which satisfies the 4.5% minimum depth-to-span ratio for the single span bridge. The shallow depth-to-span ratio will minimize the raise of the profile grade, thereby reducing the impacts to the adjacent wetlands and Lincoln Boulevard ramp terminal. The span length falls under the preferred length of 80 feet to 180 feet for California Wide Flange PC/PS Concrete Girder as described in Caltrans Bridge Design Aids Section 6-1. The noted superstructure depth includes 6’-0” depth California standard wide flange girder, a nominal haunch depth of 4” and a cast-in-place 8” thick concrete deck slab.

The use of PC/PS concrete girder will eliminate the need of extensive falsework. In addition, the duration of construction will be shortened as compared to a cast-in-place option. Falsework requiring adjustment of the profile grade to maintain a minimum vertical clearance of 15 feet on the traffic opening.

5.2b Cast-In-Place Prestressed (CIP/PS) Concrete Box Girder (Option 2)

A conventional CIP/PS concrete box girder superstructure is also a feasible structure alternative for the proposed bridge replacement. This alternative will have the same span configuration and structure depth as the PC/PS option, which also satisfies the standard depth-to-span ratio of 4.5% for the single span bridge.

For this alternative, falsework during construction will be required over the Lincoln Boulevard. This will require raising the profile and increasing the duration of construction as compared to the PC/PS option. Raising the profile will increase the construction limit and cost of the project.

5.2c Abutments

Closed-end high cantilever seat-type abutments founded on 36-inch diameter Cast-In-Drilled-Hole (CIDH) concrete piles are proposed to support the superstructure and to reduce the bridge length. The approach embankments will be retained by cost-effective Mechanically Stabilized Earth (MSE) retaining walls. Driven concrete piles were considered; however, as the battered piles are prohibited to be used at abutments subject to seismic downdrag loads as described in Caltrans Memo-To-Designers Section 5-1, the small diameter driven piles as opposed to large diameter CIDH piles, may not be capable of providing adequate lateral support. Abutments will be skewed to match the proposed Lincoln Boulevard.

5.3 Recommended Alternative

Since the traffic on the Culver Boulevard that serves as an Avenue I (Major Highway Class II) and Avenue III (Modified Scenic) will be fully closed during construction, the construction duration is an important key factor to select the structure type. A precast concrete bridge can be built fast and reduced the rase of the profile. In addition, the costs for the considered alternatives are competitive with the cost variation in marginal 10% range. Therefore, the California Wide Flange PC/PS Concrete Girder superstructure is recommended for this bridge. The General Plan of the recommended alternative is provided in **Appendix C.**

5.3a Superstructure

California Wide Flange PC/PS Concrete Girder superstructure type is recommended for the bridge.

5.3b Substructure

Closed-end high cantilever seat-type abutments are recommended for the bridge.

5.3c Approach Slab

Since the proposed bridge is on a two-lane road in an urban area (a multilane urbanized highway facility) with seat-type abutments, Structure Approach Slab Type N (30S) is proposed. The proposed approach slab type is based on the selection process for Structure Approach Pavement System as described in Caltrans MTD 5-3.

6.0 SITE CONSTRAINTS

The proposed bridge will require removal of the existing Culver Boulevard Overcrossing and the abandoned bridge abutments. The adjustment of the bridge profile will be limited by roadway constrains such that there will be minimal roadway modification on the approaches by reducing the raise of the profile grade while the required vertical clearance over the Lincoln Boulevard traveled way is satisfied. In addition, the proposed abutments need to be set to meet sight distance requirements on horizontal curve alignment.

An underground 230KV power line adjacent to Culver Boulevard that will require protection in place. Per the existing condition, the sidewalk was constructed on each side of the bridge deck while it was not constructed on the roadway approaches. The current GAD plans show the sidewalk will be constructed on the approach roadway.

7.0 STRUCTURE DESIGN CRITERIA

7.1 Load and Resistance Factor Design

The structure will be designed in accordance with the AASHTO LRFD Bridge Design Specification, 8th edition with latest California Amendments. Design live loads will consist of HL-93 load and California permit load. Load combinations per AASHTO LRFD Code Section 3.4.1 will be applied.

7.2 Seismic Design

Design of the new bridge will comply with Caltrans Seismic Design Criteria (SDC) version 2.0 in its entirety.

8.0 FOUNDATIONS

A Structure Preliminary Geotechnical Report (SPGR) is provided in **Appendix F**. A short summary of the report is provided below.

8.1 Description of Subsurface Soil Conditions

The site is located within the Los Angeles basin section of the Peninsular Ranges geomorphic province of southern California. The Los Angeles basin is generally underlain by Quaternary alluvial deposits, which overlie several thousand feet of Tertiary marine and non-marine sediments. The previous investigations indicate that the site is underlain by Quaternary Alluvial Floodplain Deposits (Map Symbol – Qa), which are covered with both hydraulic fill and conventional fill.

Quaternary-age alluvial sediments primarily associated with the Ballona Creek drainage are believed to underlie the entire site to the maximum depth explored. The upper portion of these alluvial deposits (from a few feet above mean sea level down to about 35 or 40 feet below mean sea level) is typically poorly consolidated, and most commonly consists of interbedded lean and fat clay (CL or CH) and silt (ML and MH), with occasional bed of silty and clayey sand (SM and SC). At elevations below approximately 35 or 45 feet below mean sea level (MSL), the density of the alluvium typically increases, and the beds of silty, clayey and poorly graded sand (SM, SC or SP) become more common.

The existing bridge abutments are believed to be underlain by compacted fill, as well as hydraulic fill soils placed during the development of Marina Del Rey. The hydraulic fills are similar in composition to the underlying alluvium, as they were likely generated from these deposits. Consequently, the hydraulic fill is not differentiated from the alluvium on the logs. Hydraulic fill was likely placed to roughly 0 feet to 5 feet (MSL), with conventional fill placed above that elevation.

8.2 Groundwater

Temporary groundwater monitoring wells were established within four of the hollow stem borings conducted at the Playa Vista development immediately southeast of the Lincoln Boulevard bridge (Group Delta, 1999), while they were destroyed during the construction of the Playa Vista residential development. Based on the final readings within these monitoring wells, the groundwater elevations at that location varied from roughly 2 feet to 5 feet (MSL) in December 1998. Additionally, the High Groundwater Map suggests that groundwater levels may rise to about 5 feet below existing grades in the site vicinity (CDMG, 1998).

It should be noted that groundwater levels at the site are likely to be closely related to the water surface elevation within Ballona Creek. Floods within the channel may cause the groundwater levels to temporarily rise within the surrounding levees (although the concrete armor on the channel walls may increase the lag time in groundwater response). Groundwater levels may also fluctuate over time throughout the site due to changes in the water surface elevation and flow within the creek, as well as variations in rainfall, irrigation, or site drainage conditions.

8.3 Corrosion Evaluation

Corrosion tests were performed on selected samples collected from the previous exploratory borings at the site. The available test data indicates that the site soils are not corrosive based on Caltrans Corrosion Guidelines (Caltrans, 2021b). However, the available resistivity tests do suggest that the on-site soils may be extremely corrosive to buried metals, based on the nomography provided in Figure 855.3B of 2020 Caltrans Highway Design Manual (Caltrans, 2020a). Typical corrosion control measures should be incorporated into the project design.

8.4 Preliminary Seismic Information and Recommendations

The site is not located within an Alquist-Priolo Earthquake Fault Zone (CDMG, 1992), and no evidence of active or potentially active faulting was encountered during our previous site investigation or literature review. Consequently, ground rupture is not considered a significant geologic hazard at the site.

The current Caltrans ARS Online tool (V3.0.2) was used to develop a preliminary design spectrum for the site located at a latitude of 33.9760° north, and a longitude of 118.4330° west. The ARS design spectrum incorporated an average shear wave velocity (V_{s30}) of 210 m/s (or 690 ft/s). The preliminary Caltrans ARS design spectrum for the site has a Peak Ground Acceleration (PGA) of 0.6g. The deaggregated mean earthquake moment magnitude (M) is 6.6 and the mean site-to-source distance (R) for the 1.0 seconds spectral acceleration is 16.6 kilometers. Note that loose soil at the site ($N_{60}<10$) would classify as Class S2 soil per Section 6.1.3 of the Caltrans Seismic Design Criteria, Version 2.0.

8.5 Liquefaction and Lateral Spreading

The site is located within an area previously identified as susceptible to liquefaction. Based on the preliminary liquefaction settlement analyses, the bottom of the liquefiable layers may extend to elevations -25 feet to -30 feet. Additionally, the total liquefaction settlement associated with the design level earthquake at the site should typically vary from about 1 inch to 3 inches. Liquefaction settlement may result in a downdrag load on the piles, settlement of the approach embankments, and lateral spreading of the abutments. Liquefaction also creates the potential for loss of near-surface soil strength resulting in a reduced lateral pile capacity. In liquefied soils, a pile foundation needs to be designed to satisfy the seismic axial bearing stability requirements in compression extreme events for two different combinations – a) permanent loads and inertial loads resulting from the ground motion-induced inertia of the superstructure during the shaking, and b) permanent loads and liquefaction induced downdrag after the cessation of the shaking (Caltrans, 2020b).

Based on simplified empirical methods, there appears to be a strong potential for lateral spread of the Ballona Creek levees in the site vicinity. Previous analyses suggest that displacements along the levees may vary from roughly 6 inches to 18 inches (Group Delta, 2013). The bridge abutments are located near the creek levees, the lateral spreading will impact to the abutment during the designate earthquake. The precise location, depth, and density of the liquefiable layers at the abutment locations will greatly impact the seismic response and should be better defined through future subsurface investigation.

The presence of the abutment piles helps reduce the displacement at the abutment locations compared to the surrounding levees. Lateral spread analyses including soil-pile interaction may be conducted per Caltrans Geotechnical Manual (Caltrans, 2020c), Memo to Designers 20-15 (Caltrans, 2017b), and Attachment 1 to the memo for lateral spreading analysis.

8.6 Preliminary Foundation Recommendations

To resist lateral spreading seismic displacements, large diameter (36-inch or greater) CIDH, or CISS pile foundation systems are recommended for supporting the bridge structure both at bents and abutments. Although large diameter CIDH piles are feasible, special construction techniques (slurry, casing, etc.) and integrity testing (gamma-gamma logging) will be required due to shallow groundwater and caving-prone soils. Since CISS piles are driven, noise issues should be considered in the pile type section process due to the proximity to the residential development.

With proposed pile cut-offs at or around the elevation of 0 to 5 feet, downdrag loads may be experienced along up to 30 to 35 feet of the pile length, negating any pile resistance down to about El. -40 feet within the denser alluvial deposits. For estimation of pile lengths, an average nominal (ultimate) soil skin friction resistance of 1.5 ksf, and 2 ksf is assumed below El. -40 feet for CIDH piles and CISS piles, respectively. This will likely result in pile lengths of about 70 feet to 85 feet, tipping at elevations between -65 feet to -80 feet.

Smaller diameter driven piles are not recommended due to unfavorable subsurface soil conditions as the site is classified as S2 per the SDC V2.0., Section 6.1, and Section 6.2.3. Shallow foundations are not feasible for supporting the bridge structure due to seismic settlement and lateral spreading issues.

9.0 GEOMETRIC APPROVAL DRAWING (GAD)

The GAD plans for the bridge are provided in **Appendix D**.

10.0 CONSTRUCTION

10.1 Falsework

No falsework is required for the construction of the precast girder bridges.

10.2 Stage Construction

The Culvert Boulevard and the adjacent connector ramps between Lincoln Boulevard and Culver Boulevard will be closed to traffic and pedestrians during construction. The proposed bridge will be constructed in a single phase without staging after removal of the existing structures.

10.3 Traffic Detours

Long-term traffic detours through Lincoln Boulevard and Jefferson Boulevard are anticipated for construction of the bridge.

11.0 UTILITIES

Based on the field review and as-built plans, the following utilities in the project area were identified:

- Six electrical conduits are attached to the exterior girder bay on the south side of the existing Culver Boulevard bridge.
- An underground 230KV power line is located adjacent to Culver Boulevard along the west side of Lincoln Boulevard across the bridge.
- Two overhead electrical lines are present within exiting bridge region. The overhead lines cross over the bridge diagonally from the southeast corner of bridge to the northwest corner of the existing bridge. Two wooden poles located at each approach of existing bridge and one wooden pole located on the west side of bridge near the north existing bridge bent are present to support these two power lines.
- Two wooden poles with guywires are located on both sides of the street at the bridge north approach.
- A wooden pole is present on the west side of the existing bridge near the south existing bridge bent.

The utility relocation and its interaction with the bridge construction is complex and will require close coordination with Los Angeles Department of Water and Power (LADWP) during the future design phases of the Project.

12.0 BRIDGE AESTHETICS

The aesthetics of the bridge will be addressed through future design efforts. Aesthetics are typically explored as part of the detailed design preparation and are often based on inputs from the community. Aesthetic considerations will include preserving the view sheds from the bridge and incorporating artistic design featured into the bridge design.

13.0 SLOPE PROTECTION

Slope paving at the abutments is not required.

14.0 ENVIRONMENTAL CONSTRAINTS

Based on the preliminary delineation provided by the California Coastal Commission, potential wetland area exists at the vicinity of the existing loop ramp connecting Culver Boulevard and Lincoln Boulevard. As the project is located in this highly sensitive coastal environment, the project will face scrutiny from regulatory and resources agencies, as well as legacy stakeholders.

The proposed bridge with shallow structure depth is considered to minimize the need to raise the profile of Culver Boulevard, thereby reducing potential impacts to the adjacent wetland. Additionally, a MSE retaining on the east side of Culver Boulevard near the loop ramp is proposed to avoid impacts to the adjacent wetlands reserve.

15.0 PERMITS AND AGREEMENTS

Various agencies with jurisdiction at or near the Lincoln Bridge will require agreements, construction and/or encroachment permits in order to construct the project. The permit agencies will be identified in the environmental documentation which is currently in progress.

16.0 RIGHT OF WAY

Right of way acquisition and dedication are required for the proposed roadway improvement and bridge replacement.

17.0 CONSTRUCTION COSTS

The estimated costs with an APS-level contingency of 25% for the Culver Boulevard Overcrossing Bridge replacement is $11,086,000. Detailed cost estimates are provided in **Appendix B**.

18.0 BRIDGE SUMMARY

Table 1: Culver Boulevard Overcrossing Summary

Structure Name	Culver Boulevard Overcrossing
Structure Type	California Wide Flange Precast Prestressed Concrete Girder
Spans	1
Structure Depth	7'-0"
Abutments	High Cantilever Seat-Type
Vertical Clearance	15’-0” minimum
Temporary Minimum Vertical Clearances	N/A
Barriers	Type 732SW
Slope Paving	No
Structure Approach	Type N (30S)
Utilities in Bridge	Electrical conduits
Temperature Range	10^0 to 80^0
Freeze-Thaw area	No

APPENDIX A

APS CHECKLIST

Consultant Prepared Advance Planning Study (APS) Checklist

Date: 12/15/2022	Consultant Firm (for structures): CNS ENGINEERS, INC.		Phone No: (951) 687-1005
Designed by: Quyet Nguyen			Phone No: (951) 687-1005
EA: 33880	County: LA	Rte: 01 (LINCOLN BLVD)	KP(PM) 30.16 to 30.74
Project Description: SR-01 - Lincoln Blvd Multimodal Bridge Project			
Bridge No(s): 53-0089	Bridge Name(s): Culver Blvd Overcrossing (Replace)		
Total number of bridges in project: 02		APS Alternative Letter or Number (if more than one):	
Purpose of this APS:	Initial APS Cost & Feasibility ☒	Revised scope ☐	Update cost ☐

Part A Items to collect and considerations prior to beginning the APS

All items listed in Part A are to be made available and submitted if requested by the Liaison Engineer. (Mark **N/A** if not applicable)

- ☒ Preliminary profile grade of proposed structure.
- ☒ Typical section of the proposed structure. (Including barrier type, sidewalks, cross slope %, etc.)
- ☒ Grades or spot elevations of roadway below the structure.
- N/A ☐ Typical section of roadway below the structure. (Including shoulders, gutters, embankment slope.)
- ☒ Site map: including horizontal alignment of new structure and the roadway below, topo, contours, etc.
- ☒ Stage construction or detour plan for traffic on the structure. (number of lanes to remain open, Temp Railing, etc.)
- N/A ☐ Stage construction or detour plan for the roadway below the structure. (falsework openings for each stage and any restrictions.)
- ☒ "As Built" plans for existing structures.
- N/A ☐ Future widening plans of upper and lower roadway (verify with Route Concept Report).
- ☒ Site aerial photograph (at the proposed structure).
- ☒ Environmental and/or permit requirements (areas of potential impact, construction windows, etc.)
- ☒ Overhead and underground utility plans
- ☒ Any other information that you feel is necessary to complete the study. (Other concerns that may affect the APS: local agency requirements such as aesthetics, improvements in vicinity of structure, airspace usage, other obstructions, etc.)

Consultant Prepared Advance Planning Study (APS) Checklist

Part B Considerations during the APS design and cost estimate preparation

1. Has this project been discussed with: the OSFP Liaison Engineer? (Local projects) ☒ No ☐
   the Caltrans District Project Manager? Yes ☒ No ☐
   the roadway consultant? Yes ☒ No ☐

2. Have the Caltrans Structures Maintenance records been reviewed? Yes ☒ No ☐
   If the records recommend any work for the structure, is it included in the APS? N/A Yes ☐ No ☒

3. Are there special aesthetic considerations? Budget Included, Details not yet known Yes ☒ No ☐

4. (Widenings and Modifications)
   Has this project been reviewed for seismic retrofit requirements? N.A. New Structures Yes ☐ No ☒
   Are seismic retrofit requirements included in the APS? Yes ☐ No ☒

5. Any special Railroad requirements? Yes ☐ No ☒
   Shoofly required? Yes ☐ No ☒
   Cost of shoofly included as a separate item in the project cost estimate? Yes ☐ No ☒

6. Any special foundation requirements, including scour critical work, special excavation such as Type A, Type D, and/or hazardous or contaminated material? Yes ☒ No ☐

7. Any special construction requirements, including limited site accessibility or seasonal work? Yes ☒ No ☐

8. Other items to be included in the cost such as slope paving, approach slabs, and/or adjacent retaining walls? Yes ☒ No ☐

9. Remove existing bridge? Yes ☒ No ☐
   Total Deck Area: 7,354 SF

10. Any other unusual or special requirements? Yes ☐ No ☒

11. Provide and attach a consultant prepared Design Memo to summarize and document any important assumptions, discussions, decisions, unusual items, local agency requirements such as aesthetics, improvements in vicinity of the structure, airspace usage, other obstructions, or any items noted above. Summary attached? Yes ☒ No ☐

Designer: (Printed Name)	Designer's Signature:	Date:
QUYET NGUYEN	[signature]	12/15/22

APPENDIX B
APS ESTIMATE

☐ GENERAL PLAN ESTIMATE ☒ ADVANCE PLANNING ESTIMATE

RCVD BY:

IN EST:
OUT EST:

BRIDGE: CULVER BLVD BRIDGE **BR. No.: 53-0XXX** **DISTRICT:** 07
TYPE: PC/PS WIDE FLANGE GIRDERS **RTE:**
CU: **CO:** LA
EA: 33880 **PM:**
LENGTH: 150.00 **WIDTH:** 54.33 **AREA (SF) =** 8,150

DESIGN SECTION: CNS Engineers, Inc. .
 # OF STRUCTURES IN PROJECT : 1 **EST. NO.**
PRICES BY : Q. Nguyen **COST INDEX:**
QUANTITIES BY: T. Ge **DATE:** 10/1/2021
QUANTITIES CHECKED BY: Q. Nguyen **DATE:** 10/1/2021

	CONTRACT ITEMS	TYPE	UNIT	QUANTITY	PRICE	AMOUNT
1	BRIDGE REMOVAL		LS	1.00	$121,000.00	$121,000
2	STRUCTURE EXCAVATION (BRIDGE)		CY	970	$150.00	$145,500
3	STRUCTURE BACKFILL (BRIDGE)		CY	1,520	$100.00	$152,000
4	36" CAST-IN-DRILLED-HOLE CONCRETE PILING		LF	6,720	$600.00	$4,032,000
5	STRUCTURAL CONCRETE, BRIDGE FOOTING		CY	350	$500.00	$175,000
6	STRUCTURAL CONCRETE, BRIDGE		CY	510	$1,200.00	$612,000
7	STRUCTURAL CONCRETE, BRIDGE (POLYMER FIBER)		CY	270	$1,250.00	$338,000
8	STRUCTURAL CONCRETE, APPROACH SLAB	TYPE N(30S)	CY	160	$1,000.00	$160,000
9	FURNISH PRECAST PRESTRESSED CONCRETE GIRDER (140'-150')	(140'-150')	EA	7	$80,000.00	$560,000
10	ERECT PRECAST PRESTRESSED CONCRETE GIRDER		EA	7	$11,000.00	$77,000
11	JOINT SEAL ASSEMBLY (MR 1")		LF	112	$50.00	$5,600
12	BAR REINFORCING STEEL (BRIDGE)		LB	903,000	$1.30	$1,174,000
13	CHAIN LINK RAILING	TYPE 7	LF	520	$130.00	$67,600
14	CONCRETE BARRIER (MODIFIED TYPE 732SW)	TYPE 732SW	LF	520	$400.00	$208,000
15	BRIDGE AESTHETIC TREATMENT		LS	1	$154,134.00	$154,134

SUBTOTAL	$7,981,834
MOBILIZATION (@ 10 %)	$886,870.44
SUBTOTAL BRIDGE ITEMS	$8,868,704
CONTINGENCIES @25%	$2,217,176
BRIDGE TOTAL COST	$11,085,881
COST PER SQ. FT.	$1,360.00
BRIDGE REMOVAL (CONTINGENCIES INCL.)	
WORK BY RAILROAD OR UTILITY FORCES	
BRIDGE SEISMIC RETROFIT CONTINGENCIES	
GRAND TOTAL	$11,085,881
FOR BUDGET PURPOSES - SAY	**$11,086,000**

ROUTING

1. DES SECTION
2. OFFICE OF BRIDGE DESIGN - NORTH
3. OFFICE OF BRIDGE DESIGN - CENTRAL
4. OFFICE OF BRIDGE DESIGN - SOUTH
5. OFFICE OF BRIDGE DESIGN - WEST
6. OFFICE OF BRIDGE DESIGN SOUTHERN CALIFORNIA

COMMENTS:

☐ GENERAL PLAN ESTIMATE　　　☒ ADVANCE PLANNING ESTIMATE

RCVD BY:

IN EST:

OUT EST:

BRIDGE: CULVER BLVD BRIDGE　**BR. No.: 53-0XXX**　**DISTRICT:** 07

TYPE: CIP/PS CONCRETE BOX GIRDER　**RTE:**

CU:　**CO:** LA

EA: 33880　**PM:**

LENGTH: 150.00　**WIDTH:** 54.33　**AREA (SF) =** 8,150

DESIGN SECTION: CNS Engineers, Inc. .

 # OF STRUCTURES IN PROJECT : 1　**EST. NO.**

PRICES BY : Q. Nguyen　**COST INDEX:**

QUANTITIES BY: T. Ge　**DATE:** 10/1/2021

QUANTITIES CHECKED BY: Q. Nguyen　**DATE:** 10/1/2021

	CONTRACT ITEMS	TYPE	UNIT	QUANTITY	PRICE	AMOUNT
1	BRIDGE REMOVAL		LS	1.00	$121,000.00	$121,000
2	STRUCTURE EXCAVATION (BRIDGE)		CY	970	$150.00	$145,500
3	STRUCTURE BACKFILL (BRIDGE)		CY	1,520	$100.00	$152,000
4	36" CAST-IN-DRILLED-HOLE CONCRETE PILING		LF	6,720	$600.00	$4,032,000
5	PRESTRESSING CAST-IN-PLACE CONCRETE		LS	1	$63,000.00	$63,000
6	STRUCTURAL CONCRETE, BRIDGE FOOTING		CY	350	$550.00	$192,500
7	STRUCTURAL CONCRETE, BRIDGE		CY	880	$1,200.00	$1,056,000
8	STRUCTURAL CONCRETE, BRIDGE (POLYMER FIBER)		CY	230	$1,250.00	$288,000
9	STRUCTURAL CONCRETE, APPROACH SLAB	TYPE N(30S)	CY	160	$1,000.00	$160,000
10	JOINT SEAL ASSEMBLY (MR 1")		LF	112	$50.00	$5,600
11	BAR REINFORCING STEEL (BRIDGE)		LB	1,006,950	$1.30	$1,309,000
12	CHAIN LINK RAILING	TYPE 7	LF	520	$130.00	$67,600
13	CONCRETE BARRIER (MODIFIED TYPE 732SW)	TYPE 732SW	LF	520	$400.00	$208,000
15	BRIDGE AESTHETIC TREATMENT		LS	1	$153,584.00	$153,584

SUBTOTAL	$7,953,784
MOBILIZATION (@ 10 %)	$883,753.78
SUBTOTAL BRIDGE ITEMS	$8,837,538
CONTINGENCIES @25%	$2,209,384
BRIDGE TOTAL COST	$11,046,922
COST PER SQ. FT.	$1,355.00
BRIDGE REMOVAL (CONTINGENCIES INCL.)	
WORK BY RAILROAD OR UTILITY FORCES	
BRIDGE SEISMIC RETROFIT CONTINGENCIES	
GRAND TOTAL	$11,046,922
FOR BUDGET PURPOSES - SAY	**$11,047,000**

ROUTING

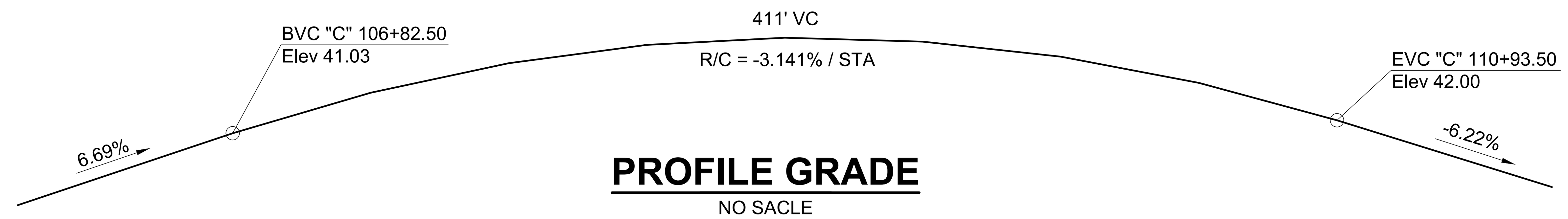
1. DES SECTION
2. OFFICE OF BRIDGE DESIGN - NORTH
3. OFFICE OF BRIDGE DESIGN - CENTRAL
4. OFFICE OF BRIDGE DESIGN - SOUTH
5. OFFICE OF BRIDGE DESIGN - WEST
6. OFFICE OF BRIDGE DESIGN SOUTHERN CALIFORNIA

COMMENTS:

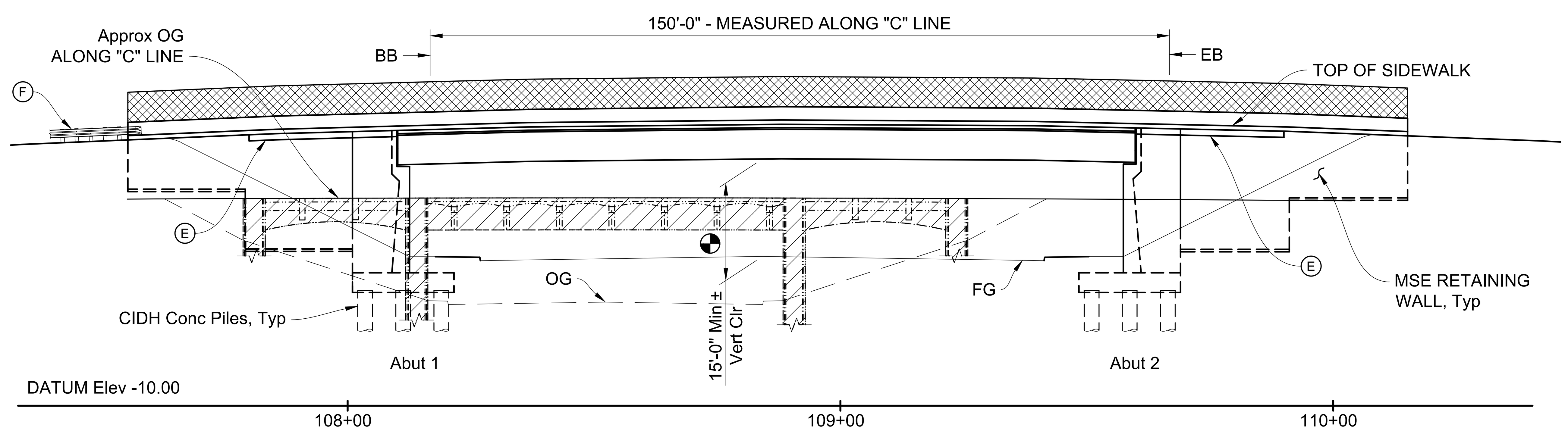
APPENDIX C
APS PLAN SHEETS

DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT
7	LA	1	30.16–30.74

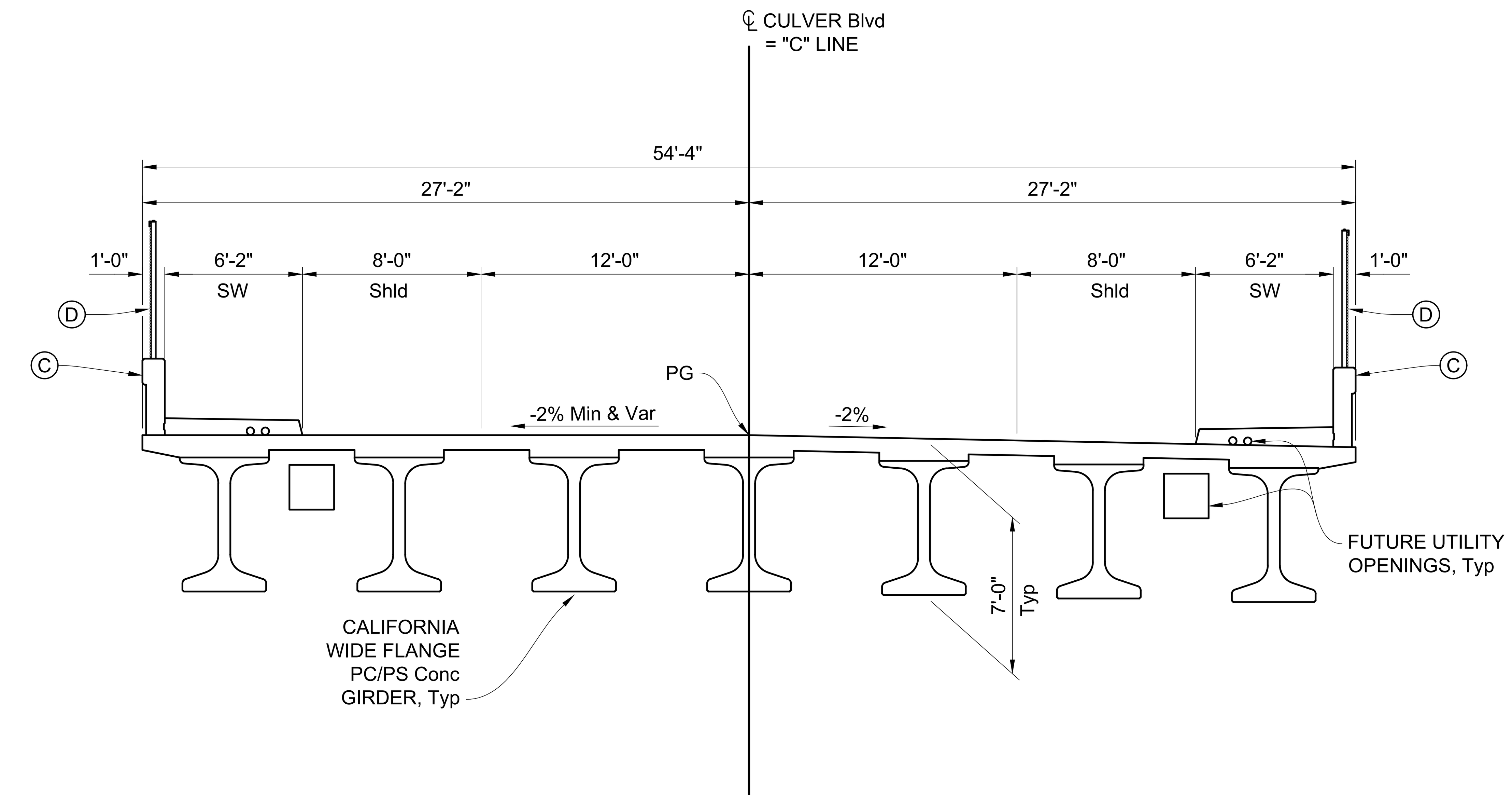
CNS ENGINEERS, INC.
11870 PIERCE ST, STE 265
RIVERSIDE, CA 92505



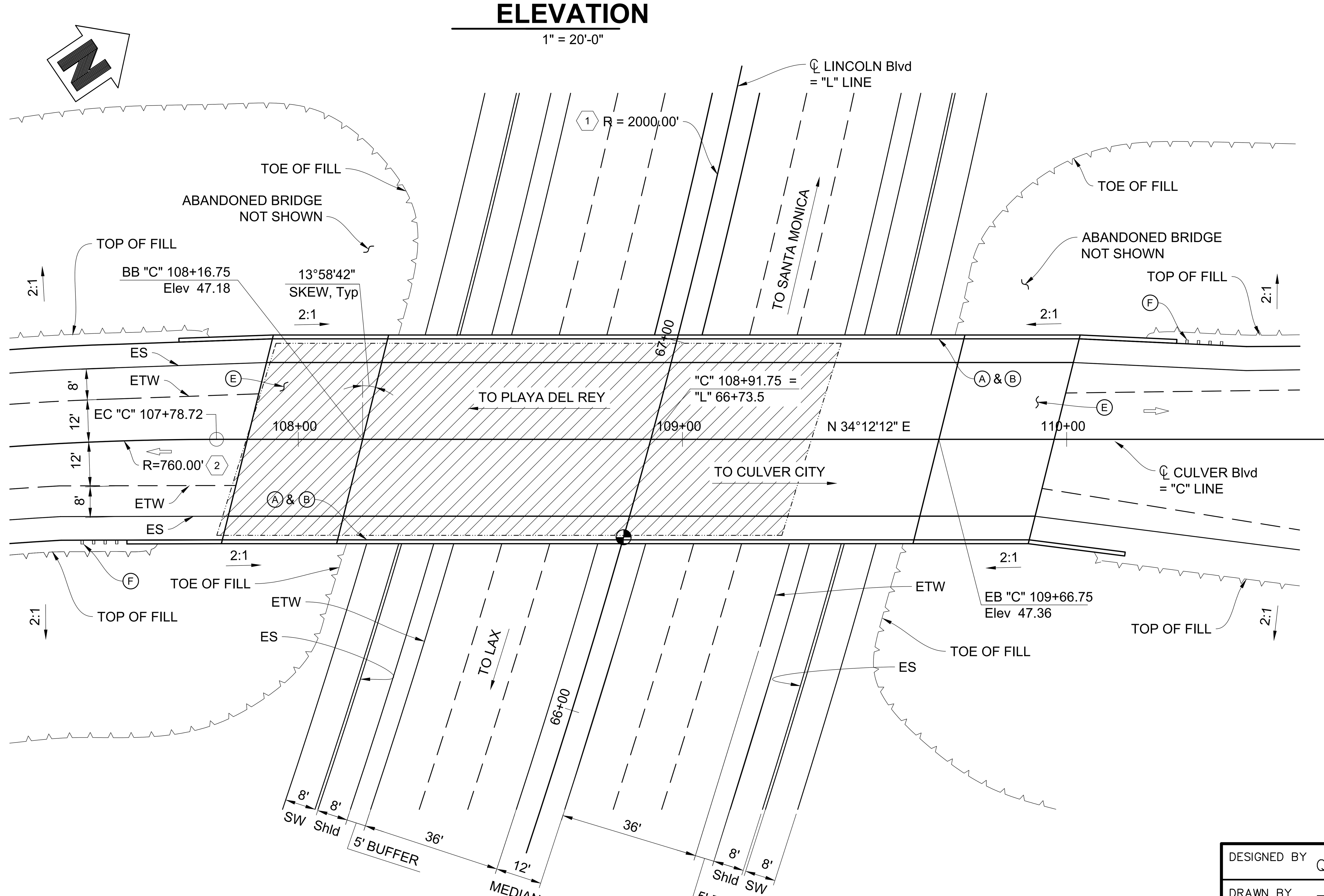
PROFILE GRADE
NO SACLE



ELEVATION
1" = 20'-0"



TYPICAL SECTION
1" = 5'-0"



PLAN
1" = 20'-0"

LEGEND:

- Exist Structure
- Traffic Direction
- Bridge (Br. No. 53-0089) Removal
- Point of Minimum Vertical Clearance

KEY NOTES:

- (A) Paint "Br. No. 53-0XXX"
- (B) Paint "CULVER BLVD OC"
- (C) Conc Barrier, Type 732SW (Mod)
- (D) Chain Link Railing, Type 7
- (E) Structure Approach, Type N (30S)
- (F) MGS, see "ROAD PLANS"

NOTE:

Date of Estimate		12/22/2022
Str Depth	=	7'-0"
Length	=	150'-0"
Width	=	54'-4"
Area	=	8,150 sqft
Avg Cost per Sq Ft Including 10% Mobilization & 25% Contingency	=	$1360.00
Total Cost	=	$11,086,000

CURVE DATA TABLE

CURVE No.	R	Δ	T	L
1	2000.00'	25°36'56.00"	886.72'	894.15'
2	760.00'	56°11'15.00"	715.79'	745.30'

DESIGNED BY	Q. Nguyen	DATE
DRAWN BY	T. Ge	DATE
CHECKED BY	J. Lu	DATE
APPROVED	J. Lu	DATE

Quyet Nguyen
PROJECT ENGINEER

PLANNING STUDY

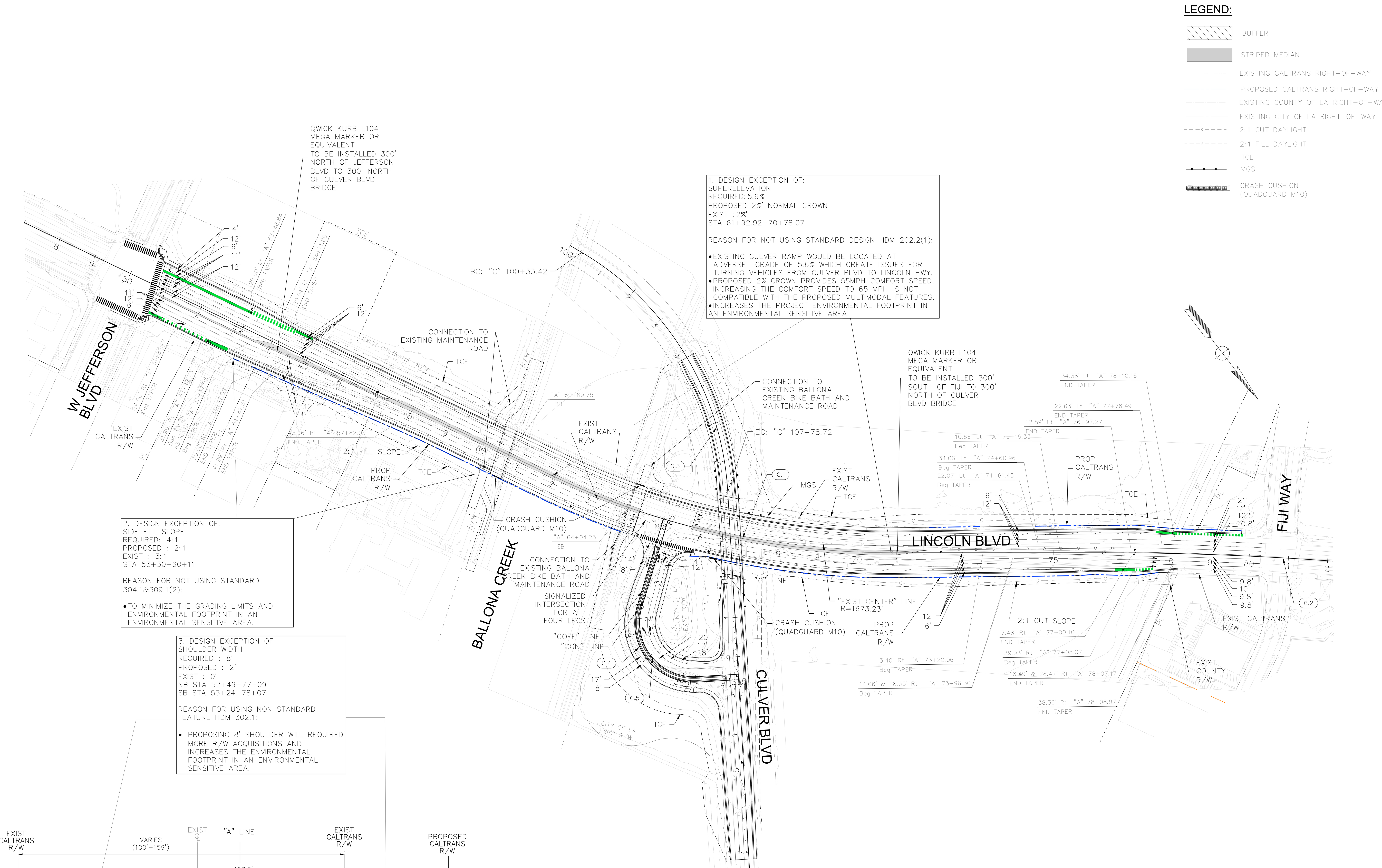
CULVER BLVD OVERCROSSING BRIDGE (REPLACE)

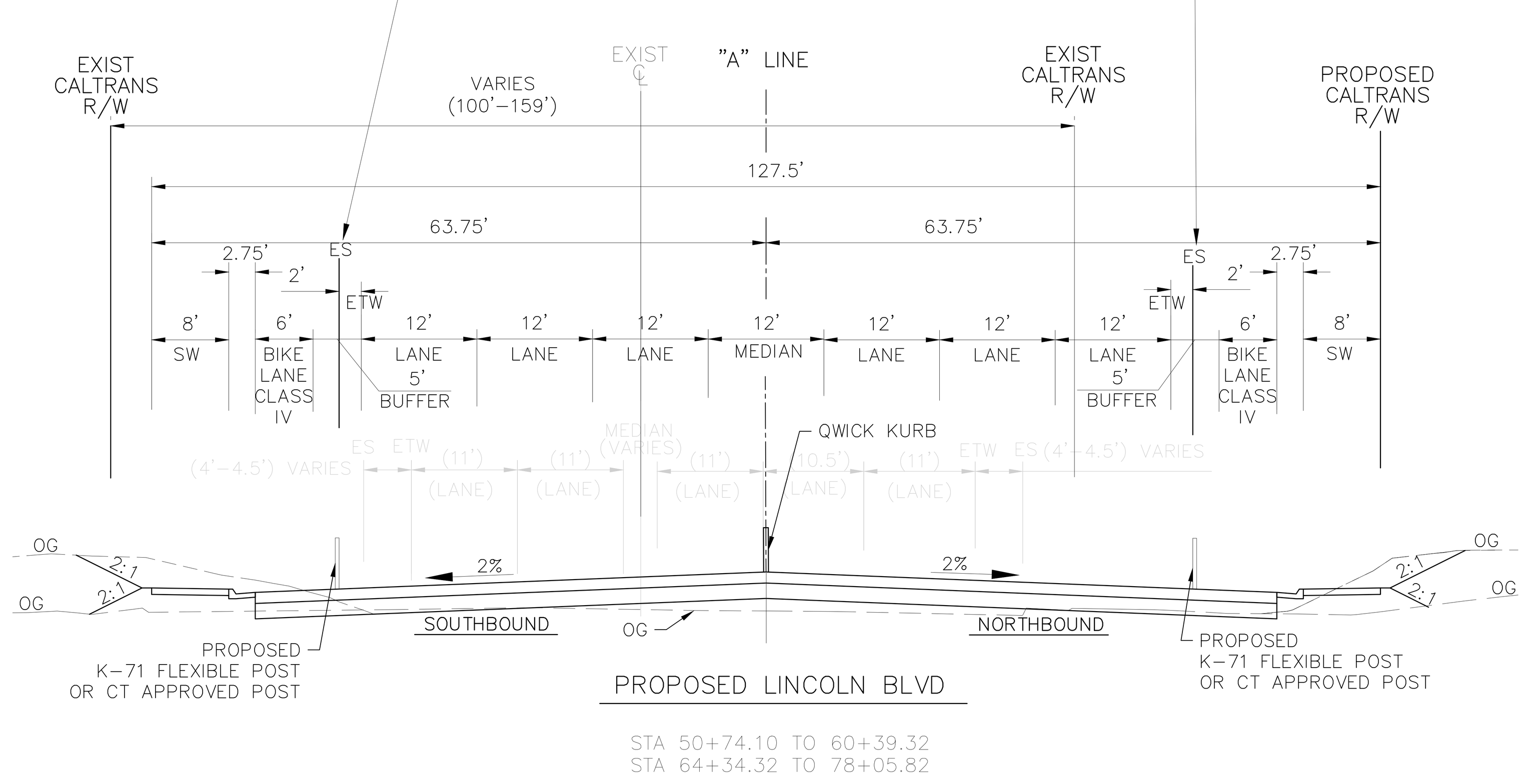
UNIT: X	BRIDGE No.: X
CONTRACT No.: X	PROJECT No. & PHASE: X

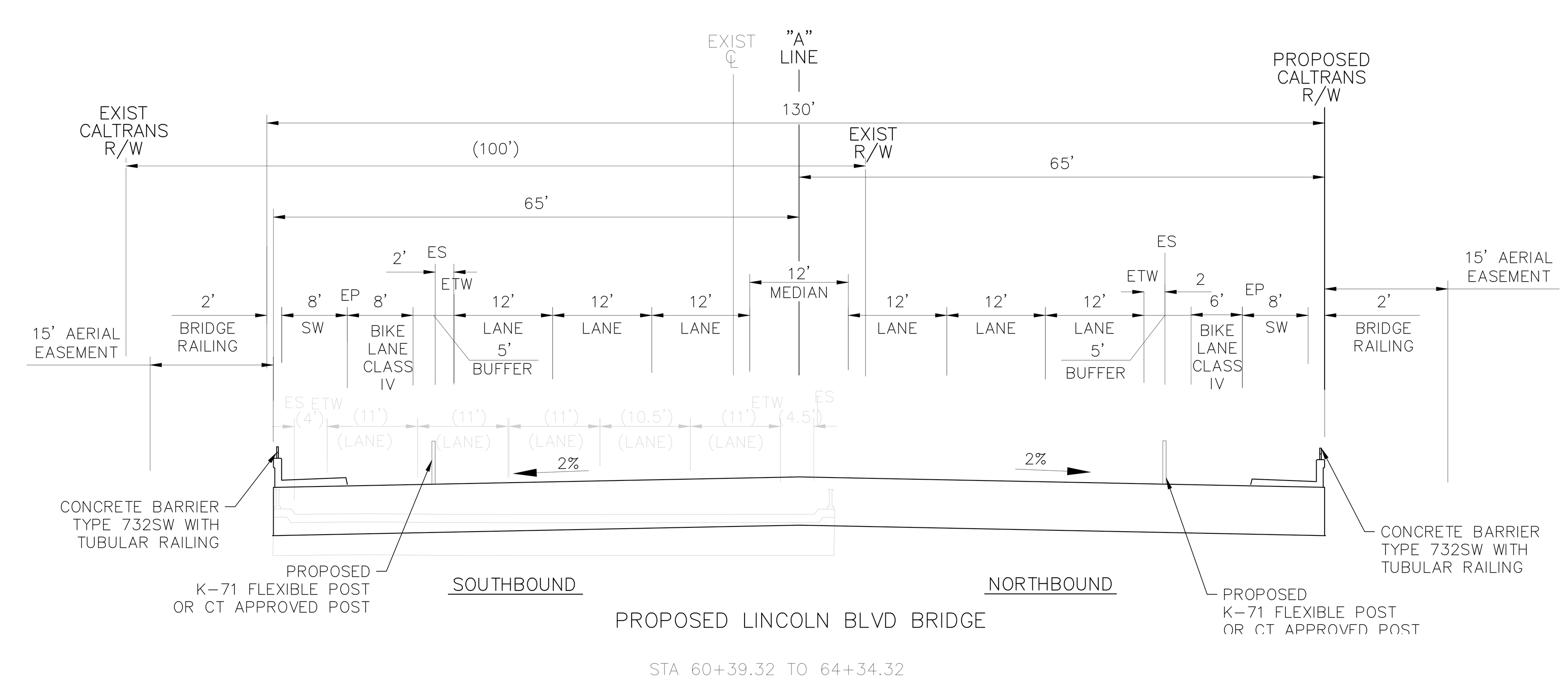
DESIGN OVERSIGHT

SIGN OFF DATE

APPENDIX D
GAD PLANS







	DESIGN SPEED	POST SPEED LIMIT
LINCOLN BLVD	50 MPH	45 MPH
CULVER BLVD ("C" STA 104+17–110+12)	40 MPH	35 MPH
CULVER BLVD ("C" STA 110+12+117+17)	50 MPH	45 MPH
ON&OFF-RAMP	25 MPH	

CURVE DATA

No.	R	Δ	T	L
C.1	2000'	25°36'56"	886.72'	894.15'
C.2	8000'	9°58'01"	1389.93'	1391.68'
C.3	760'	56°11'15"	715.79'	745.30'
C.4	151'	110°03'38"	247.48'	290.06'
C.5	138'	110°03'38"	226.24'	265.17'

GEOMETRIC REVIEW DOCUMENT
LINCOLN BLVD IMPROVEMENT
ALTERNATIVE 1

EA 07-33880
SCALE 1" = 100'

November 7, 2022

APPENDIX E
SELECTED STRUCTURE AS-BUILT PLANS

California Department of Transportation
Division of Maintenance

Structure Maintenance and Investigations

BRIDGE
INSPECTION
RECORDS
INFORMATION
SYSTEM

The requested documents have been generated by BIRIS.

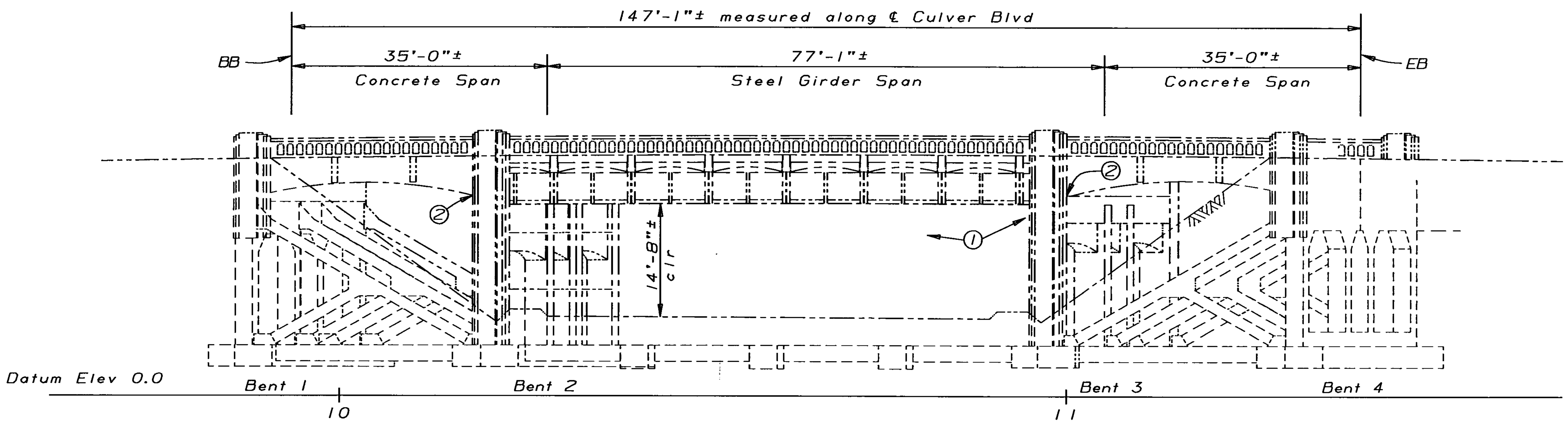
DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	LA	1, 90, 405	Var	166	167

REGISTERED ENGINEER - CIVIL

REGISTERED PROFESSIONAL ENGINEER M.Z. HALEEM No. 24743 Exp. 12-31-97 CIVIL STATE OF CALIFORNIA

9-19-94
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.



ELEVATION

1" = 10'

- CULVER BLVD. OVERCROSSING 53-89

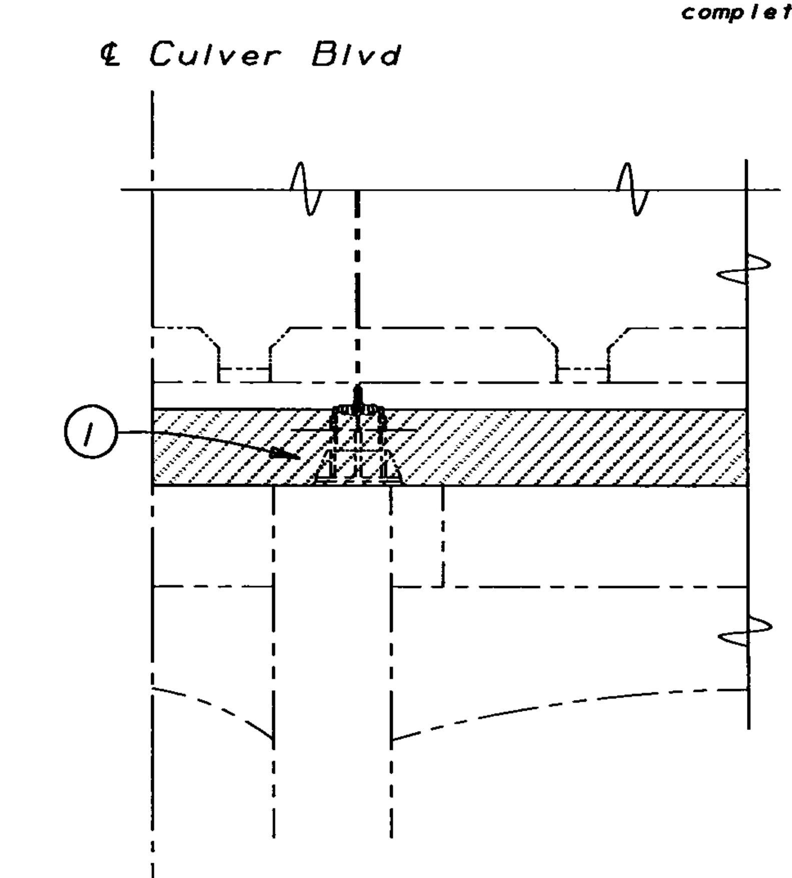
QUANTITIES

STRUCTURAL CONCRETE, BRIDGE	34	CY
DRILL AND BOND DOWEL	134	LF
CORE CONCRETE (1")	265	LF
REPLACE BEARINGS LOCATION A	8	EA
BAR REINFORCING STEEL (BRIDGE)	7,700	LB

(1) Under steel girders only. Replace bearing & sole plate with concrete seat extension & bearing pad.

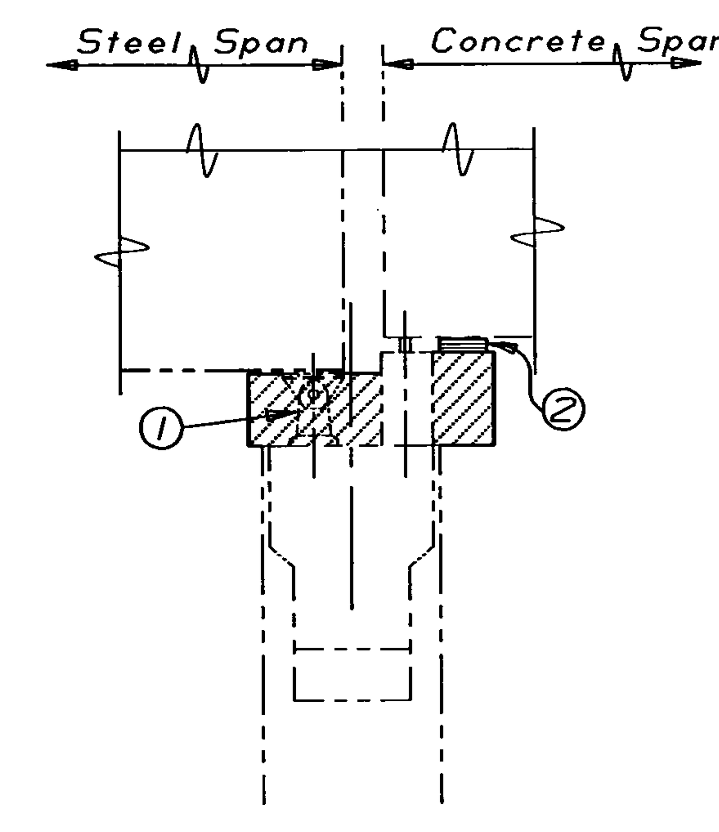
(2) Under concrete girders. Install new Elastomeric Brg Pads on concrete seat extensions.

▨ Indicates concrete seat extension



SECTION A-A

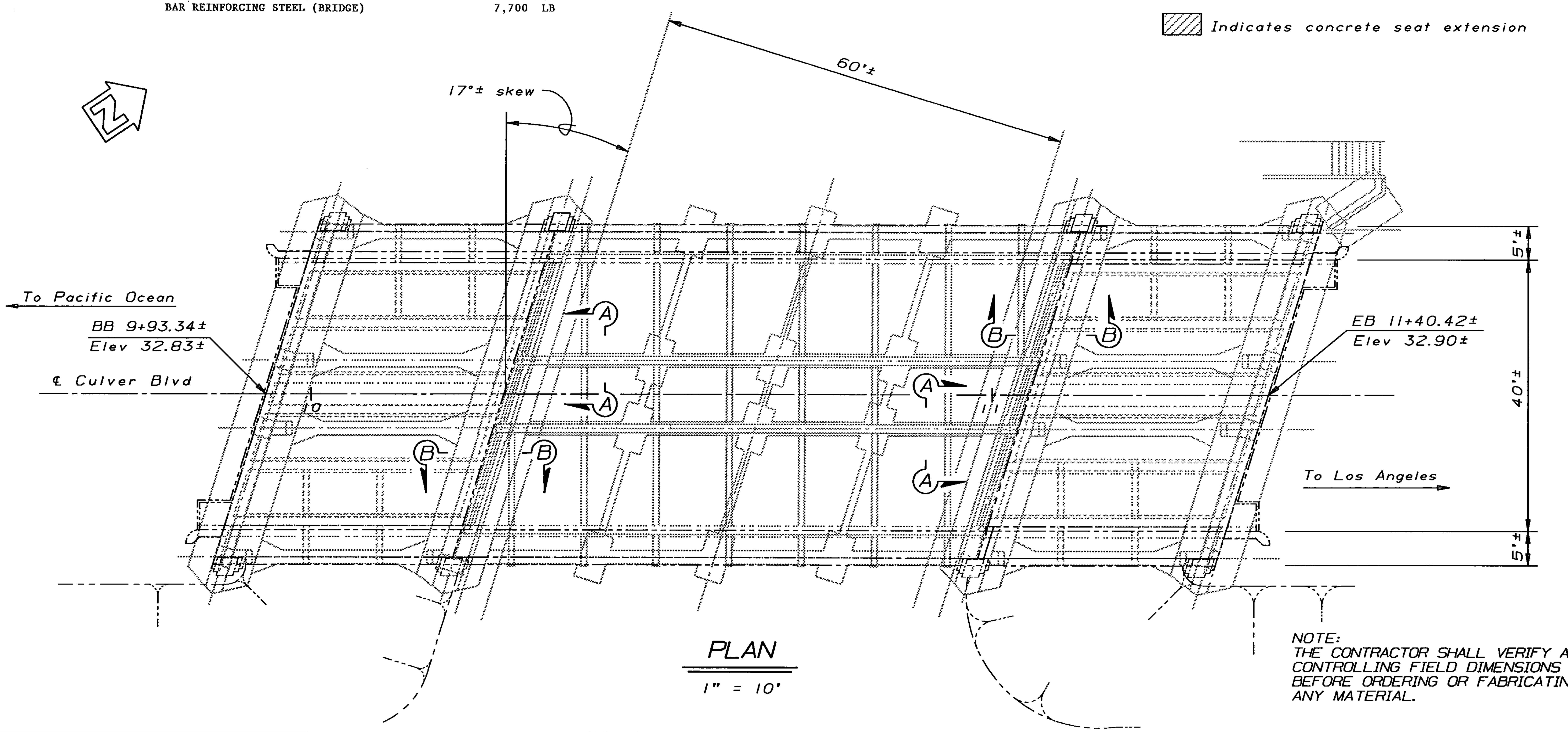
1/4" = 1'-0"



SECTION B-B

1/4" = 1'-0"

INDEX TO PLANS



PLAN

1" = 10'

GENERAL NOTES
LOAD FACTOR DESIGN

DESIGN: BRIDGE DESIGN SPECIFICATIONS (1983 AASHTO with Interims and Revisions by CALTRANS)

SEISMIC LOADING: Peak Rock Acceleration = 0.7 g; Depth of Alluvium ≥ 150 ft.

REINFORCED CONCRETE: (EXIST) f_y = 40,000 psi; f'_c = 5,000 psi; n = 9

(NEW CONST) f_s = 60,000 psi; f'_c = 4,000 psi; n = 9

STRUCTURAL STEEL: f_y = 36,000 psi

NO CORRECTIONS THIS SHEET

AS BUILT

CORRECTIONS BY H.O. WILL / RJE

CONTRACT NO. 07-119964

DATE 6-12-96/9-9-97

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

EARTHQUAKE RETROFIT PROJECT NO.198

DESIGN ENGINEER: Ramin Rashedi

	BY	CHECKED		BY	CHECKED
DESIGN	J. Holombo	Kien T Le	LOAD FACTOR DESIGN		
DETAILS	Rich Kuroko 3-92	Kien T Le	LAYOUT	J. Holombo	Kien T Le
QUANTITIES	Lai Fong	Dae Yoo 1-94	SPECIFICATIONS		PLANS AND SPECS COMPARED

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 11

BRIDGE NO. 53-89
POST MILE 30.47

CULVER BOULEVARD OVERCROSSING
GENERAL PLAN

DS OSD 2138 (CADD 4/89)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 07
EA 119961

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY): 3-30-92, 4-1-92, 2-4-93, 2-8-93, 12-8-93, 8-8-94, 8-12-94

SHEET 1 OF 2

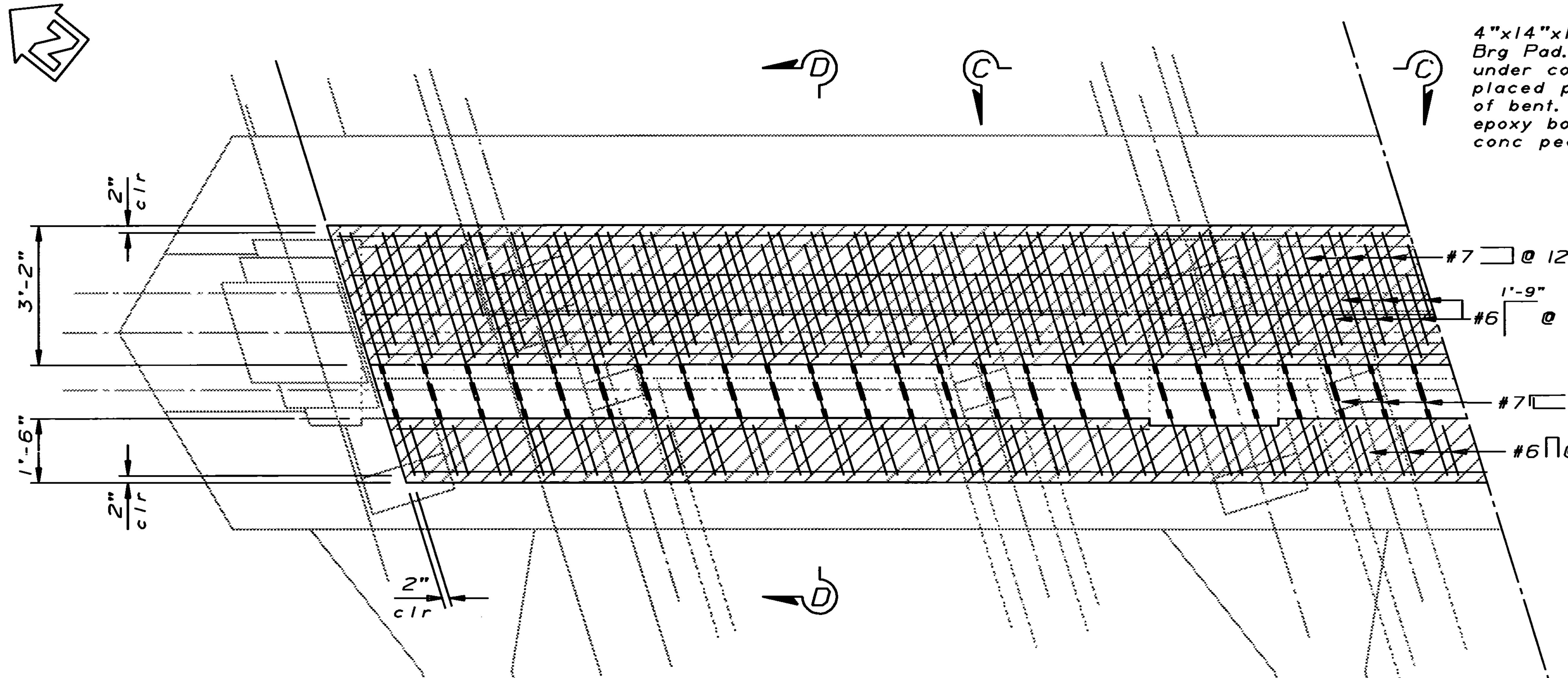
DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	LA	1, 90, 405	Var	167	167

REGISTERED ENGINEER - CIVIL

REGISTERED PROFESSIONAL ENGINEER M.Z. HALEEM No. 24743 Exp. 12-31-97 CIVIL STATE OF CALIFORNIA

9-19-94

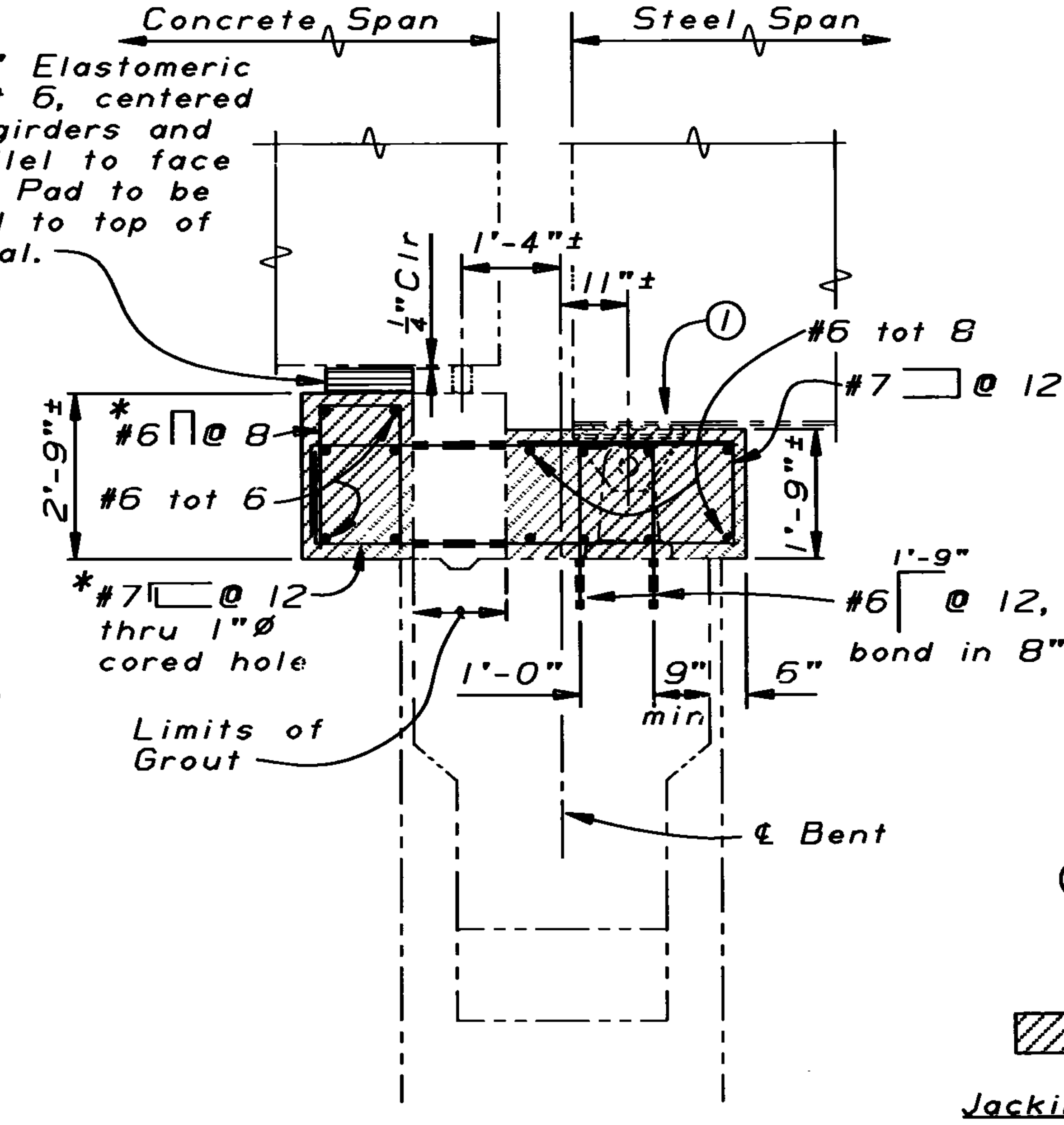
PLANS APPROVAL DATE



PLAN

1/2" = 1'-0"

Bent 2 shown, Bent 3 similar



SECTION D-D

1/2" = 1'-0"

* Place reinf parallel to girders & space along ℄ Bent

(1) Under steel girder only. Replace bearing & sole plate with concrete seat extension & bearing pad (tot 8).

▨ Indicates concrete seat extension

Jacking Notes:

The jacking force shall be applied to all jacks simultaneously. The total vertical lift shall be enough to release existing bearings and install new bearing pads, but no greater than 1/2". The differential lift of girders shall not exceed 1/16".

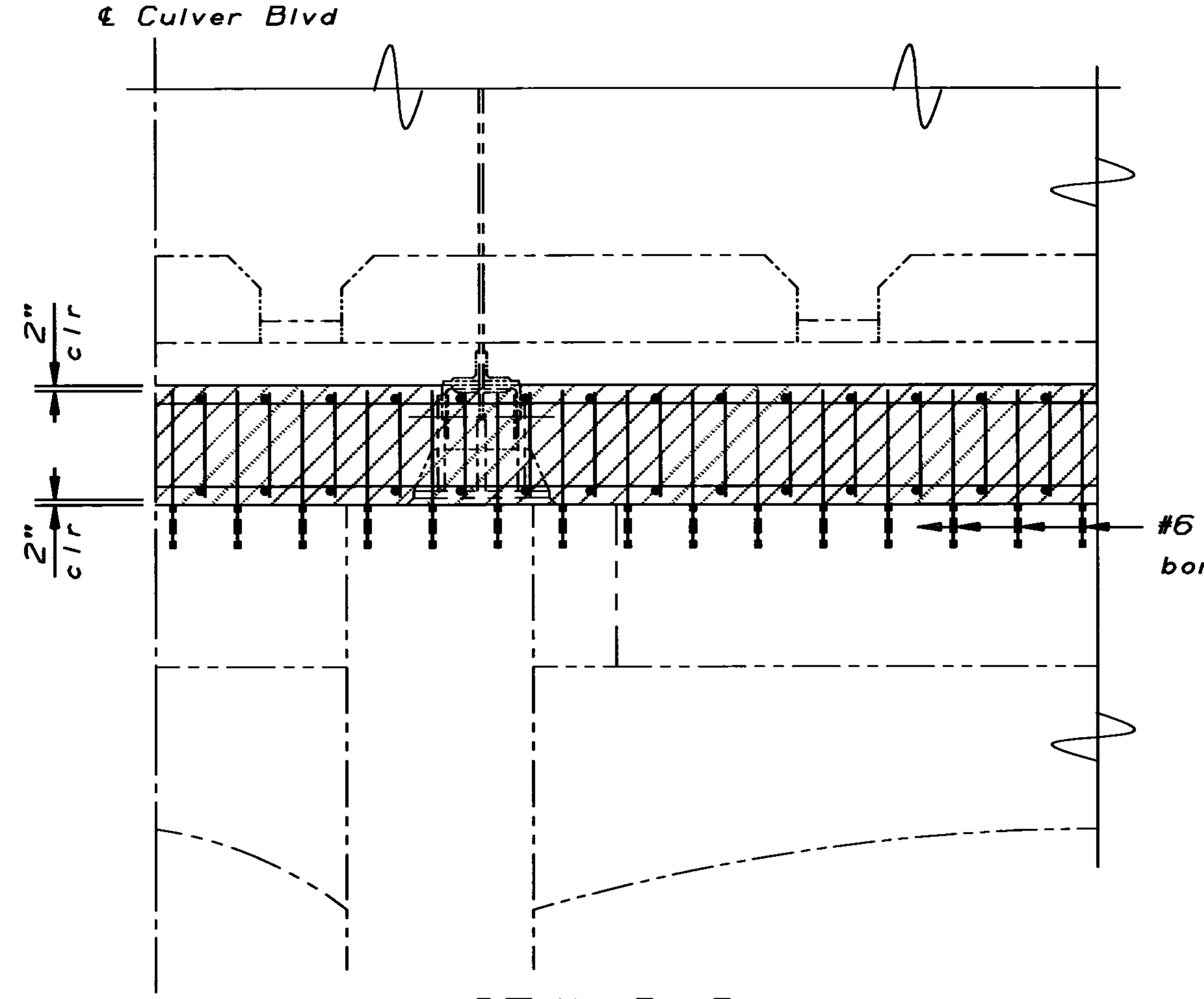
NO CORRECTIONS THIS SHEET

AS BUILT

CORRECTIONS BY H.O. WILL/RJE

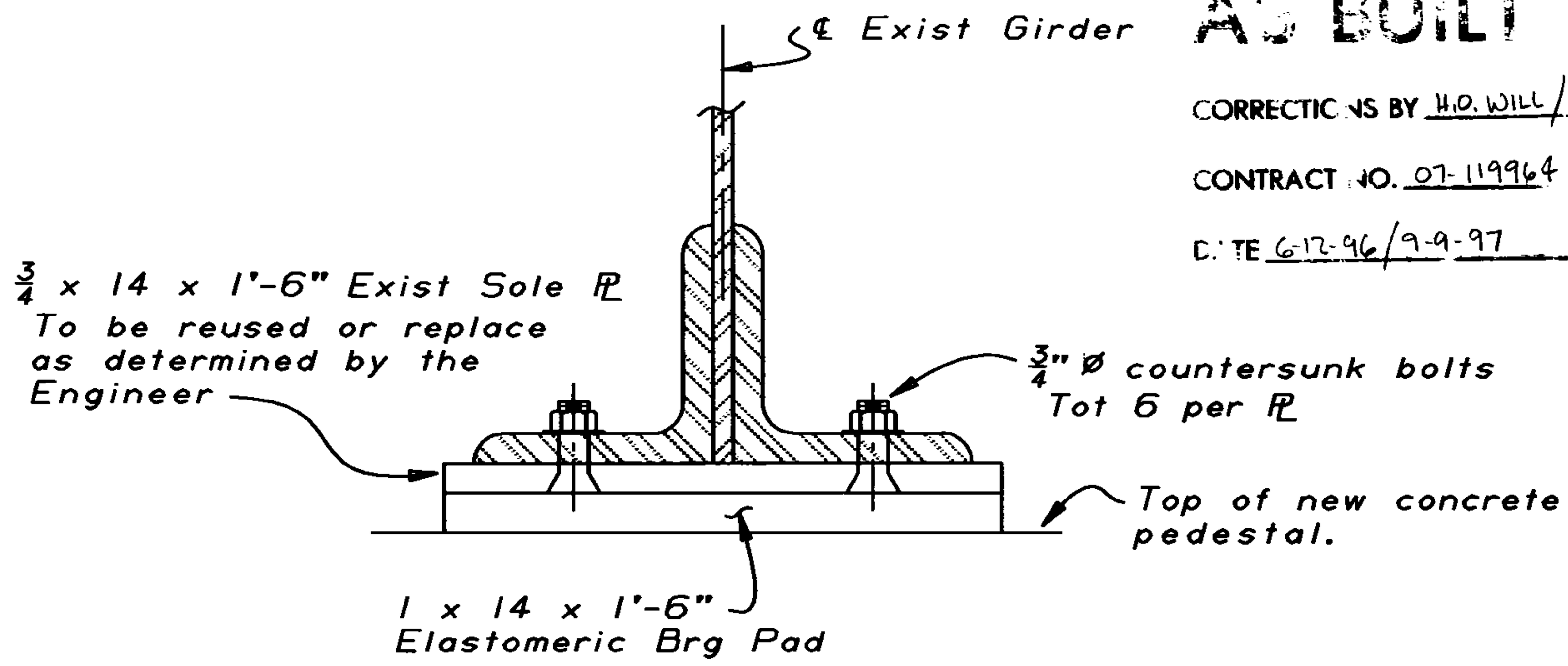
CONTRACT NO. 07-119964

DATE 6-12-96/9-9-97



VIEW C-C

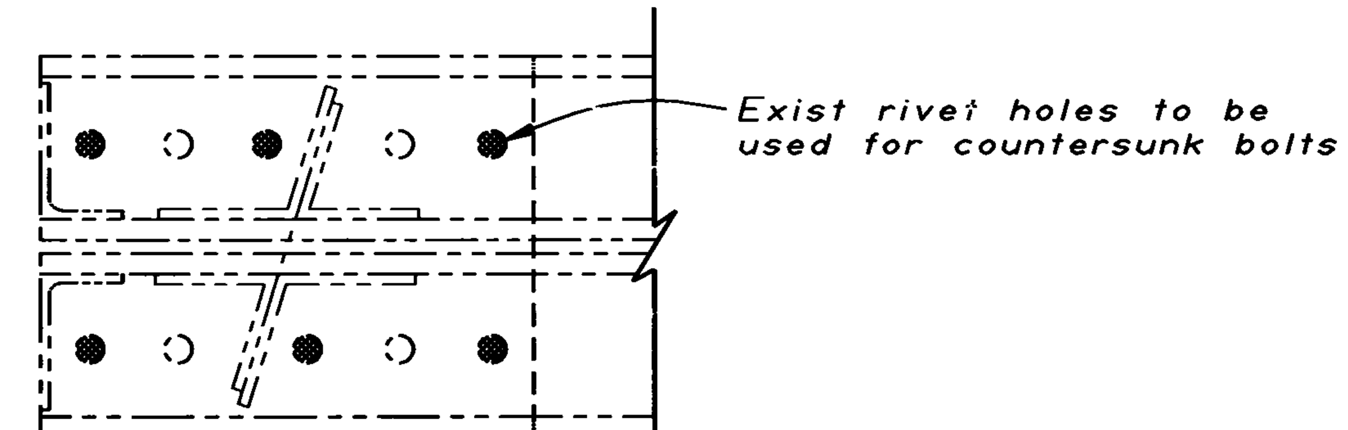
1/4" = 1'-0"



SOLE PLATE

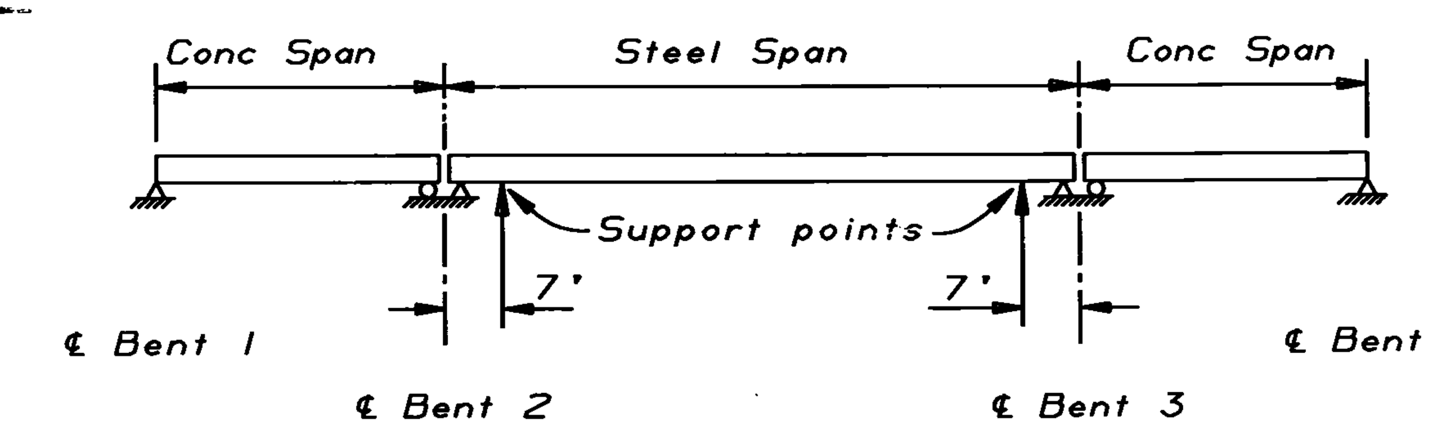
3" = 1'-0"

Remove Sole Plate & reuse or replace.



BOLT PATTERN

No Scale



TEMPORARY SUPPORT LOCATIONS

@ Steel Span only

SERVICE CONDITIONS	BENT 2	BENT 3
DL	43 Tons/Girder	43 Tons/Girder
LL WITH IMPACT	37 Tons/Girder	37 Tons/Girder
DL + (LL+I)	80 Tons/girder	80 Tons/girder

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

EARTHQUAKE RETROFIT PROJECT NO.198

DESIGN	BY Jay Holombo		CHECKED Kien T Le
DETAILS	BY Rich Kuroko	2-93	CHECKED Kien T Le
QUANTITIES	BY Lai Fong		CHECKED Dae Yoo

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 11

BRIDGE NO. 53-89
POST MILE 30.47

CULVER BOULEVARD OVERCROSSING
BENTS 2 & 3 DETAILS

DS OSD 2139 (CADD 4/89)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 07
EA 119961

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY) 2-8-93 | 2-9-93 | 6-21-93 | 12-10-93 | 12-14-93 | 1-7-94 | 1-12-94 | 7-8-94 | 8-9-94 | 8-12-94

SHEET 2 OF 2

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION - OFFICE OF COMPUTER SERVICES

JOINTS & DRAINS (BJD)

07-LA-1-9.93-LA

Wilmington OH

CNTY	SUFFIX	BRIDGE NUMBER	SUFFIX
53		352	

1 … 8

TYPE	UPDATE CODE	JOINT LOCATION	SKEW	JOINT LENGTH	MOVEMENT RATING	JOINT TYPE	YEAR PLACED	JOINT RATING	HEADER TYPE	OVERLAY THICKNESS	HEADER RATING	DATE OF RATINGS MO/YR
(1)	11	12	17	19	23	26	28	30	31	32	35	36
		PN001	16	80	0.6	AA	36	6	0	2.0	0	0787
		HA003	16	80	0.6	AA	36	6	0	2.0	0	0787
		HB003	16	80	0.6	AA	36	6	0	2.0	0	0787
		HA006	16	80	0.6	AA	36	6	0	2.0	0	0787
		HB006	16	80	0.6	AA	36	6	0	2.0	0	0787
		PN008	16	80	0.6	AA	36	6	0	2.0	0	0787
					.					.		
					.					.		
					.					.		
					.					.		
					.					.		

TYPE	UPDATE CODE	TEMP. RANGE
(2)	11	12

TYPE	UPDATE CODE	NO. OF DECK DRAINS
(3)	11	15
		000

UPDATE CODE - FOR ADDS AND CHANGES - LEAVE BLANK
FOR DELETES - ENTER 'D'

JOINT LOCATION - P2 = JT.@PIER #2, B12A = PORTION OF JOINT @ BENT #12, H1 = JT@HINGE #1
L2 = LONGITUDINAL JOINT #2

SKEW - OF EACH JOINT TO ONE DEGREE

LENGTH OF JOINT OR SEAL - TO NEAREST FOOT, CURB TO CURB EXCEPT INCLUDE SIDEWALK IF SEALED

MOVEMENT RATING - TO TENTH OF INCH

JT OR SEAL TYPE - AA = TYPE A, BB = TYPE B, MM = TYPE M
SF = STEEL FINGER, SS = STEEL SLIDE PLATES
TR = TRANSFLEX, WF = WABOFLEX, WA = WABO ALU STRIP, RV = DELASTIFLEX RV, DL = DELASTIFLEX DL, ALUMINUM = AL, MAUER = MR, OP = OPEN

YEAR SEAL PLACED - YEAR ONLY

HEADER TYPES -
- A = REINF. CONCRETE
- B = STEEL PLATE
- C = METAL TUBING
- D = METAL ANGLES
- E = POLYESTER STYRENE
- F = POLYURETHANE
- G = EPOXY MORTAR
- H = FONDU
- J = SET 45
- K = 201

OVERLAY THICKNESS - MAXIMUM TO TENTH OF INCH

DATE OF RATINGS - MONTH, YEAR

CONDITION RATINGS (JOINTS & HEADERS) -
- 8 = NEW OR NO REPAIRS NEEDED
- 6 = MINOR REPAIRS NEEDED
- 4 = MARGINAL CONDITION - GOOD FOR 1 YR.
- 2 = REPLACE NOW OR AS SOON AS POSSIBLE

TEMPERATURE RANGE - AMBIENT RANGE FOR SITE TO ONE DEGREE

NUMBER OF DECK DRAINS - DO NOT INCLUDE SCUPPER DRAINS

IN CASE OF QUESTION CONTACT:
Name Robert Y. Wong
Phone ATSS 640-3718 Date July, 87

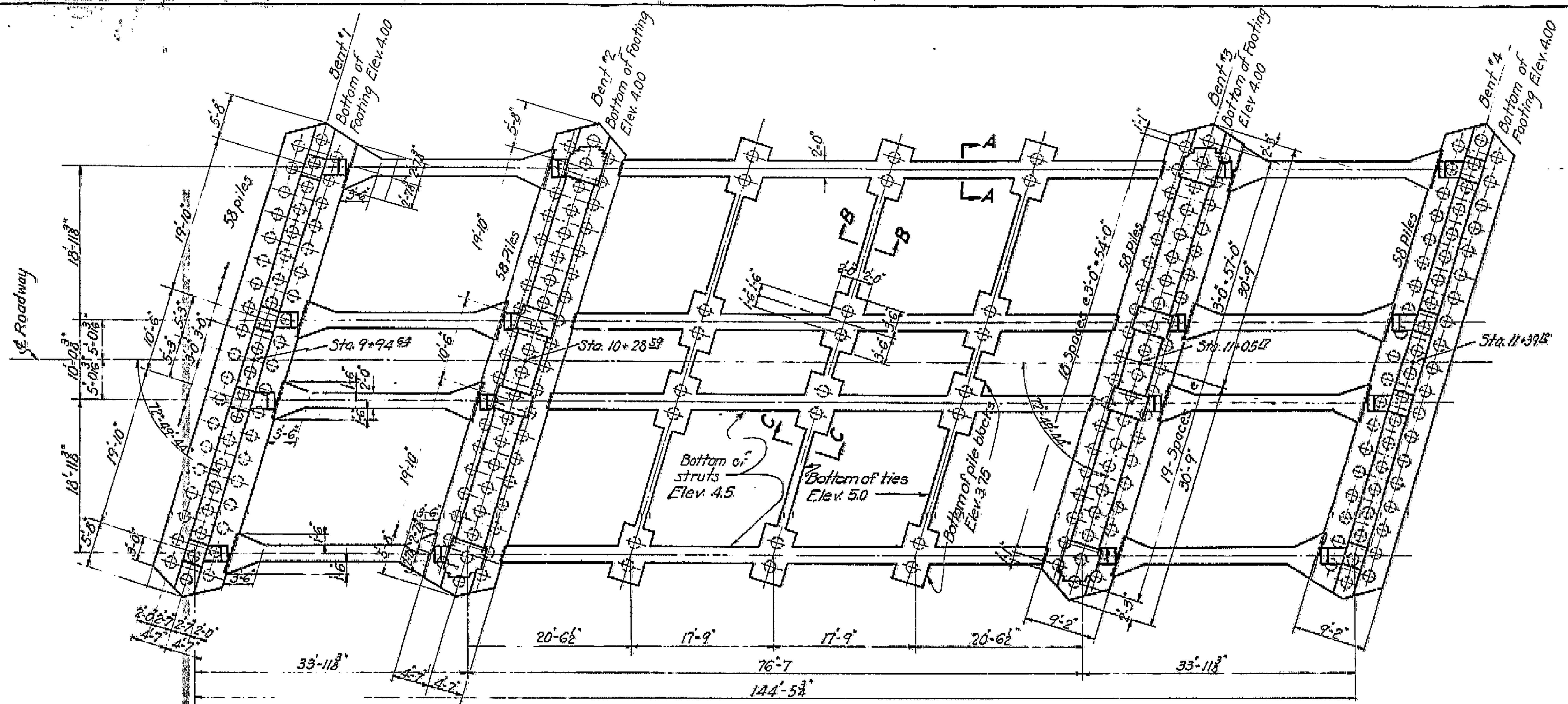
— FOR USE BY OFFICE STRUCTURES MAINTENANCE —

DAS-CS-051

Dist.	County	Route	Sec.	Sheet No.	Total Sheets
VII	L.A.	60	6	2	5

October 5

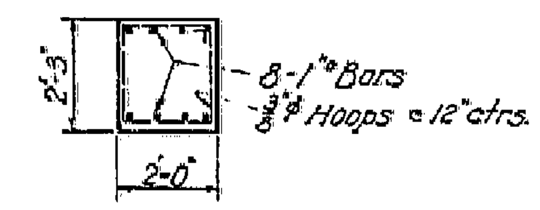
Prints for Estimating
7-20 Prints for District
9-12 Change Elevations of piles



FOUNDATION PLAN

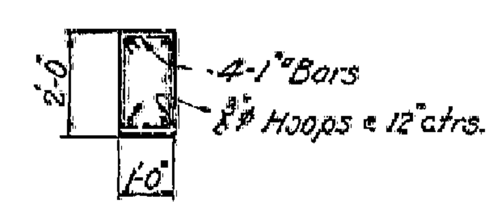
Scale: ⅛" = 1'-0"

Pile spacing the same for all bents.

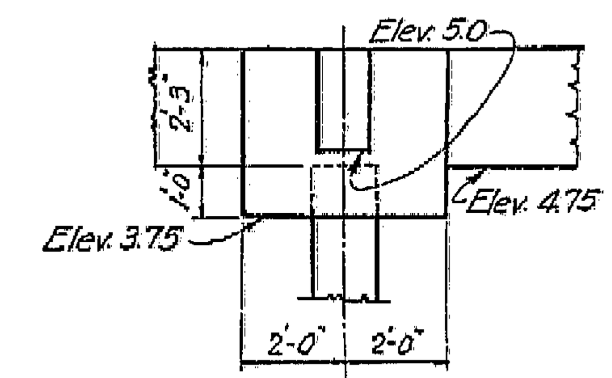


SECT. A-A

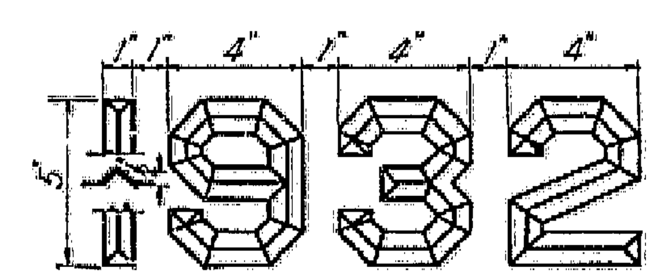
Scale: ⅜" = 1'-0"



SECT. B-B



SECT. C-C



Date to be recessed into curbs. One at each end of bridge on the right hand side as approached.

DATE

GENERAL NOTES

Rails and posts to be class "E" concrete. Class "F" concrete in bottom of beams to be paid for as class "A" concrete. See Section 26 Standard Specifications. All other concrete to be class "A" concrete.

All exposed edges to be chamfered 1" except rail posts which shall be chamfered ¼".

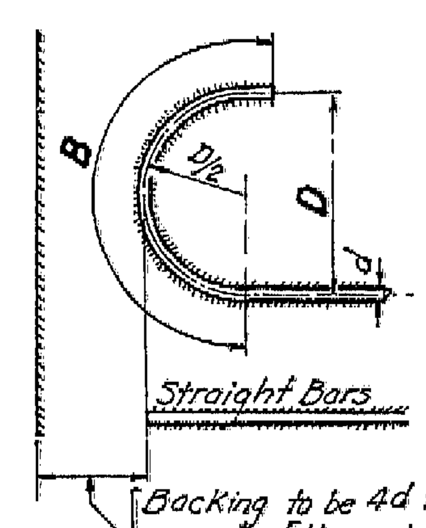
All reinforcing steel to be intermediate grade deformed bars. Unless otherwise shown they shall be embedded at least two diameters and where spliced to lap at least 45 diameters.

All piles to be treated douglas fir. See Sect. 39 and 40 Stand. Specifications. Minimum bearing value per pile to be 22 tons. Minimum penetration to be 12'. One pile in bent #2 and #3 to be used as a test pile.

Length of piles for estimating purposes taken as 40'.

Design, fabrication and construction to conform with the Special Provisions for this project and the Standard Specifications of the California State Dept. of Public Works, Division of Highways, dated Jan. 1930.

H-15 Loading is used throughout.



Backing to be 4d for all bars except of those in the bottom of girders which shall be 2d.

SIZE	D	B
⅜	2	5
½	2½	6
⅝	3	7
¾	3¾	8
⅞	4½	9
1	5	10½
1⅛	5½	11½
1¼	6¼	12

BAR DATA

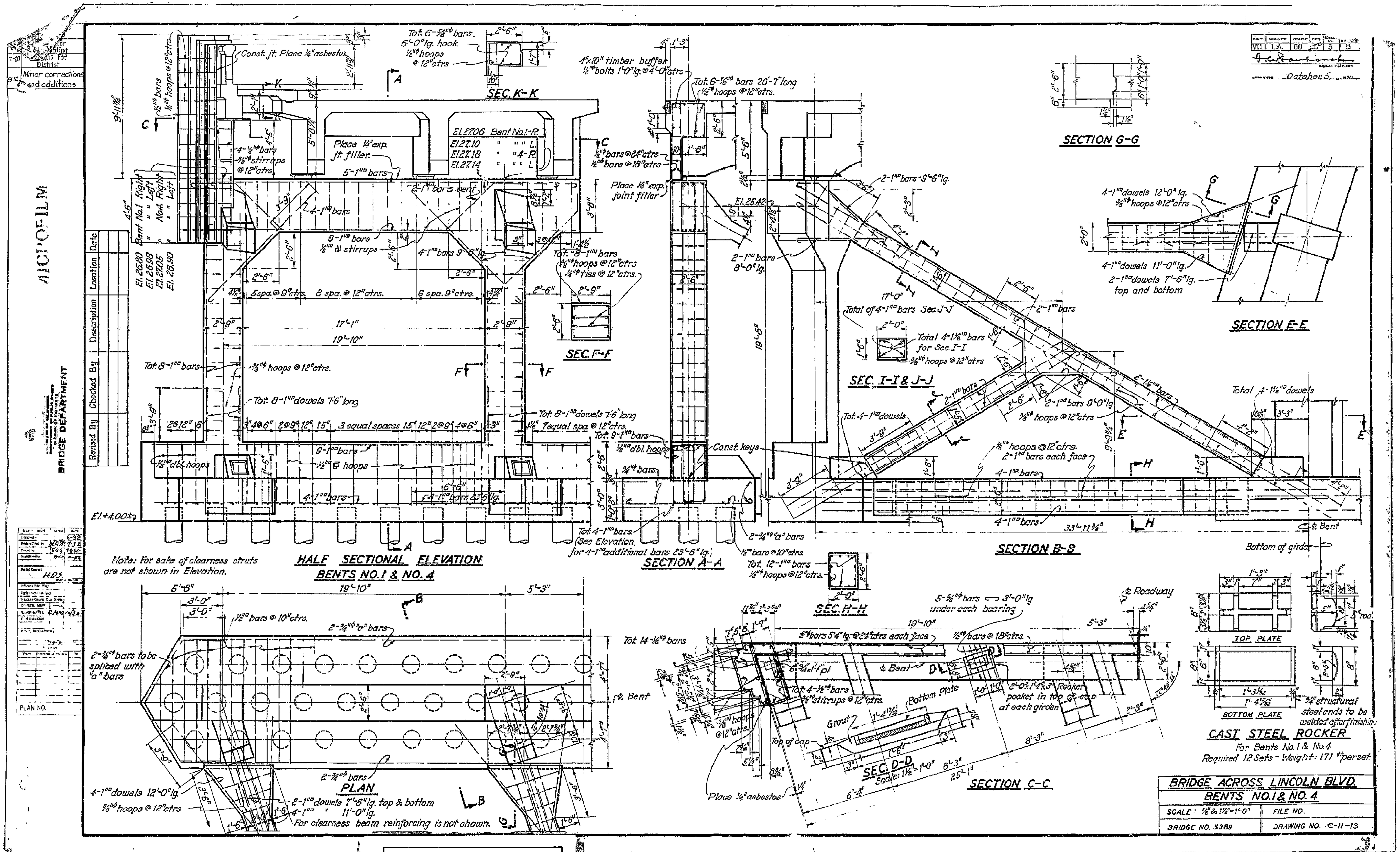
AS BUILT PLANS
Contract No. 411C54
Date Completed
Document No. 7000 2622

Location	Revision	Date	By	Chk

BRIDGE ACROSS LINCOLN BLVD.
FOUNDATION PLAN
SCALE: AS SHOWN — FILE NO.
BRIDGE NO. 5389 — DRAWING NO. C-11-12

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

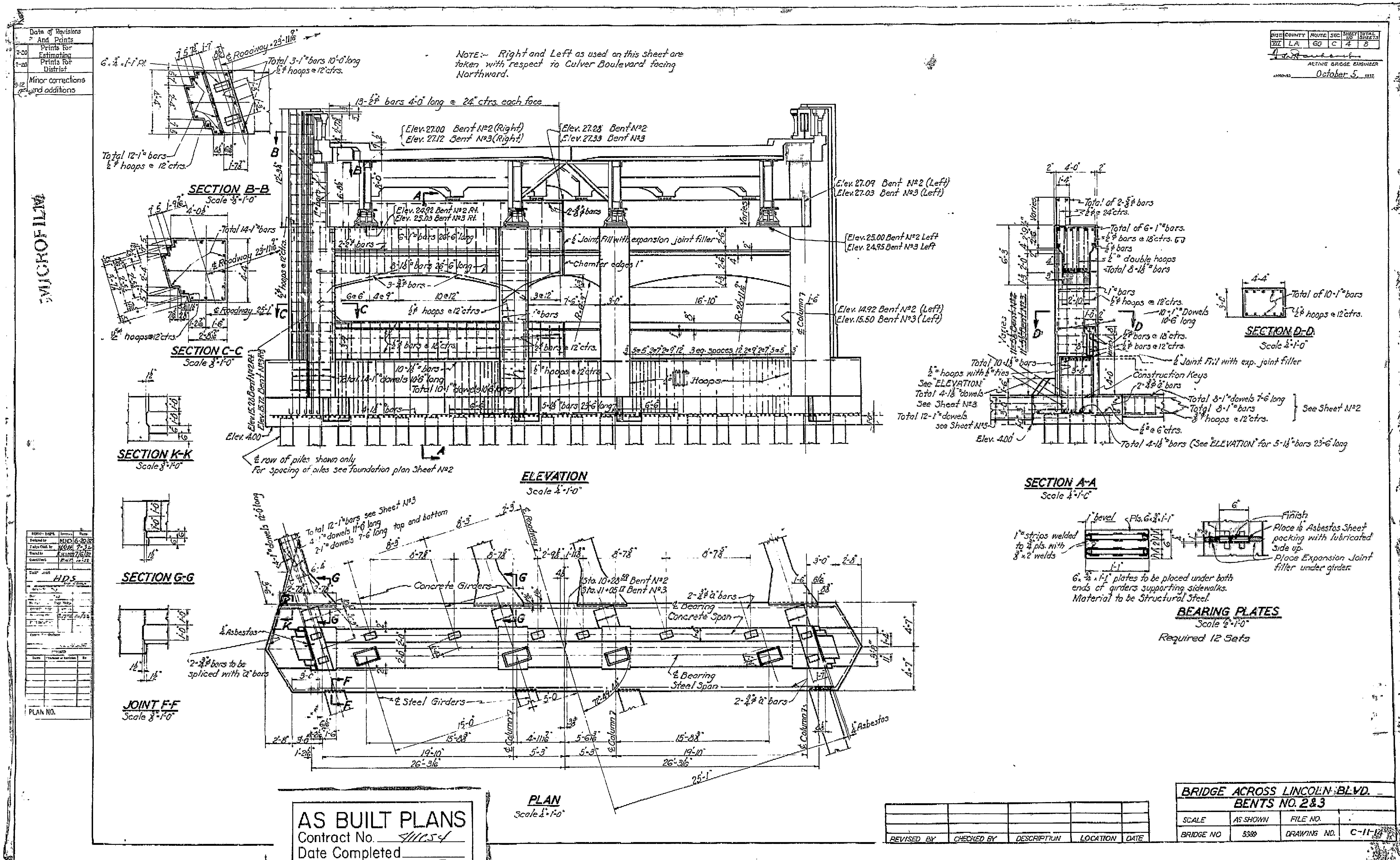
DATE ______ SIGNATURE ______ TITLE ______



AS BUILT PLANS
Contract No. 4IICS4
Date Completed
Document No. 7000 2622

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

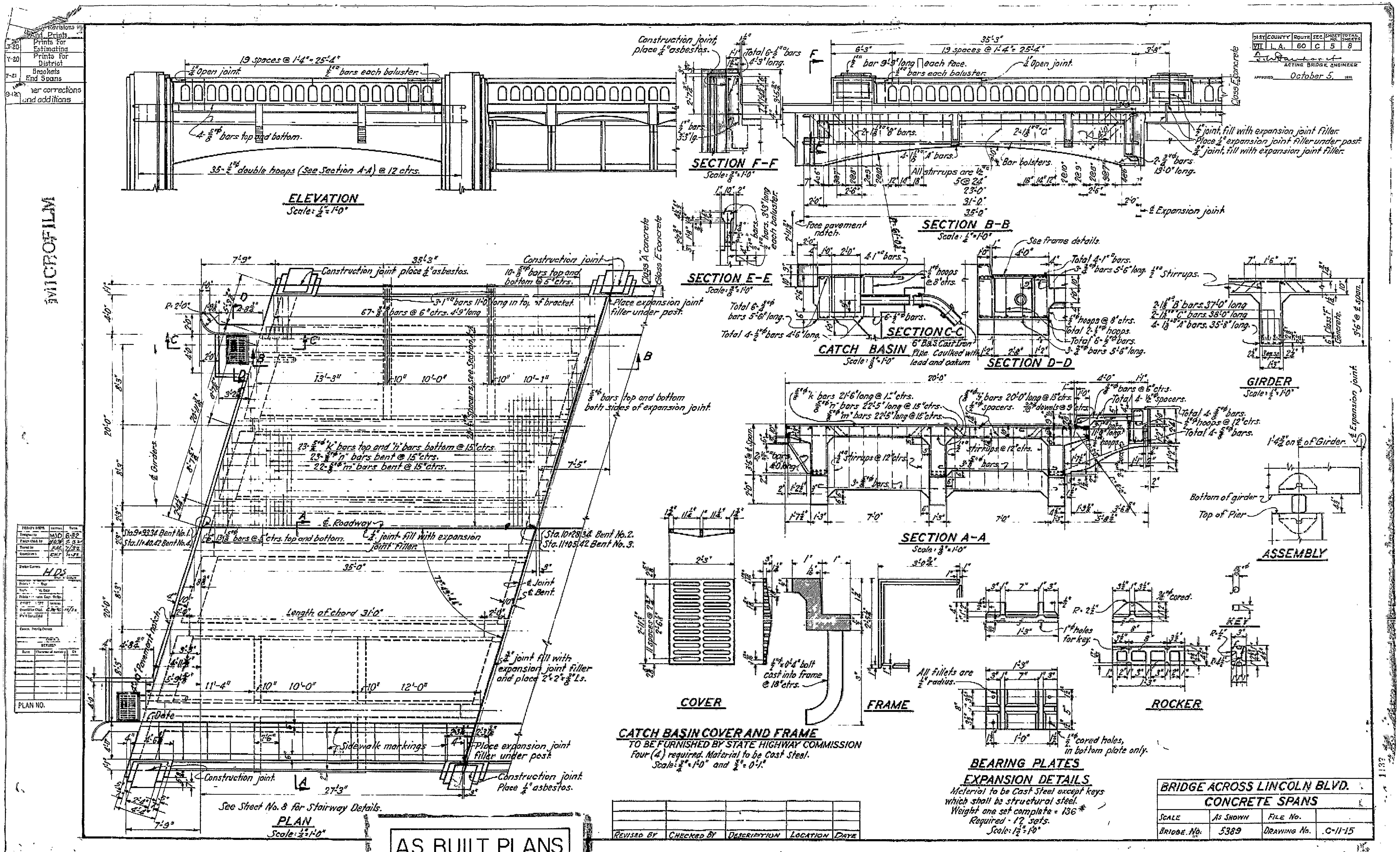
DATE ______ SIGNATURE ______ TITLE ______



AS BUILT PLANS
Contract No. 41IC54
Date Completed
Document No. 7000 2622

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

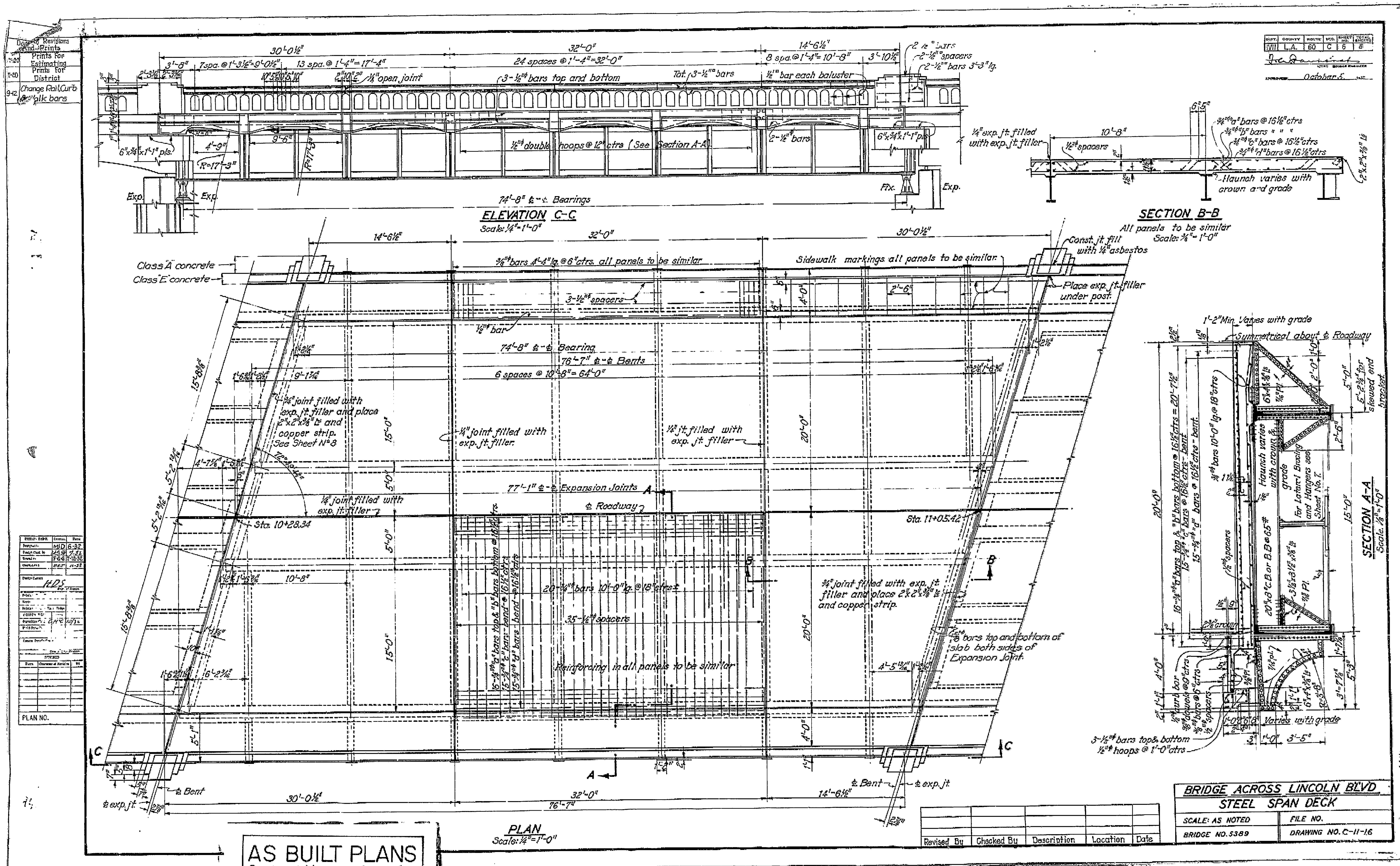
DATE ________ SIGNATURE ________ TITLE ________



AS BUILT PLANS
Contract No. 411C54
Date Completed ______
Document No. 70002622

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

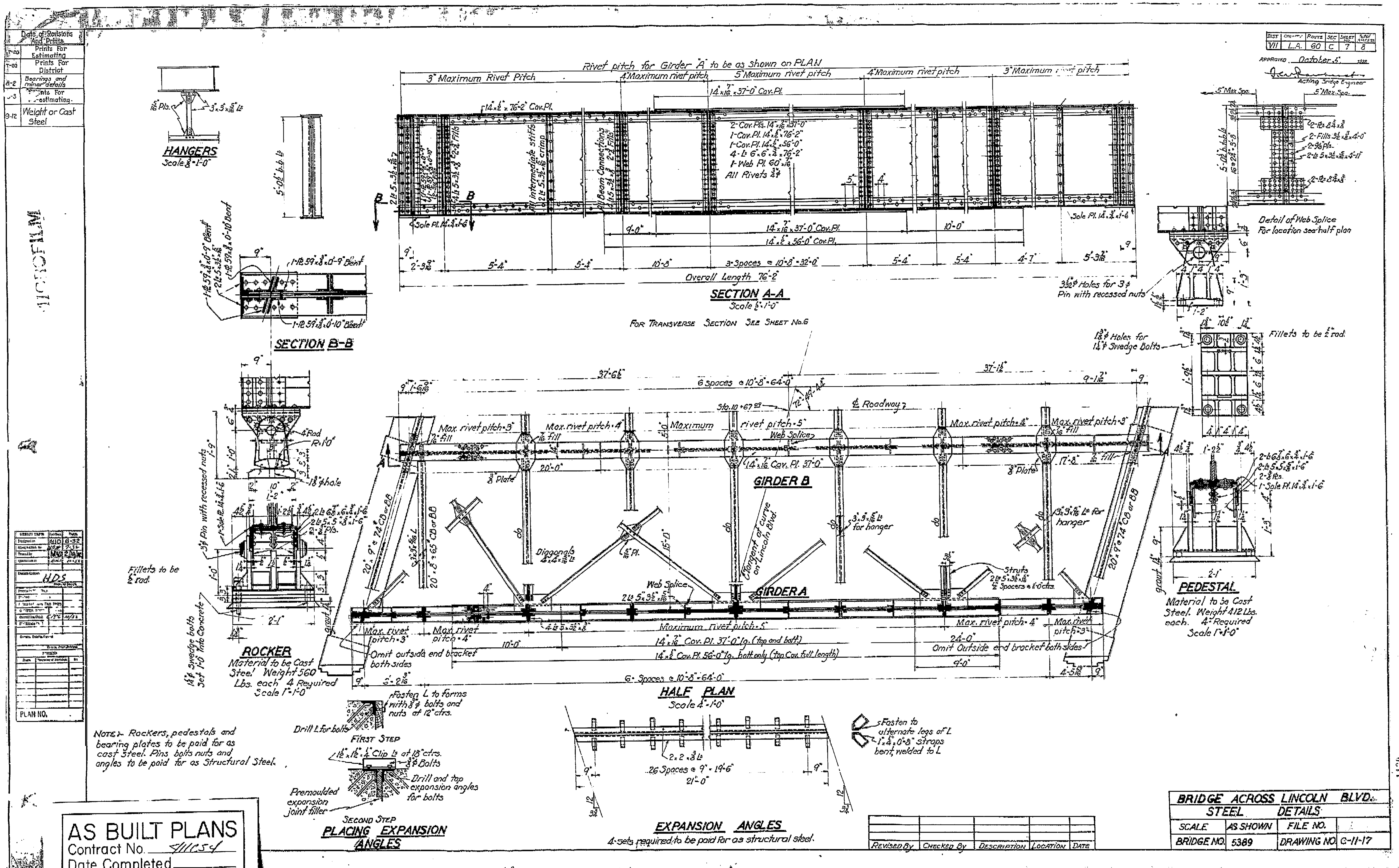
DATE ______ SIGNATURE ______ TITLE ______



AS BUILT PLANS
Contract No. 411C54
Date Completed
Document No. 7006 2622

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

DATE ______ SIGNATURE ______ TITLE ______



AS BUILT PLANS
Contract No. 411C54
Date Completed
Document No. 7000 2622

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

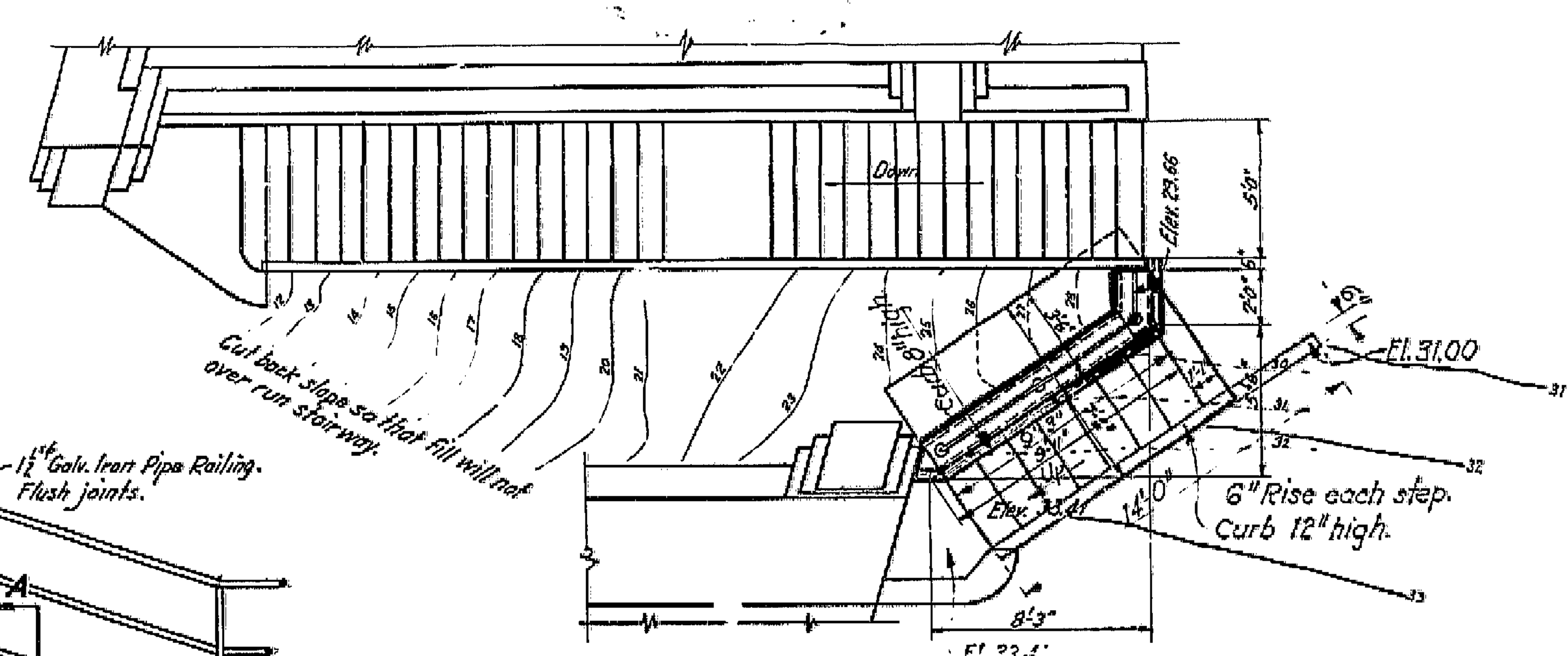
DATE ________ SIGNATURE ________ TITLE ________

VII L.A. 60 C

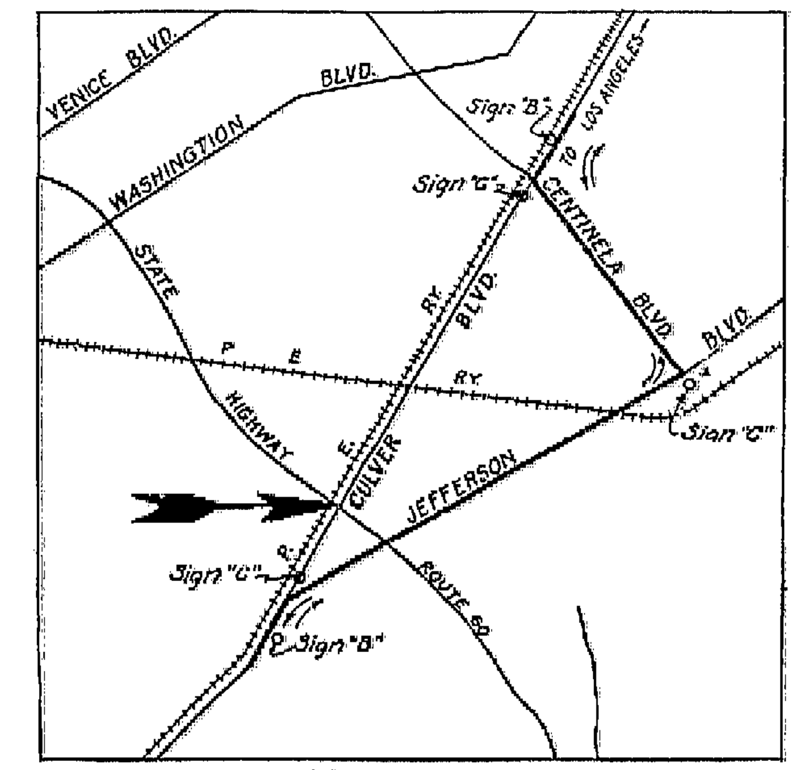
October 5, 1932

BRIDGE DEPARTMENT

MICROFILMED

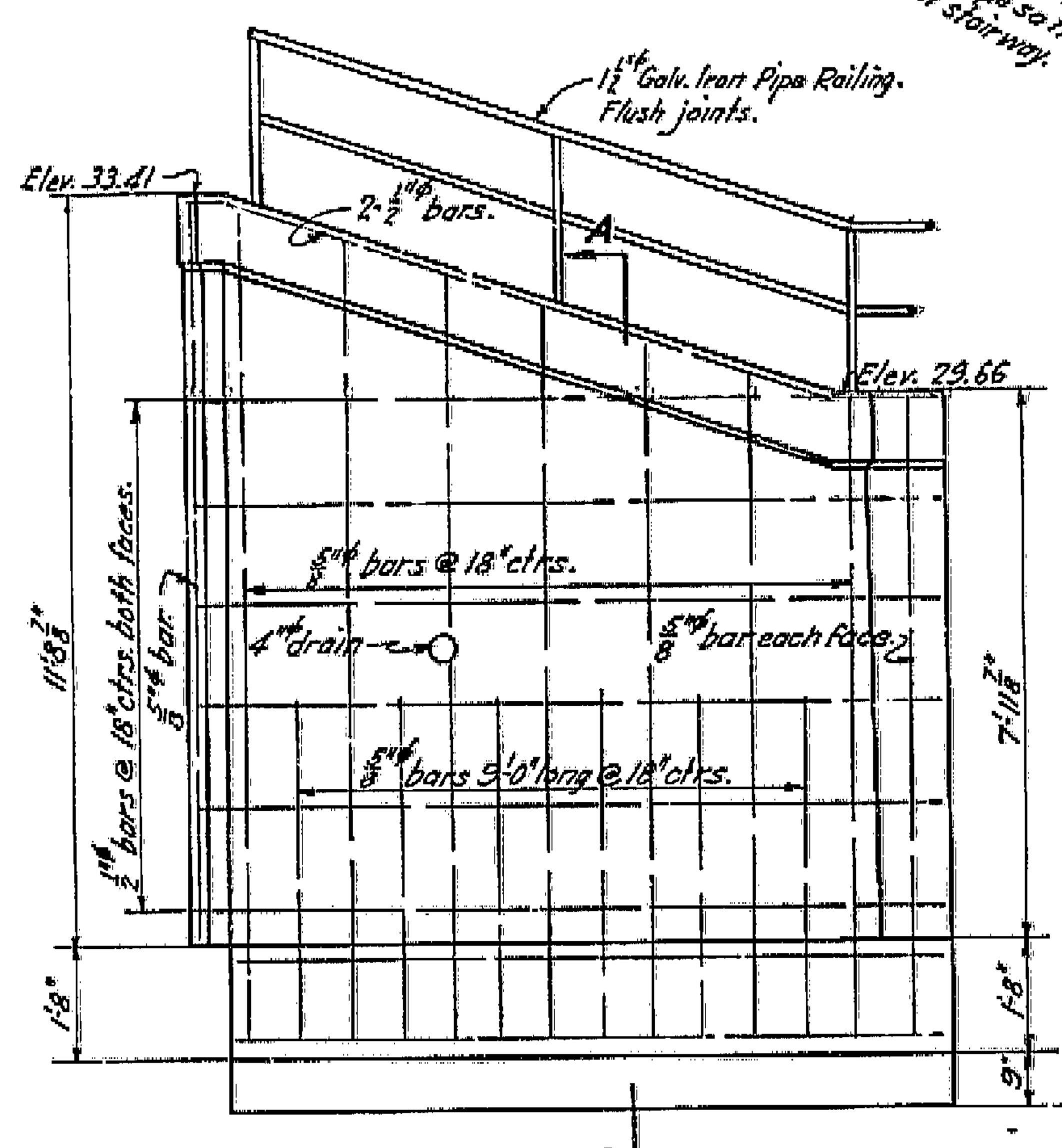


PLAN
Scale: 1/4" = 1'-0"

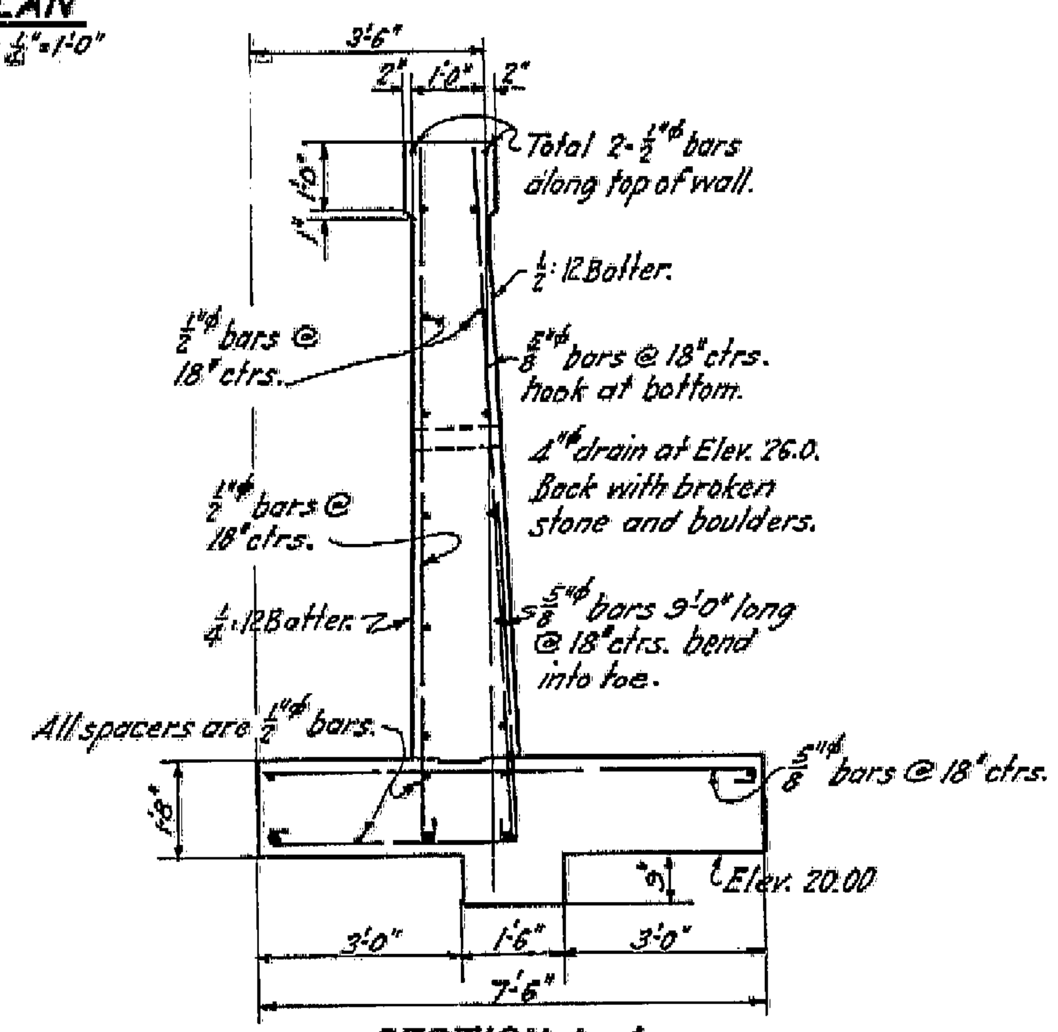


Note: See "Special Provisions" for type of sign.

DETOUR ROUTING
Scale: 1" = 2 Mi.

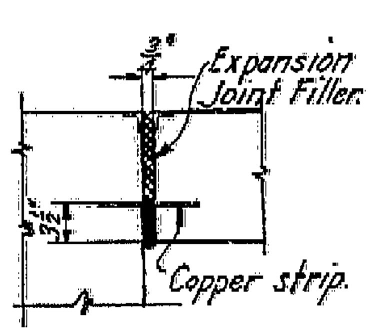


REAR ELEVATION
Scale: 1/2" = 1'-0"

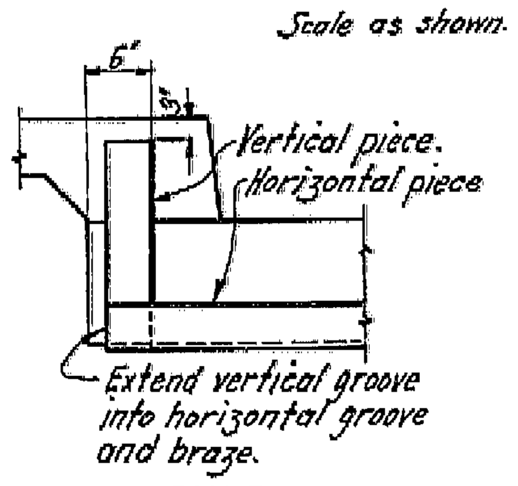


SECTION A-A
Scale: 1/2" = 1'-0"

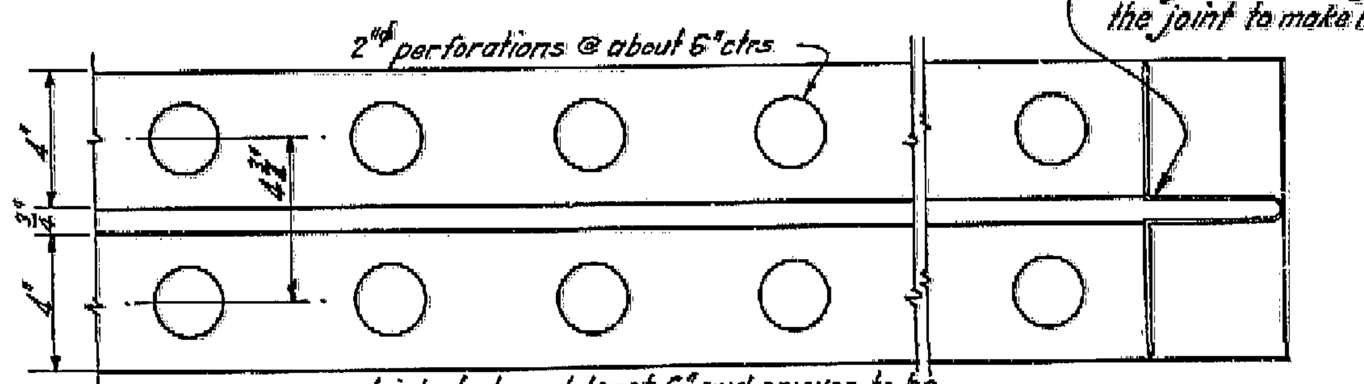
RETAINING WALL
Scale as shown.



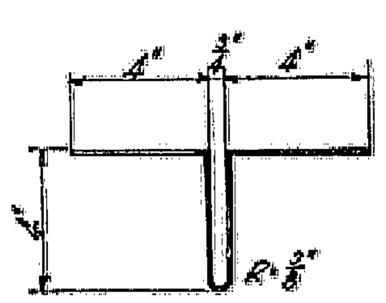
JOINT SECTION
Scale: 1" = 1'-0"



CURB
Scale: 1" = 1'-0"



PLAN
Scale: 3" = 1'-0"



SECTION
Scale: 3" = 1'-0"

COPPER STRIP

Material to be 20 gage Copper Sheets and are to be placed in the Expansion Joints.
To be paid for as structural steel.

BRIDGE ACROSS LINCOLN BLVD.	
MISCELLANEOUS	
SCALE AS SHOWN	FILE NO.
BRIDGE NO. 5389	DRAWING NO. C-11-18

AS BUILT PLANS
Contract No. 4I1C54
Date Completed
Document No. 7006 2622

I HEREBY CERTIFY THAT THIS IS A TRUE AND ACCURATE COPY OF THE ABOVE DOCUMENT TAKEN UNDER MY DIRECTION AND CONTROL ON THIS DATE IN SACRAMENTO, CALIFORNIA PURSUANT TO AUTHORIZATION BY THE DIRECTOR OF PUBLIC WORKS.

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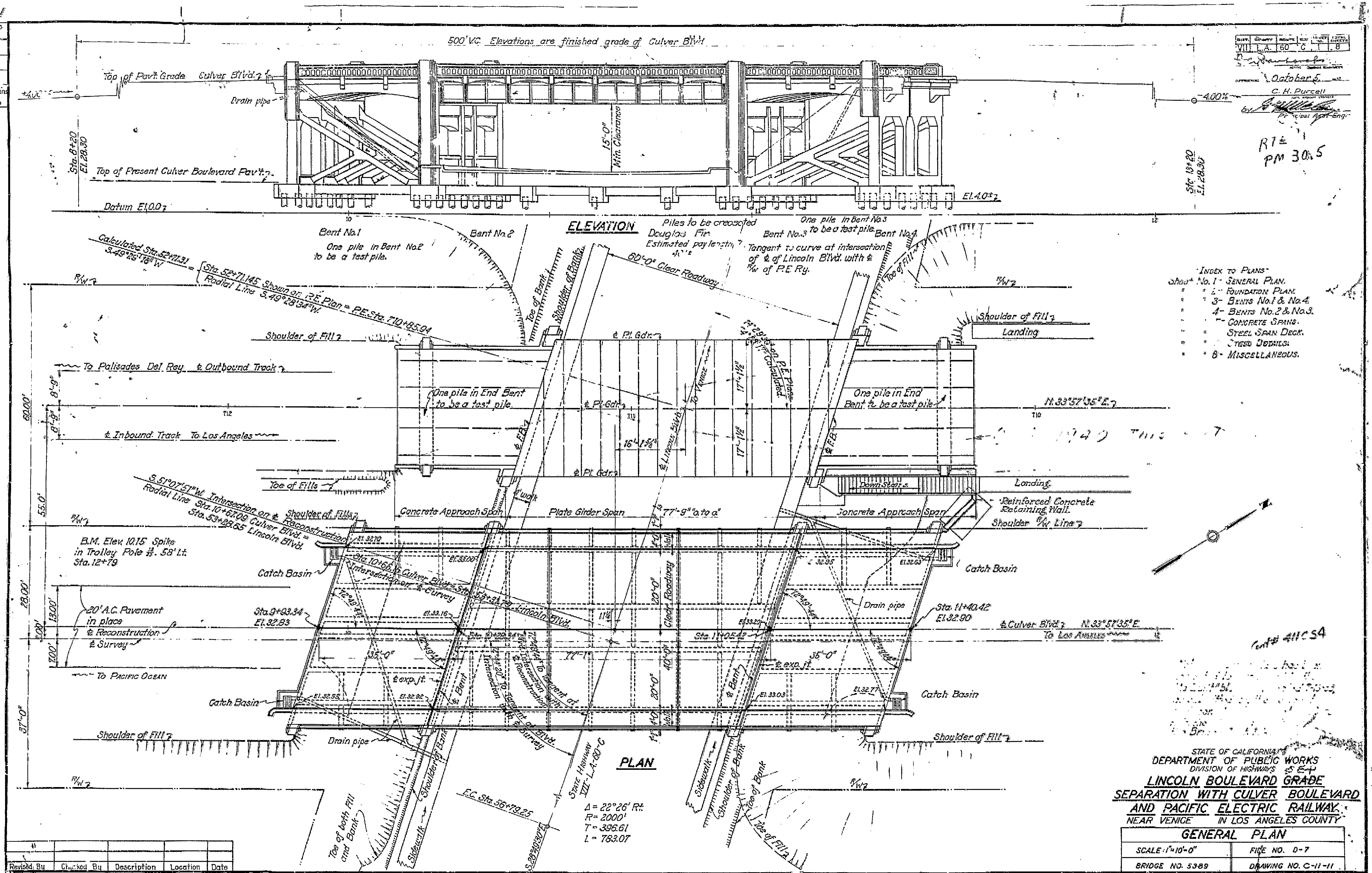

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APPENDIX F

STRUCTURE PRELIMINARY GEOTECHNICAL REPORT

STRUCTURE PRELIMINARY GEOTECHNICAL REPORT
CULVER BOULEVARD BRIDGE REPLACEMENT
LOS ANGELES, CALIFORNIA

Submitted to

PSOMAS
and
CALTRANS

Prepared for

PSOMAS
555 South Flower Street, Suite 4300
Los Angeles, California, 90071

Prepared by

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Group Delta Project No. LA1590
November 7, 2022

PSOMAS
555 South Flower Street, Suite 4300
Los Angeles, California, 90071

November 7, 2022
Project No. LA1590

Attention: Tim Hayes
Project Manager

SUBJECT: Structure Preliminary Geotechnical Report
Culver Boulevard Bridge Replacement
Los Angeles, California

Dear Mr. Hayes,

Group Delta is pleased to submit our Structure Preliminary Geotechnical Report (SPGR) for the subject new bridge structure replacing the existing Culver Boulevard bridge in accordance with our revised proposal dated October 4, 2022. Please feel free to contact us if you have questions or comments.

Sincerely,
GROUP DELTA CONSULTANTS, INC

REGISTERED PROFESSIONAL ENGINEER
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LOS ANGELES, CALIFORINA

1.0 INTRODUCTION

The following document presents a Structure Preliminary Geotechnical Report (SPGR) for the proposed new Culver Boulevard bridge replacing the existing Culver Boulevard bridge (Bridge No. 53-89) in Los Angeles, California. Culver Boulevard crosses over Lincoln Boulevard about 300 feet northwest of Ballona Creek, as shown on the Site Location Map, Figure 1A. The site vicinity is shown in more detail in Figure 1B. Photographs of the bridge at present, and during construction in 1937 are provided in Figures 1C and 1D.

A preliminary layout for the proposed new bridge is shown in the Proposed Development, Figure 2A. The bridge profile and deck configuration are shown in Figure 2B. The approximate locations of 36 explorations that have previously been conducted within about 1,500 feet of Lincoln Boulevard are shown in the Existing Explorations, Figure 3A. An aerial photograph showing the approximate locations of the 4 explorations we propose for the final design is provided in Figure 3B.

The purpose of this study was to characterize the pertinent geotechnical conditions at the site and provide preliminary geotechnical input for the proposed bridge. Our conclusions and recommendations are based on the previous subsurface explorations and laboratory testing, as well as supplemental engineering analyses, and our previous experience with similar geologic conditions. This SPGR was prepared in general accordance with Caltrans Guidelines for the Preparation of Foundation Reports for Bridges (Caltrans, 2021a).

1.1 Purpose and Scope of Work

This SPGR is provided to support Advanced Planning Studies at the Project Approval/Environmental Document (PA/ED) stage of the project, in accordance with Caltrans's "Foundation Reports for Bridges" (Caltrans, 2021a). The scope of work included:

- A review of the surface characteristics of the site, available geologic hazard maps, geotechnical reports, and aerial photographs.
- A review of 36 explorations that were conducted in the site vicinity between 1998 and 2013.
- A review of previous laboratory tests conducted on samples collected from the exploratory borings.
- Analysis of the available field and laboratory data to help develop preliminary geotechnical input for the proposed bridge.
- Summary of anticipated site conditions, geology, and subsurface conditions.

- Summary of subsurface data and as-built foundation data.
- Preliminary scour and corrosion evaluation.
- Preliminary seismic information and recommendations.
- Preliminary evaluation of the liquefaction and seismic settlement and evaluation of the slope stability (lateral spreading) of the abutments based on liquefied soil profile, depths of liquefaction, residual shear strengths, etc.
- Preliminary recommendations for foundation type, size, and capacity.
- Recommend scope of additional investigations for final design, and
- Preparation of this report.

2.0 PROJECT DESCRIPTION

2.1 Project

The project consists of the construction of a new single-span precast girder bridge along Culver Boulevard crossing over Lincoln Boulevard 1,600 feet northwest of West Jefferson Boulevard replacing the existing Culver Boulevard bridge. Based on the structural drawings for the planning study, the bridge has a span of 150 feet. The bridge will be approximately 54 feet 4 inches wide with two traffic lanes and a shoulder and sidewalk on either side. The abutment retaining walls are stepped with a height of about 25 feet and 15 feet and each step is about 25 feet long.

The new bridge is proposed to be constructed over the existing bridge. Vehicular traffic along Culver Boulevard will be diverted during the construction. As discussed above, the existing bridge will be demolished.

2.2 Pertinent Reports and Investigations

The following reports and investigations from nearby projects performed by Group Delta and Pacific Soils Engineering were available and reviewed.

- Group Delta's nearby project Ballona Wetlands (Group Delta, 2013) that included three rotary wash (RW) borings, one hollow stem auger (HSA) boring, and six cone penetration test (CPT) soundings.

- Group Delta's nearby development project in Playa Vista (Group Delta, 1999) that included eleven borings and 8 CPTs.

- Pacific Soils Engineering's nearby development project in Playa Vista (Pacific Soils Engineering, 1998) that included eight exploratory borings and twelve CPTs.

2.3 Project Datum

The elevation data presented herein reflect feet above Mean Sea Level (MSL) based on the North American Vertical Datum of 1988 (NAVD88). Topographic roadway elevations, the elevation of the proposed bridge, and elevations from the as-built plans of the existing bridge are based on the National Geodetic Vertical Datum of 1929 (NGVD29). The horizontal datum is the North American Datum of 1983 (NAD83).

2.4 Exceptions to Policies and Procedures

No exceptions to policy or procedures are proposed.

3.0 FIELD INVESTIGATION

3.1 Existing Field and Laboratory Data

No new explorations were performed as part of this study. The available subsurface data in the site vicinity included three previous geotechnical investigations conducted near the Lincoln Boulevard Multi-Modal Improvement Project between 1998 and 2013. The data from the most recent field investigation for the Ballona Wetlands Restoration Project is reproduced in Figures A-1 through A-10 in Appendix A (Group Delta, 2013). The Ballona Wetlands study included the advancement of three rotary wash (RW) borings, one hollow-stem-auger (HSA) boring, and six cone penetrometer test (CPT) soundings within about 1,500 feet of Lincoln Boulevard. These explorations were advanced between September 14th and October 16th of 2012 (Group Delta, 2013).

Photocopies of 11 exploratory borings and 8 CPT soundings we previously conducted for the Playa Vista development are attached as the second Appendix A (Group Delta, 1999). Photocopies of 8 exploratory borings and 12 CPT soundings conducted by others for the Playa Vista development are also attached as the third Appendix A (Pacific Soils Engineering, 1998). The approximate locations for all these borings and CPT soundings are shown in the Existing Explorations, Figure 3A.

Soil samples were collected from the borings for laboratory testing and analyses. Previous testing programs included gradation analyses and Atterberg Limits to aid in material classification using the Unified Soil Classification System (USCS). Tests were conducted on relatively intact samples to estimate the in-situ dry density and moisture content of the materials encountered on site. Corrosivity tests were conducted to evaluate the pH, resistivity, chloride, and sulfate content of the on-site soils. Direct shear tests were conducted on relatively intact soil samples to aid in strength characterization. Consolidation tests were conducted on undisturbed samples of the alluvium to help characterize the potential for settlement. The laboratory test results for the three studies noted above are also presented in Appendix B (Group Delta, 1999 and 2013, and Pacific Soils Engineering, 1998).

The explorations utilized in this study are shown in Figure 3A and summarized in Table 1 below.

Table 1: Summary of Existing Subsurface Investigation

Exploration No.	Completion Date	Drill Rig Type	Hammer Type	Hammer Efficiency (%)	Approximate Ground Surface Elevation (ft)	Exploration Depth (ft)	Ground water Depth (ft)	Approximate Groundwater Elevation (ft)
Group Delta Consultants, Inc (1999)								
B-302R	12/11/1998	RW	Auto	--	17.5	66.5	20.0	2.5
B-304H	10/29/1998	HSA	Auto	--	14.6	31.0	12.2	2.4
B-305H	10/29/1998	HSA	Auto	--	15.3	31.0	12.0	3.3
B-306R	11/04/1998	RW	Auto	--	16.8	51.5	--	--
B-307R	11/06/1998	RW	Auto	--	11.4	61.0	--	--
B-309R	11/04/1998	RW	Auto	--	12.8	61.0	--	--
B-313H	10/29/1998	HSA	Auto	--	12.6	26.0	8.4	4.2
B-315H	10/30/1998	HSA	Auto	--	13.3	26.0	8.0	5.3
B-316R	11/03/1998	RW	Auto	--	14.1	57.5	--	--
B-317R	11/05/1998	RW	Auto	--	9.5	61.0	--	--
B-319R	11/05/1998	RW	Auto	--	11.7	61.0	--	--
C-301C	12/07/1998	CPT	--	--	--	68.0	14	--
C-303C	12/07/1998	CPT	--	--	--	61	14	--
C-308	11/03/1998	CPT	--	--	--	62	10	--
C-310C	11/03/1998	CPT	--	--	--	62	8	--
C-311C	11/03/1998	CPT	--	--	--	63	8	--
C-312C	11/03/1998	CPT	--	--	--	69	8	--
C-314C	11/03/1998	CPT	--	--	--	64	8	--
C-318C	11/03/1998	CPT	--	--	--	64	8	--
Group Delta Consultants, Inc (2013)								
A-RW013	09/26/2012	RW	Auto	84	13.8	56.5	--	--
A-RW015	10/02/2012	RW	Auto	84	17.1	61.5	--	--
B-RW049	10/01/2012	RW	Auto	84	17.6	69	--	--
B-HSA051	10/16/2012	HSA	Auto	84	6.3	21.5	NE	--
A-CPT-012	09/24/2012	--	--	--	13.8	48.1	--	--
A-CPT-014	09/24/2012	--	--	--	16.0	52.0	--	--
A-CPT-025	09/26/2012	--	--	--	20.0	65.1	--	--
B-CPT-050	09/14/2012	--	--	--	20.2	64.1	--	--
C-CPT-060	10/10/2012	--	--	--	14.6	49.0	--	--

Exploration No.	Completion Date	Drill Rig Type	Hammer Type	Hammer Efficiency (%)	Approximate Ground Surface Elevation (ft)	Exploration Depth (ft)	Ground water Depth (ft)	Approximate Groundwater Elevation (ft)
A-CPT-065	09/26/2012	--	--	--	20.5	63.3	--	--
Pacific Soils Engineering (1998)								
PSB-1	12/05/1997	HSA	Auto	--	16	71	14	2
PSB-2	12/09/1997	HSA	Auto	--	16	71	15	1
PSB-3	12/09/1997	HSA	Auto	--	16	71	15	1
PSB-4	12/09/1997	HSA	Auto	--	16	71	10	6
PSB-5	12/10/1997	HSA	Auto	--	16	66	--	--
PSB-6	12/10/1997	HSA	Auto	--	16	71	10	6
PSB-7	12/10/1997	HSA	Auto	--	16	71	17	-1
PSB-8	12/11/1997	HSA	Auto	--	16	71	15	1
PSCPT-1	12/10/1997	CPT	--	--	--	~50	--	--
PSCPT-2	12/10/1997	CPT	--	--	--	~50	--	--
PSCPT-3	12/10/1997	CPT	--	--	--	~50	--	--
PSCPT-4	12/10/1997	CPT	--	--	--	~52	--	--
PSCPT-5	12/10/1997	CPT	--	--	--	~50	--	--
PSCPT-6	12/10/1997	CPT	--	--	--	~51	--	--
PSCPT-7	12/10/1997	CPT	--	--	--	~51	--	--
PSCPT-8	12/10/1997	CPT	--	--	--	~51	--	--
PSCPT-9	12/10/1997	CPT	--	--	--	~50	--	--
PSCPT-10	12/10/1997	CPT	--	--	--	~50	--	--
PSCPT-11	12/10/1997	CPT	--	--	--	~50	--	--
PSCPT-12	12/10/1997	CPT	--	--	--	~51	--	--

Notes: RW = rotary wash; HSA = hollow stem auger, NE = not encountered

4.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

4.1 Site Conditions

The subject bridge site is located within the City of Marina Del Rey in Los Angeles County, California along Culver Boulevard between Station 108+16.75 and 109+66.75. The approximate location and extent of the project are shown in the Site Location Map, Figure 1A. The areas located both north and west of the roadway are primarily undeveloped wetlands associated with Ballona Creek, as discussed in the referenced report (Group Delta, 2013) however the area on the southeast has been developed with residential structures (Playa Vista). The area located immediately southeast of the Lincoln Boulevard Bridge was investigated previously as "Area De" of the Playa Vista Development (Group Delta, 1999).

The existing bridge is located at latitude 33.9760° north and longitude 118.4330° west, as shown in the Site Vicinity Plan, Figure 1B. A photograph showing the current configuration of the bridge is presented in Figure 1C. An aerial photograph showing the bridge during construction in 1937 is provided in Figure 1D.

Available drawings indicate that existing elevations along Culver Boulevard are about 32 feet. The surface of Lincoln Boulevard is about El. 10 feet beneath the bridge, as shown in Figure 2A.

The site vicinity has been repeatedly developed over the years. The Pacific Electric Railroad was constructed in the 1880s immediately north of present-day Culver Boulevard (see Figure 1D). The rail has since been demolished, although portions of the ballasted trackway may remain below grade. The Ballona Wetlands were opened to oil and gas exploration in the 1930s, and numerous oil derricks and dikes were constructed in the area through the 1950s. Ballona Creek was channelized and protected with reinforced concrete in 1934. However, previous improvements included some rip-rap slope protection along the creek, which may also remain beneath the ground surface. Development of the Marina Del Rey project in the 1950s included dredging of the harbor and the placement of hydraulic fill throughout the wetlands.

4.2 Site Geology

The site is located within the Los Angeles basin section of the Peninsular Ranges geomorphic province of southern California. The Los Angeles basin is generally underlain by Quaternary alluvial deposits, which overlie several thousand feet of Tertiary marine and non-marine sediments. The previous investigations indicate that the site is underlain by Quaternary Alluvial Floodplain Deposits (Map Symbol – Qa), which are covered with both hydraulic fill and conventional fill. The general geology in the site vicinity is shown on the Local Geologic Map, Figure 4A. Logs describing the subsurface conditions encountered in the borings and CPT soundings are provided in Appendix A. The various geologic materials encountered at the site are described in more detail below.

4.2.1 Alluvial Floodplain Deposits (Qa)

Quaternary- age alluvial sediments primarily associated with the Ballona Creek drainage are believed to underlie the entire site to the maximum depth explored. The upper portion of these alluvial deposits (from a few feet above mean sea level down to about 35 feet or 40 feet below mean sea level) is typically poorly consolidated, and most commonly consists of interbedded lean and fat clay (CL or CH) and silt (ML and MH), with occasional beds of silty and clayey sand (SM and SC). The CPT data suggests that the fine-grained soils within this zone are typically soft to medium stiff, with estimated undrained shear strengths (Su) generally ranging from about 400 pounds per square foot (psf) to 1,000 psf. The sandy soils in this zone generally varied in thickness from about 2 feet to 5 feet and were typically loose in relative density based on correlations to the available SPT blow count data ($N_{60} < 10$).

At elevations approximately 35 feet or 45 feet below mean sea level (MSL), the density of the alluvium typically increases, and the beds of silty, clayey, and poorly graded sand (SM, SC, or SP) become more common. The corrected SPT blow counts in these deeper beds of sandy alluvium typically varied from 30 to 50 or more, indicating dense to very dense conditions. Most of the CPT soundings met with refusal within these deeper alluvial deposits, with the CPT tip resistance in excess of 300 tons per square foot (TSF). The fine-grained soil layers within the deeper alluvial deposits were typically stiff to very stiff in consistency, with undrained shear strengths (Su) from the CPT interpretations typically ranging from about 1,500 psf to 2,000 psf.

Laboratory tests indicate that the alluvium is moderate to highly compressible. The results of previous consolidation tests conducted on samples of the alluvium collected in the site vicinity are presented in Appendix B. These previous tests suggest that the upper alluvial deposits are essentially normally consolidated, with a slight over-consolidation in the deeper alluvium. Our previous settlement analyses indicate that a 10-foot fill load over the alluvium may result in roughly 10 inches to 20 inches of settlement (Group Delta, 2013). Based on settlement monitoring of surcharge fill loads placed at the Playa Vista Development, it appears that the settlement should typically be 90 percent completed within about 3 months to 6 months of the completion of the fill placement (Group Delta, 1999).

Shear wave velocities were previously measured at 7 locations for the Ballona Wetlands restoration project, with an average value of Vs_{30} of 202 m/s at these locations (Group Delta, 2013). The closest measurement to the subject site was in sounding A-SCPT-022, roughly 3,000 feet west of Lincoln Boulevard (Group Delta, 2013). The average shear wave velocity in the upper 100 feet of the soil profile (Vs_{30}) at the location of A-SCPT-022 was approximately 210 m/s.

4.2.2 Artificial Fill (af)

The existing bridge abutments are believed to be underlain by compacted fill, as well as hydraulic fill soils placed during the development of Marina Del Rey. The hydraulic fills are similar in composition to the underlying alluvium, as they were likely generated from these deposits.

Consequently, the hydraulic fill is not differentiated from the alluvium on the logs. Hydraulic fill was likely placed to roughly 0 feet to 5 feet (MSL), with conventional fill placed above that elevation.

The Artificial Fill (af) observed at the four borings locations conducted near the subject site was located at elevations ranging from 0 feet to 8 feet (MSL) or higher (Group Delta, 2013). As observed in these borings, the fill typically consisted of silty sand (SM) and sandy silt (ML) that is fine to medium-grained and moist. The corrected SPT blow counts (N_{60}) collected within the fill ranged from 5 to 11 and averaged 9. This indicates that the fill is loose on average. Higher-density compacted fill is anticipated at the bridge abutment locations due to typical construction and compaction requirements in such areas. However, supplemental investigations will be needed to characterize the fill at the precise abutment locations. Although not directly observed in the previous borings, some riprap is also anticipated within the fill, based on historic aerial photographs of Ballona Creek.

4.2.3 Groundwater

Groundwater was not measured in the exploratory borings and CPT soundings conducted for the most recent site investigation (Group Delta, 2013). However, temporary groundwater monitoring wells were established within four of the hollow stem borings conducted at the Playa Vista development immediately southeast of the Lincoln Boulevard bridge (Group Delta, 1999). The groundwater elevations at that location varied from roughly 2 feet to 5 feet (MSL) in December 1998. We understand that these monitoring wells were destroyed during the construction of the Playa Vista residential development. The final groundwater readings within these monitoring wells are summarized in the table below. The approximate monitoring well locations are shown in Figure 3A.

Observation Well ID	Groundwater Record Date	Ground Surface Elevation [FT]	Groundwater Depth [FT]	Groundwater Elevation [FT], MSL
B-304H	12/23/98	16.7	14.4	2.3
B-305H	12/23/98	17.4	14.9	2.5
B-313H	12/23/98	14.6	10.5	4.1
B-315H	12/23/98	15.4	10.0	5.4

We understand that water surface elevations in the Ballona Creek channel typically vary from roughly 2 feet to 5 feet (MSL), depending in part on tidal fluctuations. The flow height in the creek may rise to roughly 6 feet to 10 feet (MSL) during winter storm events. Note that the available plans suggest that the bottom of the Ballona Creek channel is located at about 0 feet, whereas the approach abutments vary in height from about 16 feet to 32 feet, as shown in Figure 2B. The High Groundwater Map suggests that groundwater levels may rise to about 5 feet below existing grades in the site vicinity (see Figure 4B, CDMG, 1998).

It should be noted that groundwater levels at the site are likely to be closely related to the water surface elevation within Ballona Creek. Floods within the channel may cause the groundwater levels to temporarily rise within the surrounding levees (although the concrete armor on the channel walls may increase the lag time in groundwater response). Groundwater levels may also fluctuate over time throughout the site due to changes in the water surface elevation and flow within the creek, as well as variations in rainfall, irrigation, or site drainage conditions.

5.0 AS-BUILT FOUNDATION DATA

The existing 2-lane bridge was constructed in 1937 (see Figures 1C and 1D). Available as-built drawings for subsequent improvements in the site vicinity between 1978 and 2010 show that the single-span bridge is roughly 50 feet wide and 130 feet long. The bridge includes a cast-in-place concrete deck and rails supported by steel girders that span beyond the two abutment walls. Each of the abutment walls is believed to be supported by groups of vertical driven timber piles. However, no as-built drawings showing the precise pile foundation configuration have been found. The existing bridge is also depicted in Figures 2A and 2B. Note that the second set of abutment walls located west of the existing Culver Boulevard Bridge was previously abandoned (along with the railroad trackway). The approximate locations of the abandoned walls are shown in Figure 2A. Selected as-built plans for the bridge and roadway are provided in Appendix C.

No details about the existing retaining walls or their foundations near the abutments on either side of Culver Boulevard were available.

6.0 SCOUR EVALUATION

The Culver Boulevard Bridge crosses Lincoln Boulevard. The potential for scour on the existing roadway is considered to be low. The FEMA Flood Maps and Tsunami Inundation Zones for the site are shown in Figures 7A and 7B. No site-specific scour information has been provided.

7.0 CORROSION EVALUATION

Corrosion tests were performed on selected samples collected from the previous exploratory borings at the site, as summarized in Table 2. The corrosion potential for the on-site soils was assessed in accordance with the Caltrans Corrosion Guidelines (Caltrans, 2021b). Caltrans defines a corrosive environment as an area where the soil has either a chloride concentration of 500 parts per million (ppm) or greater, a sulfate concentration of 1,500 ppm or greater, or a pH of 5.5 or less. The available test data indicates that the site soils are not corrosive based on Caltrans' criteria. However, additional corrosion testing should be conducted as part of the site-specific evaluation.

Table 2: Summary of Soil Corrosivity

Boring Number and Year	Sample Depth (feet)	pH	Chloride Content (ppm)	Sulfate Content (ppm)	Minimum Resistivity (ohm-cm)
B-304H	0 to 5	8.1	<10	130	250
B-305H	0 to 5	8.2	<10	120	240
B-313H	0 to 5	7.8	30	260	130

The available resistivity tests do suggest that the on-site soils may be extremely corrosive to buried metals, based on the nomography provided in Figure 855.3B of the 2020 Caltrans Highway Design Manual (Caltrans, 2020a). All three of the soil samples previously tested had minimum resistivities below 1,000 ohm-cm. This is indicative of corrosive soil since soil corrosion is associated with electrical conductivity. Typical corrosion control measures should be incorporated into the project design. A corrosion consultant may be referred for specific recommendations.

8.0 PRELIMINARY SEISMIC INFORMATION AND RECOMMENDATIONS

The project is located in a seismically active area, as shown on the Regional Fault Map, Figure 5A. A detailed Local Fault Map is provided in Figure 5B. Other potential geologic and seismic hazards include ground rupture, strong ground shaking, seismic settlement, slope instability, lateral spread, tsunamis, and earthquake-induced flooding. Each hazard is discussed in more detail below.

8.1 Ground Rupture

Ground rupture is the result of movement on an active fault reaching the ground surface. Known faults within 100 kilometers (km) of the site are shown on the Regional Fault Map, Figure 5A. The approximate locations of both the active and potentially active faults in the site vicinity are shown on the Local Fault Map, Figure 5B (Jennings, C. W., 1994).

The site is not located within an Alquist-Priolo Earthquake Fault Zone (CDMG, 1992), and no evidence of active or potentially active faulting was encountered during our previous site investigation or literature review. Consequently, ground rupture is not considered a significant geologic hazard at the site.

8.2 Seismicity and ARS Curve

The current Caltrans ARS Online tool (V3.0.2) was used to develop a preliminary design spectrum for the site located at a latitude of 33.9760° north, and a longitude of 118.4330° west. The ARS design spectrum incorporated an average shear wave velocity (Vs_{30}) of 210 m/s (or 690 ft/s), based on the direct shear wave velocity measurements conducted in CPT sounding A-SCPT-022.

The preliminary Caltrans ARS design spectrum for the site has a Peak Ground Acceleration (PGA) of 0.6g, as shown in Figure 6. The deaggregated mean earthquake moment magnitude (M) is 6.6 and the mean site-to-source distance (R) for the 1.0 seconds spectral acceleration is 16.6 kilometers. Note that loose soil at the site (N_{60}<10) would classify as Class S2 soil per Section 6.1.3 of the Caltrans Seismic Design Criteria, Version 2.0.

8.3 Liquefaction and Seismic Settlement

The site is located within an area previously identified as susceptible to liquefaction. Liquefaction involves the sudden loss in strength of a saturated, cohesionless soil (sand and non-plastic silts) caused by the build-up of pore water pressure during cyclic loadings, such as that produced by an earthquake. This increase in pore water pressure can temporarily transform the soil into a fluid mass, resulting in sand boils, settlement, and lateral ground deformations. Typically, liquefaction occurs in areas where there are loose to medium dense sands and silts, and where the depth to groundwater is less than 50 feet from the ground surface. In summary, three simultaneous conditions are required for liquefaction:

- Historic high groundwater within 50 feet of the ground surface
- Liquefiable soils such as loose to medium dense sands
- Strong shaking, such as that caused by an earthquake

The typical groundwater level at the site is approximately 5 feet MSL. The historic high groundwater associated with flooding is estimated at about 5 feet below the ground surface (see Figure 4B). Although the alluvium at the site is predominately clayey, it does contain frequent beds of loose to medium dense sand and silt and is located in close proximity to several active fault zones. Our analyses indicate that these loose to medium dense beds of sand and silt may liquefy during the design earthquake of 0.6g. The deeper alluvial deposits typically have corrected SPT blow counts above 30, and do not appear to be liquefiable.

The results of our liquefaction analyses are summarized in Appendix D. We performed the liquefaction calculations using the available nearby Cone Penetration Test (CPT) data (Group Delta, 2013). The triggering and settlement evaluations were based on the methods originally developed in the 1998 NCEER Workshops, as implemented in the commercially available computer program CLiq. The calculations were carried to the maximum depth of the available CPT soundings, although the bulk of the associated settlement typically occurred at depths of less than 50 feet below grade. For the analyses, we used a moment magnitude of 6.6, a PGA of 0.6g, and a typical groundwater elevation of 5 feet (MSL) during the earthquake (corresponding to a minimum depth of 7 feet below grade). Based on the results of our analyses, we estimate that the total liquefaction settlement associated with the Design level earthquake at the site should typically vary from about 1 inch to 3 inches.

Liquefaction settlement may result in a downdrag load on the piles, settlement of the approach embankments, and lateral spreading of the abutments. Liquefaction also creates the potential for loss of near-surface soil strength resulting in a reduced lateral pile capacity.

Dissipation of the excess porewater pressure generated in completely liquefied soils, and hence liquefaction-induced downdrag, does not occur until the cessation of ground shaking. Therefore, the effects of liquefaction-induced downdrag on the pile need not be considered in combination with the inertial component that occurs during shaking. Thus, in liquefied soils, a pile foundation needs to be designed to satisfy the seismic axial bearing stability requirements in compression extreme events for two different combinations – a) permanent loads and inertial loads resulting from the ground motion-induced inertia of the superstructure during the shaking, and b) permanent loads and liquefaction induced downdrag after the cessation of the shaking (Caltrans, 2020b).

8.4 Slope Instability and Lateral Spreads

Lateral spreading is the result of liquefaction or plastic deformation occurring on the sloping ground during an earthquake. Lateral spreading is typically characterized by blocks of mostly intact, surficial soil displacing down-slope or towards a free face along a shear zone that has formed within an underlying liquefied sediment. The definition of lateral spreading used in this section includes flow liquefaction or flow slide failure. Based on simplified empirical methods, there appears to be a strong potential for lateral spread of the Ballona Creek levees in the site vicinity. Previous analyses suggest that displacements along the levees may vary from roughly 6 inches to 18 inches (Group Delta, 2013).

Note that the precise location, depth, and density of the liquefiable layers at the abutment locations will greatly impact the seismic response and should be better defined through future subsurface investigation.

The presence of the abutment piles helps reduce the displacement at the abutment locations. Lateral spread analyses including soil-pile interaction may be conducted per Caltrans Geotechnical Manual (Caltrans, 2020c), Memo to Designers 20-15 (Caltrans, 2017b), and Attachment 1 to the memo for lateral spreading analysis. No site-specific subsurface data is available at the abutment locations.

8.5 Tsunamis, Seiches, and Flooding

The Ballona Creek channel drains a large portion of the Los Angeles basin, and seasonal storms are expected to produce floods within the channel beneath the Lincoln Boulevard bridge annually. Available as-built maps for the existing Lincoln Boulevard bridge suggest that the design flood level within the creek may be on the order of 6 feet MSL. The approximate 100-year and 500-year flood zones are shown on the FEMA Flood Maps, Figure 7A. The ultimate 100-year design water surface level should be determined by the bridge designer and shown on the bridge plans.

The site is located about 3 km northeast of a breakwater in the Pacific Ocean, and the Ballona Creek channel bottom is only a few feet above mean sea level. The relatively close proximity to the ocean suggests that the potential may exist for flooding in the event that an earthquake-induced tsunami was to travel up the Ballona Creek channel. However, the existence of the offshore barrier islands and the configuration of the continental shelf in southern California have historically provided relief from such tsunamis. The ten largest tsunamis that occurred within the Pacific Ocean over the last century did not significantly impact the region.

Studies by the Army Corps of Engineers (US Army, 1974) suggest that a 500-year tsunami within the Pacific Ocean may result in a water surface runup of about 14 feet above tidal elevations (U.S. Army, 1974). The California Emergency Management Agency's Tsunami Inundation Map is shown in Figure 7B. This map suggests that a tsunami may travel up the Ballona Creek channel beyond the subject site. Note that the top of the existing bridge is located at an elevation of about 32 feet at the abutment locations, as shown in Figure 2A. The potential for damage to the bridge from flooding or a tsunami within the Ballona Creek channel should be evaluated by the project design team.

9.0 PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

The remainder of this report presents preliminary recommendations for the design of the proposed bridge and retaining wall foundations. These recommendations are based on empirical and analytical methods typical of the standards of practice in southern California. If these recommendations do not appear to cover a specific feature of the project, please feel free to contact our office for additions or revisions. These recommendations should be considered preliminary and subject to revision based on the findings of the supplemental field investigation.

9.1 Foundation Type

Based on the structural drawings the abutments for the new bridge are supported on a group of Cast-In-Drilled-Hole (CIDH) piles. The abutment retaining walls are also anticipated to be supported on large diameter CIDH piles. These foundation systems are feasible for supporting the bridge and the retaining wall structure. Alternatively, Cast-In-Steel-Shell (CISS) piles may also be used for supporting the abutments and the retaining walls.

To resist lateral spreading seismic displacements, large diameter (36-inch or greater) CIDH, or CISS pile foundation systems are recommended for supporting the bridge abutments.

Large diameter CIDH piles are feasible, but special construction techniques (slurry, casing, etc.) and integrity testing (gamma-gamma logging) will be required due to shallow groundwater and caving prone soils.

CISS piles are driven pipe piles that are filled with cast-in-place reinforced concrete no deeper than the shell tip elevation. Since CISS piles are driven, noise issues should be considered in the pile type selection process due to proximity to the residential development.

Our preliminary liquefaction settlement analyses indicate that the bottom of the liquefiable layers may extend to elevations -25 feet to -30 feet. With proposed pile cut-offs at or around the elevation of 0 to 5 feet, downdrag loads may be experienced along up to 30 to 35 feet of the pile length, negating any pile resistance down to about El. -40 feet within the denser alluvial deposits.

For cost-estimating purposes, we recommend that an average nominal (ultimate) soil skin friction resistance of 1.5 ksf, and 2 ksf be assumed below El. -40 feet for CIDH piles and CISS piles, respectively, for estimation of the pile lengths. This will likely result in pile lengths of about 70 to 85 feet, tipping at elevations between -65 feet to -80 feet.

Smaller diameter driven piles are not recommended due to unfavorable subsurface soil conditions as the site is classified as S2 per the SDC V2.0., Section 6.1, and Section 6.2.3. Shallow foundations are not feasible for supporting the bridge structure due to seismic settlement and lateral spreading issues.

9.2 CIDH and CISS Construction Considerations

Due to high groundwater, a wet method of construction will need to be utilized for CIDH piles. Temporary casing will need to be used for the construction of the piles and the temporary casing will need to be left in place near the ground surface to prevent water from flooding into the construction. The casings may be installed by an oscillatory or rotary method.

For wet construction, slurry should be used as drilling fluid per Caltrans Standard Specifications Section 49 (Caltrans, 2022). To maintain the hole sidewall and bottom stability, and to help reduce and potential for anomalies, it is essential that a positive slurry head of no less than 10 feet above the groundwater table be maintained at all times during drilling and concrete placement. The tip resistance of the CIDH piles should be ignored in axial capacity calculations due to the wet method of construction. A permanent casing may also need to be considered within a portion of the pile length in contact with channel water or soft soils near the invert of the Ballona Creek channel.

CISS piles are driven piles that are filled with cast-in-place reinforced concrete no deeper than the shell tip elevation. A soil plug should be left at the bottom of the CISS piles so that the pile is not undermined due to water intrusion. A 20-foot-long soil plug usually provides an adequate seal at the bottom of the pile.

Site-specific issues such as noise and vibration should be considered for this site due to its proximity to residential development. When site-specific subsurface data is available, drivability analysis should also be performed for the CISS piles.

9.3 Approach Fill Settlement and Waiting Period

Based on the general plan of the planning study, a significant amount of cut, and fill will be required to accommodate the longer new Culver Blvd bridge, particularly at the eastern abutment. The approach embankments will also be widened as well as raised several feet in profile grades. Due to the presence of soft to stiff saturated clayey/silty layers some long-term consolidation settlement should be anticipated due to grade increase and a waiting period will be required before driving abutment piles. The time required for settlement to take place will be determined based on final embankment geometry and amount of fill placed, soil types and consolidation properties, layer thickness, and single versus double drainage conditions. Waiting periods in general can be reduced by temporary surcharge and/or wick drains.

Our previous settlement analyses indicate that a 10-foot-high abutment fill load over the alluvium may result in roughly 10 inches to 20 inches of settlement (Group Delta, 2013). Based on settlement monitoring of surcharge fill loads placed at the Playa Vista Development, it appears that such settlement should typically be substantially completed within about 3 months to 6 months of the completion of the fill placement (Group Delta, 1999). Consequently, a waiting period of 90 days to 180 days may be needed for the installation of the piles at the abutment locations, if additional fill loads are proposed. The waiting period should begin after the new abutments are constructed to full height. Construction of the approach slabs and pavement should also be delayed until the waiting period is completed. Note that if the abutment piles are installed prior to fill placement, a drag log would be imparted on the piles which would result in a reduced axial pile capacity.

Settlement monuments should be installed in all new fill areas. The monuments should be surveyed regularly until the settlement is deemed substantially complete. Settlement monitoring should be performed in general accordance with CT112. Installation of the abutment piles and settlement sensitive surface improvements should be delayed until the settlement is deemed substantially complete based on the survey data. The Geotechnical Engineer should review the settlement data to determine when sufficient settlement is completed for the installation of the piles.

9.4 Abutment Approach Retaining Walls

Based on the general plan of the planning study, the abutment retaining walls are stepped with a height of about 25 feet and 15 feet and each step is about 25 feet long on either side of Culver Boulevard. Pile-supported retaining walls (Type 1 or similar) supported on large diameter (36-inch or greater in diameter) CIDH or CISS piles are recommended for the bridge abutments. The piles should be designed with considerations for downdrag due to liquefaction, as well as lateral spreading displacements.

Alternatively, Mechanically Stabilized Embankment (MSE) walls (Caltrans Pre-Designed) may be used at abutment approaches since PGA is no more than 0.6g at the site. However, since substantial static settlement is anticipated as a result of the construction of the MSE embankments, an adequate waiting period during construction, or preloading the abutment area should be implemented to avoid static downdrag on the abutment piles.

9.4.1 Retaining Wall External Loading

The retaining walls will have level backfill and be subject to normal street vehicular and live load surcharge, as well as seismic loading. Since the PGA at the site is estimated as 0.6g, the pseudo-static acceleration coefficient should be ⅓ of the PGA or K_h=0.2g per Seismic Design of Retaining Walls (Caltrans, 2021c).

9.4.2 Retaining Wall Site Constraints

Since vehicular traffic along Culver Boulevard during the construction is proposed to be diverted there is no site constraint related to the vehicular traffic along the street. The existing overhead utilities around the existing bridge may need to be protected in place, removed, or relocated as appropriate.

10.0 ADDITIONAL FIELDWORK AND LABORATORY TESTING

Additional field exploration and laboratory testing will be needed in order to provide geotechnical information adequate for final design development. One rotary wash boring and one CPT sounding are proposed at each of the bridge abutment locations, as shown in the Exploration Plan, Figure 3B. We recommend that the borings be drilled using the rotary wash method due to the presence of shallow groundwater. In the CPT soundings, shear wave velocities should be measured at 5-foot depth intervals to aid in site-specific seismic hazard analysis. All of the borings and CPT soundings should be extended to a minimum depth of 100 feet below the ground surface or refusal.

Laboratory tests should be conducted on samples collected from the proposed rotary wash borings to supplement the previous testing shown in Appendix B. All tests should be performed in accordance with applicable Caltrans and ASTM standards. As a minimum, additional soil classification, corrosion, and consolidation tests should be conducted on soils collected within the upper 50 feet of the ground surface to aid in the supplemental geotechnical analyses. Additional shear and unconfined compression tests should also be conducted to aid in pile capacity analyses.

11.0 LIMITATIONS

This report was prepared in accordance with generally accepted Geotechnical Engineering principles and practice. The professional engineering work and judgments presented in this report meet the standard of care of our profession at this time. No other warranty, expressed or implied, is made. This report has been prepared for PSOMAS and their design consultants. It may not contain sufficient information for other parties or other purposes and should not be used for other projects or other purposes without review and approval by Group Delta.

The recommendations for this project, to a high degree, are dependent upon proper quality control of site grading, fill and backfill placement, and pile foundation installation. The recommendations are made contingent on the opportunity for Group Delta to observe the earthwork operations. This firm should be notified of any pertinent changes in the project, or if conditions are encountered in the field, which differ from those described herein. If parties other than Group Delta are engaged to provide such services, they must be notified that they will be required to assume complete responsibility for the geotechnical phase of the project and must either concur with the recommendations in this report or provide alternate recommendations.

12.0 REFERENCES

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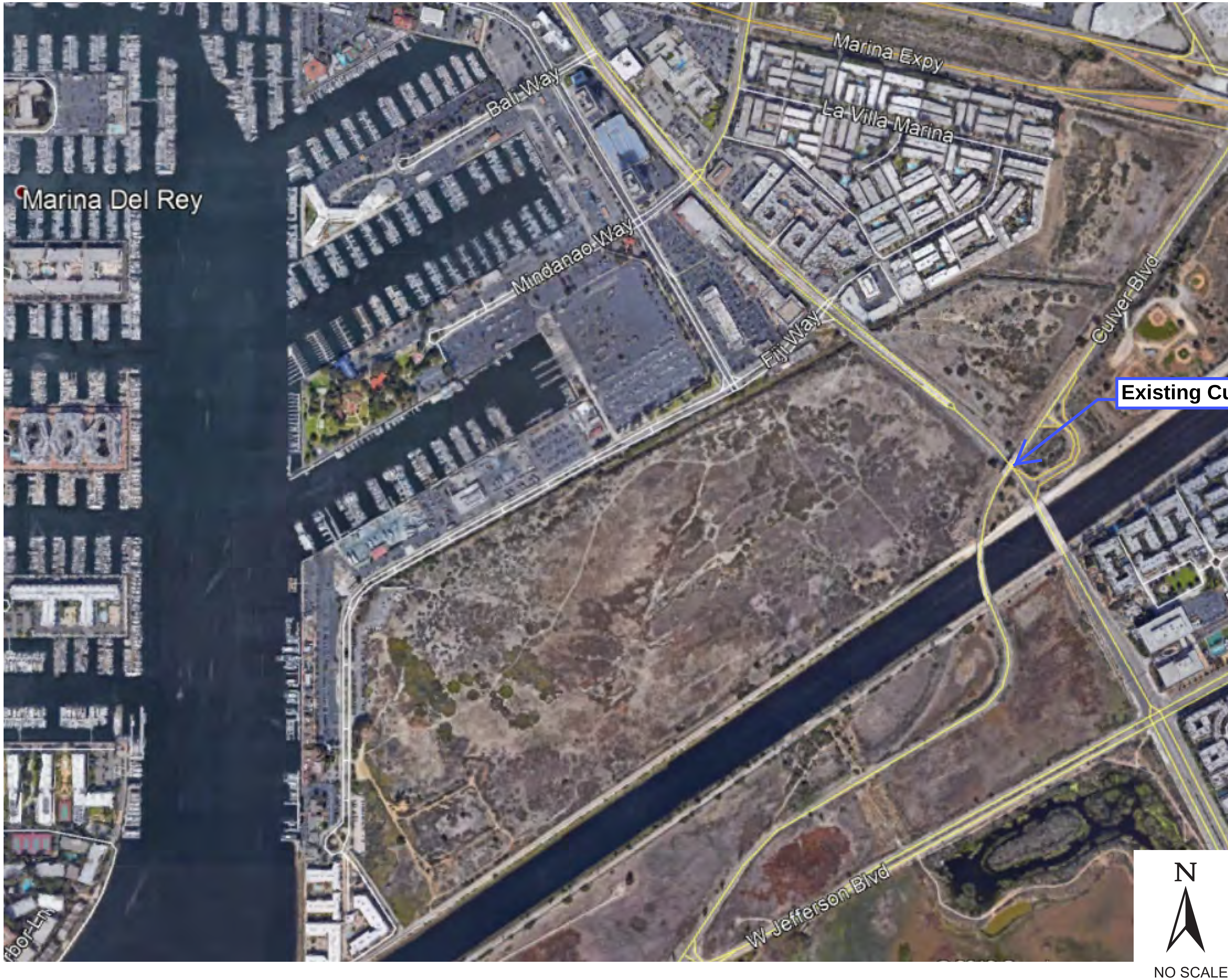
FIGURES

GROUP DELTA CONSULTANTS, INC. ENGINEERS AND GEOLOGISTS 370 AMAPOLA AVENUE, SUITE 212 TORRANCE, CALIFORNIA	PROJECT NUMBER LA1590
	DOCUMENT NUMBER
PROJECT NAME Culver Boulevard Bridge Replacement	FIGURE NUMBER 1A

SITE LOCATION MAP



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370 AMAPOLA AVENUE, SUITE 212
TORRANCE CALIFORNIA

PROJECT NAME
Culver Boulevard Bridge Replacement

PROJECT NUMBER
LA1590

DOCUMENT NUMBER

FIGURE NUMBER
1B

SITE VICINITY PLAN

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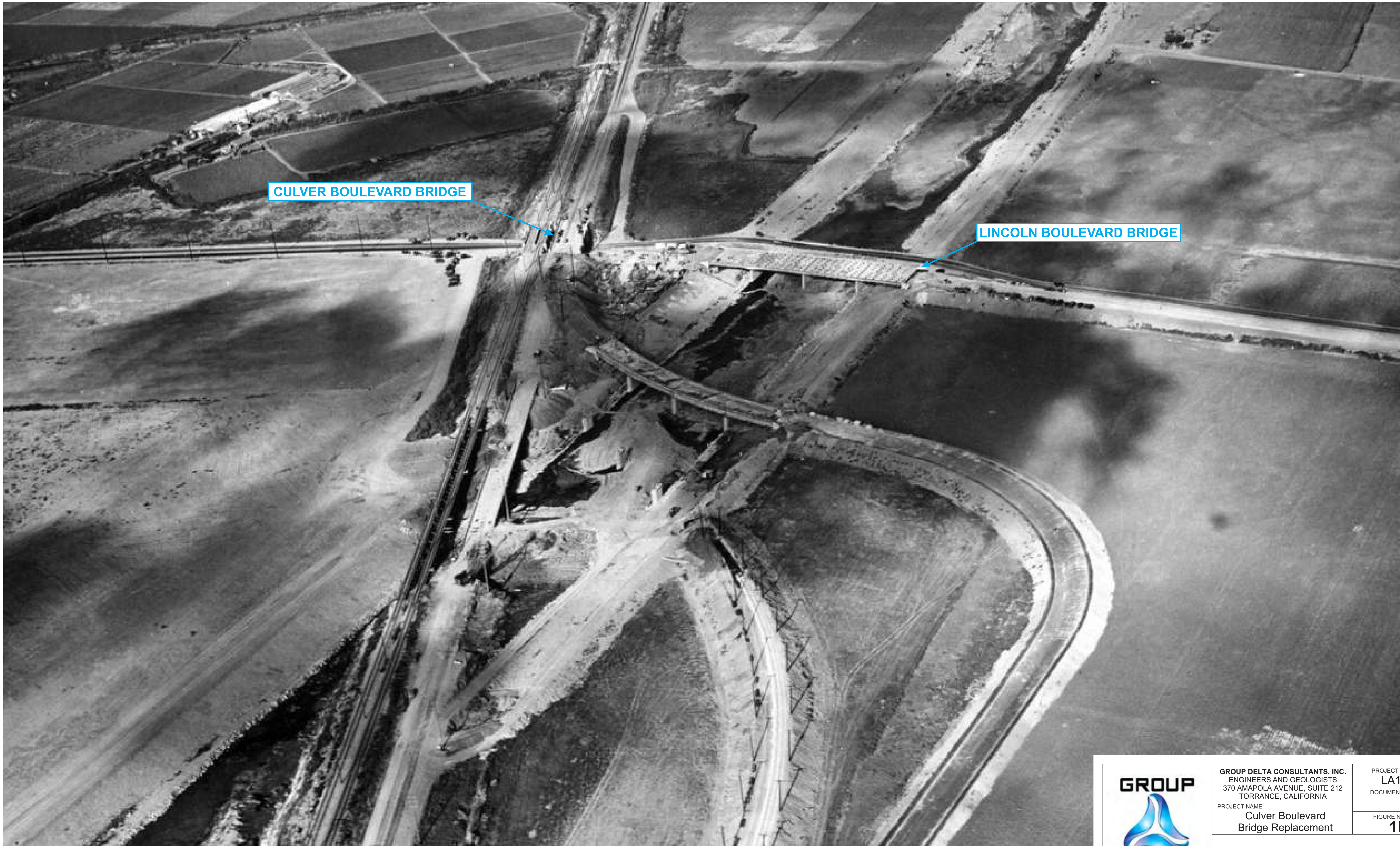
370 AMAPOLA AVENUE, SUITE 212
TORRANCE, CALIFORNIA

PROJECT NAME Culver Boulevard Bridge Replacement	PROJECT NUMBER LA1590
	DOCUMENT NUMBER
	FIGURE NUMBER 1C

SITE PHOTOGRAPH (2018)



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TORRANCE, CALIFORNIA

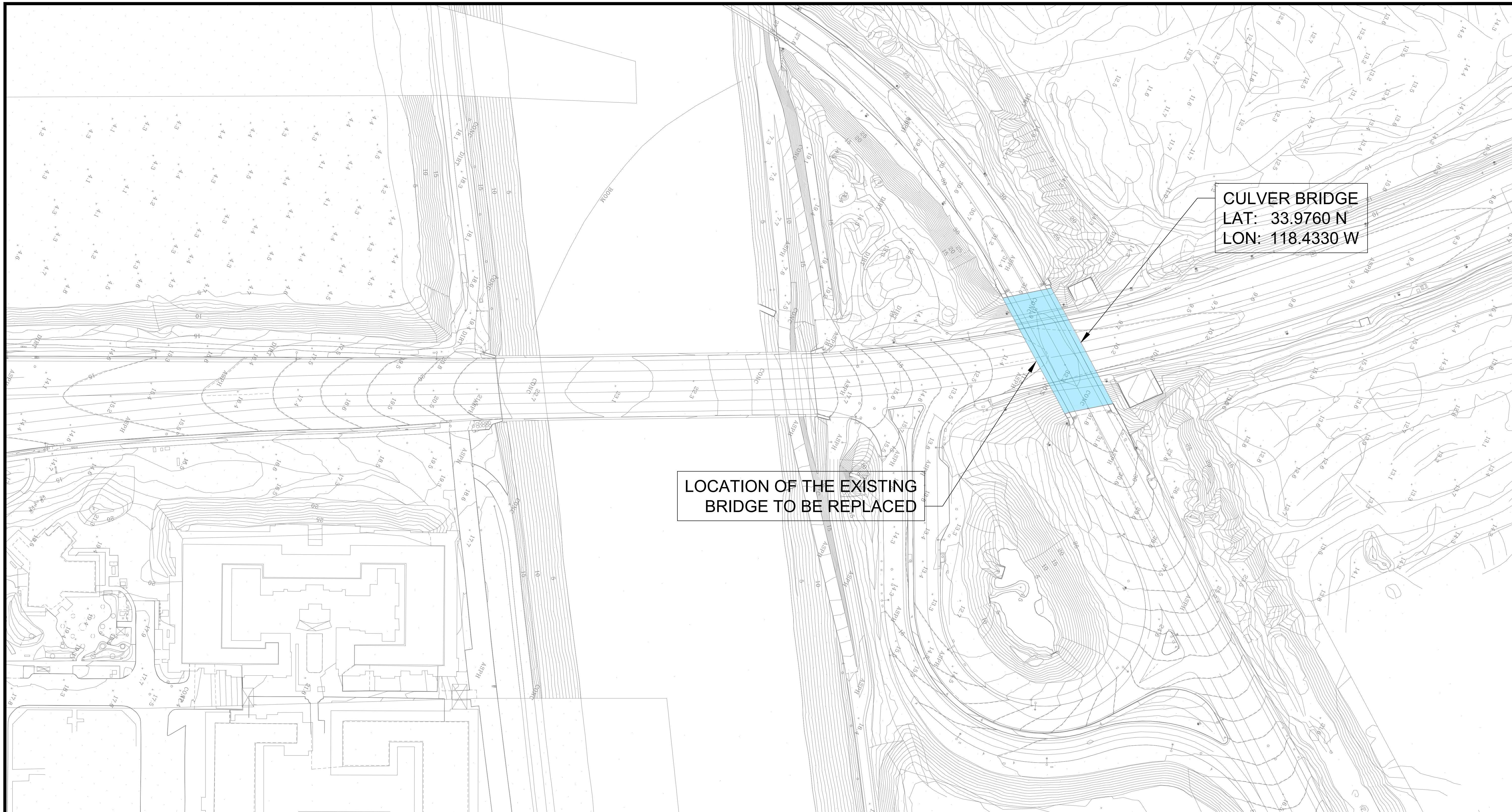
PROJECT NUMBER
LA1590

DOCUMENT NUMBER

PROJECT NAME
Culver Boulevard
Bridge Replacement

FIGURE NUMBER
1D

SITE PHOTOGRAPH (1937)



0 100' 200'

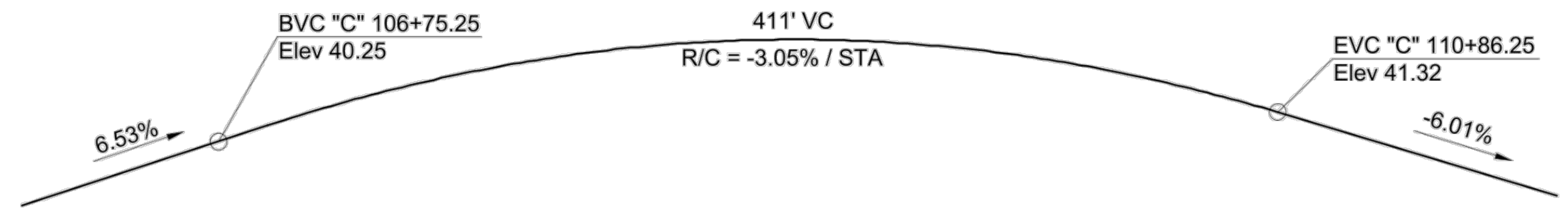
REFERENCE: PLANNING STUDY, CALTRANS, 2022

GROUP DELTA	GROUP DELTA CONSULTANTS, INC. ENGINEERS AND GEOLOGISTS 370 AMAPOLA AVENUE, SUITE 212 TORRANCE, CALIFORNIA	PROJECT NUMBER: LA1590
PREPARED BY: JMR	PROJECT NAME: CULVER BOULEVARD BRIDGE REPLACEMENT	FIGURE NUMBER: 2A
REVIEWED BY: AP	PROPOSED DEVELOPMENT	

FILE PATH: N:\Projects\1500-1599\LA1590 Psomas Lincoln Bridge and Culver Bridge SPGR\600 Drafting\LA1590 Figs 2A-2B-Culver Bridge.dwg
PLOTTED DATE: 10/26/2022 1:58:57 PM SAVED BY: josemiguelt

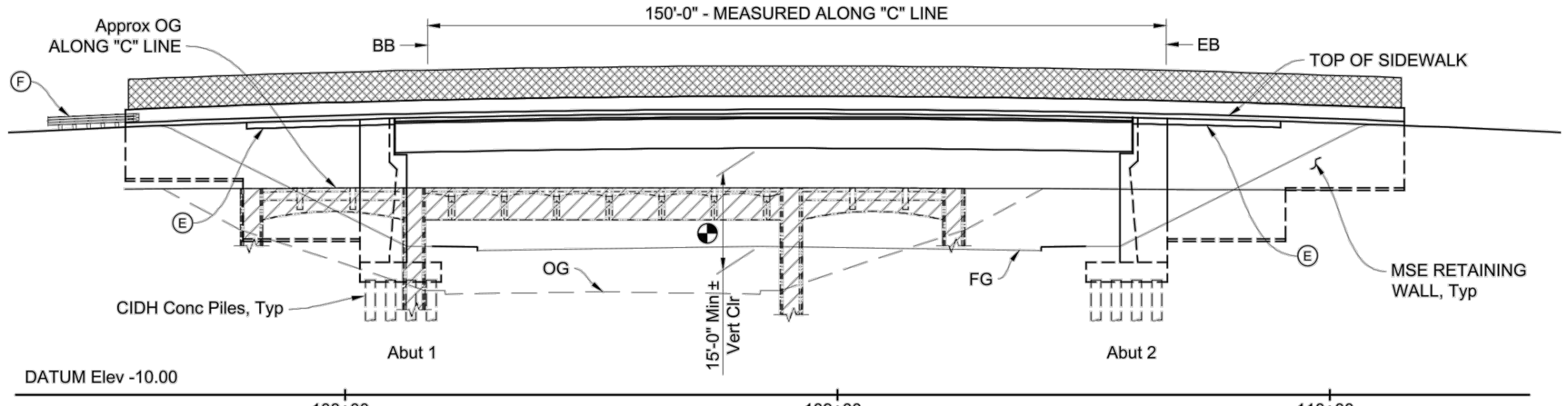
DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT
7	LA		

CNS ENGINEERS, INC.
11870 PIERCE ST, STE 265
RIVERSIDE, CA 92505



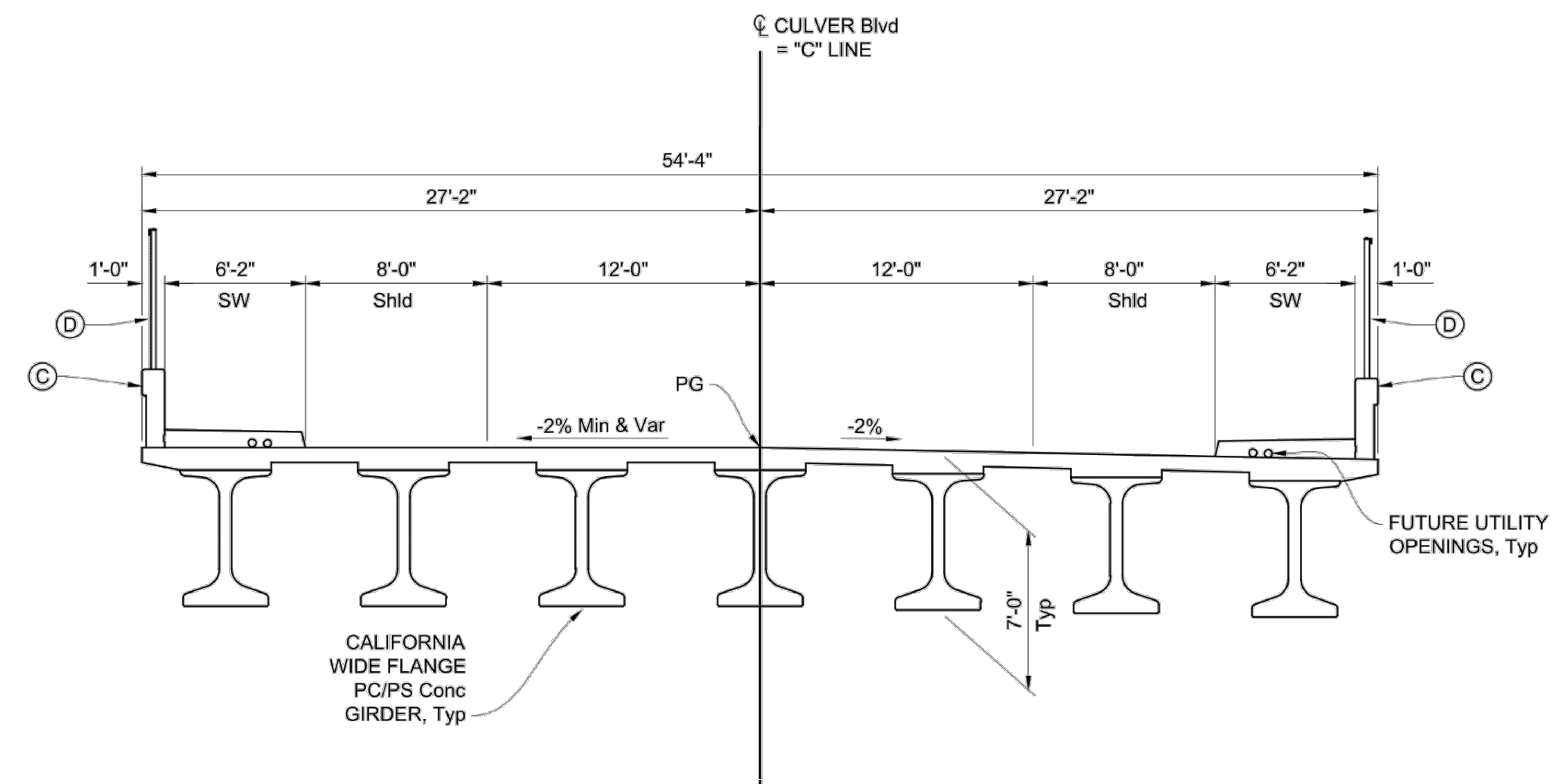
PROFILE GRADE

NO SACLE



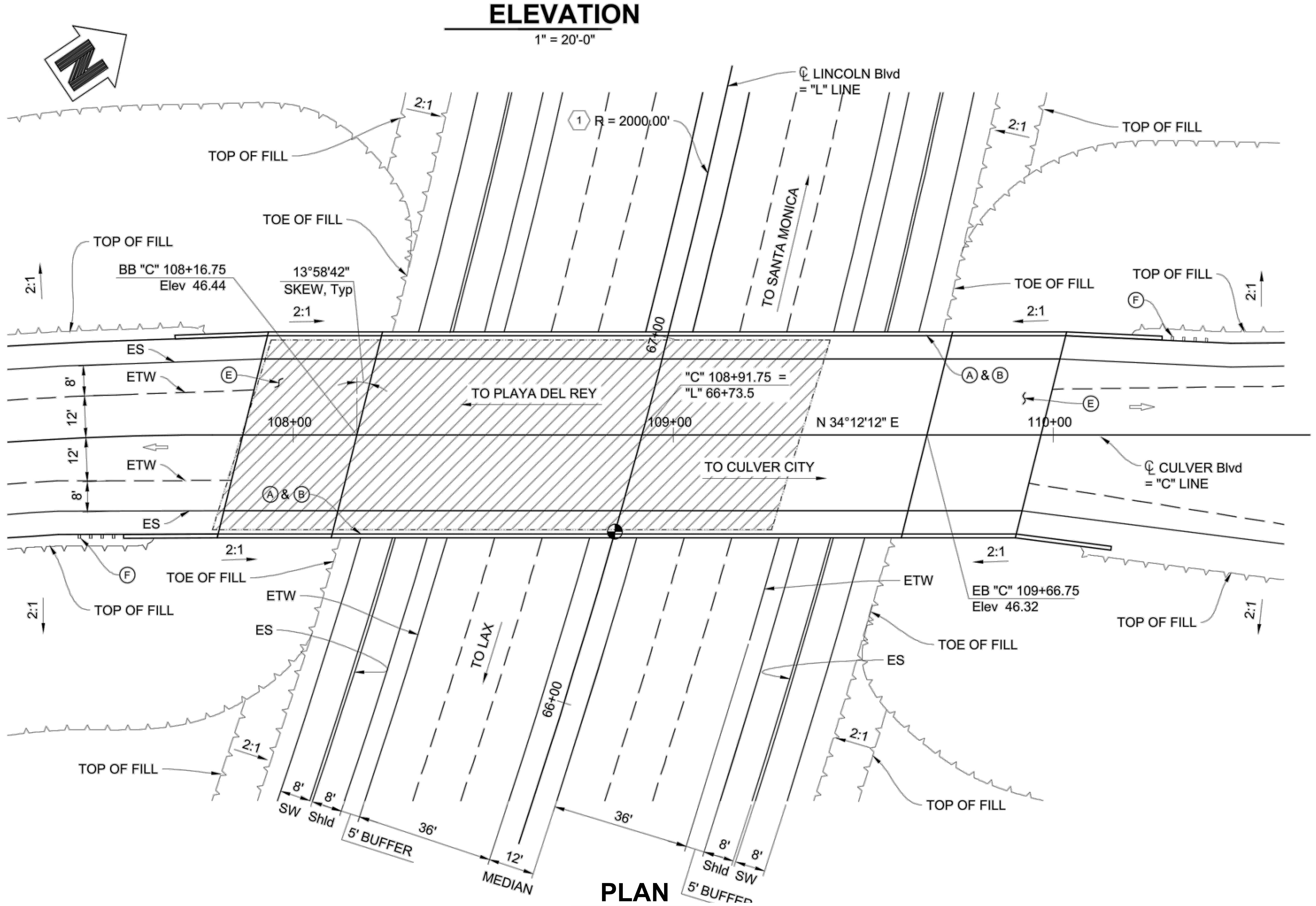
ELEVATION

1" = 20'-0"



TYPICAL SECTION

1" = 5'-0"



PLAN

1" = 20'-0"

LEGEND:

- Exist Structure
- New Construction
- Traffic Direction
- Bridge Removal
- Point of Minimum Vertical Clearance

KEY NOTES:

- (A) Paint "Br. No. ---"
- (B) Paint "CULVER BLVD OC"
- (C) Conc Barrier, Type 732SW (Mod)
- (D) Chain Link Railing, Type 7
- (E) Structure Approach, Type N (30S)
- (F) MGS, see "ROAD PLANS"

NOTE:

Date of Estimate		10/01/2021
Str Depth	=	7'-0"
Length	=	150'-0"
Width	=	54'-4"
Area	=	8,150 sqft
Avg Cost per Sq Ft Including 10% Mobilization & 25% Contingency	=	$782.00
Total Cost	=	$6,372,000

CURVE DATA TABLE

CURVE No.	R	Δ	T	L
1	2000.00'	25°36'56.00"	886.72'	894.15'

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TORRANCE, CALIFORNIA

PROJECT NUMBER: LA1590

PREPARED BY: JMR

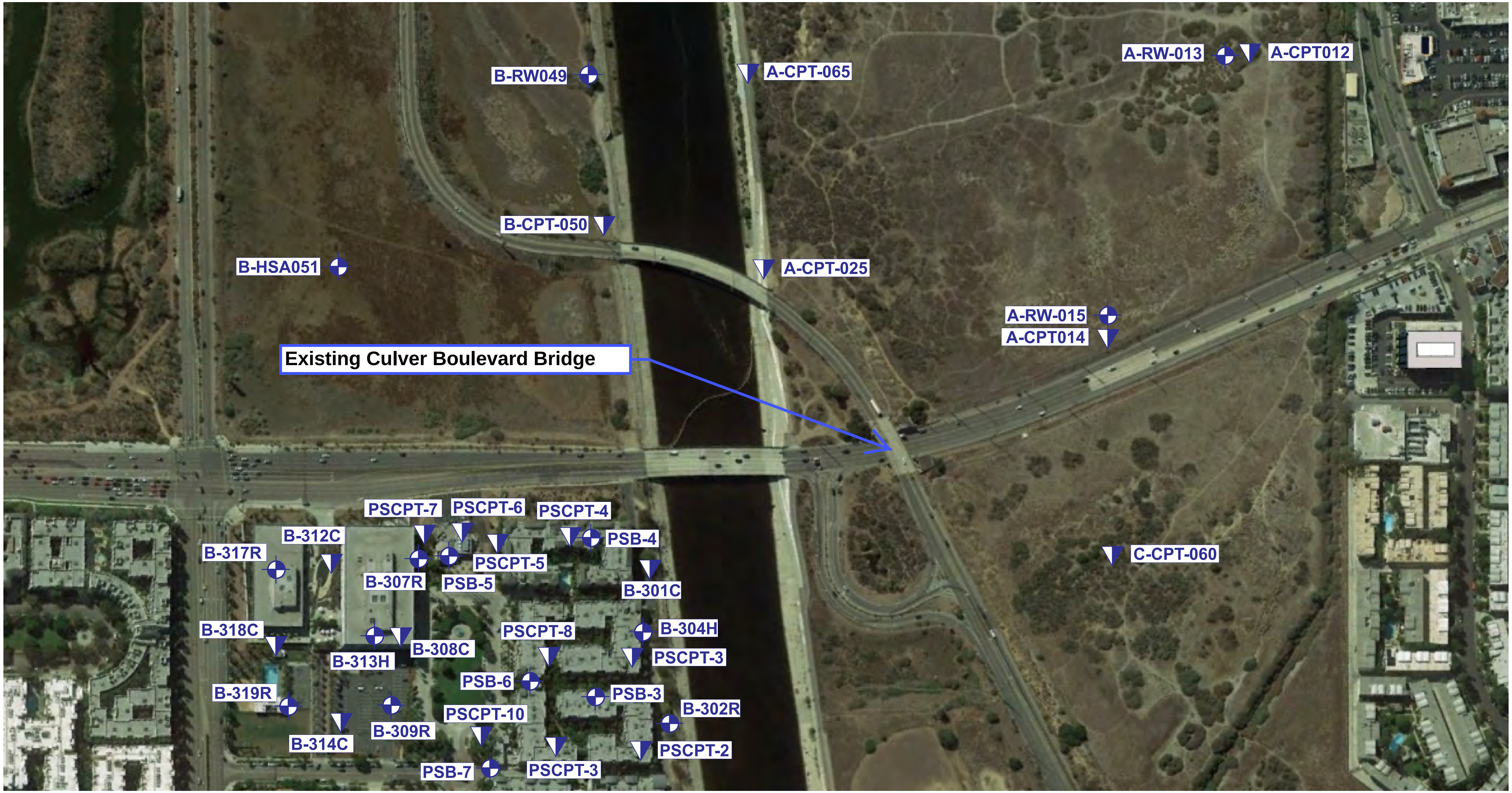
PROJECT NAME: CULVER BOULEVARD BRIDGE REPLACEMENT

FIGURE NUMBER: 2B

REVIEWED BY: AP

PROPOSED DEVELOPMENT

REFERENCE: PLANNING STUDY, CALTRANS, 2022



EXPLANATION:

B-HSA051 ⊕ Approximate locations of the existing borings in close proximity to the site (A, B or C prefix~ Group Delta, PS~Pacific Soils).

A-CPT-065 ▽ Approximate locations of existing CPT soundings in close proximity to the site (A, B or C ~ Group Delta, PS ~ Pacific Soils).

N

NO SCALE

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TORRANCE, CALIFORNIA

PROJECT NUMBER
LA1590

DOCUMENT NUMBER

PROJECT NAME
Culver Boulevard
Bridge Replacement

FIGURE NUMBER
3A

EXISTING EXPLORATIONS

EXPLANATION:

- ● Approximate locations of the 2 proposed exploratory borings
- ○ Approximate locations of the 2 proposed exploratory CPT soundings

NO SCALE

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PROJECT NAME
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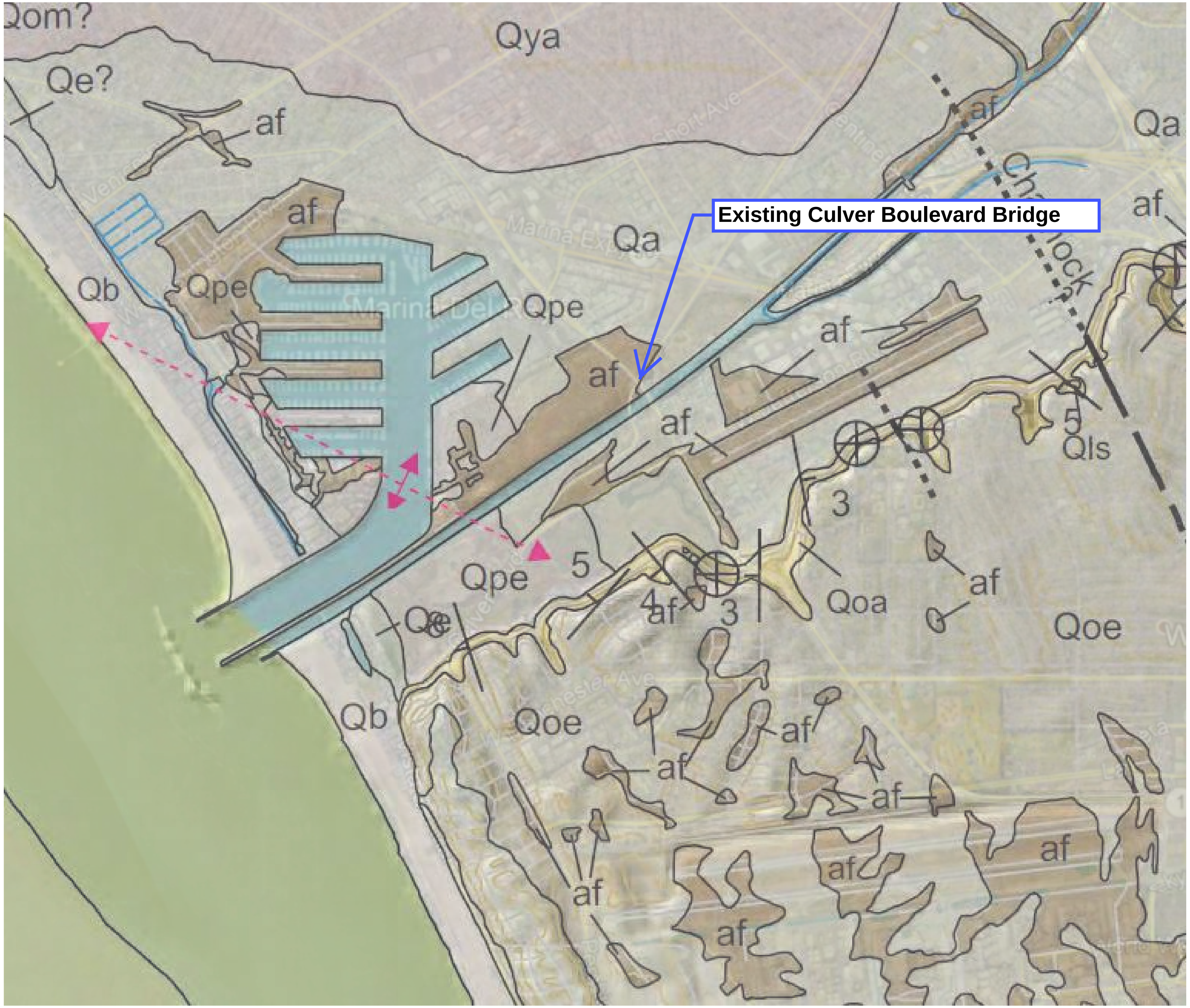
Bridge Replacement

PROJECT NUMBER
LA1590

DOCUMENT NUMBER

FIGURE NUMBER
3B

EXPLORATION PLAN



ABBREVIATED EXPLANATION

HOLOCENE

af	Artificial fill
Qw	Active channel and wash deposits
Qa	Alluvial flood plain deposits
Qls	Landslide deposits
Qb	Beach deposits
Qe	Eolian deposits
Qpe	Paralic estuarine deposits
Qyf	Young alluvial fan and valley deposits, undivided a = sand, s = silt, c = clay
Qyf2	Young alluvial fan deposits, unit 2
Qyf1	Young alluvial fan deposits, unit 1
Qya	Young alluvial flood plain deposits, unit 1
Qye	Young eolian deposits
Qype	Young paralic estuarine deposits

PLEISTOCENE

Qof	Old alluvial fan and valley deposits, undivided a = sand, s = silt, c = clay
Qoa	Old alluvial flood plain deposits, undivided
Qoe	Old eolian deposits
Qom	Old marine deposits, undivided
Qop	Old paralic deposits, undivided, a = sand, s = silt, c = clay
Qlh	La Habra Formation
	San Pedro Formation
Qsp	San Pedro Formation, undivided
Qspt	Timms Point Silt Member
Qspl	Lomita Marl Member
Qi	Inglewood Formation

Qp	Pleistocene sedimentary deposits, undivided

N

NO SCALE

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PROJECT NUMBER LA1590

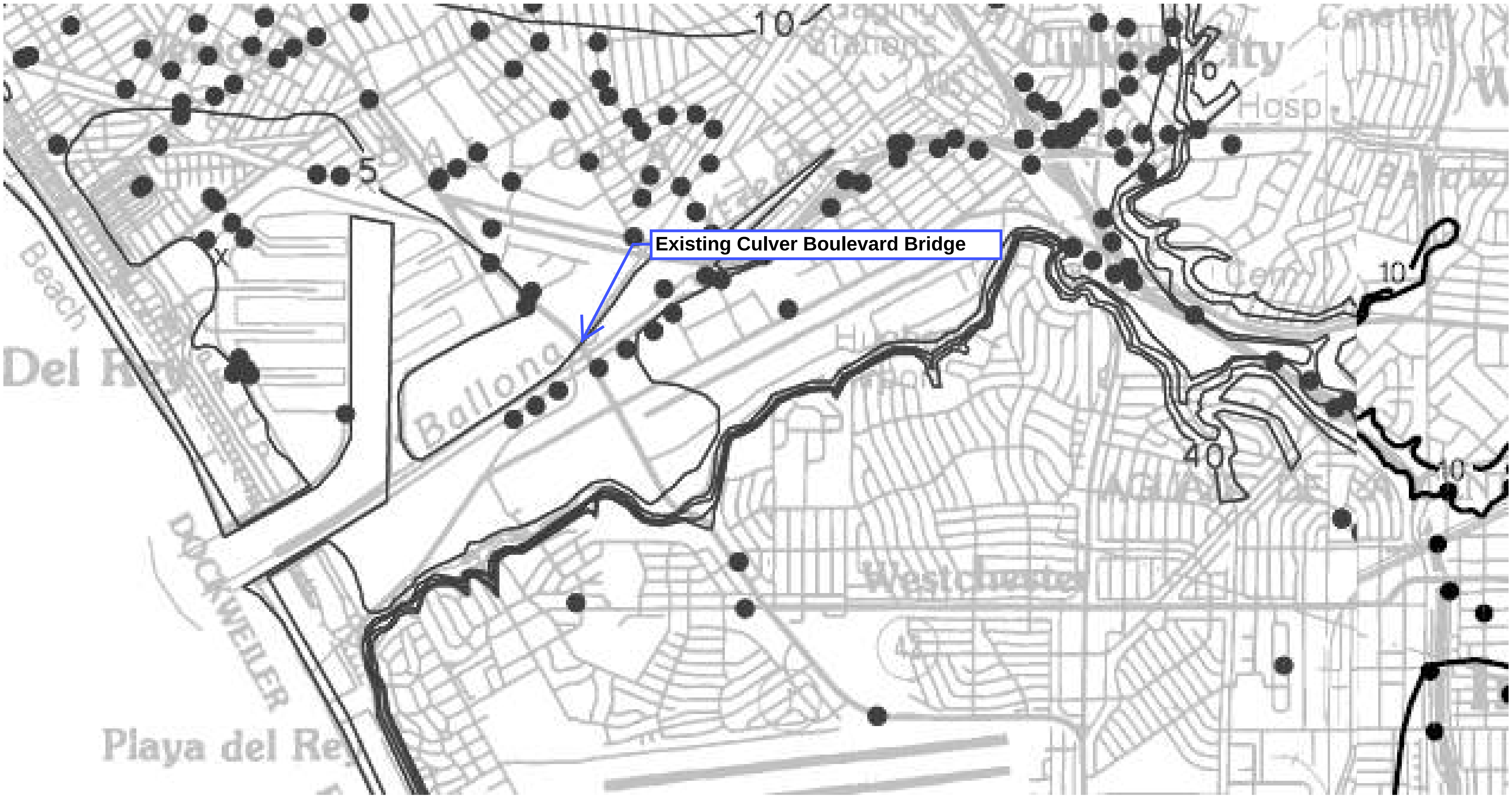
DOCUMENT NUMBER

PROJECT NAME Culver Boulevard Bridge Replacement

FIGURE NUMBER 4A

LOCAL GEOLOGIC MAP

REFERENCE: Saucedo et al. (2003). *Geologic Map of the Long Beach 30'x60' Quadrangle, California*, CGS, Scale 1:100,000.



EXPLANATION:

● Approximate location of borehole used to collect groundwater data.

— 5 — Approximate depth to historic high groundwater in feet.

REFERENCE: California Geologic Survey (1998). Seismic Hazard Zone Report for the Venice & Inglew

N

NO SCALE

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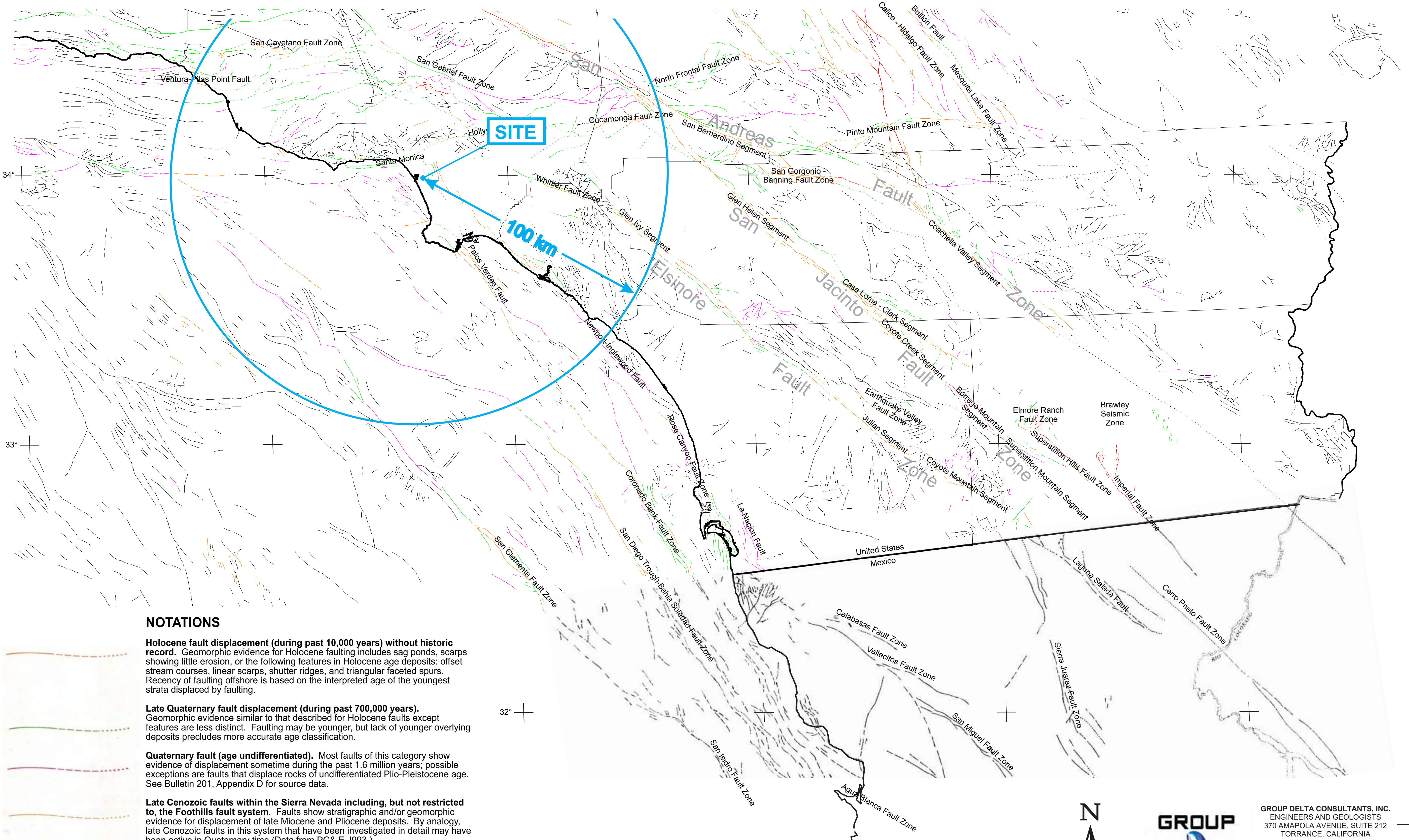
PROJECT NUMBER: LA1590

DOCUMENT NUMBER

PROJECT NAME: Culver Boulevard Bridge Replacement

FIGURE NUMBER: 4B

HIGH GROUNDWATER MAP



NOTATIONS

Holocene fault displacement (during past 10,000 years) without historic record. Geomorphic evidence for Holocene faulting includes sag ponds, scarps showing little erosion, or the following features in Holocene age deposits: offset stream courses, linear scarps, shutter ridges, and triangular faceted spurs. Recency of faulting offshore is based on the interpreted age of the youngest strata displaced by faulting.

Late Quaternary fault displacement (during past 700,000 years). Geomorphic evidence similar to that described for Holocene faults except features are less distinct. Faulting may be younger, but lack of younger overlying deposits precludes more accurate age classification.

Quaternary fault (age undifferentiated). Most faults of this category show evidence of displacement sometime during the past 1.6 million years; possible exceptions are faults that displace rocks of undifferentiated Plio-Pleistocene age. See Bulletin 201, Appendix D for source data.

Late Cenozoic faults within the Sierra Nevada including, but not restricted to, the Foothills fault system. Faults show stratigraphic and/or geomorphic evidence for displacement of late Miocene and Pliocene deposits. By analogy, late Cenozoic faults in this system that have been investigated in detail may have been active in Quaternary time (Data from PG&E, I993.)

Pre-Quaternary fault (older than 1.6 million years) or fault without recognized Quaternary displacement. Some faults are shown in this category because the source of mapping used was of reconnaissance nature, or was not done with the object of dating fault displacements. Faults in this category are not necessarily inactive.

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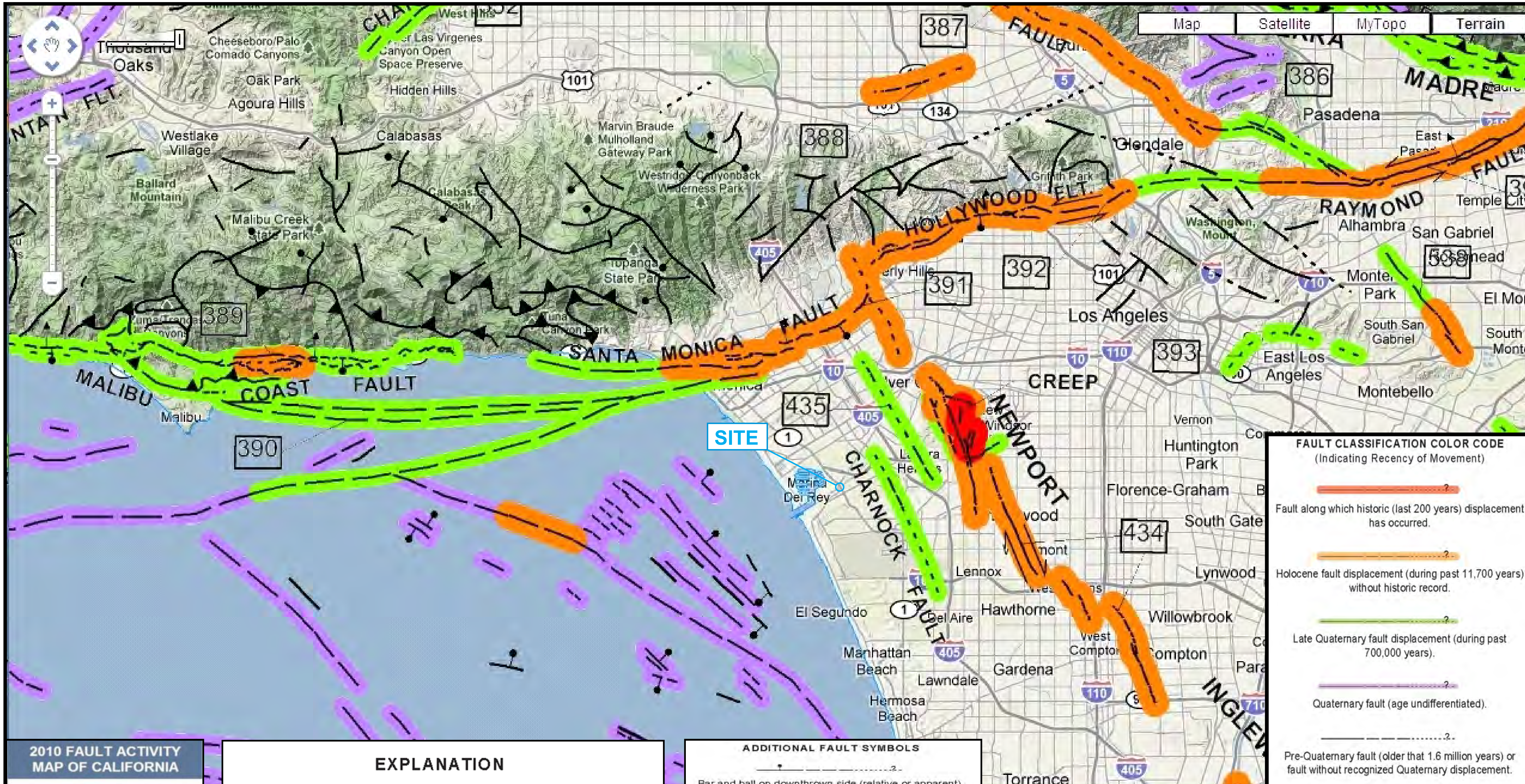
PROJECT NUMBER: LA1590

DOCUMENT NUMBER:

PROJECT NAME: Culver Boulevard Bridge Replacement

FIGURE NUMBER: 5A

REGIONAL FAULT MAP



2010 FAULT ACTIVITY MAP OF CALIFORNIA

California Geological Survey, Geologic Data Map No. 6

Compilation and Interpretation by: Charles W. Jennings and William A. Bryant

Graphics by: Milind Patel, Ellen Sander, Jim Thompson, Barbara Wanish and Milton Fonseca

EXPLANATION

Fault traces on land are indicated by solid lines where well located, by dashed lines where approximately located or inferred, and by dotted lines where concealed by younger rocks or by lakes or bays. Fault traces are queried where continuation or existence is uncertain.

ADDITIONAL FAULT SYMBOLS

Bar and ball on downthrown side (relative or apparent).

Arrows along fault indicate relative or apparent direction of lateral movement.

Arrow on fault indicates direction of dip.

Low angle fault (barbs on upper plate).

N

NO SCALE

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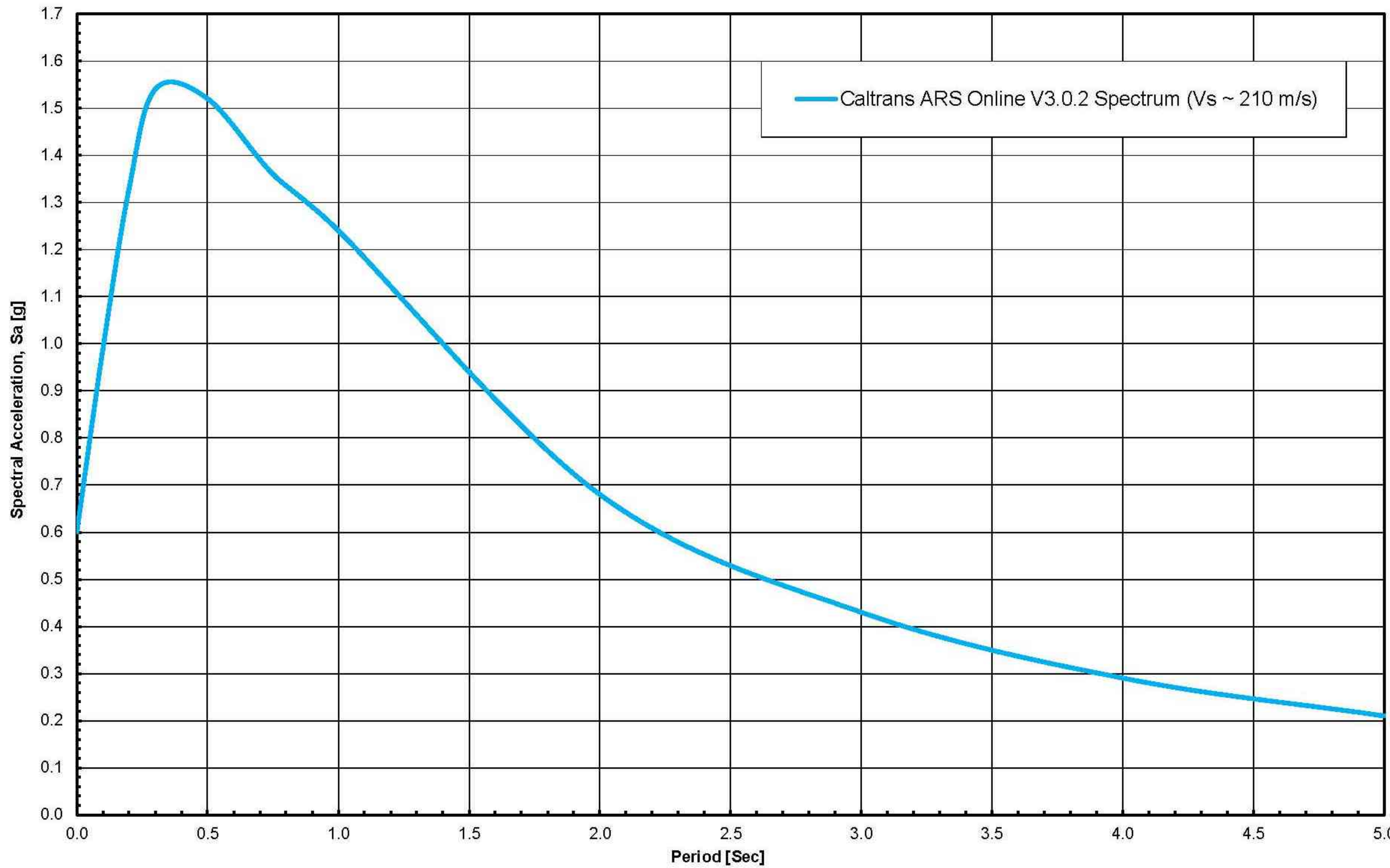
TORRANCE, CALIFORNIA

PROJECT NUMBER	LA1590
DOCUMENT NUMBER	
PROJECT NAME	Culver Boulevard Bridge Replacement
FIGURE NUMBER	5B

LOCAL FAULT MAP



Caltrans ARS Online Design Spectrum

Period [Sec]	Sa [g]
0	0.6
0.10	0.990
0.20	1.330
0.30	1.540
0.50	1.520
0.75	1.360
1.00	1.240
2.00	0.680
3.00	0.430
4.00	0.290
5.00	0.210

Mean magnitude (for PGA) = 6.6
Mean site-source distance (for Sa at 1s) = 16.6 km

REFERENCE: CALTRANS (2019). *ARS Online, Version V3.0.2,* http://dap3.dot.ca.gov/ARS_Online/, October 11, 2022.

GROUP DELTA

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ENGINEERS AND GEOLOGISTS
370 AMAPOLA AVENUE, SUITE 212
TORRANCE, CALIFORNIA

PROJECT NUMBER
LA1590

DOCUMENT NUMBER

PROJECT NAME
Culver Boulevard
Bridge Replacement

FIGURE NUMBER
6

SITE RESPONSE SPECTRUM

N
NO SCALE

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370 AMAPOLA AVENUE, SUITE 212
TORRANCE, CALIFORNIA

PROJECT NAME
Culver Boulevard Bridge Replacement

PROJECT NUMBER
LA1590

DOCUMENT NUMBER

FIGURE NUMBER
7A

FEMA FLOOD MAPS

REFERENCE: California Emergency Management Agency (2018). *FEMA Flood Plains and California Specific Flood Areas.*

REFERENCE: California Emergency Management Agency (2018). *Tsunami Emergency Response Planning Zone, Recommended Evacuation Area.*

GROUP DELTA CONSULTANTS, INC. ENGINEERS AND GEOLOGISTS 370 AMAPOLA AVENUE, SUITE 212 TORRANCE, CALIFORNIA	PROJECT NUMBER LA1590
	DOCUMENT NUMBER
PROJECT NAME Culver Boulevard Bridge Replacement	FIGURE NUMBER 7B

TSUNAMI INUNDATION ZONE

APPENDIX A
EXISTING FIELD DATA

APPENDIX A
EXISTING FIELD DATA (Group Delta, 2013)

APPENDIX A

EXISTING FIELD DATA

No site-specific subsurface explorations have yet been conducted. The approximate locations of eight explorations we have proposed at the site are shown on the Exploration Plan, Figure 3B. To aid in the preparation of this preliminary report, we reviewed three previous investigations conducted in relatively close proximity to the Lincoln Boulevard Multi-Modal Improvement Project between 1998 and 2013. The approximate locations of these existing explorations located within about 1,500 feet of the subject site are shown on the Existing Explorations, Figure 3A.

The field and laboratory data from our most recent geotechnical investigation for the Ballona Wetlands Restoration Project was still available, and is reproduced in the following Figures A-1 through A-10 (GDC, 2013). Photocopies of the previous subsurface explorations we conducted for the Playa Vista development located southeast of the Lincoln Boulevard bridge are attached as the second Appendix A (GDC, 1999). Photocopies of the previous explorations conducted by others for the Playa Vista development are attached as the third Appendix A (Pacific Soils Engineering, 1998).

The previous field exploration program for the Ballona Wetlands Restoration Project included the advancement of three rotary wash borings, one hollow stem boring, and six cone penetrometer test (CPT) soundings. These 10 explorations were completed between September 14th and October 16th, 2012. Disturbed samples were collected from the borings using a 2-inch diameter Standard Penetration Test (SPT) sampler. Less disturbed samples were also collected using a 3-inch outside diameter ring lined sampler (a modified California sampler). These samples were sealed in plastic bags, labeled, and returned to the laboratory for testing. For each sample, the number of blows needed to drive the sampler 12 inches was recorded on the logs. The drive samples were collected from the borings using an automatic hammer with an Energy Transfer Ratio (ETR) of about 84 percent. The field blow counts (N) were normalized to approximate a standard 60 percent ETR as shown on the logs (N_{60}). Undisturbed Shelby-Tube samples, as well as bulk soil samples were also collected at selected intervals. Logs describing the subsurface conditions encountered in the four previous borings are shown in Figures A-1 to A-4, immediately after the Boring Record Legends.

The cone penetrometer (CPT) soundings were advanced by either Gregg In-Situ or Kehoe Testing and Engineering in general accordance with ASTM D5778. Integrated electronic circuitry was used to measure the tip resistance (Qc) and skin friction (Fs) while the CPT was advanced into the soil with hydraulic down pressure. A piezometer located behind the cone tip also measured transient pore pressure (u). The nearby CPT data from our 2013 Ballona Wetland study is presented in Figures A-5 through A-10. Note that the first figure for each CPT sounding presents the raw data (Figures A-5a through A-10a). The estimated undrained strength (Su) and Soil Behavior Type Index (Ic) is shown in detail in Figures A-5b through A-10b. The Soil Behavior Type (SBT) profiles from the program CPeT-IT v2.0.1.55 are presented along with the raw data in color coded logs at the end of each CPT sounding. Note that the soil interpretations are a function of the normalized cone resistance and friction ratio (Robertson, 2010).

APPENDIX A

EXISTING FIELD DATA (Continued)

The previous exploratory boring and CPT locations were determined by visually estimating, pacing and taping distances from landmarks shown on the available plans. The supplemental borings proposed for the Foundation Report should be surveyed by Psomas. The exploration locations shown in Figures 3A and 3B should not be considered more accurate than is implied by the method of measurement used and the scale of the map. The lines designating the interface between differing soil materials on the logs may be abrupt or gradational. Further, soil conditions at locations between the explorations may be substantially different from those at the specific locations explored. It should be noted that the passage of time may also result in changes in the soil conditions reported in the logs.

SOIL IDENTIFICATION AND DESCRIPTION SEQUENCE

Sequence	Identification Components	Refer to Section: Field	Refer to Section: Lab	Required	Optional
1	Group Name	2.5.2	3.2.2	●	
2	Group Symbol	2.5.2	3.2.2	●	
	Description Components				
3	Consistency of Cohesive Soil	2.5.3	3.2.3	●	
4	Apparent Density of Cohesionless Soil	2.5.4		●	
5	Color	2.5.5		●	
6	Moisture	2.5.6		●	
7	Percent or Proportion of Soil	2.5.7	3.2.4	●	⬭
7	Particle Size	2.5.8	2.5.8	●	⬭
7	Particle Angularity	2.5.9			○
7	Particle Shape	2.5.10			○
8	Plasticity (for fine-grained soil)	2.5.11	3.2.5		○
9	Dry Strength (for fine-grained soil)	2.5.12			○
10	Dilatency (for fine-grained soil)	2.5.13			○
11	Toughness (for fine-grained soil)	2.5.14			○
12	Structure	2.5.15			○
13	Cementation	2.5.16		●	
14	Percent of Cobbles and Boulders	2.5.17		●	
14	Description of Cobbles and Boulders	2.5.18		●	
15	Consistency Field Test Result	2.5.3		●	
16	Additional Comments	2.5.19			○

Describe the soil using descriptive terms in the order shown

Minimum Required Sequence:

USCS Group Name (Group Symbol); Consistency or Density; Color; Moisture; Percent or Proportion of Soil; Particle Size; Plasticity (optional).

⬭ = optional for non-Caltrans projects

Where applicable:

Cementation; % cobbles & boulders; Description of cobbles & boulders; Consistency field test result

REFERENCE: Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010).

HOLE IDENTIFICATION

Holes are identified using the following convention:

H – YY – NNN

Where:

H: Hole Type Code

YY: 2-digit year

NNN: 3-digit number (001-999)

Hole Type Code and Description

Hole Type Code	Description
A	Auger boring (hollow or solid stem, bucket)
R	Rotary drilled boring (conventional)
RC	Rotary core (self-cased wire-line, continuously-sampled)
RW	Rotary core (self-cased wire-line, not continuously sampled)
P	Rotary percussion boring (Air)
HD	Hand driven (1-inch soil tube)
HA	Hand auger
D	Driven (dynamic cone penetrometer)
CPT	Cone Penetration Test
O	Other (note on LOTB)

Description Sequence Examples:

SANDY lean CLAY (CL); very stiff; yellowish brown; moist; mostly fines; some SAND, from fine to medium; few gravels; medium plasticity; PP=2.75.

Well-graded SAND with SILT and GRAVEL and COBBLES (SW-SM); dense; brown; moist; mostly SAND, from fine to coarse; some fine GRAVEL; few fines; weak cementation; 10% GRANITE COBBLES; 3 to 6 inches; hard; subrounded.

Clayey SAND (SC); medium dense, light brown; wet; mostly fine sand,; little fines; low plasticity.

GROUP DELTA

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Lincoln Boulevard Bridge Replacement

Psomas

BORING RECORD LEGEND #1

GROUP SYMBOLS AND NAMES

Graphic / Symbol	Group Names	Graphic / Symbol	Group Names
GW	Well-graded GRAVEL Well-graded GRAVEL with SAND	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
GP	Poorly graded GRAVEL Poorly graded GRAVEL with SAND		
GW-GM	Well-graded GRAVEL with SILT Well-graded GRAVEL with SILT and 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
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	ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with 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	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
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND		
GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL 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
SW	Well-graded SAND Well-graded SAND with GRAVEL		
SP	Poorly graded SAND Poorly graded SAND with GRAVEL	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
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)	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
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)	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
SM	SILTY SAND SILTY SAND with GRAVEL		
SC	CLAYEY SAND CLAYEY SAND with GRAVEL	OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY elastic ELASTIC SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
SC-SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL		
PT	PEAT	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
	COBBLES COBBLES and BOULDERS BOULDERS		

FIELD AND LABORATORY TESTING

C	Consolidation (ASTM D 2435)
CL	Collapse Potential (ASTM D 5333)
CP	Compaction Curve (CTM 216)
CR	Corrosion, Sulfates, Chlorides (CTM 643; CTM 417; CTM 422)
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	Liquid Limit, Plastic Limit, Plasticity Index (AASHTO T 89, AASHTO T 90)
PL	Point Load Index (ASTM D 5731)
PM	Pressure Meter
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)
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)

SAMPLER GRAPHIC SYMBOLS

- Standard Penetration Test (SPT)
- Standard California Sampler
- Modified California Sampler (2.4" ID, 3" OD)
- Shelby Tube
- Piston Sampler
- NX Rock Core
- HQ Rock Core
- Bulk Sample
- Other (see remarks)

DRILLING METHOD SYMBOLS

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

WATER LEVEL SYMBOLS

- First Water Level Reading (during drilling)
- Static Water Level Reading (after drilling, date)

Definitions for Change in Material

Term	Definition	Symbol
Material Change	Change in material is observed in the sample or core and the location of change can be accurately located.	solid line
Estimated Material Change	Change in material cannot be accurately located either because the change is gradational or because of limitations of the drilling and sampling methods.	dashed line
Soil / Rock Boundary	Material changes from soil characteristics to rock characteristics.	wavy lines

REFERENCE: Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010).

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BORING RECORD LEGEND #2

CONSISTENCY OF COHESIVE SOILS				
Description	Shear Strength (tsf)	Pocket Penetrometer, PP, Measurement (tsf)	Torvane, TV, Measurement (tsf)	Vane Shear, VS, Measurement (tsf)
Very Soft	Less than 0.12	Less than 0.25	Less than 0.12	Less than 0.12
Soft	0.12 - 0.25	0.25 - 0.5	0.12 - 0.25	0.12 - 0.25
Medium Stiff	0.25 - 0.5	0.5 - 1	0.25 - 0.5	0.25 - 0.5
Stiff	0.5 - 1	1 - 2	0.5 - 1	0.5 - 1
Very Stiff	1 - 2	2 - 4	1 - 2	1 - 2
Hard	Greater than 2	Greater than 4	Greater than 2	Greater than 2

APPARENT DENSITY OF COHESIONLESS SOILS	
Description	SPT N_{60} (blows / 12 inches)
Very Loose	0 - 5
Loose	5 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	Greater than 50

MOISTURE	
Description	Criteria
Dry	No discernable moisture
Moist	Moisture present, but no free water
Wet	Visible free water

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

PARTICLE SIZE		
Description		Size (in)
Boulder		Greater than 12
Cobble		3 - 12
Gravel	Coarse	3/4 - 3
	Fine	1/5 - 3/4
Sand	Coarse	1/16 - 1/5
	Medium	1/64 - 1/16
	Fine	1/300 - 1/64
Silt and Clay		Less than 1/300

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.

REFERENCE: Caltrans Soil and Rock Logging, Classification, and Presentation Manual (2010), with the exception of consistency of cohesive soils vs. N_{60}.

Plasticity

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

CONSISTENCY OF COHESIVE SOILS	
Description	SPT N_{60} (blows/12 inches)
Very Soft	0 - 2
Soft	2 - 4
Medium Stiff	4 - 8
Stiff	8 - 15
Very Stiff	15 - 30
Hard	Greater than 30

Ref: Peck, Hansen, and Thornburn, 1974, "Foundation Engineering," Second Edition.

Note: Only to be used (with caution) when pocket penetrometer or other data on undrained shear strength are unavailable. Not allowed by Caltrans Soil and Rock Logging and Classification Manual, 2010.

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Project No. LA1590

Lincoln Boulevard Bridge Replacement

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BORING RECORD LEGEND #3

BORING RECORD

PROJECT NAME	PROJECT NUMBER	BORING
Lincoln Bridge Multi-Modal Improvement Project	LA1345	**A-RW013**

SITE LOCATION	START	FINISH	SHEET NO.
Ballona Wetlands	9/26/2012	9/26/2012	1 of 3

DRILLING COMPANY	DRILLING METHOD	LOGGED BY	CHECKED BY
Cascade Drilling	Rotary Wash	N. Briffa	P. Kashighandi

DRILLING EQUIPMENT	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GROUND WATER (ft)
CME 85	3.875	56.5	13.8	▼ / *na*

SAMPLING METHOD	NOTES
Hammer: 140 lbs., Drop: 30 in.	ETR ~ 84%, N_{60} ~ 84/60 * N ~ 1.40 * N

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	DEPTH (feet)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
0	13.8	Bulk	B-1									**Artificial Fill (af):** Silty Sand (SM), brown, dry, fine to coarse grained sand, fine to coarse gravel, few organics, trace shell fragments, denser than other locations in Area A.
5		Ring	R-2	0 4 3	7	7	20	117		5		-Loose, no organics, few shell fragments.
10		SPT	S-3	3 4 4	8	11			PA	10		**Alluvium (Qa):** Sandy Silt (ML), olive brown, wet, medium stiff, highly micaceous, some oxidation. (0% Gravel; 16% Sand; 84% Fines)
15		Ring	R-4	0 0 2	2	2	48	71	PA PI C	15		Lean Clay (CL), olive brown, wet, soft, medium plasticity, highly micaceous, some oxidation. Vane Shear = 0.3 ksf (0% Gravel; 12% Sand; 88% Fines) (LL~47; PL~27; PI~20)
20		SPT	S-5	0 1 1	2	3			PI	20		Fat Clay (CH), gray, wet, soft, few fine grained sand, high plasticity, trace shell fragments, H2S odor. (LL~56; PL~28; PI~28)

Elevation scale: 10, 5, 0, -5, -10

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FIGURE A-1 a

BORING RECORD

PROJECT NAME Lincoln Bridge Multi-Modal Improvement Project		**PROJECT NUMBER** LA1345		**BORING** A-RW013
SITE LOCATION Ballona Wetlands	**START** 9/26/2012	**FINISH** 9/26/2012		**SHEET NO.** 2 of 3
DRILLING COMPANY Cascade Drilling	**DRILLING METHOD** Rotary Wash	**LOGGED BY** N. Briffa		**CHECKED BY** P. Kashighandi
DRILLING EQUIPMENT CME 85	**BORING DIA. (in)** 3.875	**TOTAL DEPTH (ft)** 56.5	**GROUND ELEV (ft)** 13.8	**DEPTH/*ELEV.* GROUND WATER (ft)** ▼ / *na*
SAMPLING METHOD Hammer: 140 lbs., Drop: 30 in.	**NOTES** ETR ~ 84%, N_{60} ~ 84/60 * N ~ 1.40 * N			

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	DEPTH (feet)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
		Shelby tube	SH-6									**Alluvium (Qa):** Fat Clay (CH), gray, wet, soft, few fine grained sand, high plasticity, trace shell fragments, H2S odor.
	-15											Lean Clay (CL), gray, wet, medium stiff, trace coarse grained sand, medium plasticity. NOTE: Increase in stiffness at bottom. (LL~34; PL~18; PI~16) Vane Shear = 1.2 ksf
30		Ring	R-7	5 5 6	11	10	15	115	PI	30		
	-20											Silty Sand (SM), gray, wet, loose, fine grained sand, trace fine gravel.
35		SPT	S-8	3 3 3	6	8				35		
	-25											Fat Clay (CH), gray, moist, stiff, medium to high plasticity, interbedded with Silt (ML), gray, wet, stiff, trace fine grained sand, medium plasticity.
40		Ring	R-9	4 4 6	10	9	57	69		40		
	-30											
45		SPT	S-10	3 3 4	7	10				45		Peat (PT), brown, moist, firm, 4" layer of Fat Clay (CH), tree stump or branch >3".
	-35											Poorly Graded Sand with Silt (SP-SM), gray, wet, dense, fine to medium sand, trace organics (wood fibers).

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FIGURE A-1 b

BORING RECORD

PROJECT NAME	Lincoln Bridge Multi-Modal Improvement Project
PROJECT NUMBER	LA1345
BORING	A-RW013
SITE LOCATION	Ballona Wetlands
START	9/26/2012
FINISH	9/26/2012
SHEET NO.	3 of 3
DRILLING COMPANY	Cascade Drilling
DRILLING METHOD	Rotary Wash
LOGGED BY	N. Briffa
CHECKED BY	P. Kashighandi
DRILLING EQUIPMENT	CME 85
BORING DIA. (in)	3.875
TOTAL DEPTH (ft)	56.5
GROUND ELEV (ft)	13.8
DEPTH/*ELEV.* GROUND WATER (ft)	▼ / *na*
SAMPLING METHOD	Hammer: 140 lbs., Drop: 30 in.
NOTES	ETR ~ 84%, N_{60} ~ 84/60 * N ~ 1.40 * N

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	DESCRIPTION AND CLASSIFICATION
			R-11	22 27 35	62	58	21	104		**<u>Alluvium (Qa):</u>** Poorly Graded Sand with Silt (SP-SM), gray, wet, dense, fine to medium grained sand, trace organics (wood fibers).
	-40									Poorly graded Sand with Gravel (SP), gray, wet, dense, fine to medium grained sand, few coarse grained sand, fine to coarse gravel, trace clay.
55			S-12	15 24 25	49	69				
	-45									Boring terminated at 56.5 ft. Groundwater not measured. Boring backfilled with bentonite grout. This boring was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).
60										
	-50									
65										
	-55									
70										
	-60									

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THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.

FIGURE A-1 c

BORING RECORD

PROJECT NAME	Lincoln Bridge Multi-Modal Improvement Project
PROJECT NUMBER	LA1345
BORING	A-RW015
SITE LOCATION	Ballona Wetlands
START	10/2/2012
FINISH	10/2/2012
SHEET NO.	1 of 3
DRILLING COMPANY	Cascade Drilling
DRILLING METHOD	Rotary Wash
LOGGED BY	N. Briffa/JW
CHECKED BY	P. Kashighandi
DRILLING EQUIPMENT	CME 85
BORING DIA. (in)	3.875
TOTAL DEPTH (ft)	61.5
GROUND ELEV (ft)	17.1
DEPTH/*ELEV.* GROUND WATER (ft)	▼ / *na*
SAMPLING METHOD	Hammer: 140 lbs., Drop: 30 in.
NOTES	ETR ~ 84%, N_{60} ~ 84/60 * N ~ 1.40 * N

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	DEPTH (feet)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
0	17.1	Bulk	B-1									**Artificial Fill (af):** Silty Sand (SM), brown, dry, fine to coarse grained sand, few fine to coarse gravels, trace cobble, little sea shells, little rootlets/branches.
5		SPT	S-2	1 4 4	8	11				5		-Dark gray to brown, moist, loose, fine to medium grained sand, low to medium plasticity, trace shell fragments, little oxidation.
10		Ring	R-3	2 4 5	9	8	27		PI	10		**Alluvium (Qa):** Fat Clay (CH), dark gray to brown, moist, stiff, fine grained sand, high plasticity, little medium grained sand. (LL~57; PL~22; PI~35) Vane Shear = 1.1 ksf
												Clayey Sand (SC), gray with mottled brown, moist, loose, fine grained sand, some oxidation, micaceous. (0% Gravel; 57% Sand; 43% Fines)
15		SPT	S-4	1 2 3	5	7			PA	15		
20		Ring	R-5	5 4 3	7	7	43	78	DS	20		-Wet, low plasticity, large shell fragments.
												Lean Clay (CL), gray, moist, medium stiff, trace fine grained sand, medium plasticity, H2S odor.

Elevation scale: 15, 10, 5, 0, -5

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FIGURE A-2 a

BORING RECORD

PROJECT NAME: Lincoln Bridge Multi-Modal Improvement Project	PROJECT NUMBER: LA1345	BORING: **A-RW015**	
SITE LOCATION: Ballona Wetlands	START: 10/2/2012	FINISH: 10/2/2012	SHEET NO.: 2 of 3
DRILLING COMPANY: Cascade Drilling	DRILLING METHOD: Rotary Wash	LOGGED BY: N. Briffa/JW	CHECKED BY: P. Kashighandi
DRILLING EQUIPMENT: CME 85	BORING DIA. (in): 3.875	TOTAL DEPTH (ft): 61.5	GROUND ELEV (ft): 17.1
DEPTH/*ELEV.* GROUND WATER (ft): ▼ / *na*			
SAMPLING METHOD: Hammer: 140 lbs., Drop: 30 in.	NOTES: ETR ~ 84%, N_{60} ~ 84/60 * N ~ 1.40 * N		

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS
			S-6	0 1 2	3	4			
30	-13		SH-7						
			R-8	13 18 18	36	34	25	107	DS
35	-18		S-9	4 5 6	11	15			PA
40	-23		R-10	3 4 4	8	7	25		
45	-28		S-11	1 4 5	9	13			PI

Elevation marks: -10, -15, -20, -25, -30

DESCRIPTION AND CLASSIFICATION

Alluvium (Qa): Lean Clay (CL), gray, moist, medium stiff, trace fine grained sand, medium plasticity, H2S odor.

(30 ft) -Moist, fine to medium grained sand.

Poorly graded Sand with Silt (SP-SM), gray, wet, medium dense, fine to coarse grained sand.

Silt (ML), gray, wet, soft, trace fine grained sand, none to low plasticity, ~3" layer of Sand with Silt (SM).

(0% Gravel; 37% Sand; 63% Fines)

(40 ft) Sandy Silt (ML), gray, wet, firm, fine grained sand, trace coarse grained sand, low plasticity.

Fat Clay (CH), gray, moist, medium stiff, high plasticity, some organics.
(LL~57; PL~28; PI~29)

Silty Sand (SM), gray, moist to wet, medium dense, fine grained sand, trace organics.

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BORING RECORD

PROJECT NAME	Lincoln Bridge Multi-Modal Improvement Project
PROJECT NUMBER	LA1345
BORING	A-RW015
SITE LOCATION	Ballona Wetlands
START	10/2/2012
FINISH	10/2/2012
SHEET NO.	3 of 3
DRILLING COMPANY	Cascade Drilling
DRILLING METHOD	Rotary Wash
LOGGED BY	N. Briffa/JW
CHECKED BY	P. Kashighandi
DRILLING EQUIPMENT	CME 85
BORING DIA. (in)	3.875
TOTAL DEPTH (ft)	61.5
GROUND ELEV (ft)	17.1
DEPTH/*ELEV.* GROUND WATER (ft)	▼ / *na*
SAMPLING METHOD	Hammer: 140 lbs., Drop: 30 in.
NOTES	ETR ~ 84%, N_{60} ~ 84/60 * N ~ 1.40 * N

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	DEPTH (feet)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			R-12	9 15 15	30	28	25	100	PA			**<u>Alluvium (Qa):</u>** Silty Sand (SM), gray, moist to wet, medium dense, fine grained sand, trace organics. (0% Gravel; 56% Sand; 44% Fines)
	-35											Poorly Graded Sand (SP), gray, wet, very dense, fine to coarse grained sand, few fine subangular gravel.
55			S-13	12 27 27	44	62				55		
	-40											
60			S-14	48 40 46	86	120				60		-Few fine to coarse gravel.
	-45											Boring terminated at 61.5 ft. Groundwater not measured. Boring backfilled with bentonite grout. This boring was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).
65										65		
	-50											
70										70		
	-55											

GDC_LOG_BORING_MMX_SOIL_SD L-962_PART 1.GPJ GDCLOG.GDT 2/13/18

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BORING RECORD

PROJECT NAME	PROJECT NUMBER	BORING
Lincoln Bridge Multi-Modal Improvement Project	LA1345	**B-RW049**

SITE LOCATION	START	FINISH	SHEET NO.
Ballona Wetlands	10/1/2012	10/1/2012	1 of 3

DRILLING COMPANY	DRILLING METHOD	LOGGED BY	CHECKED BY
Cascade Drilling	Rotary Wash	N. Briffa	P. Kashighandi

DRILLING EQUIPMENT	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GROUND WATER (ft)
CME 85	3.875	69	17.6	▼ / *na*

SAMPLING METHOD	NOTES
Hammer: 140 lbs., Drop: 30 in.	ETR ~ 84%, N_{60} ~ 84/60 * N ~ 1.40 * N

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	DEPTH (feet)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
0			B-1									**Artificial Fill (af):** Silty Sand with Gravel (SM), brown, dry, fine to coarse grained sand, fine to coarse gravel.
	15											
5			S-2	3 4 4	8	11				5		Silt (ML), brown, moist, medium stiff, low plasticity, trace roots.
	10											
10			R-3	2 4 8	12	11	31	81		10		-Olive brown, low to medium plasticity, trace dark brown clay seams. Vane Shear = 0.7 ksf
	5											
15										15		-None to low plasticity, increase in roots, highly micaceous, no clay seams. Vane Shear = 0.5 ksf
			SH-4				37	74	PA PI C			Elastic Silt (MH), dark brown with orange spots of Silt, high plasticity, trace hair or fiber, trace shell fragments. (0% Gravel; 45% Sand; 55% Fines) (LL~84; PL~41; PI~43)
	0											**Alluvium (Qa)** Lean Clay (CL), gray, wet, soft, low to medium plasticity, some laminations and pinholes of oxidation, micaceous. (LL~27; PL~20; PI~7)
20			S-5	2 1 2	3	4			PI	20		
	-5											
												Fat Clay (CH), gray, wet, medium stiff, trace fine grained sand, high plasticity, micaceous, H2S odor.

BORING RECORD

PROJECT NAME	PROJECT NUMBER	BORING
Lincoln Bridge Multi-Modal Improvement Project	LA1345	**B-RW049**

SITE LOCATION	START	FINISH	SHEET NO.
Ballona Wetlands	10/1/2012	10/1/2012	2 of 3

DRILLING COMPANY	DRILLING METHOD	LOGGED BY	CHECKED BY
Cascade Drilling	Rotary Wash	N. Briffa	P. Kashighandi

DRILLING EQUIPMENT	BORING DIA. (in)	TOTAL DEPTH (ft)	GROUND ELEV (ft)	DEPTH/*ELEV.* GROUND WATER (ft)
CME 85	3.875	69	17.6	▼ / *na*

SAMPLING METHOD	NOTES
Hammer: 140 lbs., Drop: 30 in.	ETR ~ 84%, N_{60} ~ 84/60 * N ~ 1.40 * N

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	DEPTH (feet)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
			SH-6				63	62	PI C			**Alluvium (Qa):** Fat Clay (CH), gray, wet, medium stiff, trace fine grained sand, high plasticity, micaceous, H2S odor. (LL~67; PL~33; PI~234) Vane Shear = 1.0 ksf
	-10											
												Lean Clay (CL), gray, wet, medium stiff, few fine grained sand, low to medium plasticity, trace shell fragments, slight H2S odor.
30										30		
			R-7	3 4 5	9	8	32	89				
	-15											
35										35		-Moist, stiff, trace fine grained sand, medium plasticity, trace rootlets. (LL~40; PL~23; PI~17) Vane Shear = 1.1 ksf
			SH-8				28	96	PI			
	-20											
												Silty Sand (SM), gray, wet, medium dense, fine to coarse grained sand.
40										40		
			R-9	10 10 13	23	21	22	105	DS			
	-25											
45										45		-Fine grained sand, trace seams of Elastic Silt.
			S-10	9 9 12	21	29						
	-30											

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BORING RECORD

PROJECT NAME Lincoln Bridge Multi-Modal Improvement Project	**PROJECT NUMBER** LA1345		**BORING** B-RW049
SITE LOCATION Ballona Wetlands	**START** 10/1/2012	**FINISH** 10/1/2012	**SHEET NO.** 3 of 3
DRILLING COMPANY Cascade Drilling	**DRILLING METHOD** Rotary Wash	**LOGGED BY** N. Briffa	**CHECKED BY** P. Kashighandi
DRILLING EQUIPMENT CME 85	**BORING DIA. (in)** 3.875	**TOTAL DEPTH (ft)** 69 / **GROUND ELEV (ft)** 17.6	**DEPTH/ELEV. GROUND WATER (ft)** / na
SAMPLING METHOD Hammer: 140 lbs., Drop: 30 in.	**NOTES** ETR ~ 84%, N_{60} ~ 84/60 * N ~ 1.40 * N		

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	DESCRIPTION AND CLASSIFICATION
			R-11	14 20 28	48	45	18	106		**Alluvium (Qa):** Silty Sand (SM), gray, wet, medium dense, fine to coarse grained sand.
	-35									Dense, fine to medium grained sand, trace fine gravel.
										Poorly Graded Sand with Silt (SP-SM), gray, wet, medium dense, fine to medium grained sand, few coarse grained sand.
55			S-12	16 14 15	29	41				
	-40									Lean Clay (CL), gray, moist, stiff, few fine grained sand, medium plasticity, trace organics.
60			R-13	4 5 8	13	12	31	85	PI	Vane Shear = 1.0 ksf (LL~39; PL~23; PI~16)
	-45									
65			SH-14							No recovery.
	-50		S-15	3 14 23	37	52	21			Poorly Graded Sand (SP), gray, wet, dense, fine to medium grained sand, trace fines.
70										Boring terminated at 69 ft. Groundwater not measured. Boring backfilled with bentonite grout. This boring was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).
	-55									

GDC_LOG_BORING_MMX_SOIL_SD L-962_PART 1.GPJ GDCLOG.GDT 2/13/18

BORING RECORD

PROJECT NAME Lincoln Bridge Multi-Modal Improvement Project	**PROJECT NUMBER** LA1345		**BORING** B-HSA051
SITE LOCATION Ballona Wetlands	**START** 10/16/2012	**FINISH** 10/16/2012	**SHEET NO.** 1 of 1
DRILLING COMPANY Cascade Drilling	**DRILLING METHOD** Hollow Stem Auger	**LOGGED BY** N. Briffa	**CHECKED BY** P. Kashighandi
DRILLING EQUIPMENT CME 85 All Terrain	**BORING DIA. (in)** 8	**TOTAL DEPTH (ft)** 21.5	**GROUND ELEV (ft)** 6.3
DEPTH/ELEV. GROUND WATER (ft) ▼ / na			
SAMPLING METHOD Hammer: 140 lbs., Drop: 30 in.	**NOTES** ETR ~ 84%, N_{60} ~ 84/60 * N ~ 1.40 * N		

DEPTH (feet)	ELEVATION (feet)	SAMPLE TYPE	SAMPLE NO.	PENETRATION RESISTANCE (BLOWS / 6 IN)	BLOW/FT "N"	N_{60}	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	DEPTH (feet)	GRAPHIC LOG	DESCRIPTION AND CLASSIFICATION
	5		B-1									**Artificial Fill (af):** Lean Clay (CL), brown, dry, low to medium plasticity, trace organics, trace sea shells, few fine roots, trace white residue. -Moist
			S-2	0 2 4	6	8	17					-Firm, no snail shells.
5	0		R-3	1 2 3	5	5	42	76	C	5		-Soft, light brown and gray, moist, medium plasticity.
			S-4	1 2 2	4	6						**Alluvium (Qa):** Interbedded layers of Lean Clay (CL) and Silt (ML), gray, wet, soft, fine grained sand, few oxidation, trace fine rootlets, micaceous.
10	-5		R-5	0 0 2	2	2	49	68	C	10		Silt (ML), gray, wet, very soft, low plasticity, trace oxidation, some small to large shell fragments, H2S odor.
			S-6	0 0 0	0	0			PI			Elastic Silt (MH), gray, wet, very soft, few fine grained sand, medium plasticity, few shell fragments, few tan color blebs of organics or CH, strong H2S odor. (LL~87; PL~43; PI~44)
15	-10		R-7	0 0 1	1	1	103	43		15		-Trace fine rootlets.
			S-8	0 5 7	12	17						-Increase in shell fragments.
20	-15		R-9	0 2 4	6	6	17	111		20		Sandy Lean Clay (CL), gray, wet, stiff, some fine grained sand, trace sea shells, H2S odor. Strong H2S odor occurred at ~20' (H2S >150 ppm).

Boring terminated at 21.5 ft.
Groundwater not encountered.
Boring backfilled with tamped cuttings.

This boring was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, and Presentation Manual (2010).

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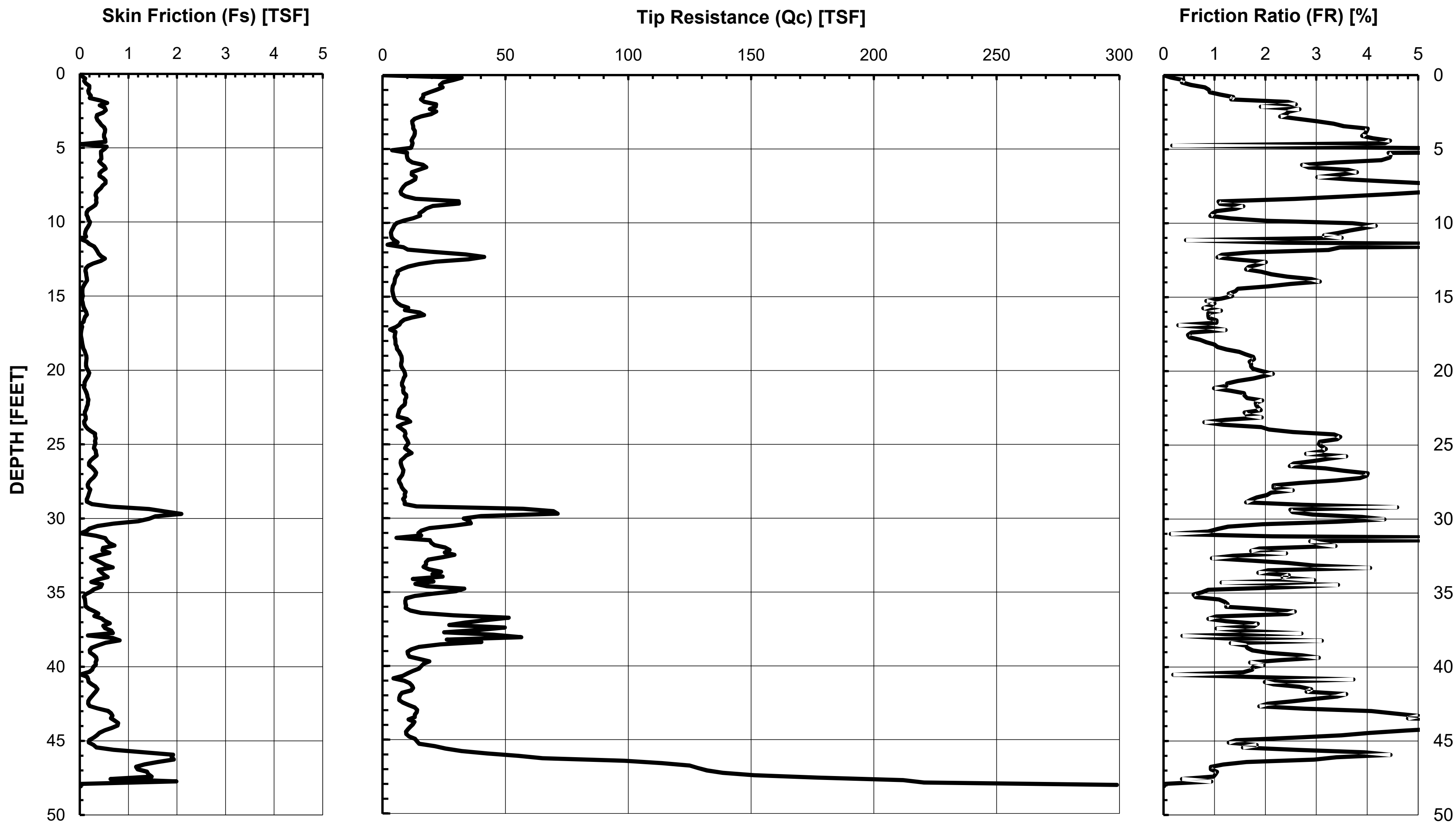
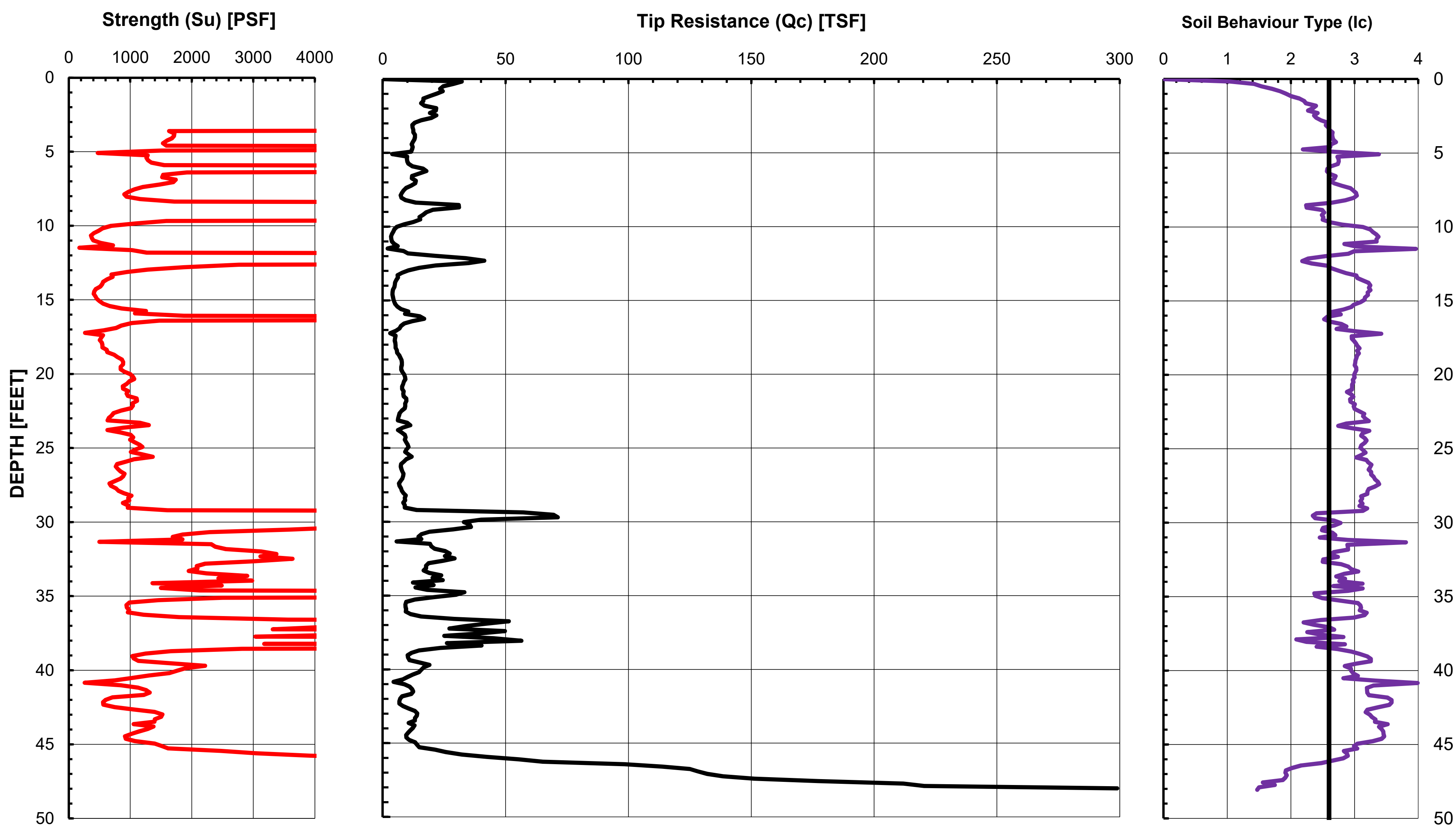
FIGURE A-4



GROUP DELTA

CONE PENETOMETER DATA (A-CPT-012)

Document No. 18-0018
Project No. LA1345
FIGURE A-5a



GROUP DELTA

INTERPRETED SOIL DATA (A-CPT-012)

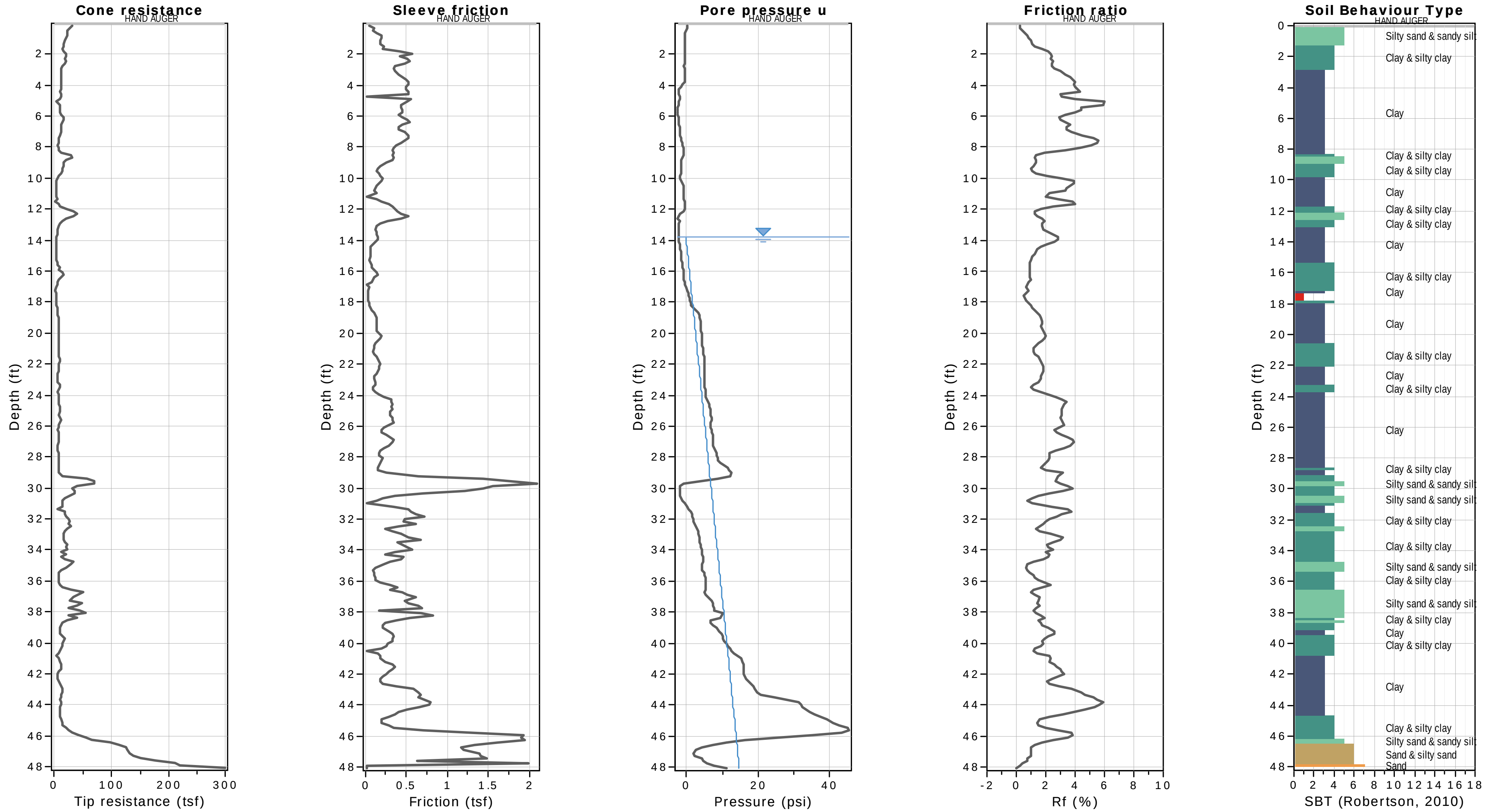
Document No. 18-0018
Project No. LA1345
FIGURE A-5b

GROUP DELTA Group Delta Consultants, Inc.
Project No. LA1345

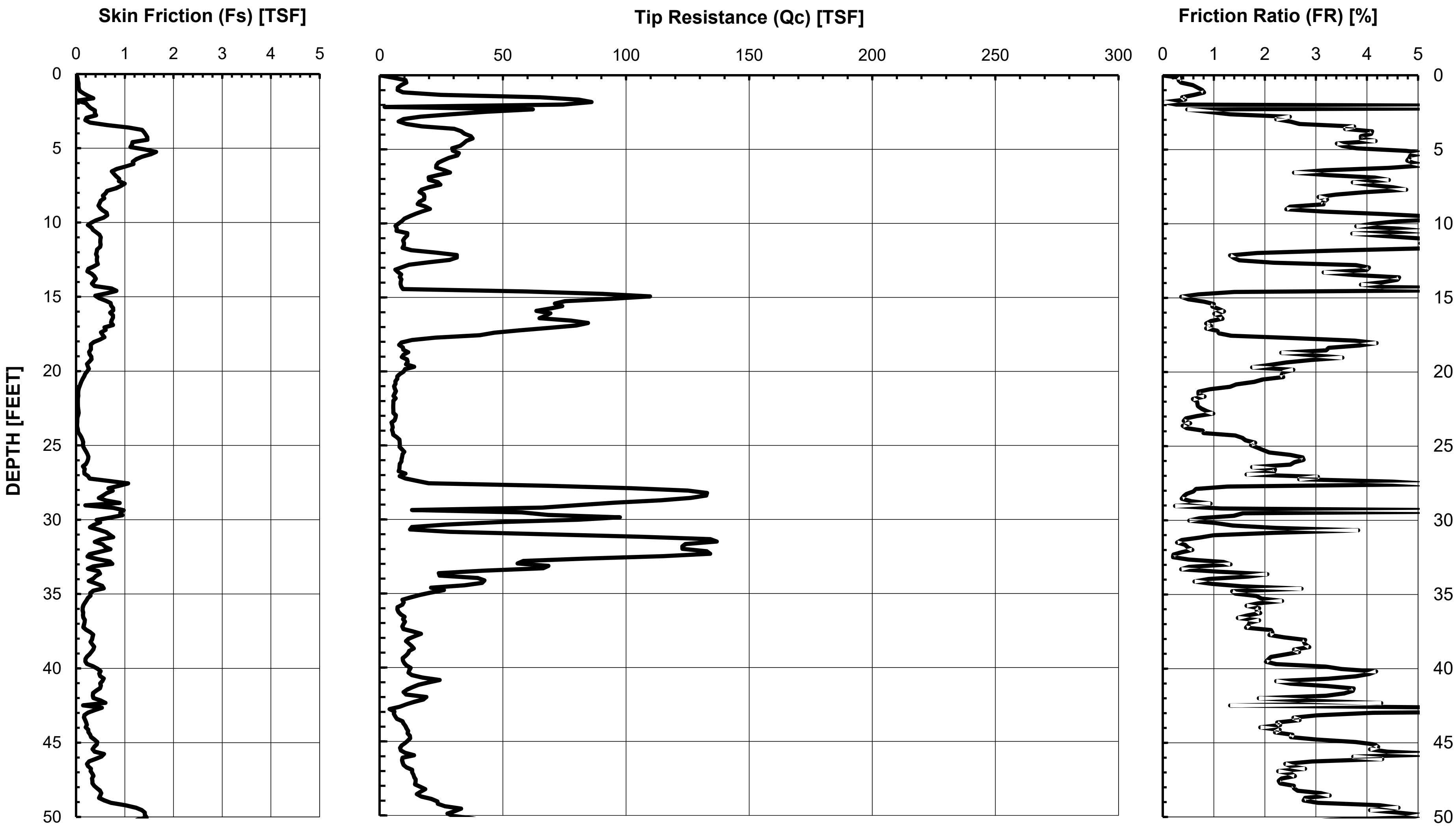
CPT: A-CPT-012

Project: Lincoln Bridge Multi-Modal Improvement Project
Location: Los Angeles, California

Total depth: 48.06 ft, Date: 9/24/2012
Surface Elevation: 13.80 ft



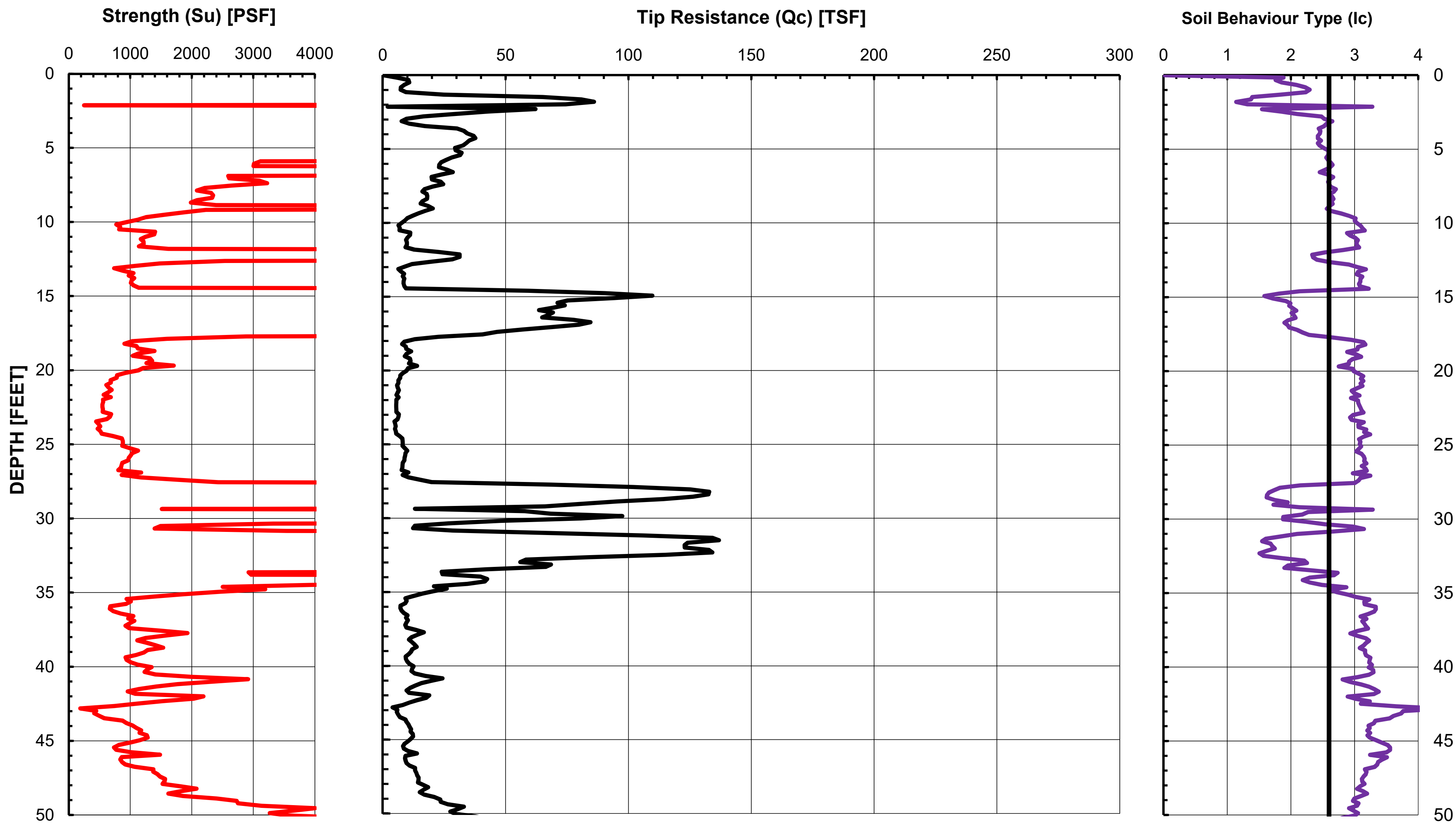
CPeT-IT v.2.0.1.55 - CPTU data presentation & interpretation software - Report created on: 2/15/2018, 8:27:59 AM
Project file: N:\Projects\LA\LA1345 Lincoln Bridge Widening\18-0018 Lincoln PFR\Appendix A\CPT\CPT Data.cpt



GROUP DELTA

CONE PENETOMETER DATA (A-CPT-014)

Document No. 18-0018
Project No. LA1345
FIGURE A-6a



INTERPRETED SOIL DATA (A-CPT-014)

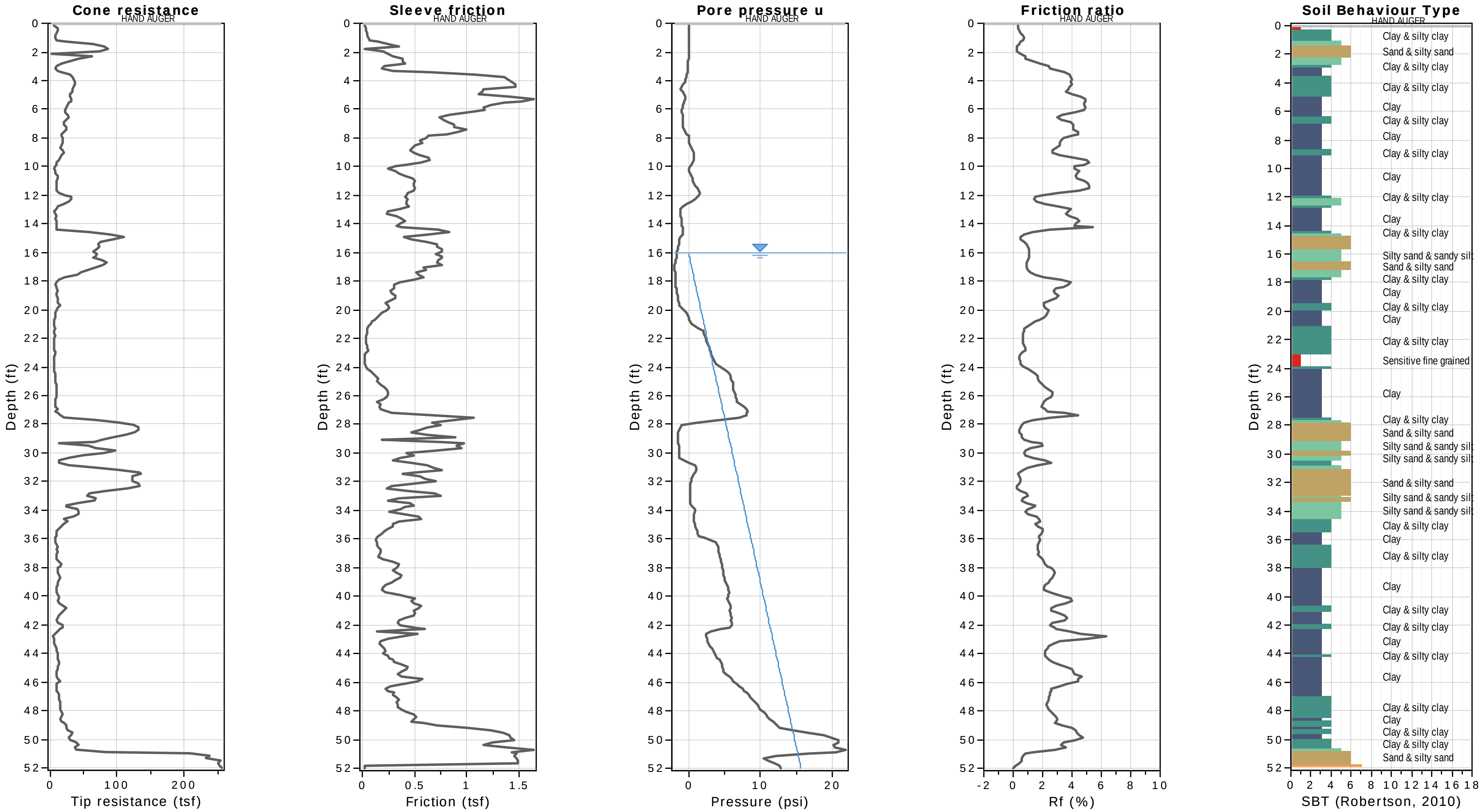
Document No. 18-0018
Project No. LA1345
FIGURE A-6b

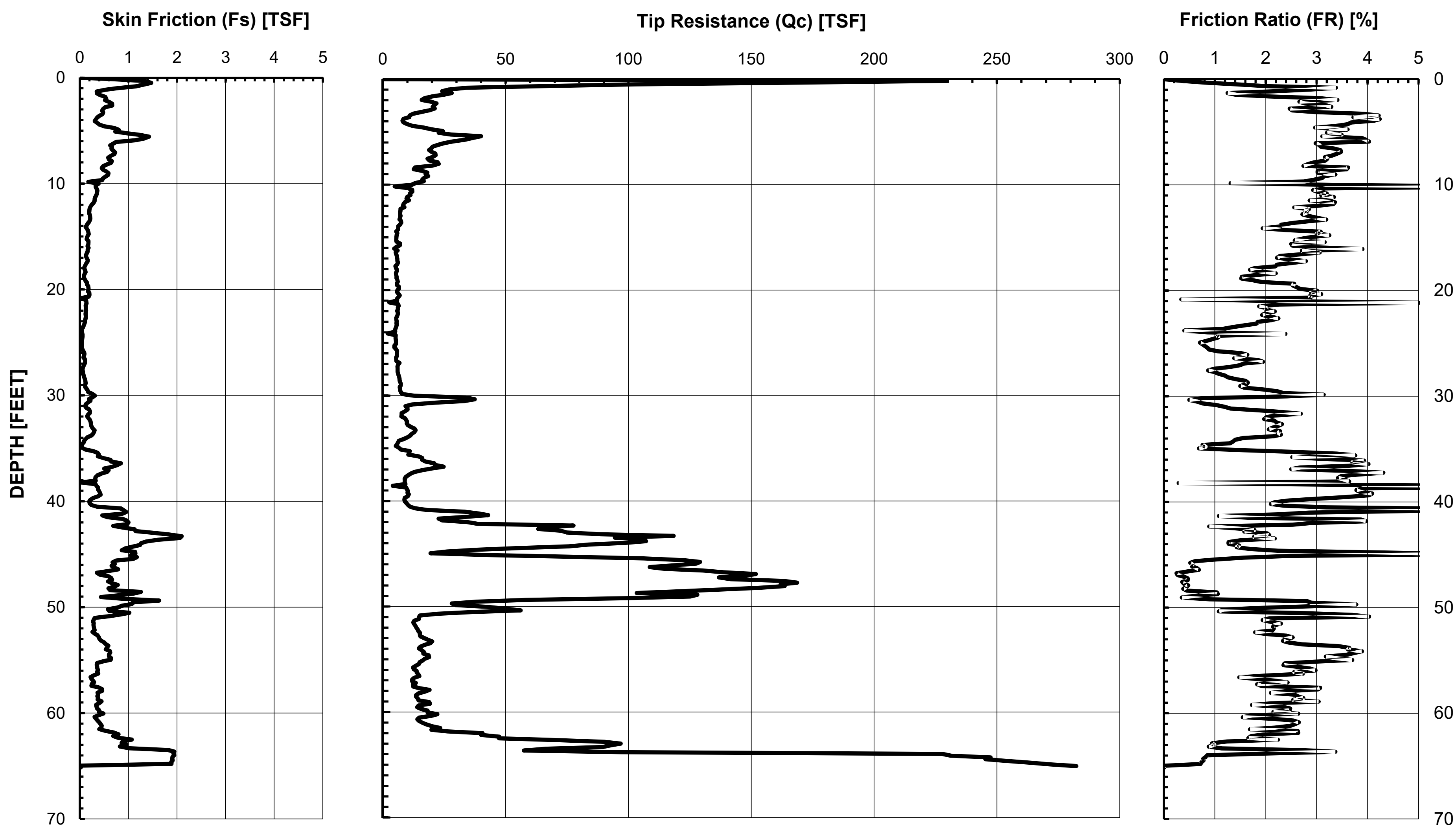
Group Delta Consultants, Inc.
Project No. LA1345

CPT: A-CPT-014

Project: **Lincoln Bridge Multi-Modal Improvement Project**
Location: **Los Angeles, California**

Total depth: 52.00 ft, Date: 9/24/2012
Surface Elevation: 16.00 ft

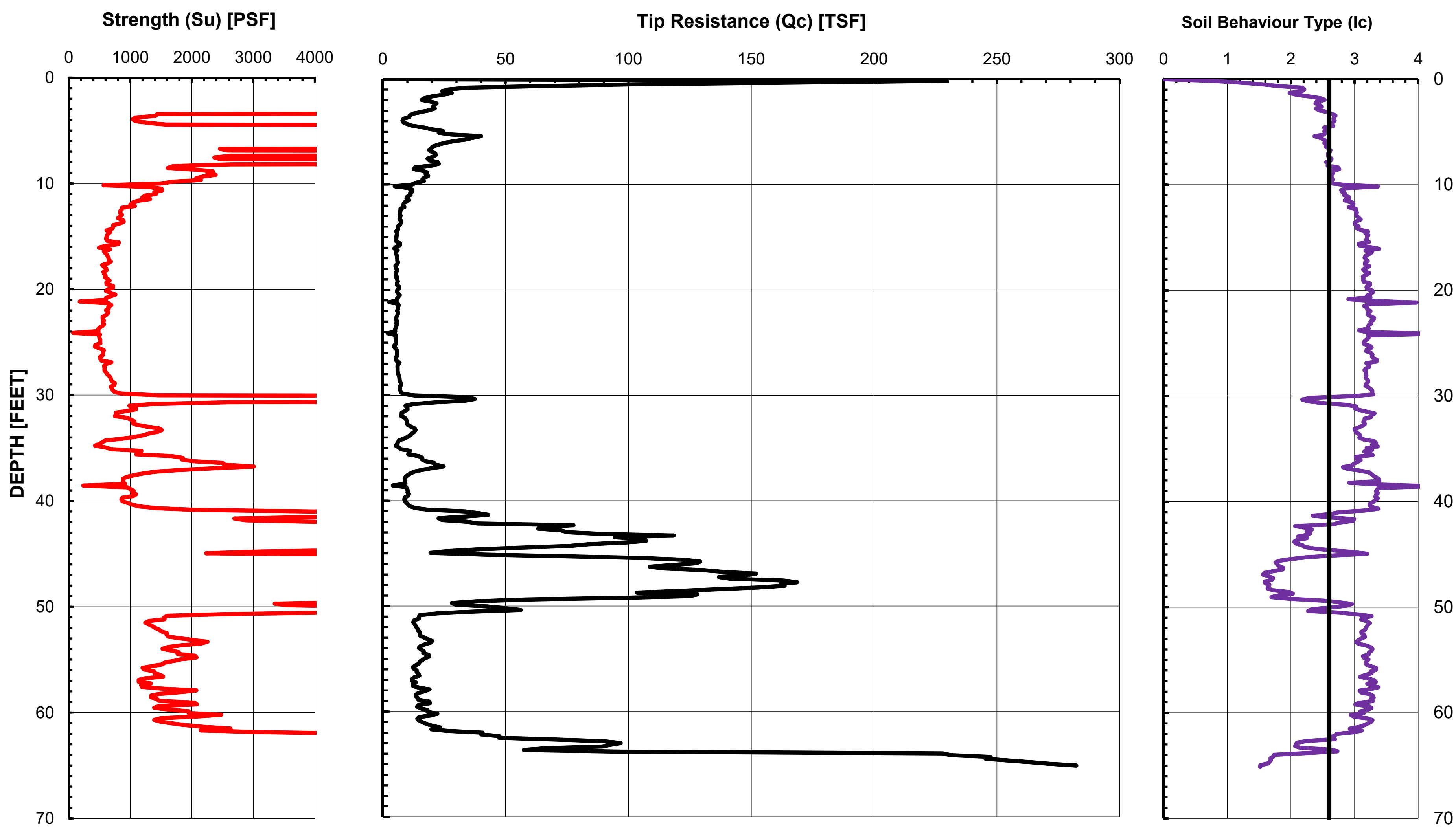




GROUP DELTA

CONE PENETOMETER DATA (A-CPT-025)

Document No. 18-0018
Project No. LA1345
FIGURE A-7a



GROUP DELTA

INTERPRETED SOIL DATA (A-CPT-025)

Document No. 18-0018
Project No. LA1345
FIGURE A-7b

Group Delta Consultants, Inc.
Project No. LA1345

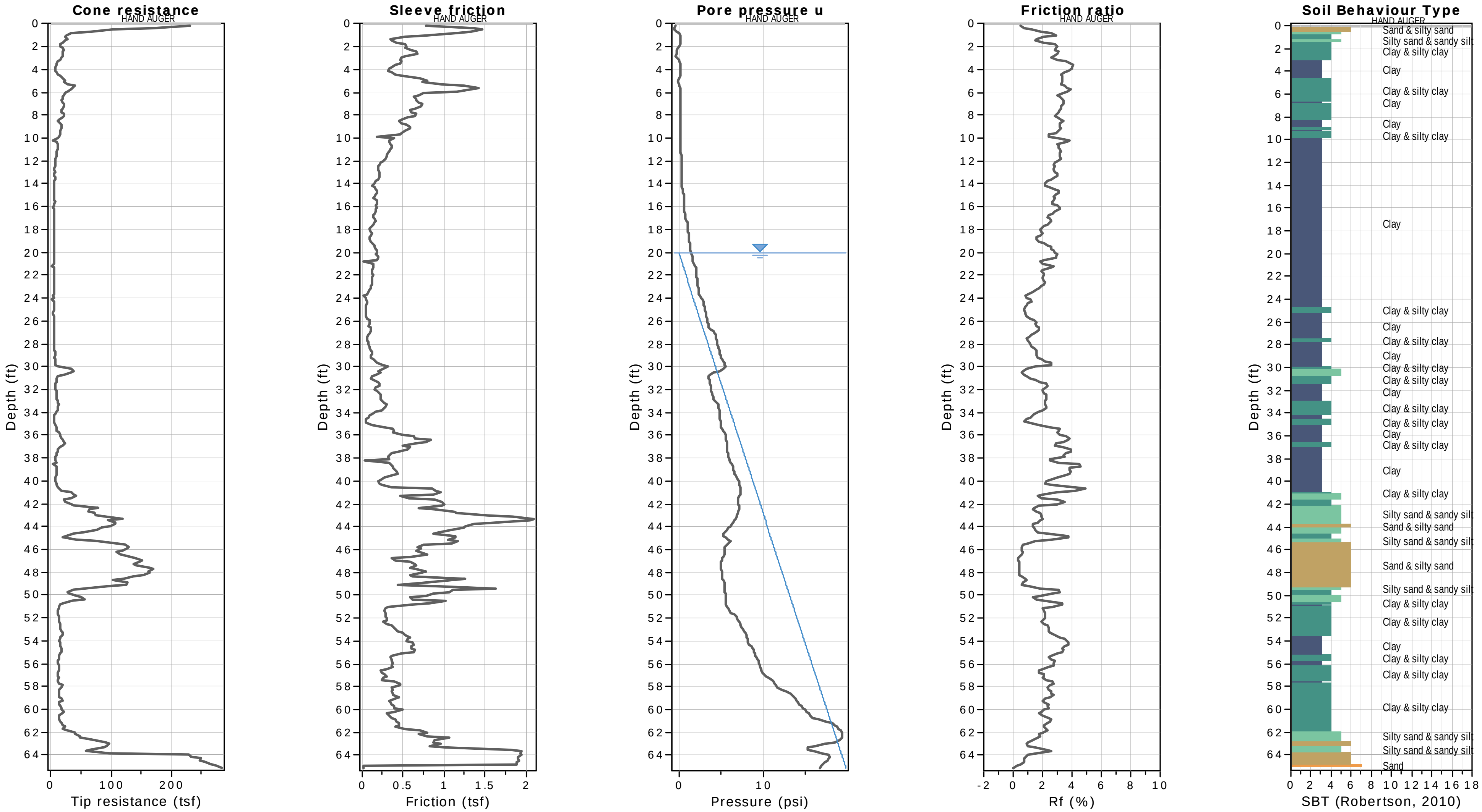
CPT: A-CPT-025

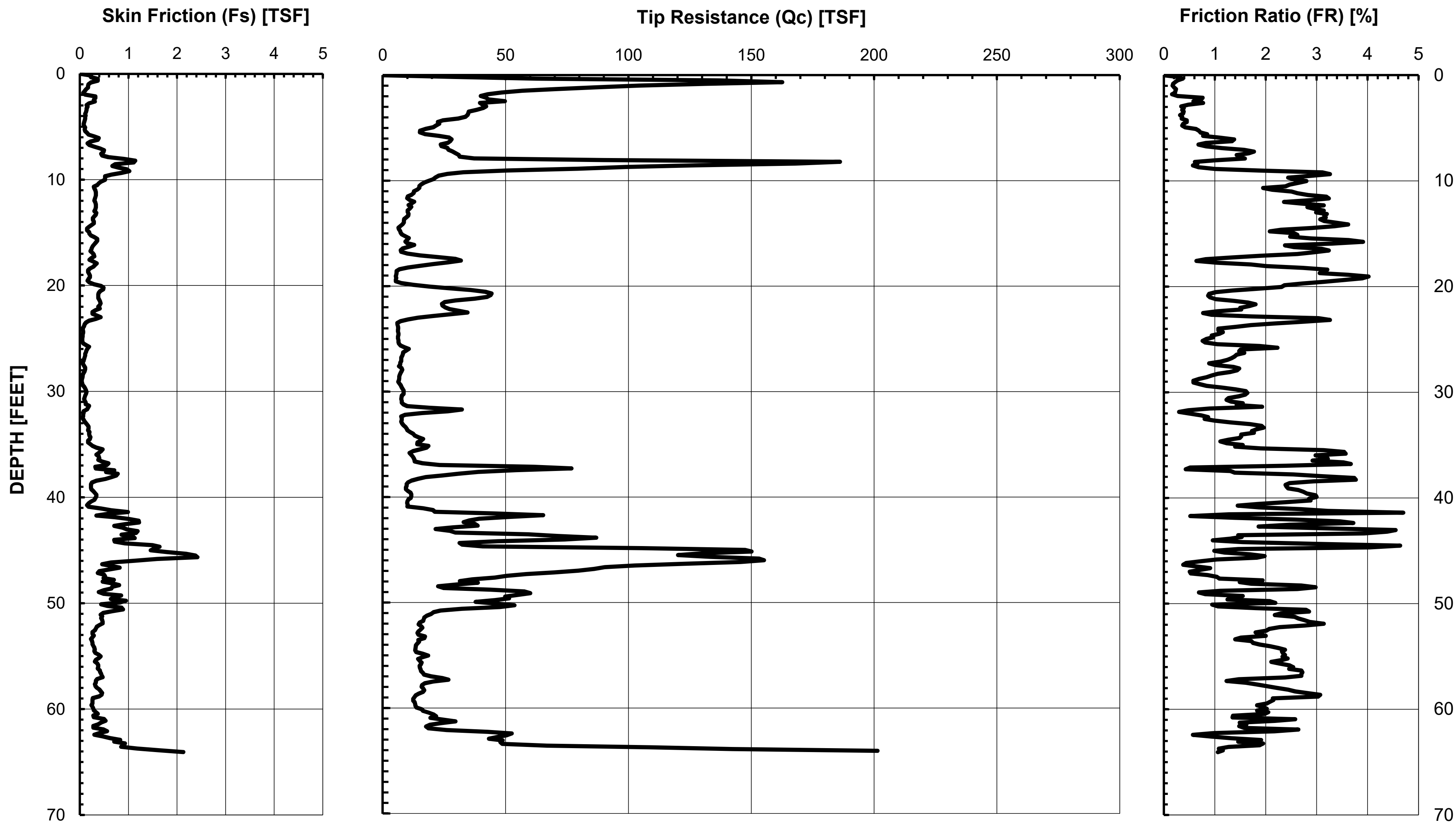
Project: **Lincoln Bridge Multi-Modal Improvement Project**

Location: **Los Angeles, California**

Total depth: 65.13 ft, Date: 9/26/2012

Surface Elevation: 20.00 ft

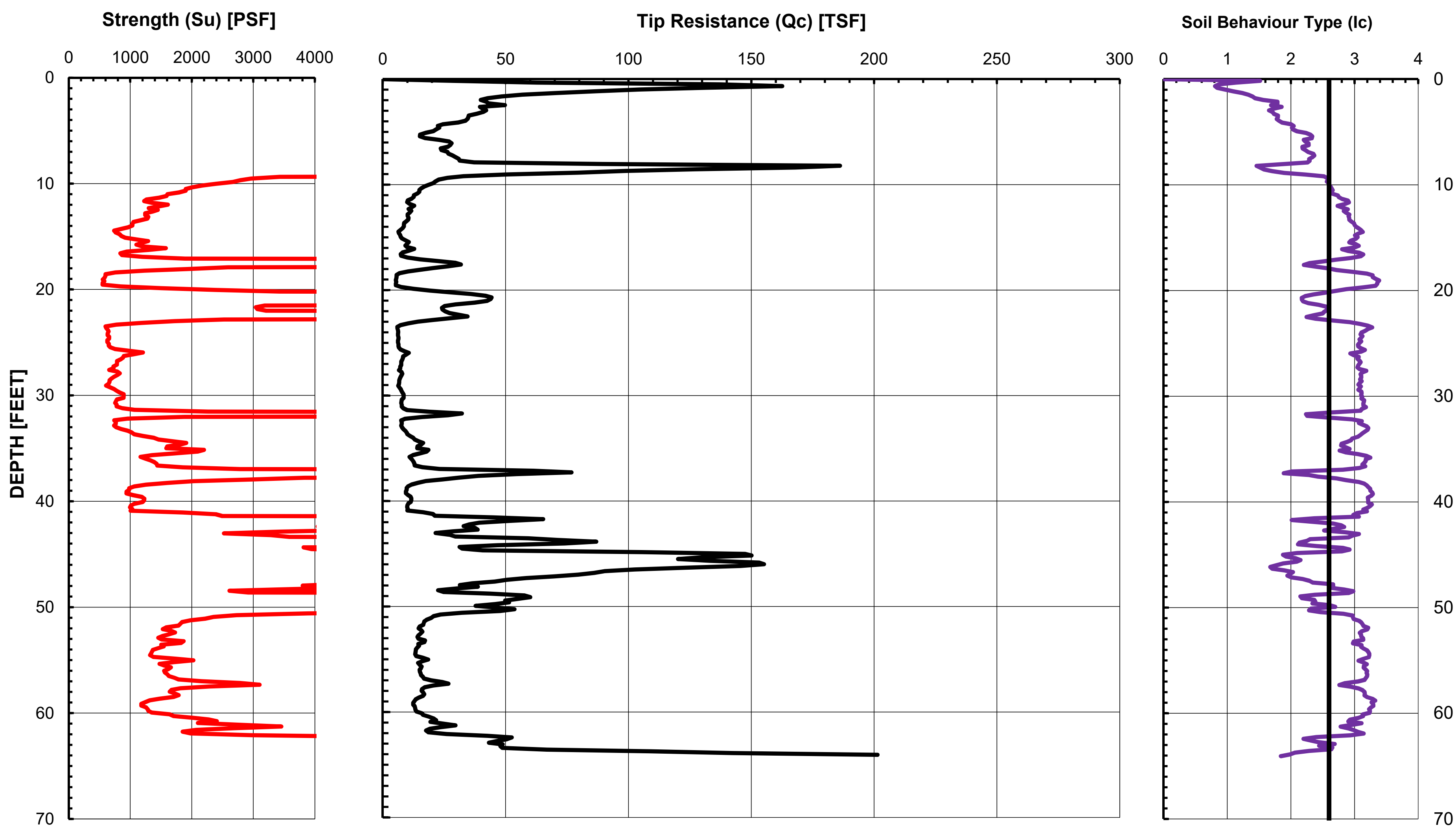




GROUP DELTA

CONE PENETOMETER DATA (B-CPT-050)

Document No. 18-0018
Project No. LA1345
FIGURE A-8a



GROUP DELTA

INTERPRETED SOIL DATA (B-CPT-050)

Document No. 18-0018
Project No. LA1345
FIGURE A-8b

Group Delta Consultants, Inc.
Project No. LA1345

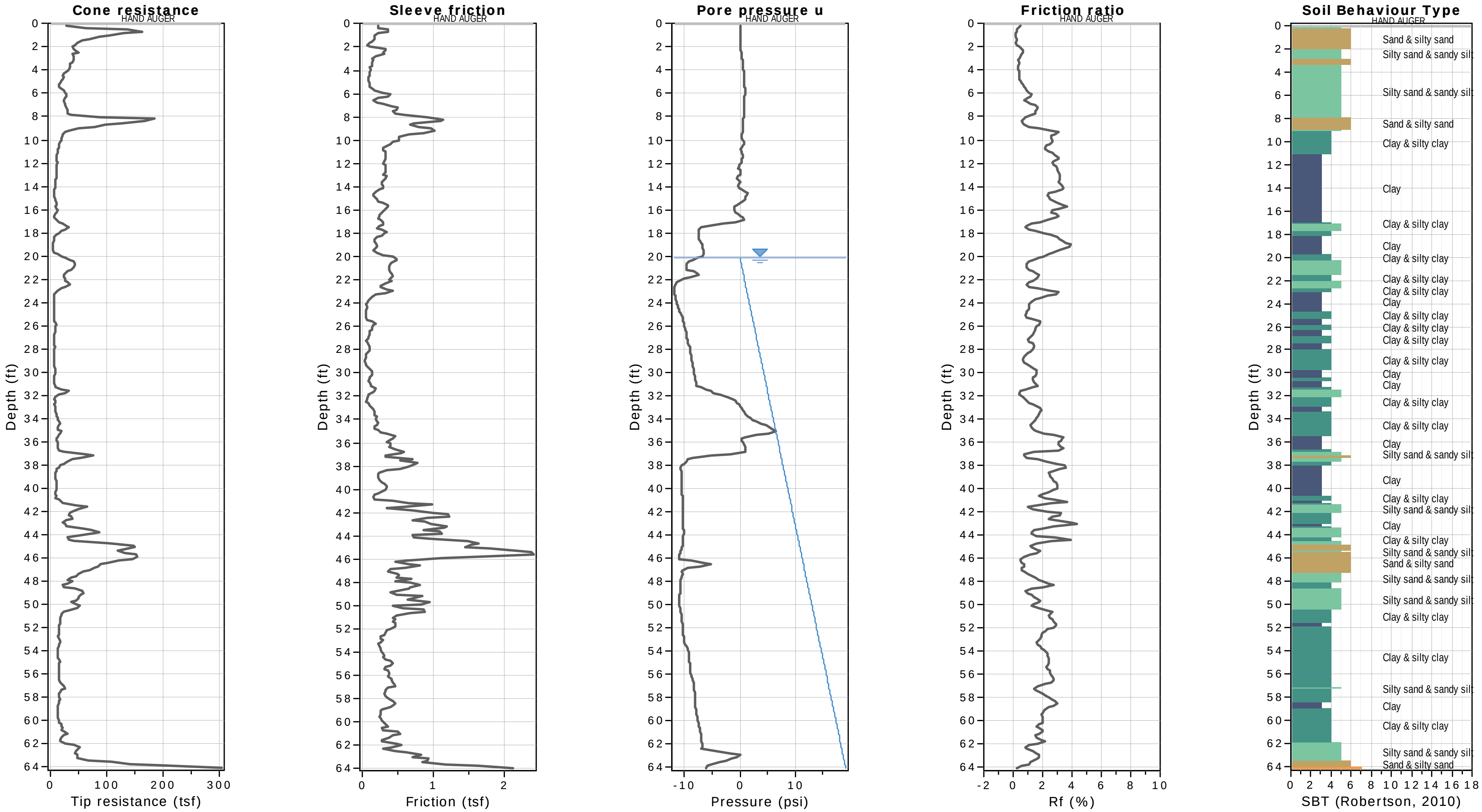
CPT: B-CPT-050

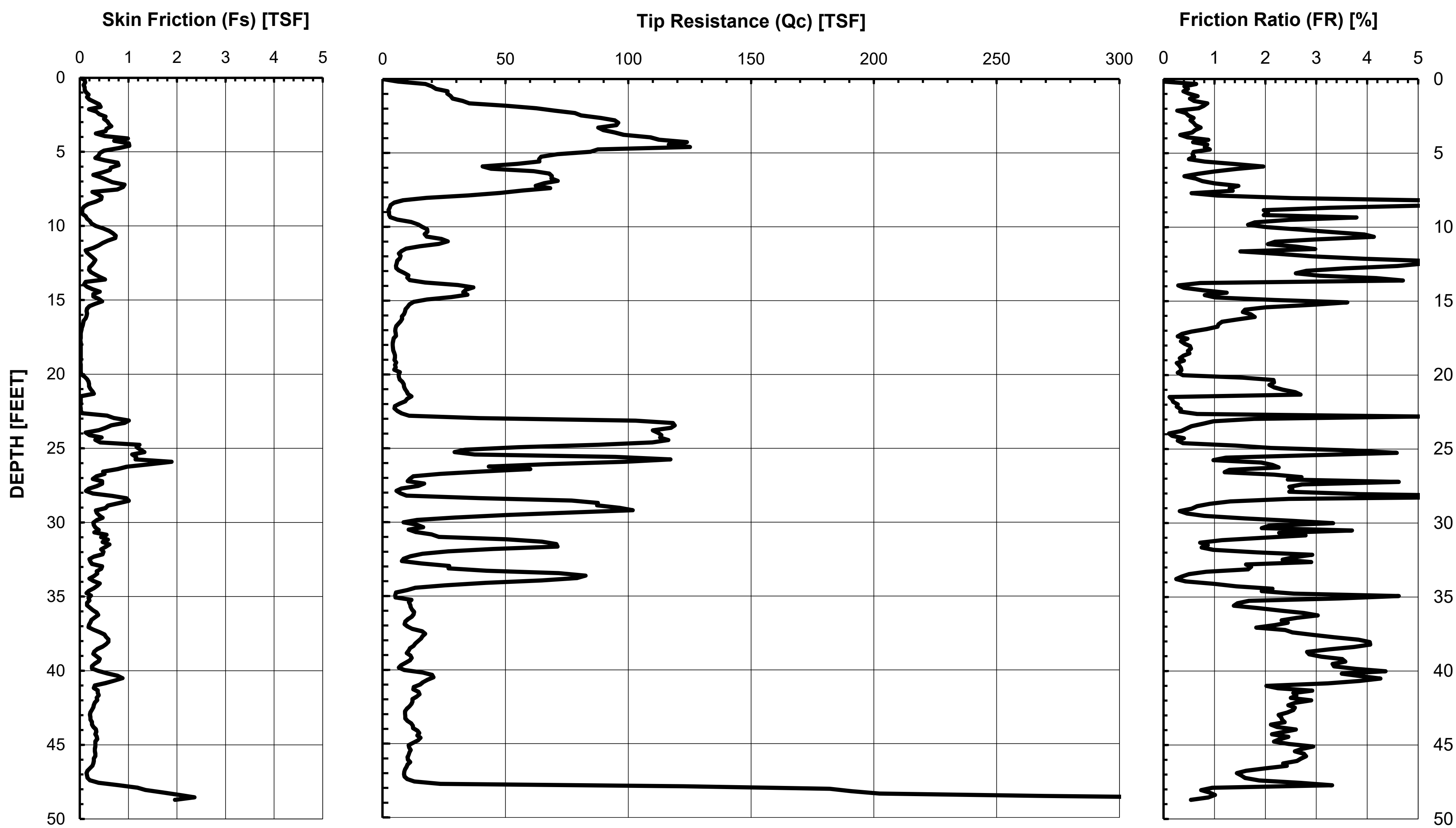
Project: **Lincoln Bridge Multi-Modal Improvement Project**

Location: **Los Angeles, California**

Total depth: 64.12 ft, Date: 9/14/2012

Surface Elevation: 20.20 ft

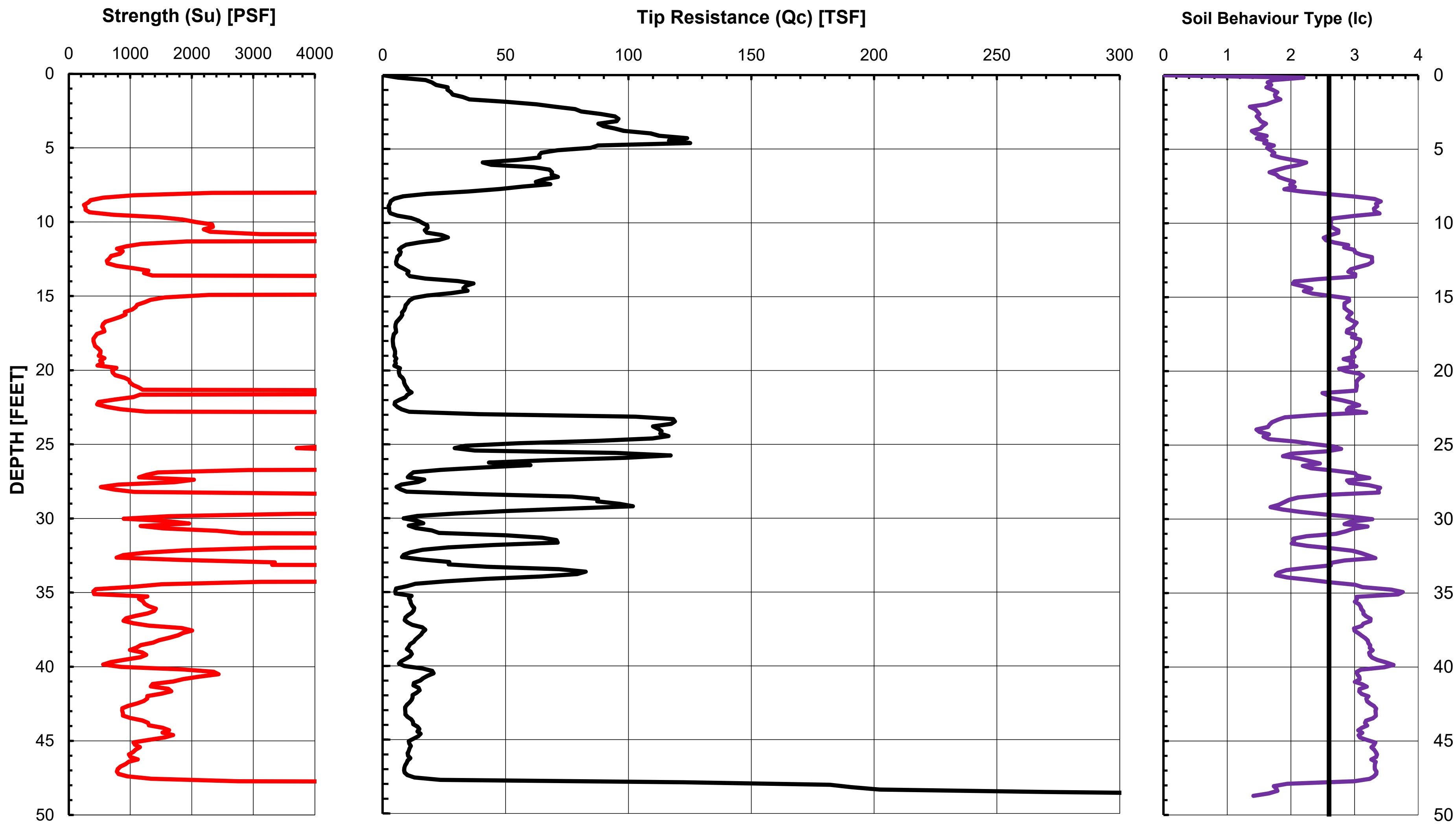




GROUP DELTA

CONE PENETOMETER DATA (C-CPT-060)

Document No. 18-0018
Project No. LA1345
FIGURE A-9a



GROUP DELTA

INTERPRETED SOIL DATA (C-CPT-060)

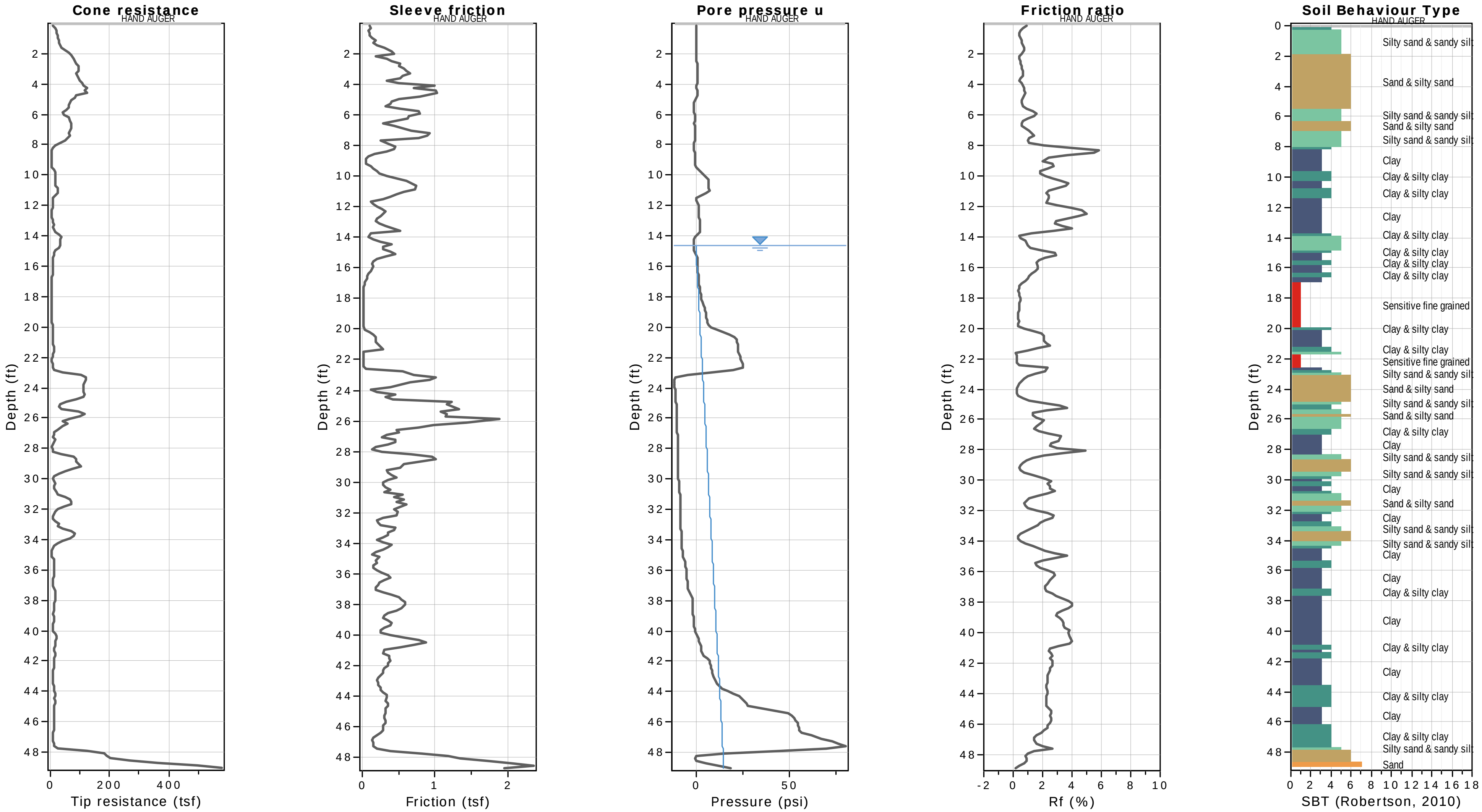
Document No. 18-0018
Project No. LA1345
FIGURE A-9b

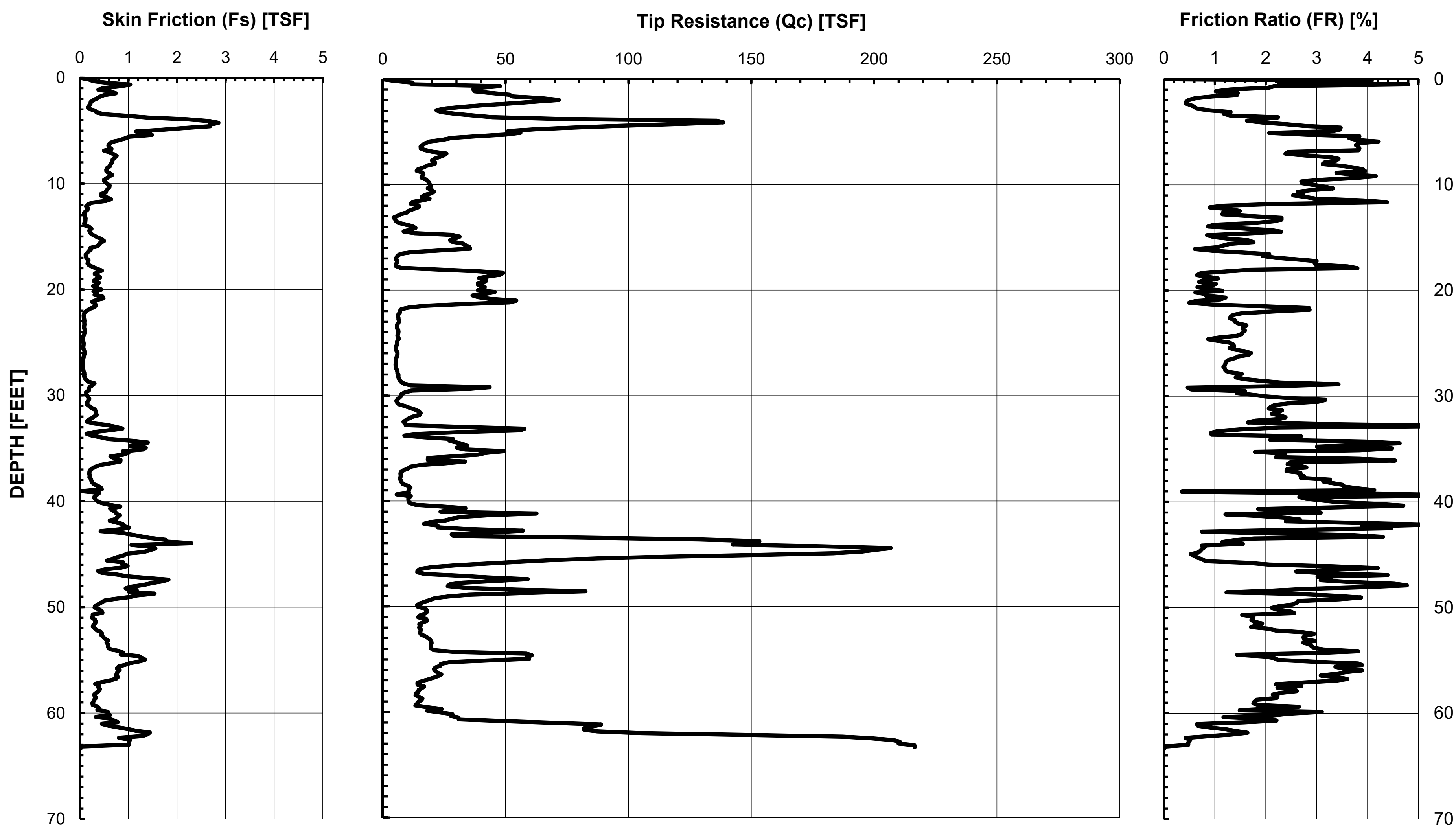
Group Delta Consultants, Inc.
Project No. LA1345

CPT: C-CPT-060

Project: **Lincoln Bridge Multi-Modal Improvement Project**
Total depth: 49.04 ft, Date: 10/10/2012

Location: **Los Angeles, California**
Surface Elevation: 14.60 ft

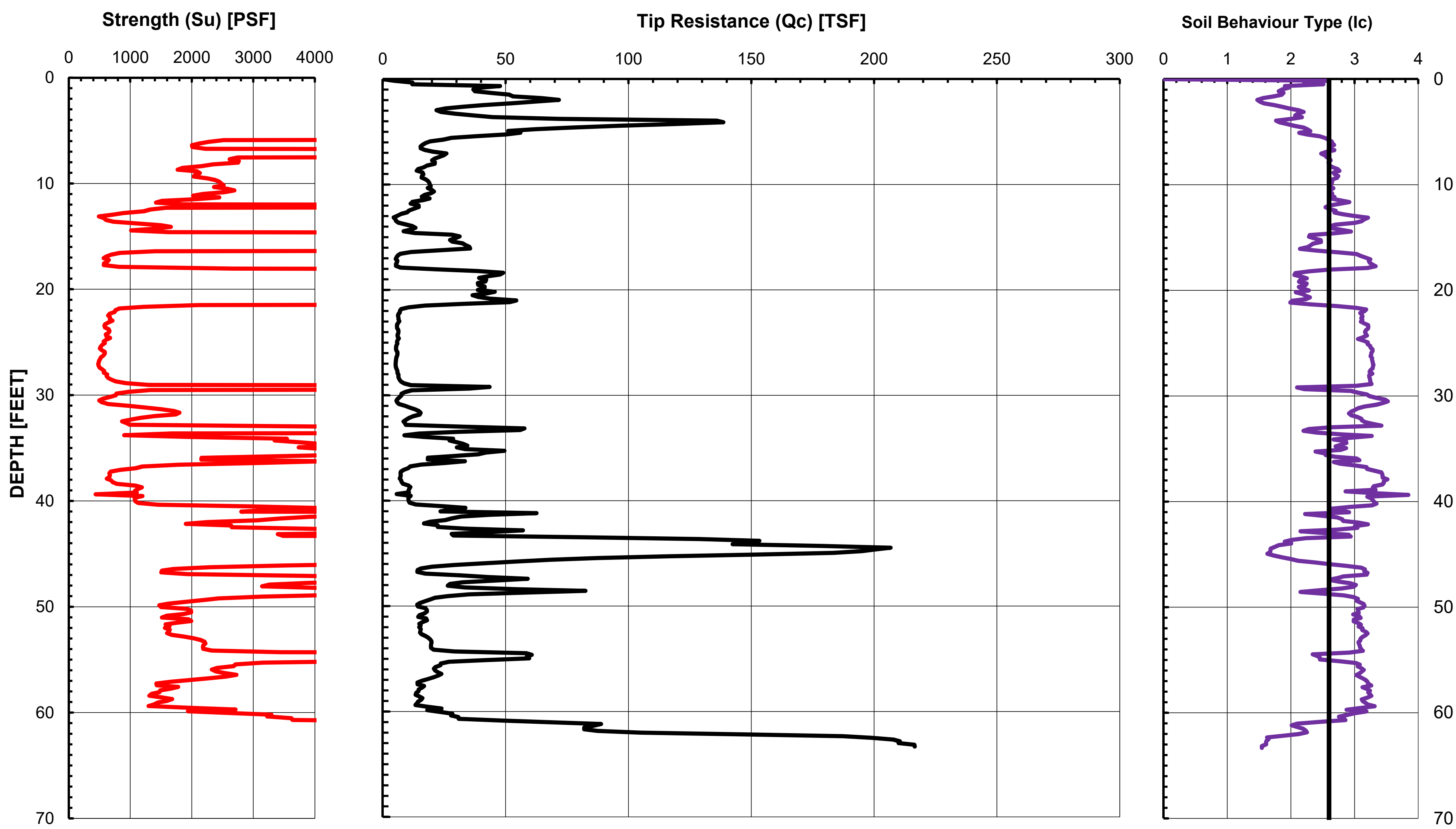




GROUP DELTA

CONE PENETOMETER DATA (A-CPT-065)

Document No. 18-0018
Project No. LA1345
FIGURE A-10a



GROUP DELTA

INTERPRETED SOIL DATA (A-CPT-065)

Document No. 18-0018
Project No. LA1345
FIGURE A-10b

Group Delta Consultants, Inc.
Project No. LA1345

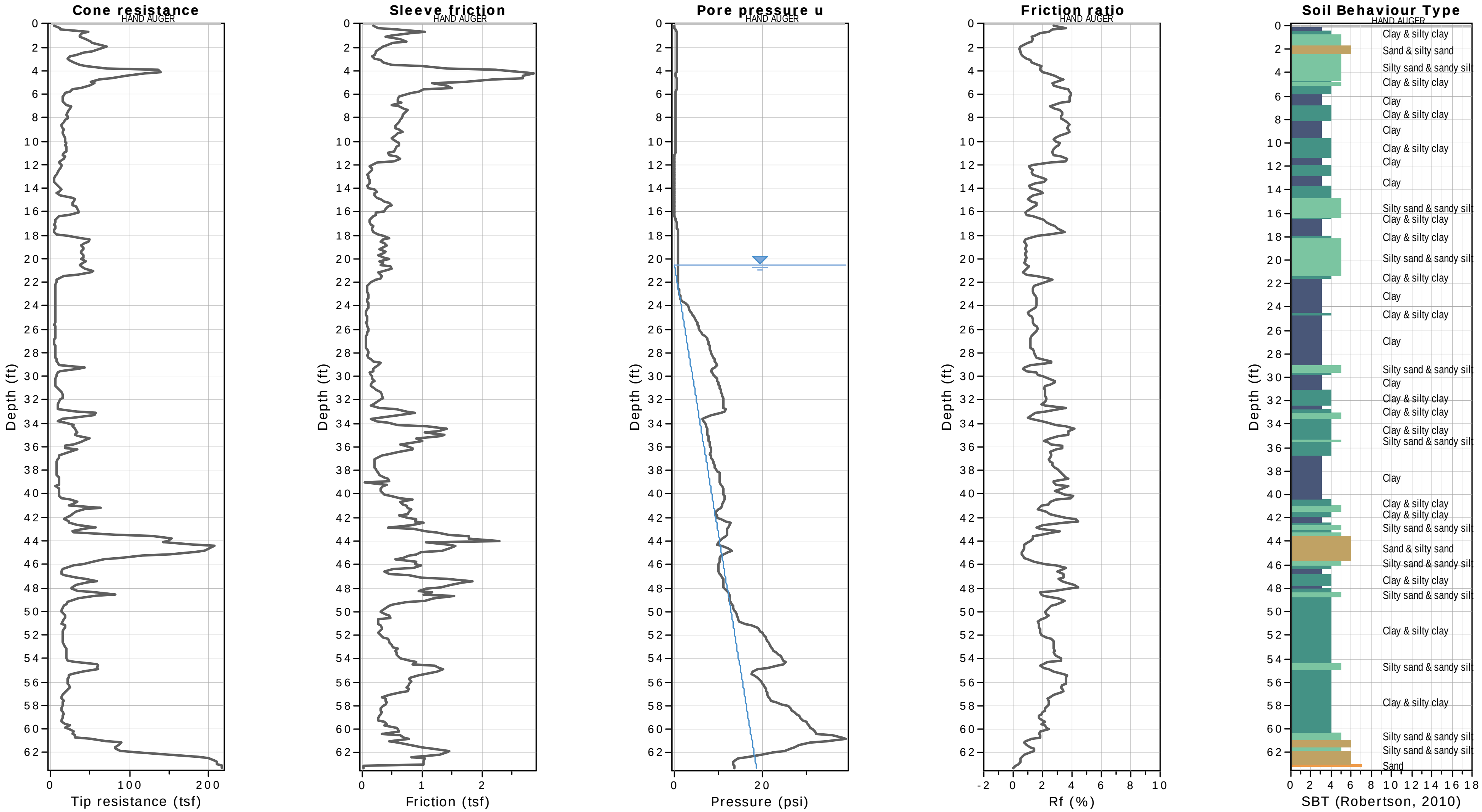
CPT: A-CPT-065

Total depth: 63.32 ft, Date: 9/26/2012

Surface Elevation: 20.50 ft

Project: **Lincoln Bridge Multi-Modal Improvement Project**

Location: **Los Angeles, California**



APPENDIX A
EXISTING FIELD DATA (Group Delta, 1999)

APPENDIX C
GDC FIELD INVESTIGATION

C.1 Introduction

The subsurface conditions at the project site were investigated by Group Delta Consultants during the period of October 29, 1998 to December 11, 1998 by performing the following activities:

- ❒ 11 soil borings to depths ranging from 26 ft to 66.3 ft below ground surface (bgs), as shown in Figure 3 of this report including the construction of a four temporary observation wells; and

- ❒ A total of eight CPTs to depths ranging from 38 ft to 69 ft bgs, also as shown in Figure 3.

C.2 Soil Drilling, Excavation, and Sampling

The borings were advanced utilizing both rotary wash and hollow-stem auger drill rig systems. The rotary wash borings had a hole diameter ranging from 4.5 inches to 6 inches; the hollow stem auger borings had a hole diameter of 10 inches. The borings were performed by both C&L Drilling (rotary) and THF Drilling (rotary and hollow-stem). This exploration program was supervised by the GDC Field Engineer, who visually inspected the soil samples, maintained detailed logs of the borings, interpreted stratigraphy, classified the soils, and obtained drive samples as well as Standard Penetration Test (SPT) samples and bulk samples at maximum vertical spacing of approximately 5-foot intervals. The soils were classified in the field and further examined in the laboratory in accordance with the Unified Soil Classification System (Figure C-1). Field classifications were modified, where necessary, on the basis of laboratory test results.

Relatively undisturbed soil samples were obtained using a 3.25-inch outside diameter sampler lined with brass rings, each 1-inch high and 2.42-inch inside diameter. The ring and tube samplers were driven with a 140-pound hammer dropping 30 inches. In addition, Standard Penetration Tests (SPT) were performed in accordance with ASTM D1586 using a 2-inch outside diameter and 1.375-inch inside diameter split-spoon barrel sampler. The SPT sampler was driven with a 140-pound safety hammer dropping 30-inches.

The Standard Penetration Test consists of counting the number of hammer blows it takes to drive the sampler approximately 1 foot into the ground. SPT blowcounts are often used as an index of the relative density and resistance of the sampled materials. The blowcounts obtained by driving the ring sampler can be converted to an approximate equivalent SPT blowcount using a multiplication factor of 0.65.

Detailed logs of the soil borings including blowcount data and in-situ moisture content and soil density are presented in Figures C-2 through C-20. Laboratory tests performed on the samples, such as moisture content and dry density, are shown in the "Other Tests" columns of the log. Descriptions and further result summaries of laboratory tests performed are provided in Appendix D.

In addition, four temporary observation wells were placed in Boring B-304H, B-305H, B-313H, and B-315H to evaluate groundwater conditions. Groundwater level measurements in these wells and other existing wells were recorded and are provided in Table C-2

C.3 Cone Penetration Test (CPT)

A total of eight CPT soundings were conducted for the Site to depths ranging from 38 ft to 69 ft bgs. This was performed in general accordance with ASTM D3441-86, using an electric cone penetrometer. The CPT soundings were performed by Gregg In-Situ, Inc. at the locations shown in Figure 3 and are presented as Figures C-21 to C-43.

CPTs are advanced from the ground surface with a truck-mounted hydraulic ram which pushes a steel rod with a conical tip and cylindrical friction-sleeve into the ground. The conical tip has a 60-degree apex angle and a projected cross-sectional area of 1.55 square inches. The cylindrical friction sleeve has a surface area of 23.25 square inches. Both the tip and the sleeve have outside diameters of 1.4 inches.

As the rod is advanced, electronic instruments measure and record both the tip resistance and the frictional resistance on the sleeve. The tip and frictional resistance are then analyzed, using available correlations, to estimate soil classification, density, strength, and compressibility of the subsurface materials. Unlike soil borings, in which drive samples are typically taken at discrete intervals, the CPT provides a continuous record of soil properties with depth. Hence, the CPT can evaluate the subsurface soil profile with much higher resolution than a soil boring, more precisely identifying the actual thickness of soft/compressible layers (to the nearest foot), and often detecting thin layers that may not be observed with conventional drilling and sampling techniques.

C.4 List of Attached Tables and Figures

The following tables and figures are attached and complete this appendix:

Table C-1	Field Exploration Summary
Table C-2	Summary of Water Level Measurements
Figure C-1	Key for Soil Classification
Figures C-2 through C-20	Boring Logs
Figures C-21 through C-43	CPT Logs

TABLE C-1
SUMMARY OF SOIL BORINGS

Expl. No.	Date Drilled	Ground Surface Elevation (feet, MSL)	Ground water Depth (feet)	Final Groundwater Elevation at Time of Exploration (feet, MSL)	Total Depth (ft)	Remarks
B-302R	12-11-98	17.5	20.0	-2.5	66.5	--
B-304H	10-29-98	14.6	12.2	+2.4	31.0	Installed 4" well
B-305H	10-29-98	15.3	12.0	+3.3	31.0	Installed 4" well
B-306R	11-04-98	16.8	--	--	51.5	--
B-307R	11-06-98	11.4	--	--	61.0	--
B-309R	11-04-98	12.8	--	--	61.0	--
B-313H	10-29-98	12.6	8.4	+4.2	26.0	Installed 4" well
B-315H	10-30-98	13.3	8.0	+5.3	26.0	Installed 4" well
B-316R	11-03-98	14.1	--	--	57.5	--
B-317R	11-05-98	9.5	--	--	61.0	--
B-319R	11-05-98	11.7	--	--	61.0	--

TABLE C-2
SUMMARY OF WATER LEVEL MEASUREMENTS

Well I.D.	Date Recorded	Time Recorded	Well Diameter Size (in)	Casing Elevation (ft, MSL)	Ground water Depth (ft)	Groundwater Elevation (ft, MSL)
Well by SE gate	11-11-98	0835	2	13.5	5.1	8.4
Well 315H	11-11-98	0902	4	15.4	9.6	5.8
Well central area	11-11-98	0906	2	14.8	10.5	4.3
Well B-305H	11-11-98	0912	4	17.4	14.6	2.8
Well B-304H	11-11-98	0921	4	16.7	14.1	2.6
Well B-313H	11-11-98	0930	4	14.6	10.1	4.5
Well by SE gate	12-04-98	1551	2	13.5	5.2	8.3
Well 315H	12-04-98	1556	4	15.4	9.5	5.9
Well central area	12-04-98	1612	2	14.8	10.4	4.4
Well B-305H	12-04-98	1600	4	17.4	14.6	2.8
Well B-304H	12-04-98	1606	4	16.7	14.1	2.6
Well B-313H	12-04-98	0615	4	14.6	10.2	4.4
Well by SE gate	12-23-98	1350	2	13.5	6.1	7.4
Well 315H	12-23-98	1240	4	15.4	10.0	5.4
Well central area	12-23-98	1330	2	14.8	10.8	4.0
Well B-305H	12-23-98	1315	4	17.4	14.9	2.5
Well B-304H	12-23-98	1300	4	16.7	14.4	2.3
Well B-313H	12-23-98	1250	4	14.6	10.5	4.1

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

PRIMARY DIVISIONS			GROUP SYMBOL	SECONDARY DIVISIONS
COARSE GRAINED SOILS MORE THAN HALF OF MATERIALS IS LARGER THAN # 200 SIEVE SIZE	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN # 4 SIEVE	CLEAN GRAVELS (LESS THAN 5% FINES)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES.
			GP	POORLY GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES.
		GRAVEL WITH FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURE, NON PLASTIC FINES.
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, PLASTIC FINES.
	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN # 4 SIEVE	CLEAN SANDS (LESS THAN 5% FINES)	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES.
			SP	POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES.
		SANDS WITH FINES	SM	SILTY SANDS, SAND-SILT MIXTURES, NON-PLASTIC FINES.
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES, PLASTIC FINES.
FINE GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN # 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT IS LESS THAN 50	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.
	SILTS AND CLAYS	LIQUID LIMIT IS GREATER THAN 50	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.
	HIGHLY ORGANIC SOILS		PT	PEAT AND OTHER HIGHLY ORGANIC SOILS.

CLASSIFICATION CRITERIA BASED ON FIELD TESTS

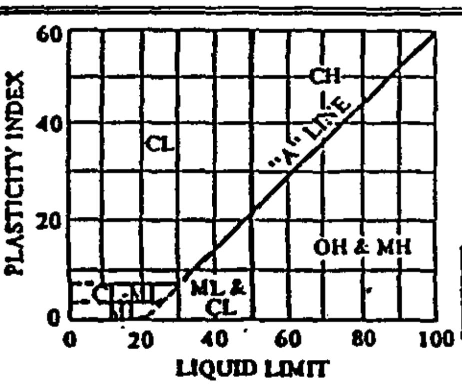
PENETRATION RESISTANCE (PR)	
SANDS AND GRAVELS	
RELATIVE DENSITY	BLOWS/FOOT*
VERY LOOSE	0 - 4
LOOSE	4 - 10
MEDIUM DENSE	10 - 30
DENSE	30 - 50
VERY DENSE	OVER 50

CLAYS AND SILTS		
CONSISTANCY	BLOWS/FOOT*	STRENGTH**
VERY SOFT	0 - 2	0 - ¼
SOFT	2 - 4	¼ - ½
FIRM	4 - 8	½ - 1
STIFF	8 - 15	1 - 2
VERY STIFF	15 - 30	2 - 4
HARD	OVER 30	OVER 4

* NUMBER OF BLOWS OF 140 POUND HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1 3/8 INCH I.D.) SPLIT BARREL SAMPLER (ASTM-1586 STANDARD PENETRATION TEST)

** UNCONFINED COMPRESSIVE STRENGTH IN TONS/SQ. FT. READ FROM POCKET PENETROMETER

CLASSIFICATION CRITERIA BASED ON LAB TESTS



GW AND SW – $C_u = \frac{D_{60}}{D_{10}}$ GREATER THAN 4 FOR GW AND 6 FOR SW; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ BETWEEN 1 AND 3

GP AND SP – CLEAN GRAVEL OR SAND NOT MEETING REQUIREMENT FOR GW AND SW

GM AND SM – ATTERBERG LIMIT BELOW "A" LINE OR P.I. LESS THAN 4

GC AND SC – ATTERBERG LIMIT ABOVE "A" LINE P.I. GREATER THAN 7

FINES (SILT OR CLAY)	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	COARSE GRAVEL	COBBLES	BOULDERS
SIEVE SIZES 200		40	10	4	3/4"	3"	10"

CLASSIFICATION OF EARTH MATERIALS IS BASED ON FIELD INSPECTION AND SHOULD NOT BE CONSTRUED TO IMPLY LABORATORY ANALYSIS UNLESS SO STATED.

KEY FOR SOIL EXPLORATION LOGS

Figure C-1

LOG OF TEST BORING

PROJECT	PROJECT NUMBER	HOLE NUMBER
PLAYA VISTA - Site DE & Ballona Creek	L-196	LEGEND

SITE	BEGUN	COMPLETED	SHEET NO.
Playa del Rey, California			1 of 1

DRILLER	DRILL METHOD	LOGGED BY	CHECKED BY

DRILL EQUIPMENT	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	DEPTH/*ELEV.* GROUND WATER
		45.0 ft.		▼

SAMPLING METHOD	NOTES
	LOCATIONS: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
						5			FILL - Soil material not native to the location.
									NATIVE - Soil material naturally deposited at the location.
						10			
									BULK 1, R-2, S-3 - Refers to the type and sequence in which the sample was taken.
						15			
									GRAB, MC, SPT - Refers to the method in which the sample was obtained.
						20			
Bulk 1 GRAB								GRAB	GRAB - Refers to collecting sample by method of placing loose soil material into a plastic bag.
						25			
R-2 MC								MC	MC (CALIFORNIA MODIFIED) - Refers to collecting the sample by method of a 2.4" inside diameter by 12" long cylindrical sampler driven into the soil by a downward force, usually provided by a free falling hammer.
S-3 SPT						30		SPT	SPT (STANDARD PENETRATING TEST) - Refers to collecting the sample by method of a 1.4" inside diameter by 18" long cylindrical sampler driven into the soil by a downward force, usually provided by a free falling hammer.
						35			THE FOLLOWING SUBSURFACE SUMMARIES APPLY ONLY AT THE LOCATION OF THESE BORINGS AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THESE LOCATIONS WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED.
						40			
						45			

LOG OF TEST BORING

PROJECT	PROJECT NUMBER	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	B-302R

SITE	BEGUN	COMPLETED	SHEET NO.
Playa del Rey, California	12/11/98	12/11/98	1 of 2

DRILLER	DRILL METHOD	LOGGED BY	CHECKED BY
C & L	ROTARY WASH	SHK	MDR

DRILL EQUIPMENT	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	DEPTH/*ELEV.* GROUND WATER
MAYHEW ROTARY	6"	66.5 ft.	17.50	▼ 20.0 / *-2.5*

SAMPLING METHOD	NOTES
R: 400-lb downhole hammer S:140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
									FILL (SM) Olive gray fine SAND
S-1 SPT	4	27.4			13	5			Very loose, with SILT
R-2 MC	5	31.8	86.2		8	10			No change
S-3 SPT	2	48.5		AL	3	15			NATIVE (CH) Dark gray, very soft, Silty CLAY
R-4 MC	5	32.3	91.0	DS	-3	20			Micaceous
S-5 SPT	1	56.4		WA	-8	25			(ML) Dark gray, very loose, medium to fine, Sandy SILT, with CLAY, some sea shells (ML) Light gray, very soft, Clayey SILT, carbonaceous
R-6 MC	5	27.1	98.1	DS	-13	30			(CL) Dark gray Silty CLAY, some plant particles
S-7 SPT	15	18.8		WA	-18	35			(ML) Dark gray, stiff, coarse to fine, Sandy SILT, some GRAVEL Stiff, no SAND and GRAVEL, some sea shells
R-8 MC	8	41.7	82.6		-23	40			(CL) Blue to olive gray, Silty CLAY

GDC_LOG_BORING L196PV.GPJ GDC_WLOG.GDT 1/4/99

LOG OF TEST BORING

PROJECT	PROJECT NUMBER	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	B-302R

SITE	BEGUN	COMPLETED	SHEET NO.
Playa del Rey, California	12/11/98	12/11/98	2 of 2

DRILLER	DRILL METHOD	LOGGED BY	CHECKED BY
C & L	ROTARY WASH	SHK	MDR

DRILL EQUIPMENT	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	DEPTH/*ELEV.* GROUND WATER
MAYHEW ROTARY	6"	66.5 ft.	17.50	▼ 20.0 / -2.5

SAMPLING METHOD	NOTES
R: 400-lb downhole hammer S:140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
S-9 SPT	8	43.9		AL	-28	45			(ML) Greenish gray, soft, Clayey SILT
S-10 SPT	Pushed				-33	50			Sample pushed (CL) dark greenish gray, soft, Silty CLAY
S-11 SPT	14	48.2		AL	-38	55			(CL) Dark gray, stiff, Silty CLAY, with trace of fine SAND
S-12 SPT	22	25.8			-43	60			(SP) Dark gray, compact, SAND, with GRAVEL
S-13 SPT	73	9.2			-48	65			Very dense
									Bottom of B-302R @ 66.5 feet *Ground water was observed at 20 feet below the top surface.* *The boring was backfilled with grout.* *The boring cuttings were placed into DOT drums.*
					-53	70			
					-58	75			
					-63	80			

GDC_LOG_BORING_L196PV.GPJ GDC_WLOG.GDT 1/4/99

BORING/WELL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	1 of 1	**B-304H**

SITE	LOGGED BY	CHECKED BY	BEGUN	COMPLETED
Playa del Rey, California	SHK	MDR	10/29/98	10/29/98

DRILLER	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	TOP OF CASING ELEV.	DEPTH/*ELEV.* GROUND WATER
THF	10"	31.0 ft.	14.55	16.69	▼ 12.2 / *2.3*

DRILL METHOD	CASING TYPE/DIA.	SCREEN TYPE/SLOT	GRAVEL PACK TYPE	GROUT TYPE/QUANTITY
HOLLOW STEM	4" PVC Casing	0.010" Slotted Casing	12 bgs, 2/12 Sand	2 bgs, Bentonite Chips

SAMPLING METHOD	NOTES
140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	DESCRIPTION AND CLASSIFICATION
BULK1 GRAB		9.8		CO			FILL (SM) Dark brown, coarse to fine, Silty SAND, damp
R-1 MC	20	18.7	98.0	AL CS	10	5	(SC) Dark gray Clayey SAND, with SILT
R-2 MC	71	11.5	95.4		5	10	(CL) Gray, medium to fine Sandy CLAY, with white cemented SAND
R-3 MC	15	30.9	90.1	WA	0	15	NATIVE (ML) Gray to olive gray, Sandy SILT, micaceous
R-4 MC	10	37.2	76.4	AL CS	-5	20	(CH) Medium gray, Silty CLAY, fossil worm holes present.
R-5 MC	10				-10	25	NO SAMPLE RECOVERED
R-6 MC	17				-15	30	
					-20	35	
					-25	40	

Bottom of B-304H @ 31 feet
Ground water was observed at 12.22 feet below ground surface on 12/23/98.
The boring cuttings and water were placed into DOT drums.

GDC_WELL_LOG L196PV.GPJ GDC_WLOG.GDT 1/4/99

BORING/WELL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	1 of 1	B-305H

SITE	LOGGED BY	CHECKED BY	BEGUN	COMPLETED
Playa del Rey, California	SHK	MDR	10/29/98	10/29/98

DRILLER	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	TOP OF CASING ELEV.	DEPTH/ELEV. GROUND WATER
THF	10"	31.0 ft.	15.29	17.43	▼ 12.0 / 3.3

DRILL METHOD	CASING TYPE/DIA.	SCREEN TYPE/SLOT	GRAVEL PACK TYPE	GROUT TYPE/QUANTITY
HOLLOW STEM	4" PVC Casing	0.010" Slotted Casing	12 bgs, 2/12 Sand	2 bgs, Bentonite Chips

SAMPLING METHOD	NOTES
140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	DESCRIPTION AND CLASSIFICATION
BULK1 GRAB							FILL (SM) Brown to dark brown, coarse to fine, Silty SAND, with CLAY, GRAVEL
		9.0		CO			
R-1 MC	20	18.6	109.0	AL CS	10	5	(CL) Dark brown, fine Sandy CLAY
R-2 MC	20	15.2			5	10	Increse in SILT, less SAND, Silty CLAY, with GRAVEL
R-3 MC	10	34.9	87.6	AL CS	0	15	NATIVE (SM) Olive gray to gray, coarse Silty SAND, with sea shell fragments, micaceous
R-4 MC	6	65.1	58.4	AL CS	-5	20	(CH) Olive to dark gray, Silty CLAY
R-5 MC	11	22.4	100.4		-10	25	Color change: Dark gray
R-6 MC	16				-15	30	NSR
							Bottom of B-305H @ 31 feet *Ground water was observed at 12.77 feet below ground surface on 12/23/98.* *The boring cuttings and water were placed into DOT drums.*
					-20	35	
					-25	40	

GDC_WELL_LOG L196PV.GPJ GDC_WLOG.GDT 1/4/99

GROUP DELTA CONSULTANTS, INC.

FIGURE C-6

LOG OF TEST BORING

PROJECT	Playa Vista - Site DE & Ballona Creek
PROJECT NUMBER	L-196
HOLE NUMBER	**B-306R**
SITE	Playa del Rey, California
BEGUN	11/04/98
COMPLETED	11/04/98
SHEET NO.	1 of 2
DRILLER	THF
DRILL METHOD	ROTARY WASH
LOGGED BY	SHK
CHECKED BY	MDR
DRILL EQUIPMENT	MOBILE 61 ROTARY
BORING DIA.	4.5"
TOTAL DEPTH	51.5 ft.
GROUND ELEV.	16.78
DEPTH/*ELEV.* GROUND WATER	▼ N/T / *na*
SAMPLING METHOD	140-lb 30-inch Free Falling Hammer
NOTES	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE I.D.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
									FILL (SC/SM) Olive gray, Silty to Clayey SAND
R-1 MC	73@11"	16.8	112.1		12	5			With GRAVEL
S-2 SPT	82				7	10			Very dense, less GRAVEL
									NATIVE
R-3 MC	33	40.8		WA	2	15			(CL) Light gray, Silty CLAY, with fine SAND, carbonaceous
S-4 SPT	18	55.9	63.9	AL	-3	20			(CH) Black to dark gray, stiff, CLAY, carbonaceous
R-5 MC	50				-8	25			No change
S-6 SPT	36				-13	30			Hard, GRAVELS up to 1/2"
R-7 MC	84	10.6	129.1	SE					(SP) Dark gray, coarse to medium, Gravelly SAND, up to 2"
S-8 SPT	19	32.7			-18	35			(CL) Dark gray, stiff, Silty CLAY
R-9 MC	72				-23	40			medium to fine SAND present

GDC_LOG_BORING L196PV.GPJ GDC_WLOG.GDT 1/4/99

LOG OF TEST BORING

PROJECT	PROJECT NUMBER	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	B-306R

SITE	BEGUN	COMPLETED	SHEET NO.
Playa del Rey, California	11/04/98	11/04/98	2 of 2

DRILLER	DRILL METHOD	LOGGED BY	CHECKED BY
THF	ROTARY WASH	SHK	MDR

DRILL EQUIPMENT	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	DEPTH/*ELEV.* GROUND WATER
MOBILE 61 ROTARY	4.5"	51.5 ft.	16.78	▼ N/T / *na*

SAMPLING METHOD	NOTES
140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
S-10 SPT	68	37.6			-28	45			Dense
S-11 SPT	66	41.1			-33	50			(CH) Dark gray, hard, CLAY, with fine SAND
									Bottom of B-306R @ 51.5 feet *Ground water measurement was not taken.* *The boring was backfilled with grout.* *The boring cuttings were placed into DOT drums.*
					-38	55			
					-43	60			
					-48	65			
					-53	70			
					-58	75			
					-63	80			

GDC_LOG_BORING L196PV.GPJ GDC_WLOG.GDT 1/4/99

LOG OF TEST BORING

PROJECT	PROJECT NUMBER	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	**B-307R**

SITE	BEGUN	COMPLETED	SHEET NO.
Playa del Rey, California	11/06/98	11/06/98	1 of 2

DRILLER	DRILL METHOD	LOGGED BY	CHECKED BY
THF	ROTARY WASH	SHK	MDR

DRILL EQUIPMENT	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	DEPTH/*ELEV.* GROUND WATER
MOBILE 61 ROTARY	4.5"	61.0 ft.	11.38	▼ N/T / *na*

SAMPLING METHOD	NOTES
140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	DESCRIPTION AND CLASSIFICATION
							FILL (CL) Olive gray Sandy CLAY
S-1 SPT	12	16.2			6	5	Gradation change: Stiff, coarse to fine Sandy CLAY, some GRAVEL
R-2 MC	26				1	10	NATIVE (CL) Medium gray to gray, CLAY
R-3 MC	26	40.0	81.5				
							(CH) Olive gray, fine Sandy CLAY, micaceous
R-4 MC	43				-4	15	No Recovery
R-5 MC	6	82.0	51.3	WA AL CS	-9	20	(CH/OH) Dark gray, Sandy CLAY / Organic Sandy CLAY
S-6 SPT	16	23.5		WA	-14	25	Gradation change: Stiff, fine Sandy / Organic Sandy CLAY
R-7 MC	49	29.5	94.8	DS	-19	30	(ML) Dark gray, fine Sandy SILT, trace of CLAY
S-8 SPT	59	28.2			-24	35	(CL) Dark gray, hard, Silty CLAY (SP) Dark gray, dense, coarse to medium, SAND, with some GRAVEL
S-9 SPT	22	36.9			-29	40	(CL) Dark gray, very stiff, Silty CLAY

GDC LOG BORING L196PV.GPJ GDC WLOG.GDT 1/4/99

LOG OF TEST BORING

PROJECT	Playa Vista - Site DE & Ballona Creek
PROJECT NUMBER	L-196
HOLE NUMBER	**B-307R**
SITE	Playa del Rey, California
BEGUN	11/06/98
COMPLETED	11/06/98
SHEET NO.	2 of 2
DRILLER	THF
DRILL METHOD	ROTARY WASH
LOGGED BY	SHK
CHECKED BY	MDR
DRILL EQUIPMENT	MOBILE 61 ROTARY
BORING DIA.	4.5"
TOTAL DEPTH	61.0 ft.
GROUND ELEV.	11.38
DEPTH/*ELEV.* GROUND WATER	▼ N/T / *na*
SAMPLING METHOD	140-lb 30-inch Free Falling Hammer
NOTES	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
S-10 SPT	25	33.6			-34	45			Very stiff
S-11 SPT	39	22.8			-39	50			(SP) Dark gray, dense, coarse to medium, SAND, with fine GRAVEL (CL) Dark gray Silty CLAY
S-12 SPT	112@15"	28.6			-44	55			(ML) Dark gray, very hard, fine Sandy SILT
S-13 SPT	120	21.0			-49	60			(SP) Gray, very dense, coarse to medium, SAND *Bottom of B-307R @ 61 feet* *Ground water measurement was not taken.* *The boring was backfilled with grout.* *The boring cuttings were placed into DOT drums.*
					-54	65			
					-59	70			
					-64	75			
					-69	80			

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LOG OF TEST BORING

PROJECT Playa Vista - Site DE & Ballona Creek			**PROJECT NUMBER** L-196	**HOLE NUMBER** B-309R
SITE Playa del Rey, California		**BEGUN** 11/04/98	**COMPLETED** 11/04/98	**SHEET NO.** 1 of 2
DRILLER THF	**DRILL METHOD** ROTARY WASH		**LOGGED BY** SHK	**CHECKED BY** MDR
DRILL EQUIPMENT MOBILE 61 ROTARY	**BORING DIA.** 4.5"	**TOTAL DEPTH** 61.0 ft.	**GROUND ELEV.** 12.76	**DEPTH/*ELEV.* GROUND WATER** ▼ N/T / *na*
SAMPLING METHOD 140-lb 30-inch Free Falling Hammer	**NOTES** LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP			

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
									FILL (SC) Olive gray, Clayey SILT, with GRAVEL
S-1 SPT	26	18.4			8	5			Compact
R-2 MC	23	27.5	91.0		3	10			NATIVE (CL) Gray to medium gray, Silty CLAY
S-3 SPT	17			AL	-2	15			Color change: Gray to olive gray, stiff
R-4 MC	24	29.2		AL	-7	20			(CL/OL) Dark gray, Silty / Organic CLAY, with sea shells and decaying plants
S-5 SPT	8			WA	-12	25			Gradation change: Soft, coarse to fine Silty / Organic Clay, with GRAVEL
R-6 MC	32	37.5	89.6		-17	30			With sections of Silty SAND
S-7 SPT	16	36.9		AL	-22	35			(CH) Dark gray, stiff, CLAY, porous
R-8 MC	32				-27	40			With some SILT

LOG OF TEST BORING

PROJECT	Playa Vista - Site DE & Ballona Creek
PROJECT NUMBER	L-196
HOLE NUMBER	B-309R
SITE	Playa del Rey, California
BEGUN	11/04/98
COMPLETED	11/04/98
SHEET NO.	2 of 2
DRILLER	THF
DRILL METHOD	ROTARY WASH
LOGGED BY	SHK
CHECKED BY	MDR
DRILL EQUIPMENT	MOBILE 61 ROTARY
BORING DIA.	4.5"
TOTAL DEPTH	61.0 ft.
GROUND ELEV.	12.76
DEPTH/*ELEV.* GROUND WATER	▼ N/T / *na*
SAMPLING METHOD	140-lb 30-inch Free Falling Hammer
NOTES	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
S-9 SPT	22	37.9			-32	45			Very stiff,
S-10 SPT	50				-37	50			Hard, SILT lenses are present
S-11 SPT	48	31.5			-42	55			Hard
S-12 SPT	70@3"	4.5			-47	60			(GP) Dark gray, very dense, well graded GRAVEL
									Bottom of B-309R @ 61 feet *Ground water measurement was not taken.* *The boring was backfilled with grout.* *The boirng cuttings were placed into DOT drums.*
					-52	65			
					-57	70			
					-62	75			
					-67	80			

GDC_LOG_BORING L196PV.GPJ GDC_WLOG.GDT 1/4/99

BORING/WELL LOG

Field	Value
PROJECT	Playa Vista - Site DE & Ballona Creek
PROJECT NUMBER	L-196
SHEET NO.	1 of 1
HOLE NUMBER	**B-313H**
SITE	Playa del Rey, California
LOGGED BY	SHK
CHECKED BY	MDR
BEGUN	10/29/98
COMPLETED	10/29/98
DRILLER	THF
BORING DIA.	10"
TOTAL DEPTH	26.0 ft.
GROUND ELEV.	12.58
TOP OF CASING ELEV.	14.62
DEPTH/*ELEV.* GROUND WATER	▼ 8.4 / *4.1*
DRILL METHOD	HOLLOW STEM
CASING TYPE/DIA.	4" PVC Casing
SCREEN TYPE/SLOT	0.010" Slotted Casing
GRAVEL PACK TYPE	12 bgs, 2/12 Sand
GROUT TYPE/QUANTITY	2 bgs, Bentonite Chips
SAMPLING METHOD	140-lb 30-inch Free Falling Hammer
NOTES	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	DESCRIPTION AND CLASSIFICATION
BULK1 GRAB				CO			FILL (SM) Dark brown, coarse to medium, Silty SAND, with GRAVEL
R-1 MC	18	19.1	105.9	GS	8	5	(CL) Olive gray with black streaks, Silty CLAY
R-2 MC	11	29.8	89.4		3	10	NATIVE (ML) Olive gray, Clayey SILLT, micaceous, wet
R-3 MC	6	39.5	81.3		-2	15	Saturated, thin 1/8" stringers of organic material
R-4 MC	4	86.4	51.4	AL CS	-7	20	(CH) Dark gray, CLAY / Organic CLAY, fossilierous
R-5 MC	9	42.1	83.5		-12	25	No change
					-17	30	
					-22	35	
					-27	40	

Bottom of B-313H @ 26 feet
Ground water was observed at 8.45 feet below ground surface on 12/23/98.
The boring cuttings and well water were placed into DOT drums.

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BORING/WELL LOG

PROJECT	PROJECT NUMBER	SHEET NO.	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	1 of 1	**B-315H**

SITE	LOGGED BY	CHECKED BY	BEGUN	COMPLETED
Playa del Rey, California	SHK	MDR	10/30/98	10/30/98

DRILLER	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	TOP OF CASING ELEV.	DEPTH/*ELEV.* GROUND WATER
THF	10"	26.0 ft.	13.34	15.36	▼ 8.0 / *5.3*

DRILL METHOD	CASING TYPE/DIA.	SCREEN TYPE/SLOT	GRAVEL PACK TYPE	GROUT TYPE/QUANTITY
HOLLOW STEM	4" PVC Casing	0.010" Slotted Casing	12 bgs, 2/12 Sand	2 bgs, Bentonite Chips

SAMPLING METHOD	NOTES
140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	WELL GRAPHICS	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
BULK1 GRAB				RV						FILL (SM) Dark brown, Silty SAND, with CLAY, GRAVEL, and some brick fragments
R-1 MC	21	10.2	120.7		8	5				Slight increase in GRAVEL
R-2 MC	6	48.7	68.7		3	10				NATIVE (CL) Medium gray, Silty CLAY, with some sea shells, micaceous
R-3 MC	9	42.7	80.6	WA	-2	15				(ML) Olive gray, Clayey SILT, micaceous, very wet
R-4 MC	10	65.1	59.8	AL CS	-7	20				(MH) Dark gray, Clayey SILT, organic content, saturated
R-5 MC	13	50.5	84.6		-12	25				No change *Bottom of B-315H @ 26 feet* *Ground water was observed at 8.0 feet below ground surface on 12/23/98.* *The boring cuttings and well water were placed into DOT drums.*
					-17	30				
					-22	35				
					-27	40				

GDC_WELL_LOG L196PV.GPJ GDC_WLOG.GDT 1/4/99

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FIGURE **C-14**

LOG OF TEST BORING

PROJECT: Playa Vista - Site DE & Ballona Creek	**PROJECT NUMBER:** L-196		**HOLE NUMBER:** B-316R
SITE: Playa del Rey, California	**BEGUN:** 11/03/98	**COMPLETED:** 11/03/98	**SHEET NO.:** 1 of 2
DRILLER: THF	**DRILL METHOD:** ROTARY WASH	**LOGGED BY:** SHK	**CHECKED BY:** MDR
DRILL EQUIPMENT: MOBILE 61 ROTARY	**BORING DIA.:** 4.5"	**TOTAL DEPTH:** 57.5 ft.	**GROUND ELEV.:** 14.08
DEPTH/ELEV. GROUND WATER: ▼ N/T / *na*			
SAMPLING METHOD: 140-lb 30-inch Free Falling Hammer	**NOTES:** LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP		

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
									FILL (SC) Olive gray, Clayey SAND, with GRAVEL
R-1 MC	29				9	5			Some SILT and brick fragments
S-2 SPT	37	34.5		WA AL	4	10			NATIVE (CL) Dark gray to olive gray, hard, Silty CLAY
R-3 MC	19				-1	15			No Sample Recovered
S-4 SPT	11	60.1			-6	20			Color change: Gray, stiff, some medium grain SAND lenses to 1/4"
R-5 MC	21				-11	25			No change
R-6 MC	22	18.6	109.4	WA					(ML) Dark gray, fine to medium Sandy SILT, slightly porous
S-7 SPT	9	30.4			-16	30			(CL) Dark gray, soft, Silty CLAY
S-8 SPT	15	31.8			-21	35			(CL/OL) Dark gray, stiff, Silty / Organic CLAY
S-9 SPT	12	33.9			-26	40			Stiff

GDC_LOG_BORING L196PV.GPJ GDC_WLOG.GDT 1/4/99

LOG OF TEST BORING

PROJECT	PROJECT NUMBER	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	B-316R

SITE	BEGUN	COMPLETED	SHEET NO.
Playa del Rey, California	11/03/98	11/03/98	2 of 2

DRILLER	DRILL METHOD	LOGGED BY	CHECKED BY
THF	ROTARY WASH	SHK	MDR

DRILL EQUIPMENT	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	DEPTH/*ELEV.* GROUND WATER
MOBILE 61 ROTARY	4.5"	57.5 ft.	14.08	▼ N/T / *na*

SAMPLING METHOD	NOTES
140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
S-10 SPT	33	27.9			-31	45			(CL) Dark gray, very stiff, CLAY, with 1" thick SAND lenses
S-11 SPT	62	35.0			-36	50			(SM) Dark gray, dense, fine Silty SAND
S-12 SPT	71	26.4			-41	55			Gradation change: Very dense, coarse to fine Silty SAND, with GRAVEL
									Bottom of B-316R @ 57.5 feet *Ground water measurement was not taken.* *The boring was backfilled with grout and capped with concrete.* *The boring cuttings were placed into DOT drums.*
					-46	60			
					-51	65			
					-56	70			
					-61	75			
					-66	80			

GDC_LOG_BORING L196PV.GPJ GDC_WLOG.GDT 1/4/99

LOG OF TEST BORING

PROJECT	PROJECT NUMBER	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	B-317R

SITE	BEGUN	COMPLETED	SHEET NO.
Playa del Rey, California	11/05/98	11/05/98	1 of 2

DRILLER	DRILL METHOD	LOGGED BY	CHECKED BY
THF	ROTARY WASH	SHK	MDR

DRILL EQUIPMENT	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	DEPTH/*ELEV.* GROUND WATER
MOBILE 61 ROTARY	4.5"	61.0 ft.	9.53	⊻ N/T / *na*

SAMPLING METHOD	NOTES
140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
									FILL (SC) Brown to olive gray, Clayey SAND, with GRAVEL
S-1 SPT	49				5	5			Dense, some glass and plastic present
R-2 MC	6	49.9	73.3		0	10			NATIVE (CL) Dark gray to light gray, Silty CLAY, carbonaceous
S-3 SPT	4	35.8	87.4	WA	-5	15			(ML) Olive gray, very soft, Clayey SILT, with medium to fine SAND, sea shells, micaceous
R-4 MC	12	93.7	47.2		-10	20			(CL) Gray, fine Sandy CLAY, fossiliferous
S-5 SPT	19	26.9			-15	25			Stiff, with SILT, carbonates present
R-6 MC	22	42.0	81.1		-20	30			Friable / cottage cheese texture when broken
S-7 SPT	21	25.5			-25	35			(ML) Dark gray, very stiff, Clayey SILT
R-8 MC	90	22.7	102.3		-30	40			(SM) Dark gray, coarse to fine, Silty SAND

GDC_LOG_BORING_L196PV.GPJ_GDC_WLOG.GDT 1/4/99

LOG OF TEST BORING

PROJECT	Playa Vista - Site DE & Ballona Creek
PROJECT NUMBER	L-196
HOLE NUMBER	B-317R
SITE	Playa del Rey, California
BEGUN	11/05/98
COMPLETED	11/05/98
SHEET NO.	2 of 2
DRILLER	THF
DRILL METHOD	ROTARY WASH
LOGGED BY	SHK
CHECKED BY	MDR
DRILL EQUIPMENT	MOBILE 61 ROTARY
BORING DIA.	4.5"
TOTAL DEPTH	61.0 ft.
GROUND ELEV.	9.53
DEPTH/*ELEV.* GROUND WATER	⊻ N/T / *na*
SAMPLING METHOD	140-lb 30-inch Free Falling Hammer
NOTES	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
S-9 SPT	49	36.0			-35	45			(CL) Dark gray, hard, Silty CLAY, 1/2" thick organic deposit
S-10 SPT	37	31.4			-40	50			Hard, no organics
S-11 SPT	89	23.6			-45	55			(SM) Dark gray, very dense, medium to fine, Silty SAND
S-12 SPT	70@1"	10.1			-50	60			(SP) Gray, very dense, coarse to medium, SAND, with GRAVEL up to 1"
									Bottom of B-317R @ 61 feet *Ground water measurement was not taken.* *The boring was backfilled with grout.* *The boring cuttings were placed into DOT drums.*
					-55	65			
					-60	70			
					-65	75			
					-70	80			

GDC_LOG_BORING L196PV.GPJ GDC_WLOG.GDT 1/4/99

LOG OF TEST BORING

PROJECT Playa Vista - Site DE & Ballona Creek		**PROJECT NUMBER** L-196		**HOLE NUMBER** B-319R
SITE Playa del Rey, California	**BEGUN** 11/05/98	**COMPLETED** 11/05/98		**SHEET NO.** 1 of 2
DRILLER THF	**DRILL METHOD** ROTARY WASH	**LOGGED BY** SHK		**CHECKED BY** MDR
DRILL EQUIPMENT MOBILE 61 ROTARY	**BORING DIA.** 4.5"	**TOTAL DEPTH** 61.0 ft.	**GROUND ELEV.** 11.67	**DEPTH/*ELEV.* GROUND WATER** ▼ N/T / *na*
SAMPLING METHOD 140-lb 30-inch Free Falling Hammer	**NOTES** LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP			

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
									FILL (CL) Olive gray Sandy CLAY
S-1 SPT	26	18.1			7	5			Very stiff, medium to fine Sandy CLAY, with some GRAVEL, soome brick fragments
R-2 MC	20				2	10			NATIVE (CL) Dark gray, Silty CLAY
R-3 MC	21	43.3	79.5						
S-4 SPT	19	39.6			-3	15			(ML) Light gray, fine Sandy SILT, micaaceous
R-5 MC	8	66.8	60.0	AL CS	-8	20			(MH) Dark gray, Clayey SILT, fossiliferous
S-6 SPT	9	31.2			-13	25			Soft, with fine grain SAND, some sea shells
R-7 MC	24	33.0	91.4	DS	-18	30			(CL) Greenish gray, mottled dark yellow-orange, Silty CLAY, trace of fine SAND
S-8 SPT	N/R	28.8			-23	35			Color change: Dark gray, fine SAND grading to SILT and Silty CLAY
S-9 SPT	36	24.7			-28	40			(SM) Dary gray, dense, fine Silty SAND

GDC_LOG_BORING L196PV.GPJ GDC_WLOG.GDT 1/4/99

GROUP DELTA CONSULTANTS, INC.

LOG OF TEST BORING

PROJECT	PROJECT NUMBER	HOLE NUMBER
Playa Vista - Site DE & Ballona Creek	L-196	B-319R

SITE	BEGUN	COMPLETED	SHEET NO.
Playa del Rey, California	11/05/98	11/05/98	2 of 2

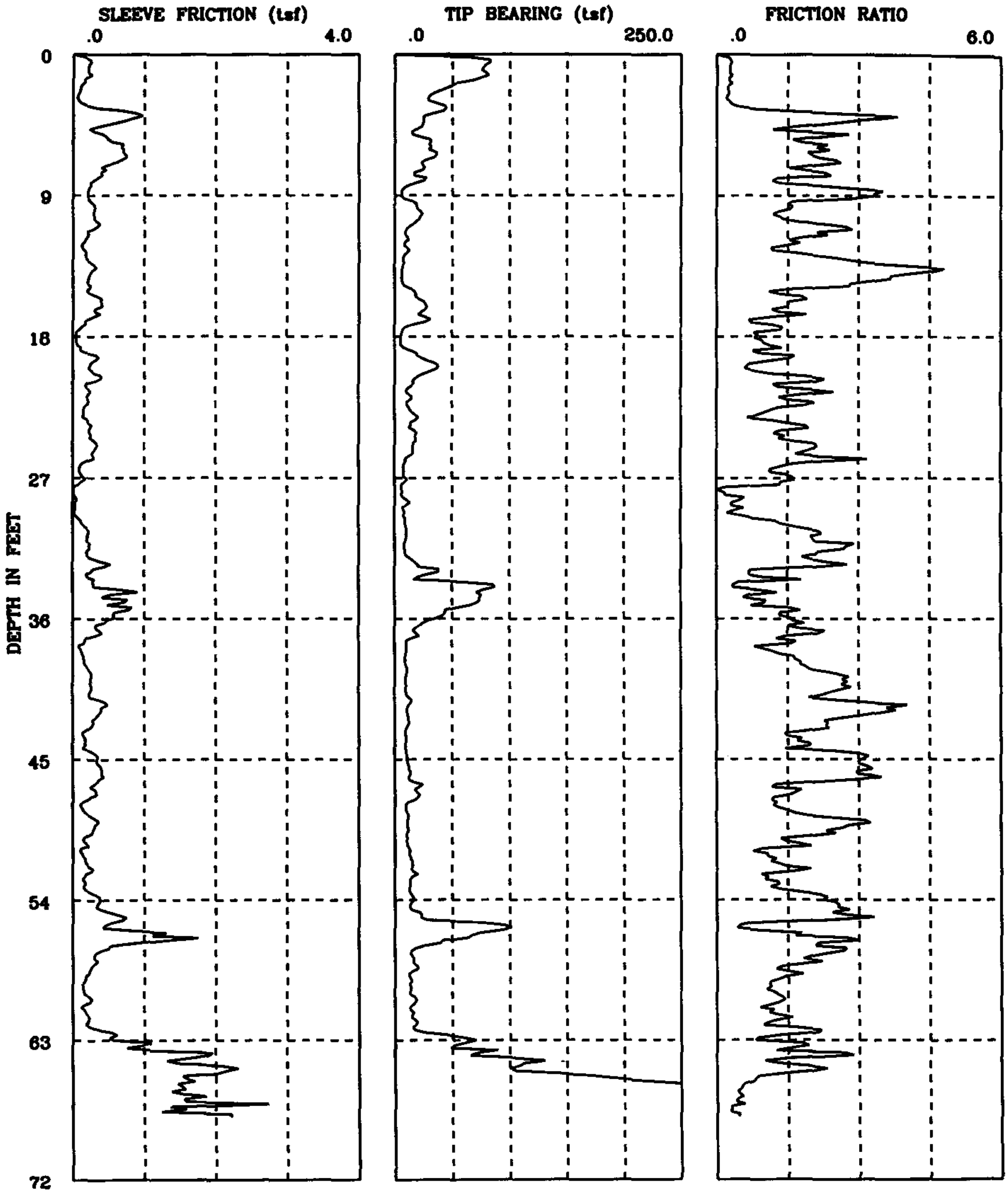
DRILLER	DRILL METHOD	LOGGED BY	CHECKED BY
THF	ROTARY WASH	SHK	MDR

DRILL EQUIPMENT	BORING DIA.	TOTAL DEPTH	GROUND ELEV.	DEPTH/*ELEV.* GROUND WATER
MOBILE 61 ROTARY	4.5"	61.0 ft.	11.67	▼ N/T / *na*

SAMPLING METHOD	NOTES
140-lb 30-inch Free Falling Hammer	LOCATION: PLEASE REFER TO FIGURE 2, SITE MAP

SAMPLE ID.	PENETRATION RESISTANCE (BLOWS/FOOT)	MOISTURE (%)	DRY DENSITY (pcf)	OTHER TESTS	ELEVATION	DEPTH (feet)	GRAPHIC LOG	SAMPLE TYPE	DESCRIPTION AND CLASSIFICATION
S-10 SPT	23	38.0			-33	45			(CL) Dark gray, compact, Silty CLAY
S-11 SPT	61	30.3			-38	50			Dense
S-12 SPT	98	25.4			-43	55			(ML) Dark gray, very hard, fine Sandy SILT
S-13 SPT	100@9"	15.0			-48	60			(SP) Gray, very dense, coarse to medium, SAND, with GRAVEL up to 1"
									Bottom of B-319R @ 61 feet *Ground water measurement was not taken.* *The boring was backfilled with grout.* *The boring cuttings were placed into DOT drums.*
					-53	65			
					-58	70			
					-63	75			
					-68	80			

GDC_LOG_BORING L196PV.GPJ GDC_WLOG.GDT 1/4/99



CPT 301C	Playa Vista Site
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

GROUP DELTA CONSULTANTS

CPT Date :12-07-98
Cone Used :**CPT B-301C**
Depth to water table (ft) : 14

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.20	1	53.89	0.15	0.28	0.02	sand to silty sand	>90	>48	13	UNDEFINED
0.50	2	74.67	0.21	0.29	0.07	sand to silty sand	>90	>48	18	UNDEFINED
0.80	3	40.45	0.10	0.24	0.12	sand to silty sand	70-80	46-48	10	UNDEFINED
1.10	4	38.62	0.32	0.84	0.18	silty sand to sandy silt	60-70	44-46	12	UNDEFINED
1.40	5	24.75	0.68	2.76	0.24	clayey silt to silty clay	UNDFND	UNDFD	12	1.6
1.70	6	22.30	0.43	1.94	0.29	sandy silt to clayey silt	UNDFND	UNDFD	9	1.4
2.00	7	34.35	0.71	2.07	0.35	sandy silt to clayey silt	UNDFND	UNDFD	13	2.2
2.30	8	22.07	0.47	2.11	0.41	sandy silt to clayey silt	UNDFND	UNDFD	8	1.4
2.70	9	14.80	0.25	1.71	0.47	clayey silt to silty clay	UNDFND	UNDFD	7	.9
3.00	10	15.40	0.27	1.73	0.54	clayey silt to silty clay	UNDFND	UNDFD	7	.9
3.30	11	20.56	0.32	1.57	0.59	sandy silt to clayey silt	UNDFND	UNDFD	8	1.3
3.60	12	10.45	0.23	2.20	0.65	clayey silt to silty clay	UNDFND	UNDFD	5	.6
3.90	13	9.67	0.15	1.52	0.71	clayey silt to silty clay	UNDFND	UNDFD	5	.5
4.20	14	6.86	0.26	3.79	0.76	clay	UNDFND	UNDFD	7	.4
4.50	15	7.20	0.23	3.19	0.81	clay	UNDFND	UNDFD	7	.4
4.80	16	20.35	0.30	1.49	0.84	sandy silt to clayey silt	UNDFND	UNDFD	8	1.2
5.10	17	25.68	0.33	1.30	0.86	sandy silt to clayey silt	UNDFND	UNDFD	10	1.6
5.40	18	13.94	0.12	0.86	0.89	sandy silt to clayey silt	UNDFND	UNDFD	5	.8
5.70	19	6.05	0.07	1.10	0.92	sensitive fine grained	UNDFND	UNDFD	3	.3
6.00	20	25.92	0.26	1.00	0.94	sandy silt to clayey silt	UNDFND	UNDFD	10	1.6
6.30	21	26.72	0.30	1.12	0.97	sandy silt to clayey silt	UNDFND	UNDFD	10	1.7
6.60	22	13.17	0.21	1.57	0.99	clayey silt to silty clay	UNDFND	UNDFD	6	.7
6.90	23	12.68	0.19	1.47	1.02	clayey silt to silty clay	UNDFND	UNDFD	6	.7
7.20	24	16.72	0.21	1.24	1.04	sandy silt to clayey silt	UNDFND	UNDFD	6	1.0
7.50	25	17.53	0.25	1.45	1.07	sandy silt to clayey silt	UNDFND	UNDFD	7	1.0
7.80	26	15.10	0.31	2.03	1.10	clayey silt to silty clay	UNDFND	UNDFD	7	.9
8.10	27	8.37	0.13	1.55	1.12	clayey silt to silty clay	UNDFND	UNDFD	4	.4
8.40	28	7.56	0.09	1.15	1.15	undefined	UNDFND	UNDFD	UDF	UNDEFINED
8.70	29	8.73	0.03	0.34	1.17	sensitive fine grained	UNDFND	UNDFD	4	.4
9.10	30	8.59	0.06	0.73	1.20	clayey silt to silty clay	UNDFND	UNDFD	4	.4
9.40	31	10.01	0.20	2.03	1.23	clayey silt to silty clay	UNDFND	UNDFD	5	.5
9.70	32	8.66	0.22	2.54	1.26	silty clay to clay	UNDFND	UNDFD	6	.4
10.00	33	24.02	0.36	1.51	1.29	sandy silt to clayey silt	UNDFND	UNDFD	9	1.4
10.30	34	43.40	0.26	0.60	1.31	silty sand to sandy silt	<40	34-36	14	UNDEFINED
10.60	35	75.37	0.65	0.86	1.34	sand to silty sand	50-60	38-40	18	UNDEFINED
10.90	36	50.75	0.60	1.19	1.36	silty sand to sandy silt	40-50	36-38	16	UNDEFINED
11.20	37	22.39	0.39	1.73	1.39	sandy silt to clayey silt	UNDFND	UNDFD	9	1.3
11.50	38	13.87	0.19	1.37	1.42	sandy silt to clayey silt	UNDFND	UNDFD	5	.7

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

GROUP DELTA CONSULTANTS

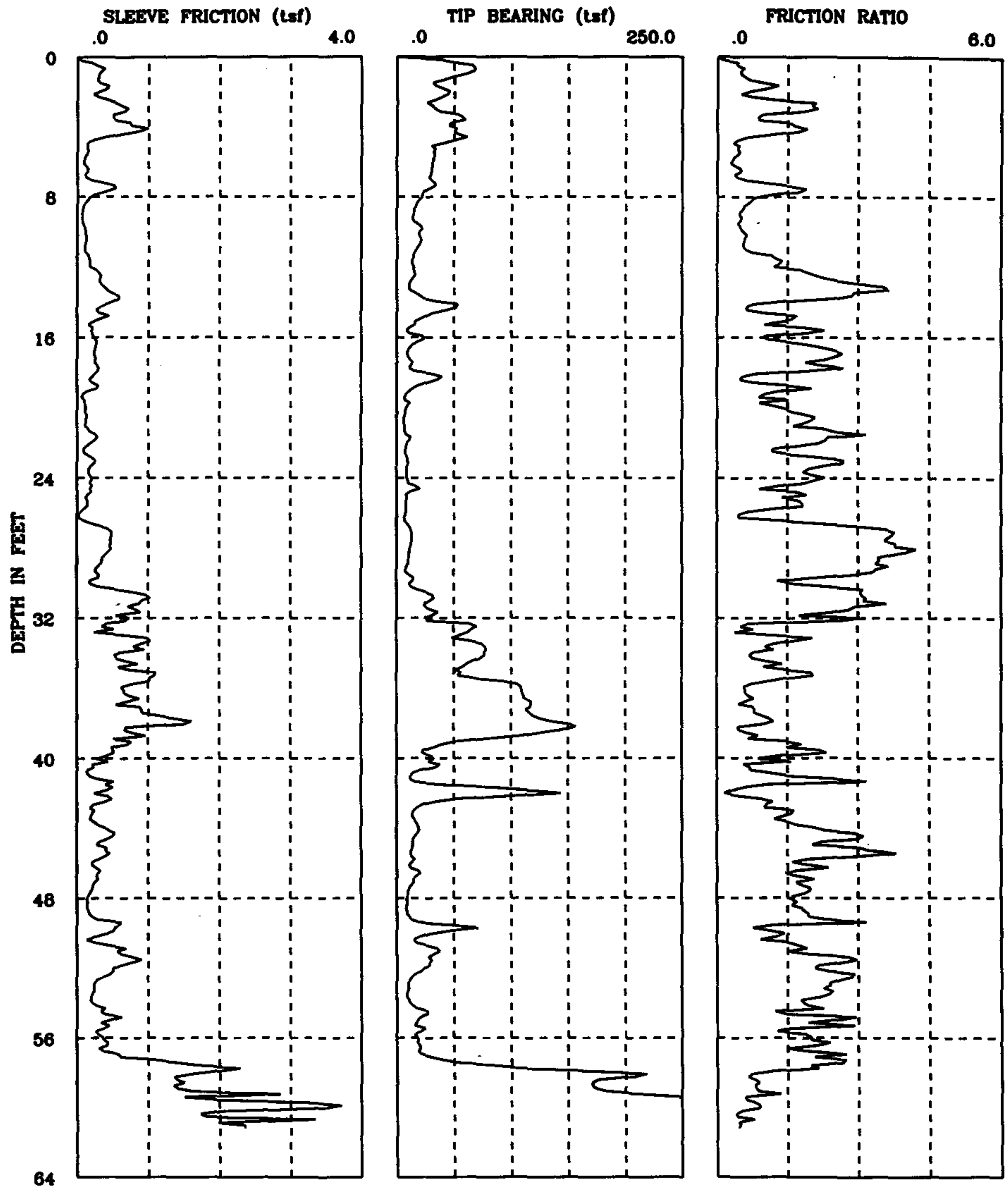
CPT Date :12-07-98
Cone Used :CPT B-301C
Depth to water table (ft) : 14

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.80	39	9.43	0.14	1.52	1.44	clayey silt to silty clay	UNDFND	UNDFD	5	.4
12.10	40	9.94	0.23	2.31	1.47	silty clay to clay	UNDFND	UNDFD	6	.5
12.40	41	9.56	0.25	2.65	1.49	silty clay to clay	UNDFND	UNDFD	6	.4
12.70	42	12.60	0.36	2.88	1.52	silty clay to clay	UNDFND	UNDFD	8	.6
13.00	43	11.74	0.33	2.81	1.54	silty clay to clay	UNDFND	UNDFD	7	.6
13.30	44	9.56	0.18	1.88	1.57	clayey silt to silty clay	UNDFND	UNDFD	5	.4
13.60	45	9.75	0.21	2.15	1.60	clayey silt to silty clay	UNDFND	UNDFD	5	.4
13.90	46	11.58	0.36	3.14	1.62	silty clay to clay	UNDFND	UNDFD	7	.5
14.20	47	16.57	0.36	2.15	1.65	clayey silt to silty clay	UNDFND	UNDFD	8	.9
14.50	48	18.67	0.28	1.50	1.67	sandy silt to clayey silt	UNDFND	UNDFD	7	1.0
14.80	49	10.51	0.16	1.55	1.70	clayey silt to silty clay	UNDFND	UNDFD	5	.5
15.10	50	11.47	0.31	2.73	1.73	silty clay to clay	UNDFND	UNDFD	7	.5
15.50	51	11.20	0.17	1.50	1.76	clayey silt to silty clay	UNDFND	UNDFD	5	.5
15.80	52	14.40	0.18	1.23	1.79	sandy silt to clayey silt	UNDFND	UNDFD	6	.7
16.10	53	15.02	0.20	1.33	1.81	sandy silt to clayey silt	UNDFND	UNDFD	6	.8
16.40	54	14.06	0.25	1.78	1.84	clayey silt to silty clay	UNDFND	UNDFD	7	.7
16.70	55	16.36	0.41	2.49	1.86	clayey silt to silty clay	UNDFND	UNDFD	8	.8
17.00	56	66.15	0.57	0.86	1.89	sand to silty sand	40-50	34-36	16	UNDEFINED
17.30	57	59.16	1.30	2.20	1.92	sandy silt to clayey silt	UNDFND	UNDFD	23	3.7
17.60	58	16.14	0.37	2.31	1.94	clayey silt to silty clay	UNDFND	UNDFD	8	.8
17.90	59	16.25	0.26	1.60	1.97	sandy silt to clayey silt	UNDFND	UNDFD	6	.8
18.20	60	13.61	0.16	1.15	1.99	sandy silt to clayey silt	UNDFND	UNDFD	5	.6
18.50	61	16.00	0.21	1.29	2.02	sandy silt to clayey silt	UNDFND	UNDFD	6	.8
18.80	62	15.31	0.19	1.26	2.04	sandy silt to clayey silt	UNDFND	UNDFD	6	.7
19.10	63	27.02	0.39	1.44	2.07	sandy silt to clayey silt	UNDFND	UNDFD	10	1.5
19.40	64	70.35	0.89	1.27	2.10	silty sand to sandy silt	40-50	34-36	22	UNDEFINED
19.70	65	101.69	1.77	1.74	2.12	silty sand to sandy silt	50-60	36-38	32	UNDEFINED
20.00	66	166.43	1.79	1.08	2.15	sand to silty sand	70-80	38-40	40	UNDEFINED
20.30	67	315.87	1.59	0.50	2.17	gravelly sand to sand	80-90	42-44	>50	UNDEFINED
20.60	68	448.42	1.40	0.31	2.20	gravelly sand to sand	>90	44-46	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



CPT 303C	Playa Vista Site
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

GROUP DELTA CONSULTANTS

CPT Date :12-07-98
Cone Used :CPT B-303C
Depth to water table (ft) : 14

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.20	1	39.17	0.20	0.50	0.02	silty sand to sandy silt	>90	>48	13	UNDEFINED
0.50	2	45.01	0.34	0.75	0.07	silty sand to sandy silt	80-90	>48	14	UNDEFINED
0.80	3	36.92	0.39	1.05	0.12	silty sand to sandy silt	60-70	44-46	12	UNDEFINED
1.10	4	48.52	0.58	1.20	0.18	silty sand to sandy silt	70-80	44-46	15	UNDEFINED
1.40	5	52.30	0.67	1.28	0.24	silty sand to sandy silt	60-70	44-46	17	UNDEFINED
1.70	6	35.67	0.14	0.39	0.29	silty sand to sandy silt	50-60	40-42	11	UNDEFINED
2.00	7	31.14	0.12	0.40	0.35	silty sand to sandy silt	40-50	40-42	10	UNDEFINED
2.30	8	29.74	0.33	1.12	0.41	silty sand to sandy silt	40-50	38-40	9	UNDEFINED
2.70	9	18.03	0.14	0.76	0.47	sandy silt to clayey silt	UNDFND	UNDFD	7	1.1
3.00	10	17.76	0.09	0.49	0.54	sandy silt to clayey silt	UNDFND	UNDFD	7	1.1
3.30	11	19.54	0.11	0.58	0.59	sandy silt to clayey silt	UNDFND	UNDFD	7	1.2
3.60	12	14.23	0.15	1.08	0.65	sandy silt to clayey silt	UNDFND	UNDFD	5	.9
3.90	13	14.12	0.30	2.12	0.71	clayey silt to silty clay	UNDFND	UNDFD	7	.8
4.20	14	16.52	0.47	2.84	0.76	clayey silt to silty clay	UNDFND	UNDFD	8	1.0
4.50	15	40.76	0.37	0.91	0.81	silty sand to sandy silt	40-50	36-38	13	UNDEFINED
4.80	16	12.62	0.21	1.69	0.84	clayey silt to silty clay	UNDFND	UNDFD	6	.7
5.10	17	15.70	0.25	1.59	0.86	sandy silt to clayey silt	UNDFND	UNDFD	6	.9
5.40	18	11.37	0.26	2.32	0.89	clayey silt to silty clay	UNDFND	UNDFD	5	.6
5.70	19	28.23	0.24	0.84	0.92	silty sand to sandy silt	<40	34-36	9	UNDEFINED
6.00	20	9.56	0.10	1.05	0.94	clayey silt to silty clay	UNDFND	UNDFD	5	.5
6.30	21	6.90	0.12	1.74	0.97	silty clay to clay	UNDFND	UNDFD	4	.3
6.60	22	8.50	0.19	2.20	0.99	silty clay to clay	UNDFND	UNDFD	5	.4
6.90	23	8.01	0.13	1.67	1.02	clayey silt to silty clay	UNDFND	UNDFD	4	.4
7.20	24	8.88	0.20	2.25	1.04	silty clay to clay	UNDFND	UNDFD	6	.5
7.50	25	12.87	0.19	1.45	1.07	clayey silt to silty clay	UNDFND	UNDFD	6	.7
7.80	26	7.88	0.14	1.82	1.10	silty clay to clay	UNDFND	UNDFD	5	.4
8.10	27	7.80	0.09	1.15	1.12	clayey silt to silty clay	UNDFND	UNDFD	4	.4
8.40	28	12.62	0.46	3.62	1.15	silty clay to clay	UNDFND	UNDFD	8	.7
8.70	29	10.96	0.41	3.74	1.17	clay	UNDFND	UNDFD	11	.6
9.10	30	10.63	0.27	2.54	1.20	silty clay to clay	UNDFND	UNDFD	7	.5
9.40	31	23.26	0.69	2.98	1.23	clayey silt to silty clay	UNDFND	UNDFD	11	1.4
9.70	32	28.00	0.74	2.64	1.26	clayey silt to silty clay	UNDFND	UNDFD	13	1.7
10.00	33	53.06	0.42	0.80	1.29	silty sand to sandy silt	40-50	36-38	17	UNDEFINED
10.30	34	67.04	0.94	1.40	1.31	silty sand to sandy silt	50-60	36-38	21	UNDEFINED
10.60	35	66.70	0.59	0.88	1.34	sand to silty sand	50-60	36-38	16	UNDEFINED
10.90	36	76.58	0.96	1.25	1.36	silty sand to sandy silt	50-60	38-40	24	UNDEFINED
11.20	37	112.48	0.70	0.62	1.39	sand to silty sand	60-70	40-42	27	UNDEFINED
11.50	38	119.14	1.05	0.88	1.42	sand to silty sand	60-70	40-42	29	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

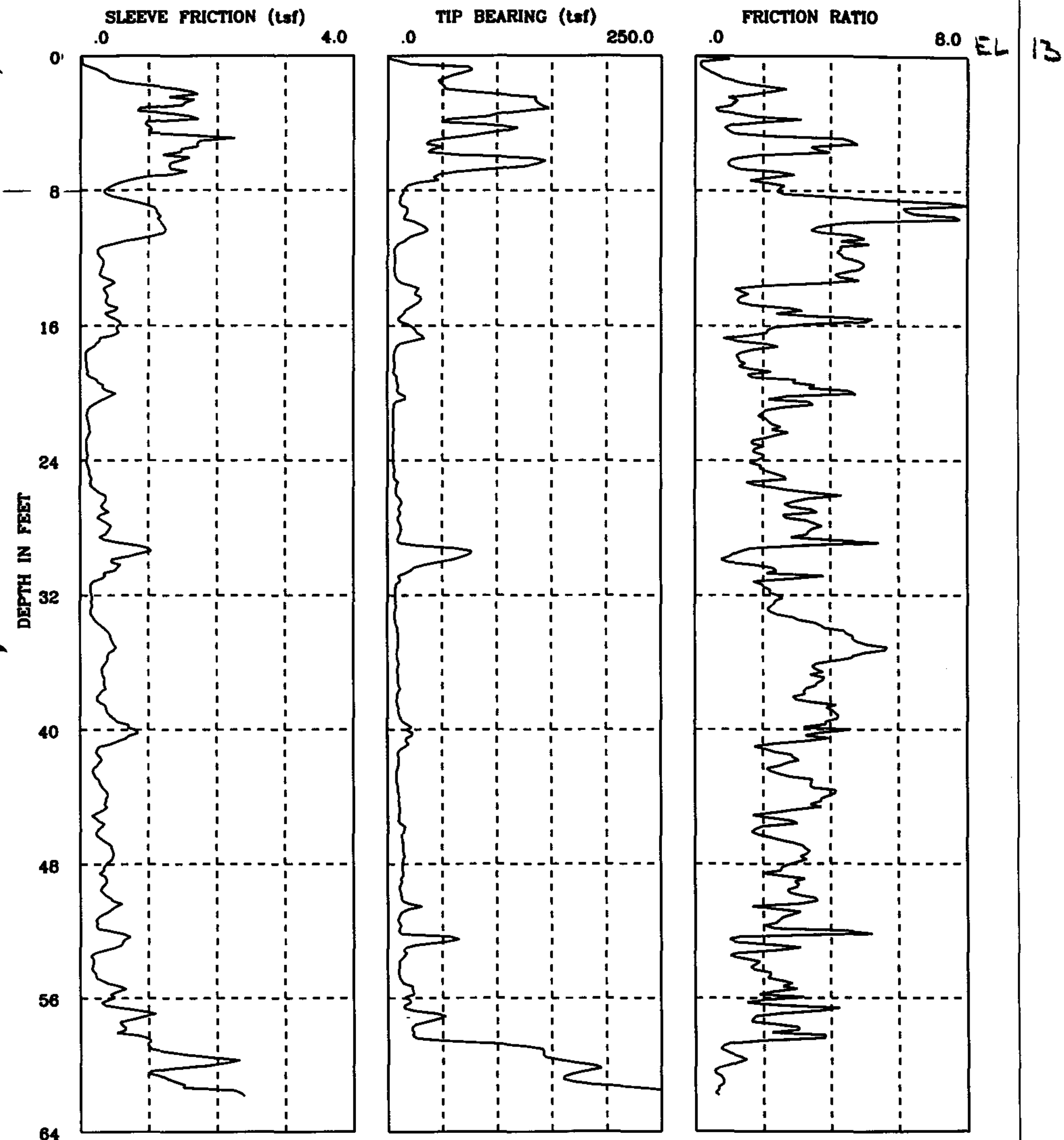
C. Date :12-07-98
Cone Used :CPT B-303C
Depth to water table (ft) : 14

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.80	39	134.72	1.04	0.77	1.44	sand	60-70	40-42	26	UNDEFINED
12.10	40	35.16	0.58	1.66	1.47	sandy silt to clayey silt	UNDFND	UNDFD	13	2.1
12.40	41	29.83	0.21	0.70	1.49	silty sand to sandy silt	<40	30-32	10	UNDEFINED
12.70	42	37.56	0.40	1.06	1.52	silty sand to sandy silt	<40	32-34	12	UNDEFINED
13.00	43	72.46	0.32	0.44	1.54	sand to silty sand	50-60	36-38	17	UNDEFINED
13.30	44	14.70	0.22	1.52	1.57	clayey silt to silty clay	UNDFND	UNDFD	7	.8
13.60	45	17.04	0.45	2.62	1.60	clayey silt to silty clay	UNDFND	UNDFD	8	.9
13.90	46	12.96	0.36	2.75	1.62	clayey silt to silty clay	UNDFND	UNDFD	6	.6
14.20	47	14.87	0.26	1.73	1.65	clayey silt to silty clay	UNDFND	UNDFD	7	.8
14.50	48	12.55	0.24	1.94	1.67	clayey silt to silty clay	UNDFND	UNDFD	6	.6
14.80	49	8.69	0.15	1.69	1.70	clayey silt to silty clay	UNDFND	UNDFD	4	.3
15.10	50	23.07	0.34	1.47	1.73	sandy silt to clayey silt	UNDFND	UNDFD	9	1.3
15.50	51	29.24	0.43	1.45	1.76	sandy silt to clayey silt	UNDFND	UNDFD	11	1.7
15.80	52	30.23	0.71	2.34	1.79	sandy silt to clayey silt	UNDFND	UNDFD	12	1.8
16.10	53	14.87	0.37	2.51	1.81	clayey silt to silty clay	UNDFND	UNDFD	7	.7
16.40	54	10.00	0.21	2.13	1.84	clayey silt to silty clay	UNDFND	UNDFD	5	.4
16.70	55	20.60	0.41	1.97	1.86	sandy silt to clayey silt	UNDFND	UNDFD	8	1.1
17.00	56	19.20	0.34	1.75	1.89	sandy silt to clayey silt	UNDFND	UNDFD	7	1.0
17.30	57	19.31	0.39	2.02	1.92	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
17.60	58	62.81	1.43	2.28	1.94	sandy silt to clayey silt	UNDFND	UNDFD	24	3.9
17.90	59	188.35	1.46	0.77	1.97	sand	70-80	40-42	36	UNDEFINED
18.20	60	278.74	2.12	0.76	1.99	sand	80-90	42-44	>50	UNDEFINED
18.50	61	414.60	2.84	0.69	2.02	gravelly sand to sand	>90	44-46	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



CPT B-308C	Playa Vista Site De
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

GROUP DELTA CONSULTANTS

CPT Date :11-03-98
Cone Used :CPT B-308
Depth to water table (ft) : 10

Job No. L196 Playa Vista Site De
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.20	1	28.78	0.05	0.19	0.02	silty sand to sandy silt	80-90	>48	9	UNDEFINED
0.50	2	56.78	0.49	0.86	0.07	silty sand to sandy silt	80-90	>48	18	UNDEFINED
0.80	3	96.95	1.59	1.64	0.12	silty sand to sandy silt	>90	>48	31	UNDEFINED
1.10	4	118.64	1.30	1.10	0.18	sand to silty sand	>90	>48	28	UNDEFINED
1.40	5	86.58	0.99	1.15	0.24	sand to silty sand	80-90	46-48	21	UNDEFINED
1.70	6	42.89	1.81	4.23	0.29	silty clay to clay	UNDFND	UNDFD	27	2.8
2.00	7	112.58	1.33	1.18	0.35	sand to silty sand	80-90	44-46	27	UNDEFINED
2.30	8	44.48	1.03	2.32	0.41	sandy silt to clayey silt	UNDFND	UNDFD	17	2.9
2.70	9	13.43	0.59	4.41	0.47	clay	UNDFND	UNDFD	13	.8
3.00	10	19.18	1.15	6.01	0.54	clay	UNDFND	UNDFD	18	1.2
3.30	11	28.17	1.12	3.96	0.58	silty clay to clay	UNDFND	UNDFD	18	1.8
3.60	12	7.20	0.34	4.67	0.61	clay	UNDFND	UNDFD	7	.4
3.90	13	6.78	0.32	4.77	0.64	clay	UNDFND	UNDFD	6	.4
4.20	14	16.48	0.39	2.39	0.66	clayey silt to silty clay	UNDFND	UNDFD	8	1.0
4.50	15	26.55	0.39	1.48	0.69	sandy silt to clayey silt	UNDFND	UNDFD	10	1.7
4.80	16	13.19	0.50	3.76	0.71	silty clay to clay	UNDFND	UNDFD	8	.8
5.10	17	27.60	0.46	1.65	0.74	sandy silt to clayey silt	UNDFND	UNDFD	11	1.7
5.40	18	7.92	0.14	1.77	0.76	clayey silt to silty clay	UNDFND	UNDFD	4	.4
5.70	19	5.70	0.09	1.58	0.79	sensitive fine grained	UNDFND	UNDFD	3	.3
6.00	20	9.12	0.24	2.67	0.82	silty clay to clay	UNDFND	UNDFD	6	.5
6.30	21	10.96	0.36	3.25	0.84	silty clay to clay	UNDFND	UNDFD	7	.6
6.60	22	5.08	0.10	2.04	0.87	silty clay to clay	UNDFND	UNDFD	3	.2
6.90	23	5.01	0.12	2.46	0.89	clay	UNDFND	UNDFD	5	.2
7.20	24	4.82	0.09	1.80	0.92	silty clay to clay	UNDFND	UNDFD	3	.2
7.50	25	5.44	0.11	1.96	0.95	silty clay to clay	UNDFND	UNDFD	3	.2
7.80	26	7.50	0.15	2.05	0.97	silty clay to clay	UNDFND	UNDFD	5	.4
8.10	27	10.56	0.33	3.13	1.00	silty clay to clay	UNDFND	UNDFD	7	.6
8.40	28	10.47	0.32	3.09	1.02	silty clay to clay	UNDFND	UNDFD	7	.5
8.70	29	11.26	0.38	3.35	1.05	silty clay to clay	UNDFND	UNDFD	7	.6
9.10	30	51.93	0.72	1.39	1.08	silty sand to sandy silt	40-50	36-38	17	UNDEFINED
9.40	31	21.41	0.49	2.27	1.11	clayey silt to silty clay	UNDFND	UNDFD	10	1.3
9.70	32	8.33	0.16	1.92	1.14	silty clay to clay	UNDFND	UNDFD	5	.4
10.00	33	7.16	0.17	2.33	1.16	silty clay to clay	UNDFND	UNDFD	5	.3
10.30	34	7.18	0.22	3.11	1.19	clay	UNDFND	UNDFD	7	.3
10.60	35	9.35	0.43	4.64	1.21	clay	UNDFND	UNDFD	9	.4
10.90	36	8.82	0.45	5.10	1.24	clay	UNDFND	UNDFD	8	.4
11.20	37	9.39	0.33	3.51	1.26	clay	UNDFND	UNDFD	9	.4
11.50	38	9.62	0.34	3.50	1.29	clay	UNDFND	UNDFD	9	.4

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

GROUP DELTA CONSULTANTS

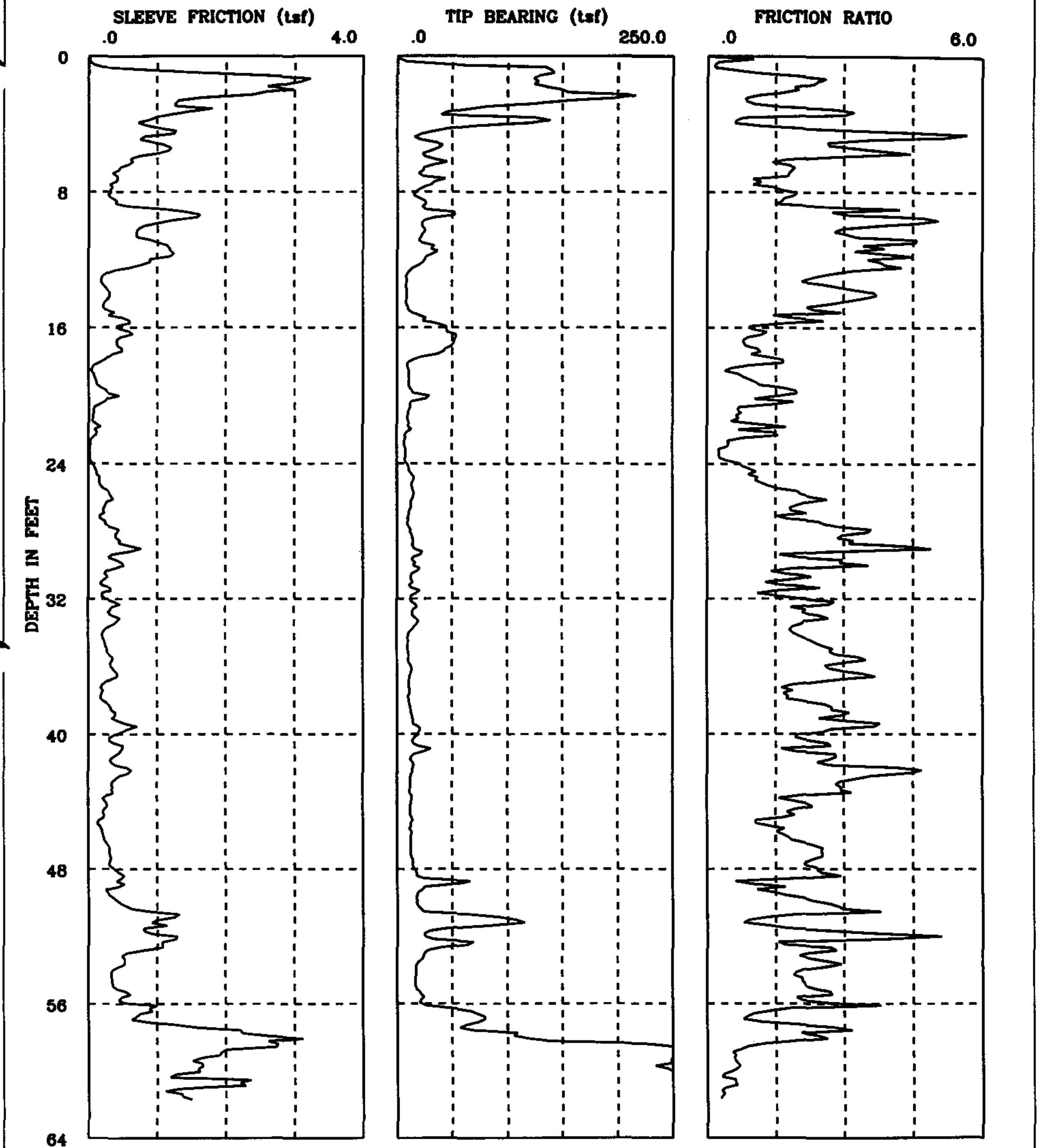
CPT Date :11-03-98
Cone Used :**CPT B-308**
Depth to water table (ft) : 10

Job No. L196 Playa Vista Site De
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.80	39	8.67	0.30	3.42	1.32	clay	UNDFND	UNDFD	8	.4
12.10	40	13.45	0.54	4.01	1.34	clay	UNDFND	UNDFD	13	.7
12.40	41	18.91	0.70	3.70	1.37	silty clay to clay	UNDFND	UNDFD	12	1.1
12.70	42	12.09	0.27	2.23	1.39	clayey silt to silty clay	UNDFND	UNDFD	6	.6
13.00	43	9.03	0.22	2.44	1.42	silty clay to clay	UNDFND	UNDFD	6	.4
13.30	44	8.54	0.31	3.67	1.45	clay	UNDFND	UNDFD	8	.4
13.60	45	10.22	0.39	3.78	1.47	clay	UNDFND	UNDFD	10	.5
13.90	46	10.85	0.28	2.55	1.50	silty clay to clay	UNDFND	UNDFD	7	.5
14.20	47	13.76	0.28	2.03	1.52	clayey silt to silty clay	UNDFND	UNDFD	7	.7
14.50	48	14.72	0.47	3.22	1.55	silty clay to clay	UNDFND	UNDFD	9	.8
14.80	49	13.76	0.34	2.49	1.58	clayey silt to silty clay	UNDFND	UNDFD	7	.7
15.10	50	11.53	0.35	3.01	1.60	silty clay to clay	UNDFND	UNDFD	7	.5
15.50	51	17.42	0.44	2.56	1.63	clayey silt to silty clay	UNDFND	UNDFD	8	.9
15.80	52	10.43	0.25	2.43	1.66	silty clay to clay	UNDFND	UNDFD	7	.4
16.10	53	34.54	0.63	1.82	1.69	sandy silt to clayey silt	UNDFND	UNDFD	13	2.1
16.40	54	13.58	0.24	1.74	1.71	clayey silt to silty clay	UNDFND	UNDFD	7	.7
16.70	55	10.73	0.21	1.99	1.74	clayey silt to silty clay	UNDFND	UNDFD	5	.5
17.00	56	20.07	0.51	2.52	1.76	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
17.30	57	19.99	0.56	2.80	1.79	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
17.60	58	36.51	0.72	1.98	1.82	sandy silt to clayey silt	UNDFND	UNDFD	14	2.2
17.90	59	48.79	0.84	1.71	1.84	silty sand to sandy silt	<40	32-34	16	UNDEFINED
18.20	60	146.80	1.64	1.12	1.87	sand to silty sand	60-70	38-40	35	UNDEFINED
18.50	61	177.58	1.37	0.77	1.89	sand	70-80	40-42	34	UNDEFINED
18.80	62	264.91	1.76	0.66	1.92	sand	80-90	42-44	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



CPT B-310C	Playa Vista Site De
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

GROUP DELTA CONSULTANTS

CPT Date :11-03-98
Cone Used :**CPT B-310C**
Depth to water table (ft) : 8

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.20	1	47.69	0.08	0.16	0.02	sand to silty sand	>90	>48	11	UNDEFINED
0.50	2	130.15	2.57	1.97	0.07	silty sand to sandy silt	>90	>48	42	UNDEFINED
0.80	3	173.17	2.23	1.29	0.12	sand to silty sand	>90	>48	41	UNDEFINED
1.10	4	84.37	1.24	1.47	0.18	silty sand to sandy silt	80-90	46-48	27	UNDEFINED
1.40	5	62.07	1.00	1.61	0.24	silty sand to sandy silt	70-80	44-46	20	UNDEFINED
1.70	6	31.08	1.01	3.24	0.29	clayey silt to silty clay	UNDFND	UNDFD	15	2.0
2.00	7	31.50	0.61	1.94	0.35	sandy silt to clayey silt	UNDFND	UNDFD	12	2.0
2.30	8	31.33	0.36	1.16	0.41	silty sand to sandy silt	40-50	38-40	10	UNDEFINED
2.70	9	20.41	0.39	1.94	0.47	sandy silt to clayey silt	UNDFND	UNDFD	8	1.3
3.00	10	35.79	1.34	3.73	0.50	clayey silt to silty clay	UNDFND	UNDFD	17	2.3
3.30	11	22.26	0.77	3.46	0.52	clayey silt to silty clay	UNDFND	UNDFD	11	1.4
3.60	12	32.33	1.18	3.64	0.55	clayey silt to silty clay	UNDFND	UNDFD	15	2.1
3.90	13	16.00	0.60	3.73	0.57	silty clay to clay	UNDFND	UNDFD	10	1.0
4.20	14	8.47	0.23	2.68	0.60	silty clay to clay	UNDFND	UNDFD	5	.5
4.50	15	8.73	0.26	2.94	0.62	silty clay to clay	UNDFND	UNDFD	6	.5
4.80	16	24.94	0.49	1.96	0.65	sandy silt to clayey silt	UNDFND	UNDFD	10	1.6
5.10	17	50.17	0.50	0.99	0.68	silty sand to sandy silt	50-60	38-40	16	UNDEFINED
5.40	18	37.73	0.40	1.06	0.70	silty sand to sandy silt	40-50	36-38	12	UNDEFINED
5.70	19	9.99	0.09	0.93	0.73	clayey silt to silty clay	UNDFND	UNDFD	5	.5
6.00	20	11.43	0.16	1.37	0.75	clayey silt to silty clay	UNDFND	UNDFD	5	.6
6.30	21	17.89	0.25	1.42	0.78	sandy silt to clayey silt	UNDFND	UNDFD	7	1.1
6.60	22	9.56	0.08	0.84	0.81	clayey silt to silty clay	UNDFND	UNDFD	5	.5
6.90	23	8.92	0.08	0.86	0.83	clayey silt to silty clay	UNDFND	UNDFD	4	.5
7.20	24	7.20	0.02	0.32	0.86	sensitive fine grained	UNDFND	UNDFD	3	.3
7.50	25	10.77	0.09	0.87	0.88	sandy silt to clayey silt	UNDFND	UNDFD	4	.6
7.80	26	14.38	0.21	1.46	0.91	clayey silt to silty clay	UNDFND	UNDFD	7	.8
8.10	27	13.19	0.28	2.10	0.94	clayey silt to silty clay	UNDFND	UNDFD	6	.7
8.40	28	9.86	0.21	2.16	0.96	clayey silt to silty clay	UNDFND	UNDFD	5	.5
8.70	29	13.24	0.43	3.25	0.99	silty clay to clay	UNDFND	UNDFD	8	.7
9.10	30	16.91	0.50	2.93	1.02	clayey silt to silty clay	UNDFND	UNDFD	8	1.0
9.40	31	15.36	0.28	1.85	1.05	clayey silt to silty clay	UNDFND	UNDFD	7	.9
9.70	32	14.46	0.23	1.59	1.07	clayey silt to silty clay	UNDFND	UNDFD	7	.8
10.00	33	15.19	0.33	2.19	1.10	clayey silt to silty clay	UNDFND	UNDFD	7	.8
10.30	34	16.44	0.36	2.21	1.12	clayey silt to silty clay	UNDFND	UNDFD	8	.9
10.60	35	10.00	0.23	2.27	1.15	silty clay to clay	UNDFND	UNDFD	6	.5
10.90	36	10.45	0.31	3.00	1.18	silty clay to clay	UNDFND	UNDFD	7	.5
11.20	37	12.22	0.37	3.00	1.20	silty clay to clay	UNDFND	UNDFD	8	.6
11.50	38	10.73	0.20	1.83	1.23	clayey silt to silty clay	UNDFND	UNDFD	5	.5

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

GROUP DELTA CONSULTANTS

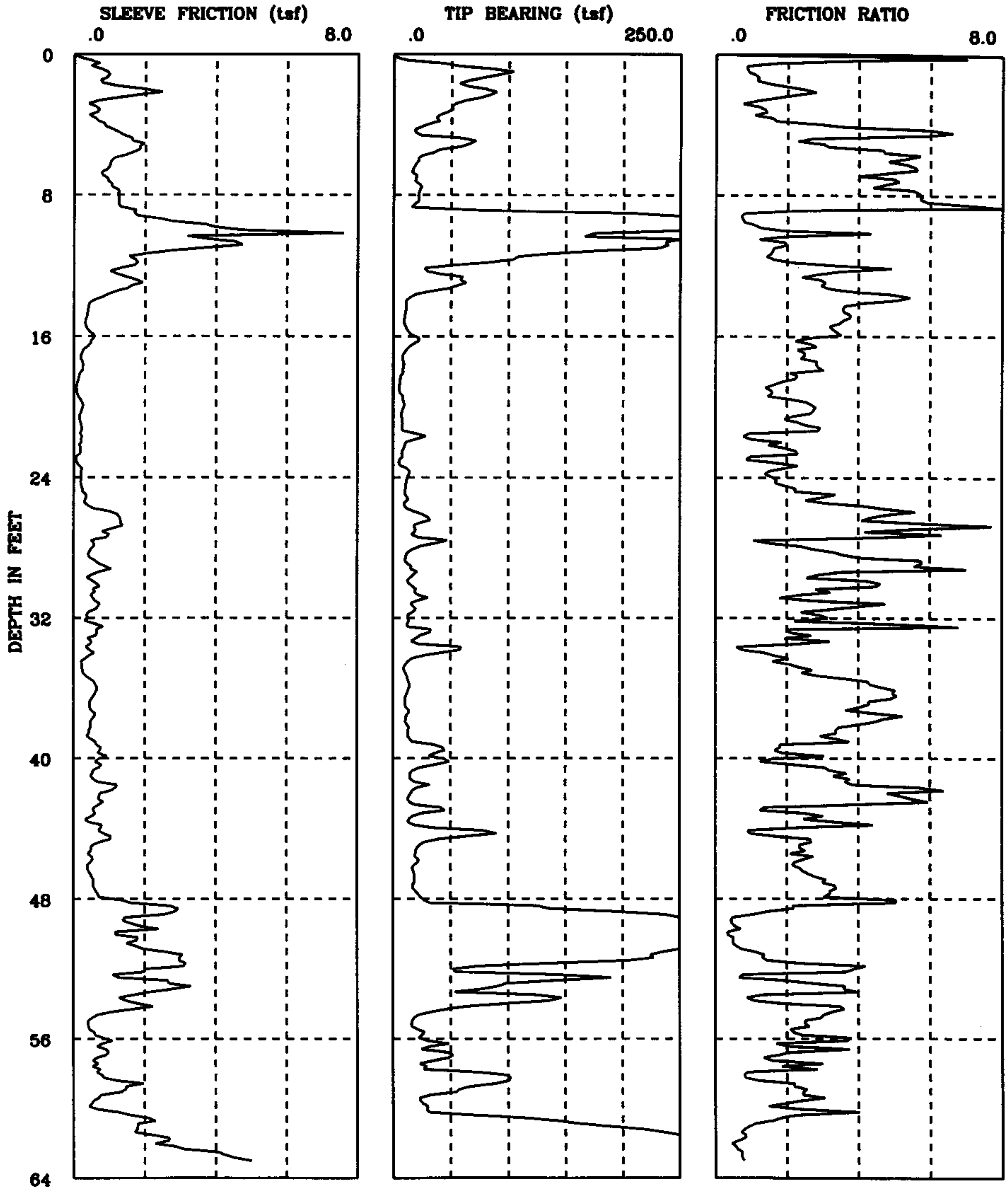
CPT Date :11-03-98
Cone Used :CPT B-310C
Depth to water table (ft) : 8

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.80	39	11.66	0.31	2.69	1.25	silty clay to clay	UNDFND	UNDFD	7	.6
12.10	40	16.42	0.48	2.94	1.28	clayey silt to silty clay	UNDFND	UNDFD	8	.9
12.40	41	17.12	0.39	2.30	1.31	clayey silt to silty clay	UNDFND	UNDFD	8	.9
12.70	42	16.74	0.38	2.27	1.33	clayey silt to silty clay	UNDFND	UNDFD	8	.9
13.00	43	13.00	0.51	3.95	1.36	clay	UNDFND	UNDFD	12	.7
13.30	44	12.23	0.32	2.59	1.38	clayey silt to silty clay	UNDFND	UNDFD	6	.6
13.60	45	12.15	0.24	1.98	1.41	clayey silt to silty clay	UNDFND	UNDFD	6	.6
13.90	46	12.28	0.18	1.47	1.43	clayey silt to silty clay	UNDFND	UNDFD	6	.6
14.20	47	12.53	0.24	1.94	1.46	clayey silt to silty clay	UNDFND	UNDFD	6	.6
14.50	48	13.10	0.31	2.39	1.49	clayey silt to silty clay	UNDFND	UNDFD	6	.6
14.80	49	18.88	0.43	2.26	1.51	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
15.10	50	31.44	0.36	1.15	1.54	silty sand to sandy silt	<40	30-32	10	UNDEFINED
15.50	51	38.92	0.79	2.02	1.57	sandy silt to clayey silt	UNDFND	UNDFD	15	2.4
15.80	52	61.75	0.88	1.43	1.60	silty sand to sandy silt	40-50	36-38	20	UNDEFINED
16.10	53	41.31	1.05	2.53	1.62	sandy silt to clayey silt	UNDFND	UNDFD	16	2.5
16.40	54	20.46	0.49	2.38	1.65	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
16.70	55	16.59	0.34	2.05	1.68	clayey silt to silty clay	UNDFND	UNDFD	8	.8
17.00	56	20.43	0.49	2.40	1.70	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
17.30	57	57.69	0.88	1.52	1.73	silty sand to sandy silt	40-50	34-36	18	UNDEFINED
17.60	58	79.74	1.57	1.97	1.75	silty sand to sandy silt	50-60	36-38	25	UNDEFINED
17.90	59	204.96	2.63	1.28	1.78	sand	70-80	40-42	39	UNDEFINED
18.20	60	263.30	1.70	0.65	1.81	sand	80-90	42-44	>50	UNDEFINED
18.50	61	346.18	1.67	0.48	1.83	gravelly sand to sand	>90	42-44	>50	UNDEFINED
18.80	62	418.30	1.42	0.34	1.86	gravelly sand to sand	>90	44-46	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



CPT B-311C	Playa Vista Site De
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

GROUP DELTA CONSULTANTS

CPT Date :11-03-98
Cone Used :**CPT B-311C**
Depth to water table (ft) : 8

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.20	1	22.80	0.31	1.37	0.02	sandy silt to clayey silt	UNDFND	UNDFD	9	1.5
0.50	2	79.48	0.89	1.12	0.07	sand to silty sand	>90	>48	19	UNDEFINED
0.80	3	74.85	1.49	1.99	0.12	silty sand to sandy silt	80-90	>48	24	UNDEFINED
1.10	4	44.56	0.61	1.37	0.18	silty sand to sandy silt	60-70	44-46	14	UNDEFINED
1.40	5	23.99	1.10	4.58	0.24	clay	UNDFND	UNDFD	23	1.5
1.70	6	54.71	1.70	3.11	0.29	sandy silt to clayey silt	UNDFND	UNDFD	21	3.6
2.00	7	18.94	1.03	5.42	0.35	clay	UNDFND	UNDFD	18	1.2
2.30	8	20.98	0.94	4.50	0.41	clay	UNDFND	UNDFD	20	1.3
2.70	9	34.15	1.37	4.00	0.47	silty clay to clay	UNDFND	UNDFD	22	2.2
3.00	10	310.10	2.85	0.92	0.50	sand	>90	>48	>50	UNDEFINED
3.30	11	241.32	5.36	2.22	0.52	silty sand to sandy silt	>90	46-48	>50	UNDEFINED
3.60	12	122.35	2.05	1.68	0.55	silty sand to sandy silt	80-90	44-46	39	UNDEFINED
3.90	13	42.05	1.41	3.35	0.57	clayey silt to silty clay	UNDFND	UNDFD	20	2.7
4.20	14	34.02	1.21	3.56	0.60	clayey silt to silty clay	UNDFND	UNDFD	16	2.2
4.50	15	10.74	0.41	3.82	0.62	clay	UNDFND	UNDFD	10	.6
4.80	16	11.06	0.37	3.38	0.65	silty clay to clay	UNDFND	UNDFD	7	.6
5.10	17	17.15	0.44	2.57	0.68	clayey silt to silty clay	UNDFND	UNDFD	8	1.0
5.40	18	8.42	0.23	2.73	0.70	silty clay to clay	UNDFND	UNDFD	5	.4
5.70	19	6.66	0.13	2.00	0.73	silty clay to clay	UNDFND	UNDFD	4	.3
6.00	20	7.38	0.14	1.90	0.75	silty clay to clay	UNDFND	UNDFD	5	.4
6.30	21	7.96	0.20	2.47	0.78	silty clay to clay	UNDFND	UNDFD	5	.4
6.60	22	14.65	0.21	1.46	0.81	sandy silt to clayey silt	UNDFND	UNDFD	6	.8
6.90	23	9.34	0.19	2.00	0.83	clayey silt to silty clay	UNDFND	UNDFD	4	.5
7.20	24	8.53	0.13	1.52	0.86	clayey silt to silty clay	UNDFND	UNDFD	4	.4
7.50	25	11.53	0.21	1.82	0.88	clayey silt to silty clay	UNDFND	UNDFD	6	.6
7.80	26	10.82	0.35	3.27	0.91	silty clay to clay	UNDFND	UNDFD	7	.6
8.10	27	23.63	1.21	5.11	0.94	clay	UNDFND	UNDFD	23	1.4
8.40	28	27.27	0.86	3.14	0.96	clayey silt to silty clay	UNDFND	UNDFD	13	1.7
8.70	29	16.17	0.49	3.03	0.99	clayey silt to silty clay	UNDFND	UNDFD	8	.9
9.10	30	14.27	0.69	4.85	1.02	clay	UNDFND	UNDFD	14	.8
9.40	31	21.76	0.63	2.88	1.05	clayey silt to silty clay	UNDFND	UNDFD	10	1.3
9.70	32	15.84	0.57	3.62	1.07	silty clay to clay	UNDFND	UNDFD	10	.9
10.00	33	19.28	0.60	3.11	1.10	clayey silt to silty clay	UNDFND	UNDFD	9	1.1
10.30	34	33.39	0.43	1.30	1.12	silty sand to sandy silt	<40	34-36	11	UNDEFINED
10.60	35	16.48	0.29	1.76	1.15	clayey silt to silty clay	UNDFND	UNDFD	8	.9
10.90	36	12.46	0.44	3.53	1.18	silty clay to clay	UNDFND	UNDFD	8	.6
11.20	37	11.70	0.56	4.82	1.20	clay	UNDFND	UNDFD	11	.6
11.50	38	11.95	0.52	4.38	1.23	clay	UNDFND	UNDFD	11	.6

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

GROUP DELTA CONSULTANTS

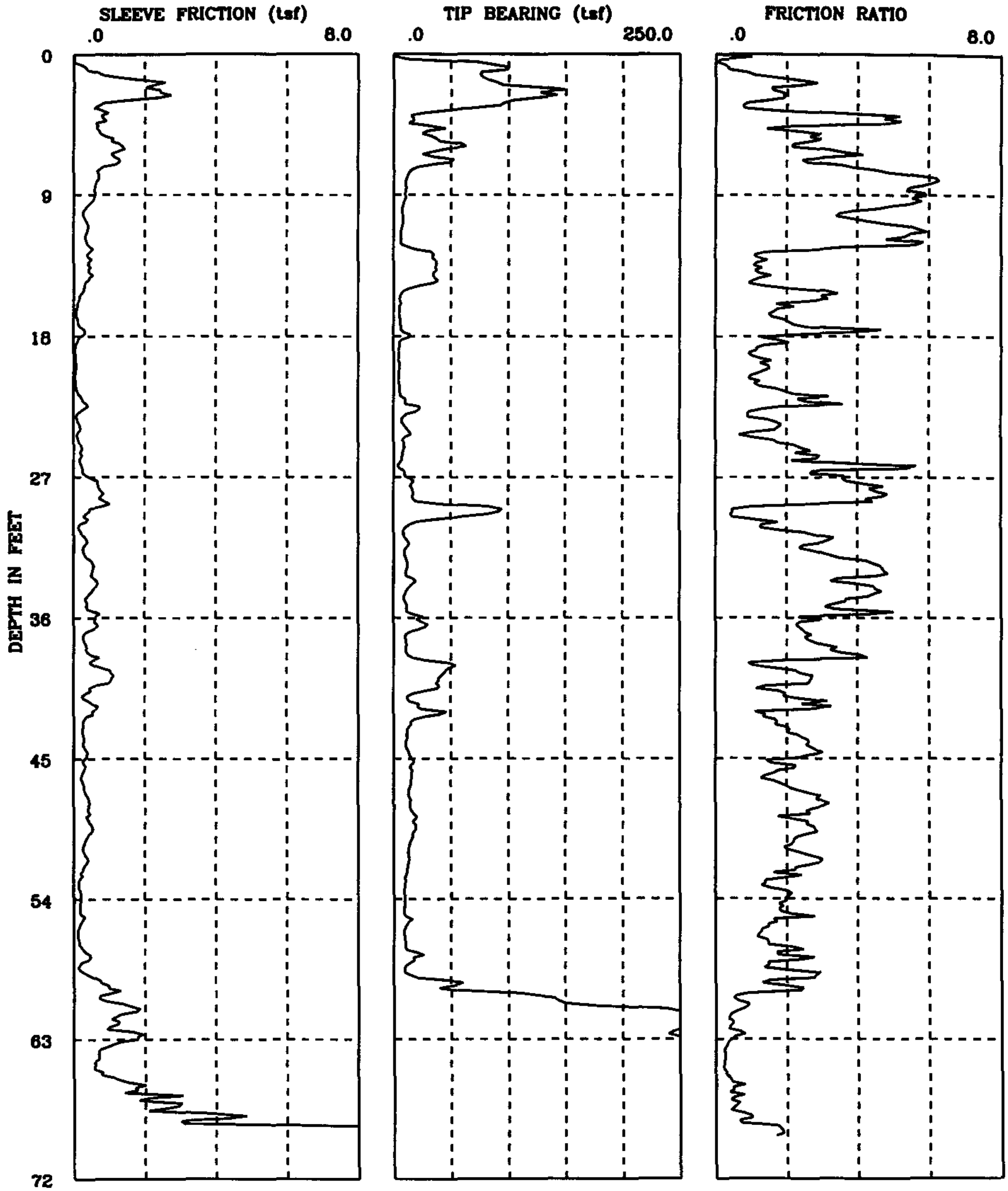
CPT Date :11-03-98
Cone Used :**CPT B-311C**
Depth to water table (ft) : 8

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.80	39	12.42	0.42	3.41	1.25	silty clay to clay	UNDFND	UNDFD	8	.6
12.10	40	32.00	0.69	2.16	1.28	sandy silt to clayey silt	UNDFND	UNDFD	12	1.9
12.40	41	32.89	0.69	2.09	1.31	sandy silt to clayey silt	UNDFND	UNDFD	13	2.0
12.70	42	18.20	0.79	4.32	1.33	clay	UNDFND	UNDFD	17	1.0
13.00	43	15.73	0.72	4.60	1.36	clay	UNDFND	UNDFD	15	.8
13.30	44	24.84	0.50	2.00	1.38	sandy silt to clayey silt	UNDFND	UNDFD	10	1.4
13.60	45	54.03	0.89	1.64	1.41	silty sand to sandy silt	40-50	36-38	17	UNDEFINED
13.90	46	20.55	0.52	2.51	1.43	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
14.20	47	18.88	0.45	2.38	1.46	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
14.50	48	18.34	0.59	3.20	1.49	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
14.80	49	63.91	1.76	2.75	1.51	sandy silt to clayey silt	UNDFND	UNDFD	24	4.0
15.10	50	296.81	1.93	0.65	1.54	sand	>90	42-44	>50	UNDEFINED
15.50	51	314.91	1.61	0.51	1.57	gravelly sand to sand	>90	44-46	>50	UNDEFINED
15.80	52	167.80	3.04	1.81	1.60	sand to silty sand	70-80	40-42	40	UNDEFINED
16.10	53	114.21	1.99	1.74	1.62	silty sand to sandy silt	60-70	38-40	36	UNDEFINED
16.40	54	112.47	1.98	1.76	1.65	silty sand to sandy silt	60-70	38-40	36	UNDEFINED
16.70	55	38.14	1.27	3.33	1.68	clayey silt to silty clay	UNDFND	UNDFD	18	2.3
17.00	56	20.89	0.49	2.33	1.70	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
17.30	57	36.40	0.92	2.54	1.73	sandy silt to clayey silt	UNDFND	UNDFD	14	2.2
17.60	58	32.75	0.70	2.15	1.75	sandy silt to clayey silt	UNDFND	UNDFD	13	1.9
17.90	59	89.12	1.17	1.32	1.78	sand to silty sand	50-60	36-38	21	UNDEFINED
18.20	60	34.70	0.86	2.47	1.81	sandy silt to clayey silt	UNDFND	UNDFD	13	2.0
18.50	61	80.33	1.53	1.91	1.83	silty sand to sandy silt	50-60	36-38	26	UNDEFINED
18.80	62	248.12	2.07	0.83	1.86	sand	80-90	42-44	48	UNDEFINED
19.10	63	531.60	3.23	0.61	1.88	gravelly sand to sand	>90	44-46	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



CPT B-312C	Playa Vista Site De
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

GROUP DELTA CONSULTANTS

CPT Date :11-03-98
Cone Used :CPT B-312C
Depth to water table (ft) : 8

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.20	1	33.18	0.08	0.25	0.02	silty sand to sandy silt	>90	>48	11	UNDEFINED
0.50	2	85.69	1.04	1.21	0.07	sand to silty sand	>90	>48	21	UNDEFINED
0.80	3	128.64	2.46	1.91	0.12	silty sand to sandy silt	>90	>48	41	UNDEFINED
1.10	4	81.53	1.00	1.22	0.18	sand to silty sand	80-90	46-48	20	UNDEFINED
1.40	5	21.07	0.78	3.72	0.24	silty clay to clay	UNDFND	UNDFD	13	1.3
1.70	6	34.36	0.88	2.55	0.29	sandy silt to clayey silt	UNDFND	UNDFD	13	2.2
2.00	7	44.44	1.25	2.81	0.35	sandy silt to clayey silt	UNDFND	UNDFD	17	2.9
2.30	8	28.31	0.92	3.26	0.41	clayey silt to silty clay	UNDFND	UNDFD	14	1.8
2.70	9	10.60	0.62	5.90	0.47	clay	UNDFND	UNDFD	10	.6
3.00	10	8.85	0.47	5.27	0.50	clay	UNDFND	UNDFD	8	.5
3.30	11	7.81	0.32	4.05	0.52	clay	UNDFND	UNDFD	7	.4
3.60	12	6.84	0.36	5.31	0.55	clay	UNDFND	UNDFD	7	.4
3.90	13	20.37	0.44	2.14	0.57	clayey silt to silty clay	UNDFND	UNDFD	10	1.3
4.20	14	36.81	0.44	1.20	0.60	silty sand to sandy silt	40-50	38-40	12	UNDEFINED
4.50	15	32.13	0.41	1.29	0.62	silty sand to sandy silt	40-50	36-38	10	UNDEFINED
4.80	16	6.71	0.20	2.93	0.65	clay	UNDFND	UNDFD	6	.3
5.10	17	4.97	0.09	1.81	0.68	silty clay to clay	UNDFND	UNDFD	3	.2
5.40	18	7.13	0.21	2.94	0.70	clay	UNDFND	UNDFD	7	.4
5.70	19	8.15	0.12	1.43	0.73	clayey silt to silty clay	UNDFND	UNDFD	4	.4
6.00	20	4.44	0.05	1.13	0.75	sensitive fine grained	UNDFND	UNDFD	2	.2
6.30	21	4.39	0.05	1.21	0.78	sensitive fine grained	UNDFND	UNDFD	2	.2
6.60	22	4.95	0.08	1.68	0.81	sensitive fine grained	UNDFND	UNDFD	2	.2
6.90	23	14.23	0.29	2.06	0.83	clayey silt to silty clay	UNDFND	UNDFD	7	.8
7.20	24	8.90	0.12	1.35	0.86	clayey silt to silty clay	UNDFND	UNDFD	4	.5
7.50	25	11.72	0.14	1.22	0.88	clayey silt to silty clay	UNDFND	UNDFD	6	.6
7.80	26	8.24	0.21	2.59	0.91	silty clay to clay	UNDFND	UNDFD	5	.4
8.10	27	6.52	0.20	3.07	0.94	clay	UNDFND	UNDFD	6	.3
8.40	28	13.89	0.56	4.03	0.96	clay	UNDFND	UNDFD	13	.8
8.70	29	17.52	0.80	4.55	0.99	clay	UNDFND	UNDFD	17	1.0
9.10	30	63.86	0.48	0.75	1.02	sand to silty sand	50-60	38-40	15	UNDEFINED
9.40	31	9.60	0.22	2.29	1.05	silty clay to clay	UNDFND	UNDFD	6	.5
9.70	32	11.04	0.31	2.78	1.07	silty clay to clay	UNDFND	UNDFD	7	.6
10.00	33	11.40	0.48	4.24	1.10	clay	UNDFND	UNDFD	11	.6
10.30	34	14.67	0.58	3.98	1.12	clay	UNDFND	UNDFD	14	.8
10.60	35	10.49	0.45	4.26	1.15	clay	UNDFND	UNDFD	10	.5
10.90	36	13.36	0.50	3.74	1.18	silty clay to clay	UNDFND	UNDFD	9	.7
11.20	37	23.55	0.59	2.52	1.20	clayey silt to silty clay	UNDFND	UNDFD	11	1.4
11.50	38	10.68	0.30	2.78	1.23	silty clay to clay	UNDFND	UNDFD	7	.5

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

GROUP DELTA CONSULTANTS

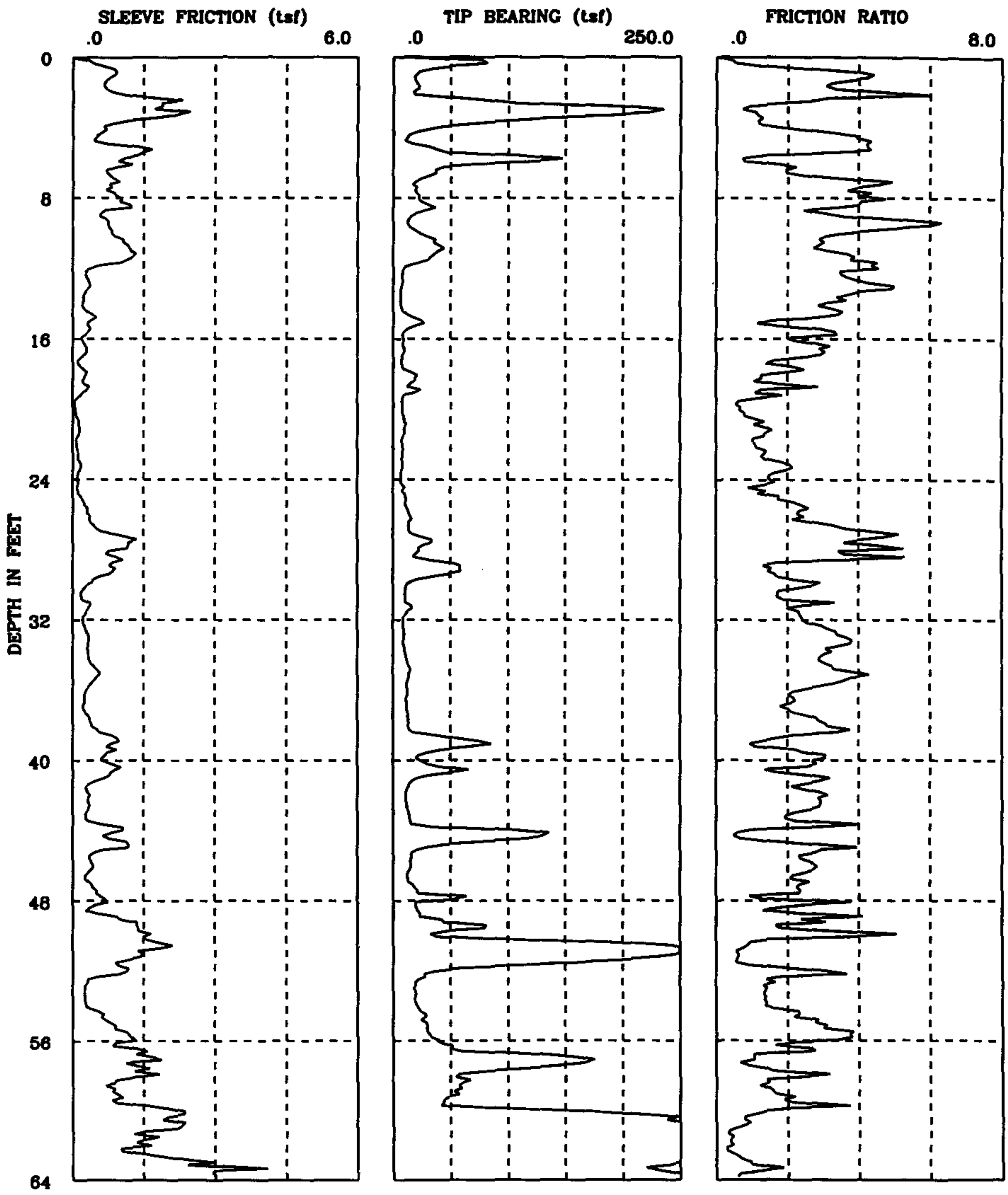
CPT Date :11-03-98
Cone Used :CPT B-312C
Depth to water table (ft) : 8

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	DEPTH (feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.80	39	16.78	0.46	2.74	1.25	clayey silt to silty clay	UNDFND	UNDFD	8	.9
12.10	40	47.07	0.91	1.93	1.28	sandy silt to clayey silt	UNDFND	UNDFD	18	2.9
12.40	41	35.43	0.69	1.96	1.31	sandy silt to clayey silt	UNDFND	UNDFD	14	2.2
12.70	42	15.53	0.45	2.88	1.33	clayey silt to silty clay	UNDFND	UNDFD	7	.8
13.00	43	29.01	0.37	1.28	1.36	sandy silt to clayey silt	UNDFND	UNDFD	11	1.7
13.30	44	12.02	0.26	2.14	1.38	clayey silt to silty clay	UNDFND	UNDFD	6	.6
13.60	45	11.44	0.32	2.80	1.41	silty clay to clay	UNDFND	UNDFD	7	.5
13.90	46	15.74	0.32	2.01	1.43	clayey silt to silty clay	UNDFND	UNDFD	8	.8
14.20	47	15.31	0.24	1.57	1.46	clayey silt to silty clay	UNDFND	UNDFD	7	.8
14.50	48	13.80	0.35	2.54	1.49	clayey silt to silty clay	UNDFND	UNDFD	7	.7
14.80	49	15.29	0.43	2.83	1.51	clayey silt to silty clay	UNDFND	UNDFD	7	.8
15.10	50	18.71	0.47	2.51	1.54	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
15.50	51	14.51	0.32	2.24	1.57	clayey silt to silty clay	UNDFND	UNDFD	7	.7
15.80	52	12.80	0.35	2.73	1.60	silty clay to clay	UNDFND	UNDFD	8	.6
16.10	53	11.06	0.22	2.02	1.62	clayey silt to silty clay	UNDFND	UNDFD	5	.5
16.40	54	9.72	0.17	1.78	1.65	clayey silt to silty clay	UNDFND	UNDFD	5	.4
16.70	55	8.96	0.17	1.90	1.68	clayey silt to silty clay	UNDFND	UNDFD	4	.3
17.00	56	11.36	0.23	2.00	1.70	clayey silt to silty clay	UNDFND	UNDFD	5	.5
17.30	57	9.41	0.12	1.31	1.73	clayey silt to silty clay	UNDFND	UNDFD	5	.4
17.60	58	15.65	0.34	2.19	1.75	clayey silt to silty clay	UNDFND	UNDFD	7	.8
17.90	59	11.51	0.22	1.88	1.78	clayey silt to silty clay	UNDFND	UNDFD	6	.5
18.20	60	40.31	0.78	1.93	1.81	sandy silt to clayey silt	UNDFND	UNDFD	15	2.4
18.50	61	133.78	1.03	0.77	1.83	sand	60-70	38-40	26	UNDEFINED
18.80	62	278.01	1.42	0.51	1.86	sand	80-90	42-44	>50	UNDEFINED
19.10	63	249.34	1.37	0.55	1.88	sand	80-90	42-44	48	UNDEFINED
19.40	64	338.62	1.21	0.36	1.91	gravelly sand to sand	>90	42-44	>50	UNDEFINED
19.70	65	261.66	0.67	0.25	1.93	gravelly sand to sand	80-90	42-44	42	UNDEFINED
20.00	66	284.85	0.90	0.31	1.96	gravelly sand to sand	80-90	42-44	45	UNDEFINED
20.30	67	336.77	2.28	0.68	1.99	sand	>90	42-44	>50	UNDEFINED
20.60	68	487.00	2.29	0.47	2.01	gravelly sand to sand	>90	44-46	>50	UNDEFINED
20.90	69	473.95	5.33	1.13	2.04	sand	>90	44-46	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



CPT B-314C	Playa Vista Site De
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

GROUP DELTA CONSULTANTS

CPT Date :11-03-98
Cone Used :**CPT B-314C**
Depth to water table (ft) : 8

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.20	1	38.72	0.44	1.14	0.02	silty sand to sandy silt	>90	>48	12	UNDEFINED
0.50	2	20.37	0.76	3.71	0.07	silty clay to clay	UNDFND	UNDFD	13	1.3
0.80	3	58.54	1.44	2.46	0.12	sandy silt to clayey silt	UNDFND	UNDFD	22	3.8
1.10	4	175.53	1.71	0.97	0.18	sand	>90	>48	34	UNDEFINED
1.40	5	24.92	0.59	2.37	0.24	sandy silt to clayey silt	UNDFND	UNDFD	10	1.6
1.70	6	55.14	1.25	2.27	0.29	sandy silt to clayey silt	UNDFND	UNDFD	21	3.6
2.00	7	67.81	0.89	1.31	0.35	silty sand to sandy silt	70-80	42-44	22	UNDEFINED
2.30	8	19.94	0.78	3.91	0.41	silty clay to clay	UNDFND	UNDFD	13	1.3
2.70	9	25.92	0.94	3.62	0.47	clayey silt to silty clay	UNDFND	UNDFD	12	1.6
3.00	10	15.27	0.76	4.98	0.50	clay	UNDFND	UNDFD	15	.9
3.30	11	35.92	1.05	2.91	0.52	sandy silt to clayey silt	UNDFND	UNDFD	14	2.3
3.60	12	26.60	1.02	3.84	0.55	silty clay to clay	UNDFND	UNDFD	17	1.7
3.90	13	7.92	0.30	3.79	0.57	clay	UNDFND	UNDFD	8	.4
4.20	14	6.48	0.27	4.12	0.60	clay	UNDFND	UNDFD	6	.3
4.50	15	10.86	0.33	3.04	0.62	silty clay to clay	UNDFND	UNDFD	7	.6
4.80	16	15.72	0.31	1.99	0.65	clayey silt to silty clay	UNDFND	UNDFD	8	.9
5.10	17	9.35	0.26	2.78	0.68	silty clay to clay	UNDFND	UNDFD	6	.5
5.40	18	8.07	0.17	2.06	0.70	silty clay to clay	UNDFND	UNDFD	5	.4
5.70	19	17.32	0.27	1.56	0.73	sandy silt to clayey silt	UNDFND	UNDFD	7	1.0
6.00	20	11.56	0.11	0.98	0.75	sandy silt to clayey silt	UNDFND	UNDFD	4	.6
6.30	21	8.77	0.08	0.95	0.78	clayey silt to silty clay	UNDFND	UNDFD	4	.5
6.60	22	9.35	0.12	1.28	0.81	clayey silt to silty clay	UNDFND	UNDFD	4	.5
6.90	23	8.07	0.10	1.24	0.83	clayey silt to silty clay	UNDFND	UNDFD	4	.4
7.20	24	7.56	0.14	1.85	0.86	silty clay to clay	UNDFND	UNDFD	5	.4
7.50	25	7.69	0.11	1.39	0.88	clayey silt to silty clay	UNDFND	UNDFD	4	.4
7.80	26	10.81	0.24	2.19	0.91	clayey silt to silty clay	UNDFND	UNDFD	5	.6
8.10	27	14.44	0.37	2.54	0.94	clayey silt to silty clay	UNDFND	UNDFD	7	.8
8.40	28	23.62	0.97	4.11	0.96	silty clay to clay	UNDFND	UNDFD	15	1.4
8.70	29	23.75	0.96	4.06	0.99	silty clay to clay	UNDFND	UNDFD	15	1.4
9.10	30	40.95	0.64	1.58	1.02	silty sand to sandy silt	40-50	36-38	13	UNDEFINED
9.40	31	10.39	0.20	1.96	1.05	clayey silt to silty clay	UNDFND	UNDFD	5	.5
9.70	32	12.34	0.29	2.38	1.07	clayey silt to silty clay	UNDFND	UNDFD	6	.7
10.00	33	9.20	0.28	3.01	1.10	silty clay to clay	UNDFND	UNDFD	6	.4
10.30	34	9.47	0.33	3.48	1.12	clay	UNDFND	UNDFD	9	.5
10.60	35	13.04	0.40	3.09	1.15	silty clay to clay	UNDFND	UNDFD	8	.7
10.90	36	12.47	0.45	3.61	1.18	silty clay to clay	UNDFND	UNDFD	8	.6
11.20	37	12.02	0.26	2.14	1.20	clayey silt to silty clay	UNDFND	UNDFD	6	.6
11.50	38	12.58	0.31	2.46	1.23	clayey silt to silty clay	UNDFND	UNDFD	6	.6

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

GROUP DELTA CONSULTANTS

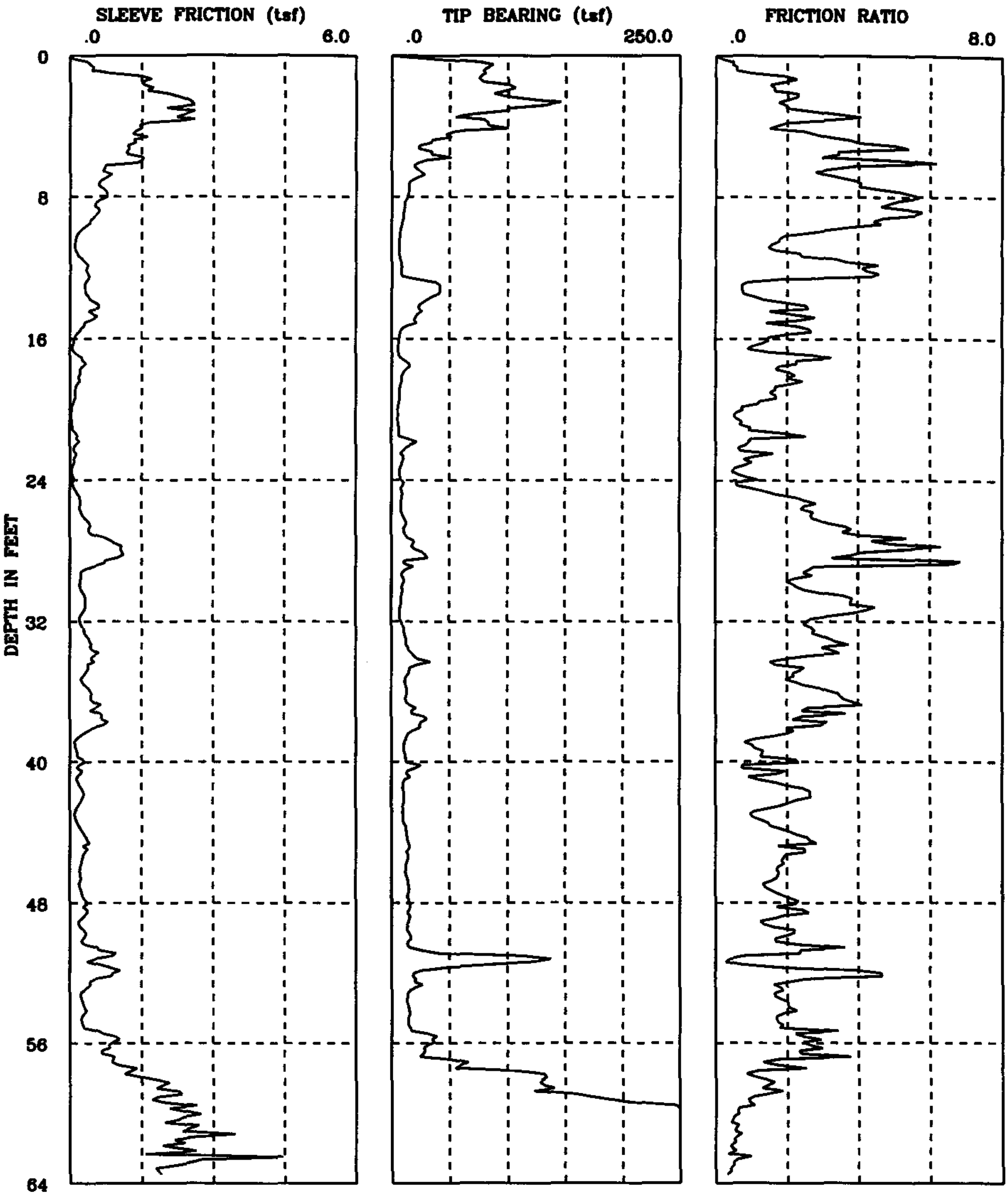
CPT Date :11-03-98
Cone Used :CPT B-314C
Depth to water table (ft) : 8

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.80	39	27.38	0.63	2.30	1.25	sandy silt to clayey silt	UNDFND	UNDFD	10	1.6
12.10	40	50.22	0.81	1.61	1.28	silty sand to sandy silt	40-50	36-38	16	UNDEFINED
12.40	41	38.47	0.83	2.17	1.31	sandy silt to clayey silt	UNDFND	UNDFD	15	2.4
12.70	42	15.38	0.43	2.80	1.33	clayey silt to silty clay	UNDFND	UNDFD	7	.8
13.00	43	11.64	0.35	2.98	1.36	silty clay to clay	UNDFND	UNDFD	7	.6
13.30	44	14.10	0.39	2.74	1.38	clayey silt to silty clay	UNDFND	UNDFD	7	.7
13.60	45	105.49	0.94	0.89	1.41	sand to silty sand	60-70	38-40	25	UNDEFINED
13.90	46	20.44	0.66	3.23	1.43	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
14.20	47	13.78	0.35	2.54	1.46	clayey silt to silty clay	UNDFND	UNDFD	7	.7
14.50	48	17.61	0.42	2.37	1.49	clayey silt to silty clay	UNDFND	UNDFD	8	.9
14.80	49	31.18	0.48	1.54	1.51	sandy silt to clayey silt	UNDFND	UNDFD	12	1.8
15.10	50	48.79	1.22	2.50	1.54	sandy silt to clayey silt	UNDFND	UNDFD	19	3.0
15.50	51	157.56	1.67	1.06	1.57	sand to silty sand	70-80	40-42	38	UNDEFINED
15.80	52	150.63	1.17	0.77	1.60	sand	70-80	40-42	29	UNDEFINED
16.10	53	22.90	0.52	2.27	1.62	sandy silt to clayey silt	UNDFND	UNDFD	9	1.3
16.40	54	19.12	0.26	1.38	1.65	sandy silt to clayey silt	UNDFND	UNDFD	7	1.0
16.70	55	24.96	0.57	2.28	1.68	sandy silt to clayey silt	UNDFND	UNDFD	10	1.4
17.00	56	30.80	1.10	3.58	1.70	clayey silt to silty clay	UNDFND	UNDFD	15	1.8
17.30	57	72.63	1.20	1.65	1.73	silty sand to sandy silt	40-50	36-38	23	UNDEFINED
17.60	58	134.04	1.50	1.12	1.75	sand to silty sand	60-70	38-40	32	UNDEFINED
17.90	59	58.25	1.03	1.77	1.78	silty sand to sandy silt	40-50	34-36	19	UNDEFINED
18.20	60	47.84	1.12	2.34	1.81	sandy silt to clayey silt	UNDFND	UNDFD	18	2.9
18.50	61	222.47	2.26	1.01	1.83	sand	80-90	40-42	43	UNDEFINED
18.80	62	386.29	1.69	0.44	1.86	gravelly sand to sand	>90	44-46	>50	UNDEFINED
19.10	63	337.19	1.54	0.46	1.88	gravelly sand to sand	>90	42-44	>50	UNDEFINED
19.40	64	327.25	3.35	1.02	1.91	sand	>90	42-44	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****



CPT B-318C	Playa Vista Site De
GROUP DELTA CONSULTANTS, INC.	Fs, Qc, AND FRICTION RATIO vs DEPTH

GROUP DELTA CONSULTANTS

CPT Date :11-03-98
Cone Used :CPT B-318C
Depth to water table (ft) : 8

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.20	1	52.66	0.29	0.54	0.02	sand to silty sand	>90	>48	13	UNDEFINED
0.50	2	85.88	1.35	1.57	0.07	silty sand to sandy silt	>90	>48	27	UNDEFINED
0.80	3	114.75	2.14	1.87	0.12	silty sand to sandy silt	>90	>48	37	UNDEFINED
1.10	4	84.76	2.35	2.77	0.18	sandy silt to clayey silt	UNDFND	UNDFD	32	5.6
1.40	5	63.30	1.48	2.34	0.24	sandy silt to clayey silt	UNDFND	UNDFD	24	4.2
1.70	6	30.44	1.27	4.16	0.29	silty clay to clay	UNDFND	UNDFD	19	2.0
2.00	7	24.73	0.99	3.99	0.35	silty clay to clay	UNDFND	UNDFD	16	1.6
2.30	8	17.23	0.68	3.97	0.41	silty clay to clay	UNDFND	UNDFD	11	1.1
2.70	9	11.85	0.63	5.27	0.47	clay	UNDFND	UNDFD	11	.7
3.00	10	8.88	0.38	4.24	0.50	clay	UNDFND	UNDFD	9	.5
3.30	11	6.76	0.12	1.73	0.52	silty clay to clay	UNDFND	UNDFD	4	.4
3.60	12	7.33	0.26	3.50	0.55	clay	UNDFND	UNDFD	7	.4
3.90	13	18.14	0.35	1.93	0.57	clayey silt to silty clay	UNDFND	UNDFD	9	1.1
4.20	14	37.58	0.35	0.92	0.60	silty sand to sandy silt	40-50	38-40	12	UNDEFINED
4.50	15	23.32	0.52	2.22	0.62	sandy silt to clayey silt	UNDFND	UNDFD	9	1.5
4.80	16	12.60	0.23	1.80	0.65	clayey silt to silty clay	UNDFND	UNDFD	6	.7
5.10	17	5.80	0.08	1.32	0.68	sensitive fine grained	UNDFND	UNDFD	3	.3
5.40	18	11.56	0.26	2.25	0.70	clayey silt to silty clay	UNDFND	UNDFD	6	.7
5.70	19	8.33	0.18	2.12	0.73	silty clay to clay	UNDFND	UNDFD	5	.4
6.00	20	6.39	0.09	1.46	0.75	sensitive fine grained	UNDFND	UNDFD	3	.3
6.30	21	5.48	0.04	0.67	0.78	sensitive fine grained	UNDFND	UNDFD	3	.2
6.60	22	8.88	0.11	1.20	0.81	clayey silt to silty clay	UNDFND	UNDFD	4	.5
6.90	23	12.15	0.11	0.88	0.83	sandy silt to clayey silt	UNDFND	UNDFD	5	.7
7.20	24	7.67	0.06	0.74	0.86	sensitive fine grained	UNDFND	UNDFD	4	.4
7.50	25	8.79	0.09	1.02	0.88	clayey silt to silty clay	UNDFND	UNDFD	4	.4
7.80	26	8.35	0.21	2.48	0.91	silty clay to clay	UNDFND	UNDFD	5	.4
8.10	27	11.05	0.34	3.11	0.94	silty clay to clay	UNDFND	UNDFD	7	.6
8.40	28	14.36	0.67	4.69	0.96	clay	UNDFND	UNDFD	14	.8
8.70	29	20.03	0.97	4.83	0.99	clay	UNDFND	UNDFD	19	1.2
9.10	30	12.01	0.30	2.46	1.02	clayey silt to silty clay	UNDFND	UNDFD	6	.6
9.40	31	8.77	0.29	3.27	1.05	clay	UNDFND	UNDFD	8	.4
9.70	32	7.27	0.27	3.67	1.07	clay	UNDFND	UNDFD	7	.3
10.00	33	10.45	0.29	2.74	1.10	silty clay to clay	UNDFND	UNDFD	7	.5
10.30	34	14.57	0.48	3.27	1.12	silty clay to clay	UNDFND	UNDFD	9	.8
10.60	35	19.95	0.39	1.96	1.15	sandy silt to clayey silt	UNDFND	UNDFD	8	1.1
10.90	36	12.49	0.31	2.46	1.18	clayey silt to silty clay	UNDFND	UNDFD	6	.6
11.20	37	13.78	0.52	3.75	1.20	silty clay to clay	UNDFND	UNDFD	9	.7
11.50	38	23.66	0.63	2.66	1.23	clayey silt to silty clay	UNDFND	UNDFD	11	1.4

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

GROUP DELTA CONSULTANTS

CPT Date :11-03-98
Cone Used :**CPT B-318C**
Depth to water table (ft) : 8

Job No. L196 Playa Vista
Tot. Unit Wt. (avg) : 115 pcf

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.80	39	16.87	0.30	1.76	1.25	clayey silt to silty clay	UNDFND	UNDFD	8	.9
12.10	40	11.11	0.13	1.20	1.28	clayey silt to silty clay	UNDFND	UNDFD	5	.5
12.40	41	15.42	0.22	1.45	1.31	sandy silt to clayey silt	UNDFND	UNDFD	6	.8
12.70	42	10.81	0.21	1.91	1.33	clayey silt to silty clay	UNDFND	UNDFD	5	.5
13.00	43	10.26	0.21	2.08	1.36	clayey silt to silty clay	UNDFND	UNDFD	5	.5
13.30	44	10.28	0.13	1.26	1.38	clayey silt to silty clay	UNDFND	UNDFD	5	.5
13.60	45	13.51	0.34	2.49	1.41	clayey silt to silty clay	UNDFND	UNDFD	6	.7
13.90	46	14.29	0.30	2.10	1.43	clayey silt to silty clay	UNDFND	UNDFD	7	.7
14.20	47	12.64	0.22	1.74	1.46	clayey silt to silty clay	UNDFND	UNDFD	6	.6
14.50	48	14.53	0.23	1.56	1.49	clayey silt to silty clay	UNDFND	UNDFD	7	.7
14.80	49	14.72	0.32	2.17	1.51	clayey silt to silty clay	UNDFND	UNDFD	7	.7
15.10	50	13.96	0.24	1.72	1.54	clayey silt to silty clay	UNDFND	UNDFD	7	.7
15.50	51	21.79	0.52	2.40	1.57	clayey silt to silty clay	UNDFND	UNDFD	10	1.2
15.80	52	82.67	0.74	0.89	1.60	sand to silty sand	50-60	36-38	20	UNDEFINED
16.10	53	19.69	0.55	2.79	1.62	clayey silt to silty clay	UNDFND	UNDFD	9	1.1
16.40	54	13.53	0.25	1.82	1.65	clayey silt to silty clay	UNDFND	UNDFD	6	.6
16.70	55	14.70	0.28	1.90	1.68	clayey silt to silty clay	UNDFND	UNDFD	7	.7
17.00	56	27.61	0.67	2.44	1.70	sandy silt to clayey silt	UNDFND	UNDFD	11	1.6
17.30	57	28.17	0.81	2.86	1.73	clayey silt to silty clay	UNDFND	UNDFD	13	1.6
17.60	58	84.48	1.14	1.35	1.75	silty sand to sandy silt	50-60	36-38	27	UNDEFINED
17.90	59	128.56	2.01	1.57	1.78	sand to silty sand	60-70	38-40	31	UNDEFINED
18.20	60	235.45	1.98	0.84	1.81	sand	80-90	42-44	45	UNDEFINED
18.50	61	444.03	2.56	0.58	1.83	gravelly sand to sand	>90	44-46	>50	UNDEFINED
18.80	62	435.12	2.46	0.56	1.86	gravelly sand to sand	>90	44-46	>50	UNDEFINED
19.10	63	469.12	2.23	0.47	1.88	gravelly sand to sand	>90	44-46	>50	UNDEFINED
19.40	64	501.82	1.99	0.40	1.91	gravelly sand to sand	>90	44-46	>50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 15

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

APPENDIX A
EXISTING FIELD DATA (Pacific Soils Engineering, 1998)

GEOTECHNICAL BORING LOG

PROJECT NO.	500464	PROJECT NAME	Playa Vista
DATE STARTED	12/5/97	GROUND ELEV.	16 +
DATE FINISHED	12/5/97	GW DEPTH (FT)	14.00
DRILLER	2R DRILLING	DRIVE WT.	140 lbs.
TYPE OF DRILL RIG	8" HOLLOWSTEM	DROP	30"

BORING DESIG. B-01
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
0							**FILL (Af):** SILTY CLAY, dark brown and CLAYEY SILT, medium brown, damp, medium stiff				
5		R		6/18/25				19.9	103	85	
							ALLUVIUM (Qal): SILTY CLAY, trace very fine sand, damp to moist, plastic at in situ moisture, medium stiff				
10		R		9/13/19			SILTY SAND, orange brown, fine to coarse, traces fine to coarse gravel, damp, medium dense	17.1	108	82	
							SILTY CLAY, black, damp to moist, medium stiff	17.9	112	96	
15		R		3/5/7		SM/ML	Fine-grained SANDY SILT to SILTY SAND, light gray, moist, medium dense, slightly micaceous	30.8	88	90	DS HY
							SILTY CLAY, dark gray, moist to wet, medium stiff				
20		R		2/3/4				49.2	73	98	
25		R		3/4/10		ML	SANDY SILT, dark gray-brown, moist, medium stiff, trace old rootlets and pin size pores, aqua coloring	19.9	106	91	CON HY
30		R		6/9/17			CLAYEY Fine to Coarse-Grained SAND, and fine to coarse gravel, wet, medium dense to dense, trace cobbles	10.2	95	36	
35		R		6/8/12			SILT, with traces of CLAY, dark gray-brown, moist to wet, medium stiff to stiff, traces of mica	30.0	93	99	

Groundwater symbol shown at approx. 14 ft.

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-1

GEOTECHNICAL BORING LOG

PROJECT NO.	500464	PROJECT NAME	Playa Vista		
DATE STARTED	12/5/97	GROUND ELEV.	16+	BORING DESIG.	B-01
DATE FINISHED	12/5/97	GW DEPTH (FT)	14.00	LOGGED BY	DO
DRILLER	2R DRILLING	DRIVE WT.	140 lbs.	NOTE	
TYPE OF DRILL RIG	8" HOLLOWSTEM	DROP	30"		

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		R		3/5/7		ML	CLAYEY SILT, dark gray, moist to wet, medium stiff to stiff, plastic with dark brown mottling, interbedded with fine-grained SANDY SILT, wet	33.4	89	99	CON HY
45		R		6/7/7				47.0	77	98	
							CLAYEY SILT, dark gray, wet, medium stiff to stiff, micaceous				
50		R		6/8/12				33.7	88	100	
							gravel				
55		R		17/ 50 for 4"			**PLEISTOCENE SAND (Ps):** Fine to Medium-Grained SAND, gray, wet, dense, with some coarse SAND, fine gravel	13.9	120	93	
60		R		51 for 6"			Becomes coarser with depth, fine to coarse-grained SAND and fine to coarse GRAVEL.	13.0	117	81	
65		R		20/33 50 for 4"			Encountered piece of cobble	26.3	97	97	
70		R		20/ 50 for 4"				24.5	100	96	
							Total Depth 71 feet Groundwater encountered at about 14 feet				

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

GROUNDWATER

SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-1

GEOTECHNICAL BORING LOG

PROJECT NO. 500464
DATE STARTED 12/9/97
DATE FINISHED 12/9/97
DRILLER 2R DRILLING
TYPE OF DRILL RIG 8" HOLLOWSTEM

PROJECT NAME Playa Vista
GROUND ELEV. 16+
GW DEPTH (FT) 15.00
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. B-02
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		B				SC	FILL (Af): Fine-Grained SANDY CLAY, brown, damp, medium stiff, with some coarse SAND and fine gravel				MAX DSR EI HY
5		R		4/7/14			@5' cobble encountered	14.3	118	91	
							SILTY Fine-Grained SAND, orange brown, damp, medium dense				
10		R		8/9/13			ALLUVIUM (Qal): SILTY CLAY, black, damp, medium stiff	19.7	107	93	
15		R		3/4/6			Fine-Grained SANDY SILT, damp to moist, medium dense, micaceous	42.5	79	99	
							SILTY CLAY, aqua blue, moist, medium stiff, plastic				
20		R		1/2/4		CL	@ 20' wet sample	33.5	90	100	DS
							Coarse to Fine-Grained SAND, black gray, moist to wet, medium dense				
25		R		4/5/7			SILTY CLAY, dark brown, moist to wet, stiff, plastic	24.7	100	98	
							Water measured at 27 feet and 3 inches during drilling				
30		R		2/4/7		ML	SILTY CLAY to CLAYEY SILT, black brown	29.9	94	99	CON HY
35		R		6/6/11							

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-2

GEOTECHNICAL BORING LOG

PROJECT NO. 500464
DATE STARTED 12/9/97
DATE FINISHED 12/9/97
DRILLER 2R DRILLING
TYPE OF DRILL RIG 8" HOLLOWSTEM

PROJECT NAME Playa Vista
GROUND ELEV. 16 +
GW DEPTH (FT) 15.00
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. B-02
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		R		3/7/8			CLAYEY SILT with some fine-grained SAND, dark brown, wet, micaceous	27.7	98	99	
45		R		5/9/16			CLAYEY Coarse-Grained SAND with gravel, black brown, wet, medium dense	27.8	95	97	
50		R		6/7/15			Fine to Medium-Grained SAND, black brown, wet, medium dense	26.6	97	98	
55		R		7/13/30			**PLEISTOCENE SAND (Ps):** Fine-Grained SILTY SAND, with fine to coarse gravel, dark gray, wet, medium dense to dense, gravel encountered 55 to 60 feet	26.0	102	89	
60		R		11/15/40			Fine to Coarse-Grained SAND, with fine to coarse gravel, gray, wet, dense	12.0	129	99	
65		R		16/50 for 6"			Same as 60' with fine cobbles	8.0	133	80	
70		R		40/50 for				10.5	131	98	
							Total Depth 71 feet Groundwater encountered at about 15 feet				

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-2

GEOTECHNICAL BORING LOG

PROJECT NO. 500464
DATE STARTED 12/9/97
DATE FINISHED 12/9/97
DRILLER 2R DRILLING
TYPE OF DRILL RIG 8" HOLLOWSTEM

PROJECT NAME Playa Vista
GROUND ELEV. 16 +
GW DEPTH (FT) 15.00
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. B-03
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
							FILL (Af): Medium to Coarse-Grained SANDY CLAY, brown, damp, medium stiff, also fine gravel				
5		R		20/19/20			Occasional cobbles	7.3	123	54	
10		R		9/11/17			**ALLUVIUM (Qal):** SILTY CLAY, black, damp, medium stiff	21.7	106	98	
15		R		6/6/8		ML	CLAYEY SAND, gray-brown, damp, medium dense	32.8	90	99	HY
20		R		1/1/2		CL	Water on sampler	48.5	73	100	CON HY
							SILTY CLAY, gray-brown, wet, stiff, roots				
25		R		2/2/4			SILTY CLAY, black, moist to wet, stiff	38.5	81	97	CHEM
30		R		3/6/7			CLAYEY SILT, black, moist to wet, moderately firm	27.1	98	98	
35		R		7/7/7		ML	Medium-Grained SANDY SILT, gray-brown, wet, medium dense	25.0	101	99	DS

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-3

A-70

GEOTECHNICAL BORING LOG

PROJECT NO.	500464	PROJECT NAME	Playa Vista
DATE STARTED	12/9/97	GROUND ELEV.	16 +
DATE FINISHED	12/9/97	GW DEPTH (FT)	15.00
DRILLER	2R DRILLING	DRIVE WT.	140 lbs.
TYPE OF DRILL RIG	8" HOLLOWSTEM	DROP	30"

BORING DESIG. B-03
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		R		3/4/7		SP	CLAYEY Coarse-Grained SAND, with gravel, black brown, wet, medium dense	11.9	101	49	CON HY
45		R		4/9/11			CLAYEY SILT with sand, black brown, wet, medium dense	34.5	87	99	
50		R		5/7/10			SILTY Medium to Fine-Grained SAND, gray-black, wet, medium dense	28.9	95	100	
55		R		4/9/12			CLAYEY SILT, gray-brown, moist to wet, firm, micaceous	22.0	106	100	
60		R		11/31/50 for 5"			**PLEISTOCENE SAND (Ps):** Medium to Coarse-Grained GRAVELLY SAND, gray-brown, wet, medium dense	20.6	103	87	
65		R		14/50 for 3"		SP	Increase in gravel size with occasional cobbles	16.5	117	99	CON HY
70		R		16/50 for 5"			Medium to Fine-Grained SAND, gray-brown, wet, medium dense, micaceous	23.7	104	99	

Total Depth 71 feet
Groundwater encountered at about 15 feet

SAMPLE TYPES:
[R] RING (DRIVE) SAMPLE
[S] SPT (SPLIT SPOON) SAMPLE
[B] BULK SAMPLE [T] TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-3

GEOTECHNICAL BORING LOG

PROJECT NO. 500464
DATE STARTED 12/9/97
DATE FINISHED 12/9/97
DRILLER 2R DRILLING
TYPE OF DRILL RIG 8"HOLLOWSTEM

PROJECT NAME Playa Vista
GROUND ELEV. 16 +
GW DEPTH (FT) 10.00
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. B-04
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
							ALLUVIUM (Qal): CLAYEY SAND, medium to coarse, dark brown, moist, medium dense, some gravel to 3/4" subrounded				
5		R		12/12/7			CLAYEY SAND, medium to coarse with gravel, brown, damp, medium dense, occasional cobble	9.9	120	66	
10		R		15/7/8		CL	SANDY CLAY, medium grained, gray-brown, damp, medium stiff	27.8	95	97	DS HY
15		R		4/5/8			SILTY SAND, medium to fine grained, gray-brown, damp, medium dense	33.3	89	98	
20		R		3/4/6			SANDY SILT, fine grained, gray-brown, damp to moist, firm	40.4	80	98	
25		R		2/1/2		ML	CLAYEY SILT, black-brown, moist, stiff, some shells	32.3	93	99	CON HY
30		R		5/4/12			No Recovery				
35		R		4/7/7			SILTY CLAY, gray-brown, moist, moderately firm	37.3	84	100	

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-4

GEOTECHNICAL BORING LOG

PROJECT NO.	500464	PROJECT NAME	Playa Vista
DATE STARTED	12/9/97	GROUND ELEV.	16 +
DATE FINISHED	12/9/97	GW DEPTH (FT)	10.00
DRILLER	2R DRILLING	DRIVE WT.	140 lbs.
TYPE OF DRILL RIG	8"HOLLOWSTEM	DROP	30"

BORING DESIG. B-04
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		R		3/3/4			SILTY CLAY, bluish gray-brown, moist, firm	35.2	88	98	CHEM
45		R		3/5/7		CL	same as above	38.0	83	99	DS
50		R		5/8/6			SILTY CLAY,with fine grained sand, blue gray-brown, moist to wet, firm	32.5	90	99	
55		R		4/4/6		ML	SILTY CLAY, black-brown, moist, firm with some fine SAND	41.8	81	99	CON HY
60		R		1/2/7			<u>PLEISTOCENE SAND (Ps):</u> SAND, medium grained, gray-brown, wet, medium dense	12.0	119	79	
65		R		50 for 3"		SP	same as above	23.1	103	99	DS HY
70		R		30/50			Coarse Grained SAND, gray-brown, wet, dense with gravel up to 1/2" subrounded	9.4	122	67	
							Total Depth 71 feet Groundwater encountered at about 10 feet				

SAMPLE TYPES:
- [R] RING (DRIVE) SAMPLE
- [S] SPT (SPLIT SPOON) SAMPLE
- [B] BULK SAMPLE
- [T] TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-4

GEOTECHNICAL BORING LOG

PROJECT NO. 500464
DATE STARTED 12/10/97
DATE FINISHED 12/10/97
DRILLER 2R DRILLING
TYPE OF DRILL RIG 8" HOLLOWSTEM

PROJECT NAME Playa Vista
GROUND ELEV. 16 +
GW DEPTH (FT)
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. B-05
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
							FILL (Af): SANDY CLAY, gravel, moist to wet, stiff				
5		R		6/14/12			CLAYEY SAND, coarse up to 1/4", black-brown, damp, stiff	9.9	119	65	
10		R		3/4/4			**ALLUVIUM (Qal):** SANDY CLAY, gray-brown, wet, soft	37.9	82	97	
15		R		3/3/4			SILTY SAND, fine grained, gray-brown, moist, soft	38.2	84	99	
20		R		1/1/1		CL	SILTY CLAY, gray-brown, wet, soft, odiferous, peat (?), micaceous	70.8	58	98	CON HY
25		R		2/1/2			SANDY CLAY, black brown, moist to wet, soft	26.6	87	77	
30		R		3/5/6			CLAYEY SILT, with fine sand, gray-brown, wet, firm	28.7	96	98	CHEM
35		R		3/3/4			SILTY fine SAND, with CLAY, blue-gray, wet, soft, micaceous	27.8	96	99	

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-5

GEOTECHNICAL BORING LOG

PROJECT NO.	500464	PROJECT NAME	Playa Vista	BORING DESIG.	B-05
DATE STARTED	12/10/97	GROUND ELEV.	16 +	LOGGED BY	DO
DATE FINISHED	12/10/97	GW DEPTH (FT)		NOTE	
DRILLER	2R DRILLING	DRIVE WT.	140 lbs.		
TYPE OF DRILL RIG	8" HOLLOWSTEM	DROP	30"		

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		R		4/4/8			CLAYEY SILT, blue-gray, moist to wet, firm, micaceous	32.0	92	99	
45		R		4/5/8			SILTY CLAY, blue-gray, wet, very firm, micaceous	36.5	85	99	
50		R		8/12/13			CLAY, blue-gray, wet, soft	33.3	89	100	
							1 foot layer of medium to fine SAND				
							CLAY, blue-gray, wet, soft				
55		R		3/4/6		ML	same with 1/8" root encountered	29.7	93	99	CON HY
60		R		5/19/30			**PLEISTOCENE SAND (Ps):** Fine to Coarse SAND, gray, wet, medium dense to dense, trace of silt, cobble fragments in tip 2 1/2"	19.6	116	99	
65		R		27/53			same with increase in grain size	9.0	139	98	
							Total Depth 66 feet Seepage at about 1 foot Possibly locally shallow perched groundwater				

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

GROUNDWATER

SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-5

GEOTECHNICAL BORING LOG

PROJECT NO. 500464
DATE STARTED 12/10/97
DATE FINISHED 12/10/97
DRILLER 2R DRILLING
TYPE OF DRILL RIG 8" HOLLOWSTEM

PROJECT NAME Playa Vista
GROUND ELEV. 16+
GW DEPTH (FT) 10.00
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. B-06
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
							FILL (Af): Medium SANDY CLAY, brown, damp, firm				
5		R		4/7/13			CLAYEY medium SAND, brown, damp, medium dense				
10		R		7/10/15			ALLUVIUM (Qal): SILTY CLAY with fine SAND, gray-brown, damp, firm	27.0	97	99	
15		R		3/6/10			SILTY fine SAND, brown, wet, loose to medium dense	30.7	95	98	
20		R		2/3/3			SANDY CLAY, gray-brown, moist to wet, soft	66.3	61	98	
25		R		3/4/7			same as above	20.7	106	95	
30		R		3/6/6		ML	SANDY SILT, gray-brown, moist to wet, soft	31.4	93	99	CON HY
							SILTY SAND, medium to coarse, gray-brown, moist to wet, dense				
35		R		3/9/15			same as above	23.4	103	99	
							SANDY CLAY, gray-brown, moist to wet, firm				

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

▼ GROUNDWATER
► SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-6

GEOTECHNICAL BORING LOG

PROJECT NO. 500464
DATE STARTED 12/10/97
DATE FINISHED 12/10/97
DRILLER 2R DRILLING
TYPE OF DRILL RIG 8" HOLLOWSTEM

PROJECT NAME Playa Vista
GROUND ELEV. 16 +
GW DEPTH (FT) 10.00
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. B-06
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		R		3/5/8			SILTY CLAY, gray-brown, moist to wet, soft to firm, micaceous	29.4	97	99	
45		R		2/4/6		ML	CLAYEY SILT, black-brown, moist to wet, firm	33.6	79	80	CON HY
50		R		3/6/8			CLAYEY SAND, black-brown, wet, dense	28.3	96	98	
							SANDY CLAY, black-brown, moist to wet, firm				
55		R		4/5/12			Fine SANDY SILT, blue-gray, moist, firm, micaceous, 1/8" root	31.2	92	99	
60		R		3/7/10			CLAYEY Medium SAND, gray-brown, wet, dense, root 1/8", micaceous, occasional coarse sizes to 1/4"	25.2	100	99	
65		R		14/50			**PLEISTOCENE SAND (Ps):** Coarse SAND, gray-brown, wet, dense	15.0	119	98	
70		R		15/50 for 5"		SP	same	17.9	109	89	DS HY
							Total Depth 71 feet Groundwater encountered at about 10 feet				

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-6

GEOTECHNICAL BORING LOG

PROJECT NO. 500464
DATE STARTED 12/10/97
DATE FINISHED 12/10/97
DRILLER 2R DRILLING
TYPE OF DRILL RIG 8" HOLLOWSTEM

PROJECT NAME Playa Vista
GROUND ELEV. 16 +
GW DEPTH (FT) 17.00
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. B-07
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
0						SC	**FILL (Af):** CLAYEY SAND, brown, damp, medium dense				MAX RV HY
5		R		6/8/13			SANDY CLAY, brown, damp, moderately firm, with gravel	15.1	111	78	
10		R		7/12/13			CLAY, some fine SAND, black, damp to moist, hard, micaceous, roots	24.3	100	96	
15		R		3/4/5			**ALLUVIUM (Qal):** SANDY SILT, black-brown, damp to moist, firm, micaceous; water (groundwater symbol)	32.4	90	99	
20		R		2/3/3			SILT with CLAY and SAND, greenish-gray, wet, firm	26.6	90	82	CHEM
25		R		2/5/4		ML	SANDY SILT, greenish gray, wet, firm	20.5	107	97	CON HY
30		R		3/5/5		ML	SANDY SILT, gray-brown, wet, firm	26.4	98	99	DS
35		R		1/2/4			No Recovery				

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE
T TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-7

GEOTECHNICAL BORING LOG

PROJECT NO.	500464	PROJECT NAME	Playa Vista		
DATE STARTED	12/10/97	GROUND ELEV.	16 +	BORING DESIG.	B-07
DATE FINISHED	12/10/97	GW DEPTH (FT)	17.00	LOGGED BY	DO
DRILLER	2R DRILLING	DRIVE WT.	140 lbs.	NOTE	
TYPE OF DRILL RIG	8" HOLLOWSTEM	DROP	30"		

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		R		6/7/12			SILTY medium to coarse SAND, gray-brown, wet, medium dense	19.8	110	99	
45		R		6/8/8			SILTY CLAY, blue-gray, moist to wet, soft to firm	23.5	99	90	
50		R		7/10/15			same as above	28.9	94	97	
55		R		6/8/10			CLAYEY SILT, blue-gray, moist to wet, firm, with roots	32.3	90	99	
60		R		12/20/30			**PLEISTOCENE SAND (Ps):** Coarse Grained SAND, blue-gray, wet, dense	17.7	112	95	
65		R		12/30/50 for 4"			same, 1 1/2" gravel in tip	15.5	116	93	
70		R		7/20/48			same	10.3	127	84	
							Total Depth 71 feet Groundwater encountered at about 17 feet				

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

GROUNDWATER

SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-7

GEOTECHNICAL BORING LOG

PROJECT NO. 500464
DATE STARTED 12/11/97
DATE FINISHED 12/11/97
DRILLER 2R DRILLING
TYPE OF DRILL RIG 8" HOLLOWSTEM

PROJECT NAME Playa Vista
GROUND ELEV. 16 +
GW DEPTH (FT) 15.00
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. B-08
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
							FILL (Af): CLAYEY fine to coarse SAND, brown, damp, loose				
5		R		11/15/6			same but damp to moist, with cobble fragments	5.6	114	32	
10		R		6/9/19			SANDY CLAY, coarse, black-brown, damp, firm, micaceous 6 inch layer of SILTY SAND	15.5	116	92	
							water				
15		R		4/6/9			**ALLUVIUM (Qal):** CLAYEY SILT, with medium SAND, gray-blue, moist to wet, firm	35.2	88	99	
20		R		2/3/4		ML	same with roots and shells	41.5	71	82	CON HY
25		R		4/6/9			CLAYEY SILT with medium SAND, blue-gray, moist to wet, firm, micaceous	20.0	106	92	
							Coarse SAND, gray, wet				
30		R		5/5/8			SILTY CLAY, gray-brown, moist to wet, soft	28.5	95	100	CHEM
35		R		2/5/7			Fine SANDY CLAY, gray-brown, moist to wet, firm, roots	35.6	89	99	

SAMPLE TYPES:
[R] RING (DRIVE) SAMPLE
[S] SPT (SPLIT SPOON) SAMPLE
[B] BULK SAMPLE [T] TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

PLATE A-8

GEOTECHNICAL BORING LOG

PROJECT NO. 500464
DATE STARTED 12/11/97
DATE FINISHED 12/11/97
DRILLER 2R DRILLING
TYPE OF DRILL RIG 8" HOLLOWSTEM

PROJECT NAME Playa Vista
GROUND ELEV. 18 +
GW DEPTH (FT) 15.00
DRIVE WT. 140 lbs.
DROP 30"

BORING DESIG. B-08
LOGGED BY DO
NOTE

DEPTH (Feet)	ELEV	SAMPLE TYPE	SAMPLE	BLOWS/FT	LITHOLOGY	GROUP SYMBOL	GEOTECHNICAL DESCRIPTION	MOISTURE CONT (%)	DRY (pcf) DENSITY	SAT-URATION (%)	OTHER TESTS
		R		3/5/7		ML	CLAYEY SILT, aqua, moist to wet, firm, micaceous, roots	35.8	87	99	CON HY
45		R		5/8/7			CLAYEY SILT, gray-black, moist to wet, firm, micaceous	31.8	92	100	
50		R		4/7/11			CLAYEY SILT, gray, moist to wet, firm, roots	24.5	97	89	
55		R		4/5/8		ML		34.2	88	99	CON HY
60		R		6/8/12			CLAYEY SAND, coarse with subrounded gravel up to 1", moist to wet, dense	28.2	95	99	
65		R		10/50		SP	**PLEISTOCENE SAND (Ps):** Coarse SAND, gray, wet, dense	17.5	110	88	DS HY
70		R		11/50 for 5"			same with increase in grain size	23.7	101	97	
							Total Depth 71 feet Groundwater encountered at about 15 feet				

SAMPLE TYPES:
R RING (DRIVE) SAMPLE
S SPT (SPLIT SPOON) SAMPLE
B BULK SAMPLE T TUBE SAMPLE

GROUNDWATER
SEEPAGE

PACIFIC SOILS ENGINEERING, INC.

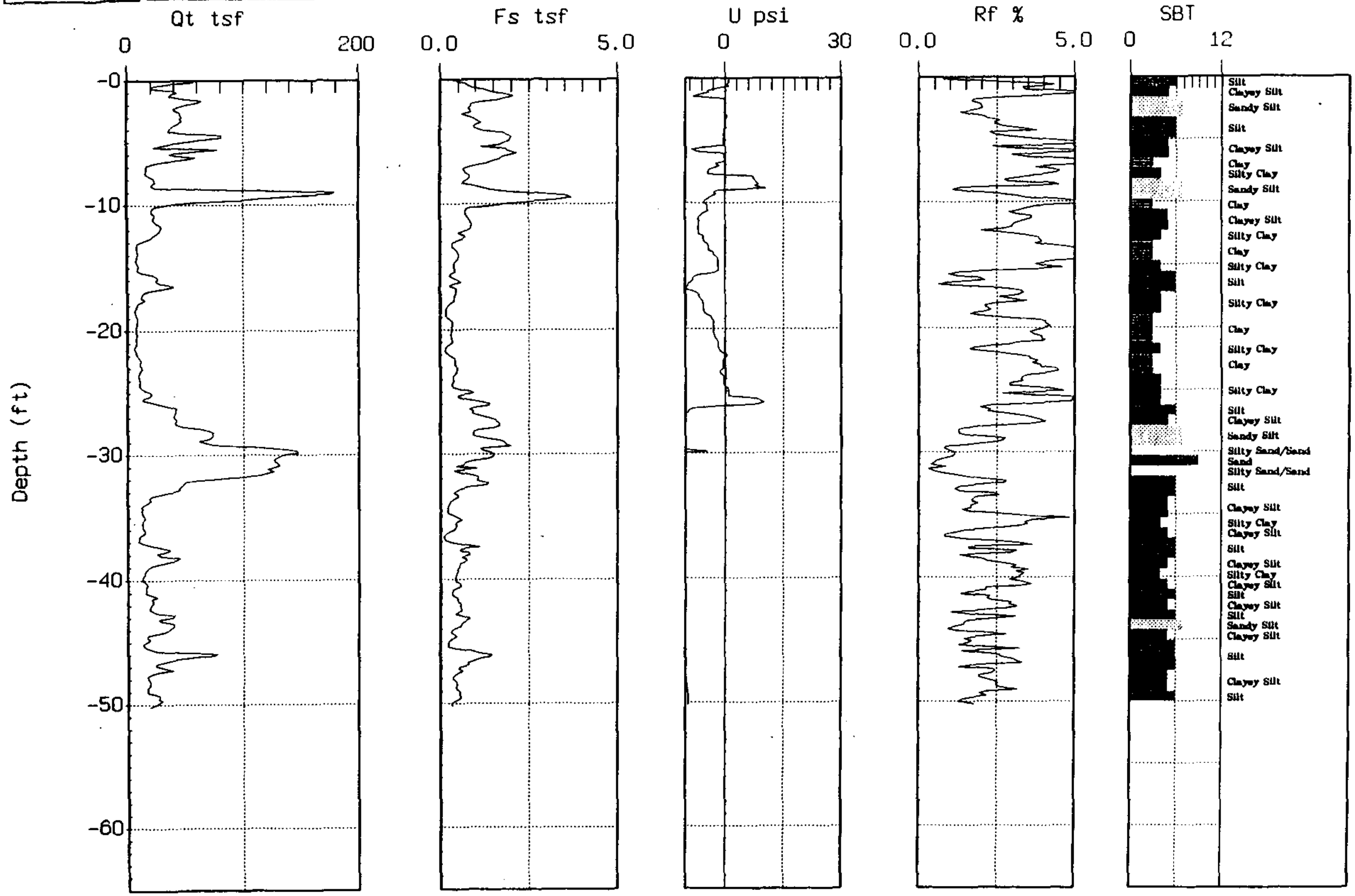
PLATE A-8

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-1

Engineer : C. KROLL
Date : 12:10:97 06:48



Max. Depth: 50.20 (ft)

Depth Inc.: 0.164 (ft)

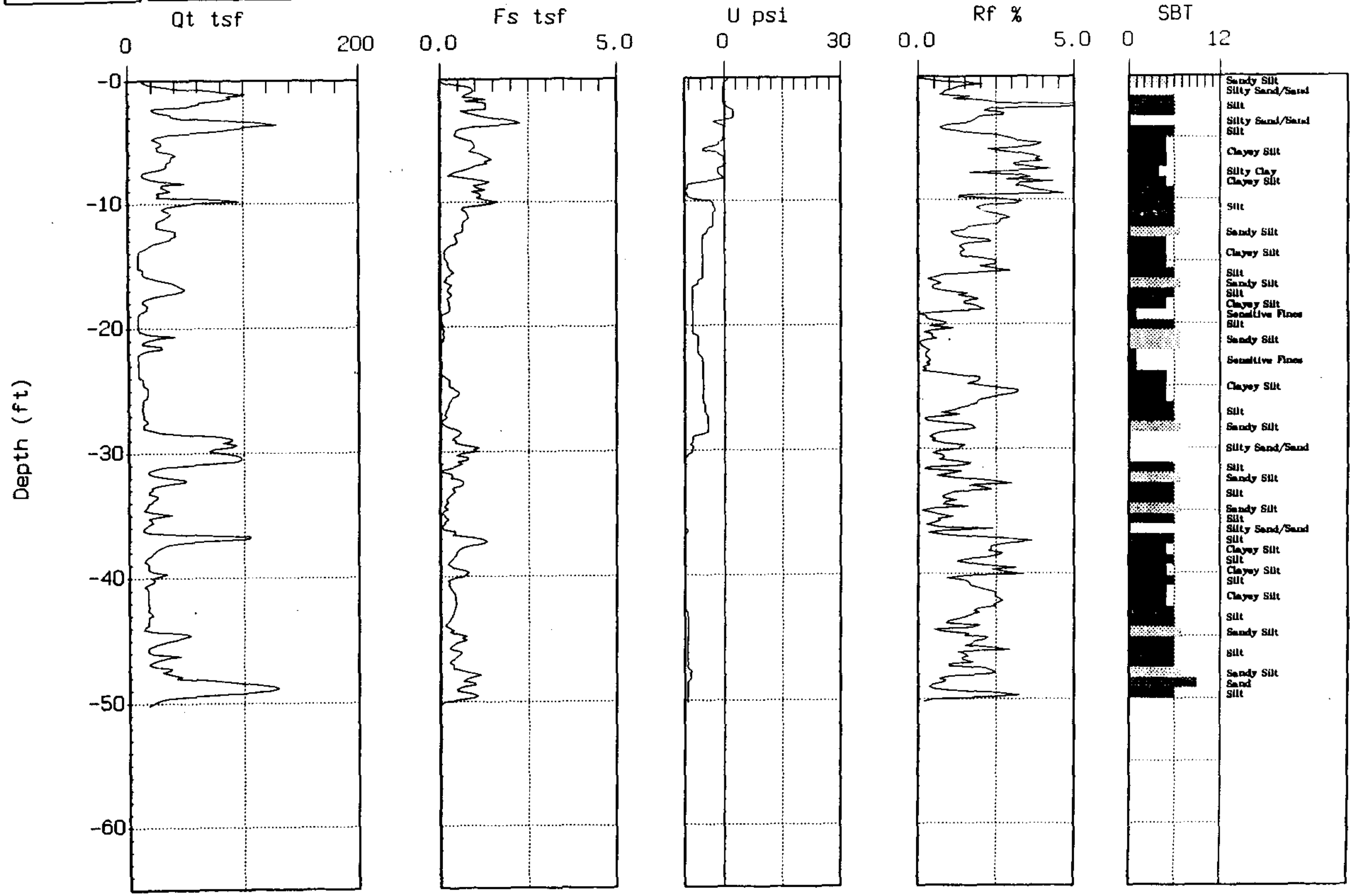
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-2

Engineer : S. KROLL
Date : 12:10:97 09:11



Max. Depth: 50.20 (ft)

Depth Inc.: 0.164 (ft)

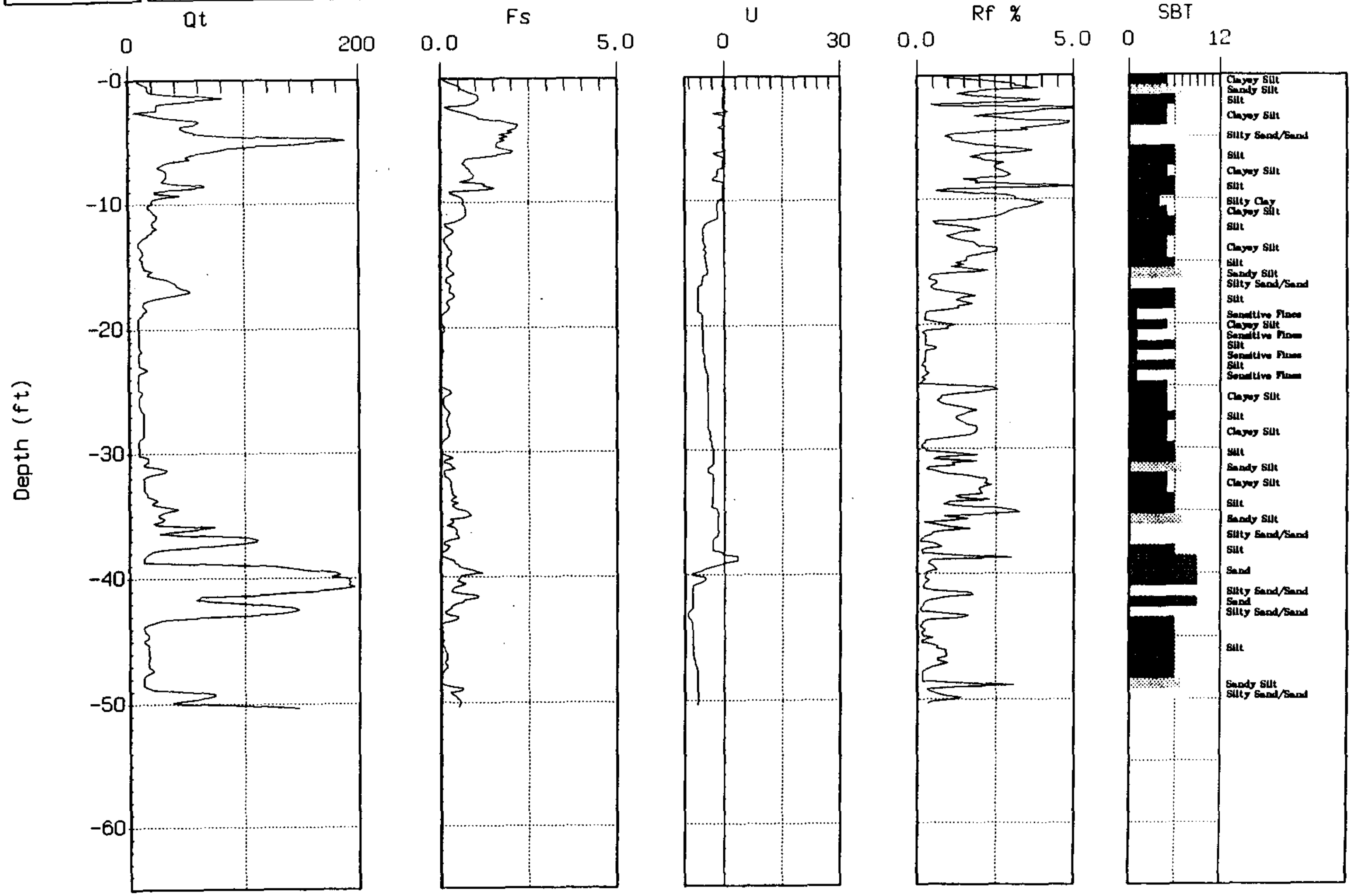
SBT: Soil Behavior Type (Robertson and Campanella 1988)

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-3

Engineer : S.KROLL
Date : 12:10:97 09:52



Max. Depth: 50.36 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

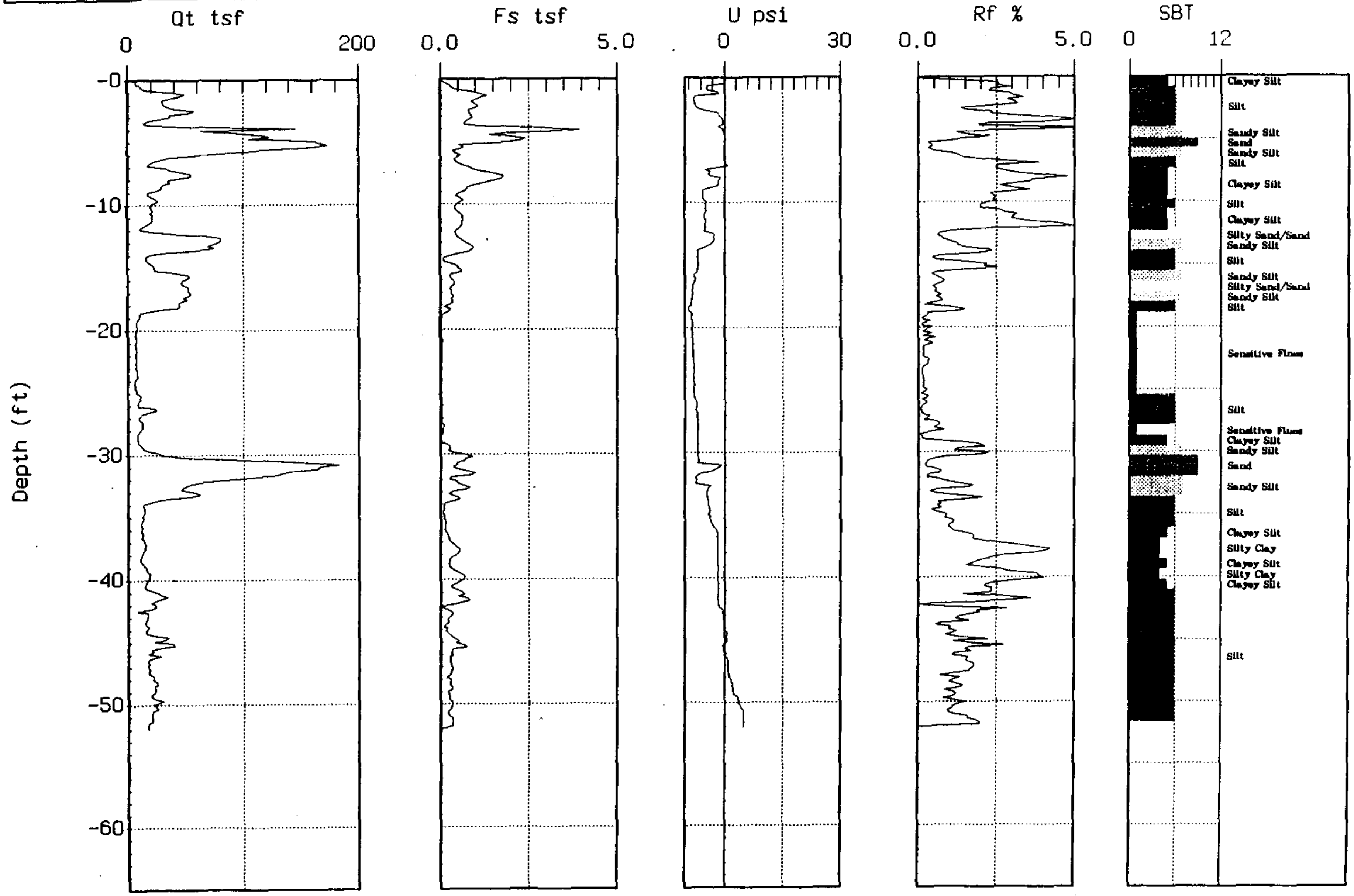
A-109

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-4

Engineer : S. KROLL
Date : 12:10:97 10:48



Max. Depth: 52.00 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

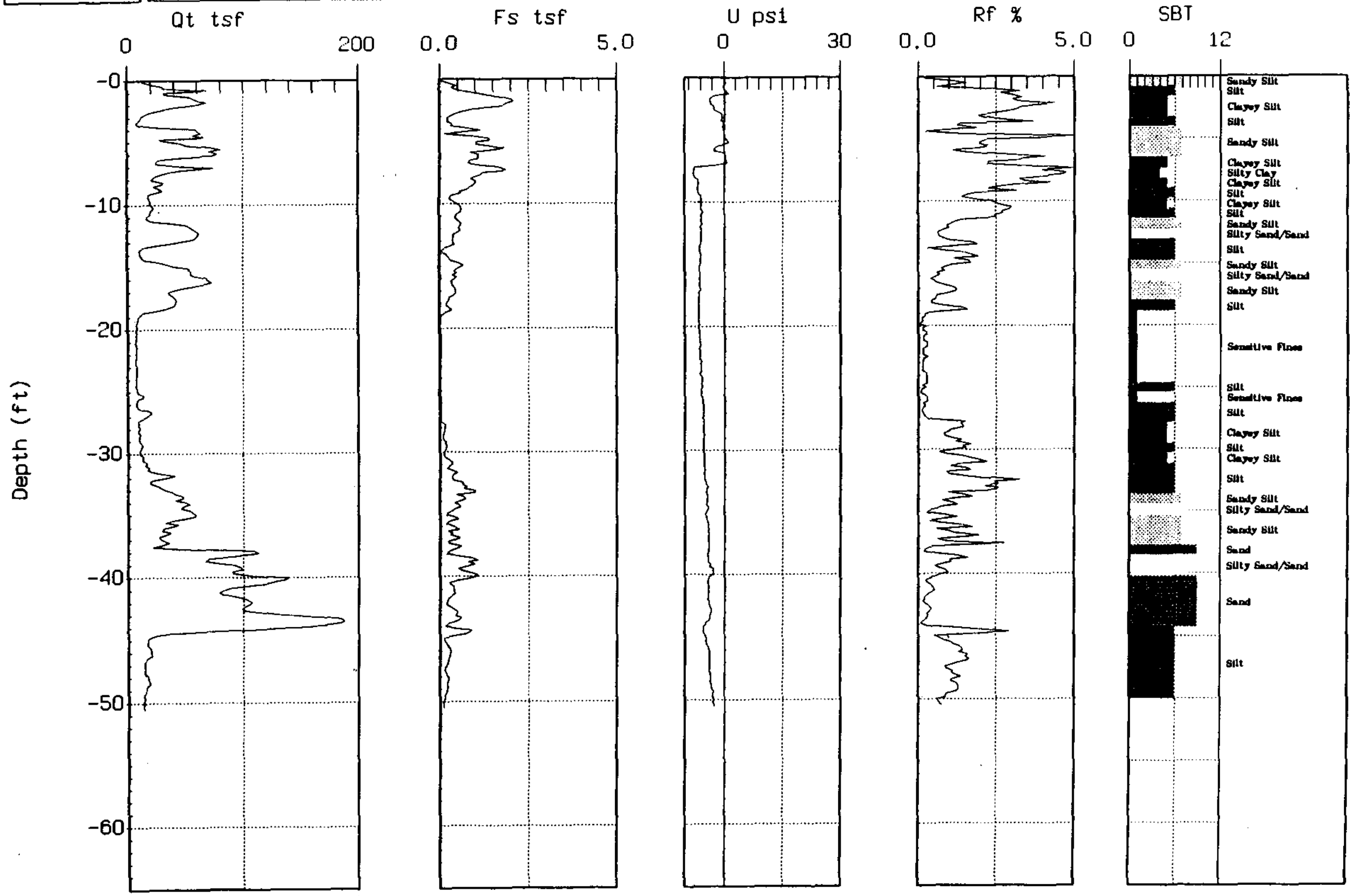
A-110

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-5

Engineer : S. KROLL
Date : 12:10:97 12:09



Max. Depth: 50.52 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

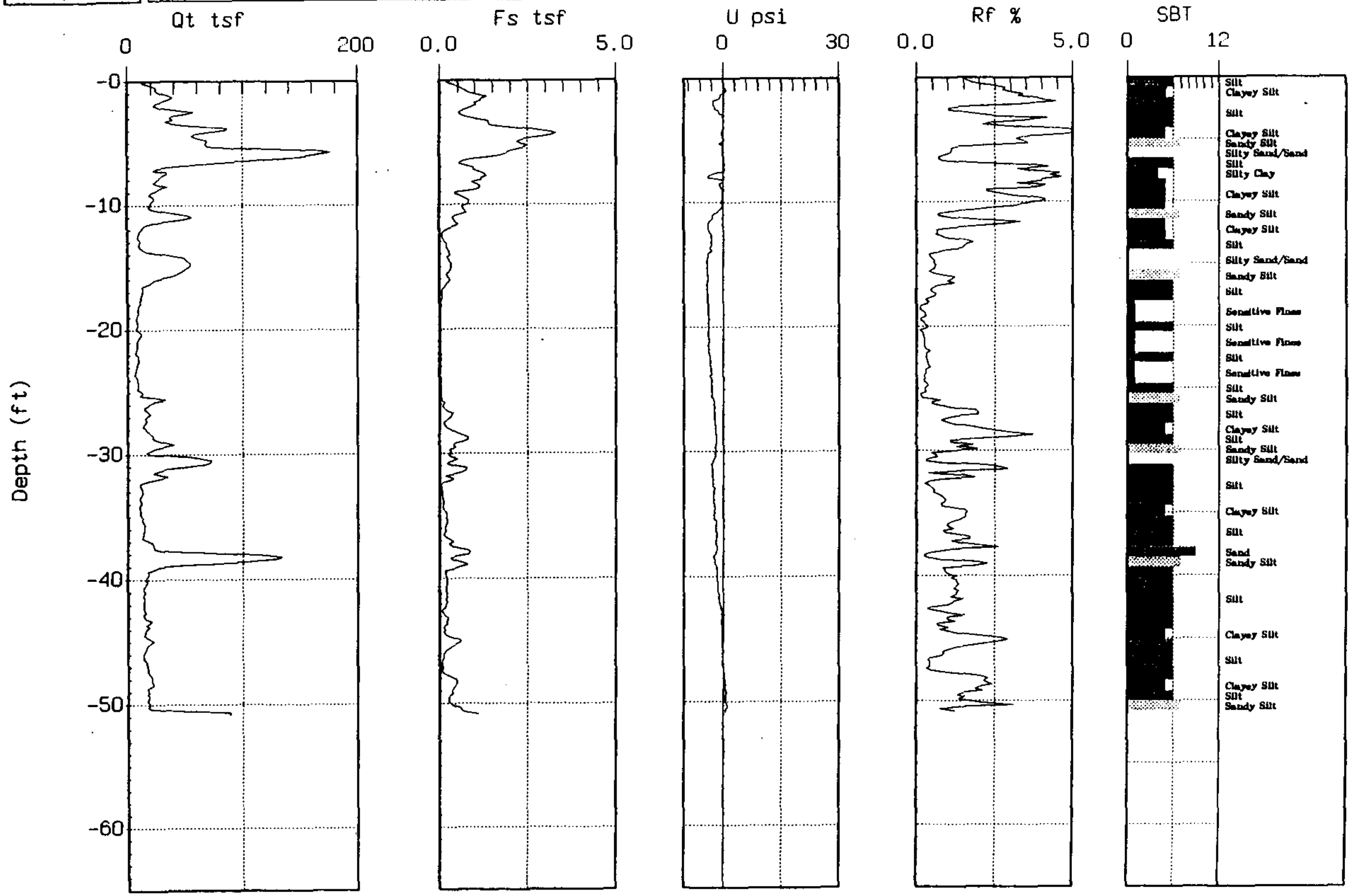
A-111

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-6

Engineer : S. KROLL
Date : 12:10:97 12:37



Max. Depth: 50.85 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

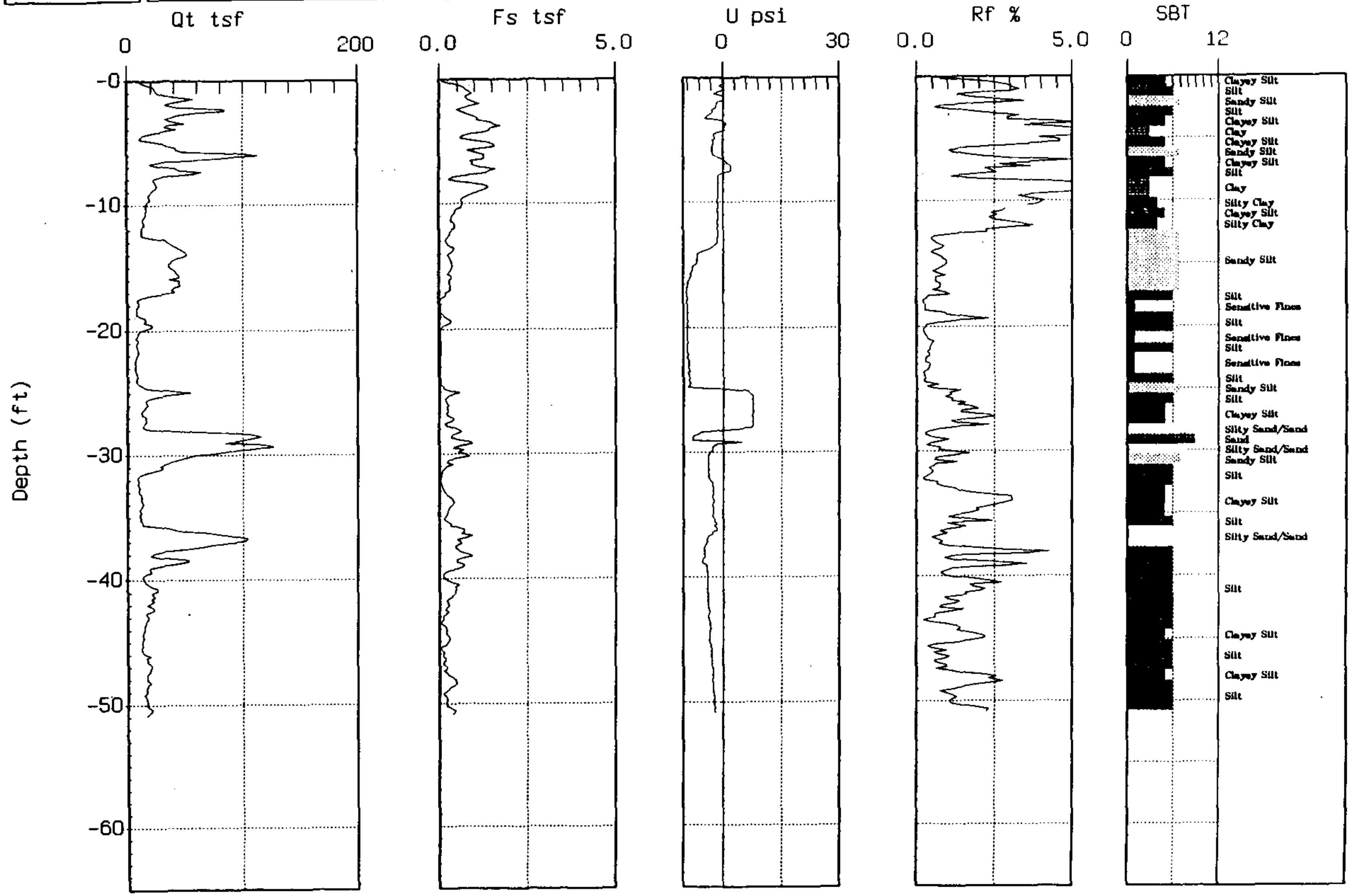
A-112

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-7

Engineer : S. KROLL
Date : 12:10:97 13:04



Max. Depth: 50.85 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

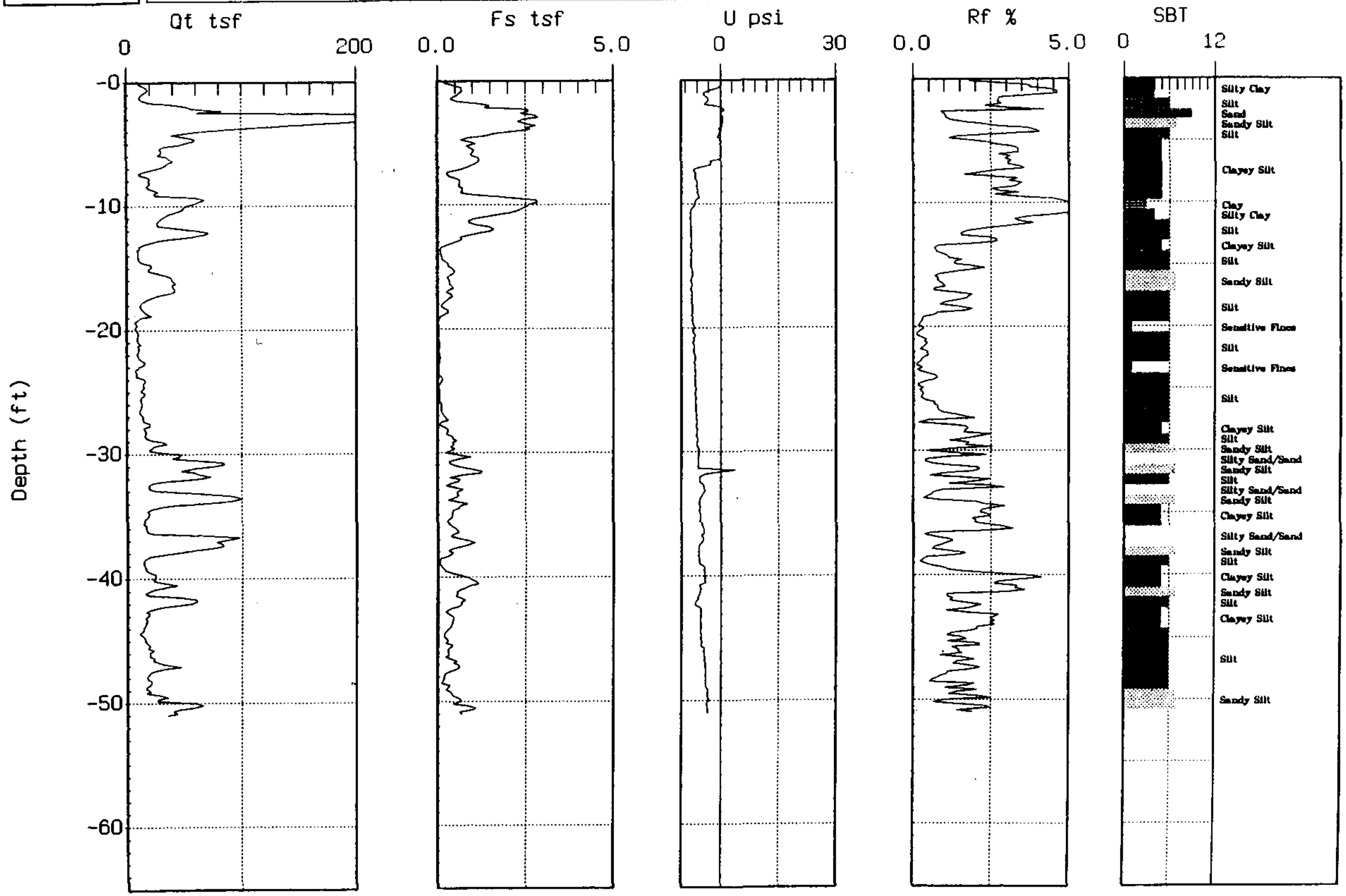
A-113

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-8

Engineer : S. KROLL
Date : 12:10:97 13:59



Max. Depth: 51.02 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

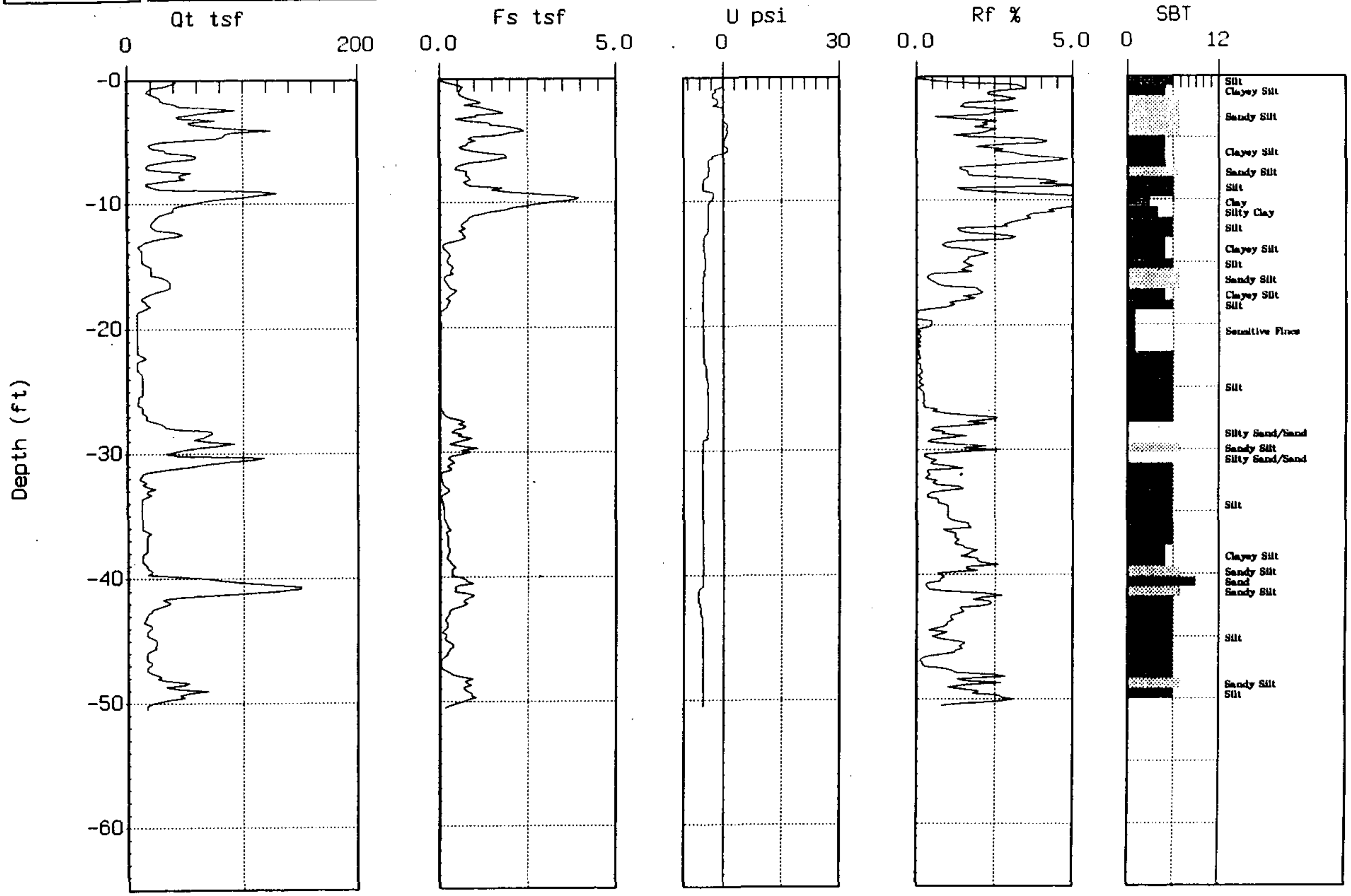
A-114

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-9

Engineer : S. KROLL
Date : 12:10:97 14:57



Max. Depth: 50.52 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

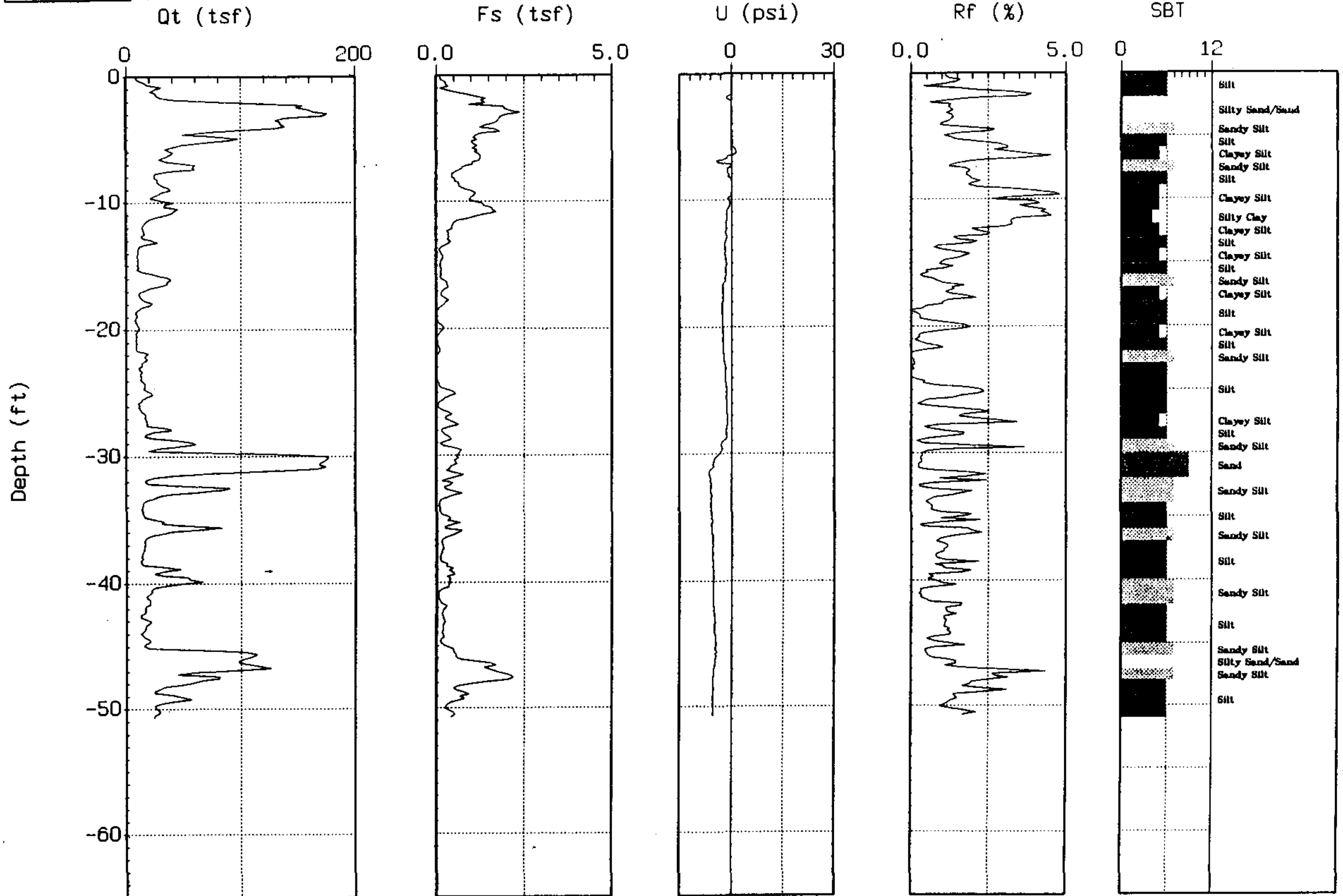
A-115

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-10

Engineer : S. KROLL
Date : 12:10:97 15:25



Max. Depth: 50.69 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

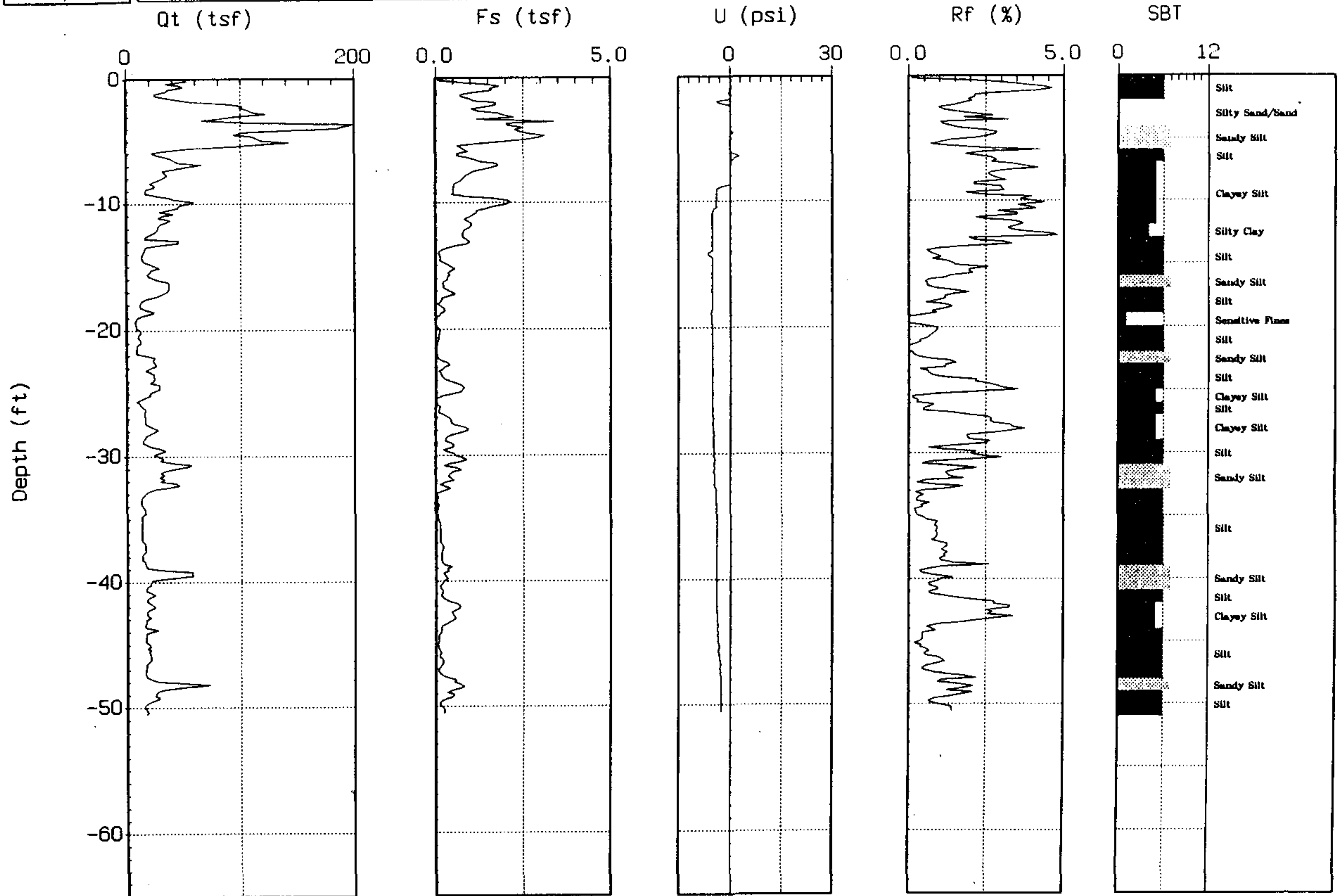
A-116

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-11

Engineer : S. KROLL
Date : 12:10:97 15:57



Max. Depth: 50.52 (ft)

Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

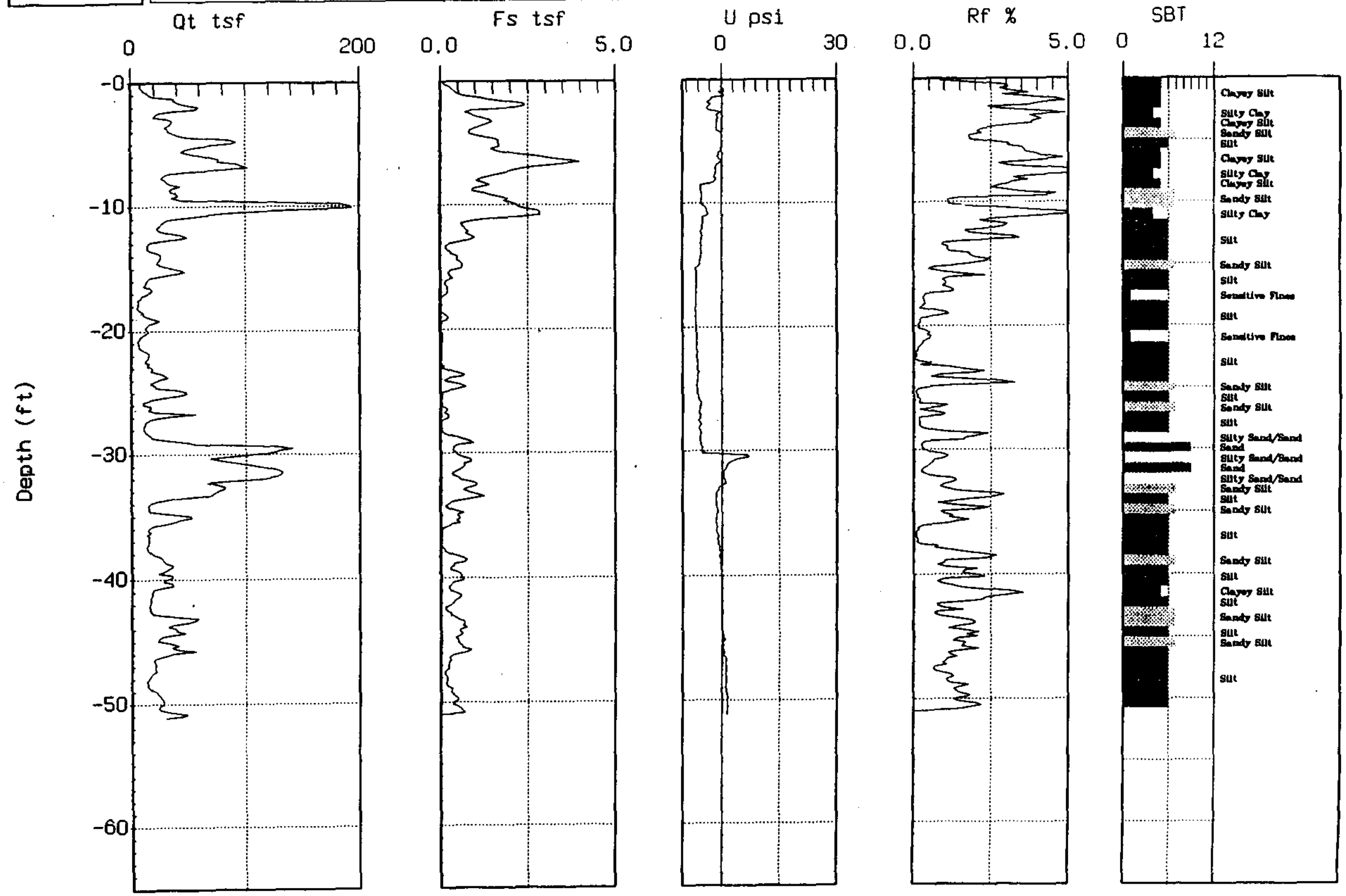
A-117

GREGG

PACIFIC SOILS

Site : PLAYA DEL REY
Location : CPT-12

Engineer : S. KROLL
Date : 12:10:97 16:23



Max. Depth: 51.18 (ft)
Depth Inc.: 0.164 (ft)

SBT: Soil Behavior Type (Robertson and Campanella 1988)

A-118

APPENDIX B
EXISTING LABORATORY DATA

APPENDIX B
EXISTING LABORATORY DATA (Group Delta, 2013)

APPENDIX B

EXISTING LABORATORY DATA

Laboratory testing was conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions and in the same locality. No warranty, express or implied, is made as to the correctness or serviceability of the test results, or the conclusions derived from these tests. Where a specific laboratory test method has been referenced, such as ASTM or Caltrans, the reference only applies to the specified laboratory test method, which has been used only as a guidance document for the general performance of the test and not as a “Test Standard”. A brief description of the various tests performed for the previous investigations in the site vicinity follows (GDC, 1999, 2013).

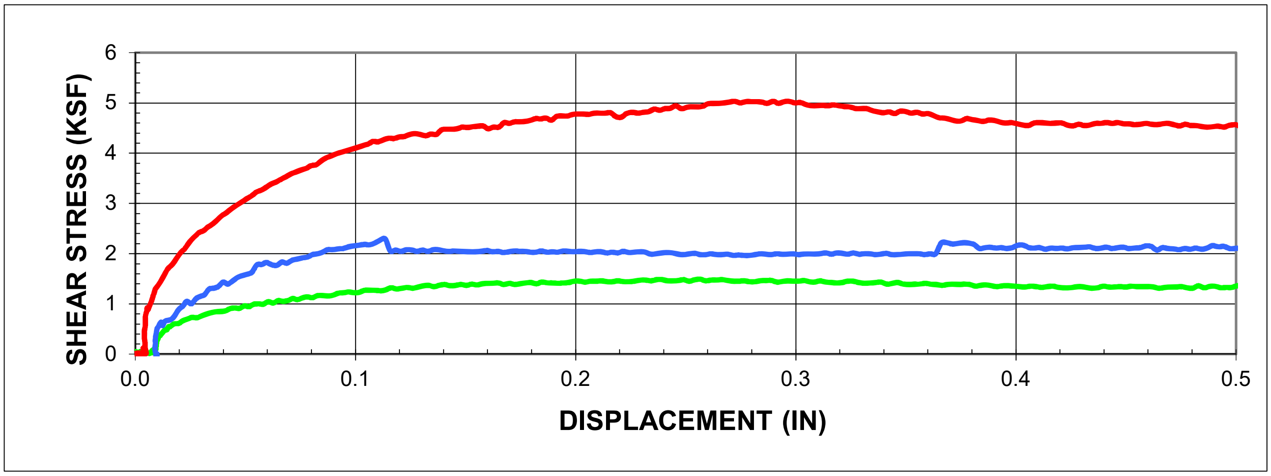
Classification: Soils were classified visually according to the Unified Soil Classification System as established by the American Society of Civil Engineers. Visual classification was supplemented by laboratory testing and classification using ASTM D2487. The soil classifications are summarized on the Boring Records in Appendix A.

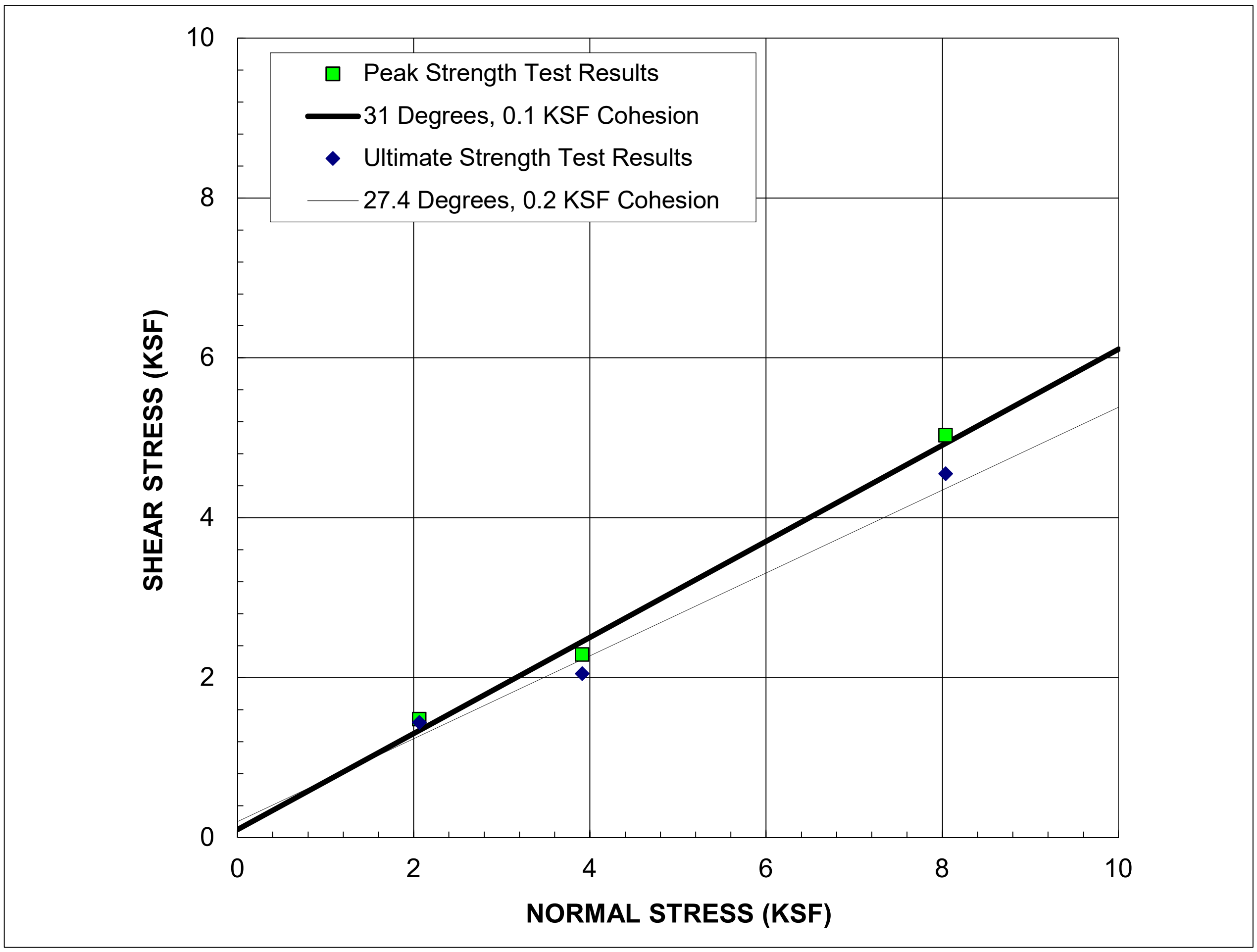
Particle Size Analysis: Particle size analyses were performed in general accordance with ASTM D422, and were used to supplement visual soil classifications. The test results are summarized on the Boring Records in Appendix A.

Atterberg Limits: ASTM D4318 was used to determine the liquid and plastic limits, and plasticity index of selected soil samples. The test results are shown on the Boring Records in Appendix A.

Direct Shear: The shear strengths of selected materials were assessed using direct shear testing conducted on relatively undisturbed soil samples in general accordance with ASTM D3080. The shear test results are shown in Figures B-1.1 through B-1.3.

Consolidation: The one-dimensional consolidation properties of selected samples were evaluated in general accordance with ASTM D2435. The samples were inundated with water under an 800 PSF load, and then subjected to controlled stress increments while restrained laterally and drained axially. The test results are presented in Figures B-2.1 through B-2.5.





SAMPLE: A-RW015 R5@20'

Description: Very Dark greenish Gray Silty Sand with Shells

	PEAK	ULTIMATE
ϕ'	31 °	27 °
c'	0.10 KSF	0.20 KSF

STRAIN RATE: 0.0050 IN/MIN

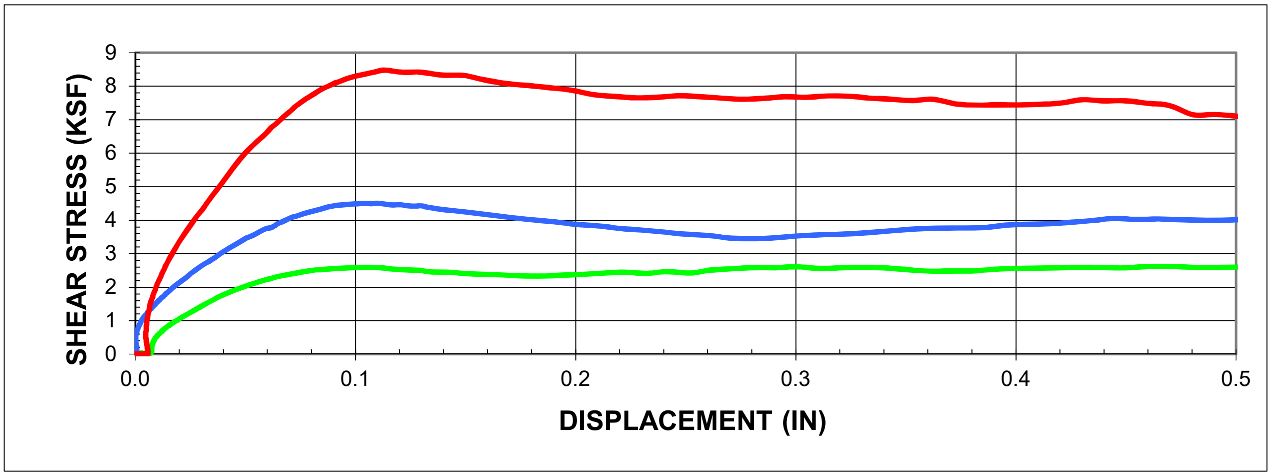
(Sample was consolidated and drained)

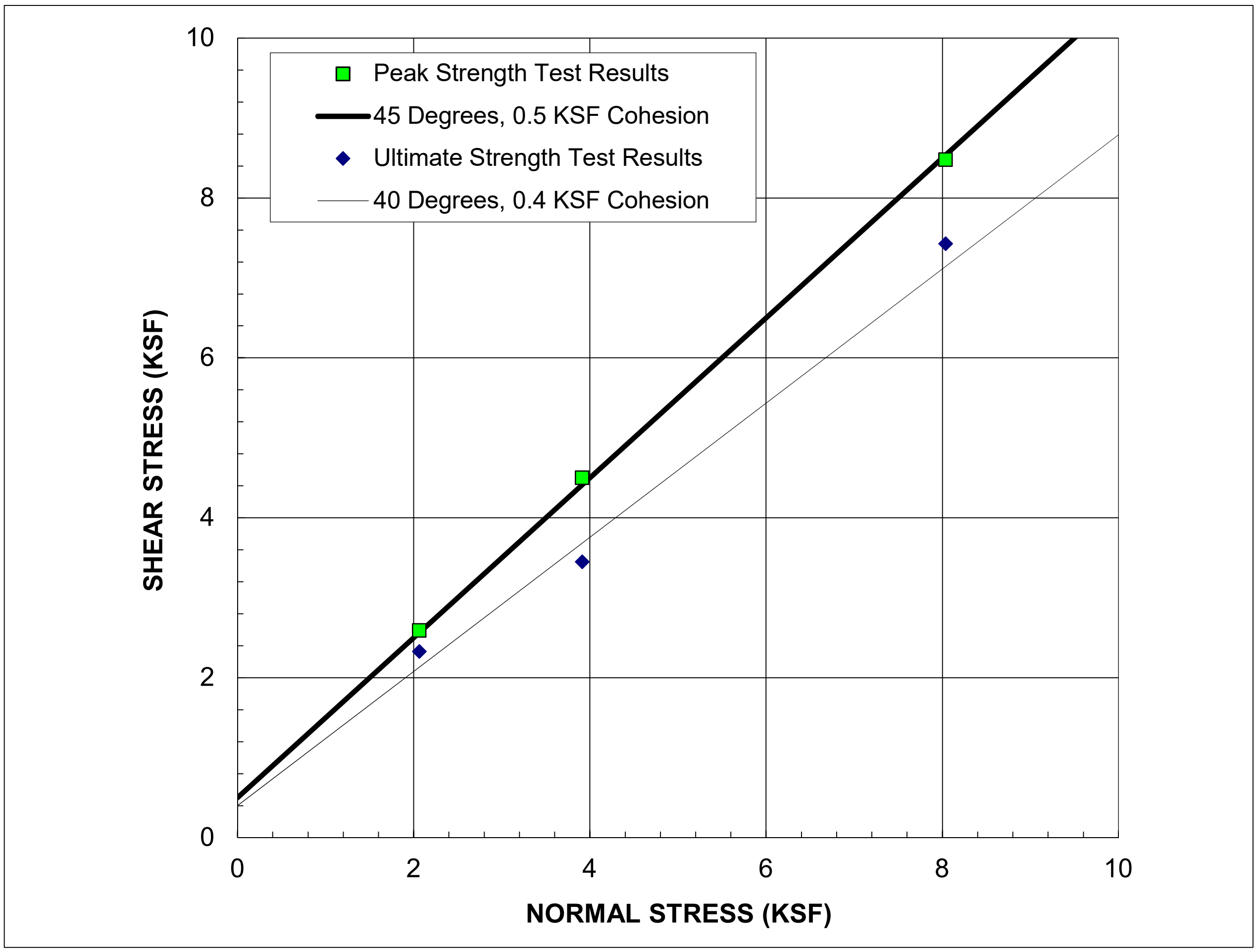
	IN-SITU	AS-TESTED
γ_d	79.8 PCF	79.8 PCF
w_c	17.5 %	17.8 %

GROUP DELTA

DIRECT SHEAR TEST RESULTS

Document No. 18-0018
Project No. LA1345
FIGURE B-1.1





SAMPLE: A-RW015 R8@32.5

Description:	Very Dark Greenish Gray Coarse Sand

	PEAK	ULTIMATE
φ'	45 °	40 °
c'	0.50 KSF	0.40 KSF

	IN-SITU	AS-TESTED
γ_d	112.5 PCF	112.5 PCF
w_c	20.8 %	19.1 %

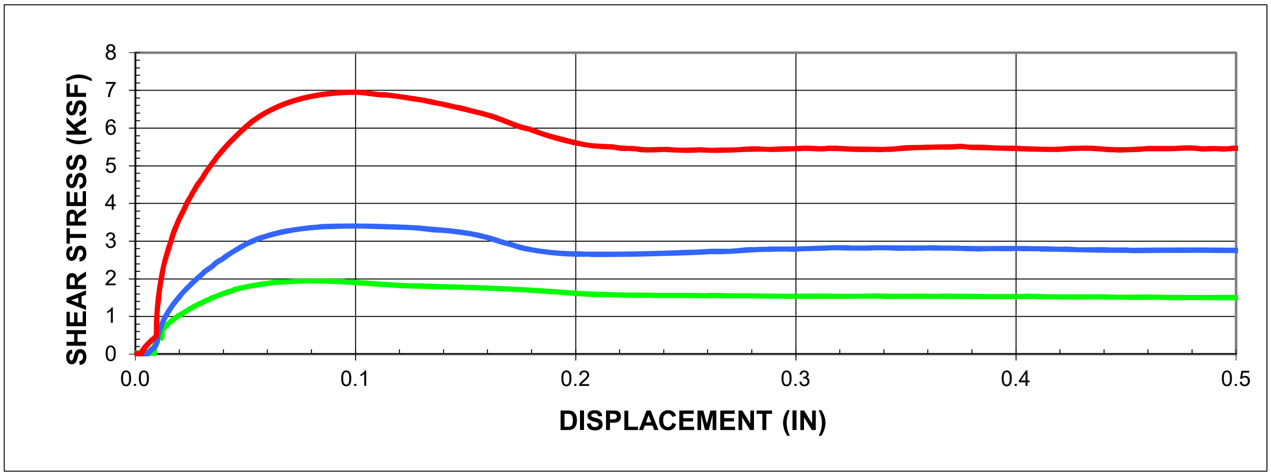
STRAIN RATE: 0.0250 IN/MIN

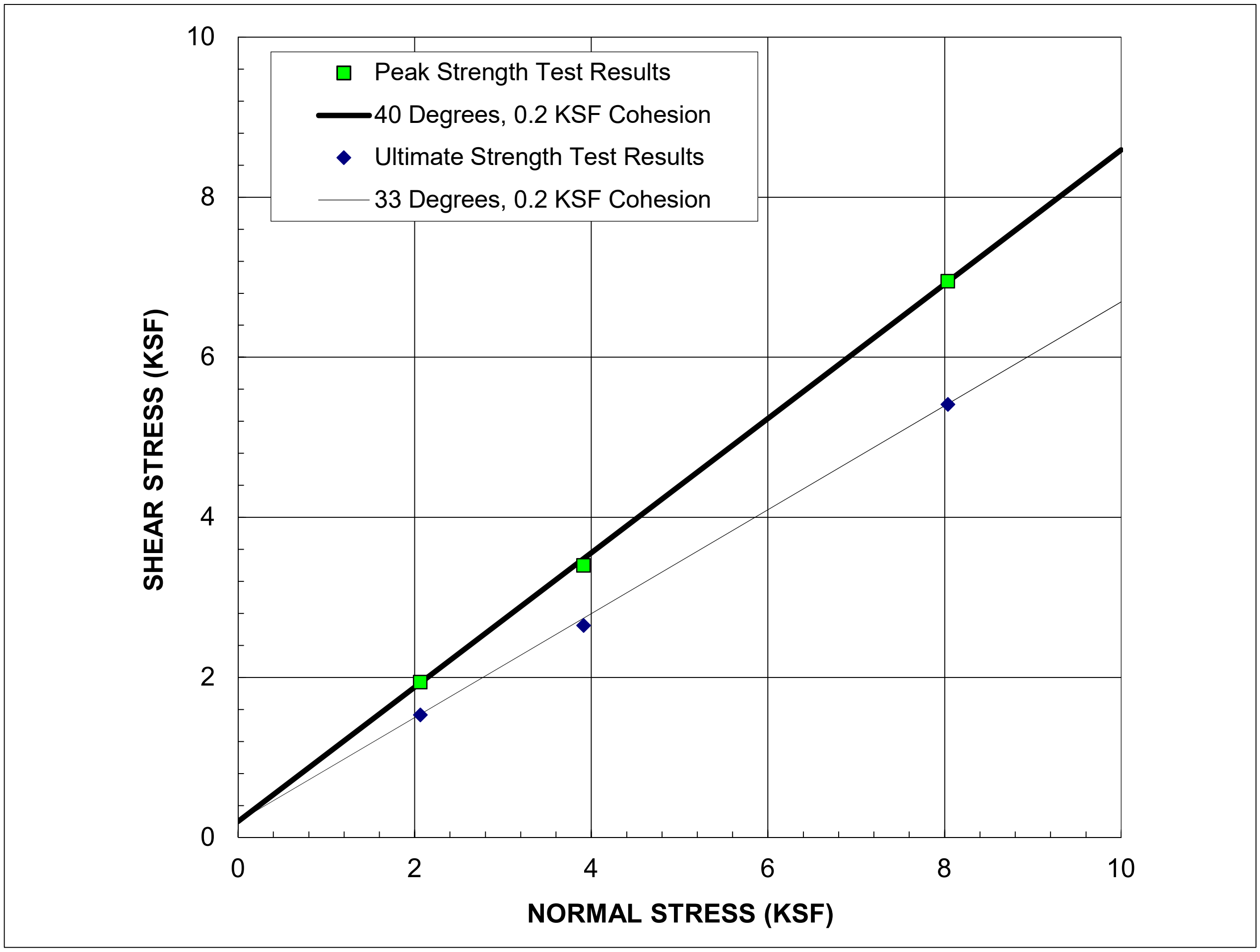
(Sample was consolidated and drained)

GROUP DELTA

DIRECT SHEAR TEST RESULTS

Document No. 18-0018
Project No. LA1345
FIGURE B-1.2





SAMPLE: B-RW049 R9@40'

Description: Dark Greenish Gray Sand

	PEAK	ULTIMATE
φ'	40 °	33 °
c'	0.20 KSF	0.20 KSF

STRAIN RATE: 0.0250 IN/MIN

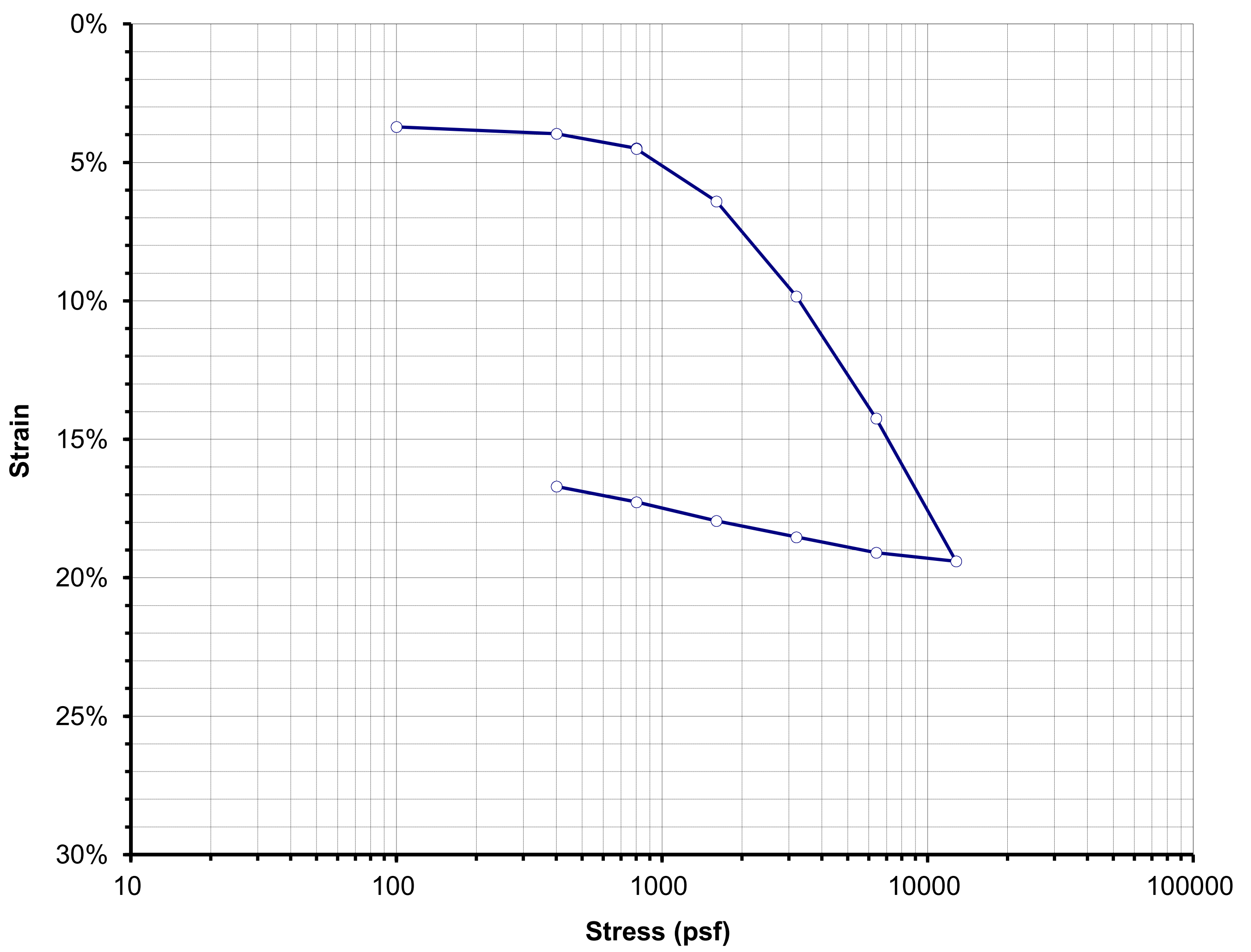
(Sample was consolidated and drained)

	IN-SITU	AS-TESTED
γ_d	102.6 PCF	102.6 PCF
w_c	20.0 %	23.0 %

GROUP DELTA

DIRECT SHEAR TEST RESULTS

Document No. 18-0018
Project No. LA1345
FIGURE B-1.3



Boring No.	A-RW013	**Sample Depth**	15
Sample No.	R4	**USCS**	0

BEFORE TEST

Initial Moisture Content:	50.9%	
Initial Dry Unit Wt:	73.3	pcf
Initial Total Unit Wt.:	110.6	pcf
Initial Void Ratio:	1.3750	
Initial Degree of Saturation:	103.3%	

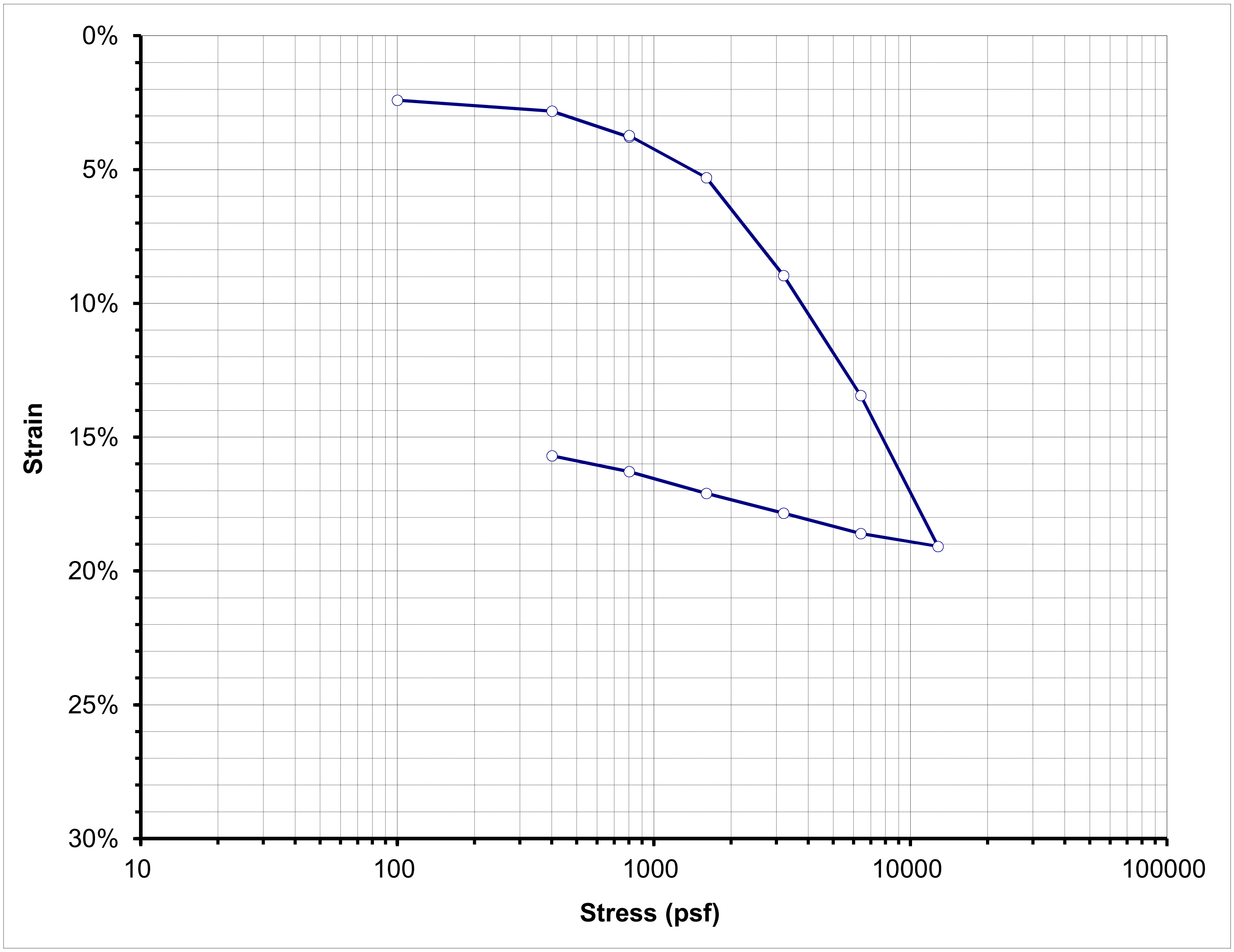
AFTER TEST

Final Moisture Content:	38.6%	
Final Dry Unit Wt:	86.7	pcf
Final Total Unit Wt.:	123.5	pcf
Final Void Ratio:	1.0076	
Final Degree of Saturation:	106.9%	

Water Added at: 800 psf

ATTERBERG LIMITS					
LL=		**PL=**		**PI=**	

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
100	3.71%	1.2868
400	3.97%	1.2807
800	4.49%	1.2684
800	4.51%	1.2679
1600	6.41%	1.2228
3200	9.84%	1.1414
6400	14.24%	1.0367
12800	19.41%	0.9141
6400	19.09%	0.9216
3200	18.53%	0.9349
1600	17.95%	0.9487
800	17.27%	0.9650
400	16.70%	0.9783



Boring No.	B-RW049	Sample Depth	15
Sample No.	R4A	USCS	0

BEFORE TEST

Initial Moisture Content:	72.7%	
Initial Dry Unit Wt:	56.2	pcf
Initial Total Unit Wt.:	97.1	pcf
Initial Void Ratio:	2.0975	
Initial Degree of Saturation:	96.7%	

AFTER TEST

Final Moisture Content:	59.5%	
Final Dry Unit Wt:	65.9	pcf
Final Total Unit Wt.:	120.1	pcf
Final Void Ratio:	1.6422	
Final Degree of Saturation:	101.0%	

Water Added at: 800 psf

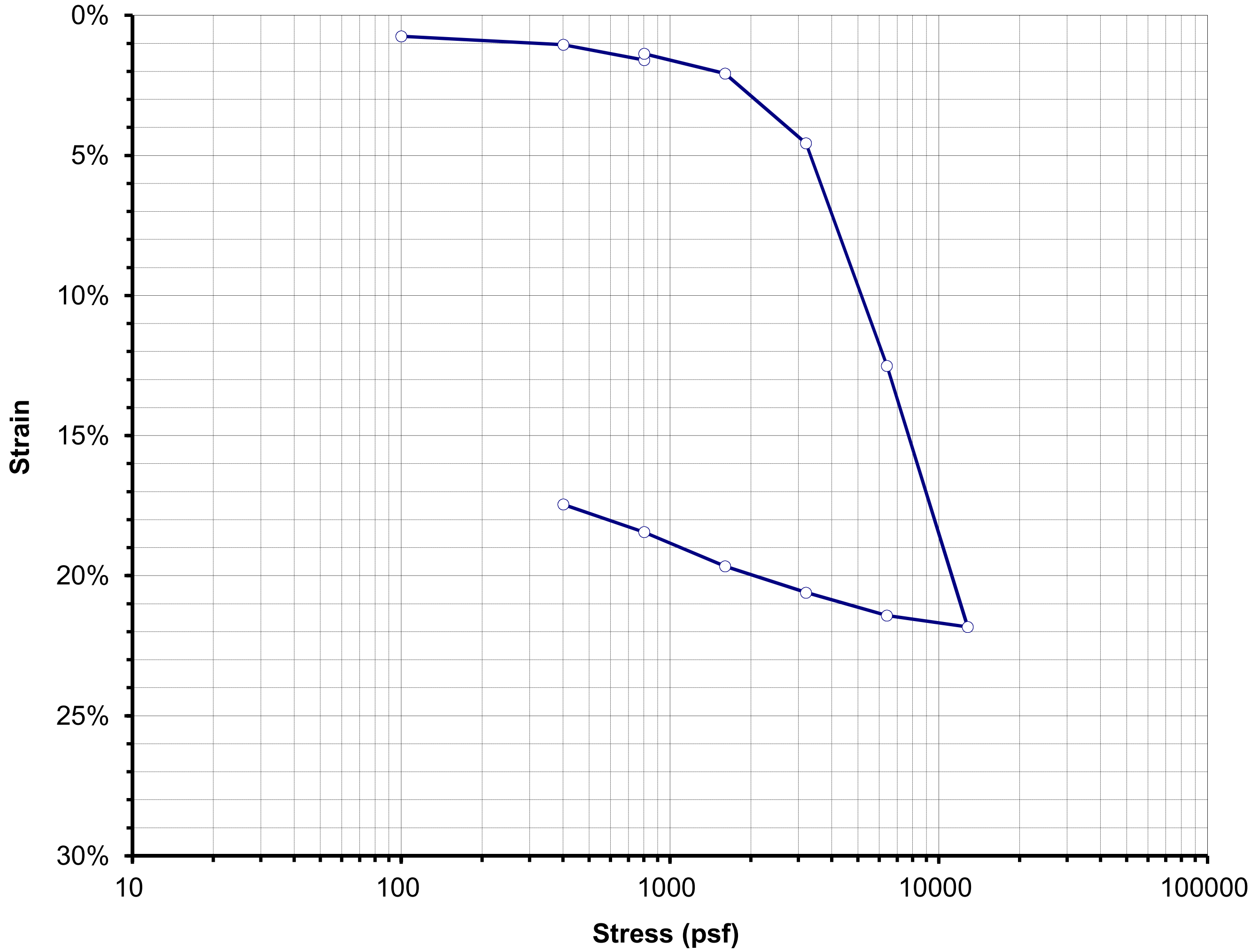
ATTERBERG LIMITS					
LL=		PL=		PI=	

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
100	2.40%	2.0230
400	2.82%	2.0103
800	3.78%	1.9805
800	3.73%	1.9820
1600	5.30%	1.9333
3200	8.96%	1.8200
6400	13.45%	1.6810
12800	19.08%	1.5065
6400	18.60%	1.5214
3200	17.84%	1.5450
1600	17.10%	1.5677
800	16.28%	1.5931
400	15.69%	1.6114

GROUP DELTA

CONSOLIDATION RESULTS

Document No. 18-0018
Project No. LA1345
FIGURE B-2.2



Boring No.	B-RW049	Sample Depth	25 ft
Sample No.	R6A	USCS	0

BEFORE TEST

Initial Moisture Content:	64.3%	
Initial Dry Unit Wt:	60.4	pcf
Initial Total Unit Wt.:	99.2	pcf
Initial Void Ratio:	1.8822	
Initial Degree of Saturation:	95.2%	

AFTER TEST

Final Moisture Content:	50.8%	
Final Dry Unit Wt:	72.4	pcf
Final Total Unit Wt.:	122.8	pcf
Final Void Ratio:	1.4048	
Final Degree of Saturation:	100.8%	

Water Added at: 800 psf

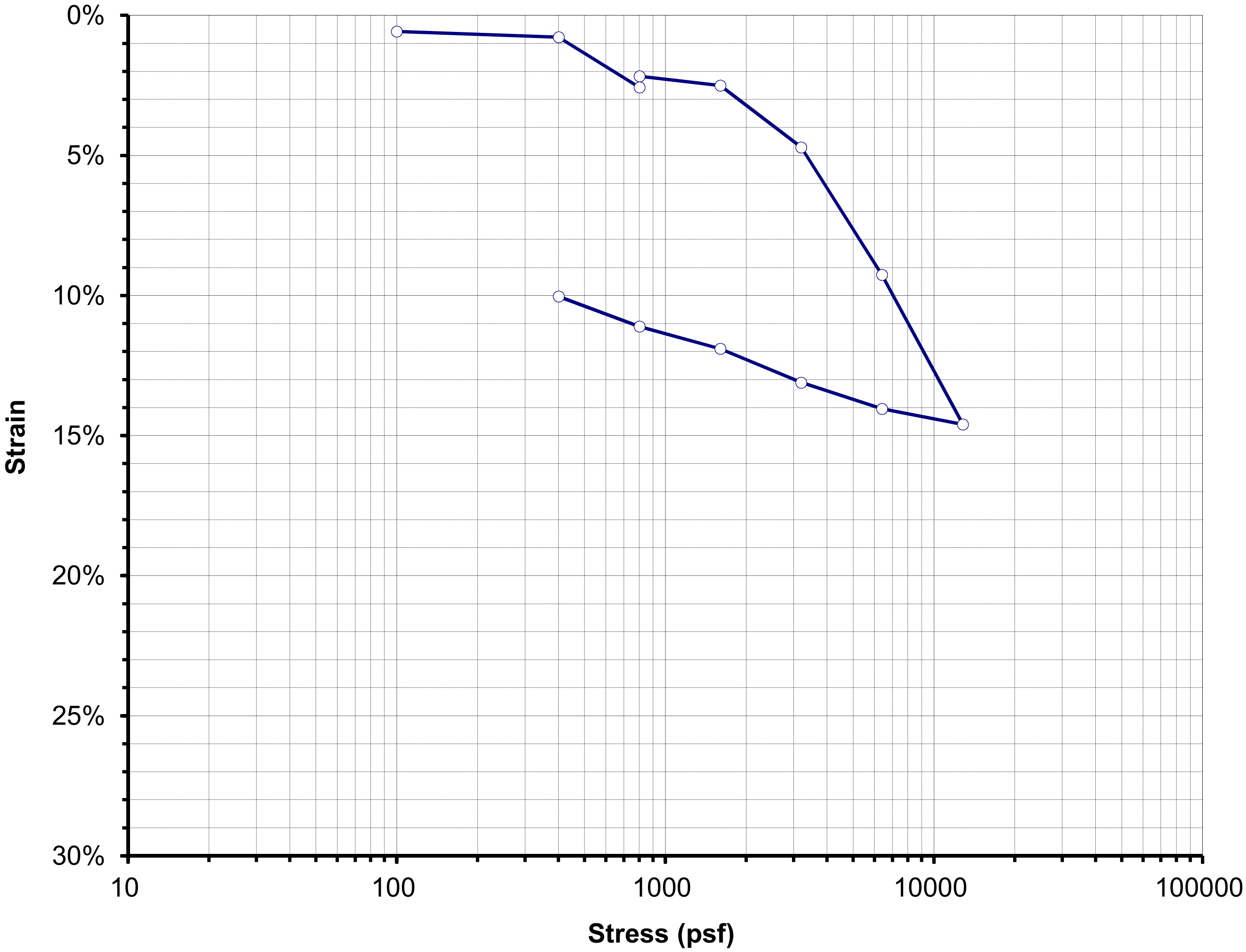
ATTERBERG LIMITS					
LL=		PL=		PI=	

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
100	0.75%	1.8605
400	1.05%	1.8518
800	1.59%	1.8362
800	1.37%	1.8426
1600	2.07%	1.8224
3200	4.57%	1.7505
6400	12.51%	1.5217
12800	21.82%	1.2532
6400	21.42%	1.2647
3200	20.60%	1.2884
1600	19.66%	1.3155
800	18.44%	1.3508
400	17.45%	1.3791

GROUP DELTA

CONSOLIDATION RESULTS

Document No. 18-0018
Project No. LA1345
FIGURE B-2.3



Boring No.	B-HSA051	**Sample Depth**	5 ft
Sample No.	R3	**USCS**	0

BEFORE TEST

Initial Moisture Content:	45.1%	
Initial Dry Unit Wt:	75.7	pcf
Initial Total Unit Wt.:	109.9	pcf
Initial Void Ratio:	1.2998	
Initial Degree of Saturation:	96.9%	

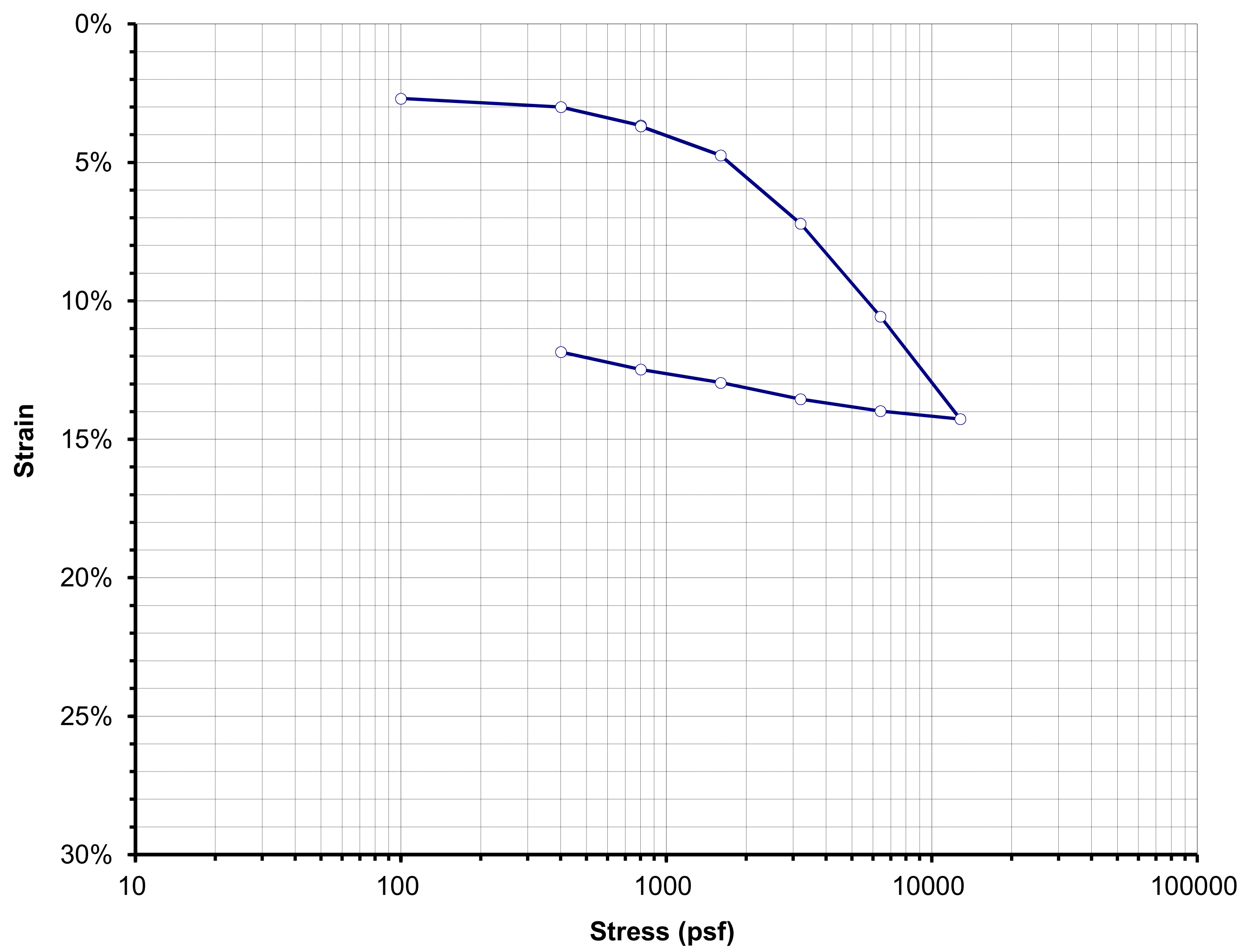
AFTER TEST

Final Moisture Content:	40.9%	
Final Dry Unit Wt:	82.5	pcf
Final Total Unit Wt.:	111.6	pcf
Final Void Ratio:	1.1111	
Final Degree of Saturation:	102.6%	

Water Added at: 800 psf

ATTERBERG LIMITS					
LL=		**PL=**		**PI=**	

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
100	0.57%	1.2867
400	0.78%	1.2819
800	2.58%	1.2406
800	2.17%	1.2498
1600	2.51%	1.2422
3200	4.71%	1.1915
6400	9.26%	1.0869
12800	14.60%	0.9641
6400	14.05%	0.9768
3200	13.11%	0.9984
1600	11.90%	1.0261
800	11.10%	1.0445
400	10.03%	1.0692



Boring No.	B-HSA051	Sample Depth	10 ft
Sample No.	R5	USCS	0

BEFORE TEST

Initial Moisture Content:	43.6%	
Initial Dry Unit Wt:	77.5	pcf
Initial Total Unit Wt.:	111.3	pcf
Initial Void Ratio:	1.2466	
Initial Degree of Saturation:	97.5%	

AFTER TEST

Final Moisture Content:	36.8%	
Final Dry Unit Wt:	86.3	pcf
Final Total Unit Wt.:	114.5	pcf
Final Void Ratio:	1.0165	
Final Degree of Saturation:	100.9%	

Water Added at: 800 psf

ATTERBERG LIMITS					
LL=		PL=		PI=	

PRESSURE (psf)	SAMPLE STRAIN	VOID RATIO
100	2.69%	1.1861
400	2.99%	1.1793
800	3.67%	1.1642
800	3.70%	1.1635
1600	4.74%	1.1401
3200	7.22%	1.0845
6400	10.57%	1.0091
12800	14.27%	0.9260
6400	13.98%	0.9326
3200	13.55%	0.9423
1600	12.95%	0.9556
800	12.48%	0.9662
400	11.85%	0.9804

GROUP DELTA

CONSOLIDATION RESULTS

Document No. 18-0018
Project No. LA1345
FIGURE B-2.5

APPENDIX B
EXISTING LABORATORY DATA (Group Delta, 1999)

APPENDIX D
GDC LABORATORY TESTING

D.1 Introduction

Relatively undisturbed Standard Penetration Test (SPT) samples and Shelby tube samples were collected and carefully sealed in the field to prevent moisture loss. All the samples were then transported to our in-house geotechnical laboratory for examination and testing. Tests were performed on selected samples as an aid in classifying the soils, and to evaluate their physical properties and engineering characteristics that may be present in the soil samples. Details of the laboratory testing program and test results are discussed in the following sections. All tests were performed in general accordance with appropriate American Society for Testing and Materials (ASTM) Test Methods. Brief descriptions of the laboratory testing program and test results are presented below.

D.2 Soil Classification

The subsurface materials were classified using the Unified Soil Classification System, in accordance with ASTM Test Methods D2487-85 and D2488-84. The soil classifications are presented on the boring logs in Appendix C.

D.3 Moisture Content

Moisture content was determined for selected samples. The samples were dried in accordance with ASTM D2937. After drying, the weight of each sample was measured and moisture content was calculated. Moisture content values are summarized in Table D-1 and presented on the boring logs in Appendix C.

D.4 Grain Size Distribution and Fines Content

Representative samples were dried, weighed, soaked in water until individual soil particles were separated, and then washed on the No. 200 sieve. The portion of the material retained on the No. 200 sieve was oven-dried and then run through a standard set of sieves in accordance with ASTM D422. In addition, silt and clay content was evaluated by performance of hydrometer tests on selected samples. The results of grain size distribution tests performed are summarized in Table D-1 and graphically shown in Figure D-1. The percentage of fines (i.e., soil passing #200 sieve) is an important factor for evaluating the liquefaction potential of sandy soils.

D.5 Atterberg Limits Tests

Liquid and plastic limits were determined for selected samples showing plasticity properties in accordance with ASTM D4318. The test results are summarized in Figures D-2 through D-4.

D.6 Direct Shear Tests

To determine the shear strength parameters of the on-site soils, direct shear tests were performed on selected undisturbed drive samples in accordance with ASTM D 3080. After the initial weight and volume measurements were made, the sample was placed in a calibrated shear machine and a selected normal load was applied. The samples were submerged, allowed to consolidate, and then were sheared to failure. Shear stress and sample deformation were monitored throughout the test. The process was repeated under two additional normal loads. The test results are summarized in Table D-3 and graphically presented in Figure D-5.

D.7 Consolidation Tests

One dimensional tests were performed on disturbed samples in accordance with ASTM D 2435-90. The tests were performed on 1-inch high samples having a diameter of 2.42 inches. After trimming the ends, the sample was placed in the consolidometer and initial reading was recorded. The sample was saturated under loading and thereafter; the sample was incrementally loaded to 16 ksf. The results of the consolidation tests are shown graphically in Figures D-6 to D-14. In addition, time rates for selected consolidation tests were performed and are presented in Figures D-15 through D-19

D.8 Resistance Value Test

A resistance or R-Value test was performed on a selected bulk sample of subgrade soils. The result of the R-Value test is presented in Table D-2.

D.9 Corrosivity Tests

Corrosivity tests were performed on selected samples. Corrosivity testing included analyses for minimum resistivity, pH, electrical conductivity, and chemical analyses such as chlorides and sulfates. The results of the tests are presented in Table D-3.

D.10 List of Attached Tables and Figures

The following figures are attached and complete this appendix:

TABLE D-1
SUMMARY OF MOISTURE CONTENT AND GRAIN SIZE DISTRIBUTION

Boring No.	Sample Depth (ft)	USCS Soil Type	Blow Counts per ft	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)
B-302R	5.0	SM	4	27.4	--	--	--	--
B-302R	10.0	SM	5	31.8	86.2	--	--	--
B-302R	15.0	CH	2	48.5	--	--	--	--
B-302R	20.0	CH	5	32.3	91.0	--	--	--
B-302R	25.0	ML	1	56.4	--	--	--	56
B-302R	30.0	CL	5	27.1	98.1	--	--	--
B-302R	35.0	ML	15	18.8	--	--	--	62
B-302R	40.0	CL	8	41.7	82.6	--	--	--
B-302R	45.0	ML	8	43.9	--	--	--	--
B-302R	55.0	CL	14	48.2	--	--	--	--
B-302R	60.0	SP	22	25.8	--	--	--	--
B-302R	65.0	SP	73	9.2	--	--	--	--
B-304H	0.0	SM	--	9.8	--	--	--	--
B-304H	5.0	SC	20	18.7	98.0	--	--	--
B-304H	10.0	CL	71	11.5	95.4	--	--	--
B-304H	15.0	ML	15	30.9	90.1	--	--	64
B-304H	20.0	CH	10	37.2	76.4	--	--	--
B-305H	0.0	SM	--	9.0	--	--	--	--
B-305H	5.0	CL	20	18.6	109.0	--	--	--
B-305H	10.0	CL	20	15.2	--	--	--	--
B-305H	15.0	SM	10	34.9	87.6	--	--	--
B-305H	20.0	CH	6	65.1	58.4	--	--	--
B-305H	25.0	CH	11	22.4	100.4	--	--	--
B-306R	5.0	SC/SM	73/11"	16.8	112.1	--	--	--
B-306R	15.0	CL	33	40.8	--	--	--	--
B-306R	20.	CH	18	55.9	63.9	--	--	--
B-306R	32.0	SP	84	10.6	129.1	34	52	14
B-306R	35.0	CL	19	32.7	--	--	--	--
B-306R	45.0	CL	68	37.6	--	--	--	--
B-306R	50.0	CH	66	41.1	--	--	--	--
B-307R	5.0	CL	12	16.2	--	--	--	--
B-307R	12.0	CL	26	40.0	81.5	--	--	--
B-307R	20.0	CH/OH	6	82.0	51.3	--	--	71
B-307R	25.0	CH/OH	16	23.5	--	--	--	65
B-307R	30.0	ML	49	29.5	94.8	--	--	--
B-307R	35.0	CL/SP	59	28.2	--	--	--	--
B-307R	40.0	CL	22	36.9	--	--	--	--
B-307R	45.0	CL	25	33.6	--	--	--	--
B-307R	50.0	SP/CL	39	22.8	--	--	--	--
B-307R	55.0	ML	112/5"	28.6	--	--	--	--
B-307R	60.0	SP	120	21.0	--	--	--	--

TABLE D-1 (continued)
SUMMARY OF MOISTURE CONTENT AND GRAIN SIZE DISTRIBUTION

Boring No.	Sample Depth (ft)	USCS Soil Type	Blow Counts per ft	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)
B-309R	5.0	SC	26	18.4	--	--	--	--
B-309R	10.0	SC	23	27.5	91.0	--	--	--
B-309R	20.0	CL/OL	24	29.2	--	--	--	--
B-309R	30.0	CL/OL	32	37.5	89.6	--	--	--
B-309R	35.0	CH	16	36.9	--	--	--	--
B-309R	45.0	CH	22	37.9	--	--	--	--
B-309R	55.0	CH	48	31.5	--	--	--	--
B-309R	60.0	GP	70/3"	4.5	--	--	--	--
B-313H	5.0	CL	18	19.1	105.9	0	27	73
B-313H	10.0	ML	11	29.8	89.4	--	--	--
B-313H	15.0	ML	6	39.5	81.3	--	--	--
B-313H	20.0	CH	4	86.4	51.4	--	--	--
B-313H	25.0	CH	9	42.1	83.5	--	--	--
B-315H	5.0	SM/SC	21	10.2	120.7	--	--	--
B-315H	10.0	CL	6	48.7	68.7	--	--	--
B-315H	15.0	CL	9	42.7	80.6	--	--	82
B-315H	20.0	MH	10	65.1	59.8	--	--	--
B-315H	25.0	MH	13	50.5	84.6	--	--	--
B-316R	10.0	CL	37	34.5	--	--	--	--
B-316R	20.0	CL	11	60.1	--	--	--	--
B-316R	27.0	ML	22	18.6	109.4	--	--	55
B-316R	30.0	CL	9	30.4	--	--	--	--
B-316R	35.0	CL/OL	15	31.8	--	--	--	--
B-316R	40.0	CL/OL	12	33.9	--	--	--	--
B-316R	45.0	CL	33	27.9	--	--	--	--
B-316R	50.0	SM	62	35.0	--	--	--	--
B-316R	55.0	SM	71	26.4	--	--	--	--
B-317R	10.0	CL	6	49.9	73.3	--	--	--
B-317R	15.0	ML	4	35.8	87.4	--	--	62
B-317R	20.0	CL	12	93.7	47.2	--	--	--
B-317R	25.0	CL	19	26.9	--	--	--	--
B-317R	30.0	CL	22	42.0	81.1	--	--	--
B-317R	35.0	ML	21	25.5	--	--	--	--
B-317R	40.0	SP	90	22.7	--	--	--	9
B-317R	45.0	CL	49	36.0	--	--	--	--
B-317R	50.0	CL	37	31.4	--	--	--	--
B-317R	55.0	SM	89	23.6	--	--	--	24
B-317R	60.0	SP	70/1"	10.1	--	--	--	9

TABLE D-1 (continued)
SUMMARY OF MOISTURE CONTENT AND GRAIN SIZE DISTRIBUTION

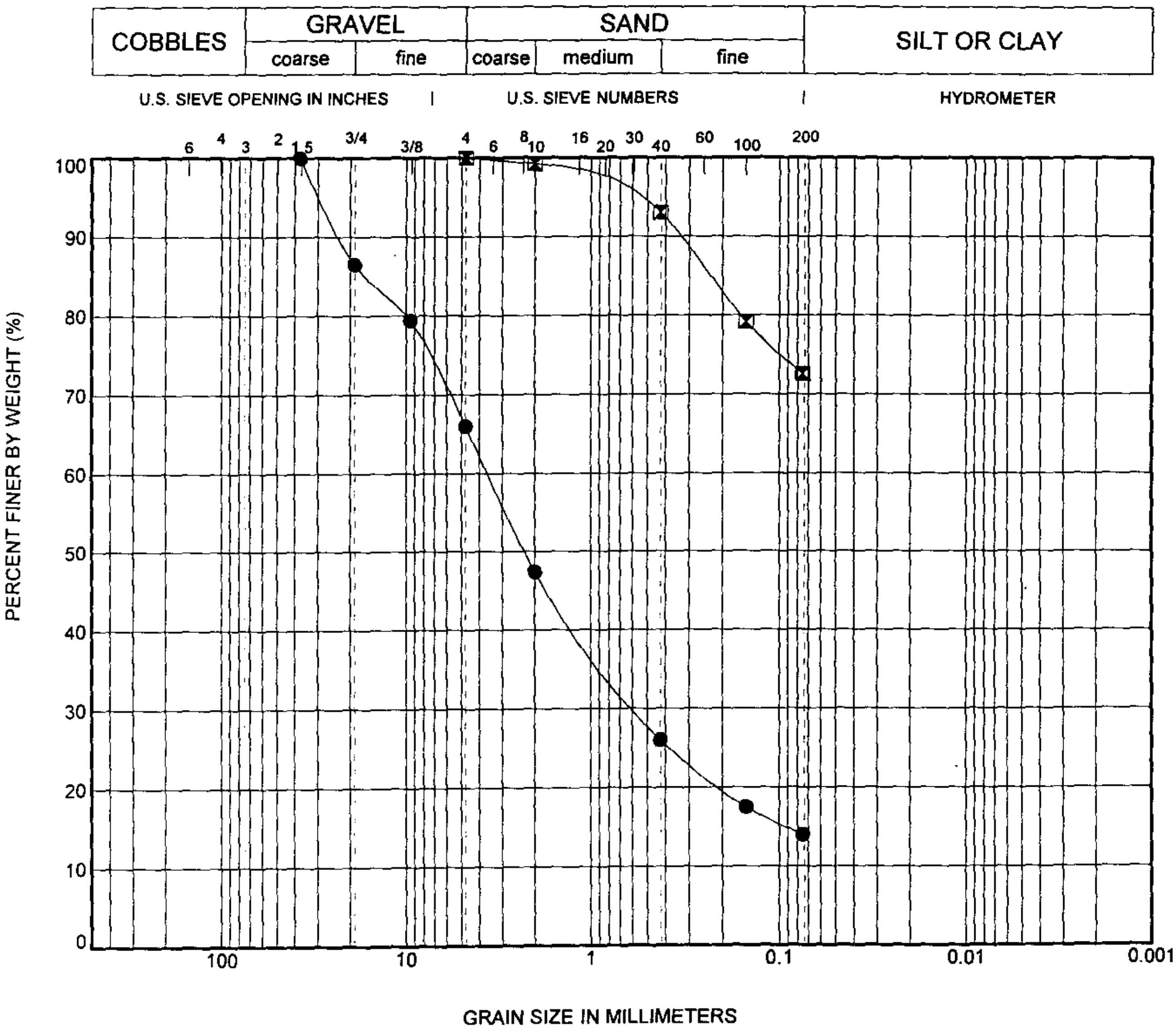
Boring No.	Sample Depth (ft)	USCS Soil Type	Blow Counts per ft	Moisture Content (%)	Dry Density (pcf)	Gravel Content (%)	Sand Content (%)	Fines Content (%)
B-319R	5.0	CL	26	18.1	--	--	--	--
B-319R	11.0	CL	21	43.3	79.5	--	--	--
B-319R	15.0	ML	19	39.6	--	--	--	--
B-319R	20.0	MH	8	66.8	60.0	--	--	--
B-319R	25.0	MH	9	31.2	--	--	--	--
B-319R	30.0	CL	24	33.0	91.4	--	--	--
B-319R	35.0	CL	--	28.8	--	--	--	--
B-319R	40.0	SM	36	24.7	--	--	--	38
B-319R	45.0	CL	23	38.0	--	--	--	--
B-319R	50.0	CL	61	30.3	--	--	--	--
B-319R	55.0	ML	98	25.4	--	--	--	--
B-319R	60.0	SP	100/9"	15.0	--	--	--	--

TABLE D-2
SUMMARY OF R-VALUE TEST RESULTS

Boring No.	Sample Depth (ft)	Soil Type	R-Value
B-315H	0.0-5.0	SC/CL	10

TABLE D-3
SUMMARY OF CORROSIVITY TEST RESULTS

Boring No.	Sample Depth (ft)	Soil Type	Soluble Sulfate (ppm)	Soluble Chloride (ppm)	Minimum Resistivity (ohm-cm)	pH
B-304H	0.0-5.0	SM	130	<10	250	8.1
B-305H	0.0-5.0	SM	120	<10	240	8.2
B-313H	0.0-5.0	SM/SC	260	30	130	7.8



SYMBOL	BORING	DEPTH (ft)	DESCRIPTION
●	B-306R	32.0	(SP) Dark Gray Gravelly SAND
⊠	B-313H	5.0	(CL) Olive Gray Silty CLAY

SYMBOL	BORING	DEPTH (ft)	D100	D60	D30	D10	LL	PL	PI	Cc	Cu
●	B-306R	32.0	37.5	3.593	0.568						
⊠	B-313H	5.0	4.75								

GDC GRAIN SIZE L196PV.GPJ GDC WLOG.GDT 12/23/98

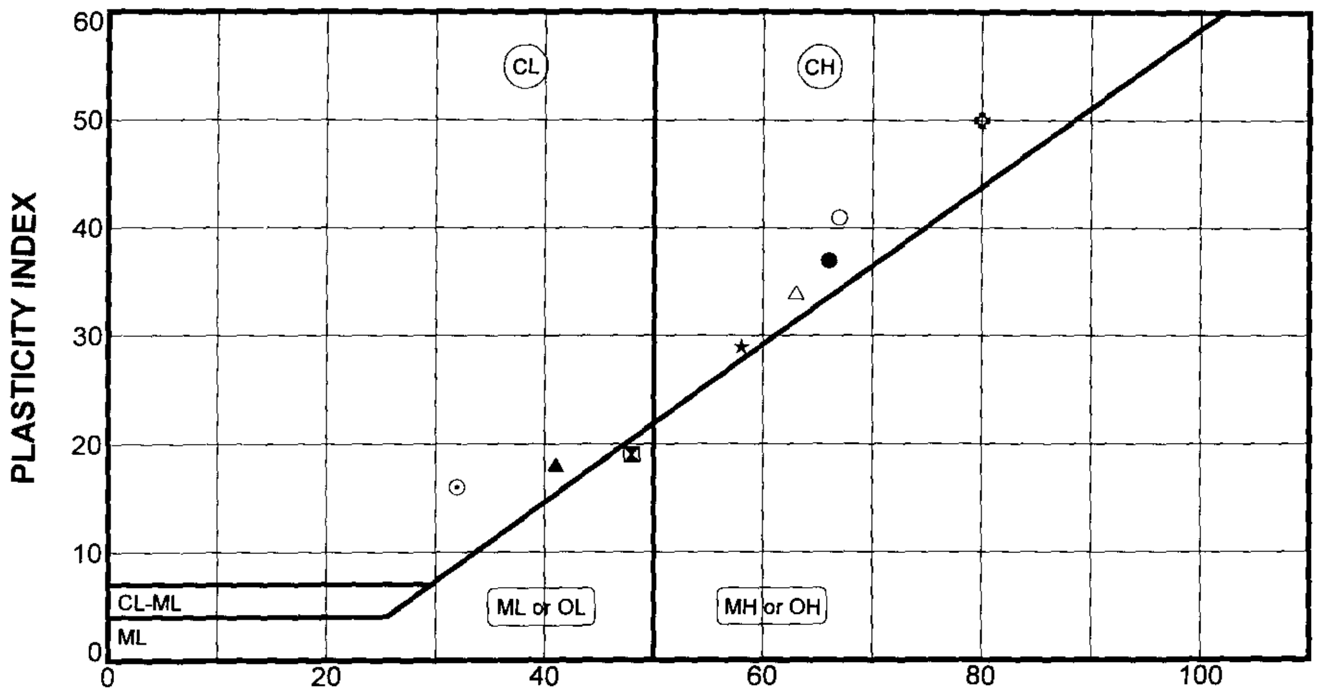
GROUP DELTA CONSULTANTS

GRAIN SIZE DISTRIBUTION

GROUP DELTA CONSULTANTS

Project: Playa Vista - Site DE & Ballona Creek
Location: Playa del Rey, California
Number: L-196

FIGURE D-1



Sym	BORING	Depth (ft)	LL	PL	PI	Description
●	B-302R	15.0	66	29	37	(CH) Dark Gray Silty CLAY
⊠	B-302R	45.0	48	29	19	(ML) Greenish Gray Clayey SILT
▲	B-302R	55.0	41	23	18	(CL) Dark Gray Silty CLAY
★	B-304H	20.0	58	29	29	(CH) Medium Gray Silty CLAY
⊙	B-305H	5.0	32	16	16	(CL) Dark Brown Sandy CLAY
✪	B-305H	20.0	80	30	50	(CH) Black to Dark Gray CLAY
○	B-306R	20.0	67	26	41	(CH) Dark Gray Silty CLAY
△	B-307R	12.0	63	29	34	(CH) Medium Gray CLAY

GDC ATTERBERG L196PV.GPJ GDC WLOG.GDT 1/4/99

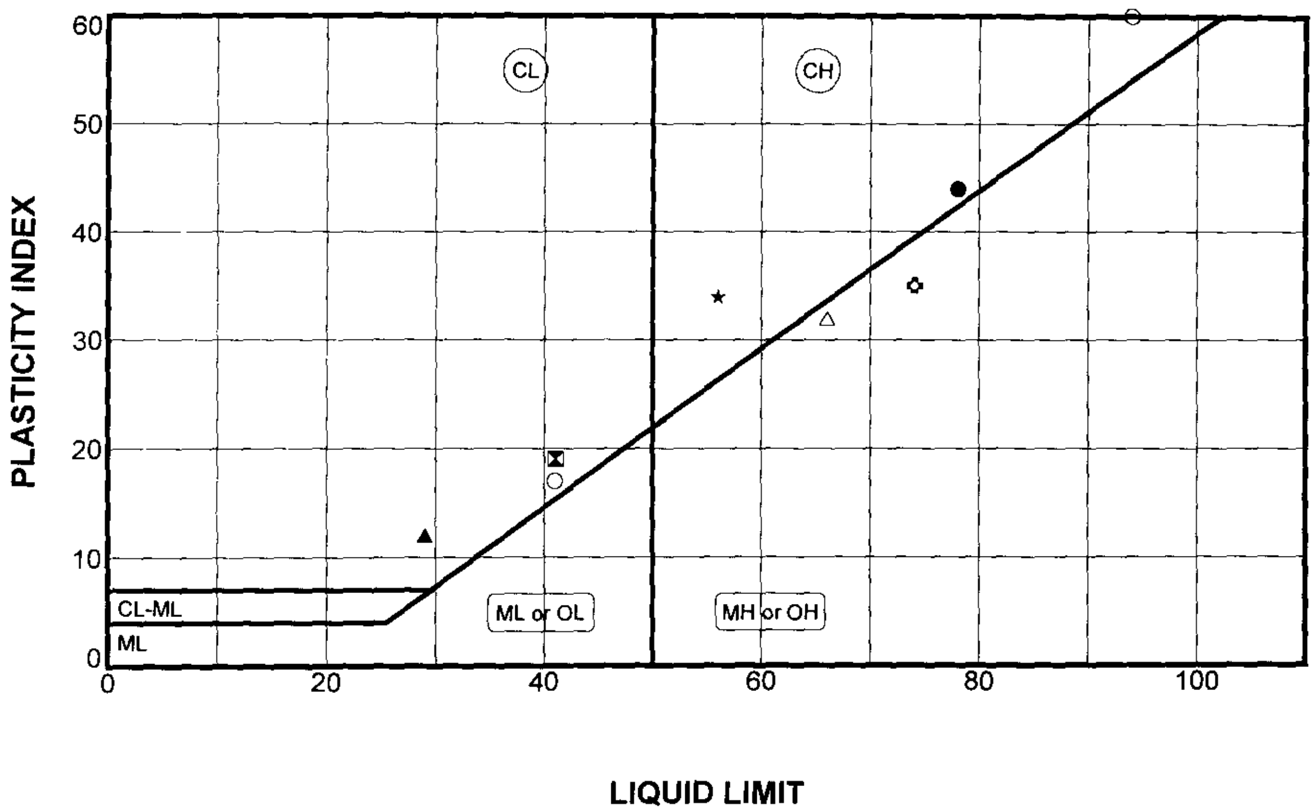
GROUP DELTA CONSULTANTS

ATTERBERG LIMITS

GROUP DELTA CONSULTANTS, INC.

Project: Playa Vista - Site DE & Ballona Creek
Location: Playa del Rey, California
Number: L-196

FIGURE **D-2**



Sym	BORING	Depth (ft)	LL	PL	PI	Description
●	**B-307R**	**20.0**	**78**	**34**	**44**	**(CH) Dark Gray Sandy CLAY**
⧗	**B-309R**	**15.0**	**41**	**22**	**19**	**(CL) Olive Gray Silty CLAY**
▲	**B-309R**	**20.0**	**29**	**17**	**12**	**(CL/OL) Dark Gray Silty Organic CLAY**
★	**B-309R**	**35.0**	**56**	**22**	**34**	**(CH) Dark Gray CLAY**
⊙	**B-313H**	**20.0**	**94**	**34**	**60**	**(CH) Dark Gray CLAY**
✿	**B-315H**	**20.0**	**74**	**39**	**35**	**(MH) Dark Gray Clayey SILT**
○	**B-316R**	**10.0**	**41**	**24**	**17**	**(CL) Dark Gray Silty CLAY**
△	**B-319R**	**20.0**	**66**	**34**	**32**	**(MH) Dark Gray Clayey SILT**

GROUP DELTA CONSULTANTS

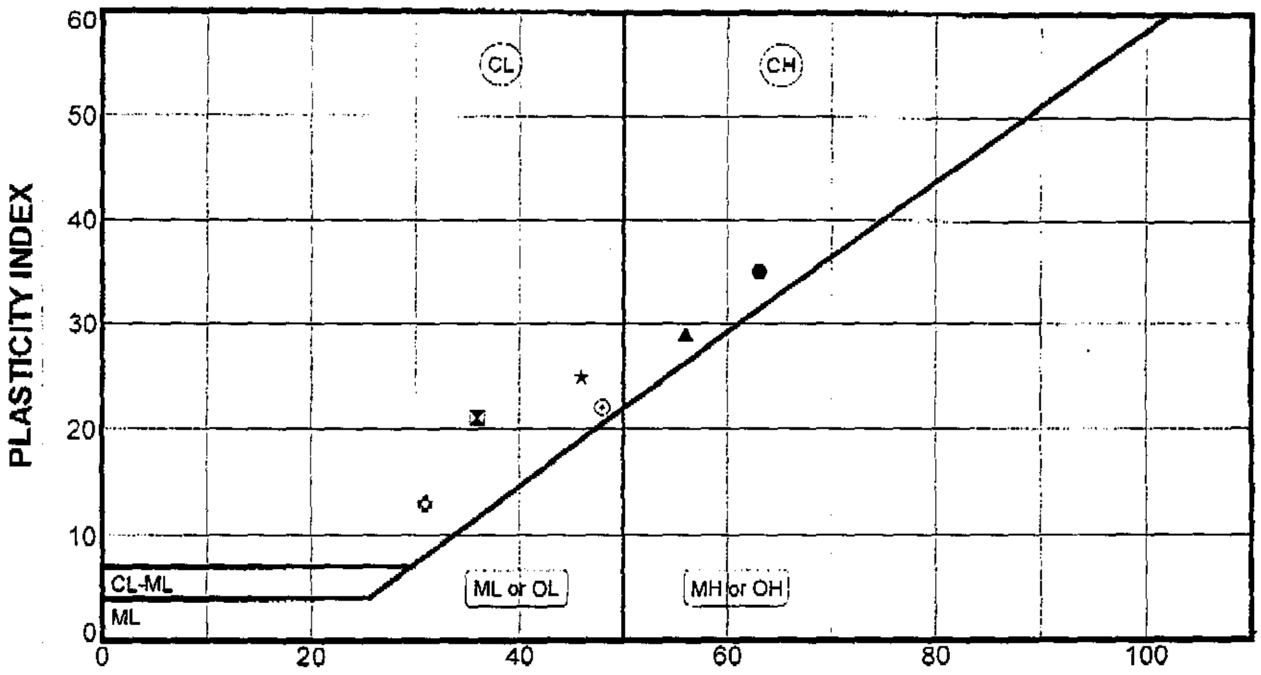
ATTERBERG LIMITS

GROUP DELTA CONSULTANTS, INC.

Project: Playa Vista - Site DE & Ballona Creek
Location: Playa del Rey, California
Number: L-196

FIGURE **D-3**

GDC ATTERBERG L196PV.GPJ GDC WLOG.GDT 1/4/99



Sym	BORING	Depth (ft)	LL	PL	PI	Description
●	B-317R	10.0	63	28	35	(CH) Dark Gray CLAY
⊠	B-317R	25.0	36	15	21	(CL) Dark Gray CLAY
▲	B-317R	30.0	56	27	29	(CH) Dark Gray CLAY
★	B-317R	35.0	46	21	25	(CL) Dark Gray CLAY
⊙	B-317R	45.0	48	26	22	(CL) Dark Gray CLAY
✧	B-317R	50.0	31	18	13	(CL) Dark Gray CLAY

GROUP DELTA CONSULTANTS

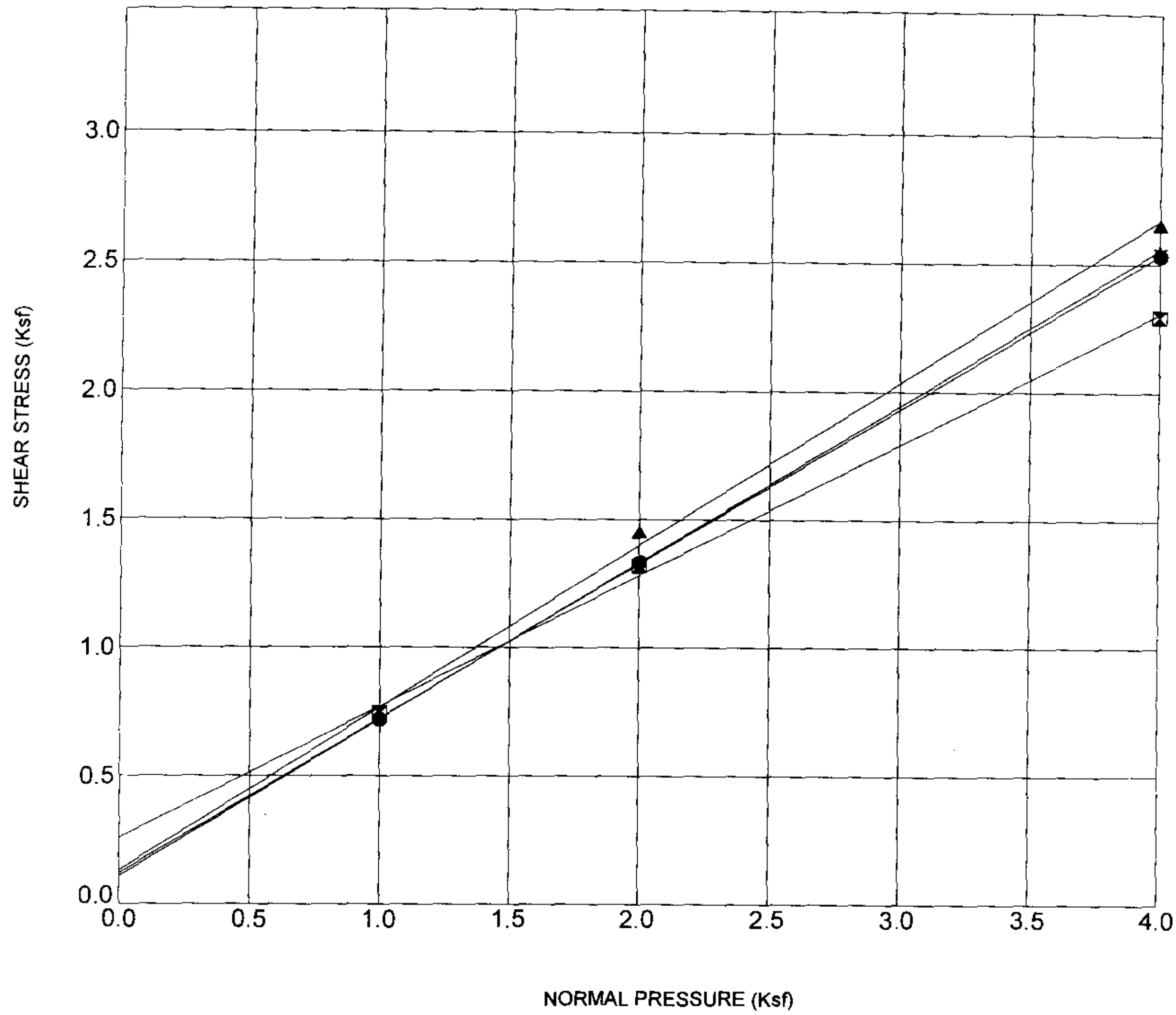
ATTERBERG LIMITS

GROUP DELTA CONSULTANTS, INC.

Project: Playa Vista - Site DE & Ballona Creek
Location: Playa del Rey, California
Number: L-196

FIGURE **D-4**

GDC ATTERBERG L196IV.GPJ GDC WLOG.GDT 1/8/99

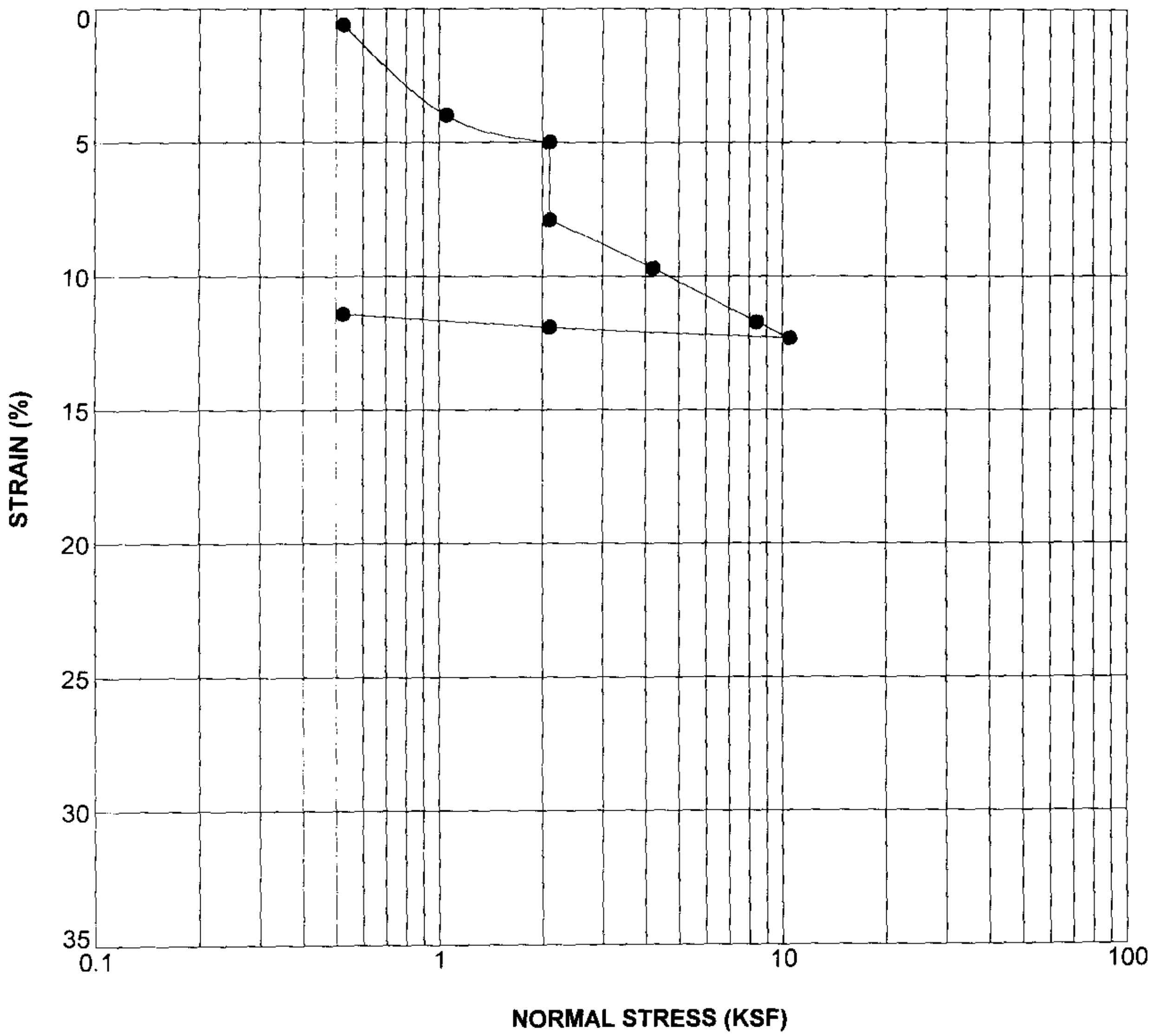


SYM	BORING	Depth(ft)	DESCRIPTION	γ_d lb/ft^3	MC % Before	MC % After	c KSF	ϕ deg
●	**B-302R**	**20.0**	**(ML) Dark Gray Clayey SILT**	**90.2**	**32.3**	**32.7**	**0.12**	**31.1**
⊠	**B-302R**	**30.0**	**(CL) Dark Gray Silty CLAY**	**98.7**	**27.1**	**40.4**	**0.26**	**27.1**
▲	**B-307R**	**30.0**	**(ML) Dark Gray Sandy SILT**	**95.0**	**29.5**	**29.8**	**0.13**	**32.4**
★	**B-319R**	**30.0**	**(CL) Greenish Gray Silty CLAY**	**91.5**	**33.0**	**30.1**	**0.11**	**31.5**

NOTE: All samples submerged unless otherwise noted
Shear Strength are Ultimate with less than 0.25 inch deflection

GROUP DELTA CONSULTANTS	**DIRECT SHEAR TEST**	Project: Playa Vista - Site DE & Ballona Creek
	GROUP DELTA CONSULTANTS, INC.	Location: Playa del Rey, California Number: L-196
		FIGURE **D-5**

GDC DIRECT SHEAR L196PV.GPJ GDC WLOG.GDT 1/4/99



SYMBOL	BORING	DEPTH (ft)	DESCRIPTION	Liquid Limit	Plastic Limit
●	**B-304H**	**5.0**	**(SC) Dark Gray Clayey SAND w/Silt**	NON PLASTIC	

	Moisture Content (%)	Dry Density (pcf)	Percent Saturation (%)	Void Ratio
INITIAL	**18.7**	**96.7**	**68.0**	**0.742**
FINAL	**15.1**	**120.6**	**100.0**	**0.397**

Specific Gravity: 2.7

Remark: SAMPLE SATURATED AT 2.1 KSF

GROUP DELTA CONSULTANTS

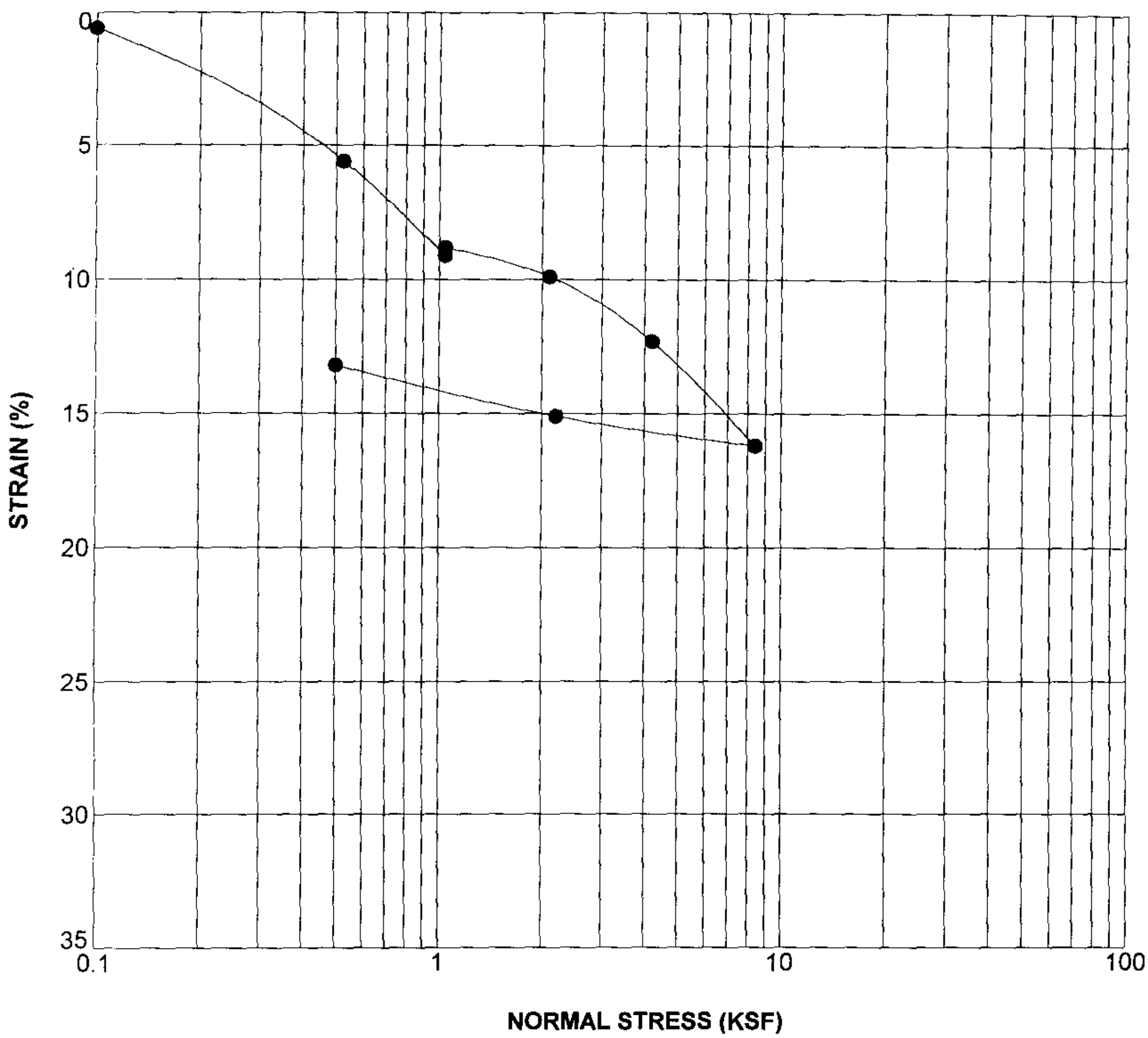
CONSOLIDATION TEST

GROUP DELTA CONSULTANTS, INC.

Project: Playa Vista - Site DE & Ballona Creek
Location: Playa del Rey, California
Number: L-196

FIGURE **D-6**

GDC_CON_STRN/SSTRS L196PV.GPJ GDC_WLOG.GDT 1/4/99



SYMBOL	BORING	DEPTH (ft)	DESCRIPTION	Liquid Limit	Plastic Limit
●	**B-304H**	**20.0**	**(CH) Medium Gray Silty CLAY**	**58**	**29**

	Moisture Content (%)	Dry Density (pcf)	Percent Saturation (%)	Void Ratio
INITIAL	**37.2**	**77.7**	**86.0**	**1.168**
FINAL	**40.8**	**83.7**	**100.0**	**1.013**

Specific Gravity: 2.7

Remark: SAMPLE SATURATED AT 1.1 KSF

GROUP DELTA CONSULTANTS

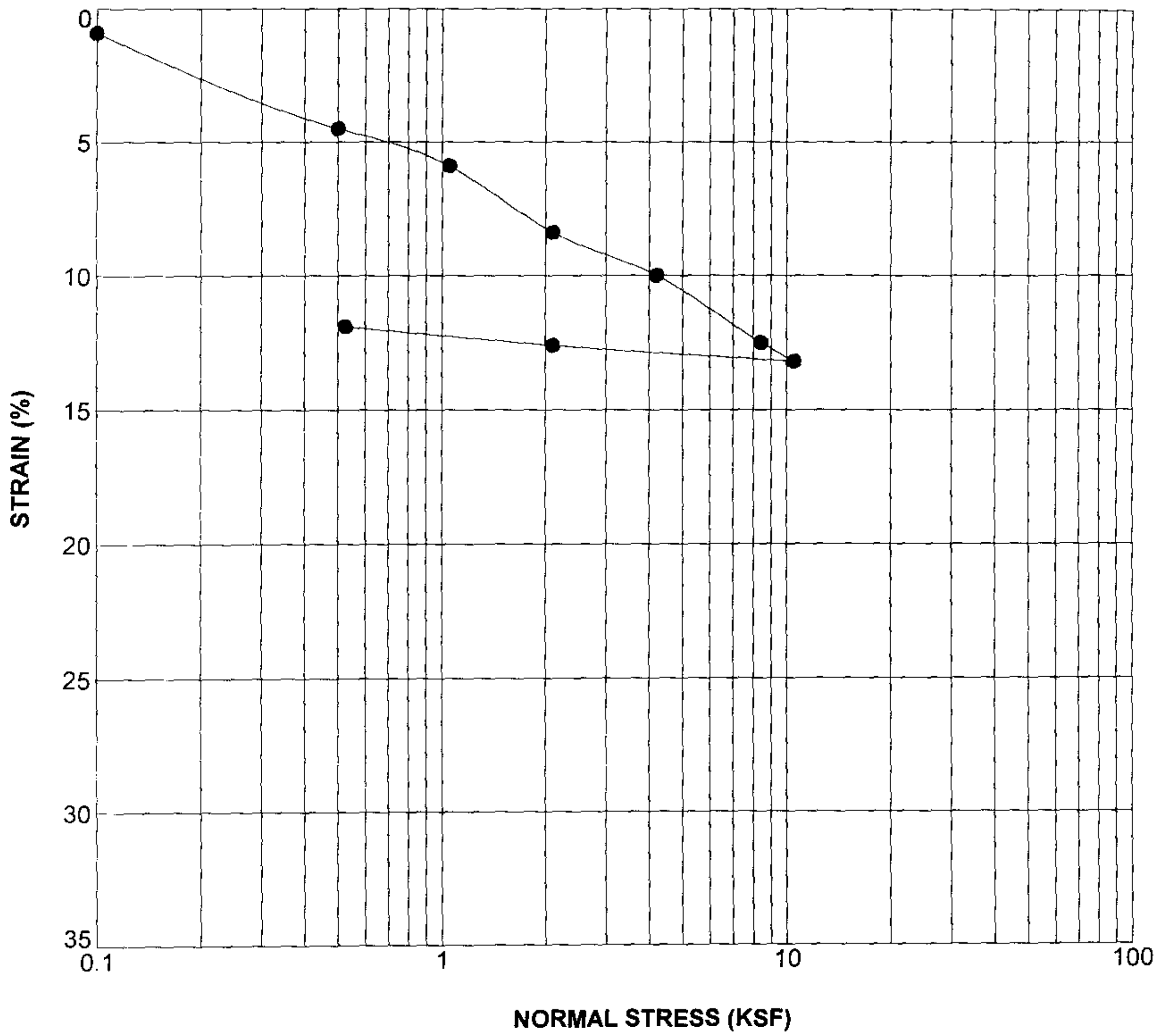
CONSOLIDATION TEST

GROUP DELTA CONSULTANTS, INC.

Project: Playa Vista - Site DE & Ballona Creek
Location: Playa del Rey, California
Number: L-196

FIGURE **D-7**

GDC CON STRNVSSTRS L196PV.GPJ GDC WLOG.GDT 1/4/99



SYMBOL	BORING	DEPTH (ft)	DESCRIPTION	Liquid Limit	Plastic Limit
●	B-305H	5.0	(CL) Dark Brown Sandy CLAY	32	16

	Moisture Content (%)	Dry Density (pcf)	Percent Saturation (%)	Void Ratio
INITIAL	18.6	108.9	91.8	0.547
FINAL	17.1	123.7	100.0	0.362

Specific Gravity: 2.7

Remark: SAMPLE SATURATED AT 1.05 KSF

GROUP DELTA CONSULTANTS

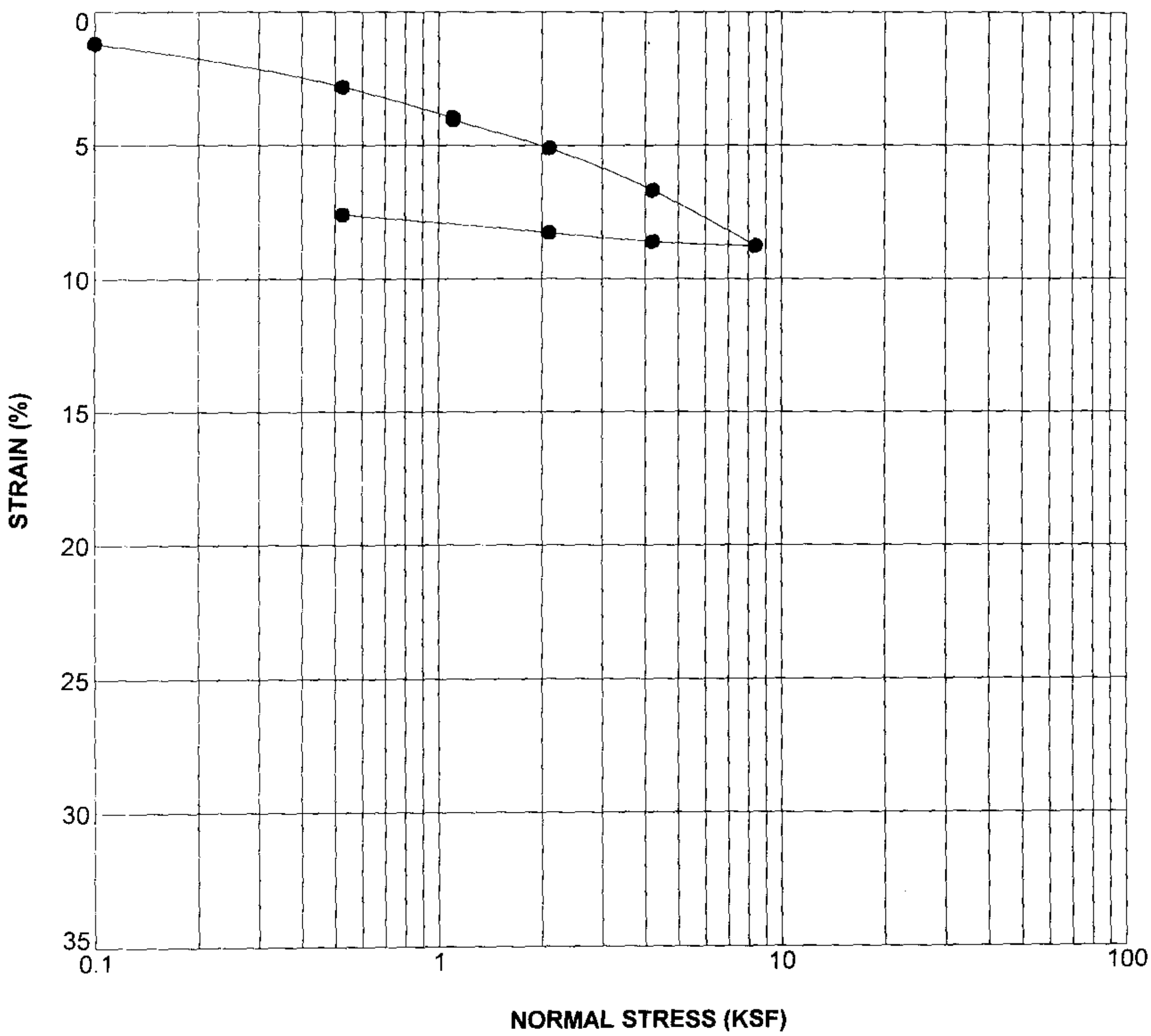
CONSOLIDATION TEST

GROUP DELTA CONSULTANTS, INC.

Project: Playa Vista - Site DE & Ballona Creek
Location: Playa del Rey, California
Number: L-196

FIGURE **D-8**

GDC_CON_STRNVSSTRS L196PV.GPJ GDC_WLOG.GDT 1/4/99



SYMBOL	BORING	DEPTH (ft)	DESCRIPTION	Liquid Limit	Plastic Limit
●	B-305H	15.0	(ML) Olive Gray Sandy SILT	NON PLASTIC	

	Moisture Content (%)	Dry Density (pcf)	Percent Saturation (%)	Void Ratio
INITIAL	34.9	87.3	100.0	0.930
FINAL	29.8	106.1	100.0	0.588

Specific Gravity: 2.7

Remark: SAMPLE SATURATED AT 1.1 KSF

GROUP DELTA CONSULTANTS

CONSOLIDATION TEST

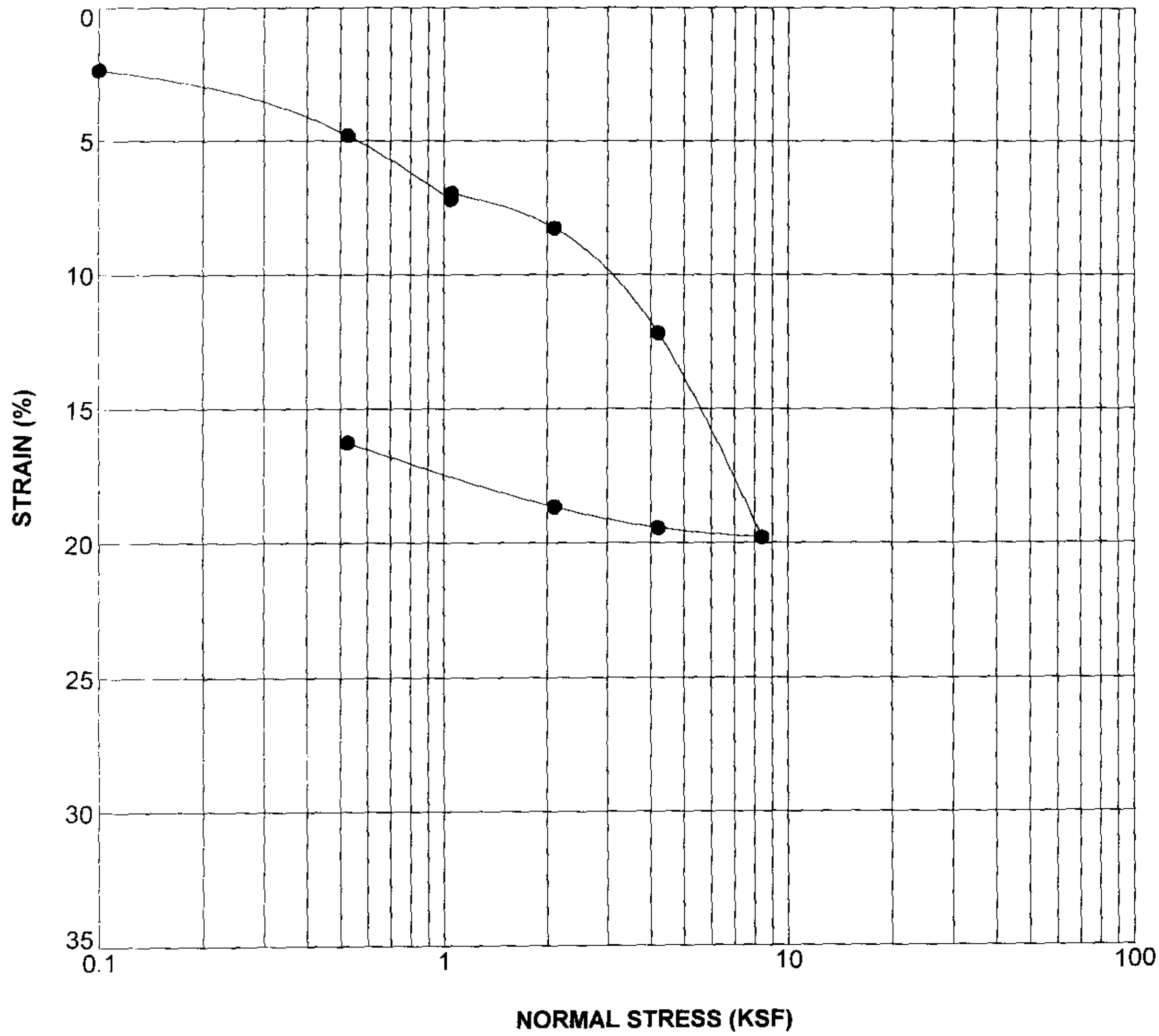
GROUP DELTA CONSULTANTS, INC.

Project: Playa Vista - Site DE & Ballona Creek

Location: Playa del Rey, California

Number: L-196

FIGURE **D-9**



SYMBOL	BORING	DEPTH (ft)	DESCRIPTION	Liquid Limit	Plastic Limit
●	**B-305H**	**20.0**	**(CH) Black to Dark Gray CLAY**	**80**	**30**

	Moisture Content (%)	Dry Density (pcf)	Percent Saturation (%)	Void Ratio
INITIAL	**65.1**	**60.7**	**99.0**	**1.776**
FINAL	**32.8**	**83.4**	**86.8**	**1.020**

Specific Gravity: 2.7

Remark: SAMPLE SATURATED AT 1.05 KSF

GROUP DELTA CONSULTANTS

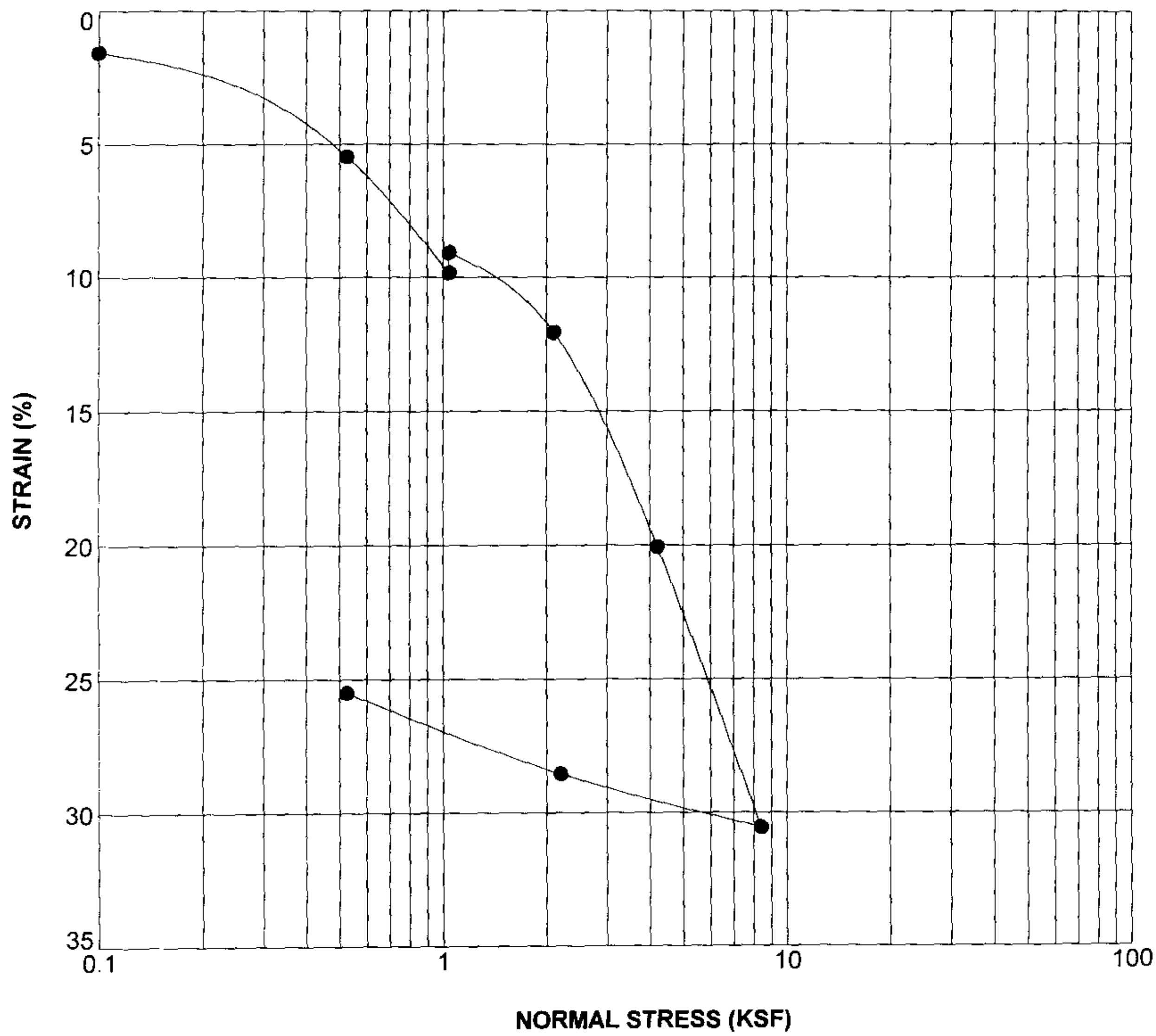
CONSOLIDATION TEST

GROUP DELTA CONSULTANTS, INC.

Project: Playa Vista - Site DE & Ballona Creek
Location: Playa del Rey, California
Number: L-196

FIGURE **D-10**

GDC_CON_STRNVSSTRS L196PV.GPJ GDC_WLOG.GDT 1/4/99



SYMBOL	BORING	DEPTH (ft)	DESCRIPTION	Liquid Limit	Plastic Limit
●	**B-307R**	**20.0**	**(CH) Dark Gray Sandy CLAY**	**78**	**34**

	Moisture Content (%)	Dry Density (pcf)	Percent Saturation (%)	Void Ratio
INITIAL	**82**	**50.1**	**93.7**	**2.362**
FINAL	**68.6**	**63.0**	**100.0**	**1.674**

Specific Gravity: 2.7

Remark: SAMPLE SATURATED AT 1.05 KSF

GROUP DELTA CONSULTANTS

CONSOLIDATION TEST

GROUP DELTA CONSULTANTS, INC.

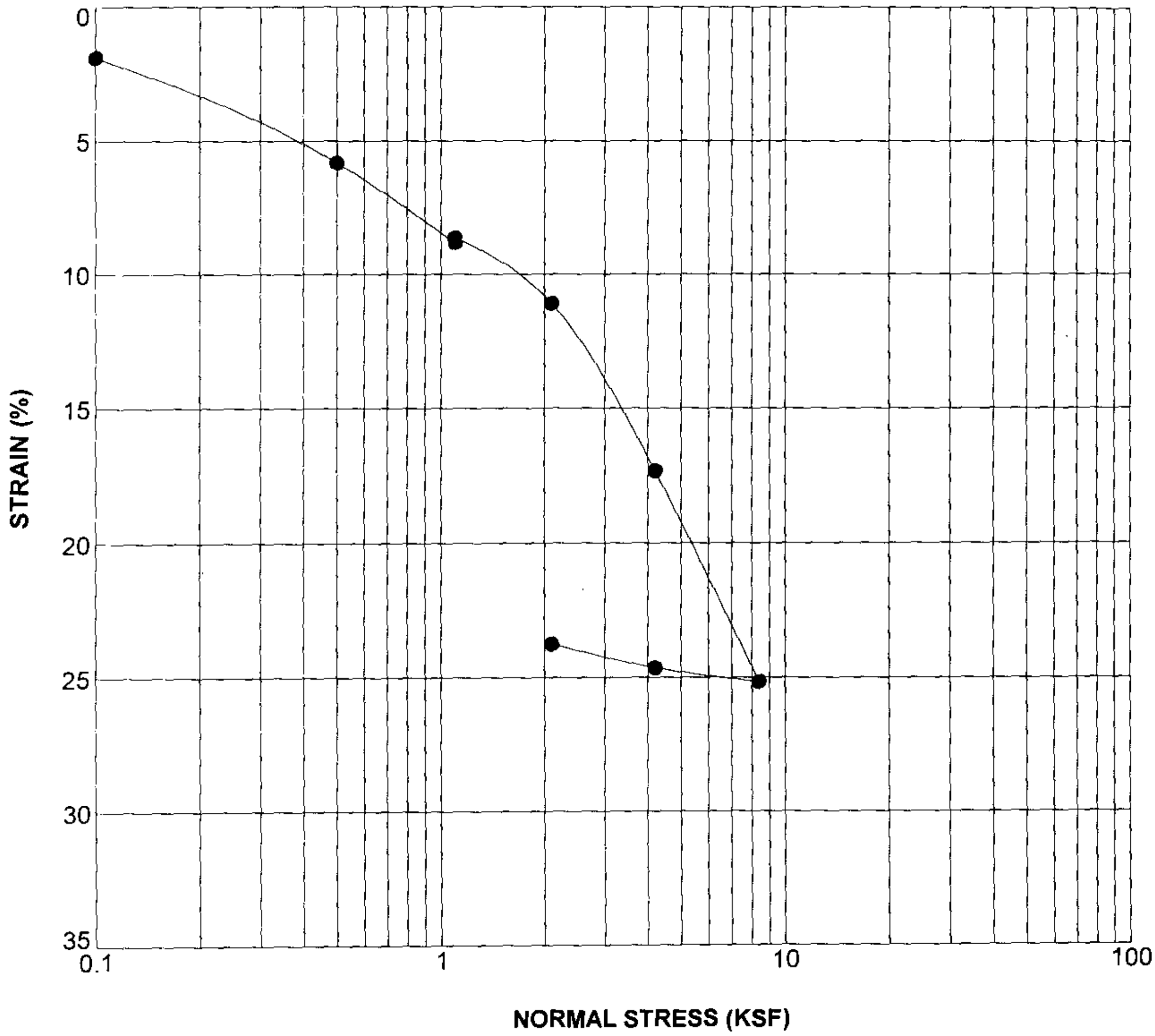
Project: Playa Vista - Site DE & Ballona Creek

Location: Playa del Rey, California

Number: L-196

FIGURE **D-11**

GDC CON STRNVSSTRS L196PV.GPJ GDC WLOG.GDT 1/4/99



SYMBOL	BORING	DEPTH (ft)	DESCRIPTION	Liquid Limit	Plastic Limit
●	B-313H	20.0	(CH) Dark Gray CLAY	94	34

	Moisture Content (%)	Dry Density (pcf)	Percent Saturation (%)	Void Ratio
INITIAL	86.4	52.9	100.0	2.185
FINAL	34.8	85.7	97.3	0.966

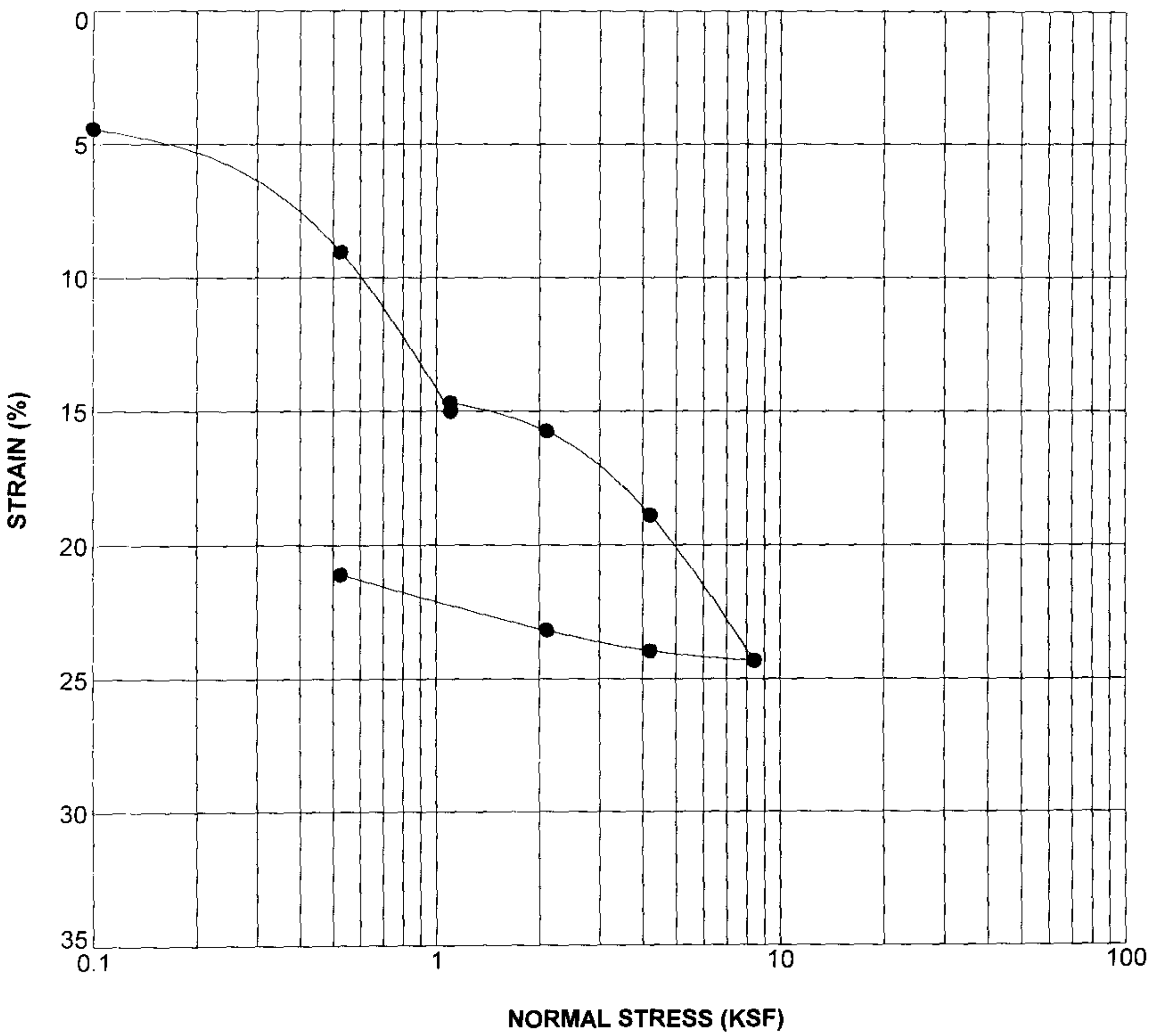
Specific Gravity: 2.7

Remark: SAMPLE SATURATED AT 1.1 KSF

GROUP DELTA CONSULTANTS	**CONSOLIDATION TEST**	Project: Playa Vista - Site DE & Ballona Creek
		Location: Playa del Rey, California
	GROUP DELTA CONSULTANTS, INC.	Number: L-196

FIGURE **D-12**

GDC_CON_STRNVSSTRS_L196PV.GPJ_GDC_WLOG.GDT_1/4/99



SYMBOL	BORING	DEPTH (ft)	DESCRIPTION	Liquid Limit	Plastic Limit
●	B-315H	20.0	(MH) Dark Gray Clayey SILT	74	39

	Moisture Content (%)	Dry Density (pcf)	Percent Saturation (%)	Void Ratio
INITIAL	65.1	61.1	100.0	1.757
FINAL	30.0	88.0	88.6	0.915

Specific Gravity: 2.7

Remark: SAMPLE SATURATED AT 1.1 KSF

GROUP DELTA CONSULTANTS

CONSOLIDATION TEST

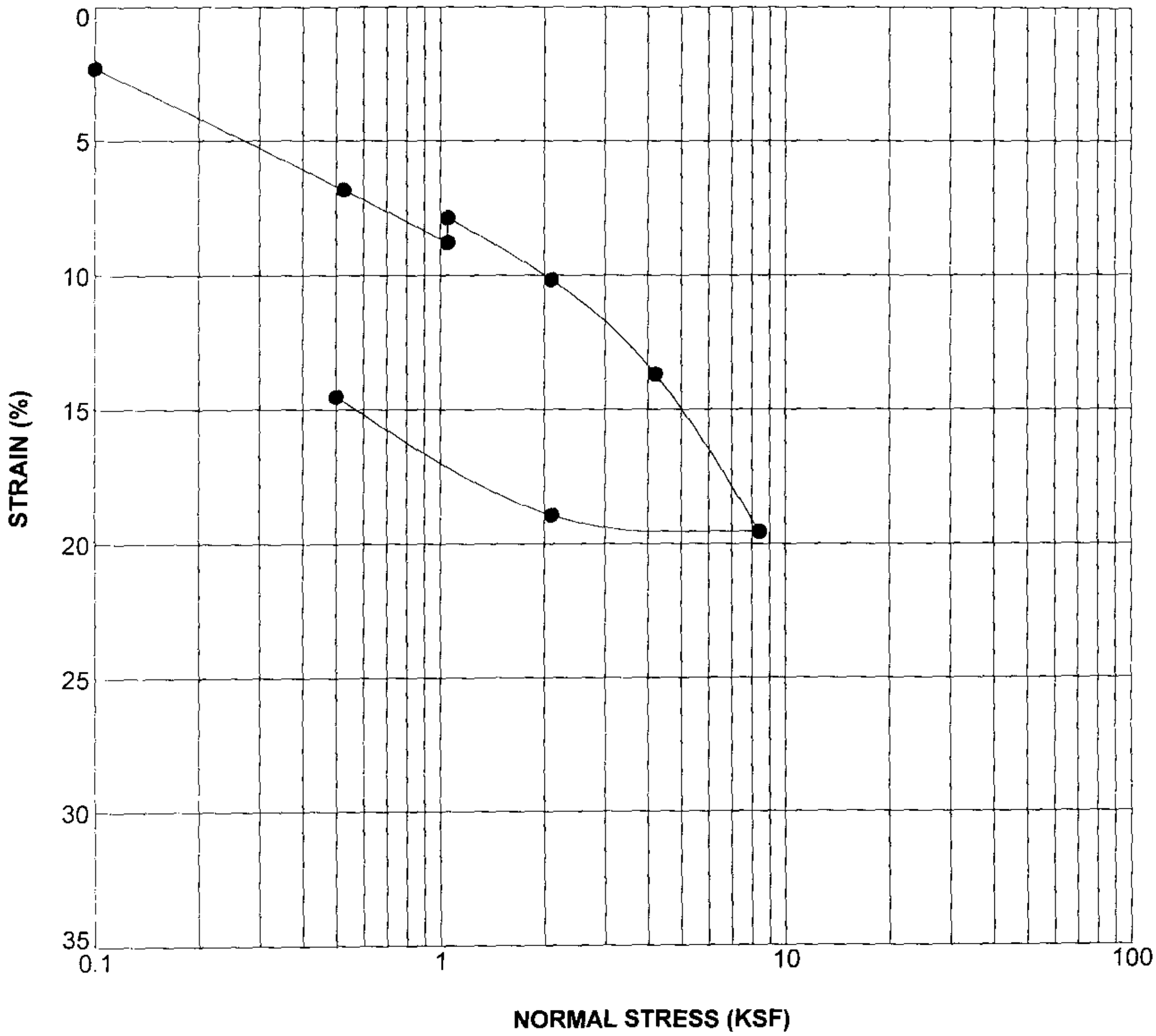
GROUP DELTA CONSULTANTS, INC.

Project: Playa Vista - Site DE & Ballona Creek

Location: Playa del Rey, California

Number: L-196

FIGURE **D-13**



SYMBOL	BORING	DEPTH (ft)	DESCRIPTION	Liquid Limit	Plastic Limit
●	B-319R	20.0	(MH) Dark Gray Clayey SILT	66	34

	Moisture Content (%)	Dry Density (pcf)	Percent Saturation (%)	Void Ratio
INITIAL	66.8	72.5	100.0	1.324
FINAL	57.0	70.0	100.0	1.407

Specific Gravity: 2.7

Remark: SAMPLE SATURATED AT 1.05 KSF

GROUP DELTA CONSULTANTS

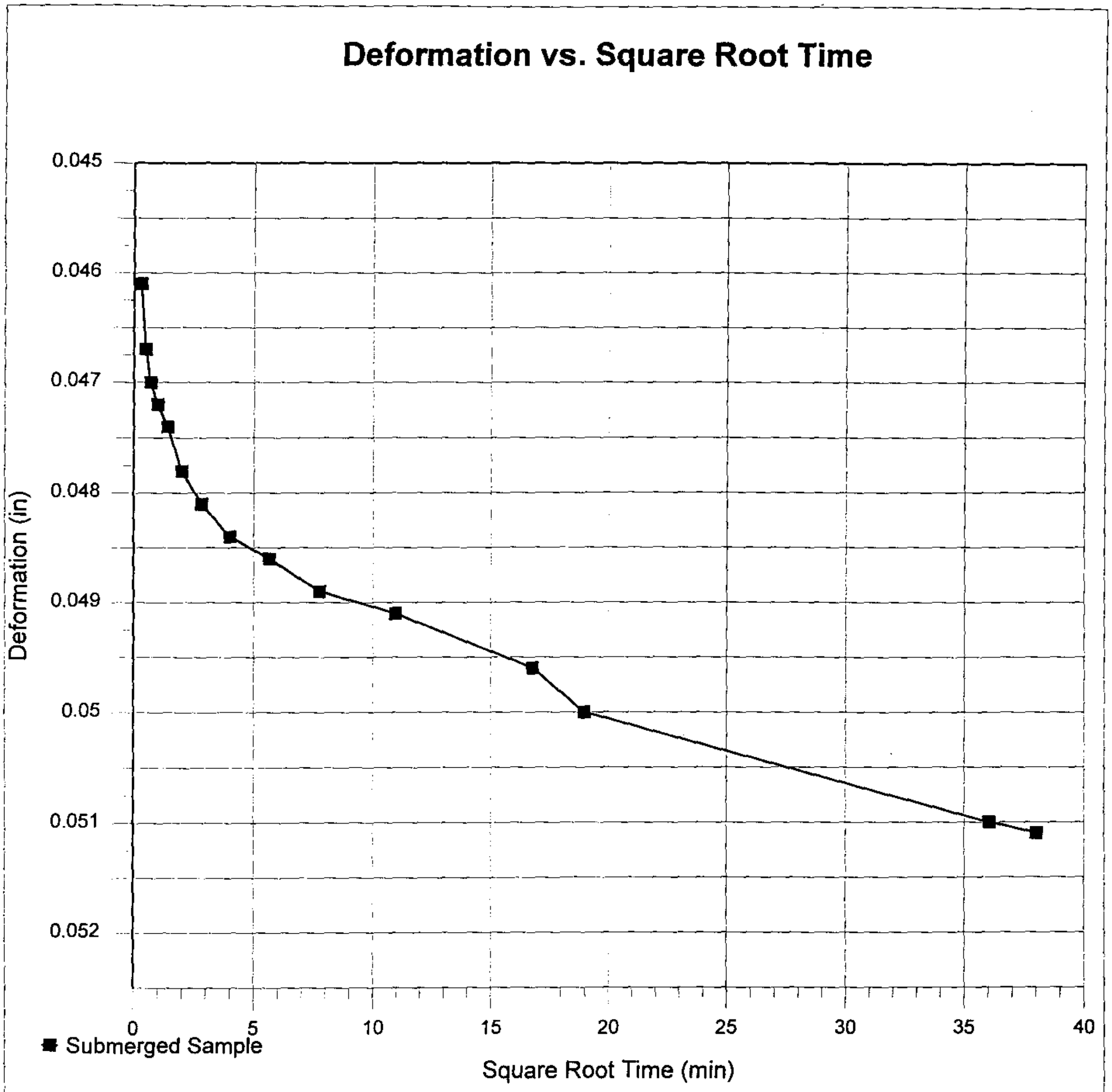
CONSOLIDATION TEST

GROUP DELTA CONSULTANTS, INC.

Project: Playa Vista - Site DE & Ballona Creek
Location: Playa del Rey, California
Number: L-196

FIGURE **D-14**

GDC_CON_STRNVSSTRS L196PV.GPJ GDC_WLOG.GDT 1/4/99



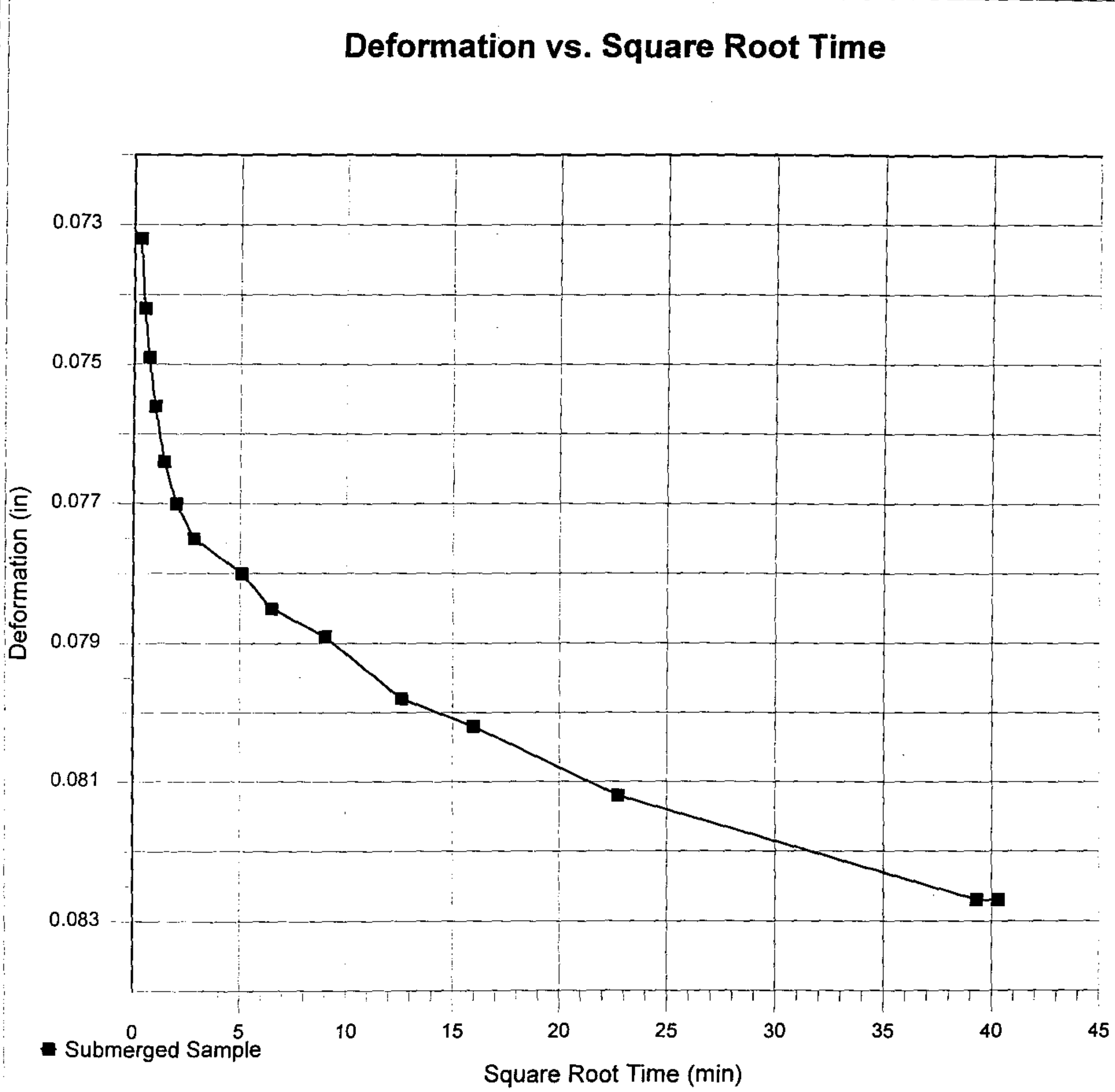
Sample Location: B-305H

Confining Pressure: 2.1 KSF

Sample Depth: 15 feet

Soil Description: (SM) Olive Gray Silty SAND

GROUP DELTA CONSULTANTS	**TIME RATE CONSOLIDATION**	Project: Playa Vista Location: Site DE & Bollona Creek Channel
	GROUP DELTA CONSULTANTS, INC.	Number: L-196 Figure: **D-15**



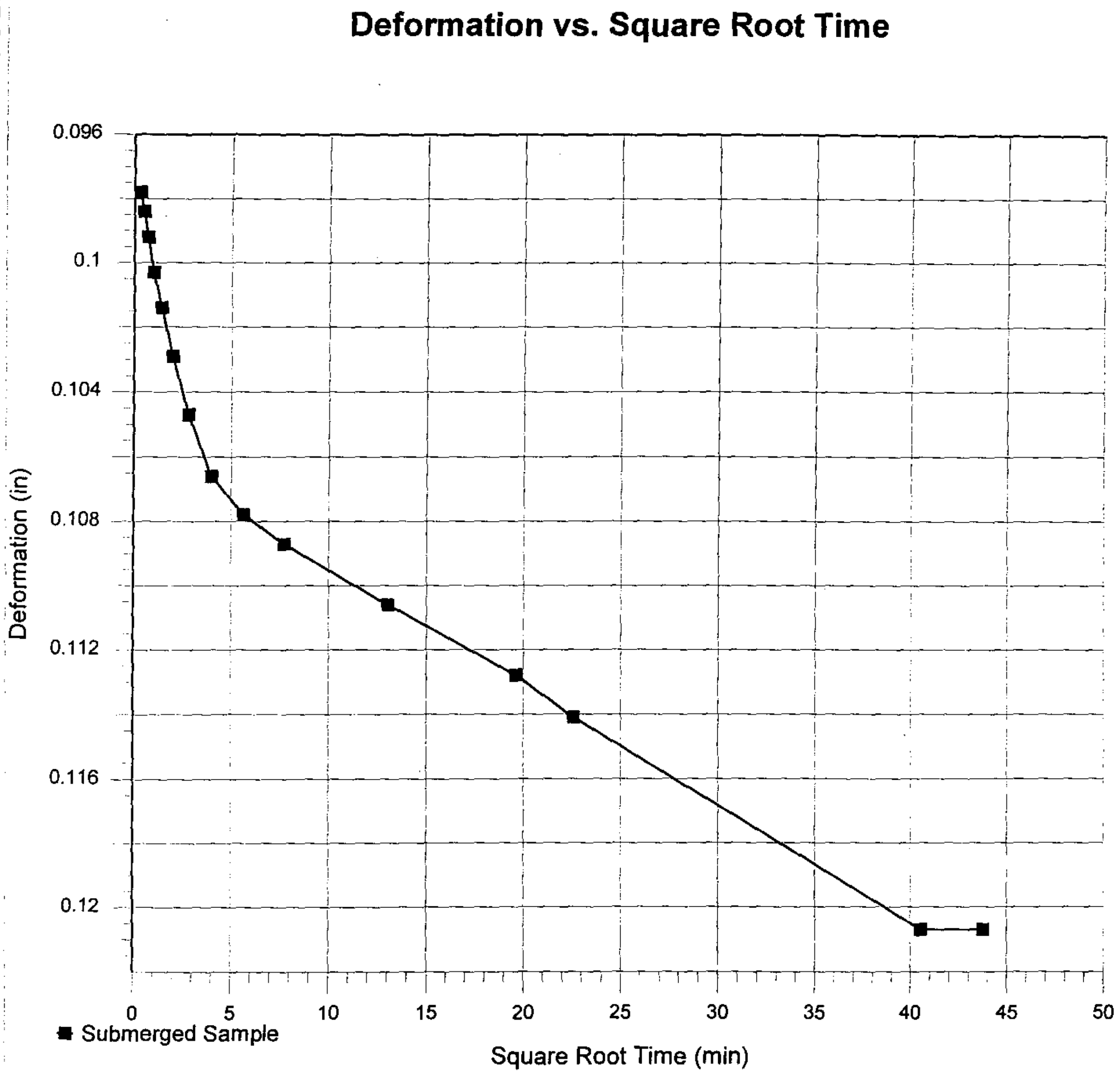
Sample Location: B-305H

Confining Pressure: 2.1 KSF

Sample Depth: 20 feet

Soil Description: (CL) Dark Gray Silty CLAY

TIME RATE CONSOLIDATION	Project: Playa Vista
	Location: Site DE & Bollona Creek Channel
GROUP DELTA CONSULTANTS, INC.	Number: L-196 Figure: **D-16**



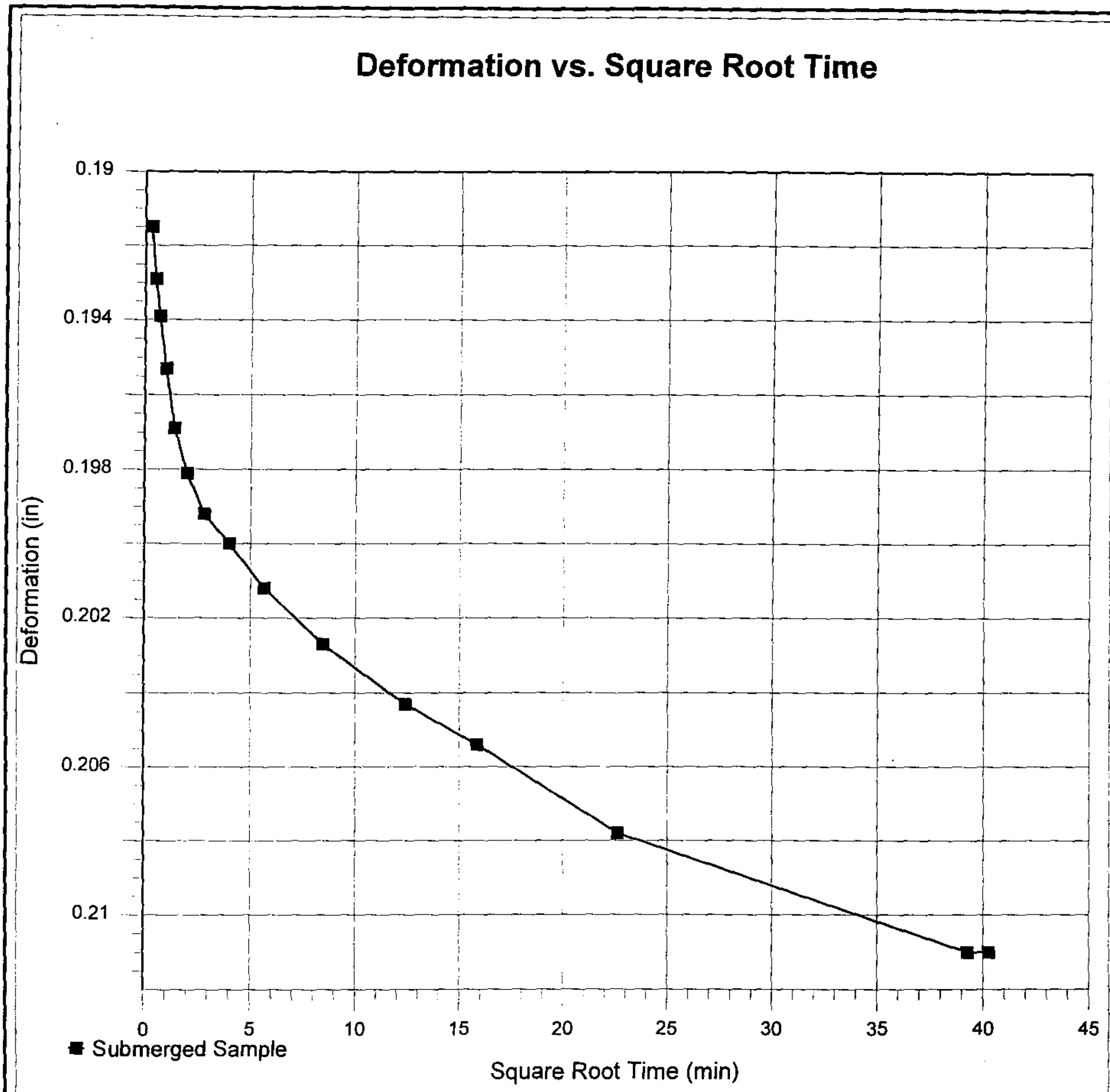
Sample Location: B-307R

Confining Pressure: 2.1 KSF

Sample Depth: 20 feet

Soil Description: (CH) Dark Gray Sandy CLAY

TIME RATE CONSOLIDATION	Project: Playa Vista
	Location: Site DE & Bollona Creek Channel
GROUP DELTA CONSULTANTS, INC.	Number: L-196 Figure: **D-17**



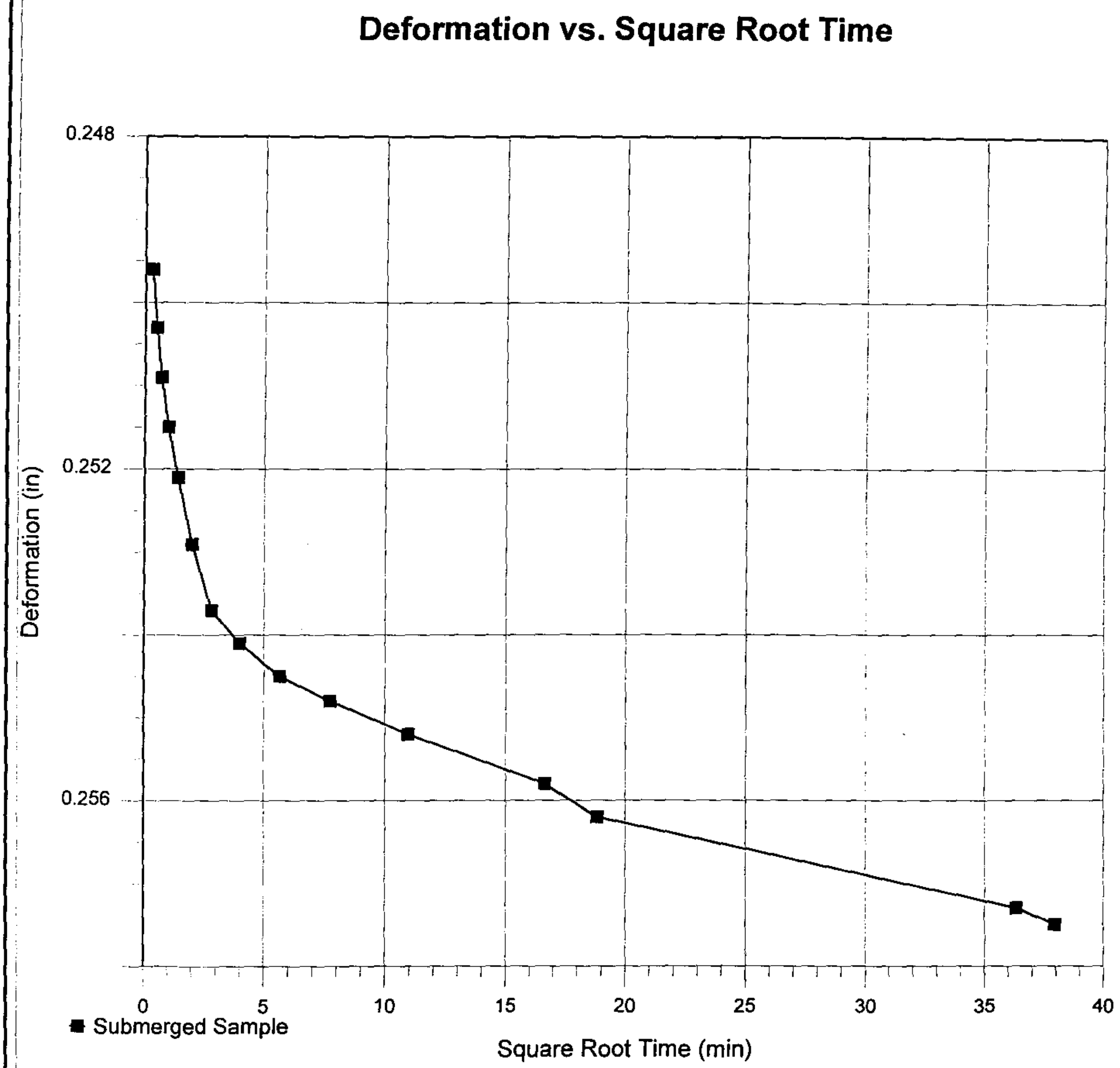
Sample Location: B-313H

Confining Pressure: 2.1 KSF

Sample Depth: 20 feet

Soil Description: (CH/OH) Dark Gray Organic CLAY

GROUP DELTA CONSULTANTS	**TIME RATE CONSOLIDATION**	Project: Playa Vista
		Location: Site DE & Bollona Creek Channel
	GROUP DELTA CONSULTANTS, INC.	Number: L-196 Figure: **D-18**



Sample Location: B-315H

Confining Pressure: 2.1 KSF

Sample Depth: 20 feet

Soil Description: (MH) Dark Gray Silty CLAY

GROUP DELTA CONSULTANTS	**TIME RATE CONSOLIDATION**	Project: Playa Vista Location: Site DE & Bollona Creek Channel
	GROUP DELTA CONSULTANTS, INC.	Number: L-196 Figure: **D-19**

APPENDIX B
EXISTING LABORATORY DATA (Pacific Soils Engineering, 1998)

APPENDIX B

Laboratory Testing

The results of laboratory testing performed during this study (for the subject site and the northerly neighboring site) are enclosed within this appendix. Table B-1 presents a summary of laboratory test results.

The following laboratory tests were performed on representative samples in accordance with the applicable latest standards or methods from the ASTM, Uniform Building Code (UBC) and California Department of Transportation.

Moisture and In-Place Density

The field moisture content and in-situ dry density were established on relatively undisturbed ring samples obtained from the borings. The moisture content was obtained in accordance with ASTM Test Method: D-2216. The in-situ dry density was computed using the net weight of the entire sample. The results of these tests are presented on the boring logs.

Classification

Soils were classified with respect to the Unified Soil Classification System (USCS) in accordance with ASTM Test Methods: D-2487 and D-2488.

Direct Shear Tests

Direct shear tests were performed on two remolded samples that were saturated under a surcharge equal to the applied normal force during testing. The apparatus used is in conformance with the requirements outlined in ASTM Test Method D-3080. The test specimens, 2.5-inches in diameter and 1-inch in height, were subjected to simple shear along a plane at mid-height.

The samples were sheared under various normal loads, a different specimen being used for each normal load. A strain of 0.050-inches per minute was used to evaluate shear strength values. The specimens were sheared until the shear stress reached a constant value or until the sample deformation had reached approximately 10 percent of the original diameter.

The shear stress values obtained from the tests were plotted versus applied normal pressures. The best-fitting straight lines were drawn through the plotted points to obtain the shear strength envelopes. The cohesion and angle of internal friction of the soil materials were evaluated from the shear strength envelopes. The direct shear test results are shown on Plates _________.

Consolidation Tests

Consolidation tests were performed on undisturbed soils samples in accordance with procedures outlined in ASTM Test Method D-2435. Samples were placed in a consolidometer and loads were applied incrementally in geometric progression. The sample (2.5-inches in diameter and 1-inch in height) was permitted to consolidate under each load increment until the slope of the characteristics linear secondary compression portion of the thickness versus log of time plot was apparent.

The percent consolidation for each load cycle was recorded as the ratio of the amount of vertical compression to the original 1-inch height. Hydroconsolidation (collapse) and expansion characteristics were also evaluated by monitoring the change in volume with saturation while the specimen was confined under constant normal street. The consolidation test results are shown on Plates B-17 through B-21.

Maximum Density/Optimum Moisture

The maximum dry density and optimum moisture content of two representative bulk samples was evaluated in accordance with ASTM Test Method D 1557-91/Method A. The results of this test are summarized in Table B-1.

Particle Size Analysis

Modified hydrometer portion ASTM Test Method D-2422-72 were conducted to aid in classification of the soils. The results of the particle size analysis are presented in Table B-1.

Expansion Index Tests

An expansion index test was performed to evaluate the expansion potential of typical onsite soils. Testing was carried out according to UBC Method 29-2. The results are presented in Table B-1.

TABLE B-1

Playa Vista W.O.500464

SUMMARY OF LABORATORY TEST DATA

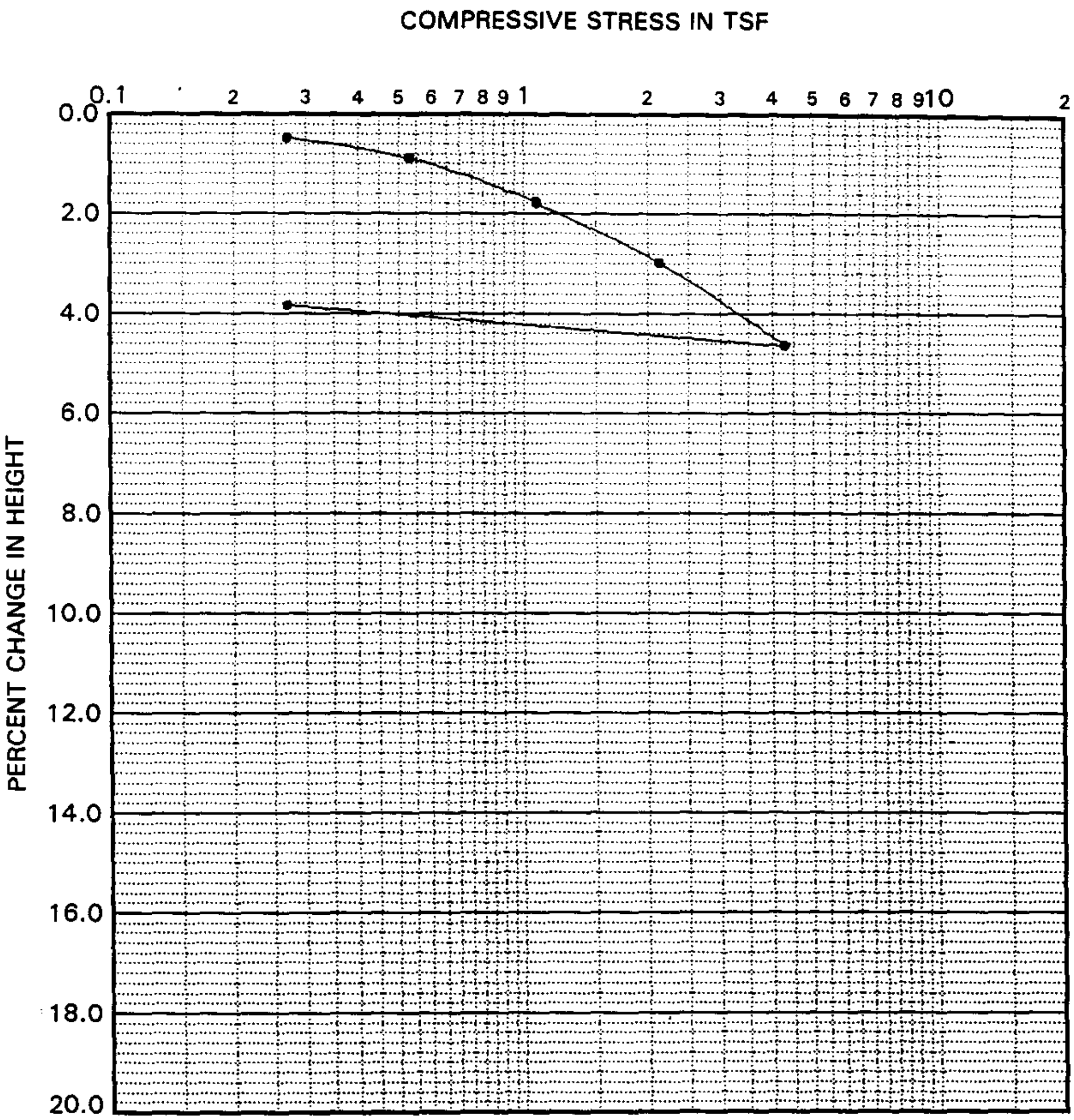
Boring	Depth (feet)	Soil Description	Group Classification	% Gravel	% Sand	% Silt	% Clay	Max.Dry Density (pcf)	Opt. Moist. (%)	EI	RV
B-01	15.0	Silty Sand/Sandy Si⁻	SM/ML	0	50	40	10				
B-01	25.0	Sandy Silt	ML	0	40	38	22				
B-01	40.0	Clayey Silt	ML	0	2	58	40				
B-02	0.0	Clayey Sand	SC	7	50	21	22	127.5	8.9	17	
B-02	20.0	Silty Clay	CL	0	27	31	42				
B-02	30.0	Clayey Silt	ML	0	7	63	30				
B-03	15.0	Sandy Clayey Silt	ML	0	23	59	18				
B-03	20.0	Silty Clay	CL	0	0	47	53				
B-03	35.0	Sandy Silt	ML	0	35	50	15				
B-03	40.0	Sand	SP	32	65	1	2				
B-03	65.0	Sand	SP	7	85	5	3				
B-04	10.0	Clay	CL	0	17	13	70				
B-04	25.0	Clayey Silt	ML	0	20	55	25				
B-04	45.0	Silty Clay	CL	0	0	37	63				
B-04	55.0	Clayey Silt	ML	0	0	52	48				
B-04	65.0	Sand	SP	0	90	7	3				
B-05	20.0	Silty Clay	CL	0	10	43	47				
B-05	55.0	Clayey Silt	ML	0	2	63	35				
B-06	30.0	Sandy Silt	ML	0	32	51	17				
B-06	45.0	Clayey Silt	ML	0	2	51	47				
B-06	70.0	Sand	SP	7	88	2	3				
B-07	0.0	Clayey Sand	SC	11	45	20	24	125.8	9.4		32
B-07	25.0	Clayey Sandy Silt	ML	0	38	37	25				
B-07	30.0	Sandy Silt	ML	0	47	43	10				
B-08	20.0	Clayey Silt	ML	0	2	71	27				
B-08	40.0	Clayey Silt	ML	0	0	53	47				
B-08	55.0	Clayey Silt	ML	0	5	57	38				
B-08	65.0	Sand	SP	0	97	1	2				

TABLE B-1

Playa Vista W.O.500464

SUMMARY OF LABORATORY TEST DATA

Boring	Depth (feet)	Soil Description	Group Classif-ication	% Gravel	% Sand	% Silt	% Clay	Max.Dry Density (pcf)	Opt. Moist. (%)	EI	RV
B-09	20.0	Clayey Silt	ML	0	12	50	38				
B-09	45.0	Clayey Silt	ML	0	15	58	27				
B-10	0.0	Sandy Clay	CL	4	44	24	28	123.3	10.0		
B-10	40.0	Clayey Silt	ML	0	0	68	32				
B-10	60.0	Sand	SP	20	78	0	3				
B-11	0.0	Sandy Clay	CL	5	38	27	30	121.4	10.1	34	
B-11	15.0	Silty Clay	CL	0	12	36	52				
B-11	25.0	Clayey Silt	ML	0	18	45	37				
B-11	35.0	Sandy Silt	ML	0	32	53	15				
B-11	60.0	Sand	SP	0	92	5	3				



boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-01	25.0	106.0	19.9	60	ML	Sandy Silt

REMARKS: WATER ADDED AT 1.07 TSF

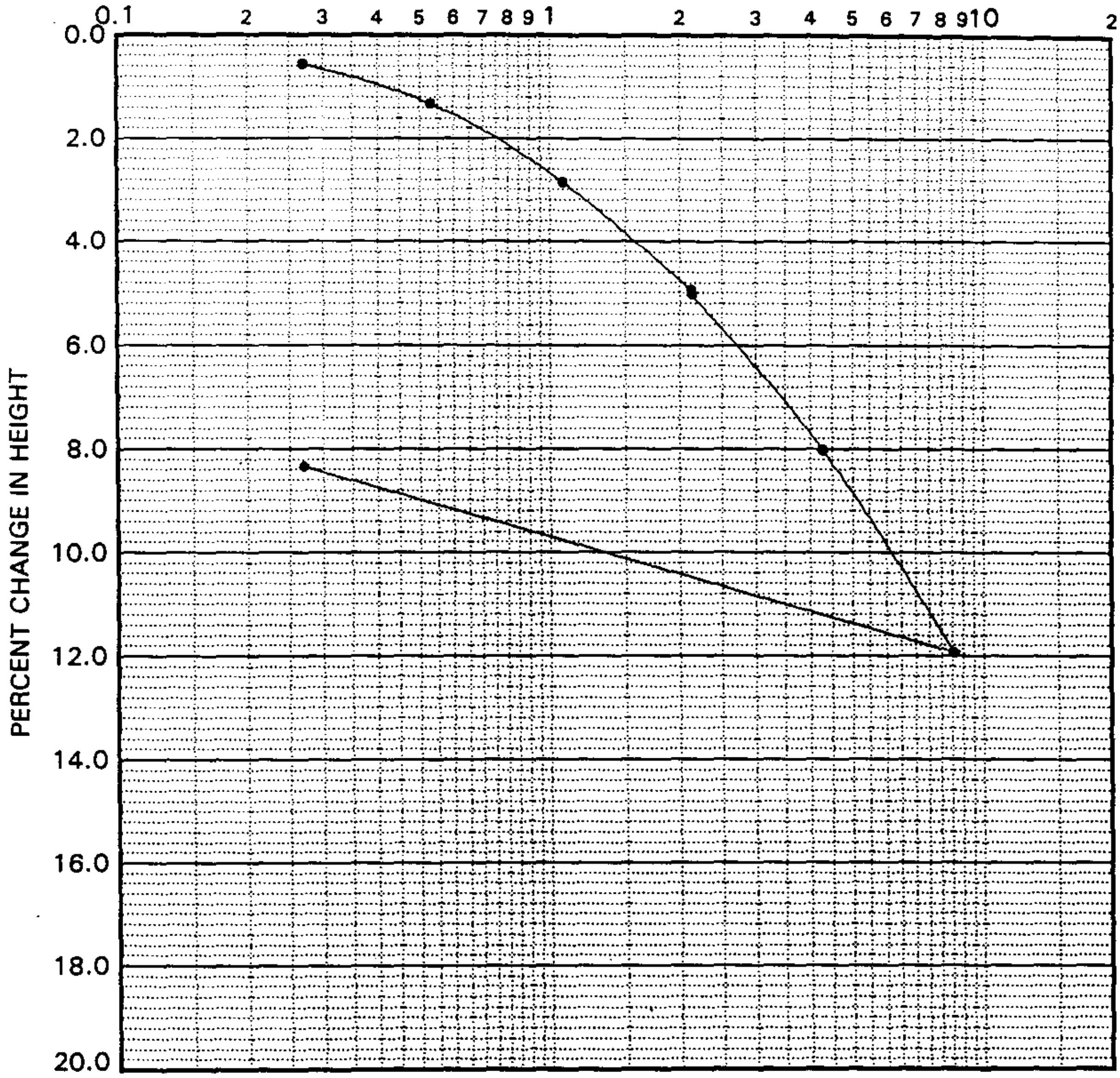
CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 PLATE B-1

A-86

COMPRESSIVE STRESS IN TSF



boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-01	40.0	89.0	33.4	98	ML	Clayey Silt

REMARKS: WATER ADDED AT 2.13 TSF

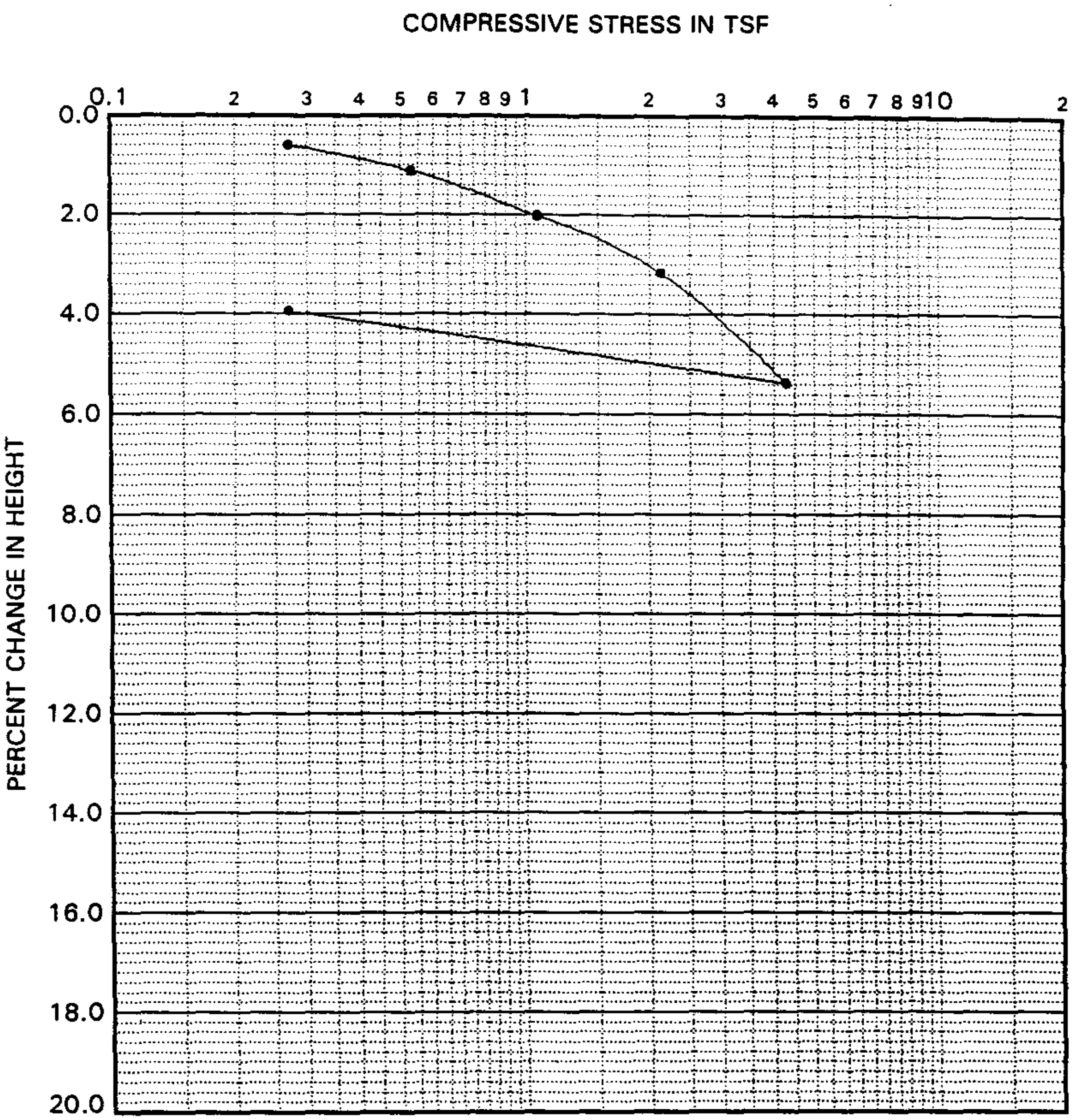
CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.

3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 **PLATE B-2**

A-87



boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-02	30.0	94.1	29.9	93	ML	Clayey Silt

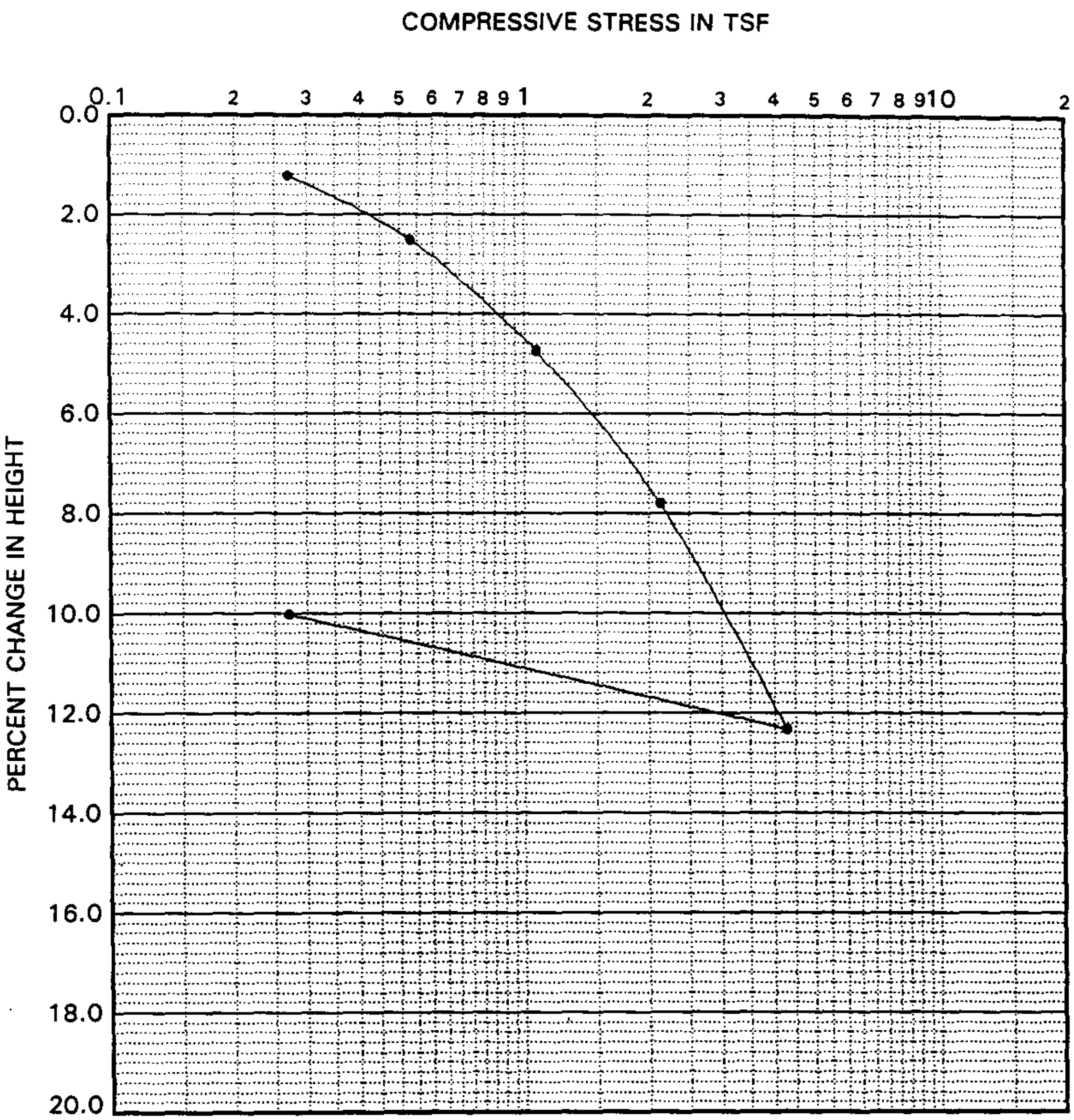
REMARKS: WATER ADDED AT 1.07 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 **PLATE B-3**

A-88



boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-03	20.0	73.4	48.5	100	CL	Silty Clay

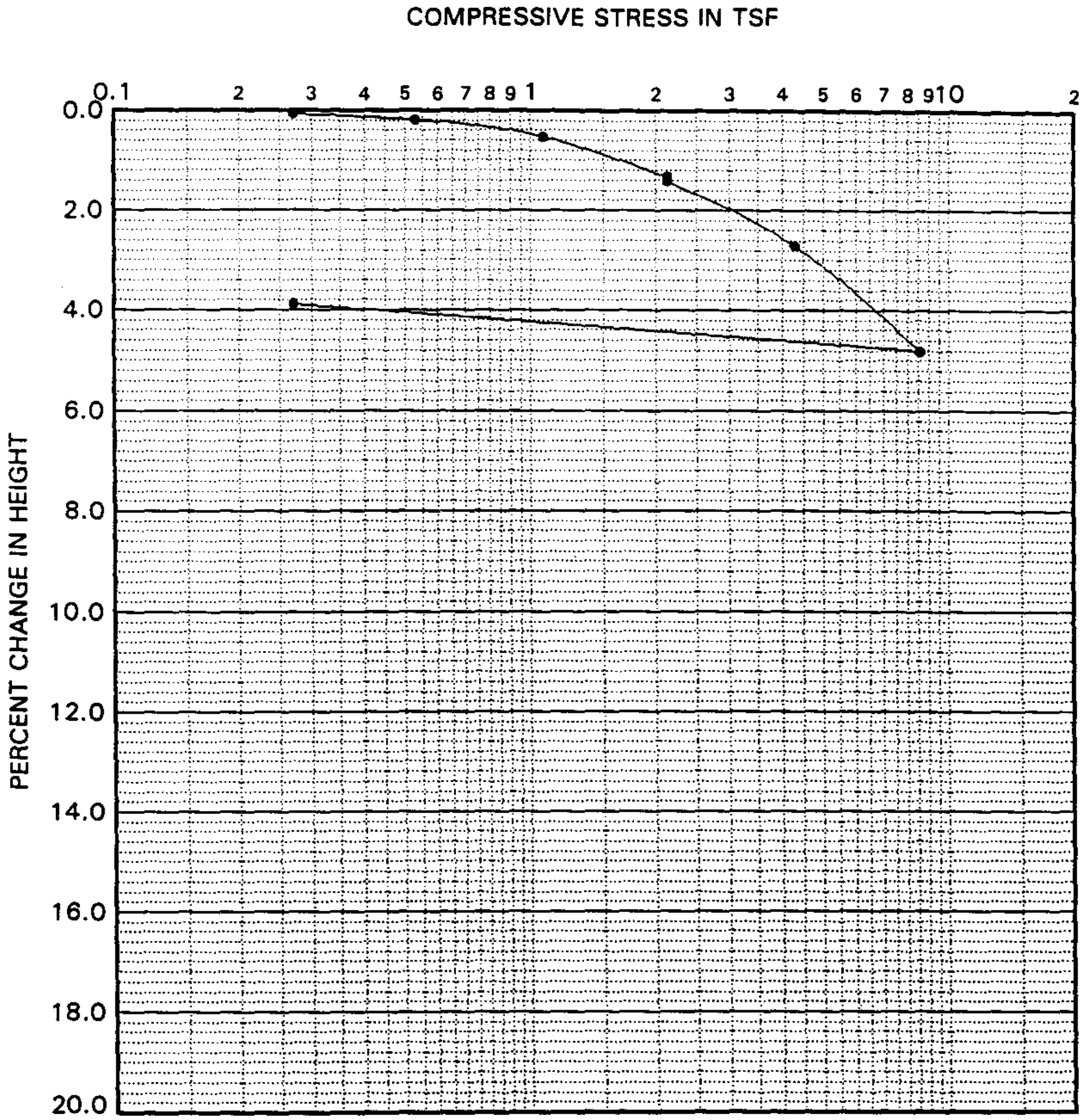
REMARKS: WATER ADDED AT 1.07 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.

3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 **PLATE B-4**



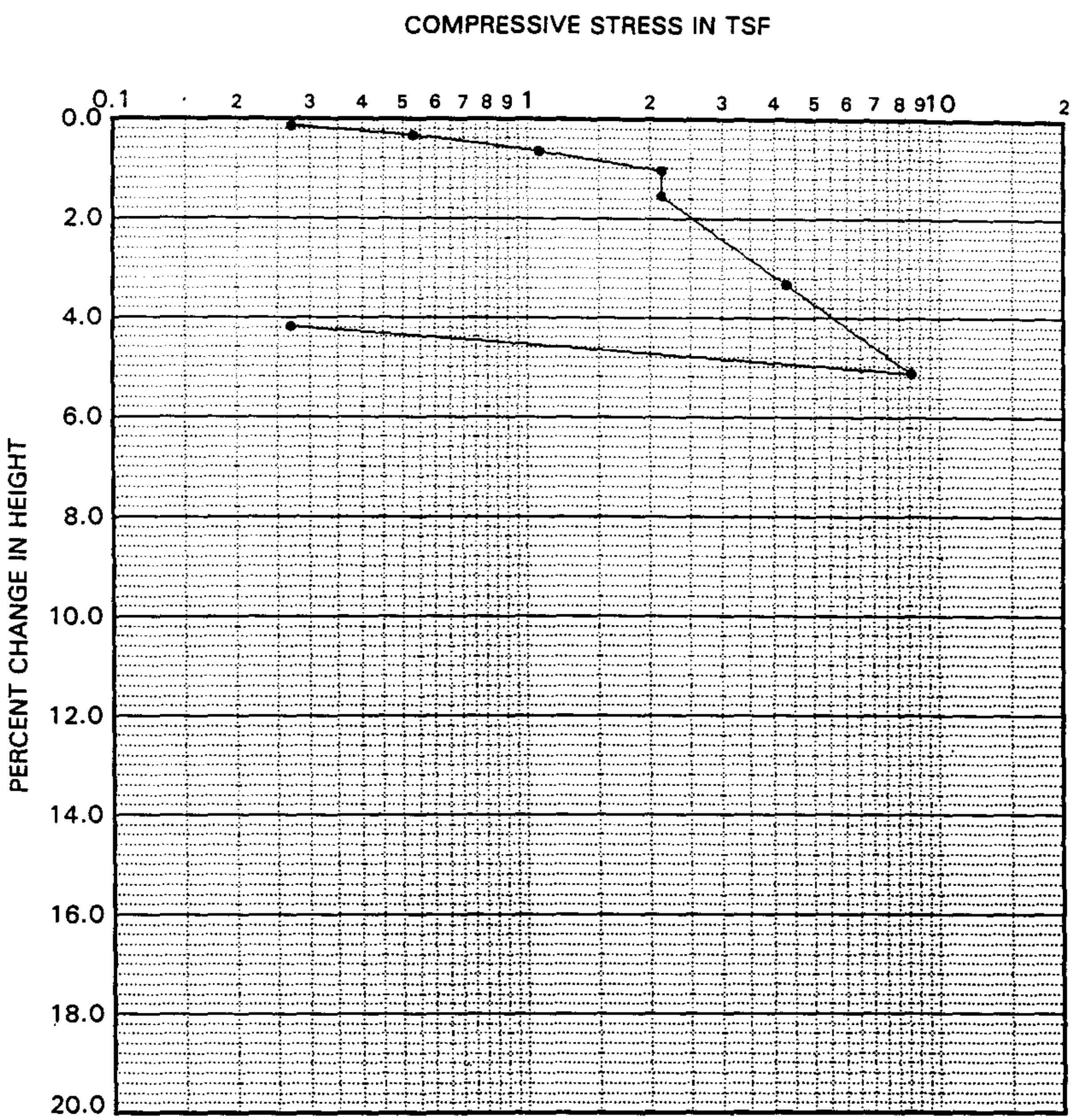
boring	depth (ft.)	dry density	in situ moist.	-200 sieve,	group symbol	typical names
B-03	40.0	101.4	11.9	3	SP	Sand

REMARKS: WATER ADDED AT 2.13 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 **PLATE B-5**



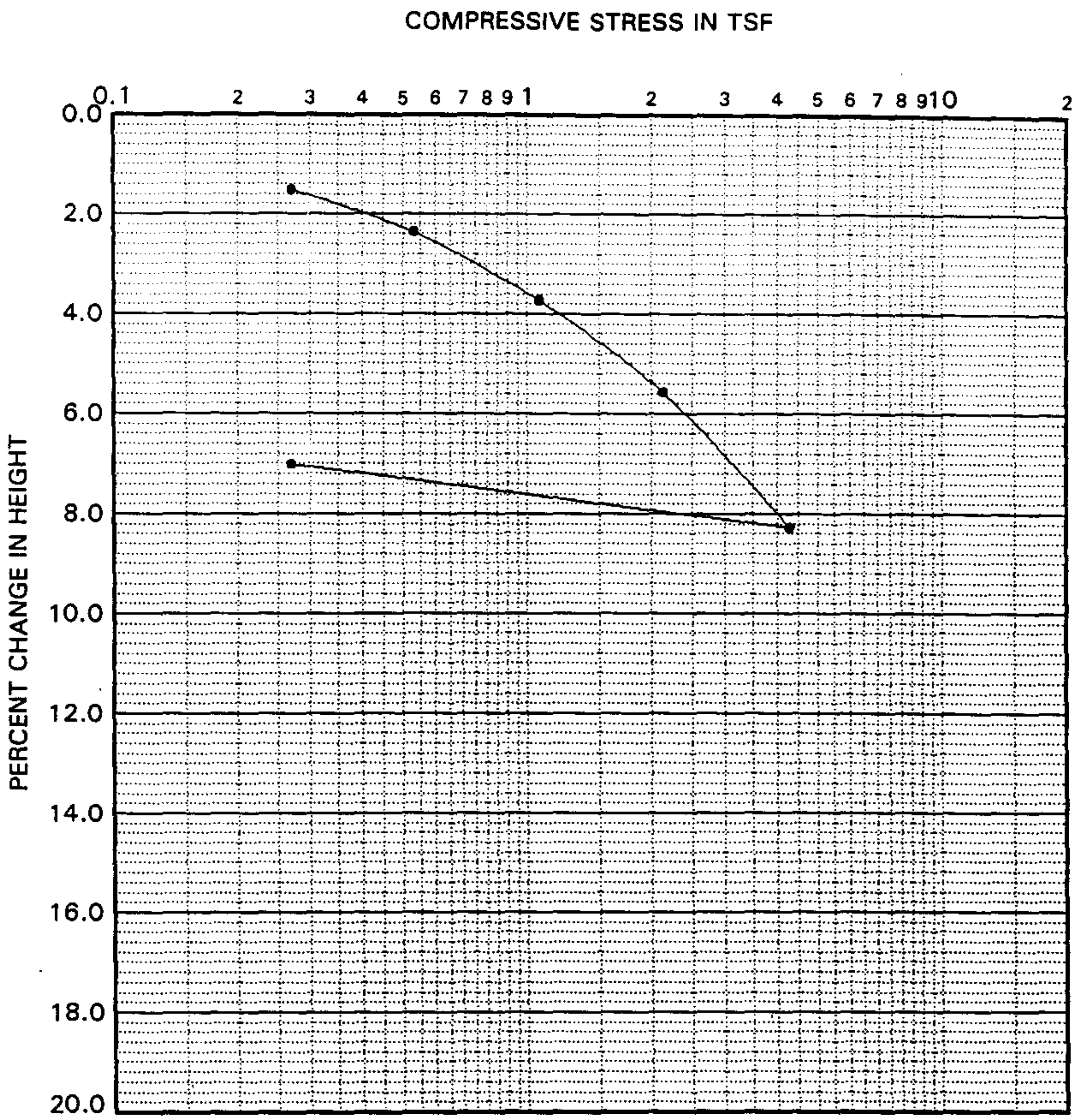
boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-03	65.0	117.5	16.5	8	SP	Sand

REMARKS: WATER ADDED AT 2.13 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 PLATE B-6



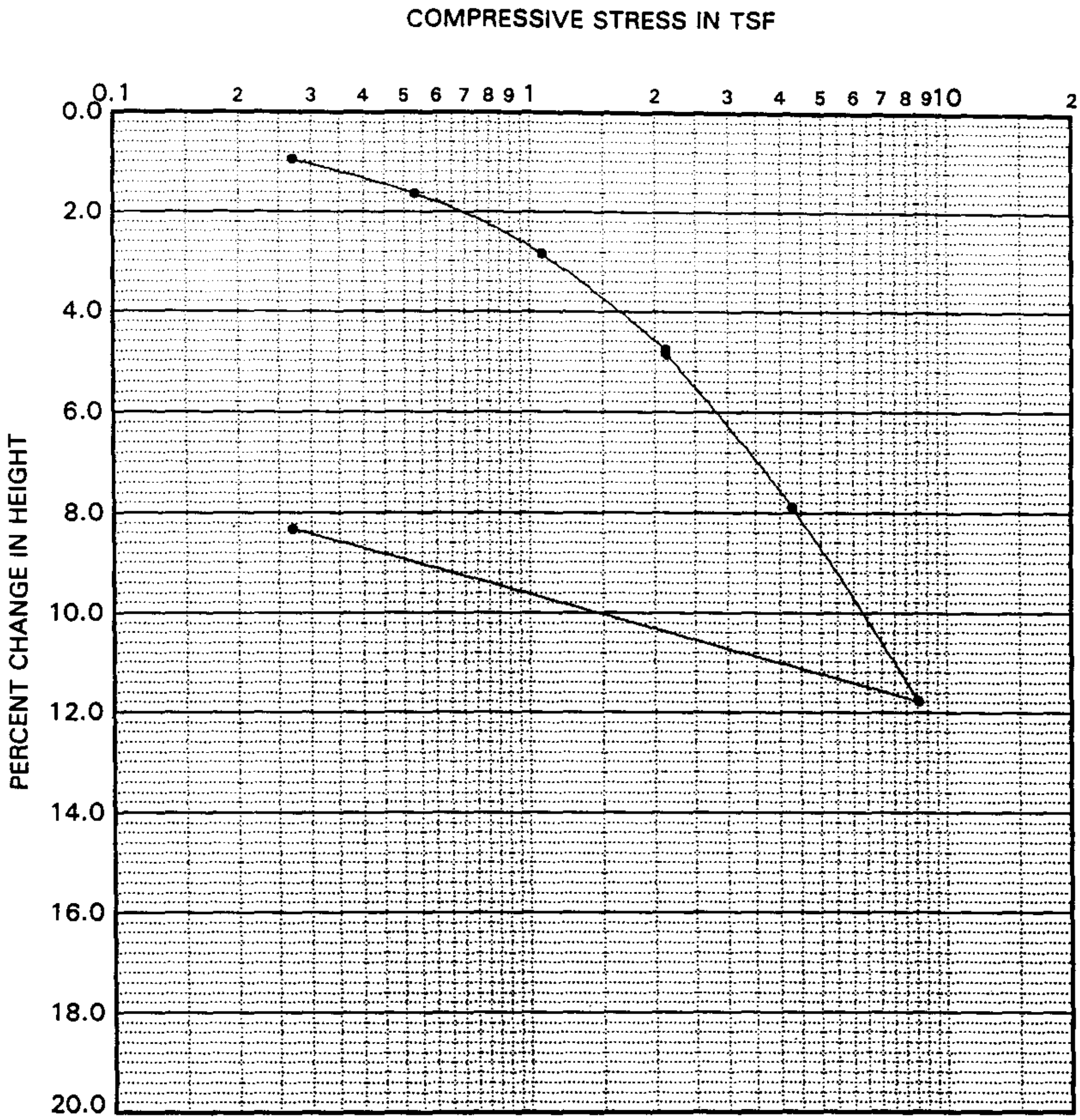
boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-04	25.0	93.2	32.3	80	ML	Clayey Silt

REMARKS: WATER ADDED AT 1.07 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 **PLATE B-7**



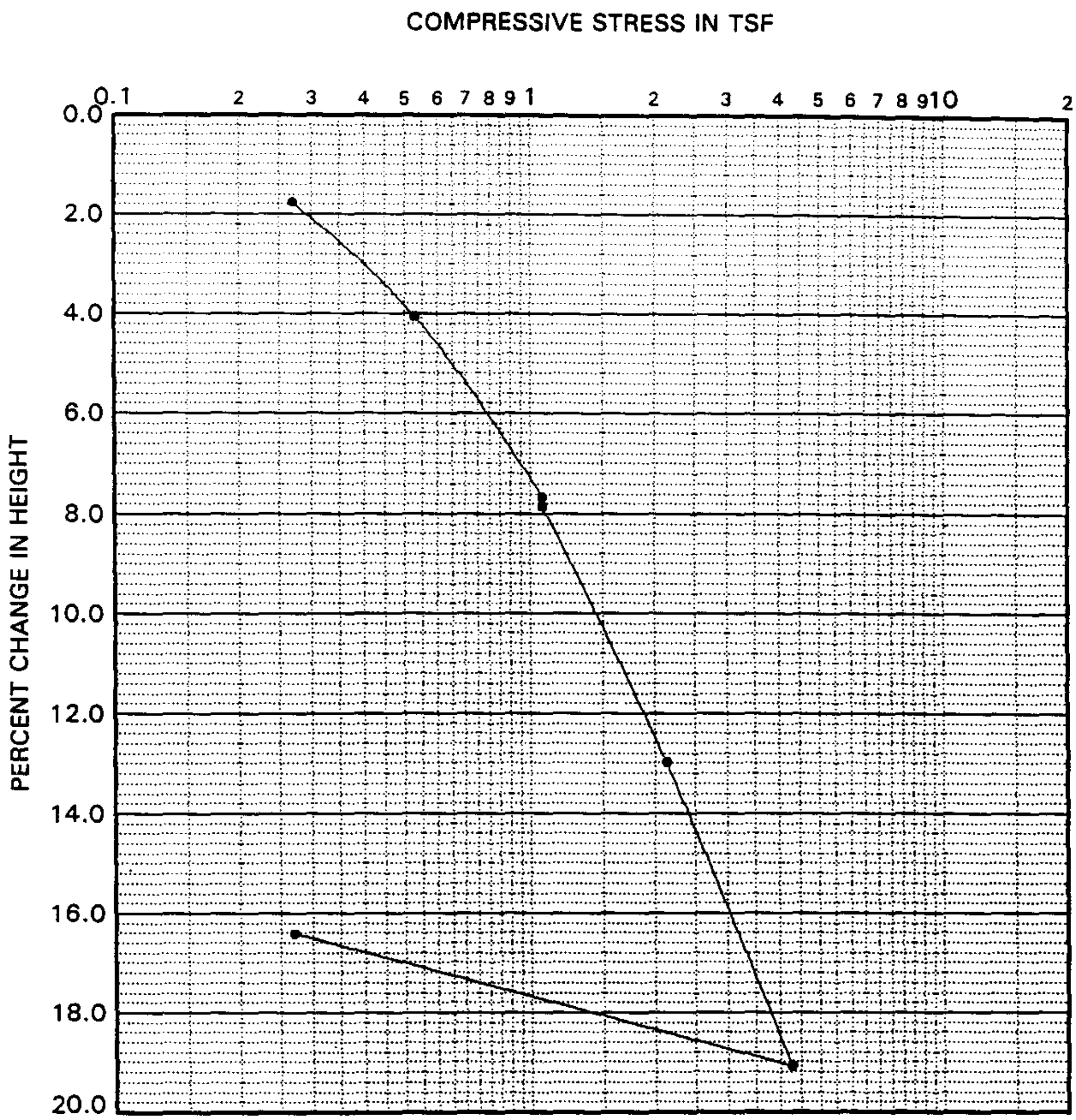
boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-04	55.0	81.1	41.8	100	ML	Clayey Silt

REMARKS: WATER ADDED AT 2.13 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122
W.O. 500464 PLATE B-8

A-93



boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-05	20.0	57.7	70.8	90	CL	Silty Clay

REMARKS: WATER ADDED AT 1.07 TSF

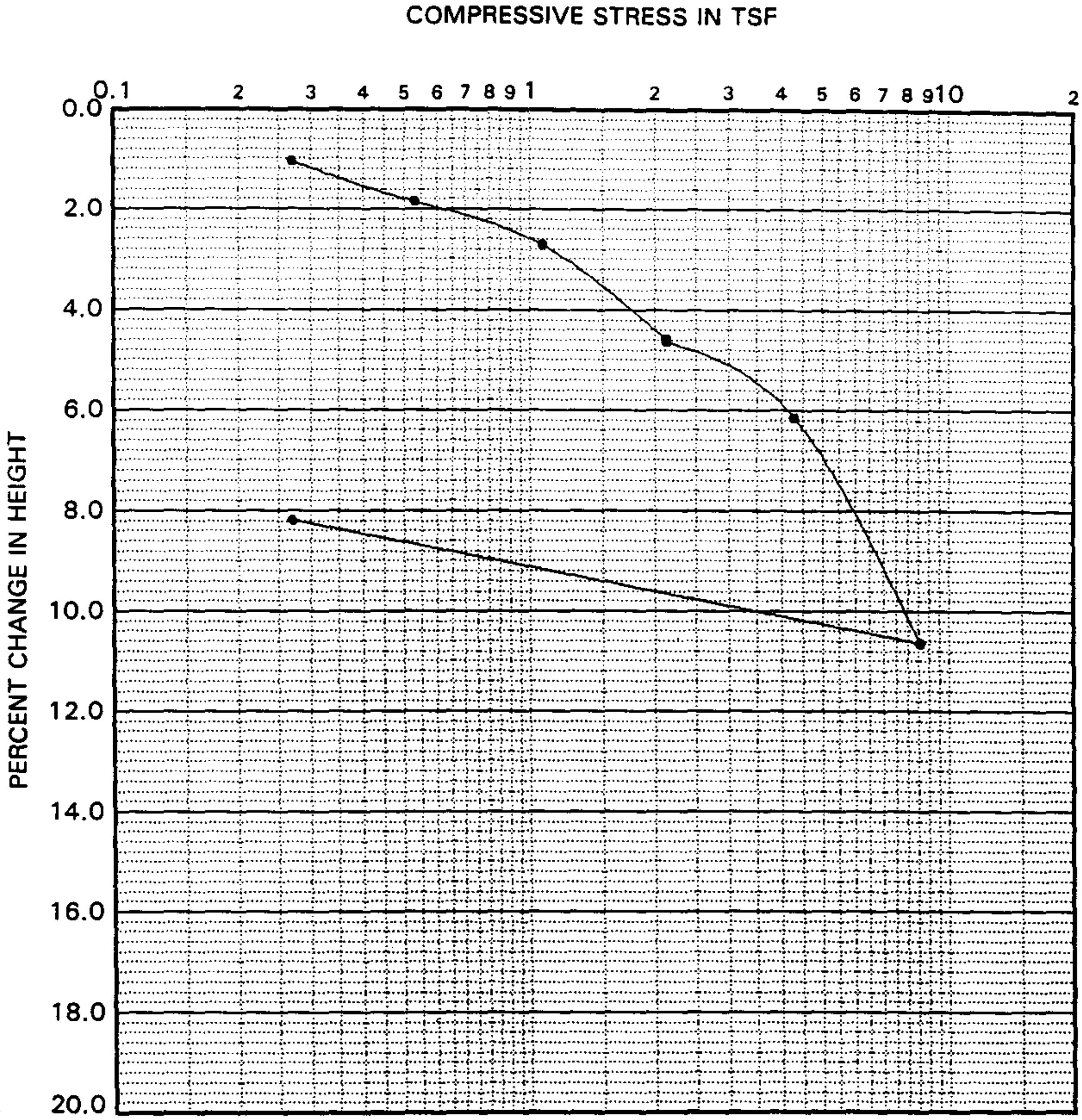
CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.

3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 **PLATE B-9**

A-94



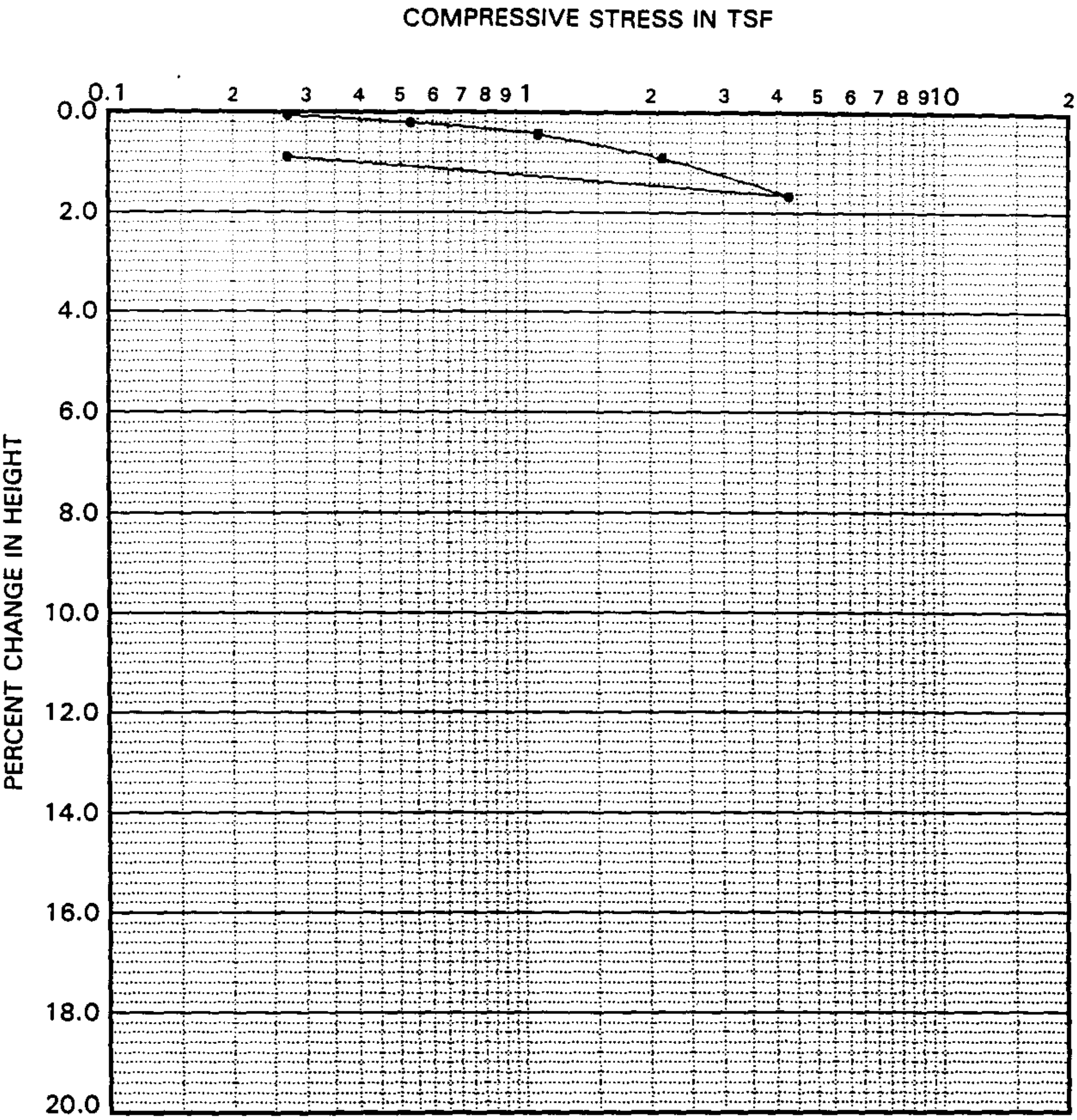
boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-05	55.0	93.1	29.7	98	ML	Clayey Silt

REMARKS: WATER ADDED AT 2.13 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 PLATE B-10



boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-06	30.0	93.2	31.4	68	ML	Sandy Silt

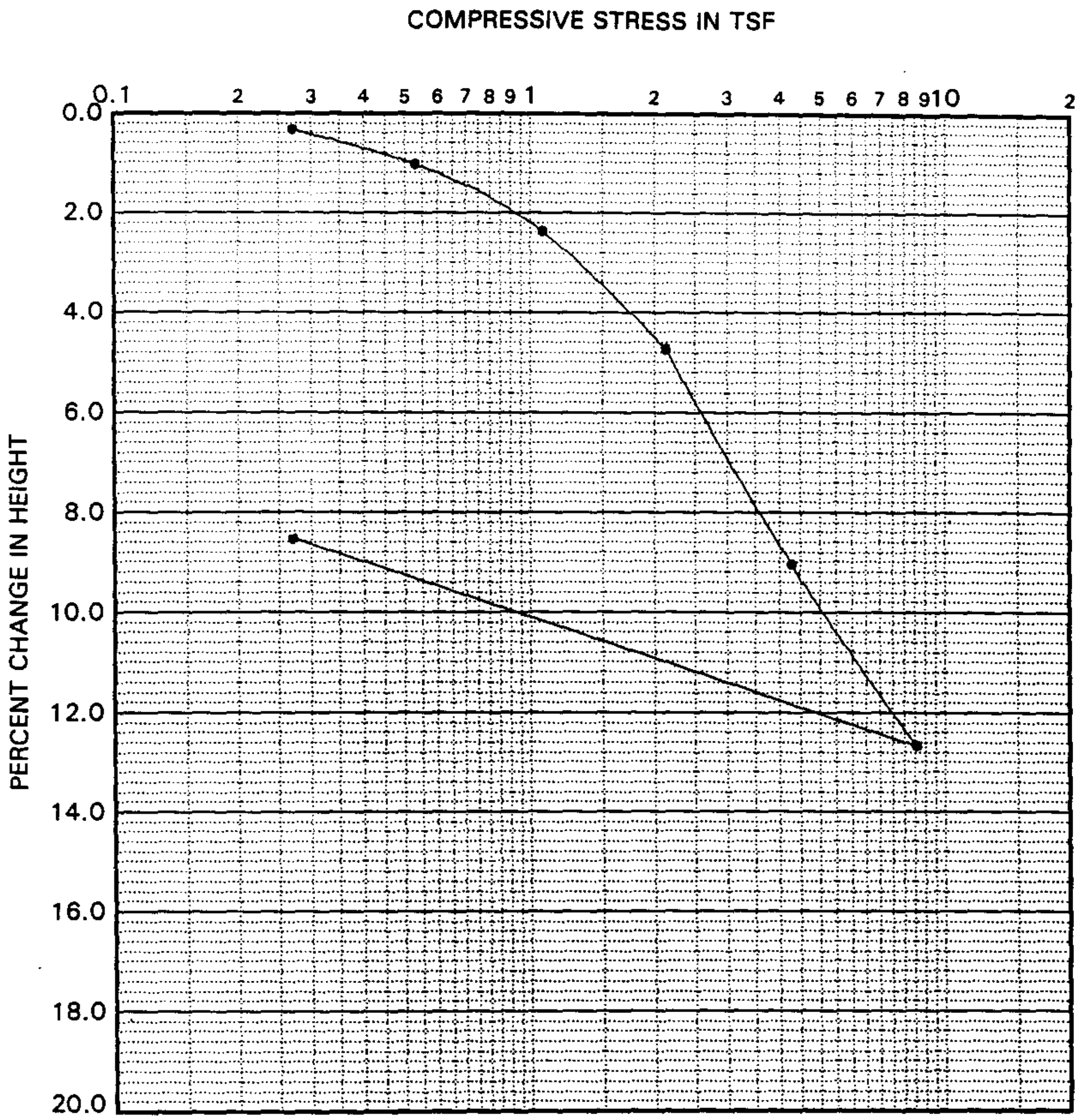
REMARKS: WATER ADDED AT 1.07 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.

3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 **PLATE B-11**



boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-06	45.0	79.1	33.6	98	ML	Clayey Silt

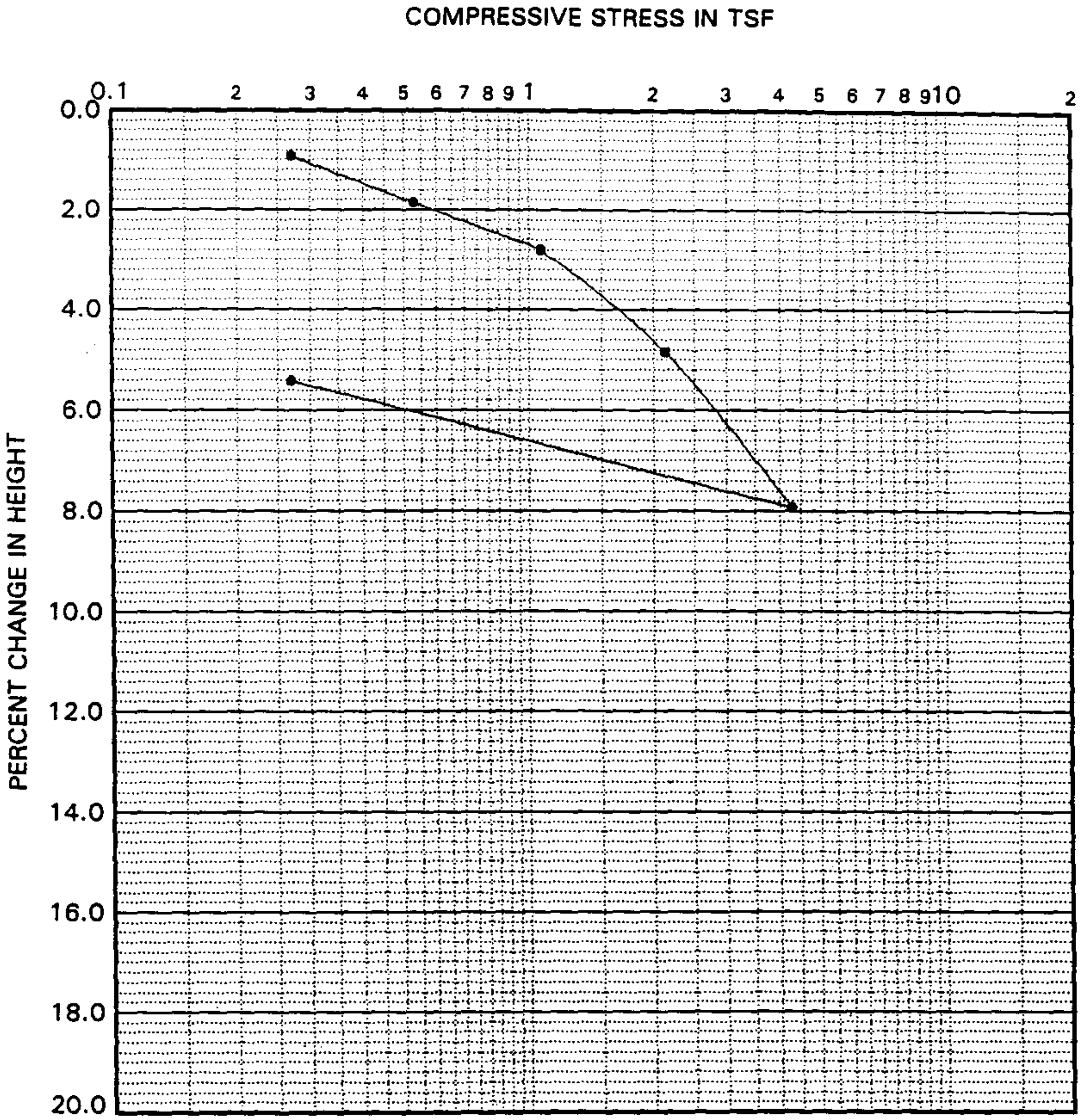
REMARKS: WATER ADDED AT 2.13 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.

3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 PLATE B-12



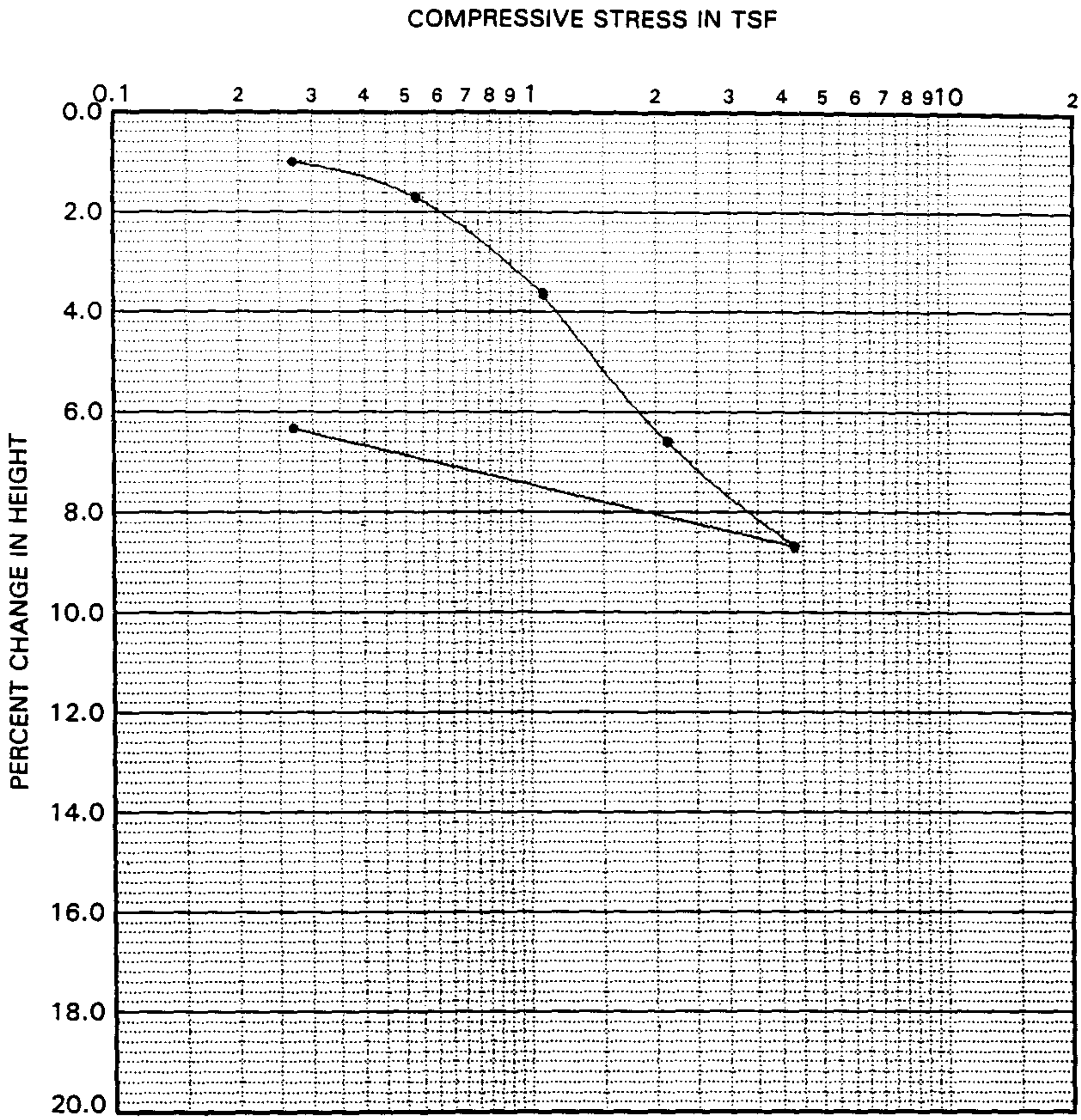
boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-07	25.0	107.3	20.5	62	ML	Clayey Sandy Silt

REMARKS: WATER ADDED AT 1.07 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 PLATE B-13

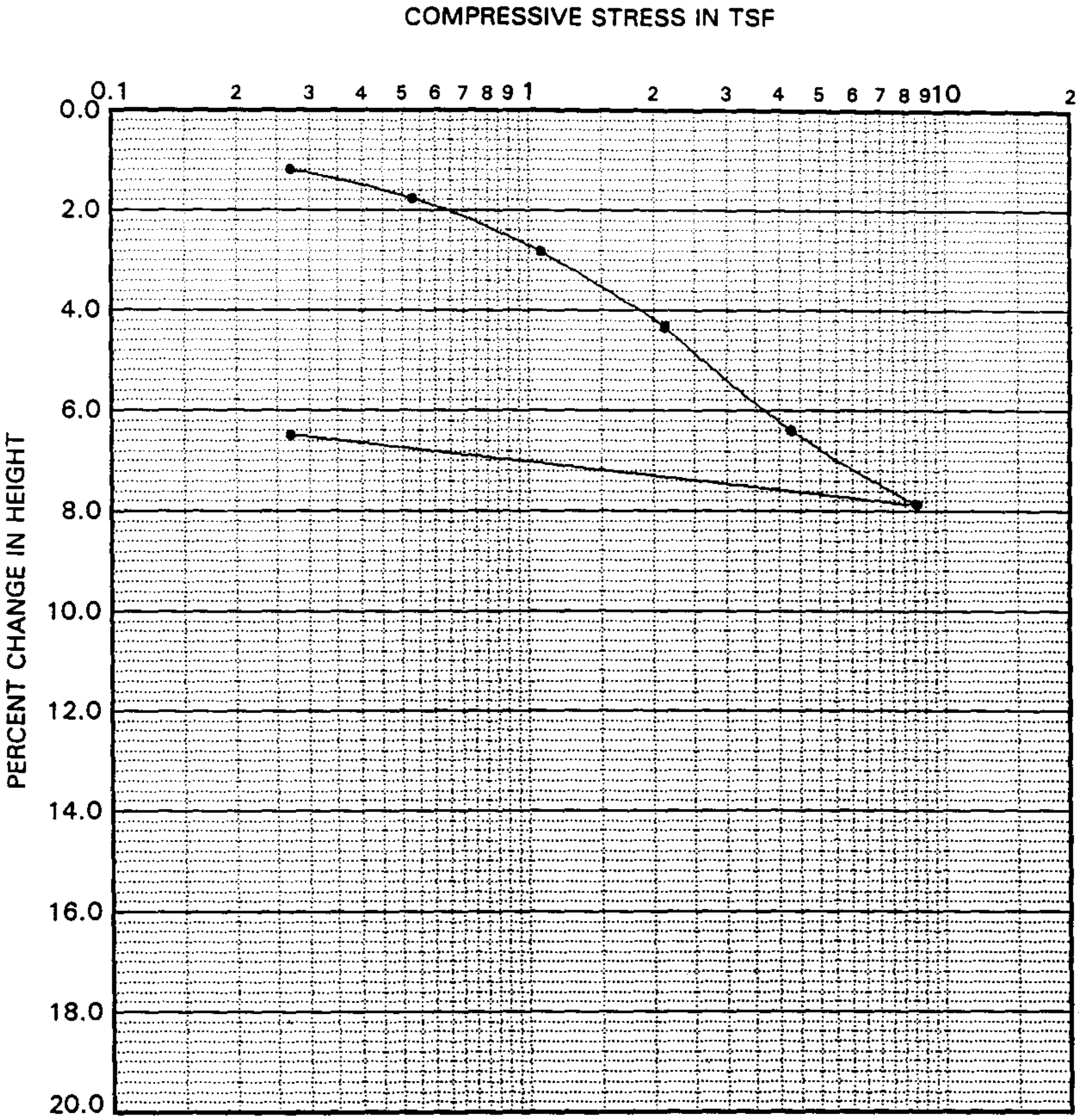


boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-08	20.0	71.3	41.5	98	ML	Clayey Silt

REMARKS: WATER ADDED AT 1.07 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122
W.O. 500464 **PLATE B-14**



boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-08	40.0	87.2	35.8	100	ML	Clayey Silt

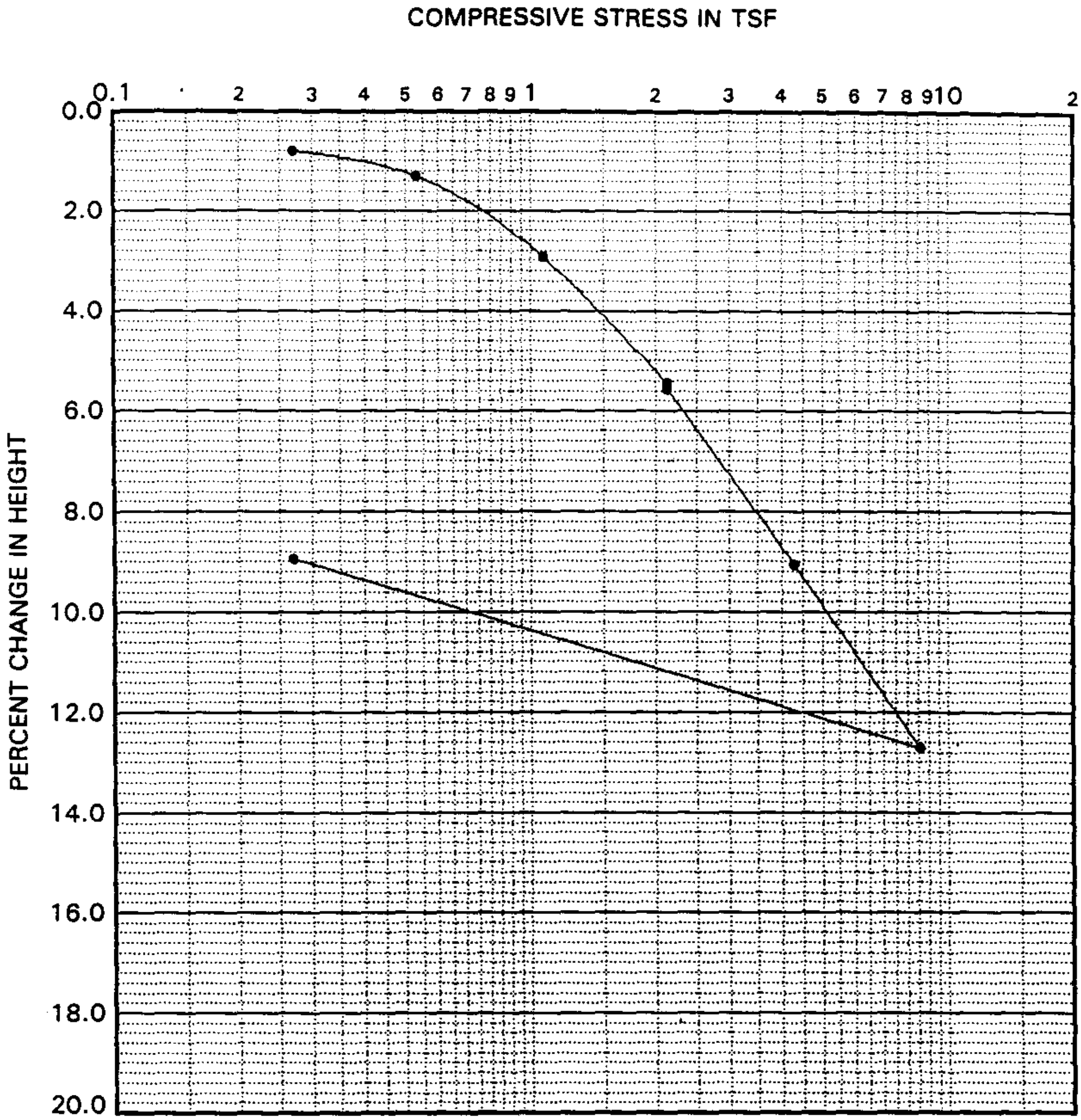
REMARKS: WATER ADDED AT 2.13 TSF

CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 PLATE B-15

A-100



boring	depth (ft.)	dry density	in situ moist.	-200 sieve	group symbol	typical names
B-08	55.0	87.9	34.2	95	ML	Clayey Silt

REMARKS: WATER ADDED AT 2.13 TSF

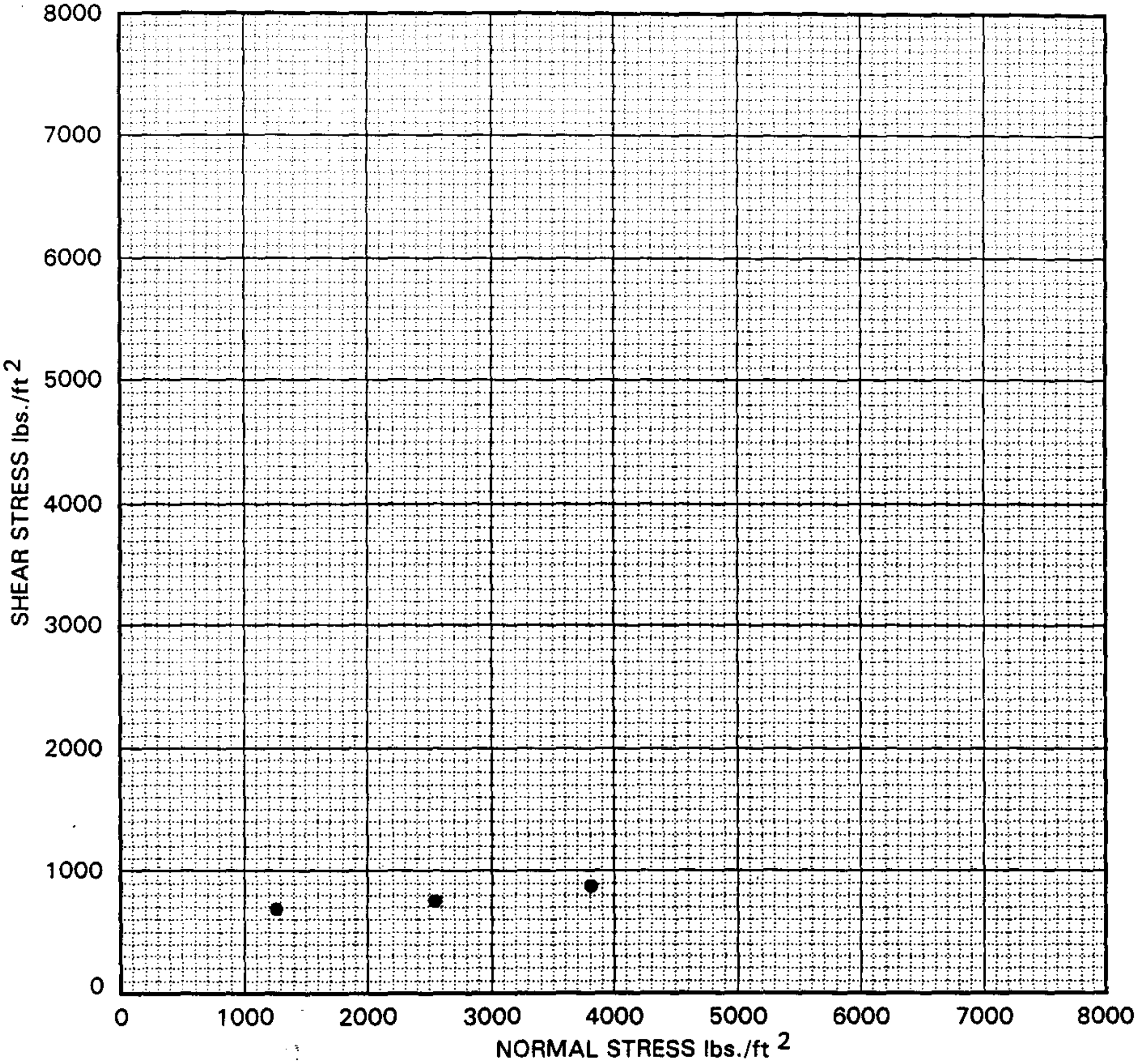
CONSOLIDATION CURVE

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 PLATE B-16

A-101

DIRECT SHEAR TEST
Undisturbed



Silty Sand/Sandy Silt	COHESION	600 psf.
SM/ML	FRICTION ANGLE	5.0 degrees

symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	B-01	15.00			

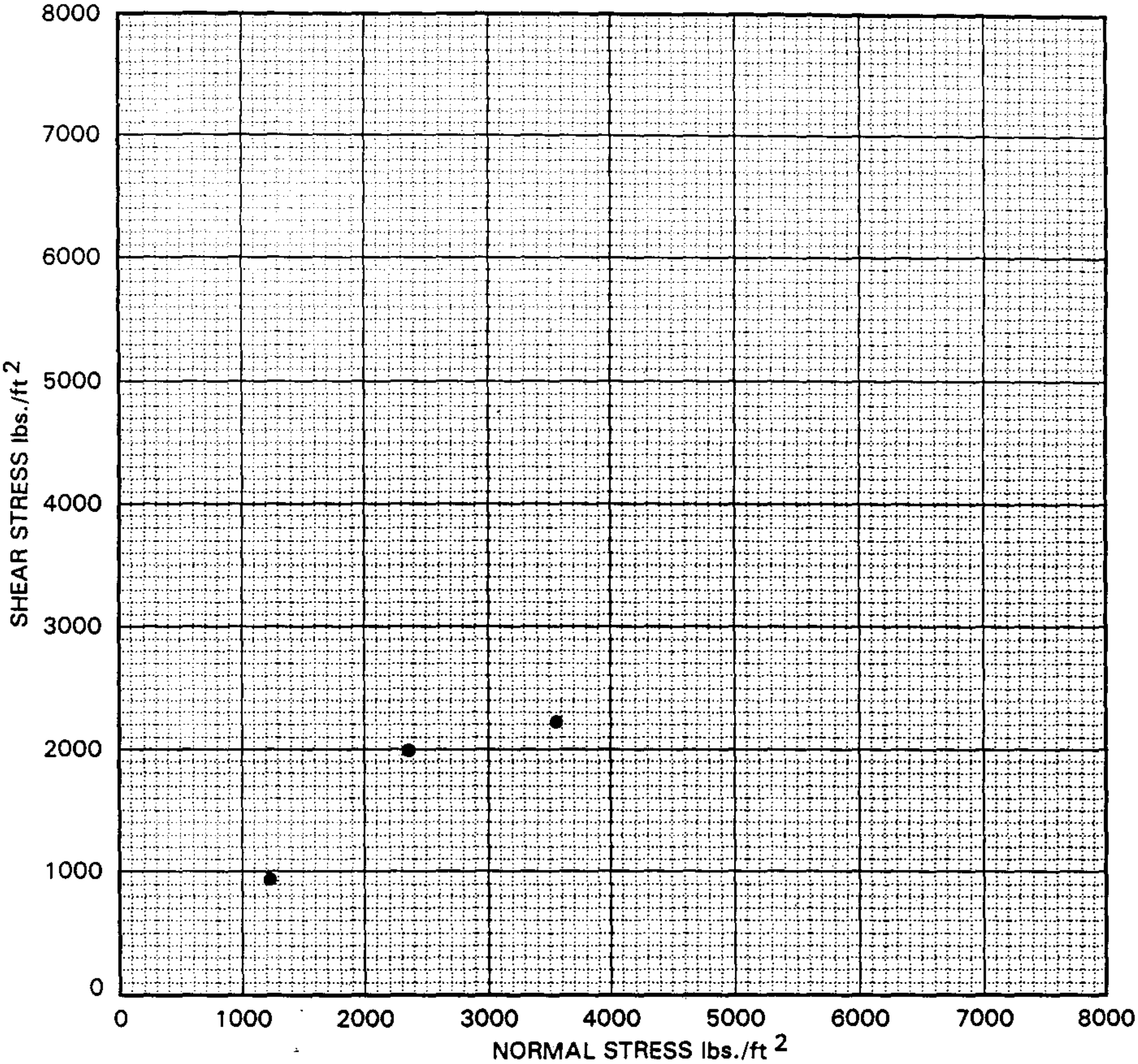
DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 **PLATE B-22**

A-102

DIRECT SHEAR TEST
Remolded



	COHESION 450 psf.
	FRICTION ANGLE 28.0 degrees

symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	B-02	5.00			

DIRECT SHEAR TEST

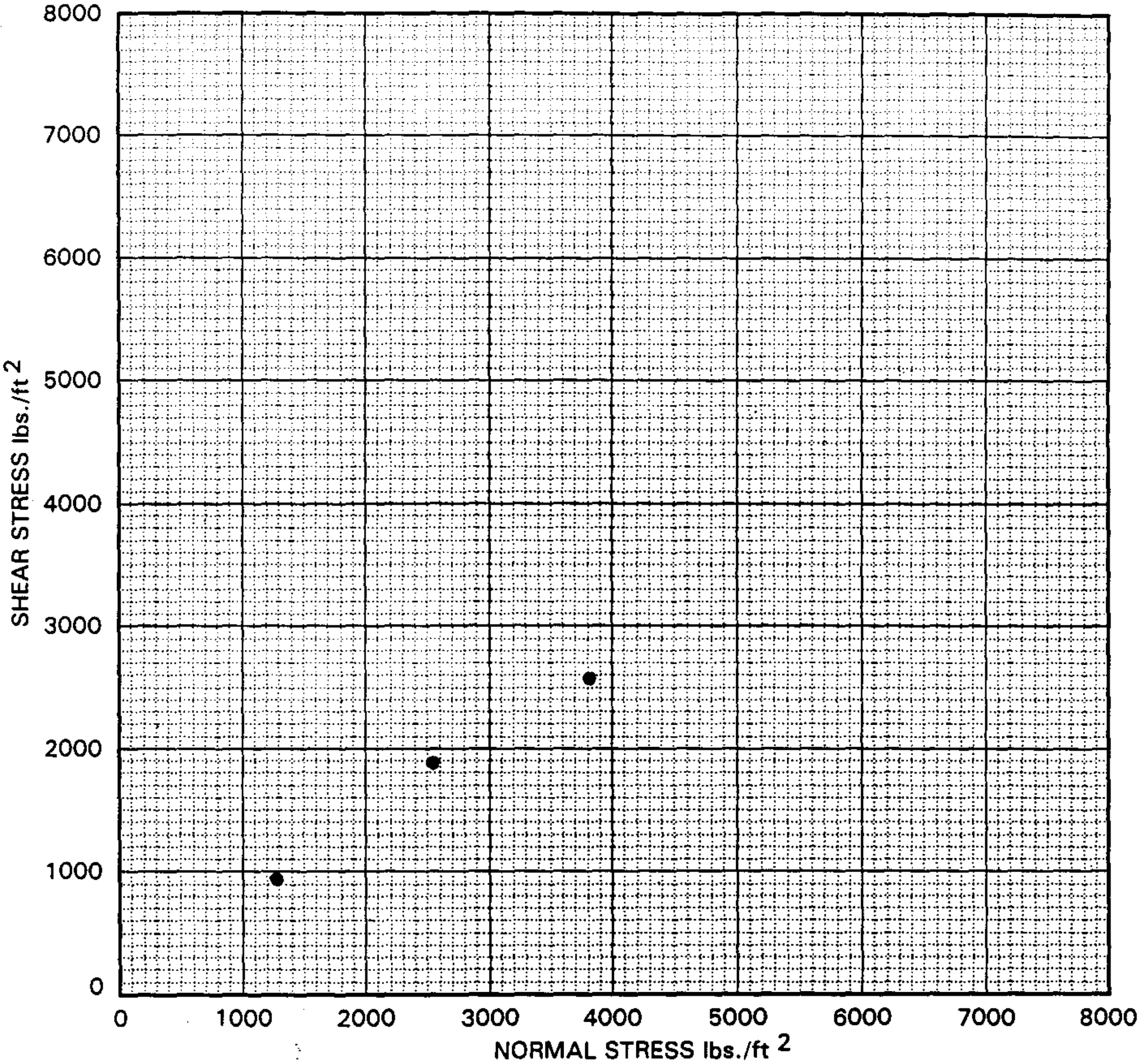
PACIFIC SOILS ENGINEERING, INC.

3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 **PLATE B-23**

A-103

DIRECT SHEAR TEST
Undisturbed



Sand	COHESION 200 psf.
SP	FRICTION ANGLE 32.0 degrees

symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	B-04	65.00			

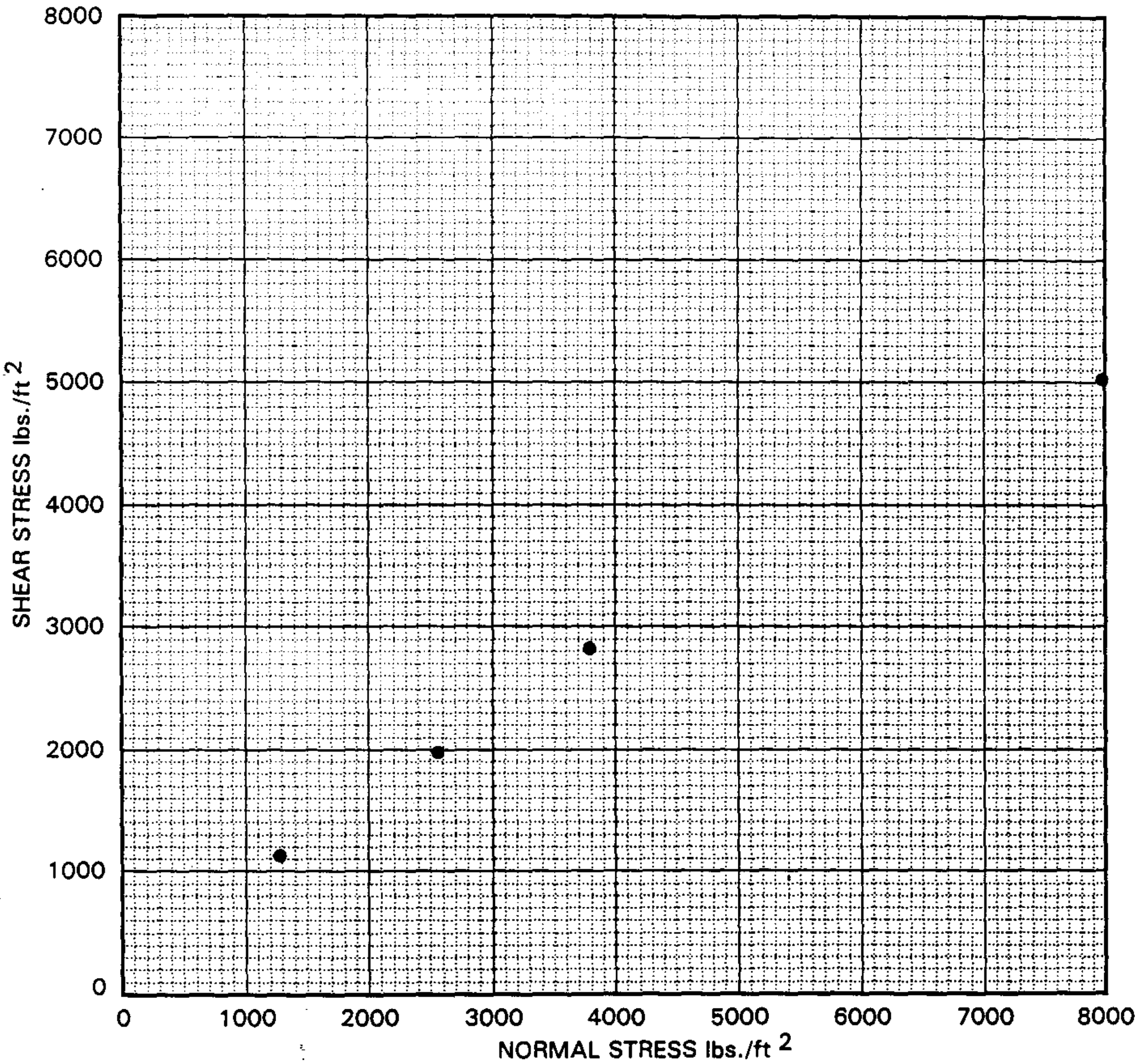
DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 **PLATE B-24**

A-104

DIRECT SHEAR TEST
Undisturbed



Sand		COHESION	psf.
SP		FRICTION ANGLE	degrees

symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	B-06	70.00			

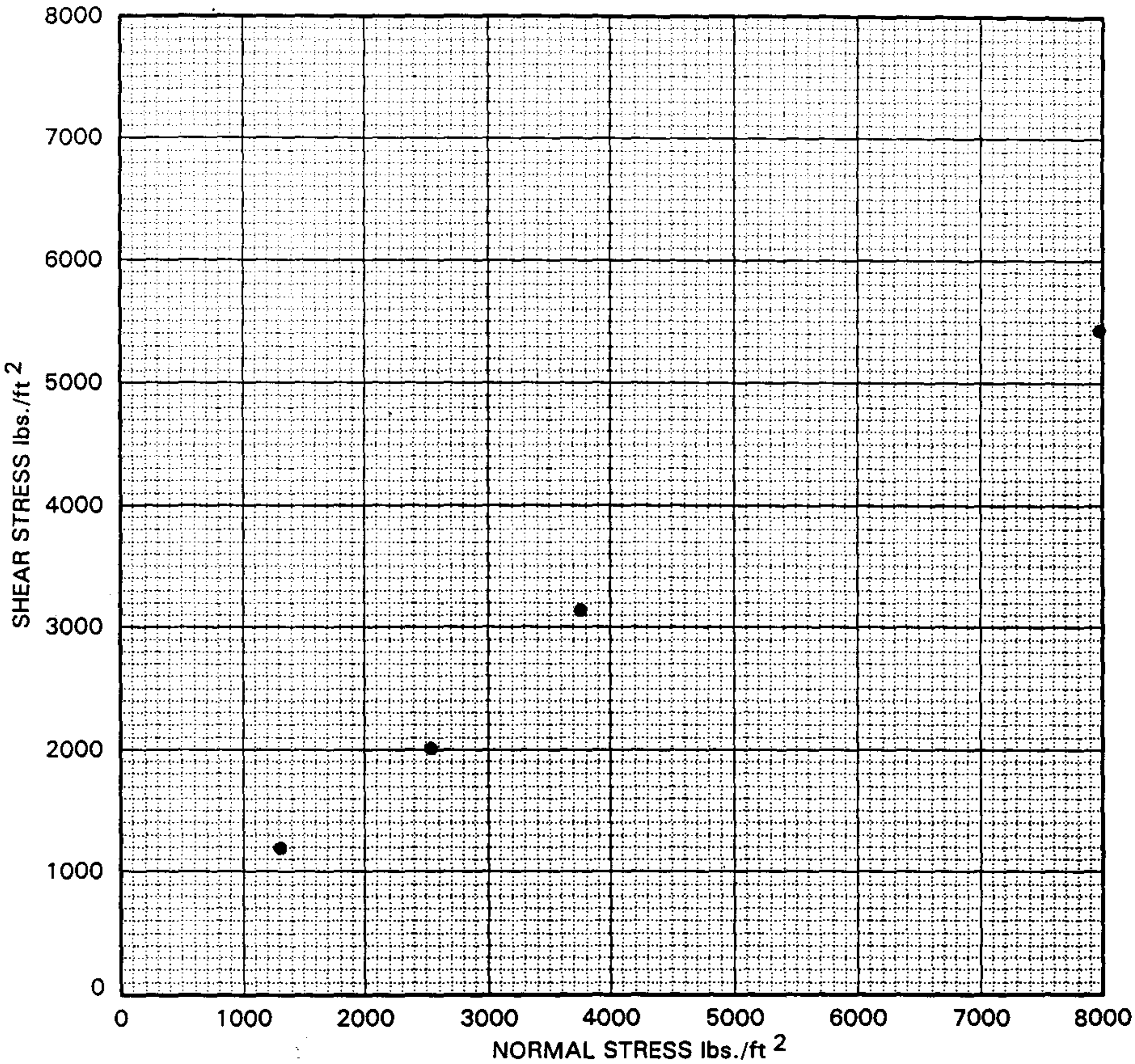
DIRECT SHEAR TEST

PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 PLATE B-25

A-105

DIRECT SHEAR TEST
undisturbed



Sand	COHESION 400 psf.
SP	FRICTION ANGLE 33.0 degrees

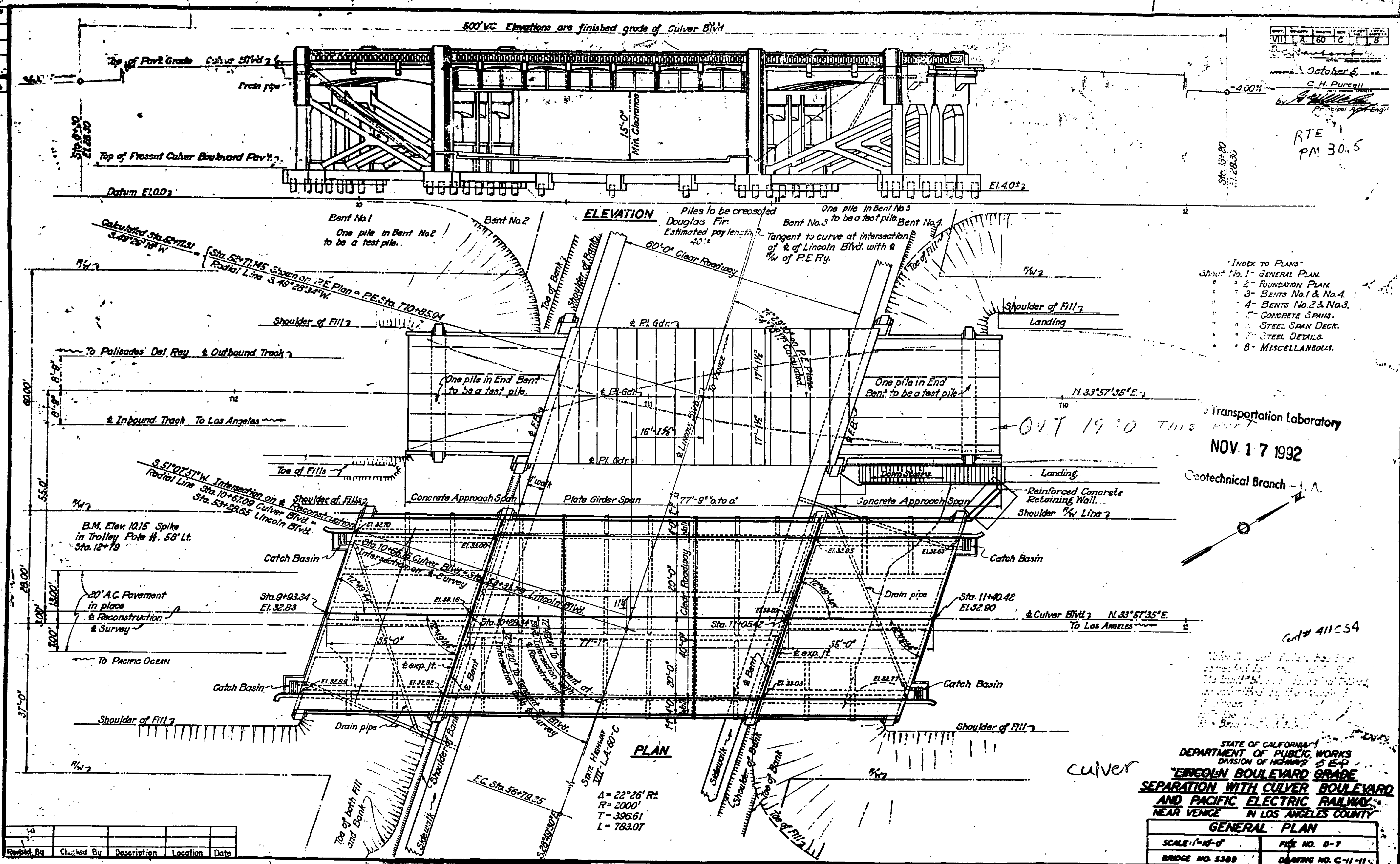
symbol	boring	depth (ft.)	symbol	boring	depth (ft.)
●	8-08	65.00			

DIRECT SHEAR TEST

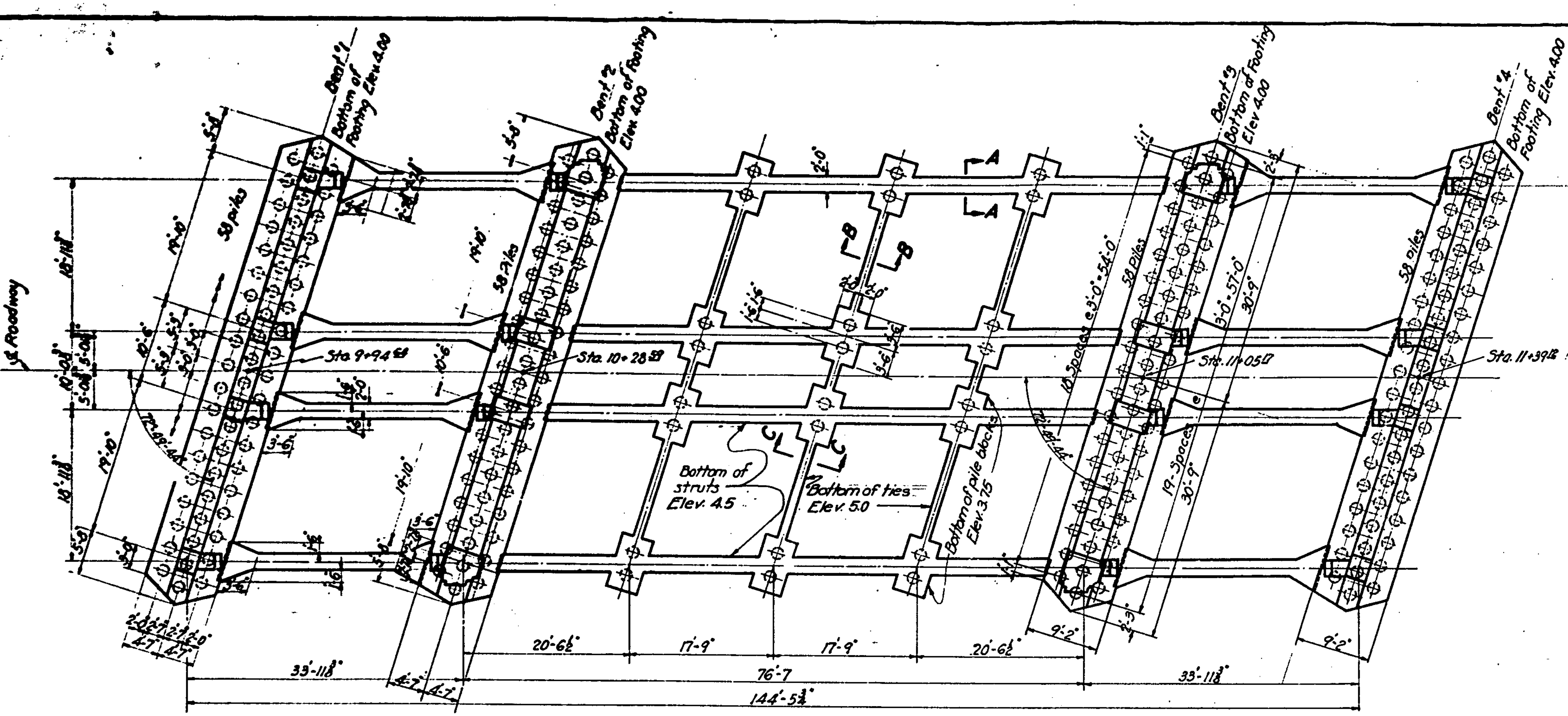
PACIFIC SOILS ENGINEERING, INC.
3002 DOW AVE., TUSTIN, CA 92680 714-730-2122

W.O. 500464 **PLATE B-26**

APPENDIX C
RELEVANT AS-BUILT DRAWINGS



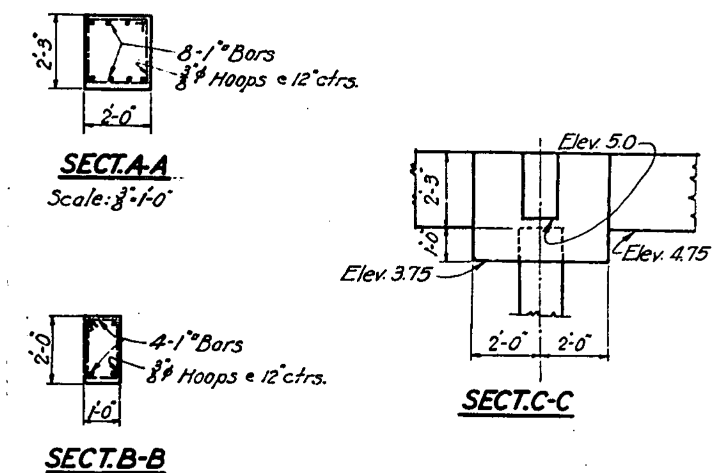
AS BUILT PLANS
Contract No. 411C54



FOUNDATION PLAN

Scale: ⅛" = 1'-0"

Pile spacing the same for all bents.

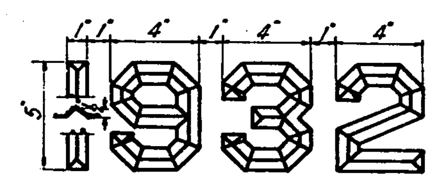


SECT. A-A

Scale: ⅜" = 1'-0"

SECT. B-B

SECT. C-C



Date to be recessed into curbs. One at each end of bridge on the right hand side as approached.

DATE

GENERAL NOTES

Rails and posts to be class "E" concrete. Class "F" concrete in bottom of beams to be paid for as class "A" concrete. See Section 26 Standard Specifications. All other concrete to be class "A" concrete.

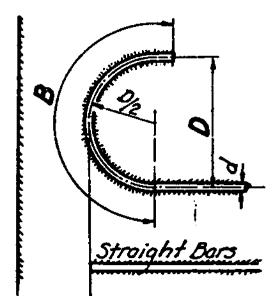
All exposed edges to be chamfered 1" except rail posts which shall be chamfered ½".

All reinforcing steel to be intermediate grade deformed bars. Unless otherwise shown they shall be embedded at least two diameters and where spliced to lap at least 45 diameters.

All piles to be treated douglas fir. See Sect. 39 and 40 Stand. Specifications. Minimum bearing value per pile to be 22 tons. Minimum penetration to be 12'. One pile in bent #2 and #3 to be used as a test pile. Length of piles for estimating purposes taken as 30'.

Design, fabrication and construction to conform with the Special Provisions for this project and the Standard Specifications of the California State Dept. of Public Works, Division of Highways, dated Jan. 1930.

H-15 Loading is used throughout.



SIZE	D	B
⅜	2	5
½	2½	6
⅝	3	7
¾	3¾	8
⅞	4½	9
1	5	10½
1⅛	5½	11½
1¼	6¼	12

Backing to be 4d for all bars except of those in the bottom of girders which shall be 2d.

BAR DATA

DIST	COUNTY	ROUTE	SEC	SHEET NO	TOTAL SHEETS
VII	L.A.	60	C	2	8

October 5

Transportation Laboratory

NOV 17 1992

Geotechnical Branch

Culver

AS BUILT PLANS
Contract No. 411C54
Date Completed
Document No. 7000 2622

LOCATION	REVISION	DATE	BY	CH'D

BRIDGE ACROSS LINCOLN BLVD.

FOUNDATION PLAN

SCALE AS SHOWN FILE NO.

BRIDGE NO. 5389 DRAWING NO. C-11-12

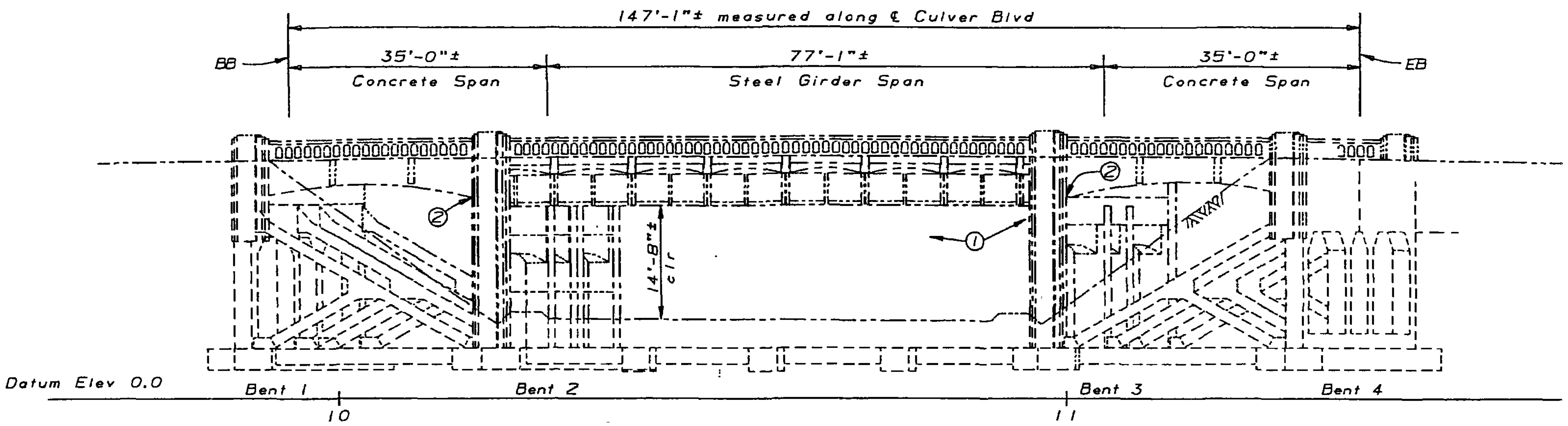
DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	LA	1, 90, 405	Var	166	167

REGISTERED ENGINEER - CIVIL

REGISTERED PROFESSIONAL ENGINEER M.Z. HALEEM No. 24743 Exp. 12-31-97 CIVIL STATE OF CALIFORNIA

9-19-94
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.



ELEVATION

1" = 10'

- CULVER BLVD. OVERCROSSING 53-89

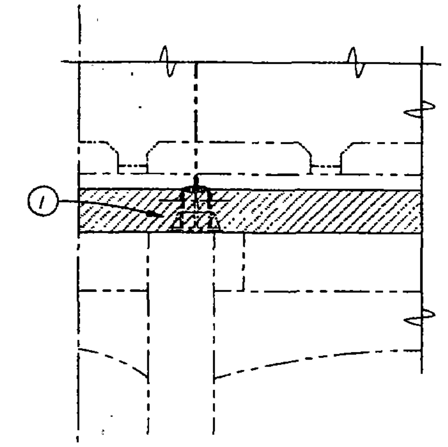
QUANTITIES

STRUCTURAL CONCRETE, BRIDGE	34	CY
DRILL AND BOND DOWEL	134	LF
CORE CONCRETE (1")	265	LF
REPLACE BEARINGS LOCATION A	8	EA
BAR REINFORCING STEEL (BRIDGE)	7,700	LB

(1) Under steel girders only. Replace bearing & sole plate with concrete seat extension & bearing pad.

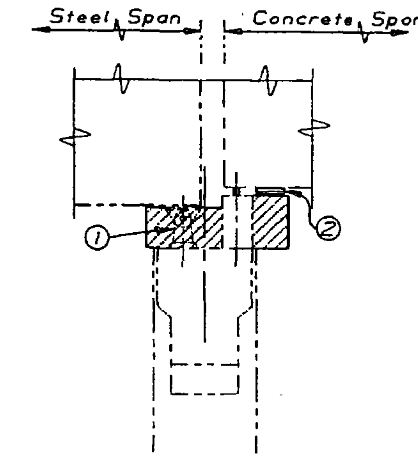
(2) Under concrete girders. Install new Elastomeric Brg Pads on concrete seat extensions.

▨ Indicates concrete seat extension



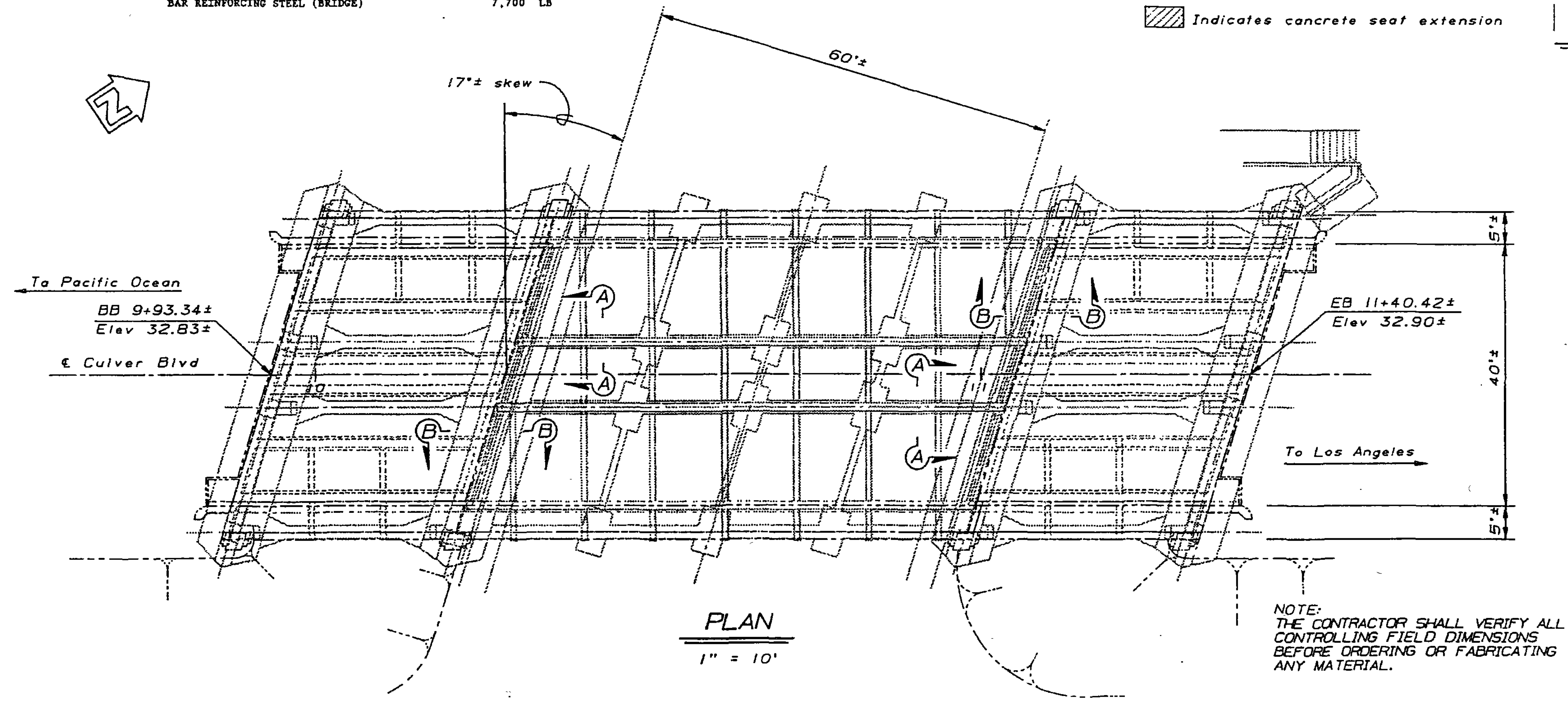
SECTION A-A

1/4" = 1'-0"



SECTION B-B

1/4" = 1'-0"



PLAN

1" = 10'

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

INDEX TO PLANS

SHEET NO.	TITLE
1	General Plan
2	Bent 2 & 3 Details

GENERAL NOTES
LOAD FACTOR DESIGN

DESIGN: BRIDGE DESIGN SPECIFICATIONS (1983 AASHTO with Interims and Revisions by CALTRANS)

SEISMIC LOADING: Peak Rock Acceleration = 0.7 g
Depth of Alluvium ≥ 150 ft.

REINFORCED CONCRETE: (EXIST) f_y = 40,000 psi
f'_c = 5,000 psi
n = 9

(NEW CONST) f_s = 60,000 psi
f'_c = 4,000 psi
n = 9

STRUCTURAL STEEL: f_y = 36,000 psi

NO CORRECTIONS THIS SHEET

AS BUILT

CORRECTIONS BY H.D.HILL /RJE

CONTRACT NO. 07-119964

DATE 6-12-96/9-9-97

EARTHQUAKE RETROFIT PROJECT NO.198

DESIGN	BY J. Holombo	CHECKED Kien T Le	LOAD FACTOR DESIGN		
DETAILS	BY Rich Kuroko 3-92	CHECKED Kien T Le	LAYOUT	BY J. Holombo	CHECKED Kien T Le
QUANTITIES	BY Loi Fong	CHECKED Doe Yoo 1-94	SPECIFICATIONS	BY	PLANS AND SPECS COMPARED

DESIGN ENGINEER Ramin Rashedi

STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 11

BRIDGE NO. 53-89
POST MILE 30.47

CULVER BOULEVARD OVERCROSSING
GENERAL PLAN

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

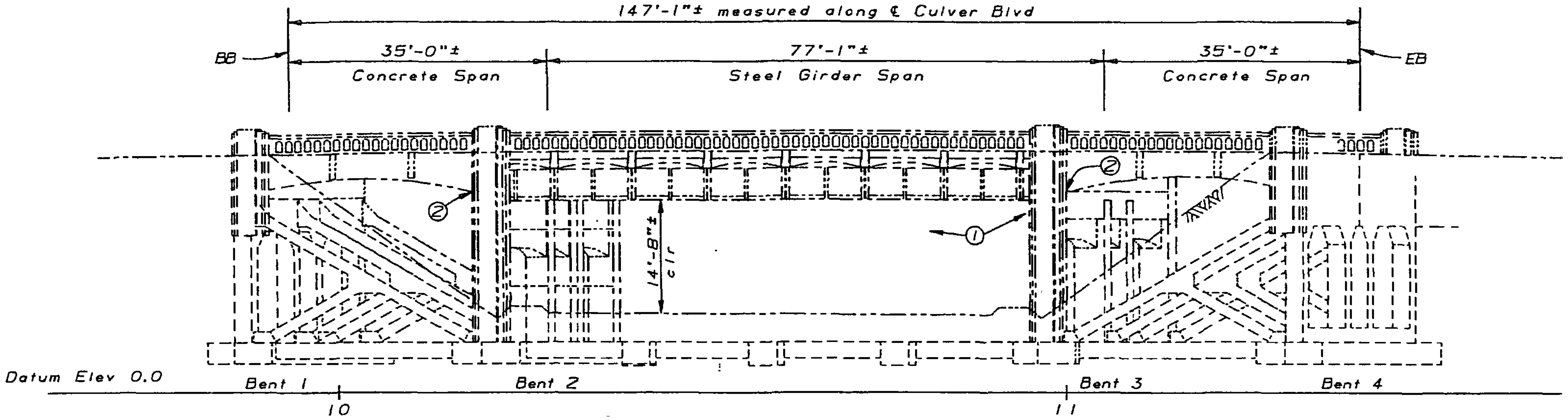
CU 07
EA 119961

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES (PRELIMINARY STAGE ONLY)

SHEET 1 OF 2

DS OSD 2138 (CADD 4/89)



ELEVATION

1" = 10'

- CULVER BLVD. OVERCROSSING 53-89

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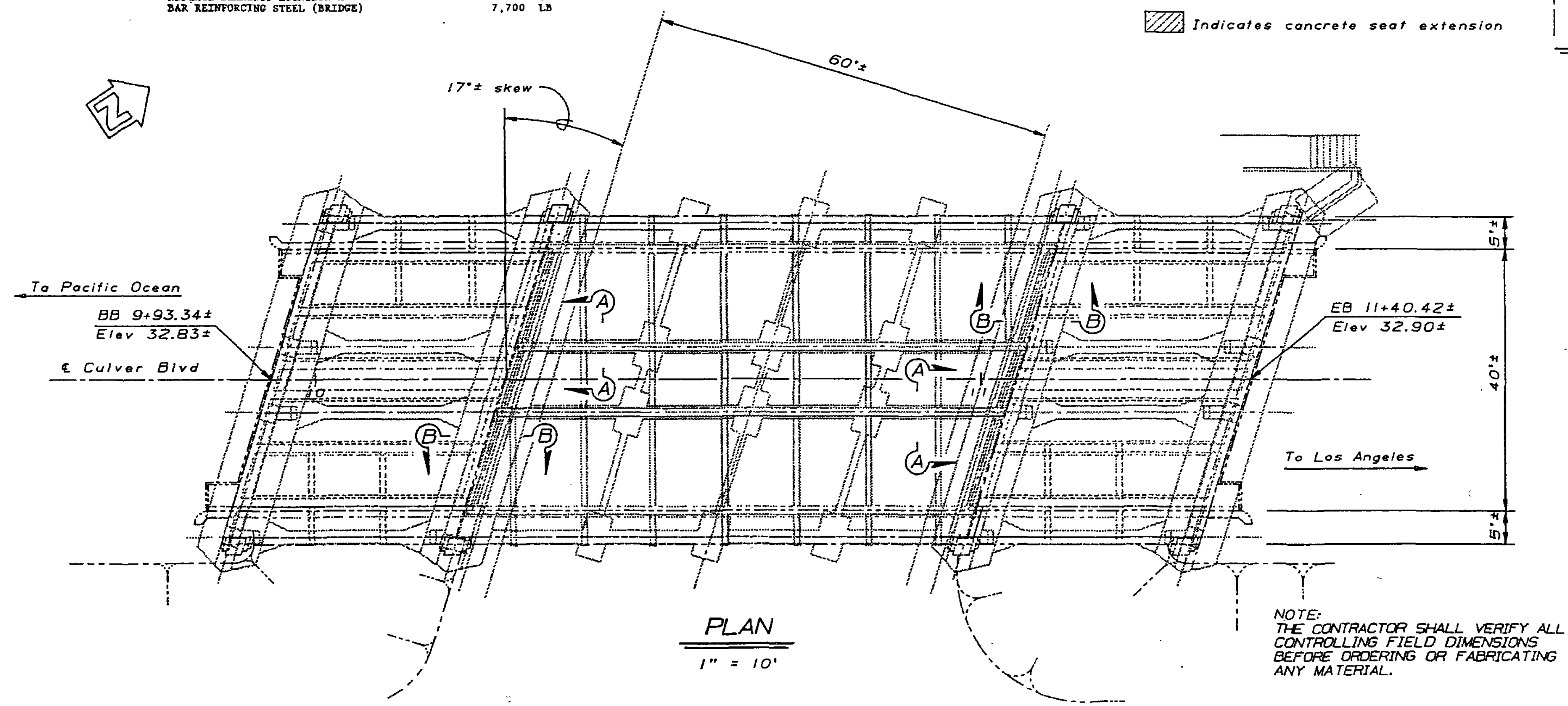
Indicates concrete seat extension



PLAN

1" = 10'

NOTE:
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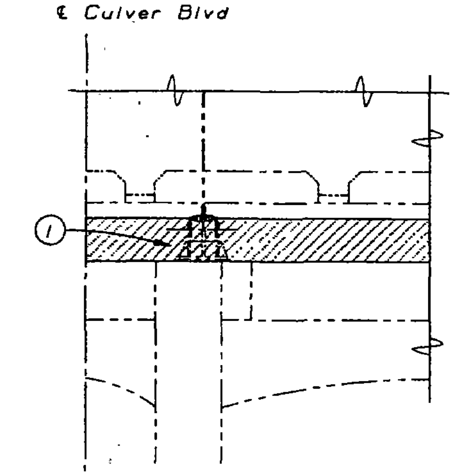
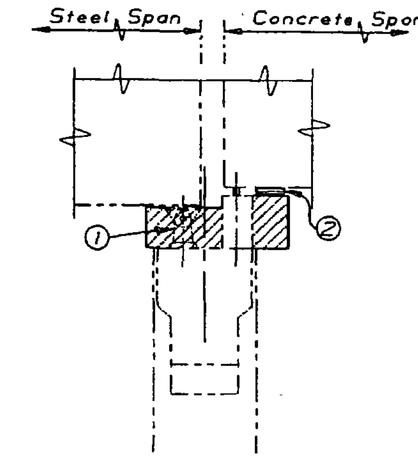


SECTION A-A

1/4" = 1'-0"



SECTION B-B

1/4" = 1'-0"

DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	LA	1, 90, 405	Var	166	167

M.Z. Haleem
REGISTERED ENGINEER - CIVIL

REGISTERED PROFESSIONAL ENGINEER M.Z. HALEEM No. 24743 Exp. 12-31-97 CIVIL STATE OF CALIFORNIA

9-19-94
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REINFORCED CONCRETE: (EXIST) f_y = 40,000 psi; f'_c = 5,000 psi; n = 9

(NEW CONST) f_s = 60,000 psi; f'_c = 4,000 psi; n = 9

STRUCTURAL STEEL: f_y = 36,000 psi

NO CORRECTIONS THIS SHEET
AS BUILT
CORRECTIONS BY H.D.HILL / RJE
CONTRACT NO. 07-119964
DATE 6-12-96 / 9-9-97

EARTHQUAKE RETROFIT PROJECT NO.198

DESIGN	BY J. Holombo	CHECKED Kien T Le	LOAD FACTOR DESIGN			
DETAILS	BY Rich Kuroko 3-92	CHECKED Kien T Le	LAYOUT	BY J. Holombo	CHECKED Kien T Le	
QUANTITIES	BY Loi Fong	CHECKED Doe Yoo 1-94	SPECIFICATIONS	BY	PLANS AND SPECS COMPARED	

Ramin Rashedi
DESIGN ENGINEER

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF STRUCTURES
STRUCTURE DESIGN 11

BRIDGE NO. 53-89
POST MILE 30.47

CULVER BOULEVARD OVERCROSSING
GENERAL PLAN

DS OSD 2138 (CADD 4/89)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 07
EA 119961

DISREGARD PRINTS BEARING EARLIER REVISION DATES

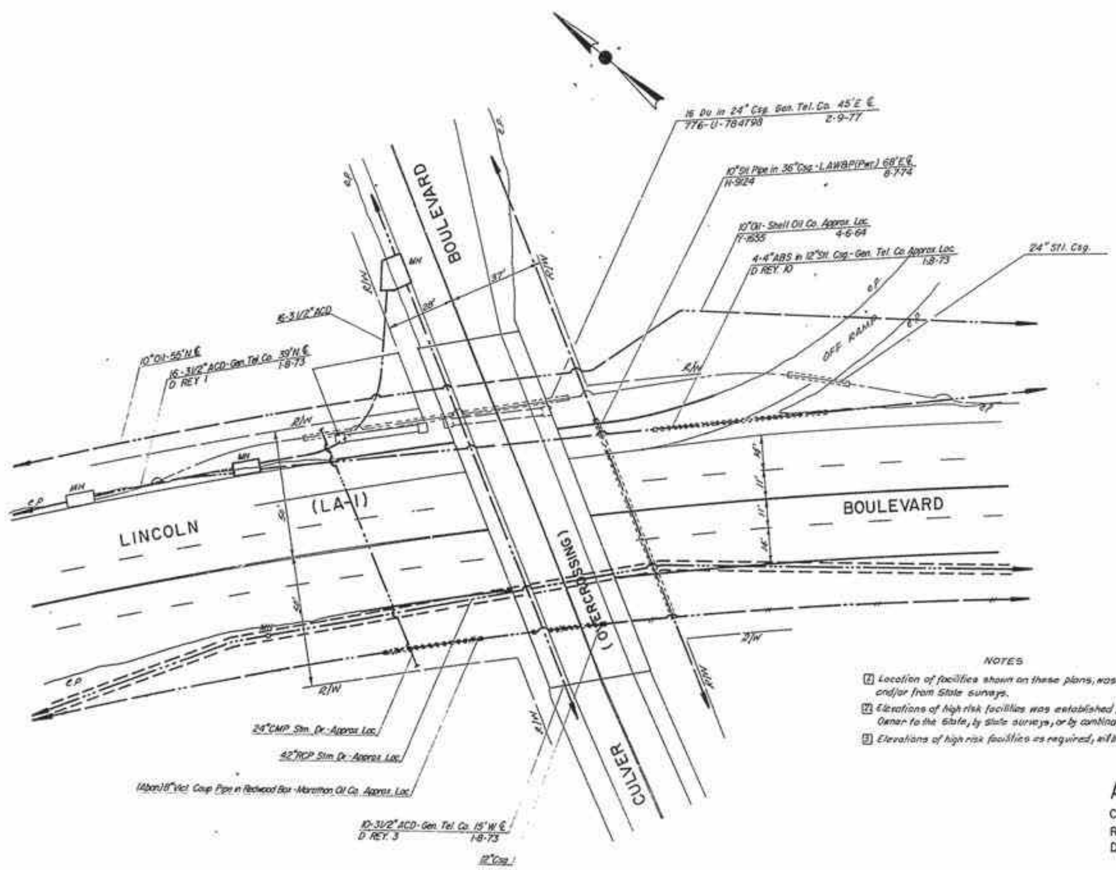
REVISION DATES (PRELIMINARY STAGE ONLY): 3-30-92, 4-1-92, 2-4-93, 2-9-93, 12-9-93, 8-8-94, 8-12-94

SHEET 1 OF 2

Dist.	County	Route	Post Miles Total Project	Sheet No.	Total Sheets
07	LA	1	30.3/32.3	4	36

UTILITY ENGINEER — REGISTERED CIVIL ENGINEER NO. C-[illegible]

DATE APPROVED February 6, 1978



NOTES

1. Location of facilities shown on these plans, was obtained either from Owner's records and/or from State surveys.
2. Elevations of high risk facilities was established from information furnished from by the Owner to the State, by State surveys, or by combination of both.
3. Elevations of high risk facilities as required, will be determined at time of construction.

AS BUILT

CONTRACT NO. 07-330104
RESIDENT ENGR. W.J. Steele (ET)
DATE October 15 1979

1927

LOCATION "2"

UTILITY PLAN

LINCOLN BOULEVARD at CULVER BOULEVARD

0 20 40 60 80 100
FEET

4

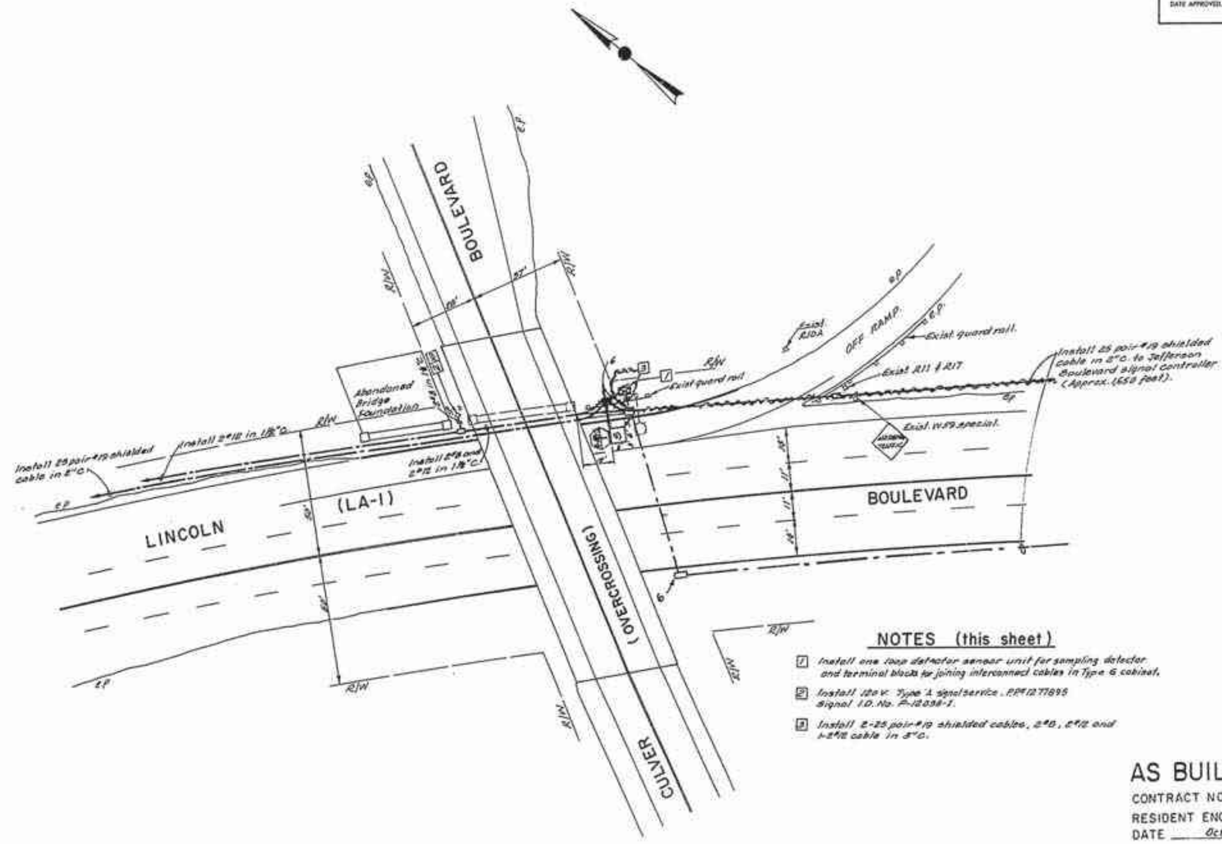
FORM HD 82 PF

07351 330101

AS BUILT PLANS
Contract No. 07-330104
Date Completed 10-15-79
Document No. 7000 8368

Dist	County	Route	Post Miles Total Project	Sheet No.	Total Sheets
07	LA	1	30.3/323	15	36

R. J. Cannon
REGISTERED TRAFFIC ENGINEER NO. 96
DATE APPROVED February 6, 1978



NOTES (this sheet)

1. Install one loop detector sensor unit for sampling detector and terminal blocks for joining interconnect cables in Type 6 cabinet.
2. Install 120 V. Type 'A' signal service. PP#1277895 Signal I.D. No. P-12038-1.
3. Install 2-25 pair #19 shielded cables, 2#8, 2#12 and 1-2#12 cable in 3"C.

AS BUILT

CONTRACT NO 07-330104
RESIDENT ENGR W.J.Steele (B7)
DATE October 15,1979

LOCATION "2"
TRAFFIC SIGNAL PLAN
LINCOLN BOULEVARD at CULVER BOULEVARD

0 20 40 60 80 100 FEET

1927

TRAFFIC	INIT	DATE
DESIGNED	LQ	
TOPO	D.B.	
ELECT	LQ	
TOPO	LQ	
ELECT	BS7	
SIGNING	D.R.	
STRIPING		
AREA CHECK		

NOTE THIS PLAN ACCURATE FOR SIGNALS, LIGHTING, SIGNING, STRIPING AND PAVEMENT MARKINGS

Engineer	Date	Project Engineer	Approval Recommended by	Date
Harry Owen	5/77	Ben Takanouchi		5/77

FORM HD 62 PF

07351 330101

15

AS BUILT PLANS
Contract No. 07-330104
Date Completed 10-15-79
Document No. 7000 8368

DIST	COUNTY	ROUTE	KILOMETER POST TOTAL PROJECT	SHEET NO.	TOTAL SHEETS
07	LA	1	43.9/50.0	19	277

Caltrans Metric

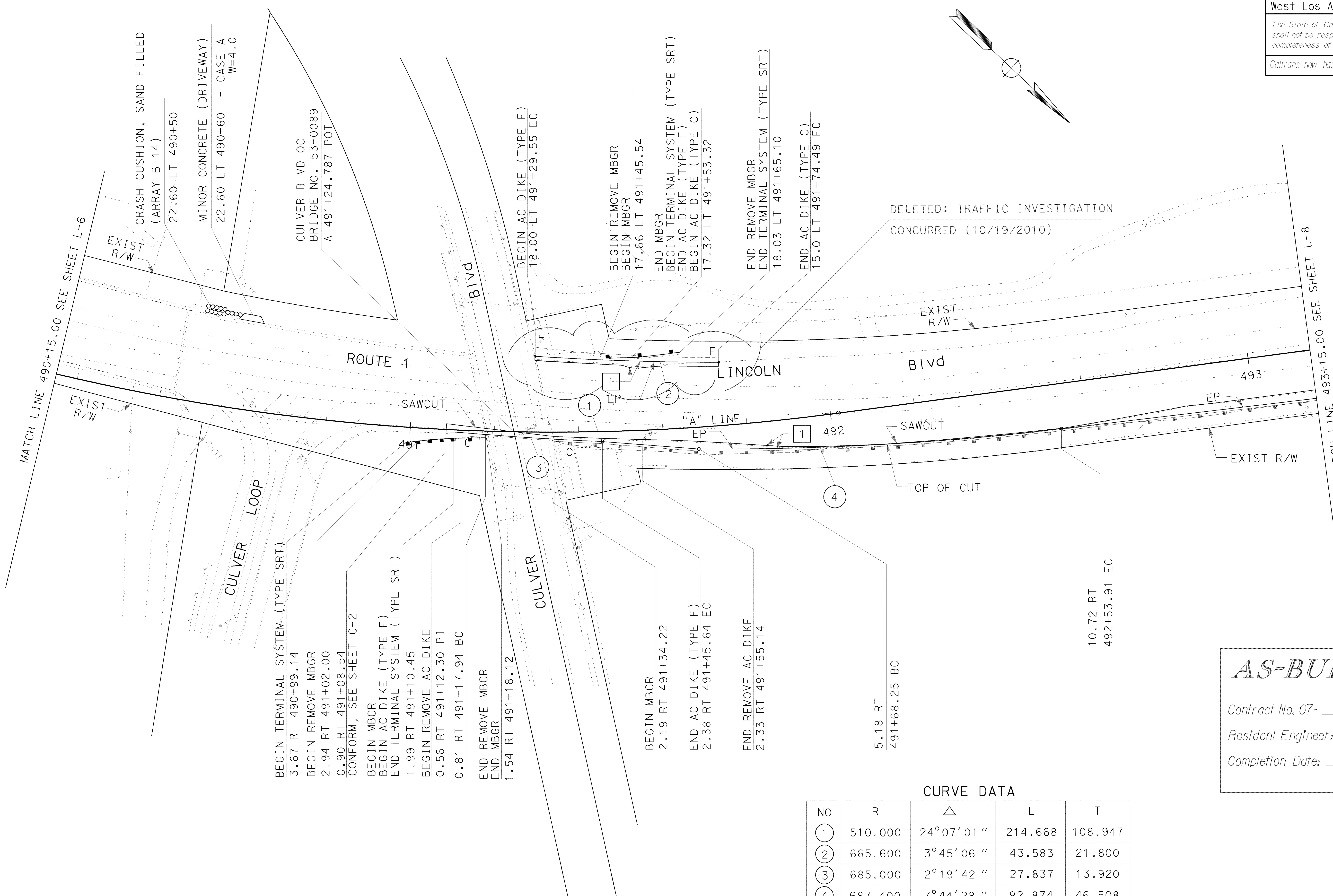
11-26-03
REGISTERED CIVIL ENGINEER
12-6-04
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER BG Wright No. C59331 Exp. 6-30-07 CIVIL STATE OF CALIFORNIA

P S O M A S
11444 West Olympic Boulevard
West Los Angeles, CA 90064-1549

NOTES:

1. FOR COMPLETE RIGHT OF WAY DATA, SEE RIGHT OF WAY RECORD MAPS AT DISTRICT OFFICE.
2. FOR LEGEND AND ADDITIONAL NOTES, SEE SHEET L-1.



CURVE DATA

NO	R	Δ	L	T
1	510.000	24°07′01″	214.668	108.947
2	665.600	3°45′06″	43.583	21.800
3	685.000	2°19′42″	27.837	13.920
4	687.400	7°44′28″	92.874	46.508

AS-BUILT
Contract No. 07- 166OU4
Resident Engineer: G.TRUJILLO
Completion Date: 08/31/10

ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SHOWN

LAYOUT
LOCATION 2
SCALE 1:500

L-7

DATE	REVISED BY	DATE REVISED
GM 8/02	CALCULATED/DESIGNED BY	
BW 8/02	CHECKED BY	

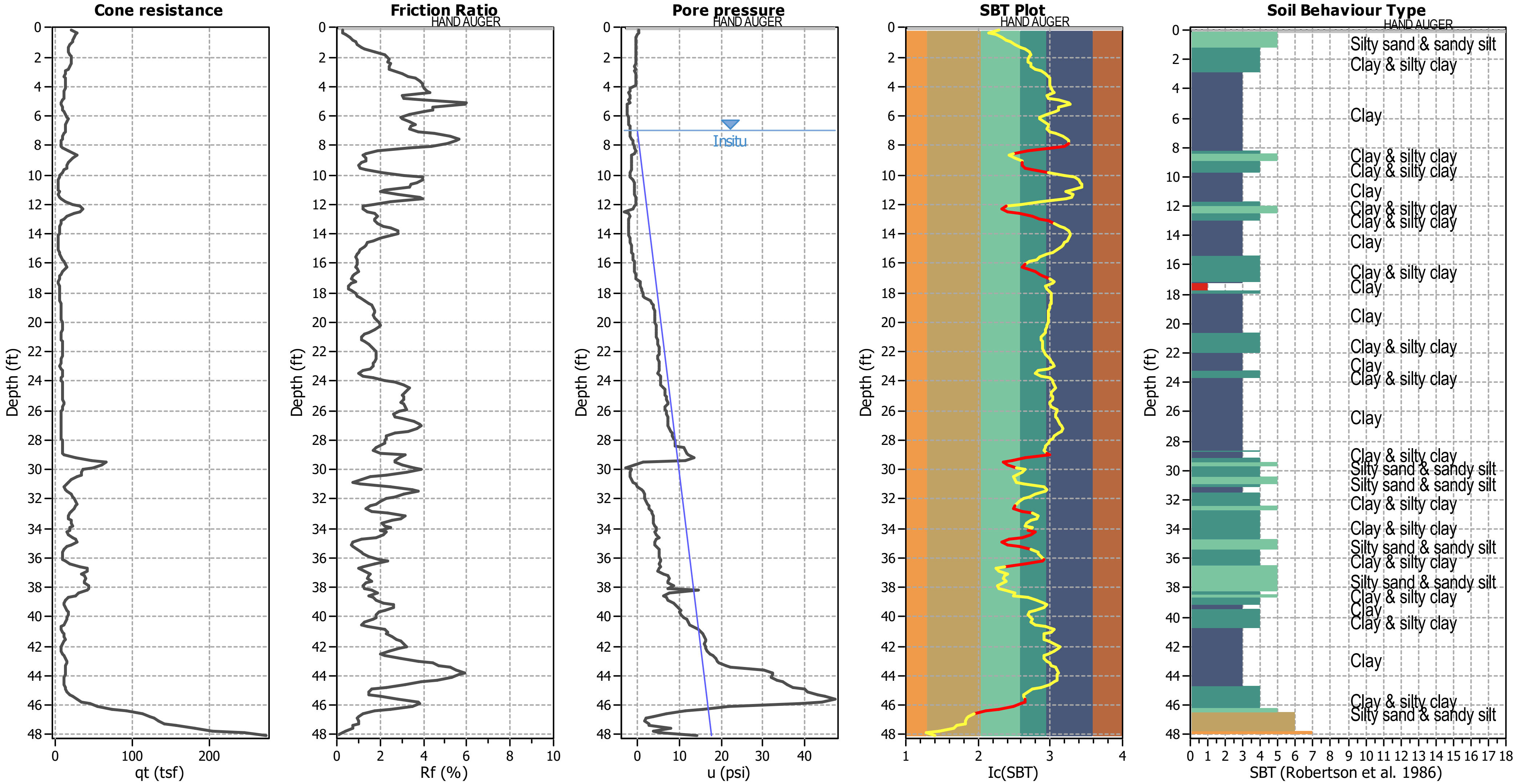
DESIGN OVERSIGHT
FEKADE S. MESFIN

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans

LAST REVISION 10-22-03 DATE PLOTTED => 07-JUN-2011 TIME PLOTTED => 10:01

APPENDIX D
LIQUEFACTION ANALYSIS

CPT basic interpretation plots



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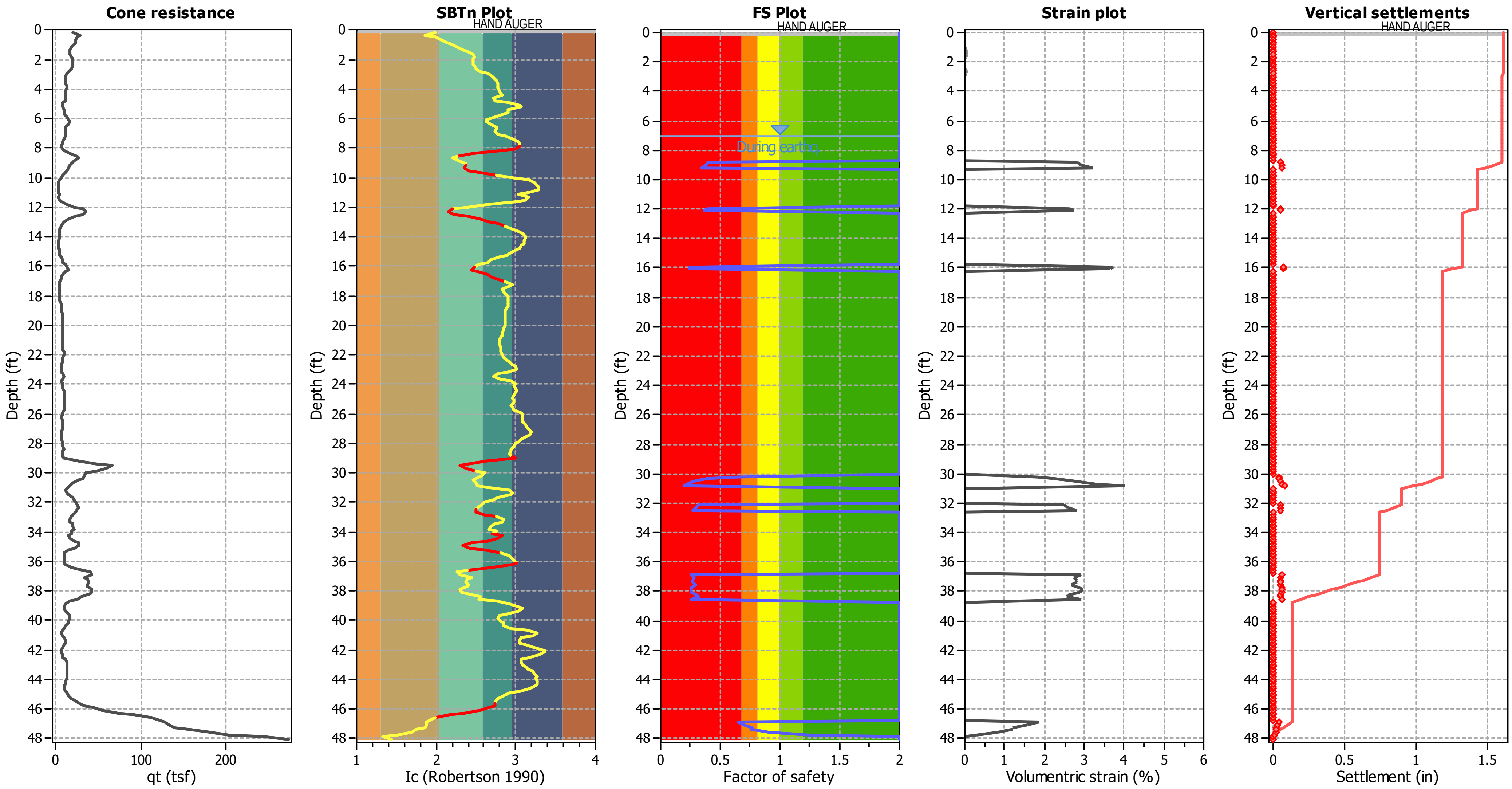
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.60	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.60	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	7.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained	4. Clayey silt to silty	7. Gravely sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

Estimation of post-earthquake settlements



Abbreviations

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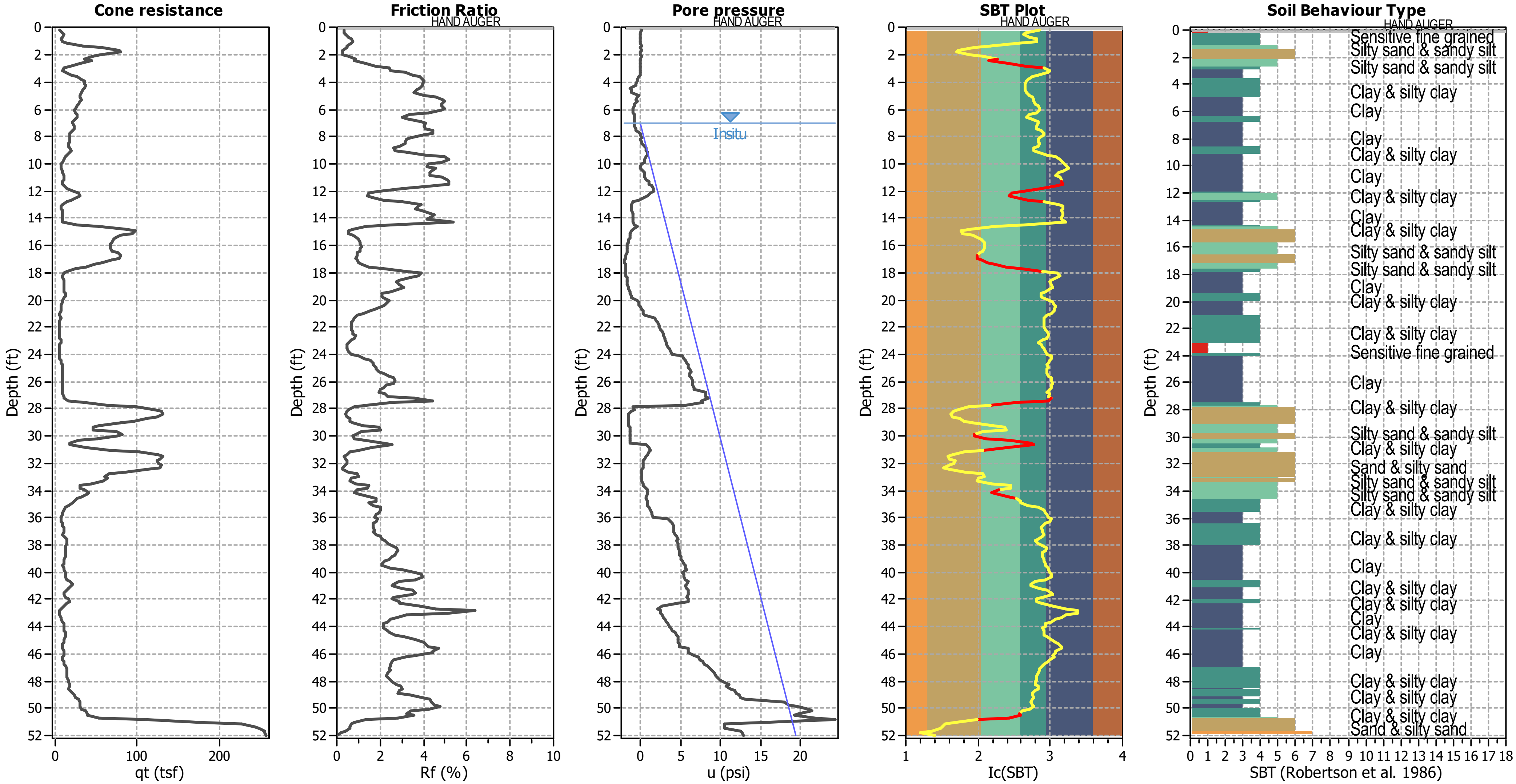
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

CPT basic interpretation plots



Input parameters and analysis data

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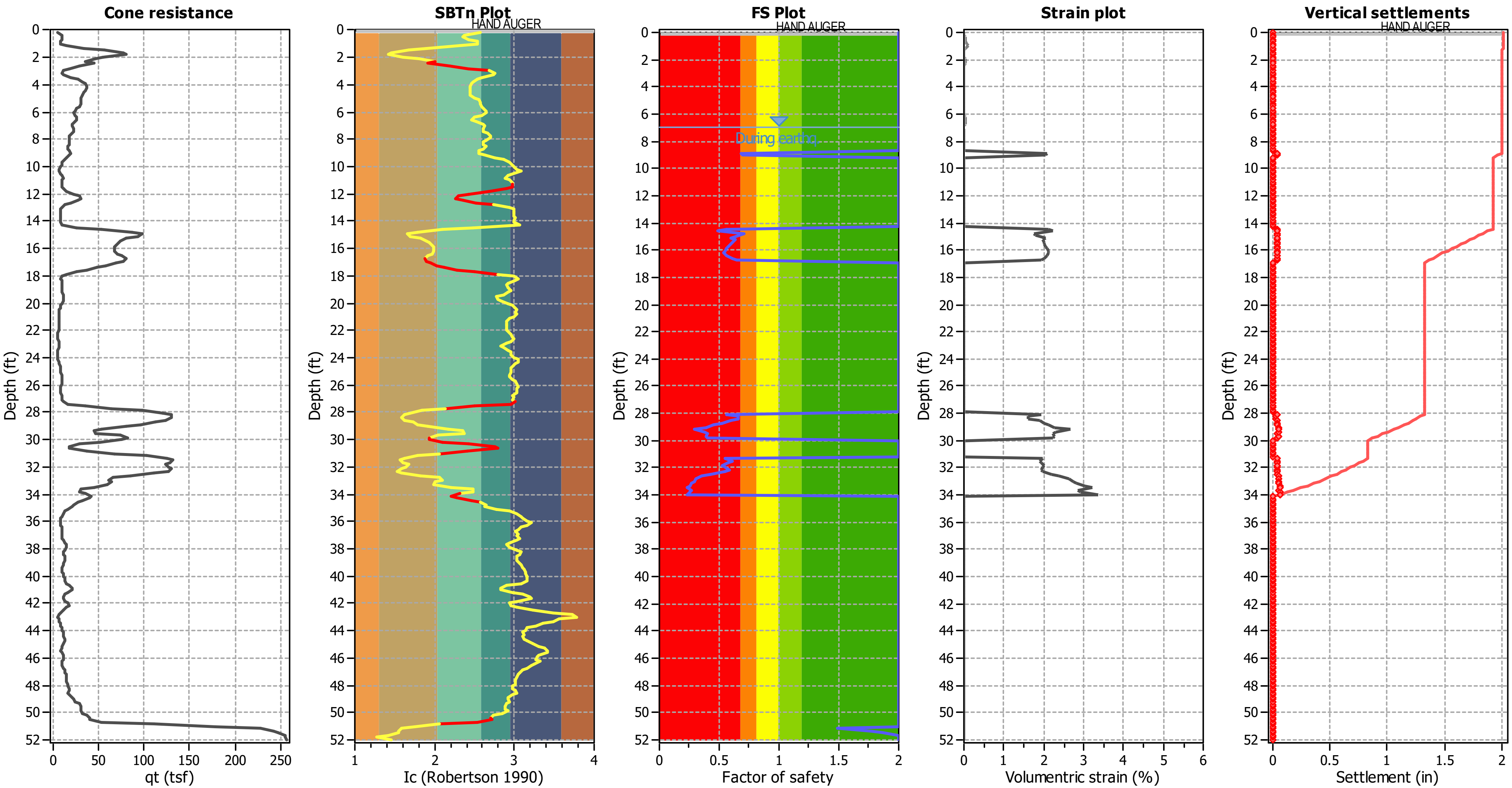

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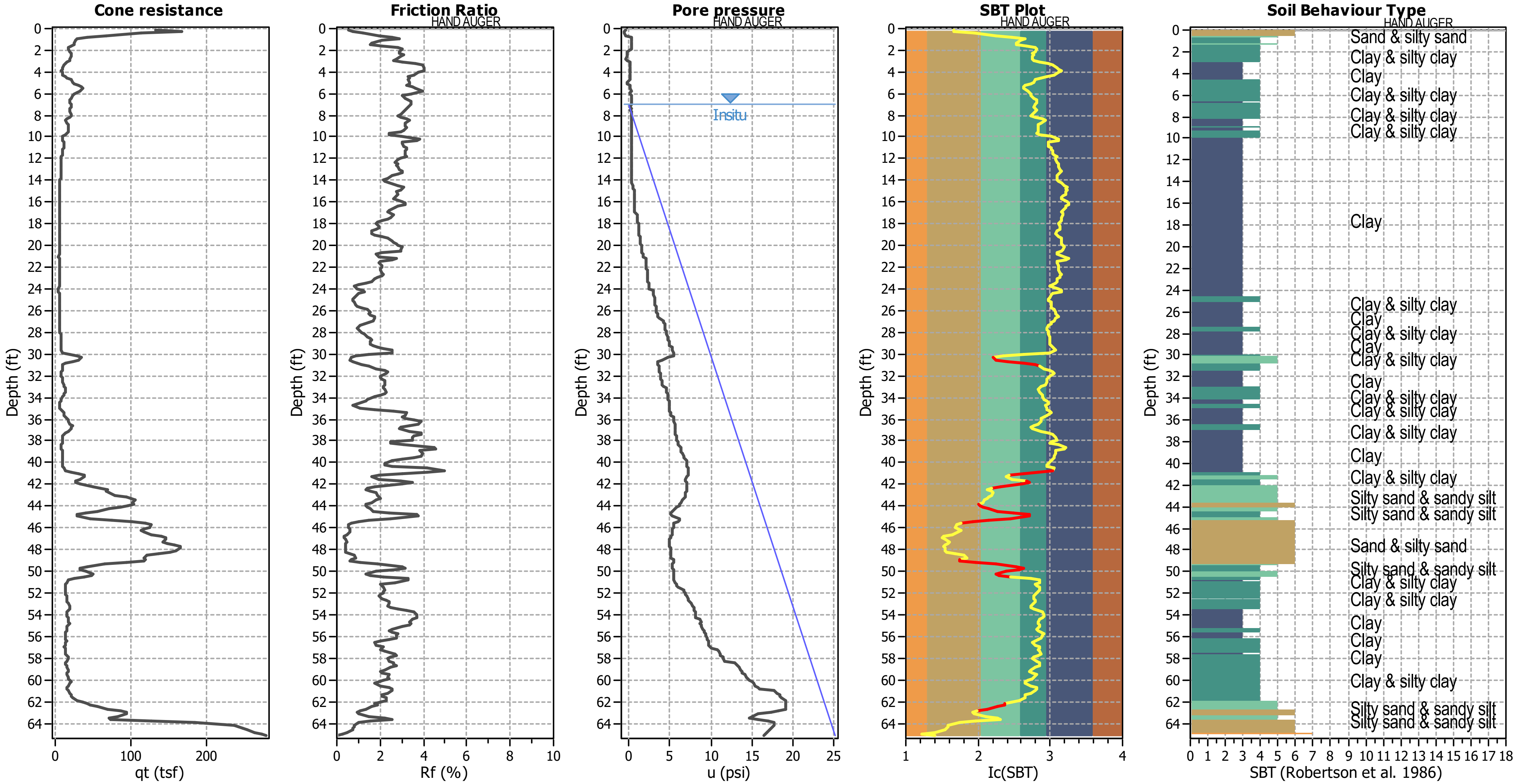

Input parameters and analysis data

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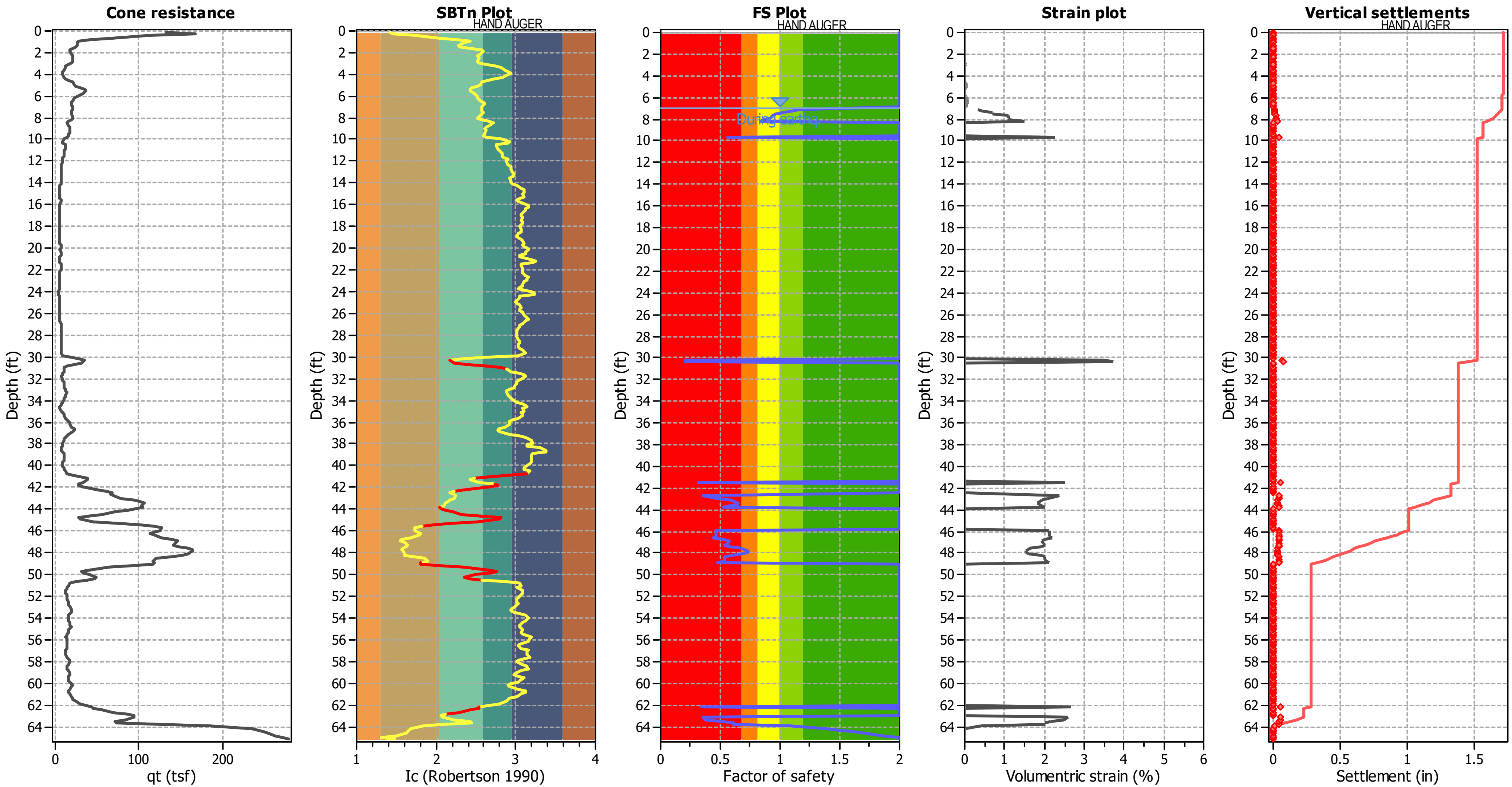

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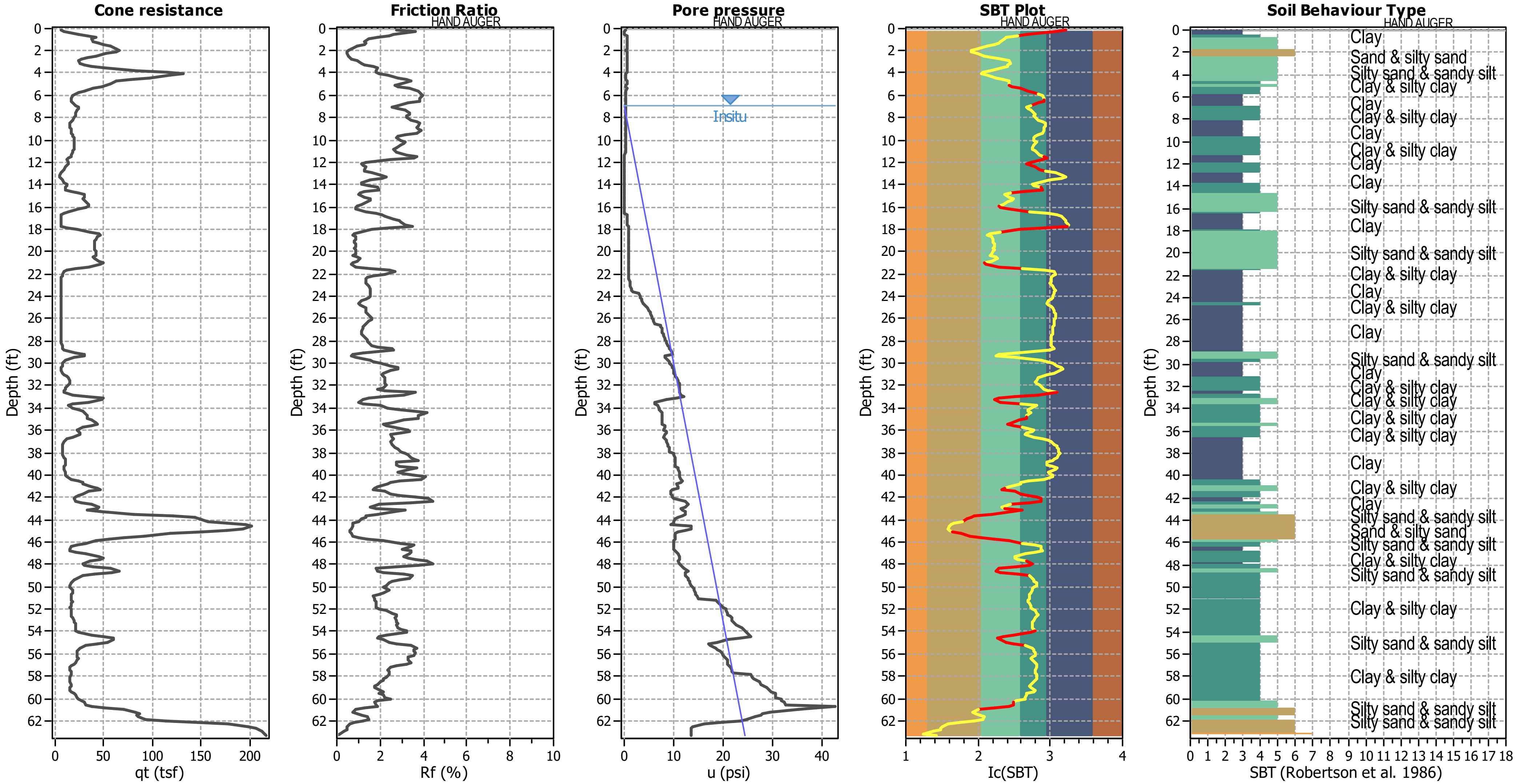

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9. Very stiff fine grained

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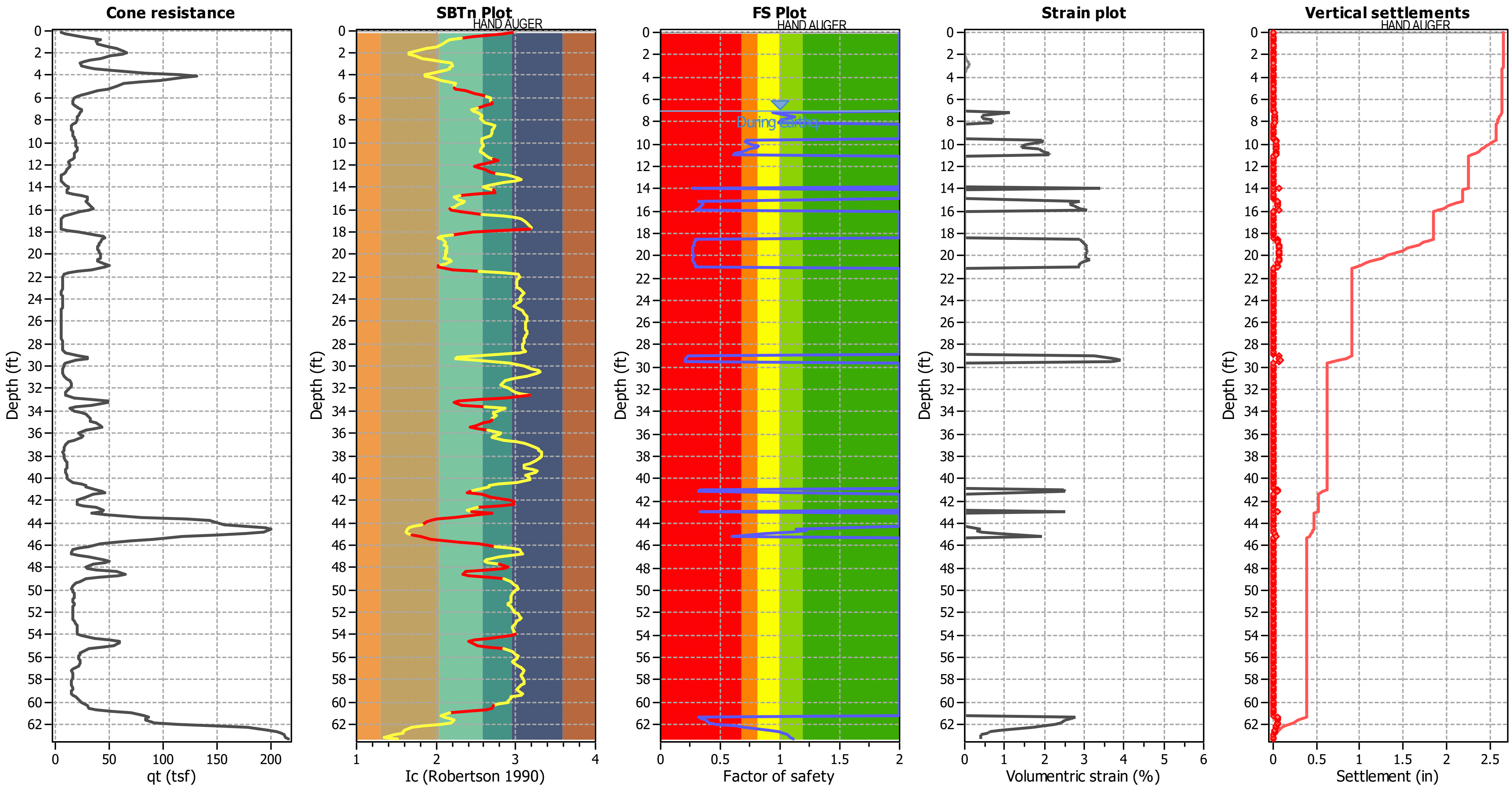

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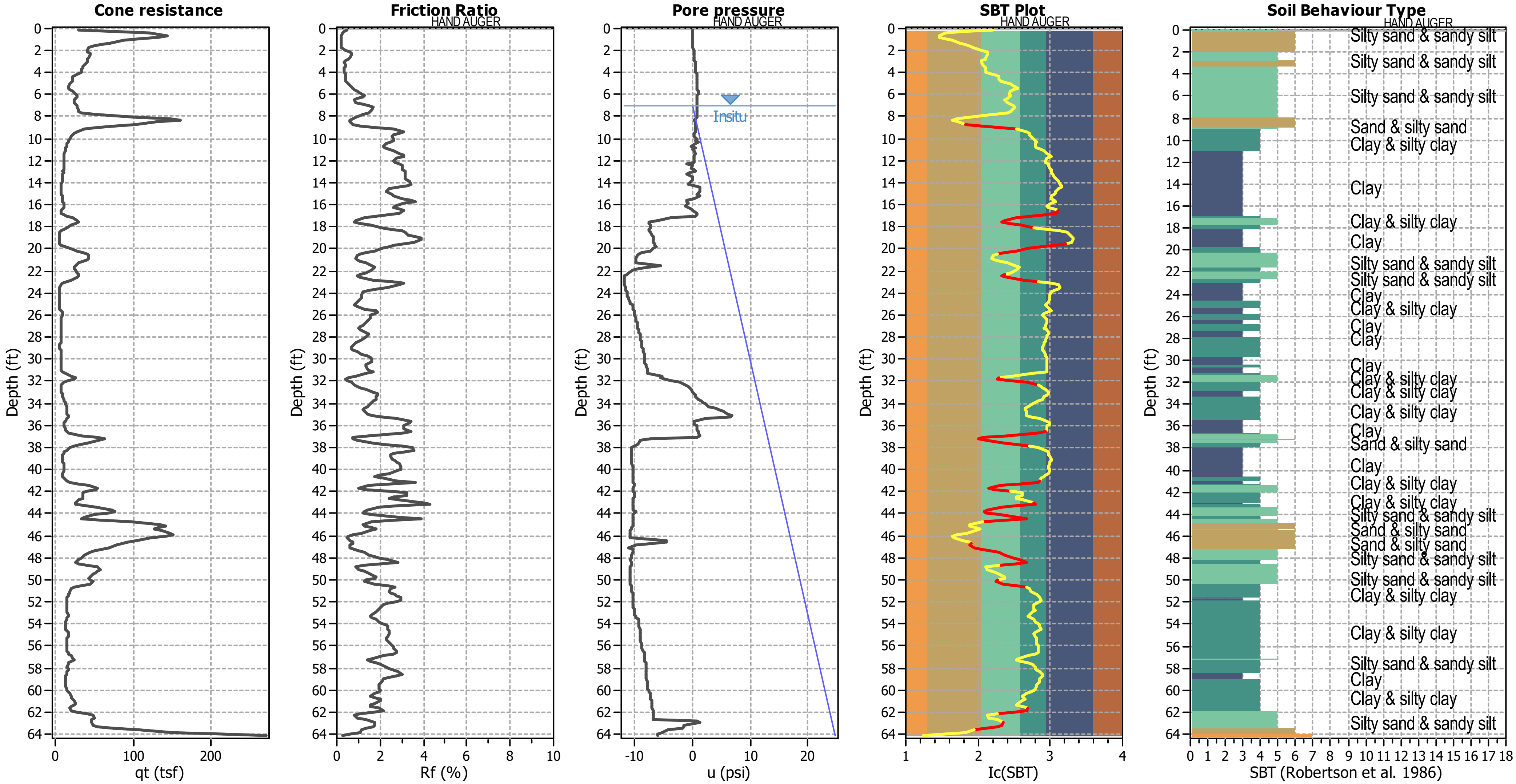

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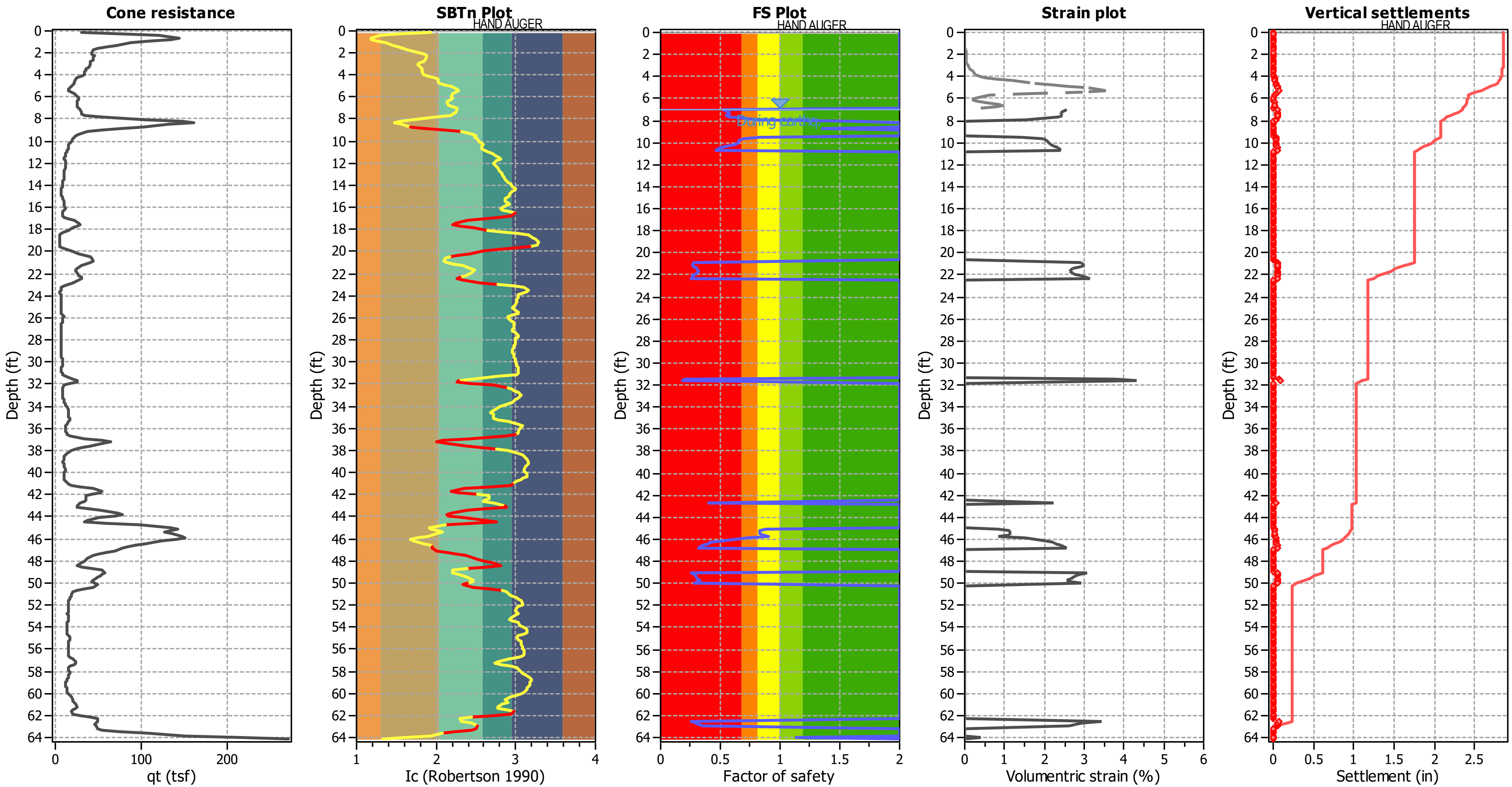

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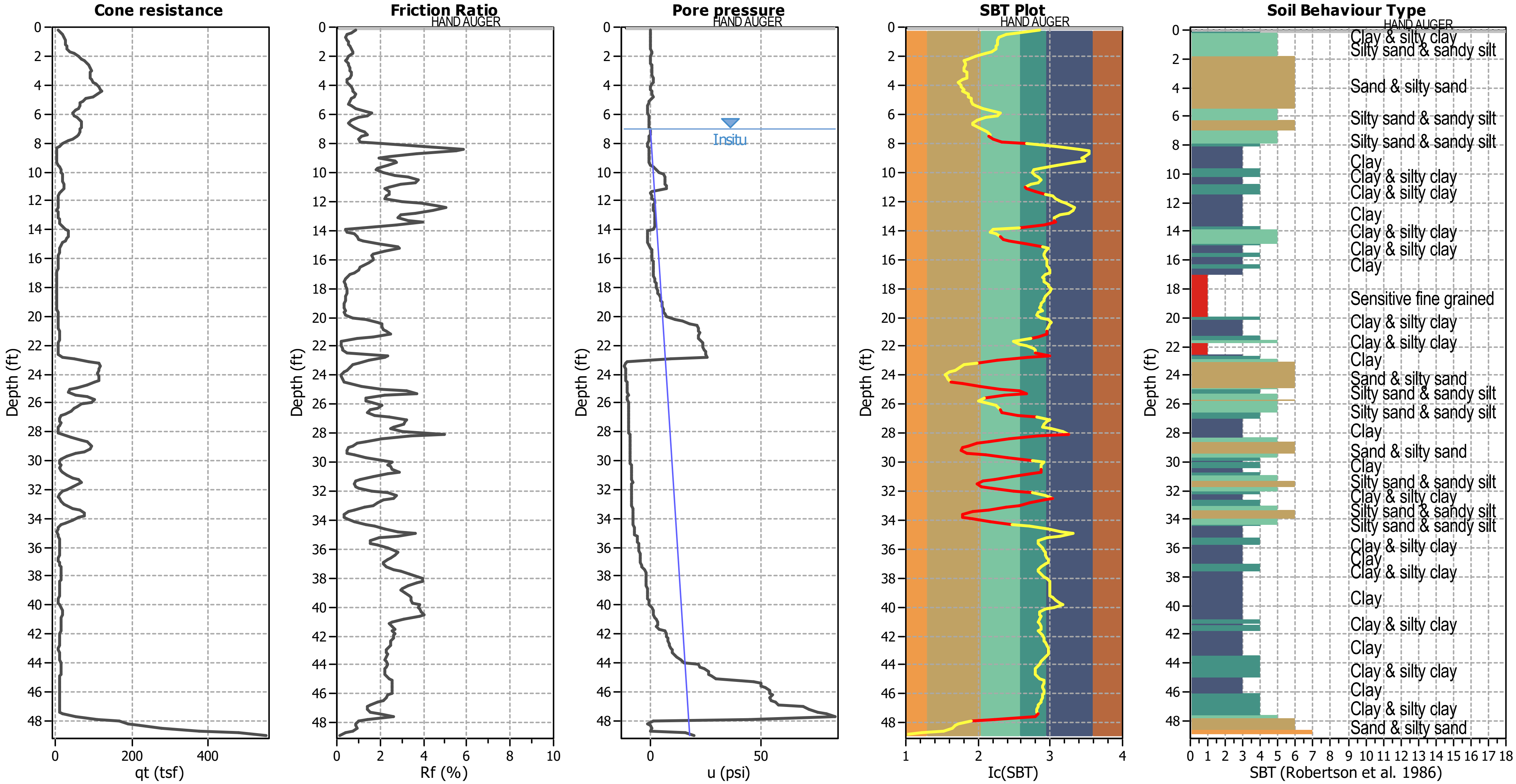

Input parameters and analysis data

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Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
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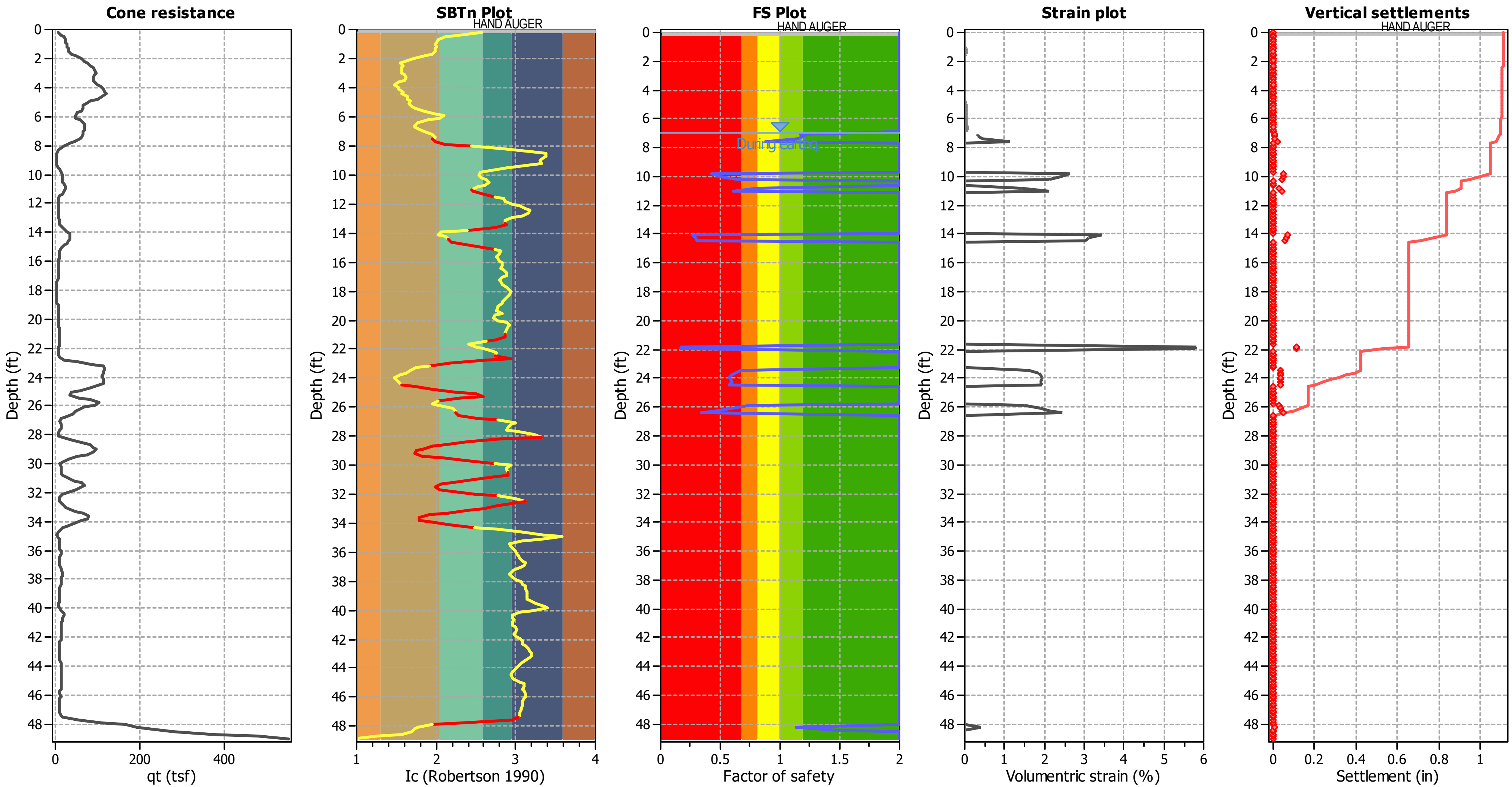

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Q. Lincoln Bridge Multi-Modal Bridge Improvements
Hydraulics Study

Lincoln Bridge Multi-Modal Bridge Improvements Hydraulics Study

Los Angeles County, California

Prepared for:

Psomas
555 South Flower Street, Suite 4300
Los Angeles, CA 90071
213.223.1400

Prepared by:

Michael Baker International
5 Hutton Centre Drive, Suite 500
Santa Ana, CA 92707

Michael Baker INTERNATIONAL

Contact Persons:

Mujahid Chandoo, P.E.

October 2022

JN 173324

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Table of Contents

Figures

Tables

Appendices

1 Introduction

This report summarizes an update to HEC-RAS numerical modeling and sediment transport analysis associated with Lincoln Bridge Multi-Modal Improvement Project (City of Los Angeles Department of Transportation [LADOT] TOS 27). Previously, Psomas completed sea level rise (SLR) analysis and HEC-RAS modeling of lower Ballona Creek and Lincoln Boulevard Bridge for the existing conditions for pre-2018 Caltrans and California Coastal Commission (CCC) SLR. Since the project started, new SLR criteria for California has been enacted (State of California Sea-Level Rise Guidance 2018 Update) (California 2018). Additionally, discussions between Psomas, CCC, Caltrans, LADOT and the US Army Corps of Engineers (USACE) have refined the regulatory requirements concerning hydraulic analysis and SLR related to the project.

The project is located along Ballona Creek bounded by Marina Del Rey to the north and the Ballona Wetlands to the south. The project includes the widening and other multimodal improvements of Lincoln Boulevard over the Creek south of Culver Boulevard (Figure 1). The project is approximately 8,700 feet upstream of the Pacific Ocean and approximately 3,200 feet downstream of the Marina Freeway crossing of the Creek.

1.1 Purpose

The purpose of the project is to create a new multi-modal corridor along SR-1/Lincoln Boulevard between Fiji Way and Jefferson Boulevard to improve traffic operations and to serve transit, bicyclists, and pedestrians while minimizing impacts to Ballona Wetlands Reserve, Ballona Creek, and other environmental resources. The purpose of this study is to assess the hydraulic impacts of the proposed bridge in order to minimize environmental impacts to Marina Del Rey and the Ballona Wetlands.

1.2 Need

Lincoln Boulevard serves as a critical north-south connection on the Westside. There are few arterial connections that provide continuous access through the Westside, which results in Lincoln Boulevard being oversaturated during peak commute periods. Lincoln Boulevard narrows from three to two lanes in the southbound direction, approximately 1,050 feet north of the existing Lincoln Bridge over Ballona Creek, and from four to three lanes in the northbound direction, approximately 320 feet north of the intersection with Jefferson Blvd, to the intersection with Fiji Way. These lane reductions create a major bottleneck.

The average vehicle travel speeds along Lincoln Boulevard are 15 mph during peak periods when measured between Ozone Ave in the City of Santa Monica and Sepulveda Boulevard while the design speed is 50 mph. Travel times are greatly impacted by bottlenecks resulting in slower speeds along much of the corridor.

In addition, access for pedestrians along Lincoln Boulevard is disjointed north and south of the Ballona Creek bridge which does not have sidewalks. Lincoln Boulevard also lacks bicycle facilities across the bridge. Pedestrian and bicycle facilities are also deficient along Culver Boulevard.

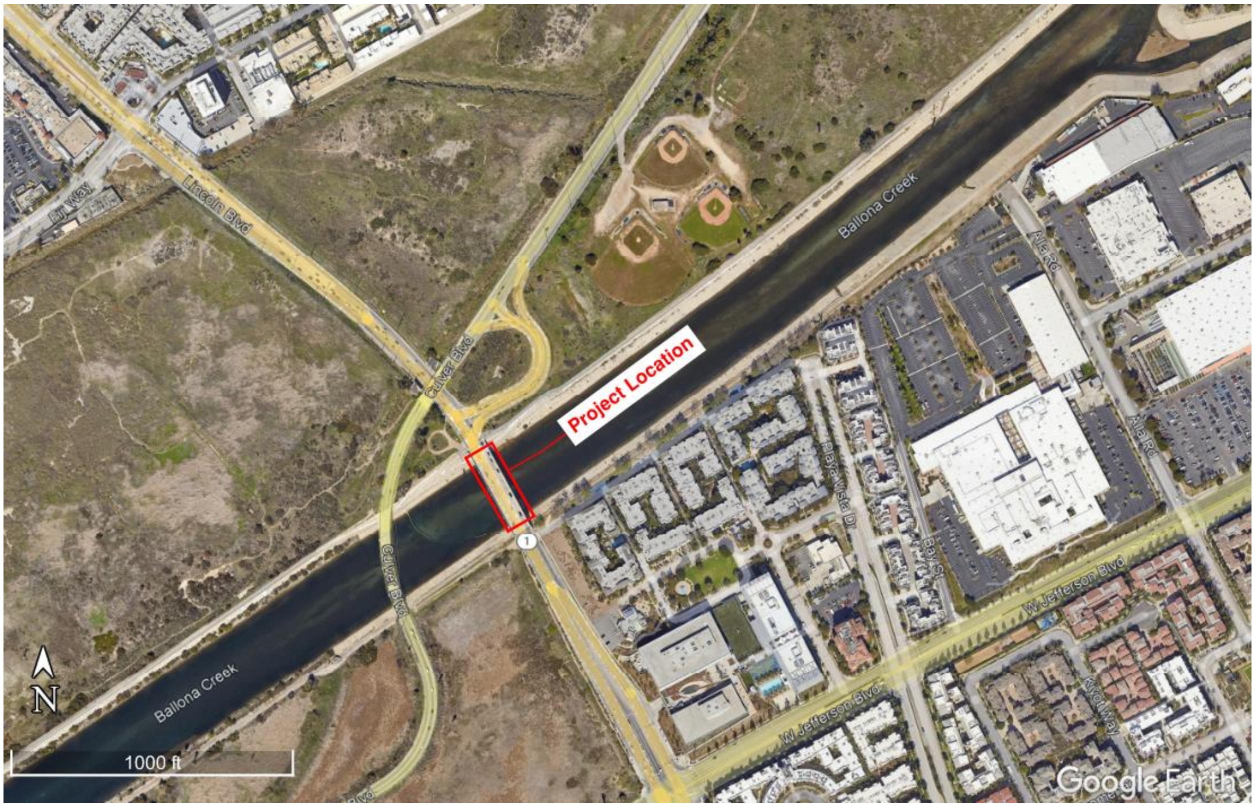

Figure 1: Project Location and Vicinity Map

1.3 Study Goals

The study has the following goals:

1. Two design discharges will be analyzed using the HEC-RAS hydraulics models of lower Ballona Creek: Los Angeles County Department of Public Works (LACDPW) Capital Storm discharge (QCAP) and USACE 100-year discharge (USACE).
2. Two sea level change criteria will be used for the downstream boundary conditions in HEC-RAS modeling: USACE and California (2018). No tsunami, wave run-up or other oceanographic factors are included as part of the SLR analysis because Lincoln Bridge is located approximately 2.5 miles inland of the coast. In addition, the Creek is leveed from its downstream terminus at the Pacific Ocean to upstream of the Lincoln Bridge crossing. The change in bottom elevation between the terminus and the Lincoln Bridge crossing is approximately 7 feet and the opening of the channel is approximately 300 feet. While some open ocean waves may diffract, refract, or reflect through the levee mouth and propagate upstream, it is highly unlikely that open ocean waves will impact Lincoln Bridge. Geotechnical subsidence or uplift is also not included in SLR analysis.
   USACE SLR values will be taken from USACE Sea-Level Change Curve Calculator Monica Gage intermediate value, and California (2018) SLR values will be taken from Table 25. Three values will be utilized from Table 25: Low, Medium-High and Extreme Risk Aversion (H++) for High Emissions. The basis for SLR will include two different starting water surface elevation datums: mean higher high water (MHHW) at the request of California Coastal Commission and Caltrans, and mean sea level (MSL), as per USACE ER 1100-2-8162 (local MSL) and ETL 1100-2-1 (non-ecosystem). Per the Santa Monica Gage, all elevations will be in NAVD88; bridge elevations will be adjusted accordingly.
3. All hydraulic modeling will be conducted using the HEC-RAS model developed by ESA in conjunction with USACE and modified by Michael Baker. The Michael Baker-modified model will be updated to incorporate:
   a. two design discharges (USACE and QCAP),
   b. two starting water surface elevations (MSL and MHHW),
   c. four SLR criteria (USACE Intermediate, and California 2018 Low, Medium-High, and H++),
   d. two bridge conditions (existing and proposed).
4. A scour analysis will be developed for Lincoln Bridge. Bridge scour for the existing and proposed bridge conditions will be developed in the HEC-RAS models using the software's hydraulic design function following HEC-18, Evaluating Scour at Bridges. Bridge scour will be calculated for the USACE and QCAP discharges assuming a MSL downstream boundary condition. The MSL boundary condition is expected to be the most conservative in that a lower water surface elevation for a given discharge will have a higher velocity in subcritical flow regimes. Only changes to Lincoln Bridge will be analyzed in the proposed condition bridge scour analysis.

2 Hydrologic and Bridge Design Conditions

2.1 Hydrologic Conditions

There are three design discharges available for the project reach of Ballona Creek: US Army Corps of Engineers (USACE) 100-year discharge; Federal Emergency Management Agency (FEMA) 100-year discharge; and the Los Angeles County Department of Public Works (LACDPW) 50-year burned-and-bulked, or Capital, (QCAP) discharge. For the purposes of the present study only the USACE and QCAP discharges are considered and are summarized in Table 1. No changes to the channel or watershed are proposed as part of the project, and the project will not alter the hydrology in the proposed condition.

Table 1: Design Discharges (cfs) for Ballona Creek at Lincoln Boulevard

FEMA	USACE	QCAP
44,270	46,000	51,240

2.2 Existing and Proposed Bridge Conditions

In the existing condition, the bridge is a four-bent structure with three pier walls. The piers are 90.0 feet apart with a width ranging from 3.25 to 4.50 feet (average 3.875 feet) without debris and a 7.75-foot debris width (double the average width). The bridge deck is approximately 69.0 feet wide and 334.5 feet long. The deck is vertically curved with the low chord ranging from 17.9 to 21.3 feet NAVD88, and a high chord ranging from 21.4 to 25.8 feet NAVD88. The deck is not super-elevated. The representation of the existing bridge in HEC-RAS is shown in Figure 2.

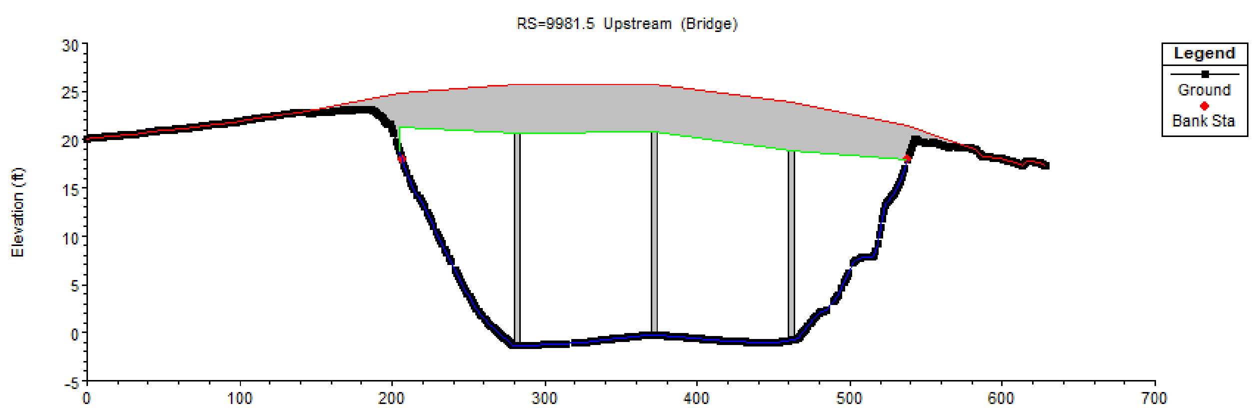

Figure 2: Existing Bridge (upstream section looking downstream)

In the proposed condition, the bridge is a three-bent structure with two pier groups. The circular pier groups are approximately 111.5 feet apart. Each pier is 5.5 feet wide without debris and has an 11.0-foot debris width. The bridge deck is approximately 130.0 feet wide and 334.5 feet long. The deck is vertically curved with the low chord ranging from 23.6 to 25.1 feet, and a high chord ranging from 28.6 to 30.2 feet. The representation of the proposed bridge in HEC-RAS is shown in Figure 3. All bridge design details of the existing and proposed conditions were provided by Psomas' (D. Fredricks, personal communication, 2021) and can be found in Appendix A. Deck elevations were provided in NGVD29 and were adjusted to NAVD88 to be consistent with the datums of the Santa Monica Gage.

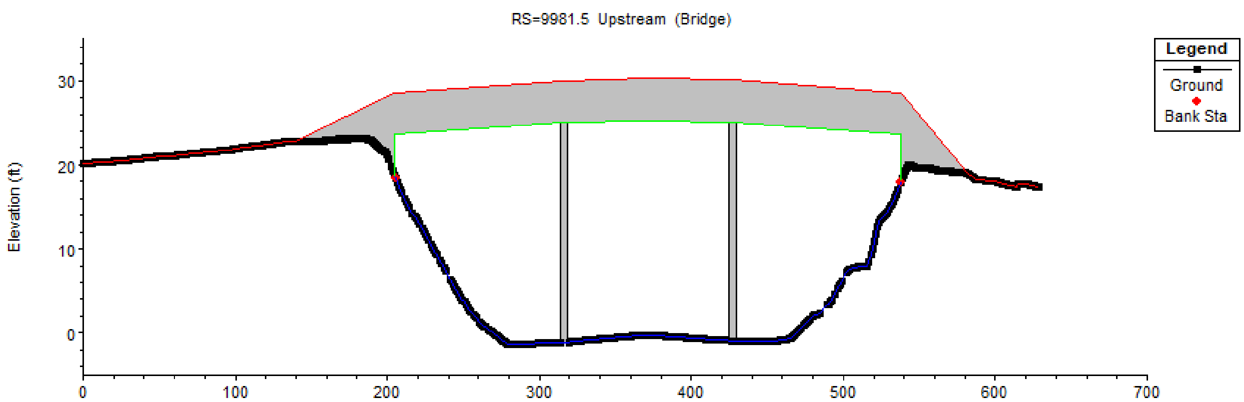

Figure 3: Proposed Bridge (upstream section looking downstream)

3 Sea Level Rise Design Considerations

All hydraulic analysis in the present study employs sea level rise design considerations based on two design parameters USACE (2019) and California (2018). USACE (2019) analysis is expected to be required to comply with future Clean Water Act (CWA) Section 408 permitting requirements. California (2018) analysis is expected to be required for State-related permitting (i.e. Caltrans, CCC, etc.).

Previous iterations (2018 and earlier) of this study included older Caltrans/CCC SLR values, and the present version of the report is intended to update the design to meet current SLR design guidelines within the State.

The USACE Sea-Level Change Curve Calculator is an online sea-level change calculator (at the time of writing, Version 2022.60: https://cwbi-app.sec.usace.army.mil/rccslc/slcc_calc.html). The present study utilizes the USACE 2013 dataset as well as the Santa Monica, CA Gage 9410840 for the year 2100, which is the furthest out in time for which the projections are valid. A copy of the USACE calculator output data is included in the Appendix B. The calculator indicates that relative sea-level change (SLC) for the intermediate projection is 4.15 feet relative to the NAVD88 datum. This value is used for all modeling with the USACE SLR boundary condition. It is important to note that the USACE projections include the local rate of vertical land movement. The estimated USACE relative SLC projections for the Santa Monica Gage are shown in Figure 4.

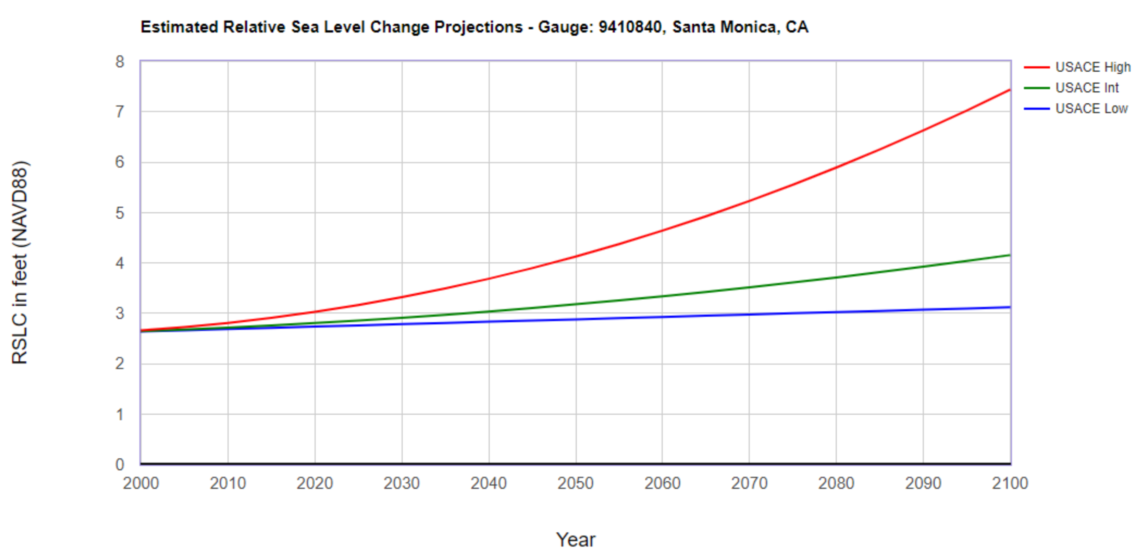

Figure 4: USACE Seal Level Change Projections for Santa Monica, CA

USACE has several guidance documents addressing SLC considerations for Corps-related projects. Both ER 1100-2-8162 (USACE 2013) and ETL 1100-2-1 (USACE 2014) address starting water surface elevations for analysis in SLC in coastal projects. While the documents appear to give latitude to local Corps Districts for final selection of starting water surface elevations, the documents give weight to MSL as local MSL, and non-ecosystem analyses, respectively. The present study uses both MSL (2.60 feet NAVD88) and MHHW (5.24 feet NAVD88) for USACE-related analyses of SLC to be consistent with analyses under California (2018) (see below, Section 4). Previous discussions with USACE staff (C. Mesa, personal communication, 2019) failed to produce additional guidance since no 408 permit application documentation had been provided to the Los Angeles District at the time of the communication.

State SLR criteria utilizes data from Table 25 in California (2018), Santa Monica gage. In the present study only the high emissions values for the low, medium-high and extreme risk aversion are used for modeling. These values are 3.3, 6.8 and 10.0 feet, respectively, for year 2010, which was chosen to be consistent with USACE analysis. It is important to note that California (2018) does not specify a starting sea surface elevation from which to conduct analysis. Additionally, multiple meetings with CCC and Caltrans staff in 2018 and 2019 failed to produce documentation specifying a starting sea surface elevation. For calculations herein both mean sea level (MSL) and mean higher high water (MHHW) for Santa Monica gage 9410840, 2.60 and 5.24 feet NAVD88, respectively, were employed. Datums are shown in the Appendix.

The values used for SLC/SLR for present study are summarized in Table 2.

Table 2: Sea Level Change/Rise Values by Agency for Santa Monica, CA

AGENCY	USACE	CALIFORNIA		
CRITERIA	INTERMEDIATE	LOW	MEDIUM-HIGH	EXTREME
VALUE	4.15	3.30	6.80	10.0

Several other design considerations may be included in SLC/SLR analyses. These considerations include local sedimentation/erosion, channel/levee overtopping, tsunamis, geotechnical uplift/subsidence, local inundation, and coastal erosion. While these topics are generally beyond the scope of the present study a discussion of them can be found in the Ballona Wetlands Restoration Project Draft EIS/EIR, Appendix F (ESA 2017). ESA (2017) notes that some bed aggradation has occurred in the area of Lincoln Bridge in the period on the order of 1 to 2 feet over the period 1961 to 2012. Between the Bridge and the end of the South Jetty, the bed aggradation has ranged from approximately 0 to greater than 3 feet during the same period. A discussion of aggradation in the proposed condition is included in Section 4.

4 Hydraulic Analysis of Existing and Proposed Conditions

4.1 HEC-RAS Model

All hydraulic modeling is conducted using the HEC-RAS numerical model developed initially by ESA (2017). The model is run in steady state, sub-critical mode, with downstream boundary conditions as described previously. All model geometry information remains unchanged, and only the proposed bridge geometry is included in proposed conditions modeling.

In the present study, HEC-RAS modeling consists of two discharges (USACE and QCAP), two starting water surface elevations (MSL and MHHW), four SLR criteria (USACE Intermediate, and California [2018] Low, Medium-High, and H++), and two bridge conditions (existing and proposed). The combination of modeling scenarios results in 32 discrete model plans. All HEC-RAS model files can be found in Appendix C. For readability, this report focuses on the design limits of Lincoln Bridge, and a discussion of all simulations is not included.

Part of the reason for not discussing all of the simulation results is because some simulations are not expected alter the critical basis of design values since they produce less conservative results than other simulations (i.e. simulations utilizing MSL produce lower changes in velocity, water surface elevation and/or greater freeboard than simulations utilizing MHHW). Other simulations are not discussed because the Ballona Creek Levees are overtopped in the model results. For overtopping cases, the results are both not valid (that is, the cross sections do not contain the discharge), and the model results raise the larger issue of coastal retreat. Coastal retreat becomes important for the purposes of the present project as rising SL inundates the areas adjacent to the project including Ballona Wetlands, Marina Del Rey and the roads which cross them. For example, there is no need to consider the design elements of Lincoln Bridge as sea levels rise and inundate portions of Ballona Wetlands where Lincoln Boulevard drops under Culver Boulevard to the north of the project site: the road to and from the Bridge would be impassable. Therefore, the discussions that follow focus on simulations that are valid. Table 3 summarizes the inputs and validity of all HEC-RAS model runs.

Table 3: Validity of HEC-RAS model runs

	Plan #	Plan Name in HEC-RAS	Discharge	Initial Elevation	Sea Level Rise	Change in WSE (ft) [NAVD88]	Is the analysis valid?
Existing	1	EX-USACE-MHHW-USACE	USACE	MHHW	USACE - Int	9.39	YES
	2	EX-USACE-MHHW-Low	USACE	MHHW	CA - Low	8.54	YES
	3	EX-USACE-MHHW-MH	USACE	MHHW	CA - M-H	12.04	NO
	4	EX-USACE-MHHW-HH	USACE	MHHW	CA - H++	15.24	NO
	5	EX-USACE-MSL-USACE	USACE	MSL	USACE - Int	6.75	YES
	6	EX-USACE-MSL-Low	USACE	MSL	CA - Low	5.90	YES
	7	EX-USACE-MSL-MH	USACE	MSL	CA - M-H	9.40	YES
	8	EX-USACE-MSL-HH	USACE	MSL	CA - H++	12.6	NO
	9	EX-QCAP-MHHW-USACE	QCAP	MHHW	USACE - Int	9.39	YES
	10	EX-QCAP-MHHW-Low	QCAP	MHHW	CA - Low	8.54	YES
	11	EX-QCAP-MHHW-MH	QCAP	MHHW	CA - M-H	12.04	NO
	12	EX-QCAP-MHHW-HH	QCAP	MHHW	CA - H++	15.24	NO
	13	EX-QCAP-MSL-USACE	QCAP	MSL	USACE - Int	6.75	YES
	14	EX-QCAP-MSL-Low	QCAP	MSL	CA - Low	5.90	YES
	15	EX-QCAP-MSL-MH	QCAP	MSL	CA - M-H	9.40	YES
	16	EX-QCAP-MSL-HH	QCAP	MSL	CA - H++	12.60	NO
Proposed	17	PR-USACE-MHHW-USACE	USACE	MHHW	USACE - Int	9.39	YES
	18	PR-USACE-MHHW-Low	USACE	MHHW	CA - Low	8.54	YES
	19	PR-USACE-MHHW-MH	USACE	MHHW	CA - M-H	12.04	NO
	20	PR-USACE-MHHW-HH	USACE	MHHW	CA - H++	15.24	NO
	21	PR-USACE-MSL-USACE	USACE	MSL	USACE - Int	6.75	YES
	22	PR-USACE-MSL-Low	USACE	MSL	CA - Low	5.90	YES
	23	PR-USACE-MSL-MH	USACE	MSL	CA - M-H	9.40	YES
	24	PR-USACE-MSL-HH	USACE	MSL	CA - H++	12.60	NO
	25	PR-QCAP-MHHW-USACE	QCAP	MHHW	USACE - Int	9.39	YES
	26	PR-QCAP-MHHW-Low	QCAP	MHHW	CA - Low	8.54	YES
	27	PR-QCAP-MHHW-MH	QCAP	MHHW	CA - M-H	12.04	NO
	28	PR-QCAP-MHHW-HH	QCAP	MHHW	CA - H++	15.24	NO
	29	PR-QCAP-MSL-USACE	QCAP	MSL	USACE - Int	6.75	YES
	30	PR-QCAP-MSL-Low	QCAP	MSL	CA - Low	5.90	YES
	31	PR-QCAP-MSL-MH	QCAP	MSL	CA - M-H	9.40	YES
	32	PR-QCAP-MSL-HH	QCAP	MSL	CA - H++	12.60	NO

4.2 Bridge Hydraulics

The impacts of the proposed bridge on channel hydraulics are summarized in Table 4 by comparing the existing and proposed velocity and water surface elevations (WSE) for different events. These events considered a combination of hydrologic conditions and sea level rise scenarios as necessary to maintain validity of the hydraulic analysis as described in Section 4.1.

Table 4 shows the changes in velocity from existing to proposed for the cross sections (XS) in the vicinity of Lincoln Bridge (located at XS 9981.5). For all scenarios examined, the average difference in velocity is approximately +0.01 foot per second (fps). That is, all valid hydraulic analyses show that the proposed bridge condition has a negligible impact on velocity compared to the existing bridge condition.

Table 4 also shows the changes in water surface elevation in NAVD88 from existing to proposed for the cross sections in the vicinity of the bridge. For all scenarios examined, the difference in WSE ranges from zero to a decrease in 0.02 ft. Therefore, all valid hydraulic analyses show that the proposed project has a negligible impact on depth compared to the existing bridge condition.

4.3 Sea-Level Rise Impact on Channel Hydraulics

As noted in Section 4.1, the magnitude of SLR plays a significant role on flow containment within the Ballona Creek channel and the validity of this analysis. However, for cases in which the analysis is valid, the impacts of different SLR scenarios are significantly low with regards to velocity and depth. Per Table 4, increasing the SLR while maintaining the same discharge and initial elevation yields no more than an increase in 0.1 fps in velocity or 0.3 ft in WSE. Because of these insignificant differences observed in both the existing and proposed conditions, no additional analysis of future aggradation/degradation impacts to channel hydraulics are described here. This approach is further supported by the findings of ESA (2017) which indicate that long-term aggradation of the channel bed has occurred since 1961 (see Section 3, above). That is, for the purposes of design of the Lincoln Bridge, additional or accelerated aggradation is expected to decrease the capacity of Ballona Creek channel fostering overtopping of the levees at lower SLR magnitudes and/or at less frequent discharge events than the USACE design discharge. In any case, the primary driver of the design of Lincoln Bridge improvements is not the local hydraulics within the Ballona Creek channel, but the ability of the levees and surrounding area to contain and resist the local relative increase in sea surface elevation. It is recommended that future analyses of proposed Lincoln Bridge improvements proceed under the most conservative hydrologic conditions that yielded valid hydraulic analyses—that is, scenarios considering the QCAP design discharge of 51,240 cubic feet per second, the MSL initial elevation of 2.6 feet, and the California Medium-High SLR scenario of 6.8 feet.

Table 4: Impacts of the Proposed Bridge on Channel Hydraulics

Discharge	Initial Elevation	SLR Scenario	Existing		Proposed		Change in Velocity	Existing		Proposed		Change in WSE
			XS	Velocity (fps)	XS	Velocity (fps)	(fps)	XS	WSE (ft)	XS	WSE (ft)	(ft)
USACE	MHHW	USACE - Intermediate	12520	10.53	12520	10.54	0.01	12520	17.66	12520	17.65	-0.01
			12121	10.74	12121	10.75	0.01	12121	17.35	12121	17.34	-0.01
			11613	10.67	11613	10.68	0.01	11613	17.08	11613	17.06	-0.02
			11028	10.63	11028	10.64	0.01	11028	16.76	11028	16.74	-0.02
			10424	10.64	10424	10.65	0.01	10424	16.41	10424	16.39	-0.02
			10037	10.09	10037	10.10	0.01	10037	16.29	10037	16.27	-0.02
			9886	10.85	9886	10.85	0	9886	15.61	9886	15.61	0
		CA - Low	12520	10.57	12520	10.58	0.01	12520	17.60	12520	17.58	-0.02
			12121	10.79	12121	10.80	0.01	12121	17.29	12121	17.27	-0.02
			11613	10.73	11613	10.74	0.01	11613	17.01	11613	16.99	-0.02
			11028	10.69	11028	10.70	0.01	11028	16.68	11028	16.66	-0.02
			10424	10.71	10424	10.72	0.01	10424	16.32	10424	16.30	-0.02
			10037	10.16	10037	10.17	0.01	10037	16.20	10037	16.18	-0.02
			9886	10.94	9886	10.94	0	9886	15.49	9886	15.49	0
	MSL	USACE - Intermediate	12520	10.63	12520	10.65	0.02	12520	17.52	12520	17.51	-0.01
			12121	10.86	12121	10.87	0.01	12121	17.20	12121	17.19	-0.01
			11613	10.80	11613	10.81	0.01	11613	16.92	11613	16.9	-0.02
			11028	10.77	11028	10.78	0.01	11028	16.58	11028	16.56	-0.02
			10424	10.80	10424	10.81	0.01	10424	16.21	10424	16.19	-0.02
			10037	10.24	10037	10.26	0.02	10037	16.08	10037	16.06	-0.02
			9886	11.06	9886	11.06	0	9886	15.35	9886	15.35	0
		CA - Low	12520	10.65	12520	10.66	0.01	12520	17.50	12520	17.49	-0.01
			12121	10.87	12121	10.88	0.01	12121	17.18	12121	17.17	-0.01
			11613	10.82	11613	10.83	0.01	11613	16.89	11613	16.88	-0.01
			11028	10.78	11028	10.80	0.02	11028	16.56	11028	16.54	-0.02
			10424	10.82	10424	10.84	0.02	10424	16.18	10424	16.16	-0.02
			10037	10.26	10037	10.28	0.02	10037	16.05	10037	16.03	-0.02
			9886	11.09	9886	11.09	0	9886	15.31	9886	15.31	0
		CA - M-H	12520	10.53	12520	10.54	0.01	12520	17.66	12520	17.65	-0.01
			12121	10.74	12121	10.75	0.01	12121	17.35	12121	17.34	-0.01
			11613	10.67	11613	10.68	0.01	11613	17.08	11613	17.07	-0.01
			11028	10.63	11028	10.64	0.01	11028	16.76	11028	16.74	-0.02
			10424	10.64	10424	10.65	0.01	10424	16.41	10424	16.39	-0.02
			10037	10.09	10037	10.10	0.01	10037	16.29	10037	16.27	-0.02
			9886	10.85	9886	10.85	0	9886	15.61	9886	15.61	0

Discharge	Initial Elevation	SLR Scenario	Existing		Proposed		Change in Velocity	Existing		Proposed		Change in WSE
			XS	Velocity (fps)	XS	Velocity (fps)	(fps)	XS	WSE (ft)	XS	WSE (ft)	(ft)
QCAP	MHHW	USACE - Intermediate	12520	10.53	12520	10.54	0.01	12520	17.66	12520	17.65	-0.01
			12121	10.74	12121	10.75	0.01	12121	17.35	12121	17.34	-0.01
			11613	10.67	11613	10.68	0.01	11613	17.08	11613	17.06	-0.02
			11028	10.63	11028	10.64	0.01	11028	16.76	11028	16.74	-0.02
			10424	10.64	10424	10.65	0.01	10424	16.41	10424	16.39	-0.02
			10037	10.09	10037	10.1	0.01	10037	16.29	10037	16.27	-0.02
			9886	10.85	9886	10.85	0	9886	15.61	9886	15.61	0
		CA - Low	12520	10.57	12520	10.58	0.01	12520	17.6	12520	17.58	-0.02
			12121	10.79	12121	10.8	0.01	12121	17.29	12121	17.27	-0.02
			11613	10.73	11613	10.74	0.01	11613	17.01	11613	16.99	-0.02
			11028	10.69	11028	10.7	0.01	11028	16.68	11028	16.66	-0.02
			10424	10.71	10424	10.72	0.01	10424	16.32	10424	16.3	-0.02
			10037	10.16	10037	10.17	0.01	10037	16.2	10037	16.18	-0.02
			9886	10.94	9886	10.94	0	9886	15.49	9886	15.49	0
	MSL	USACE - Intermediate	12520	10.63	12520	10.65	0.02	12520	17.52	12520	17.51	-0.01
			12121	10.86	12121	10.87	0.01	12121	17.2	12121	17.19	-0.01
			11613	10.8	11613	10.81	0.01	11613	16.92	11613	16.9	-0.02
			11028	10.77	11028	10.78	0.01	11028	16.58	11028	16.56	-0.02
			10424	10.8	10424	10.81	0.01	10424	16.21	10424	16.19	-0.02
			10037	10.24	10037	10.26	0.02	10037	16.08	10037	16.06	-0.02
			9886	11.06	9886	11.06	0	9886	15.35	9886	15.35	0
		CA - Low	12520	10.65	12520	10.66	0.01	12520	17.5	12520	17.49	-0.01
			12121	10.87	12121	10.88	0.01	12121	17.18	12121	17.17	-0.01
			11613	10.82	11613	10.83	0.01	11613	16.89	11613	16.88	-0.01
			11028	10.78	11028	10.8	0.02	11028	16.56	11028	16.54	-0.02
			10424	10.82	10424	10.84	0.02	10424	16.18	10424	16.16	-0.02
			10037	10.26	10037	10.28	0.02	10037	16.05	10037	16.03	-0.02
			9886	11.09	9886	11.09	0	9886	15.31	9886	15.31	0
		CA - M-H	12520	10.53	12520	10.54	0.01	12520	17.66	12520	17.65	-0.01
			12121	10.74	12121	10.75	0.01	12121	17.35	12121	17.34	-0.01
			11613	10.67	11613	10.68	0.01	11613	17.08	11613	17.07	-0.01
			11028	10.63	11028	10.64	0.01	11028	16.76	11028	16.74	-0.02
			10424	10.64	10424	10.65	0.01	10424	16.41	10424	16.39	-0.02
			10037	10.09	10037	10.1	0.01	10037	16.29	10037	16.27	-0.02
			9886	10.85	9886	10.85	0	9886	15.61	9886	15.61	0

4.4 Scour Analysis

Two approaches to scour analysis are utilized to understand the impacts to sediment transport and channel bed response resulting from the proposed Lincoln Bridge improvements. The first approach follows the guidelines of LACDWP (2006) and the second employs bridge scour calculations using the hydraulic design package in HEC-RAS based on HEC-18 (FHWA 2012). The benefit of the former is that it considers the total bed response, including general and long-term bed adjustment, and local scour. The benefit of the latter is that considers the different elements of bridge scour directly in the HEC-RAS model. Generally, both approaches follow all or part, respectively, of Federal Highways guidelines for scour analysis for stream crossings. The methods and analysis results are described below.

4.4.1 LACDPW Scour Analysis

LACDPW (2006) requires that the sum of several design parameters be used to develop the scour-depth toe-down. These parameters include long-term bed change (degradation component only), general bed change (degradation component only), and several elements of local scour (general local scour, bend scour, low flow incitement and bed form height). In the present study, the long-term bed change is set to 0.0 feet following the findings of (ESA 2017) that indicates long-term aggradation has occurred historically at the site. General adjustment is calculated using Appendix C of the Manual, which is represented with a second-order polynomial. No bends are present in the project reach of the channel so bend scour is set to 0.0 feet. Low flow incisement is set to 2.0 feet as a conservative estimate of the thalweg depth, which is a typical approach for channels in Los Angeles County. Bed form height is calculated following Appendix C of the Manual, which relies upon academic literature (Kennedy's equation). Local scour is based on the impacts of piers (Neill's equation) and abutments (Lin's equation), and generally follows the approach of FHWA (2012). The maximum scour is then compared to the design scour depth in the legacy County Design Manual (LACFCD 1982) and the greater of the two values is used for design toe-down. The LACDPW scour calculations for all modeled scenarios are presented in Appendix D. Table 5 summarizes the total scour results for the total design scour after LACDPW (2006) comparing the existing and proposed condition bridges for all valid analyses. The proposed bridge condition results in an additional 0.01 feet of bridge scour compared to the existing condition for all valid analyses.

Table 5: LACDPW Scour Results (feet) at Lincoln Bridge

Discharge	Initial Elevation	SLR Scenario	Existing	Proposed
USACE	MHHW	USACE - Int	24.22	24.23
		CA - Low	22.48	22.49
	MSL	USACE - Int	22.56	22.57
		CA - Low	22.57	22.58
		CA - M-H	22.42	22.43
QCAP	MHHW	USACE - Int	23.11	23.12
		CA - Low	23.15	23.16
	MSL	USACE - Int	23.21	23.22
		CA - Low	23.22	23.23
		CA - M-H	23.11	23.12

4.4.2 HEC-18 Scour Analysis

HEC-18 analysis is conducted in the HEC-RAS model using the software's hydraulic design function. The function utilizes hydraulic information from the model to perform the scour calculations. The calculations are limited to contraction, pier and abutment components of local scour. Table 6 summarizes the HEC-18 scour results after FHWA (2012) comparing the existing and proposed condition bridges for all valid simulations examined. The analyses show that on average, the proposed bridge condition results in an increase of 2.5 feet of pier scour and a decrease in 0.1 feet of contraction score when compared to the existing condition.

Table 6: HEC-18 Scour Results (feet) at Lincoln Bridge

Discharge	Initial Elevation	SLR Scenario	Existing				Proposed			
			Contraction	Pier	Abutment	**Total**	Contraction	Pier	Abutment	**Total**
USACE	MHHW	USACE - Int	0.94	9.72	0.0	10.66	0.87	12.21	0.0	13.08
		CA - Low	0.97	9.74	0.0	10.71	0.88	12.23	0.0	13.11
	MSL	USACE - Int	0.99	9.76	0.0	10.75	0.92	12.26	0.0	13.18
		CA - Low	1.00	9.77	0.0	10.77	0.91	12.27	0.0	13.18
		CA - M-H	0.94	9.72	0.0	10.66	0.87	12.20	0.0	13.07
QCAP	MHHW	USACE - Int	1.00	9.97	0.0	10.97	0.92	12.51	0.0	13.43
		CA - Low	1.02	9.98	0.0	11.00	0.93	12.52	0.0	13.45
	MSL	USACE - Int	1.02	10.00	0.0	11.02	0.94	12.55	0.0	13.49
		CA - Low	1.03	10.00	0.0	11.03	0.95	12.56	0.0	13.51
		CA - M-H	0.99	9.97	0.0	10.96	0.92	12.51	0.0	13.43

Because there is no abutment scour observed, the pier and abutment scour cones are not expected to overlap at Lincoln Bridge in either the existing or proposed condition. Therefore, when using HEC-18 guidelines for determining scour under Lincoln Bridge, the pier and abutment scour should not be summed; the contraction scour should instead be summed with either the pier or abutment scour for an appropriate analysis. HEC-18 analysis results for all valid simulations are included in the Appendix D.

5 Conclusion and Final Recommendations

The purpose of the Lincoln Bridge Multi-Modal Bridge Improvement Project is to create a new multi-modal corridor along SR-1/Lincoln Boulevard in order to improve traffic operations and services while minimizing impacts to Ballona Creek and Ballona Wetlands Reserve. The purpose of this hydraulic study is to update the HEC-RAS model provided by Psomas with revised SLR criteria and up-to-date design plans in an effort to analyze the hydraulic impacts of the proposed bridge design. It is worth noting that using updated SLR criteria yielded overtopping of the modeled channel for certain proposed runs; runs in which the channel could not contain the full flow are invalid analyses for which conclusions cannot be drawn.

Results of the hydraulic analysis show that the proposed bridge design has minimal impacts on channel water surface elevation and velocity in the vicinity of the bridge. For all valid model runs, the proposed bridge design yields a channel velocity increase of 0.01 feet per second on average. Additionally, the proposed design yields an average decrease in water surface elevation (NAVD88) of 0.02 feet when compared to the hydraulic results of the existing bridge design. The LACDPW scour analysis of the Lincoln Bridge show that the proposed bridge design results in an additional 0.01 feet of bridge scour compared to the existing condition for all valid analyses. Results of the HEC-18 scour analysis show an average increase of 2.4 feet of total scour for the proposed design in comparison to the existing bridge.

It is recommended that all future analyses of proposed bridge designs use the most hydrologically conservative scenario that yielded valid hydraulic analyses. That is, scenarios considering the QCAP design discharge of 51,240 cubic feet per second, the MSL initial elevation of 2.6 feet, and the California Medium-High SLR scenario of 6.8 feet. If future models require using hydrologic conditions that resulted in channel overtopping for more conservative analyses, it is recommended that Psomas obtain additional terrain data to expand the area of analysis to include the Ballona Wetlands Reserve. Additional terrain data would make it possible to extend the HEC-RAS cross sections to contain the full flow or to add a 2D area to capture surface flow if needed.

6 References

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7 Appendices

Please refer to digitally submitted appendices.