# APPENDIX F

# STRUCTURE PRELIMINARY GEOTECHNICAL REPORT

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**Earth Mechanics, Inc.**
Geotechnical & Earthquake Engineering

November 13, 2019

EMI Project No. 19-143

HNTB
200 E. Sandpointe Avenue, Suite 200
Santa Ana, California 92707

Attention: Mr. Patrick Somerville

Subject: **Structure Preliminary Geotechnical Report**
**Yorba Linda Blvd Bridge over Santa Ana River (Widen), Bridge No. 55C-0509**
**Yorba Linda Boulevard and Savi Ranch Parkway Widening Project**
**City of Yorba Linda, California**

Dear Mr. Somerville:

Attached is our Structure Preliminary Geotechnical Report (SPGR) for the proposed widening of the Yorba Linda Boulevard Bridge over the Santa Ana River (Bridge No. 55C-0509) in the City of Yorba Linda, California. The bridge widening is part of the Yorba Linda Boulevard and Savi Ranch Parkway Widening Project. This report was prepared to support the Project Approval and Environmental Document (PA-ED) phase of the project. The SPGR includes information required by the 2017 California Department of Transportation (Caltrans) Foundation Reports for Bridges document.

The recommendations and conclusions provided in this report are based on available subsurface soil information. The conclusions and recommendations are considered preliminary and should be verified in the future by conducting a site-specific geotechnical field investigation, laboratory soil testing, and engineering analyses.

Please submit this report to the City of Yorba Linda and any other participating agencies for their review. EMI will provide responses to comments. Upon concurrence of the responses, the report will be revised accordingly. We appreciate the opportunity to provide geotechnical services for this project. If you have any questions please do not hesitate to contact us.

Sincerely,
EARTH MECHANICS, INC.

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Project Geologist

# STRUCTURE PRELIMINARY GEOTECHNICAL REPORT

# YORBA LINDA BOULEVARD BRIDGE OVER SANTA ANA RIVER (WIDEN)
## BRIDGE NO. 55C-0509
## YORBA LINDA, CALIFORNIA

*Prepared for:*

*HNTB*
*200 E. Sandpointe Avenue, Suite 200*
*Santa Ana, CA 92707*

Prepared by:

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EMI Project No. 19-143

November 13, 2019

Earth Mechanics, Inc.
Geotechnical & Earthquake Engineering

## TABLE OF CONTENTS

## TABLES

## FIGURES

Page

## APPENDIX

## 1.0 INTRODUCTION

This Structure Preliminary Geotechnical Report (SPGR) has been prepared to provide preliminary geotechnical and foundation information to assist the structural designers with the Advance Planning Study (APS) for the proposed widening of the existing Yorba Linda Boulevard Bridge (Bridge No. 55C-0509) spanning the Santa Ana River. The contents of this SPGR follow the reference titled "Foundation Reports for Bridges" (Caltrans, 2017a). The SPGR includes preliminary geotechnical, seismic, and foundation information for the proposed bridge widening.

The preliminary foundation recommendations provided in this report are based on the subsurface information shown on the as-built Log of Test Borings (LOTB) sheet which is included in the as-built plans for the existing bridge structure. The as-built LOTB is provided in Appendix A. A site-specific geotechnical investigation will be performed for the proposed bridge widening during the final design phase. The preliminary recommendations herein require verification when additional site-specific information becomes available.

## 2.0 SCOPE OF WORK

The geotechnical scope of work included: (1) reviewing available geotechnical and geologic information including published geologic maps and seismic hazard reports, (2) reviewing as-built plans of the existing bridge, (3) reviewing APS plans for the proposed widening prepared by the structural designer; and, (4) assessing the foundation types for the proposed bridge structure. The geotechnical and geologic references reviewed for this project are listed in the references section of this report.

## 3.0 PROJECT DESCRIPTION

The project intends to improve traffic operations along Yorba Linda Boulevard, South Weir Canyon Road, and Savi Ranch Parkway by widening the existing roads and providing additional storage at intersections for turning movements. The project measures approximately 0.40 mile along Yorba Linda Boulevard between La Palma Avenue and the SR-91 westbound off-ramp, and 0.10 mile along South Weir Canyon Road between the SR-91 eastbound off-ramp and Santa Ana Canyon Road. Yorba Linda Boulevard is proposed to be widened from La Palma Avenue to Santa Ana Canyon Road (including the existing bridge over the Santa Ana River) and includes a Class IV protected bikeway along the northeastern side of Yorba Linda Boulevard between Old Canal Road and the bicycle connection for the Santa Ana River Trail at La Palma Avenue. The project also includes widening along the north side of Savi Ranch Parkway approximately 0.15 mile between Yorba Linda Boulevard and Mirage Street.

Project improvements include new pavement, curb and gutter, drainage structures, curb ramps, traffic signal modifications, striping, signs, and landscaping. The project also includes widening the existing Yorba Linda Boulevard Bridge (spanning the Santa Ana River) and constructing a retaining wall along the north side of Savi Ranch Parkway.

This SPGR is specifically for the proposed widening of the existing Yorba Linda Boulevard Bridge that spans the Santa Ana River. The location of the bridge is shown on Figure 1. The proposed bridge is six-span, reinforced concrete box girder structure. Preliminary plans show the proposed bridge length to be 775 feet and the width appears to vary between about 40 and 57 feet. The maximum span length is 131.5 feet. The bridge will be supported on tall diaphragm walls at the abutments and continuous reinforced concrete walls at the piers. Widening the bridge requires lengthening the pier walls and replacing the existing pier wall extensions (noses) on the upstream side of the bridge. Depending on the pile type selected, either pile driving or drilling equipment will be required within the river channel.

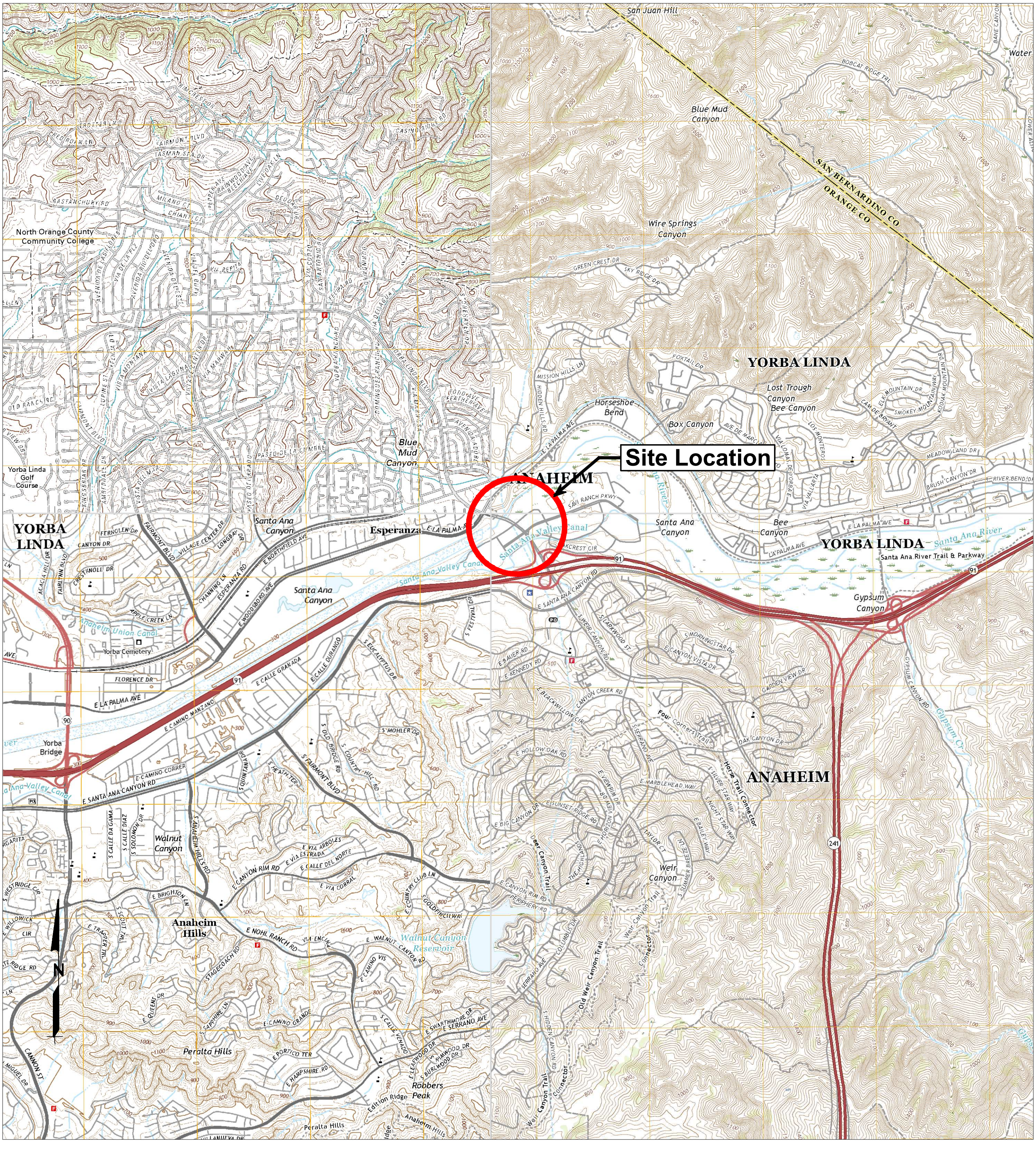
## 4.0 EXCEPTION TO POLICY AND PROCEDURES

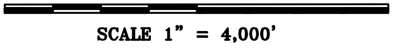
From a geotechnical standpoint, there are no known geotechnical conditions that would cause deviation from Caltrans policies or procedures that require an exception.

## 5.0 FIELD INVESTIGATION

No site-specific field investigation was performed for the preparation of this SPGR. Conclusions and preliminary recommendations provided herein are based on the subsurface soil information shown on the as-built LOTB sheet; the as-built LOTB is attached in Appendix A for reference. The as-built LOTB sheet for the original bridge appears to show that five 2.5-inch diameter penetrometer borings were conducted along or in the vicinity of the existing bridge. The date that the borings were conducted is unknown. The as-built LOTB shows top-of-borehole elevations to range between about +313 and +324 feet. The borings were advanced to depths between about 26 and 49 feet below the ground surface, reaching elevations ranging between about +290 and +255 feet. The as-built logs do not indicate the presence or absence of groundwater. The existing bridge was constructed in 1983; therefore, the vertical datum at the time of the field investigation and bridge construction is presumed to be NGVD29.

A supplemental site-specific geotechnical field investigation, including exploratory boreholes and Cone Penetration Test (CPT) soundings, is recommended to be performed during PS&E. Because of the potential gravelly nature of the subsurface soils, pushing CPT soundings to target depths may not be feasible. Laboratory testing is required on soil samples collected from the supplemental investigation to determine relevant physical and engineering properties of the soils.





SCALE 1" = 4,000'

REFERENCE: USGS Topographic 7.5 Minute Quadrangle Map Prado Dam Quadrangle (2018), Orange Quadrangle (2018), Yorba Linda Quadrangle (2018), and Black Star Quadrangle (2018)

**Earth Mechanics, Inc.**
Geotechnical and Earthquake Engineering

**Yorba Linda Boulevard Bridge Over Santa Ana River (Widen)**

Site Location Map

| | | |
|---|---|---|
| Project No. | 19-143 | Date: October 2019 |

Figure 1

# 6.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

## 6.1 Physiography and Topography

The site is located in Santa Ana Canyon, a narrow canyon between the Puente/Chino Hills on the north and the Santa Ana Mountains on the south (Figure 2). The Upper Santa Ana River (USAR) Valley lies to the east and the Los Angeles Basin to the west. The canyon was cut by the Santa Ana River which flows westerly from the USAR Valley to the Los Angeles Basin. The flow of the Santa Ana River is controlled by Prado Dam which lies a little more than a mile to the east.

The bridge site is located in a shallow valley which runs along the general alignment of the Santa Ana River. The topography in the vicinity of the site slopes gently from northeast to southwest. The existing ground elevation along Yorba Linda Boulevard, within the footprint of the existing bridge and in the vicinity of the bridge, ranges from about +330 feet to about +350 feet. Along the Santa Ana River, beneath the existing bridge, elevations range from about +334 to +311 feet.

## 6.2 Stratigraphy

The Santa Ana Canyon floodplain is underlain by non-indurated (i.e. unconsolidated) river sediments (fluvial deposits) deposited within the Quaternary time period (about the past 100 thousand years). These deposits are predominantly sand and gravel with some lenses of fine-grained deposits (silts) and large particles (cobbles). Boulders are present but make up a relatively small percentage of the deposits. Figure 2 provides a map showing the distribution of geologic units across the surface of the project area.

The non-indurated Quaternary-age fluvial deposits overlie deformed Tertiary-age (approximately 5 to 40 million years old) bedrock. The Tertiary rocks are separated by the Whittier fault with the younger rocks on the north side of the fault dipping at moderate angles to the north, and older rocks on the south side of the fault dipping to the west.

Basement rocks comprise the ancient Santiago Peak volcanics (approximately 100 to 150 million years old) which crop out in the slopes south of the Whittier fault. However, these basement rocks are deep below the project area and are not of direct significance to the project.

## 6.3 Geologic Structure

Figure 3 is a regional fault map showing the known active faults in region. The fault of most importance to the project is the Elsinore fault zone, Whittier fault segment which extends north of the project area. Other faults of significance are the Chino fault and the Elsinore fault, both of which lie to the east. The Whittier, Elsinore, and Chino faults are believed to be related and merge toward the southeast. The convergence is characterized by a very complex branching and braided fault pattern which is largely covered by alluvium of the Santa Ana River floodplain and by landslides in the northeast Santa Ana Mountains (e.g. the Green River landslide). Published geologic maps show little agreement on the exact location of the Whittier fault. Figure 3 shows one location of the fault; unlike Figure 3, other published maps (for example, Weber, 1977 and Dibblee, 2001) show several faults in the convergence zone of the Whittier and Elsinore faults. Although these faults are young, they are generally not considered to be active seismogenic (earthquake generating) structures. However, these faults could possibly suffer displacements during a major earthquake on the Whittier, Chino, or Elsinore fault. The Scully Hill fault, just north of the project area, is one of these faults.

### 6.4 Seismicity

The site is located in seismically active southern California. The present-day seismotectonic stress field in the Los Angeles region is one of north-northeasterly compression which is indicated by the geologic structures, earthquake focal-mechanism solutions, and geodetic measurements. Data suggests crustal shortening of between 5 and 9 mm/year across the greater Los Angeles area (Argus et al., 1999).

Historical earthquake epicenter maps show widespread seismicity throughout the Los Angeles region. Earthquakes occur primarily as loose clusters along the Newport-Inglewood Structural Zone, the southern margin of the Santa Monica Mountains, the margin between the Santa Susana-San Fernando Valley and the southern margin of the San Gabriel Mountains, and in the Coyote Hills-Puente Hills area.

Although the historical earthquakes occur in proximity to known faults, they are difficult to directly associate with mapped faults. Part of this difficulty is due to the fact that the basin is underlain by several poorly known subsurface thrust faults, generally referred to as blind thrust faults. Ward (1994) estimated that about 40 percent of seismic moment cannot be associated with known faults.

The largest historical earthquake within the Los Angeles Basin was the 1933 Long Beach event which had a magnitude of about $M_W$=6.4 ($M_L$=6.3). This earthquake did not rupture the surface but is believed to have been associated with the Newport-Inglewood Structural Zone (NISZ), a major strike-slip fault in the Los Angeles Basin (Benioff, 1938). The association is based on abundant ground failures along the NISZ trend but no unequivocal surface rupture was identified. Reevaluation of the seismicity data by Hauksson and Gross (1991) relocated the earthquake hypocenter to about six miles below the Huntington Beach-Newport Beach city boundary.

Other major earthquakes in the region include the 1994 Northridge and the 1971 San Fernando earthquakes both of which occurred in the San Fernando Valley region. The 1994 earthquake had a moment magnitude ($M_W$) of about 6.7 ($M_S$=6.8, $M_L$=6.4), and occurred on a southerly dipping subsurface fault which was unknown prior to the earthquake. The main shock occurred at a depth of about 12 miles. Earthquake aftershocks clearly defined the rupture surface dipping about 35 degrees southerly from a depth of about 1.2 or 1.9 miles to 14 miles (Hauksson et al, 1995). The causative fault was never identified with certainty. The event may have occurred on an eastern extension of the Oakridge fault (Yeats and Huftile, 1995), a southerly dipping feature fault bounding the Ventura Basin and the Santa Susana Mountains.

The 1971 San Fernando earthquake was of similar size ($M_W$=6.7, $M_S$=6.4, $M_L$=6.4) to the 1994 event but did involve surface rupture. The 1971 event occurred on a northerly dipping thrust fault that dips from the northern side of the San Fernando Valley to a depth of about 9.3 miles under the San Gabriel Mountains. Several mapped surface faults were involved such as the Sylmar fault, Tujunga fault, and Lakeview fault. These faults are commonly considered to be part of the Sierra Madre fault system which extends easterly from the San Fernando Valley, along the base of the San Gabriel Mountains on the north side of the San Gabriel Valley, and to the Cucamonga fault in the San Bernardino area.

The 1987 Whittier earthquake ($M_L$=5.9, $M_W$=5.9) occurred on a subsurface fault dipping under the Puente Hills to about 10 miles beneath the San Gabriel Basin (Shaw and Shearer, 1999; Shaw et al., 2002). This event did not rupture the ground surface.

Another significant earthquake in the region was the 1812 earthquake which caused damage at the San Juan Capistrano Mission. The location and magnitude of the 1812 earthquake are unknown because of the sparse population at the time, but geological studies (Jacoby et al., 1988; Fumal et al., 1993; Weldon et al., 2004) postulated that the earthquake did not occur in the Capistrano area, but rather was a large (M>7.0) distant event on the San Andreas fault in the Wrightwood area of the San Gabriel Mountains.

The earliest documented earthquake in the Los Angeles region was reported by the Portola expedition as they camped near the Santa Ana River in 1769. This event has been attributed by various geoscientists to just about every fault in the Los Angeles area but it could just as well have been a distant event that shook a wide area as did the 1971 San Fernando, the 1987 Whittier, and the 1994 Northridge events, as well as other more distant events (i.e. 1992 Landers event).

Several active and potentially active faults are located in the region. Table 1 lists the faults nearest the bridge site, the approximate distance in miles between the nearest point on the fault and the bridge site, the maximum magnitude, and fault type.

**Table 1. Potential Seismic Sources**

| **Fault Name** | **Closest Distance to Fault Rupture Plane, Rrup (Miles)** | **Maximum Earthquake ($M_W$)** | **Fault Type** |
|---|---|---|---|
| Elsinore (Whittier Section) | 1.18 | 6.9 | SS |
| Elsinore (Glen Ivy Section) | 4.60 | 7.7 | SS |
| Elsinore (Chino Section) | 4.46 | 6.6 | SS |
| Peralta Hills | 2.73 | 6.1 | R |
| Yorba Linda (Seismicity Zone) | 2.71 | 6.4 | R |
| Puente Hills Blind Thrust (Coyote Hills) | 7.25 | 6.8 | R |
| *Note: SS = Strike Slip fault; R = Reverse fault.* | | | |

## Elsinore Fault Zone

The northwest-trending Elsinore fault zone extends nearly 150 miles from the Mexican border to the northern edge of the Santa Ana Mountains. The predominant sense of displacement across this fault zone is thought to be right-lateral. From geomorphic evidence, the fault zone is considered capable of seismic offsets of up to about 20 feet. Rockwell et al. (1985) suggested offset sediments exposed in trenches to indicate a 200- to 300-year recurrence interval for ground rupturing earthquakes. The Elsinore fault zone is considered active by the State of California and an Alquist-Priolo Earthquake Fault Zone has been established for the fault.

### Whittier Section

Locally, the Whittier Section of the Elsinore fault zone is located about 350 feet southwest of the mapped fault trace (Jennings, 2010). Although no major historical earthquakes have been attributed to the Whittier section, studies done by several investigators, most of which included trenching, have documented movement on this fault in the last 11,000 years (Leighton 1987; Rockwell et al., 1988; Gath et al., 1992; Patterson and Rockwell, 1993). Slip rates range from 2.5 to 3 mm/year (Rockwell et al., 1990; Gath et al., 1992). The estimated maximum earthquake to occur along the Whittier fault segment is Mw 6.8 per Cao et al. (2003). The fault trace is located approximately one mile north of the project site.

Glen Ivy Section

The Glen Ivy section of the Elsinore fault is located about 4.6 miles southeast of the bridge site. The fault is a right lateral strike slip fault with an estimated slip rate of 5±2 mm/year (Millman and Rockwell, 1986). The maximum moment magnitude earthquake along the Elsinore-Glen Ivy Segment is estimated to be 6.8 (Mw) (Frankel et al., 2002; Petersen et al., 1996).

Chino Section

The Chino Section separates from the main portion of Elsinore Fault zone south of Corona and extends northward through the Chino Hills, dying out in the Los Serranos suburb of the City of Chino Hills. The tectonic geomorphology of the Chino Fault zone indicates predominately right-lateral strike-slip motion with a component of reverse-oblique movement, based on offset ridgeline, deflected drainages and beheaded drainages in the Chino Hills. The Chino Fault zone is considered active by the State of California and an Alquist-Priolo Earthquake Fault zone has been established around the fault (CGS, 2003). The Chino Fault zone has a long term slip rate ranging from 0.03 to 0.09 inches (0.7 to 2.2 millimeters) per year and a magnitude in the 6.5 to 7.0 range. The fault is located approximately 4.5 miles northwest of the project site.

### Yorba Linda (Seismicity Zone)

The Yorba Linda seismicity zone is a five to ten mile long, northeast-southwest trending zone between latitude 33° 45' N and 33° 55' N. The seismicity zone is believed to be the source of the 2008 Chino Hills earthquake ($M_W$=5.4). The seismicity zone is located approximately 2.7 miles northwest of the project site.

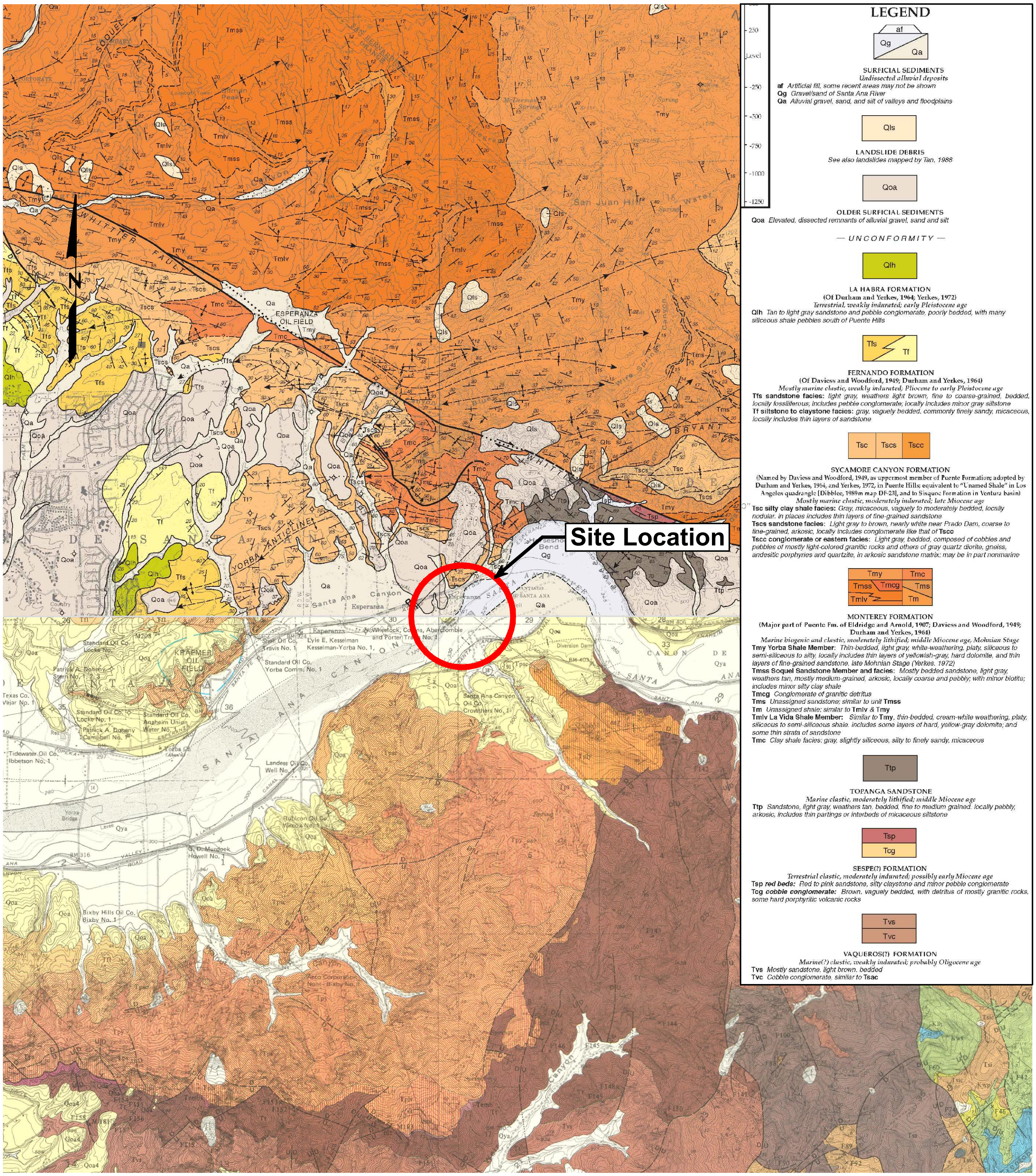
### Puente Hills Blind Thrust Fault

The Puente Hills blind thrust fault (Coyote Hills segment) dips northerly under the San Gabriel Valley (Shaw et al., 2002). The blind thrust system consists of stepped segments with the Santa Fe Springs segment stepped to the right from the Los Angeles segment farther west and the Coyote Hills segment southeast of the Santa Fe Springs segment.

## 6.5 Subsurface Soil Conditions

The as-built LOTB sheet for the existing Yorba Linda Boulevard Bridge (previously referred to as the Weir Canyon Road Bridge) shows a meager amount of information for the subsurface soils and conditions. The LOTB shows that the subsurface soils are gravelly sand. There are no descriptions for color, moisture content, density, and gradation. There are no blowcounts on the logs which are typically shown for penetration borings. There is no mention of whether or not groundwater was observed.

As-built LOTBs for the nearby Weir Canyon Road Undercrossing (at SR-91) shows brown and yellow brown slightly compact to compact gravelly sand overlying brown and light brown dense and very dense gravelly sand, sandy gravel, and cobbles.



## LEGEND

af | Qg | Qa

SURFICIAL SEDIMENTS
*Undissected alluvial deposits*
**af** *Artificial fill, some recent areas may not be shown*
**Qg** *Gravel/sand of Santa Ana River*
**Qa** *Alluvial gravel, sand, and silt of valleys and floodplains*

Qls

LANDSLIDE DEBRIS
*See also landslides mapped by Tan, 1988*

Qoa

OLDER SURFICIAL SEDIMENTS
**Qoa** *Elevated, dissected remnants of alluvial gravel, sand and silt*

— *UNCONFORMITY* —

Qlh

LA HABRA FORMATION
**(Of Durham and Yerkes, 1964; Yerkes, 1972)**
*Terrestrial, weakly indurated; early Pleistocene age*
**Qlh** *Tan to light gray sandstone and pebble conglomerate, poorly bedded, with many siliceous shale pebbles south of Puente Hills*

Tfs | Tf

FERNANDO FORMATION
**(Of Daviess and Woodford, 1949; Durham and Yerkes, 1964)**
*Mostly marine clastic, weakly indurated; Pliocene to early Pleistocene age*
**Tfs sandstone facies:** *light gray, weathers light brown, fine to coarse-grained, bedded, locally fossiliferous; includes pebble conglomerate; locally includes minor gray siltstone*
**Tf siltstone to claystone facies:** *gray, vaguely bedded, commonly finely sandy, micaceous, locally includes thin layers of sandstone*

Tsc | Tscs | Tscc

SYCAMORE CANYON FORMATION
(Named by Daviess and Woodford, 1949, as uppermost member of Puente Formation; adopted by Durham and Yerkes, 1964, and Yerkes, 1972, in Puente Hills; equivalent to "Unamed Shale" in Los Angeles quadrangle [Dibblee, 1989m map DF-23], and to Sisquoc Formation in Ventura basin)
*Mostly marine clastic, moderately indurated; late Miocene age*
**Tsc silty clay shale facies:** *Gray, micaceous, vaguely to moderately bedded, locally nodular, in places includes thin layers of fine-grained sandstone*
**Tscs sandstone facies:** *Light gray to brown, nearly white near Prado Dam, coarse to fine-grained, arkosic, locally includes conglomerate like that of* **Tscc**
**Tscc conglomerate or eastern facies:** *Light gray, bedded, composed of cobbles and pebbles of mostly light-colored granitic rocks and others of gray quartz diorite, gneiss, andesitic porphyries and quartzite, in arkosic sandstone matrix; may be in part nonmarine*

Tmy | Tmc | Tmss | Tmcg | Tms | Tmlv | Tm

MONTEREY FORMATION
**(Major part of Puente Fm. of Eldridge and Arnold, 1907; Daviess and Woodford, 1949; Durham and Yerkes, 1964)**
*Marine biogenic and clastic, moderately lithified; middle Miocene age, Mohnian Stage*
**Tmy Yorba Shale Member:** *Thin-bedded, light gray, white-weathering, platy, siliceous to semi-siliceous to silty, locally includes thin layers of yellowish-gray, hard dolomite, and thin layers of fine-grained sandstone, late Mohnian Stage (Yerkes, 1972)*
**Tmss Soquel Sandstone Member and facies:** *Mostly bedded sandstone, light gray, weathers tan, mostly medium-grained, arkosic, locally coarse and pebbly; with minor biotite; includes minor silty clay shale*
**Tmcg** *Conglomerate of granitic detritus*
**Tms** *Unassigned sandstone; similar to unit* **Tmss**
**Tm** *Unassigned shale; similar to* **Tmlv** *&* **Tmy**
**Tmlv La Vida Shale Member:** *Similar to* **Tmy**, *thin-bedded, cream-white weathering, platy, siliceous to semi-siliceous shale, includes some layers of hard, yellow-gray dolomite; and some thin strata of sandstone*
**Tmc** *Clay shale facies: gray, slightly siliceous, silty to finely sandy, micaceous*

Ttp

TOPANGA SANDSTONE
*Marine clastic, moderately lithified; middle Miocene age*
**Ttp** *Sandstone, light gray, weathers tan, bedded, fine to medium grained, locally pebbly, arkosic, includes thin partings or interbeds of micaceous siltstone*

Tsp | Tcg

SESPE(?) FORMATION
*Terrestrial clastic, moderately indurated; possibly early Miocene age*
**Tsp *red beds:*** *Red to pink sandstone, silty claystone and minor pebble conglomerate*
**Tcg *cobble conglomerate:*** *Brown, vaguely bedded, with detritus of mostly granitic rocks, some hard porphyritic volcanic rocks*

Tvs | Tvc

VAQUEROS(?) FORMATION
*Marine(?) clastic, weakly indurated; probably Oligocene age*
**Tvs** *Mostly sandstone, light brown, bedded*
**Tvc** *Cobble conglomerate, similar to* **Tsac**

**0 5,000 10,000 FEET**

**SCALE 1" = 5,000'**

**Earth Mechanics, Inc.**
**Geotechnical and Earthquake Engineering**

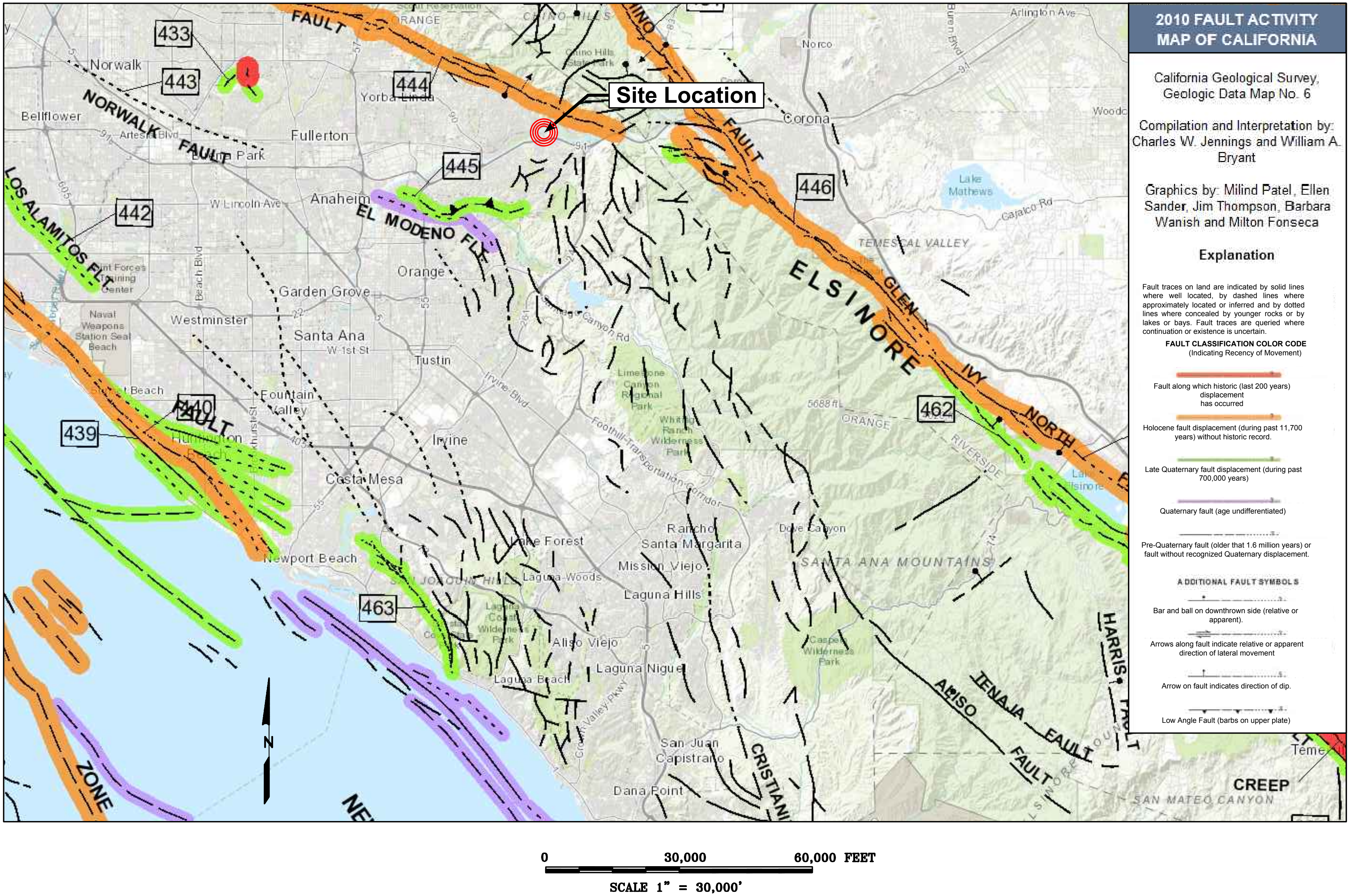
**Yorba Linda Boulevard Bridge Over Santa Ana River (Widen)**

Project No. 19-143

Date: October 2019

Regional Geologic Map

Figure 2



**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.

**FAULT CLASSIFICATION COLOR CODE**
(Indicating Recency of Movement)

🟥 Fault along which historic (last 200 years) displacement has occurred

🟧 Holocene fault displacement (during past 11,700 years) without historic record.

🟩 Late Quaternary fault displacement (during past 700,000 years)

🟪 Quaternary fault (age undifferentiated)

Pre-Quaternary fault (older that 1.6 million years) or fault without recognized Quaternary displacement.

**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)

**Earth Mechanics, Inc.**

Geotechnical and Earthquake Engineering

**Yorba Linda Boulevard Bridge Over Santa Ana River (Widen)**

Project No. 19-143

Date: October 2019

Regional Fault Map

Figure 3

# 7.0 GEOLOGIC HAZARDS

## 7.1 Seismic Shaking

The energy released during an earthquake propagates from the fault rupture surface in the form of seismic waves. Strong ground motion from seismic wave propagation can cause significant damage to structures. At any given location, the intensity of the ground motion is a function of the distance to the fault rupture, the local soil/bedrock conditions, and the earthquake magnitude. Intensity is usually greater in areas underlain by unconsolidated soil than in areas underlain by more competent rock.

Earthquakes are characterized by a moment magnitude, which is a quantitative measure of the strength of the earthquake based on strain energy released during the event. The magnitude is independent of the site, but is dependent on several factors including the type of fault, rock type, and stored energy. Moderate to severe ground shaking will be experienced at the project site if a large magnitude earthquake occurs on one of the nearby principal late Quaternary faults; moderate to severe ground shaking can cause structural damage to on-site improvements.

Due to the proximity of numerous faults, the existing and proposed bridge is expected to experience strong to moderate ground shaking in the event of a major earthquake from a nearby fault. To estimate Peak Ground Acceleration (PGA), EMI used the current web-based Caltrans ARS Online software V2.3.09 (Caltrans, 2017b) to develop Acceleration Response Spectrum (ARS) curves. The PGA is the zero-period spectral acceleration from the design ARS curve.

## 7.2 Surface Fault Rupture

In general terms, an earthquake is caused when strain energy in rocks is suddenly released by movement along a plane of weakness. In some cases, fault movement propagates upward through the subsurface materials and causes displacement at the ground surface as a result of differential movement. Surface rupture usually occurs along traces of known or potentially active faults, although many historic events have occurred on faults not previously known to be active. Seismicity within this region is a result of the dominantly reverse-slip regime of the region.

The California Geologic Survey (CGS) establishes criteria for faults as active, potentially active or inactive. Active faults are those that show evidence of surface displacement within the last 11,000 years (Holocene age). Potentially active faults are those that demonstrate displacement within the past 1.6 million years (Quaternary age). Faults showing no evidence of displacement within the last 1.6 million years may be considered inactive for most structures, except for critical or certain life structures. In 1972 the Alquist-Priolo Special Studies Zone Act (now known as the Alquist-Priolo Earthquake Fault Zone Act, 1994, or Alquist-Priolo Earthquake Hazards Act, APEHA) was passed into law which requires fault studies within 500 feet of active or potentially active faults. The APEHA designates “active” and “potentially active” faults utilizing the same age criteria as that used by the CGS.

In addition to the faults listed in Table 1, other large faults in the Southern California area have the potential to impact proposed improvements. These include the San Andreas Fault, San Gabriel Fault and other undefined large blind thrust faults. Active and potentially active faults have the potential for generating surface fault rupture. Although, not all earthquake events along active faults result in surface fault rupture or ground deformation. Surface fault rupture can only be predicted based on past earthquake and surface fault rupture data. This includes past fault rupture lengths and depths in relation to past earthquakes and their associated magnitude, recurrence, and direction. Lack of previous surface fault rupture events or information can make it very difficult to predict future fault rupture events.

No known active faults traverse through or within 1,000 feet of the bridge site, and the site is not located within an Alquist-Priolo Earthquake Fault Zone. Therefore, the risk of ground surface rupture and related hazards at the project site is expected to be low.

### 7.3 Earthquake-Induced Landslides

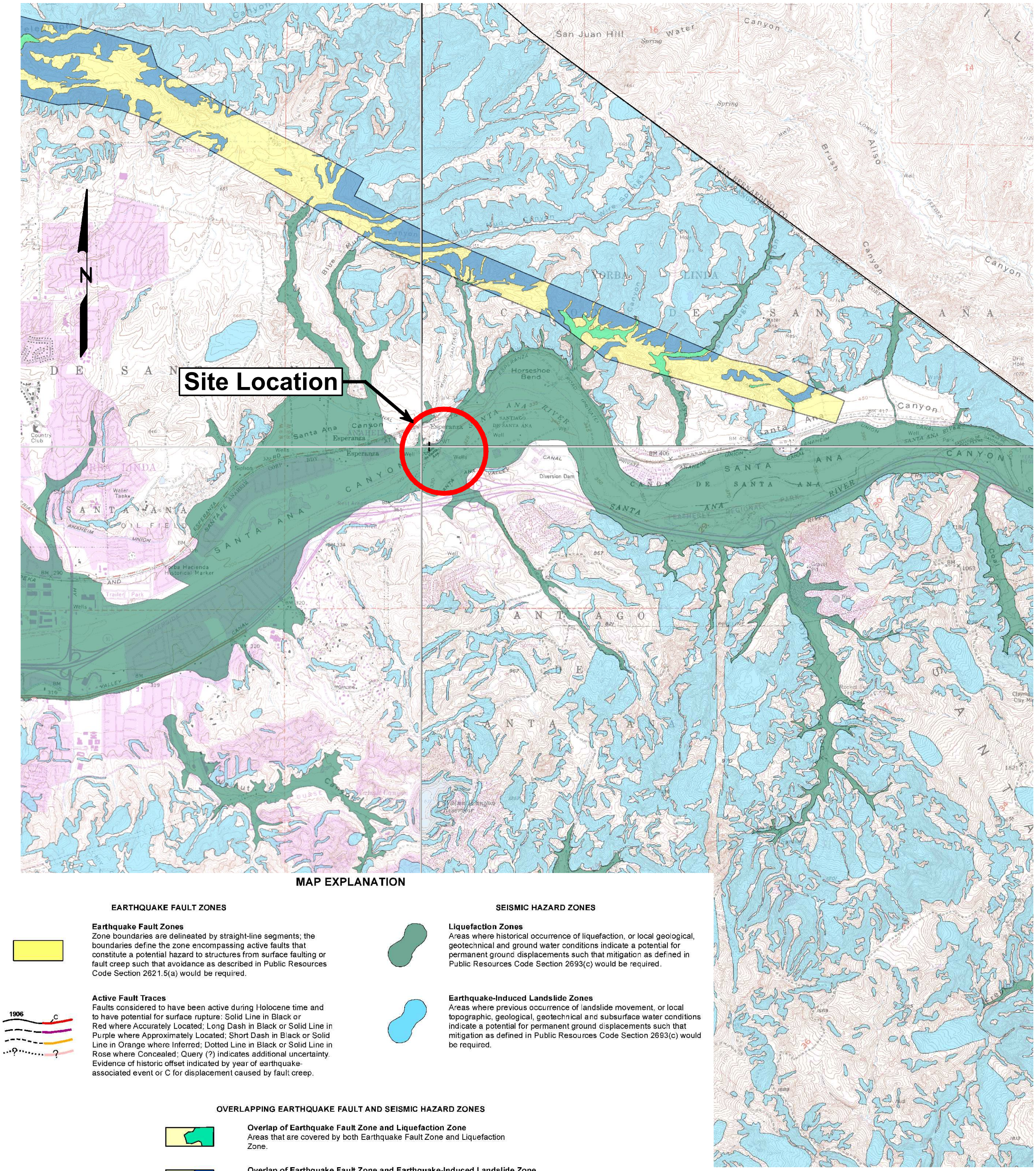
According to the State of California Earthquake Zones of Required Investigation maps for the Black Star Canyon, Yorba Linda, Orange, and Prado Dam Quadrangles (Figure 4), the bridge site is not within an area designated as an earthquake-induced landslide zone. The terrain in the immediate vicinity of the bridge site is relatively flat; therefore, seismically-induced landsliding is not a concern.

### 7.4 Expansive Soil

Soils that undergo relatively significant volume change (shrink and swell) due to changing moisture content are characteristically expansive soils. Soil moisture content can change due to rainfall, irrigation, water line leaks, fluctuating groundwater elevation, hot weather, drought, or other natural or human factors. Based on the available subsurface information, the existing soils within the bridge area are expected to be primarily composed of sand and gravel, which are not expansive soils. A site-specific geotechnical investigation will be performed during PS&E to verify the expansion potential of soils at the bridge site and adjacent improvements.

### 7.5 Collapsible Soil

Collapsible soils are soils that collapse (settle) under applied loads when water is introduced into the soil. Soil collapse, due to the introduction of water, is also referred to as hydro-consolidation. Natural deposits susceptible to hydro-consolidation are typically aeolian, alluvial, or colluvial soils with high apparent dry strength. The dry strength of the soils may be attributed to capillary tension, the clay and silt constituents in the soil, or the presence of cementing agents (i.e. salts). Once these soils are subjected to excessive moisture and embankment or foundation loads, the constituency including soluble salts or bonding agents is weakened or dissolved and collapse occurs resulting in settlement. Typical collapsible soils are light colored, low in plasticity, and have relatively low densities. The available subsurface information does not note the presence of collapsible soils and laboratory test data is not available; therefore, it is unknown if collapsible soils exist. Based on the known information, presence of collapsible soils is not likely. A comprehensive geotechnical investigation will be conducted during the design phase of the project to assess the presence of collapsible soils and determine the impact of collapsible soils on the proposed bridge widening if such soils exist.



## MAP EXPLANATION

### EARTHQUAKE FAULT ZONES

🟨 **Earthquake Fault Zones**
Zone boundaries are delineated by straight-line segments; the boundaries define the zone encompassing active faults that constitute a potential hazard to structures from surface faulting or fault creep such that avoidance as described in Public Resources Code Section 2621.5(a) would be required.

**Active Fault Traces**
Faults considered to have been active during Holocene time and to have potential for surface rupture: Solid Line in Black or Red where Accurately Located; Long Dash in Black or Solid Line in Purple where Approximately Located; Short Dash in Black or Solid Line in Orange where Inferred; Dotted Line in Black or Solid Line in Rose where Concealed; Query (?) indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated event or C for displacement caused by fault creep.

1906 C

?  ?

### SEISMIC HAZARD ZONES

**Liquefaction Zones**
Areas where historical occurrence of liquefaction, or local geological, geotechnical and ground water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

**Earthquake-Induced Landslide Zones**
Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

### OVERLAPPING EARTHQUAKE FAULT AND SEISMIC HAZARD ZONES

**Overlap of Earthquake Fault Zone and Liquefaction Zone**
Areas that are covered by both Earthquake Fault Zone and Liquefaction Zone.

**Overlap of Earthquake Fault Zone and Earthquake-Induced Landslide Zone**
Areas that are covered by both Earthquake Fault Zone and Earthquake-Induced Landslide Zone.

**Note: Mitigation methods differ for each zone –**
**AP Act only allows avoidance; Seismic Hazard Mapping Act allows mitigation by engineering/geotechnical design as well as avoidance.**

0 5,000 10,000 FEET

**SCALE 1" = 5,000'**

**Earth Mechanics, Inc.**
**Geotechnical and Earthquake Engineering**

**Yorba Linda Boulevard Bridge Over Santa Ana River (Widen)**

Project No. 19-143

Date: October 2019

Seismic Hazard Map

Figure 4

## 8.0 GROUNDWATER

The as-built logs for the existing Yorba Linda Boulevard Bridge do not indicate the presence or absence of groundwater. EMI reviewed the as-built LOTBs for the nearby Weir Canyon Road Undercrossing (UC) which is located about 1,600 feet southeast of the Yorba Linda Boulevard Bridge. The borings drilled in 1968, 1990, and 2010, for the original Weir Canyon Road UC and subsequent widenings, did not encounter groundwater.

The California Division of Mines and Geology (California Geological Survey) prepared Seismic Hazard Zone Reports for the Black Star Canyon, Yorba Linda, Orange, and Prado Dam 7.5-minute quadrangles (CDMG, 2000a, 2005, 1997, 2000b) which include historical groundwater maps. Based on information in these reports, the highest historical groundwater near the project site ranged between zero feet and 30 feet below the ground surface.

Existing groundwater information was gathered from the California Department of Water Resources website. Six groundwater monitoring wells are located within one-half mile of the bridge site. Based on the measurements in the six wells, the depth from the ground surface to the shallowest groundwater level varied from about 7 to 42 feet, which corresponds to elevations ranging from about +308 to +326 feet. The monitoring period ranged between years 1969 and 2010 during which relatively small variations in groundwater depths were observed. The vertical datum for historical measurements is NGVD29.

Based on the available groundwater data reviewed to date, EMI recommends using a groundwater elevation of +311 feet, which roughly corresponds with the Santa Ana River invert elevation, for liquefaction analysis and preliminary assessment of possible bridge foundations.

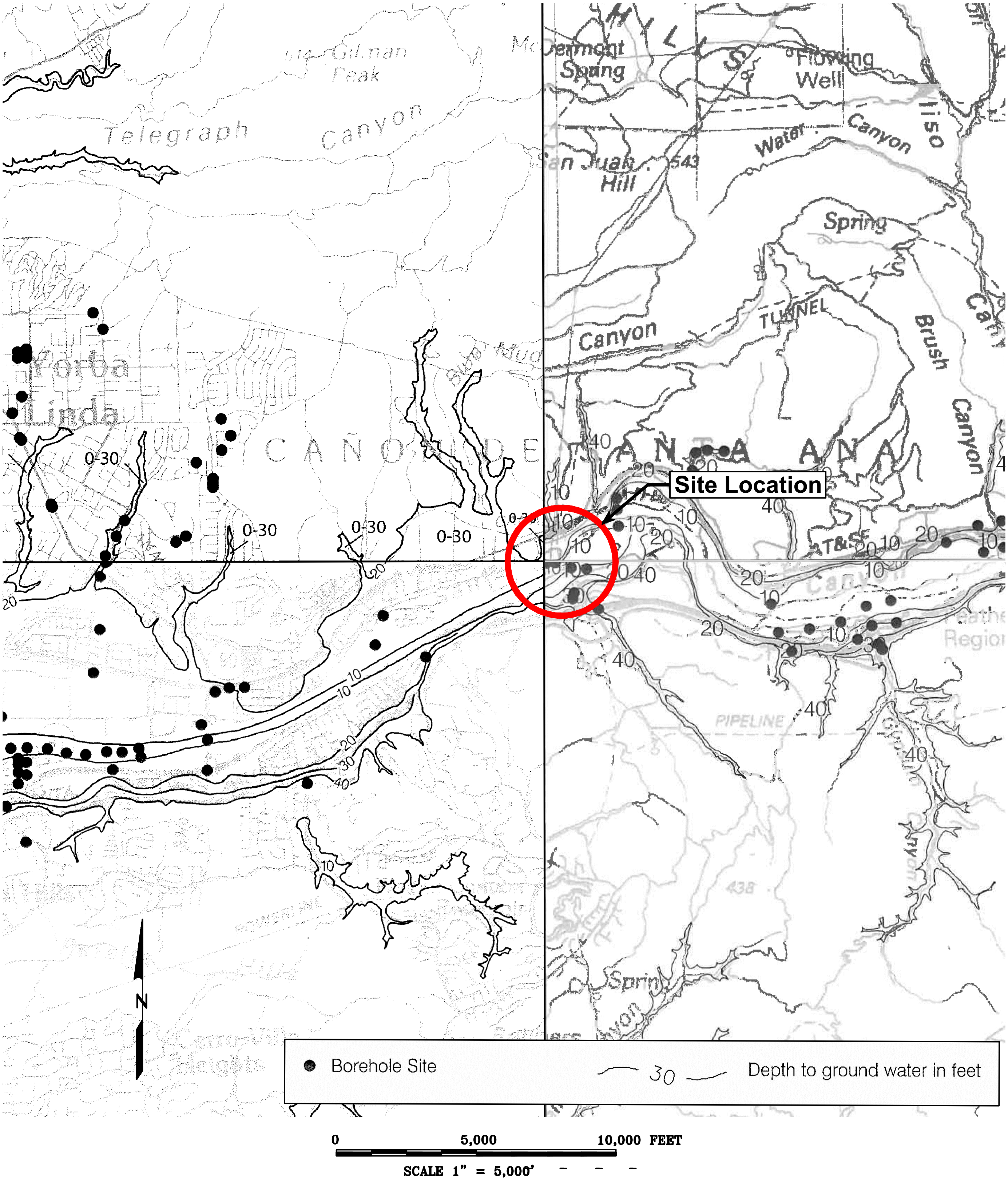
It should be noted that the groundwater level can fluctuate due to several reasons including variation in seasonal precipitation, irrigation, groundwater injection or extraction, improvements to or addition of flood control facilities, or numerous other man-made and natural influences. As a result, the groundwater information provided herein is used for preliminary assessments only. Groundwater conditions will be reexamined during PS&E for the project.

## 9.0 SCOUR EVALUATION

The existing and proposed bridge crosses the Santa Ana River. At the bridge location, the Santa Ana River bottom is currently unlined and therefore scour potential should be considered a design issue. Scour depth should be evaluated by the project civil engineer during PS&E.

## 10.0 SOIL CORROSION EVALUATION

Corrosion test results are not shown on the as-built LOTB sheets and are otherwise not available. Therefore, corrosion potential of on-site soils is unknown. According to the Caltrans Corrosion Guidelines (Caltrans, 2018a), soils are considered corrosive if the pH is 5.5 or less, or chloride content is 500 parts per million (ppm) or greater, or sulfate content is 1,500 ppm or greater. Based on EMI's experience, fine-grained soils with high clay content have a higher tendency to be corrosive, whereas sand, silt, and gravel tend to be non-corrosive. According to the as-built LOTB sheet, the site soils are gravelly sand and sandy gravel and therefore are not expected to be corrosive.



Earth Mechanics, Inc.
Geotechnical and Earthquake Engineering

**Yorba Linda Boulevard Bridge Over Santa Ana River (Widen)**

Project No. 19-143

Date: October 2019

# REGIONAL HISTORICAL GROUNDWATER MAP

Figure 5

Soil corrosivity will be evaluated during PS&E based on laboratory tests on site-specific soils collected from supplemental exploratory boreholes. If soils are found to be corrosive, appropriate recommendations for concrete and steel will be provided.

# 11.0 PRELIMINARY SEISMIC INFORMATION AND RECOMMENDATIONS

## 11.1 Seismic Design

The site is located in seismically active southern California and can experience moderate to strong ground shaking from both local and distant earthquakes. The most influential faults affecting ground motion at the site are listed in Table 2 along with their fault ID, fault type, and their maximum earthquake magnitude according to the Caltrans Fault Database (Merriam, 2012).

The current web-based Caltrans ARS Online software V2.3.09 (2017b) was used to determine Acceleration Response Spectrum (ARS) curves and estimate Peak Ground Acceleration (PGA). The web-based software gives ARS curves for the deterministic and probabilistic earthquake models. The PGA is the zero-period spectral acceleration from the ARS curves. The small-strain shear wave velocity ($Vs_{30}$) value, for the upper 100 feet of soil, was assumed based on the soil description shown on the as-built boring logs. The site latitude and longitude and $Vs_{30}$ are shown in Table 3.

**Table 2. General Fault Information and Deterministic PGA**

| Fault | Fault ID | Fault Type | Maximum Earthquake Magnitude | Approximate Site to Fault Distance, Rrup (miles) | Deterministic PGA |
|---|---|---|---|---|---|
| Elsinore Fault Zone (Whittier Section) | 352 | SS | 6.9 | 1.2 | 0.464 |
| Elsinore (Glen Ivy) rev | 365 | SS | 7.7 | 4.6 | 0.369 |
| Elsinore Fault Zone (Chino Section) | 355 | SS | 6.6 | 4.4 | 0.458 |
| *Note: SS = Strike Slip.* | | | | | |

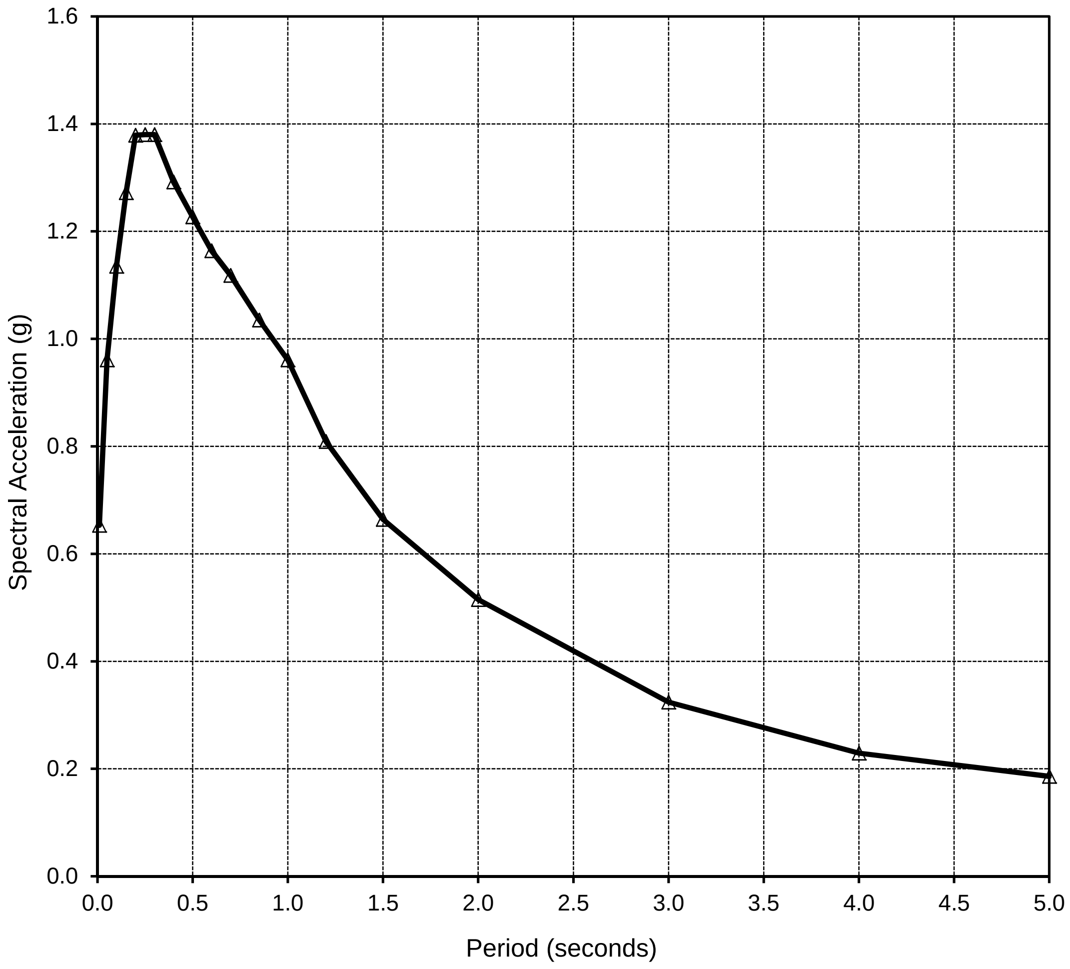
**Table 3. Key Parameters for Determining Preliminary ARS Curves**

| | | |
|---|---|---|
| Site Coordinates | Latitude = 33.87443 degrees | Longitude = -117.74877 degrees |
| Shear Wave Velocity, $V_{s30}$ | 886 feet/sec (270 m/sec) and 984 feet/sec (300 m/sec) | |

Based on the results of the web-based Caltrans software, the probabilistic response spectrum is the controlling ARS curve. The spectral acceleration coordinates and preliminary ARS curve is presented in Table 4. The design magnitude (M) is 7.1 and the preliminary PGA is 0.65g. The preliminary ARS curve, the design magnitude, and the preliminary PGA will be updated during the PS&E phase of the project based on an updated $V_{s30}$ value estimated from supplemental boreholes and CPT soundings.

## Table 4. Spectral Acceleration Coordinates and Preliminary Design ARS Curve

| **Period, T (sec)** | ***Acceleration (g)*** | **Period, T (sec)** | ***Acceleration (g)*** |
|---|---|---|---|
| 0.01 | *0.653* | 0.70 | *1.118* |
| 0.05 | *0.961* | 0.85 | *1.035* |
| 0.10 | *1.135* | 1.00 | *0.961* |
| 0.15 | *1.272* | 1.20 | *0.809* |
| 0.20 | *1.379* | 1.50 | *0.664* |
| 0.25 | *1.380* | 2.00 | *0.515* |
| 0.30 | *1.380* | 3.00 | *0.324* |
| 0.40 | *1.292* | 4.00 | *0.229* |
| 0.50 | *1.227* | 5.00 | *0.186* |
| 0.60 | *1.164* | | |



### 11.2 Liquefaction Potential

Soil liquefaction is the loss of shear strength in generally cohesionless, saturated soils when pore-water pressure induced in the soil by a seismic event becomes equal to or exceeds the overburden pressure. The primary factors influencing liquefaction potential are: groundwater elevation, soil type and grain-size characteristics, relative density of the soil, initial confining pressure, and intensity and duration of ground shaking. Soils most susceptible to liquefaction are saturated low-density sands and silty sands within 50 feet of the ground surface. With increasing overburden, soil density, and increasing clay content, the likelihood of liquefaction decreases.

According to the State of California Earthquake Zones of Required Investigation maps for the Black Star Canyon, Yorba Linda, Orange, and Prado Dam Quadrangles (Figure 4), the bridge site is located within a soil liquefaction zone.

The as-built LOTB lacks sufficient information to conduct preliminary liquefaction analysis (i.e. no Standard Penetration Test (SPT) blowcounts, descriptions of density, fines content, and soil plasticity information). Because the bridge is spanning an active river bed and there is potential for high groundwater, there may be layers of sandy soils that are susceptible to liquefaction under strong ground shaking. For preliminary design and cost estimating, it should be assumed that soil liquefaction can occur due to a strong earthquake event. Soil liquefaction will be assessed during PS&E after supplemental exploratory boreholes have been conducted and subsurface soil samples have been collected and tested. If soil liquefaction is found to be possible, the final foundation design will incorporate the effects of soil liquefaction.

### 11.3 Seismically-Induced Settlement

If soil liquefaction is possible, then liquefaction-induced settlement is possible. Like the soil liquefaction assumption described above, seismically-induced settlement should be assumed to occur. Liquefaction-induced settlement will be assessed during PS&E after supplemental subsurface soil information is obtained. If seismically-induced settlement is confirmed, then foundation design will incorporate the effects of seismically-induced settlement.

### 11.4 Seismic Slope Instability

The project area is composed of relatively flat terrain with the exception of the side slopes of the Santa Ana River. If soil liquefaction is determined to occur, then lateral spreading may be a design issue. Seismic slope stability will be assessed during the PS&E phase of the project after additional subsurface information is collected.

### 11.5 Ground Rupture

No known active faults traverse through or within 1,000 feet of the bridge site, and the site is not located within an Alquist-Priolo Earthquake Fault Zone. Therefore, the risk of ground surface rupture and related hazards at the project site is expected to be low. In addition, according to Caltrans Memo To Designers 20-10 (Caltrans, 2013) a fault rupture hazard analysis is not required since the project site does not fall within an Alquist-Priolo Earthquakes Fault Zone or within 1,000 feet of an unzoned fault that is Holocene or younger in age.

## 12.0 AS-BUILT FOUNDATION DATA

The existing bridge was constructed in 1983. The bridge is a six-span cast-in-place, reinforced concrete box girder structure. At Abutment 1 there is an additional span between the abutment back wall and abutment front wall; this span is a reinforced concrete T-beam structure. The bridge is founded on pile-supported footings. As-built plans show foundation information for each support including bottom of pile cap elevations and the specified pile tip elevations. General information on the existing foundations is summarized below and in Table 5.

Abutment 1 consists of a back wall and front wall. The back wall is 7 feet tall and is supported on a 94-foot long, 3-foot wide, and 2-foot thick pile footing which has a single row of HP 10x57 steel piles. The front wall is about an 8-foot tall seat-type wall and is supported on a 95-foot long, 3-foot wide, and 2-foot thick pile footing which has a single row of HP 10x57 steel piles.

The pier supports (walls) have two rows of HP 10x57 steel piles, each row having 22 piles. The width of the pier footings is 6 feet and the lengths vary from 76 to 94.5 feet. The pier footings are 3-foot thick reinforced concrete elements. Piers 3, 4, and 5 include pier extensions (noses) on the upstream side of the bridge; each pier extension is supported on 10 piles (two rows of five piles).

Abutment 7 is a 14.5-foot tall diaphragm wall supported on a pile footing having a length and width of about 123 feet and 6 feet, respectively. The footing is supported on two rows of HP 10x57 steel piles; the front row of piles consists of 14 battered piles and the back row consists of nine vertical piles.

**Table 5. Summary of Foundation Data Shown on As-Built Plans**

| Bridge Plans | Support | Pile Type | Design Load, tons (kips) [1] | Number of Piles | Approximate Bottom of Pile Cap Elevation (feet) | Specified Pile Tip Elevations (feet) [2] |
|---|---|---|---|---|---|---|
| 1984 As-Built Plans | Abutment 1 - Back Wall | HP 10x57 | 70 (140) | 8 | +336.5 | +298.0 |
| | Abutment 1 - Front Wall | HP 10x57 | 70 (140) | 17 | +318.0 | +298.0 |
| | Pier 2 | HP 10x57 | 70 (140) | 44 | +317.0 | +275.0 |
| | Pier 3 | HP 10x57 | 70 (140) | 44 | +303.0 | +280.0 |
| | Pier 4 | HP 10x57 | 70 (140) | 44 | +303.0 | +280.0 |
| | Pier 5 | HP 10x57 | 70 (140) | 44 | +303.0 | +280.0 |
| | Pier 6 | HP 10x57 | 70 (140) | 44 | +303.0 | +280.0 |
| | Abutment 7 | HP 10x57 | 70 (140) | 23 | +335.0 | +303.0 |
| | Pier Extensions (Piers 3,4,5) | HP 10x57 | Unknown | 10 | +303.5 | +253.0 |

*Notes: 1. Design Load is Working Stress Design (WSD) Load.*
*2. Specified pile tip elevations shown on as-built plans; as-built plans do not show as-built average tip elevations.*
*3. Table created from information shown on 1984 as-built plans.*

## 13.0 PRELIMINARY FOUNDATION RECOMMENDATIONS

Generally, bridge foundation designs should satisfy requirements in the AASHTO Bridge Design Specifications, the Caltrans Amendments to the AASHTO BDS, and other applicable Caltrans design documents including the Seismic Design Criteria, Memo to Designers, and the Geotechnical Manual. Foundation designs conducted during the PS&E phase of the project should satisfy requirements that are mandatory at that future time.

Foundation Type: Foundation types used for bridges can be shallow foundations (spread footings) or deep foundations (piles). Deep foundations can be drilled or driven piles. Drilled piles can be small- to large-diameter Cast-in-Drilled-Hole (CIDH) piles or Cast-in-Steel-Shell (CISS) piles. Driven piles can be steel or precast, pre-stressed concrete.

In selecting a suitable foundation type, several things are considered including subsurface soil/bedrock conditions, physical site conditions and constraints, axial and lateral load demands, presence and type of existing foundations, proposed construction, and environmental restrictions.

Because of the potential for static and seismically-induced settlement of foundation soils under strong ground shaking (PGA is greater than 0.6g), spread footings are not recommended because of concern for differential settlement between the existing and the proposed bridge structures and differential settlement between supports.

For planning purposes, we recommend using deep foundations for the proposed bridge structure. Driven piles and Cast-in-Drilled-Hole (CIDH) piles are feasible foundation alternatives. Driven steel piles can be HP-sections or steel pipe (Caltrans Standard Alternative “W”). Because of the gravelly nature of the foundation soils, driven concrete piles are not recommended. CIDH piles are feasible; however, because of the potential for granular soils (sand and gravel) with little fines content, CIDH pile construction could be problematic due to the potential for caving. Therefore, CIDH piles are not the preferred pile alternative. CISS piles are generally cost prohibitive and not used unless circumstances require their use. Consequently, based on the anticipated subsurface soil conditions, we recommend using driven steel HP piles to support the proposed bridge structure.

The preliminary plan shows wing walls proposed at the northeast and northwest quadrants of the proposed bridge. Details of proposed wing walls are not available currently so preliminary recommendations cannot be provided. However, based on the known subsurface conditions of the site, we consider conventional cast-in-place concrete walls with deep foundations or MSE walls suitable alternatives. The wing walls can be supported on the same pile type used for the abutment walls. Foundation recommendations for walls will be provided during the PS&E phase of the project. Proposed retaining walls must satisfy State and local requirements for stability including internal and external (global) stability. Stability analysis of proposed retaining walls and embankments will be performed during PS&E

Static Settlement and Settlement Period: For the proposed widening, we anticipate that relatively small to moderate sized wedges of fill will be placed to widen the existing embankments; therefore, the static settlement is expected to be small. Also, because the foundation soils are anticipated to be predominantly granular, settlement is expected to occur during the earthwork operation. Consequently, no settlement waiting period is anticipated. The settlement magnitude and settlement period will need to be evaluated using information obtained from supplemental site-specific boreholes and CPT soundings and grading plans that will be prepared during the final design phase of the project.

## 14.0 CONSTRUCTION CONSIDERATIONS

Driven Steel Piles: Since pile driving may be difficult due to the presence of gravelly soils and the potential presence of cobbles or buried rip-rap, it may be prudent to use heavier steel piles such as HP 14x89 or HP 14x117 to support the proposed bridge structure.

Residential buildings and commercial businesses are located in the vicinity of the bridge site. At the east end of the bridge (Abutment 1), the closest commercial building is located about 120 feet east of Abutment 1. At the west end of the bridge (Abutment 7), the nearest residential and commercial buildings are located about 475 feet west and 500 feet northwest of Abutment 7. Noise and vibration may be a concern when driving piles at Abutment 1. Noise and vibration is not anticipated to be a concern for pile driving at Abutment 7. Noise and vibration due to pile driving will be further addressed during PS&E. Noise and vibration mitigation will be addressed once details of the proposed improvements and foundations are developed.

CIDH Piles: If CIDH piles are selected are selected as the foundation, constructing the piles can be problematic due to the granular nature of the foundation soils. Because the subsurface soils are anticipated to be mostly sand and gravel, using temporary casing or slurry to construct the piles should be assumed. If piles are constructed using slurry, CIDH piles must have a minimum diameter of 24 inches and incorporate PVC tubes into the steel reinforcement cage (to conduct gamma-gamma testing) in accordance with Memo to Designers 3-1 (Caltrans, 2014).

## 15.0 ADDITIONAL FIELD WORK AND LABORATORY TESTING

Currently available subsurface information does not provide sufficient data to conduct a comprehensive foundation analysis for the proposed widening of the Yorba Linda Boulevard Bridge. EMI recommends performing a supplemental geotechnical field investigation to collect sufficient and appropriate information to characterize the subsurface soils and stratigraphy. EMI recommends excavating at least five exploratory boreholes during the PS&E phase of the project. Laboratory soil testing is recommended to obtain relevant physical and engineering properties of the in-situ soil. At least two CPT soundings should be performed to obtain continuous subsurface information and estimate shear wave velocity. Because of the potential gravelly nature of the subsurface soils and the potential for cobbles, pushing CPT soundings to target depths may not be successful. Boreholes and CPT soundings should extend to a depth of at least 20 feet below the estimated pile tip elevation or 100 feet, whichever is deeper. Boreholes or CPT's at the abutments will likely require shoulder or lane closures along Yorba Linda Boulevard, and boreholes/CPT's at the piers will require access into the Santa Ana River.

Geotechnical field investigations shall satisfy requirements in the AASHTO Bridge Design Specifications, the Caltrans Amendments to AASHTO BDS, and other applicable Caltrans geotechnical investigation requirements that are in place at the time of PS&E.

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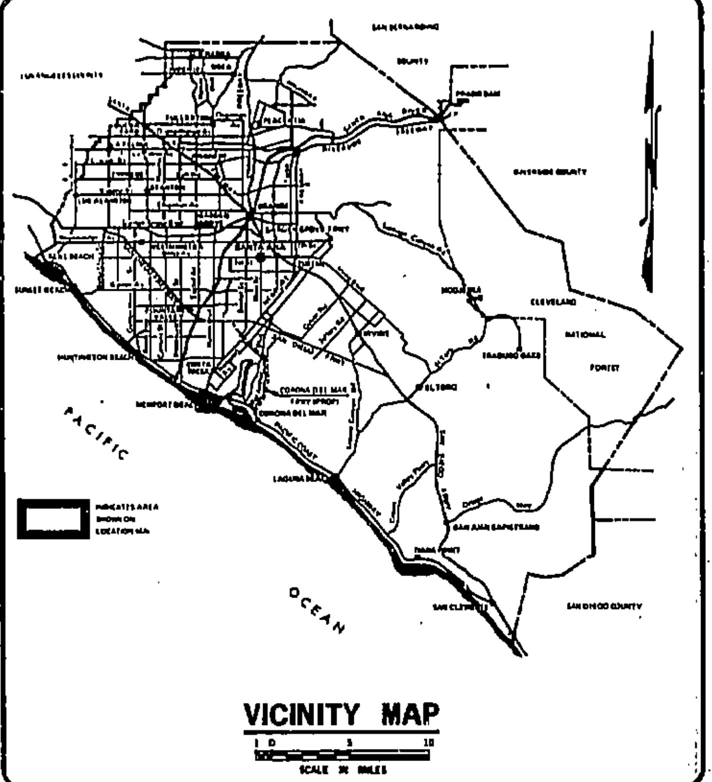
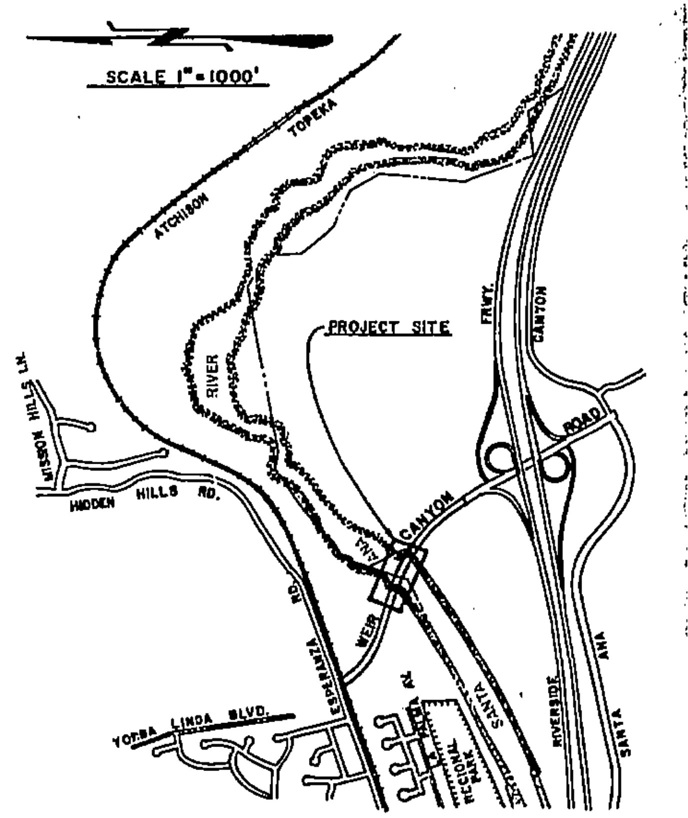
# APPENDIX A

# AS-BUILT PLANS



VICINITY MAP



LOCATION MAP

# ORANGE COUNTY
# ENVIRONMENTAL MANAGEMENT AGENCY

SANTA ANA, CALIFORNIA
M. STORM , DIRECTOR

PLANS FOR CONSTRUCTION OF

# WEIR CANYON ROAD BRIDGE
## (SA~3)
## Across
# SANTA ANA RIVER
## (Channel E01)

55C-509

**INDEX OF SHEETS**

| SHEET | DESCRIPTION |
|---|---|
| 1 | TITLE SHEET |
| 2 | ROAD APPROACH RAMPS |
| | **BRIDGE PLANS** |
| B-1 | GENERAL PLAN |
| B-2 | INDEX AND NOTES |
| B-3 | DECK CONTOURS |
| B-4 | FOUNDATION PLAN |
| B-5 | ABUTMENT 1 |
| B-6 | ABUTMENT 1 DETAILS |
| B-7 | ABUTMENT 7 |
| B-8 | PIERS |
| B-9 | TYPICAL SECTION |
| B-10 | GIRDER LAYOUT |
| B-11 | GIRDER REINFORCEMENT 1 |
| B-12 | GIRDER REINFORCEMENT 2 |
| B-13 | HINGE DETAILS |
| B-14 | RESTRAINER DETAILS |
| B-15 | MISCELLANEOUS DETAILS 1 |
| B-16 | MISCELLANEOUS DETAILS 2 |
| B-17 | JOINT SEAL ASSEMBLY |
| B-18 | CONCRETE BARRIER TYPE 26 |
| B-19 | TUBULAR HAND RAILING |
| B-20 | LOG OF TEST BORING |

| UTILITY | PHONE NO. |
|---|---|
| ORANGE COUNTY SANITATION DISTRICT (MR. BUD FRY) | (714) 540-2910 |
| METROPOLITAN WATER DISTRICT (MR. TOM LOVIL) | (213) 626-4282 |
| PACIFIC TELEPHONE COMPANY (MR. BILL BADSGARD) | (714) 999-5715 |
| SOUTHERN CALIFORNIA EDISON COMPANY (MR. D METSKER) | (213) 435-1121 |
| UNDERGROUND SERVICE ALERT | 1 (800) 422-4133 |

**BENCH MARK:** O.C.S. ALUMINUM CAP 2J-27-69
FROM ℄ AVE. BARCELONA 0.2 MI. EAST ALONG ESPERANZA RD. TO 36" PIPE CULVERT SCRIBED 1944, IN WEST END OF SLY HEADWALL.
ELEV. 370.649 ADJ. 1976

**BASIS OF BEARING:**
THAT PORTION OF THE ℄ OF WEIR CANYON ROAD BETWEEN EC #1 AND BC #2 (STA 22+53.03 AND STA 27+19.64), N.73°11'42" W. AS SHOWN ON SM 70-10.

| NO. | DESCRIPTION | SHT. | APPROVED | DATE |
|---|---|---|---|---|
| | | | | |

REVISIONS

FUNDED BY: HIGHWAY USERS' TAX

**EMA-DEVELOPMENT**

SUBMITTED: N.H. Tallez
SECTION CHIEF RCE 16789

RECOMMENDED: A.W. Willi 7/30/82
DIVISION MANAGER RCE 13164

APPROVED: C.R. Nelson 8-2-82
ASSISTANT DIRECTOR RCE 13142

**BASIS OF STATIONING:**
BC #2 ON SM 70-10 (THE CURVE GENERALLY DESCRIBED AS CONCAVE NORTHEASTERLY WITH R=1600', Δ=67°38'19", L=1888.83, T=1071.89') IS HELD AS STATION 27+19.64. STATIONING INCREASES IN A NORTHERLY DIRECTION ALONG THE ALIGNMENT.

W. O. NO. RC 9267
DWG. NO.

SHEET 1 OF 22

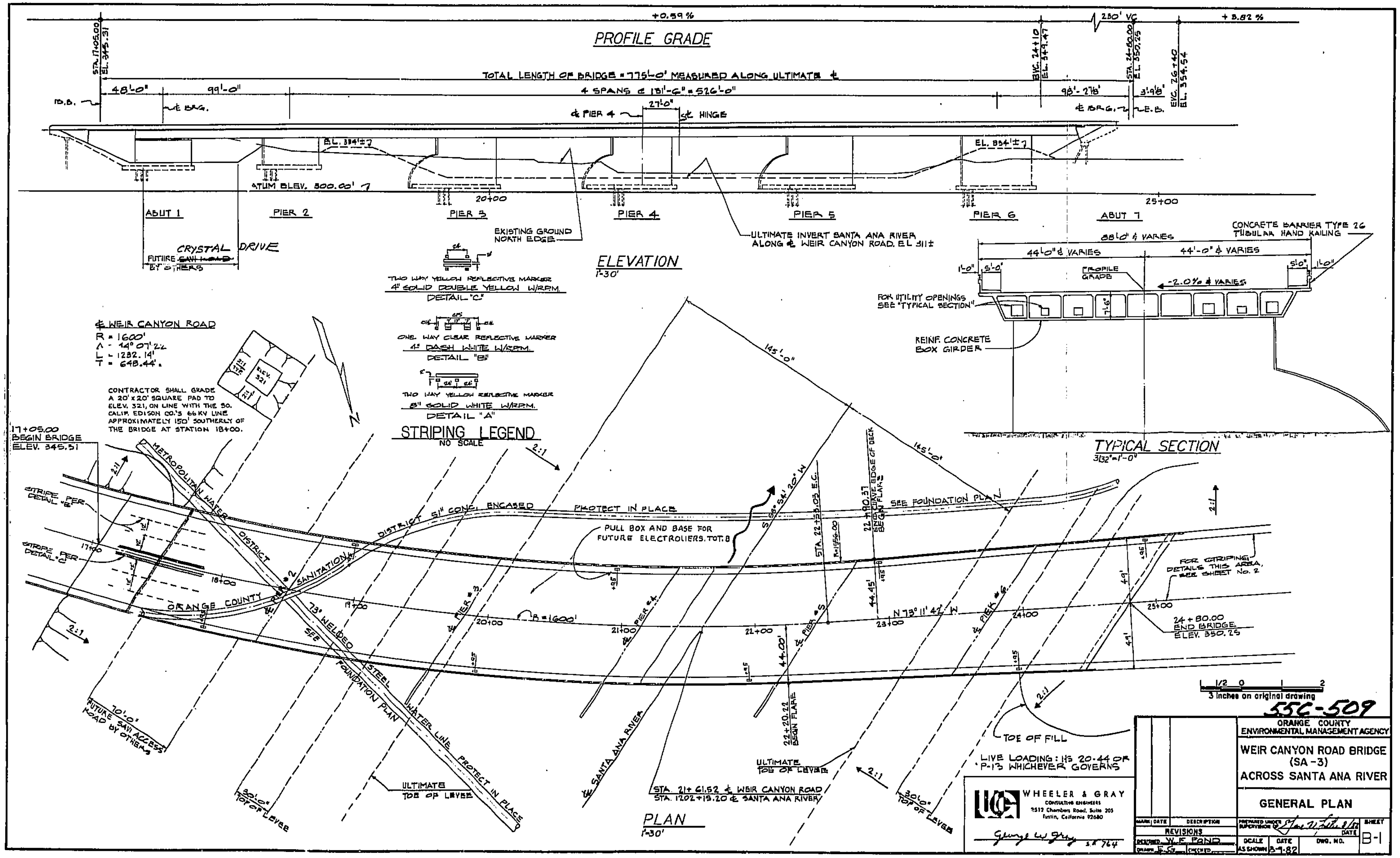
AS BUILT PLANS
Contract No. UNKNOWN
Date Completed
Document No. 7000 8532

12X

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.

DATE 8/2/84 SIGNATURE Donald Blackford TITLE SUPERVISOR OF MICROFILM SERVICES

DAS-55-78



LIVE LOADING: HS 20-44 OR P-13 WHICHEVER GOVERNS

556-509

WHEELER & GRAY
CONSULTING ENGINEERS
2512 Chambers Road, Suite 205
Tustin, California 92680

George W Gray S.E. 764

| MARK | DATE | DESCRIPTION |
|---|---|---|
| REVISIONS | | |

DESIGNED W. F. POND
DRAWN E. G.
CHECKED

ORANGE COUNTY
ENVIRONMENTAL MANAGEMENT AGENCY

WEIR CANYON ROAD BRIDGE
(SA-3)
ACROSS SANTA ANA RIVER

GENERAL PLAN

PREPARED UNDER SUPERVISION OF
DATE
SCALE AS SHOWN
DATE 3-9-82
DWG. NO.
SHEET B-1

**AS BUILT PLANS**
Contract No. UNKNOWN
Date Completed
Document No. 7000 8532

12X

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DATE 8/2/84
SIGNATURE Donald Blackford
TITLE SUPERVISOR OF MICROFILM SERVICES

DAS-SS-78

| CURVE | RADIUS | Δ | L | T |
|---|---|---|---|---|
| Ⓐ | R = 200' | 51°00'41" | 178.06' | 95.42' |
| Ⓑ | R = 200' | 40°35'50' | 141.71' | 75.98' |
| Ⓒ | R = 1520' | 8°17'34" | 220.00' | 110.19' |
| Ⓓ | R = 200' | 50°44'59" | 177.15' | 94.86' |

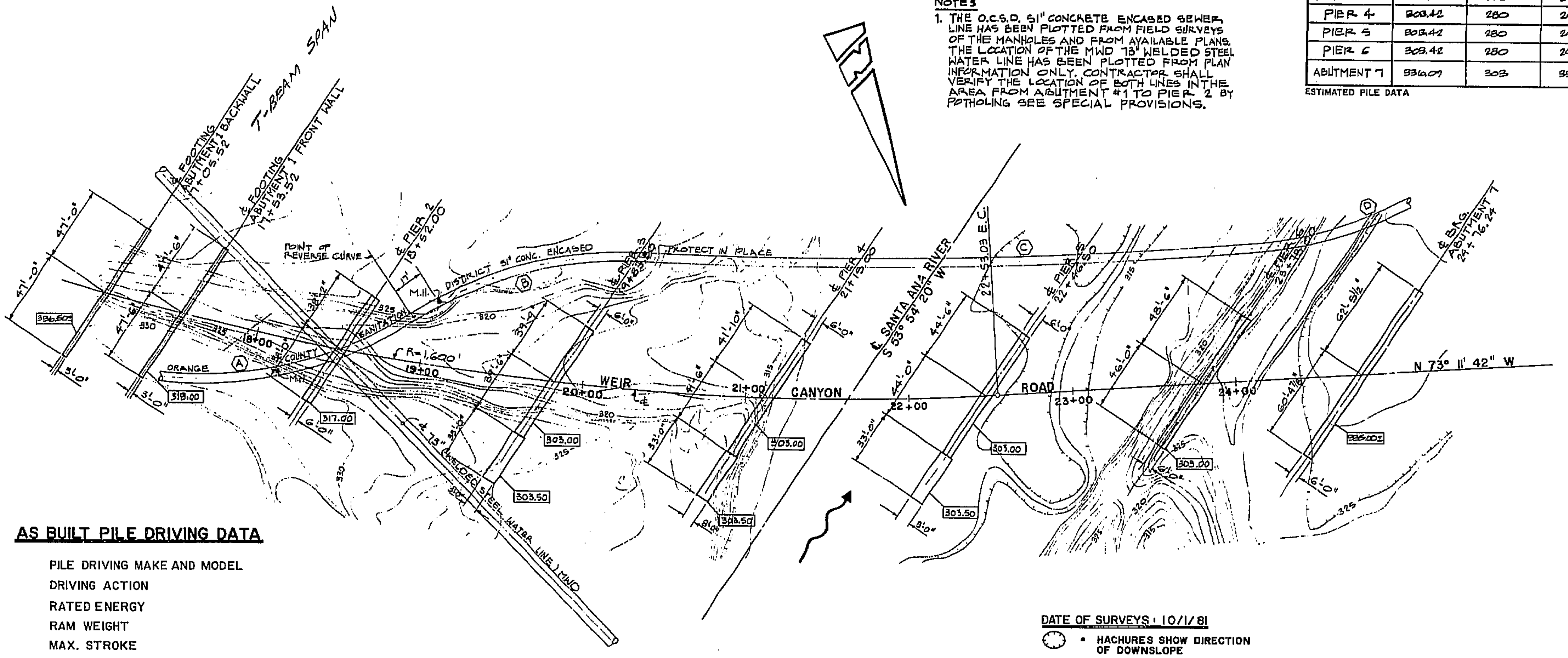
OCSD 51" SEWER LINE CURVE DATA

Notes

1. THE O.C.S.D. 51" CONCRETE ENCASED SEWER LINE HAS BEEN PLOTTED FROM FIELD SURVEYS OF THE MANHOLES AND FROM AVAILABLE PLANS. THE LOCATION OF THE MWD 73" WELDED STEEL WATER LINE HAS BEEN PLOTTED FROM PLAN INFORMATION ONLY. CONTRACTOR SHALL VERIFY THE LOCATION OF BOTH LINES IN THE AREA FROM ABUTMENT #1 TO PIER 2 BY POTHOLING SEE SPECIAL PROVISIONS.

| LOCATION | CUT OFF ELEVATION | MINIMUM PENETRATION ELEVATION | ESTIMATED LENGTH |
|---|---|---|---|
| ABUTMENT 1 BACKWALL | 326.92 | 278 | 29 |
| ABUTMENT 1 FRONTWALL | 316.42 | 298 | 20 |
| PIER 2 | 317.42 | 275 | 42 |
| PIER 3 | 303.42 | 280 | 24 |
| PIER 4 | 303.42 | 280 | 24 |
| PIER 5 | 303.42 | 280 | 24 |
| PIER 6 | 303.42 | 280 | 24 |
| ABUTMENT 7 | 336.07 | 303 | 33 |

ESTIMATED PILE DATA



## AS BUILT PILE DRIVING DATA

PILE DRIVING MAKE AND MODEL

DRIVING ACTION

RATED ENERGY

RAM WEIGHT

MAX. STROKE

BEARING VALUE FORMULA

P= OR P=

| LOCATION | CUT-OFF ELEVATION | AVG. TIP ELEVATION | AVG. STROKE HEIGHT | AVG. BLOWS PER FOOT | AVG. BEARING VALUE (TONS) |
|---|---|---|---|---|---|
| ABUTMENT 1 BACKWALL | | | | | |
| ABUTMENT 1 FRONTWALL | | | | | |
| PIER 2 | | | | | |
| PIER 3 | | | | | |
| PIER 4 | | | | | |
| PIER 5 | | | | | |
| PIER 6 | | | | | |
| ABUTMENT 7 | | | | | |

NOTE: FOR USE OF PROJECT ENGINEER UPON COMPLETION OF CONSTRUCTION.

## FOUNDATION PLAN

1" = 30'

PILE NOTE
STEEL PILES HP 10x57
(DESIGN LOADING 70 TONS)
SPECIFIED TIP ELEV.

| | | |
|---|---|---|
| ABUT | 1 | 298 |
| PIER | 2 | 275 |
| PIER | 3-6 | 280 |
| ABUT | 7 | 303 |

DATE OF SURVEYS: 10/1/81

◌ = HACHURES SHOW DIRECTION OF DOWNSLOPE

℄ OF ABUTMENTS AND PIERS ARE PARALLEL TO ℄ SANTA ANA RIVER

000.00 INDICATES BOTTOM OF FOOTING ELEVATION

1/2 0 1 2
3 inches on original drawing

55C-509

WHEELER & GRAY
CONSULTING ENGINEERS
2513 Chambers Road, Suite 205
Tustin, California 92680

George W Gray
RCE 7644

| MARK | DATE | DESCRIPTION |
|---|---|---|
| | | |

REVISIONS

DESIGNED N.E. POND
DRAWN R.G. CHECKED

ORANGE COUNTY
ENVIRONMENTAL MANAGEMENT AGENCY

WEIR CANYON ROAD BRIDGE
(SA-3)
ACROSS SANTA ANA RIVER

FOUNDATION PLAN

PREPARED UNDER SUPERVISION OF
DATE

| SCALE | DATE | DWG. NO. | SHEET |
|---|---|---|---|
| AS SHOWN | 8-7-82 | | B-4 |

AS BUILT PLANS
Contract No. UNKNOWN
Date Completed
Document No. 7000 8532

12X

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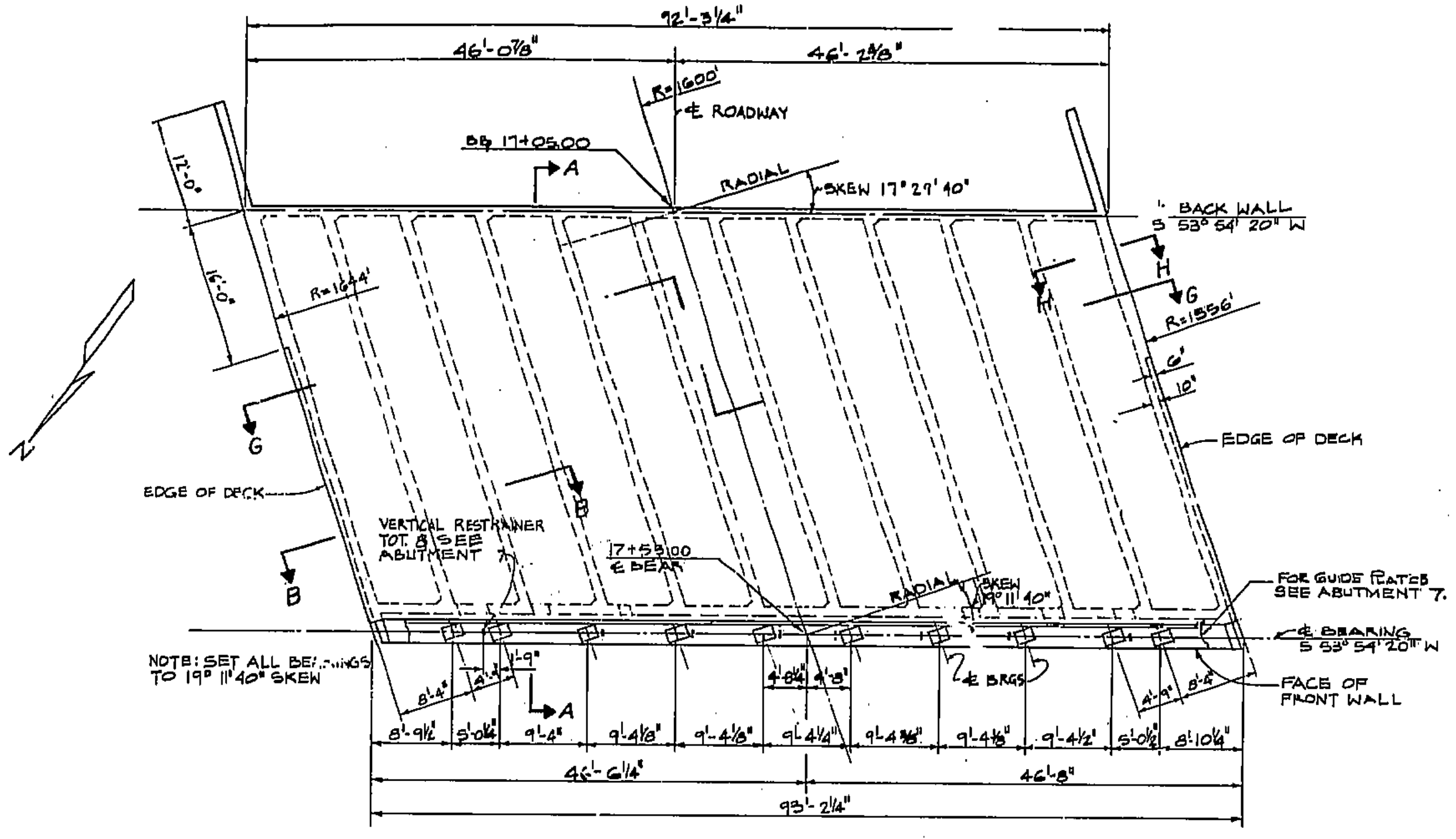
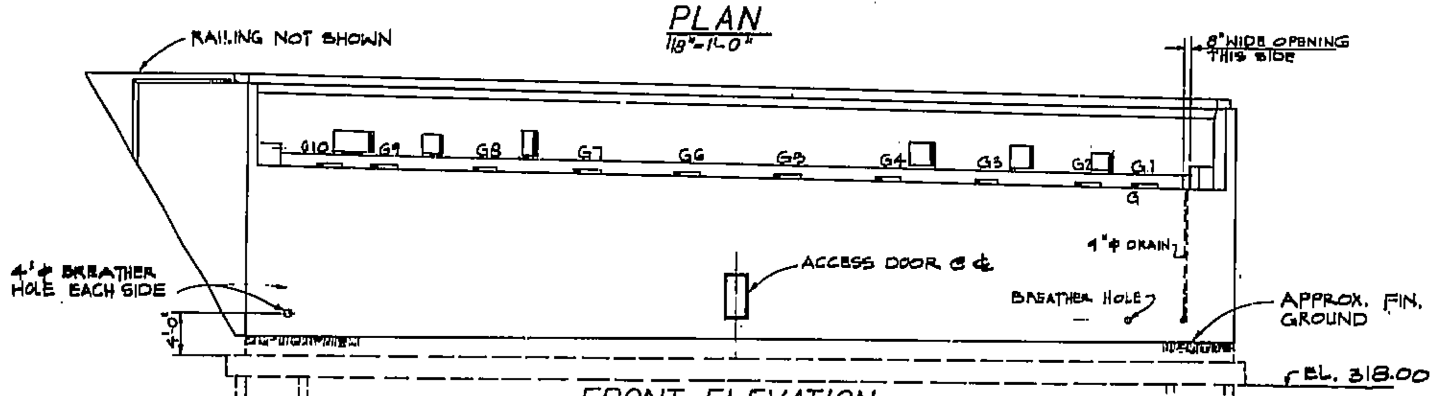
DATE 8/2/84 SIGNATURE Donald Blackford TITLE SUPERVISOR OF MICROFILM SERVICES

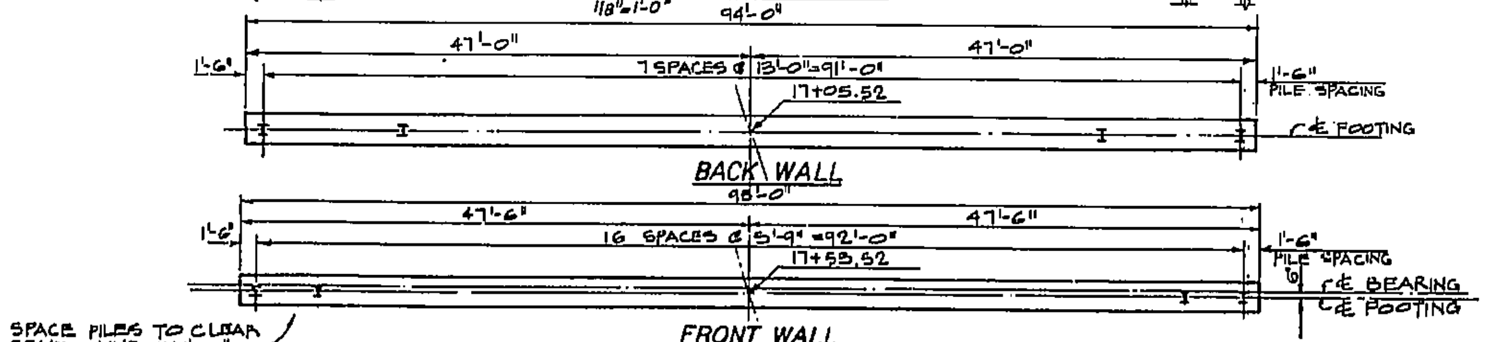
DAS-35-78



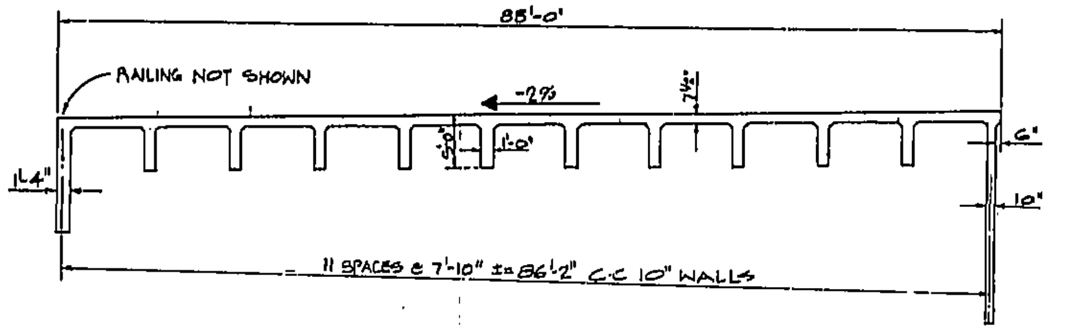
## PLAN
1/8"=1'-0"



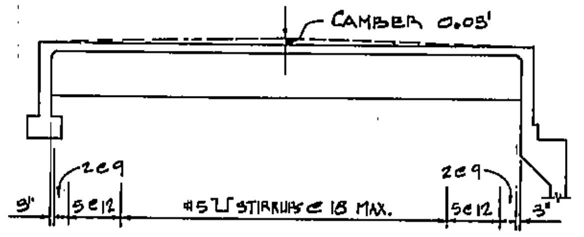
## FRONT ELEVATION
1/8"=1'-0"



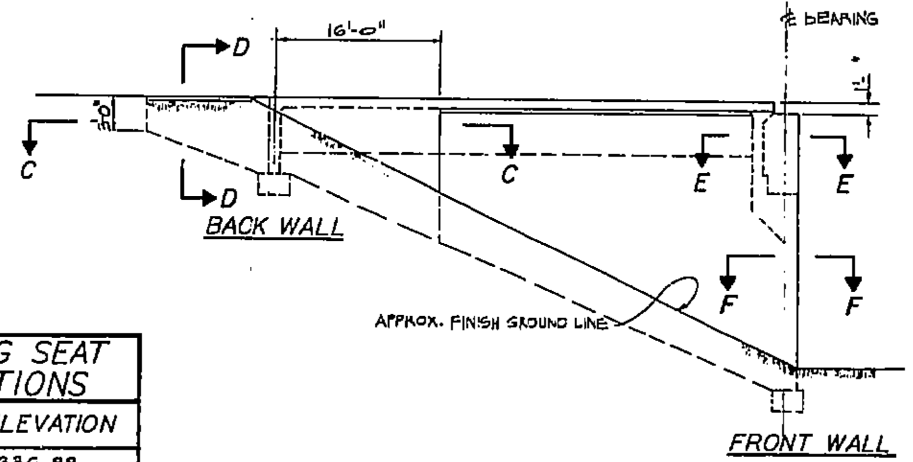
## FOOTING PLAN
1/8"=1'-0"



## SECTION G-G
1/8"=1'-0"



## STIRRUP SPACING
1/8"=1'-0"



## SIDE ELEVATION
1/8"=1'-0"

NOTE:
FOR SECTIONS SEE "ABUTMENT 1 DETAILS"

| BEARING SEAT ELEVATIONS | |
|---|---|
| GIRDER | ELEVATION |
| G-1 | 336.88 |
| G-2 | 336.97 |
| G-3 | 337.12 |
| G-4 | 337.28 |
| G-5 | 337.44 |
| G-6 | 337.59 |
| G-7 | 337.75 |
| G-8 | 337.91 |
| G-9 | 338.07 |
| G-10 | 338.16 |

1/2 0 1 2
3 inches on original drawing

55C-509

ORANGE COUNTY
ENVIRONMENTAL MANAGEMENT AGENCY

WEIR CANYON ROAD BRIDGE
(SA-3)
ACROSS SANTA ANA RIVER

ABUTMENT 1

WHEELER & GRAY
CONSULTING ENGINEERS
2512 Chambers Road, Suite 205
Tustin, California 92680

George W Gray S.E. 764

| MARK | DATE | DESCRIPTION |
|---|---|---|
| REVISIONS | | |

DESIGNED W. E. POND
DRAWN R.G.
CHECKED
PREPARED UNDER SUPERVISION OF
DATE
SCALE AS SHOWN
DATE 8-9-82
DWG. NO.
SHEET B-5

AS BUILT PLANS
Contract No. UNKNOWN
Date Completed
Document No. 7000 8532

12X

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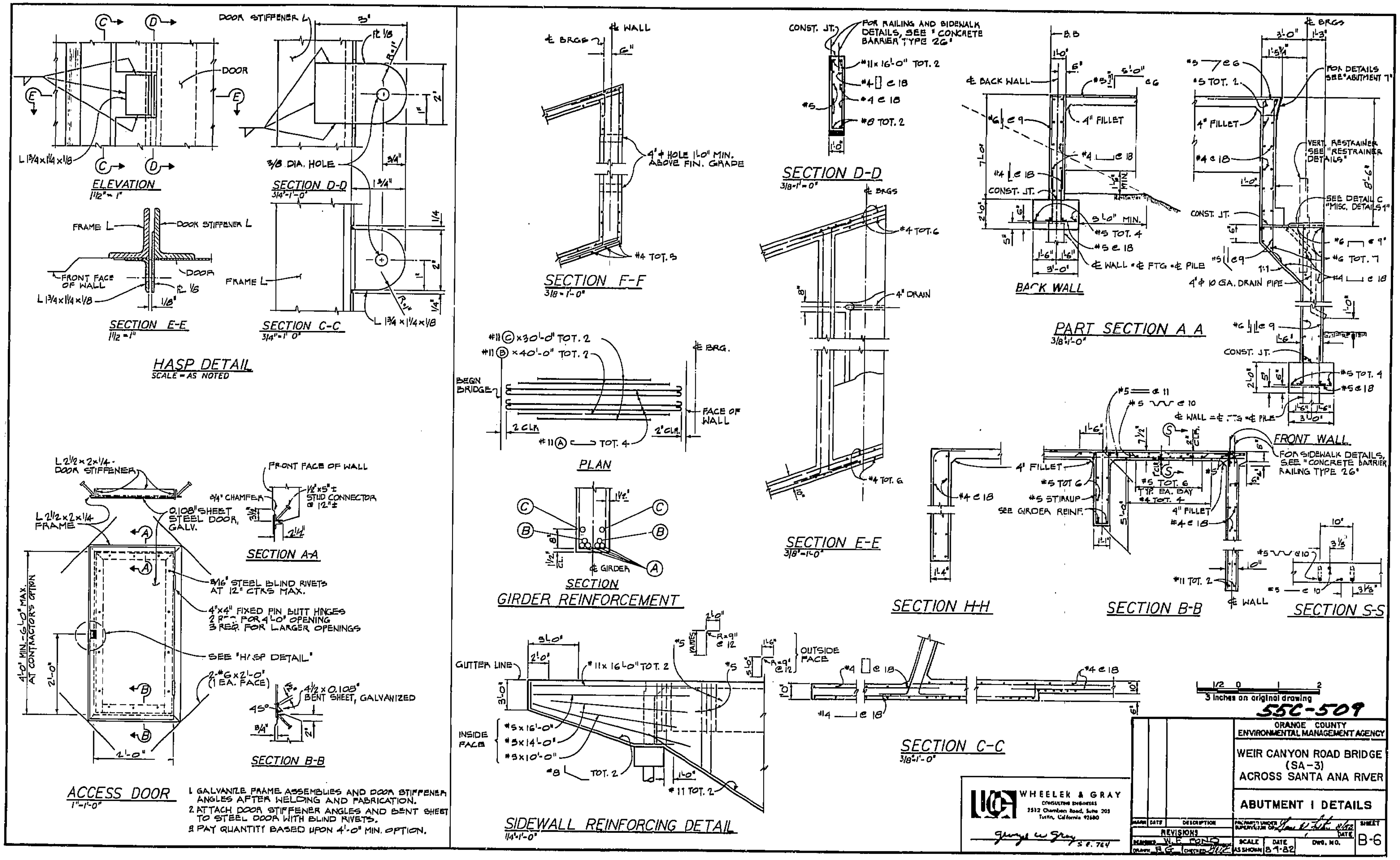
DATE 8/2/84 SIGNATURE Donald Blackford TITLE SUPERVISOR OF MICROFILM SERVICES

DAS-58-78



WHEELER & GRAY
CONSULTING ENGINEERS

ORANGE COUNTY
ENVIRONMENTAL MANAGEMENT AGENCY

WEIR CANYON ROAD BRIDGE
(SA-3)
ACROSS SANTA ANA RIVER

ABUTMENT 1 DETAILS

REVISIONS
SCALE AS SHOWN
DATE 8-4-82
SHEET B-6

AS BUILT PLANS
Contract No. UNKNOWN
Date Completed
Document No. 7000 8532

12X

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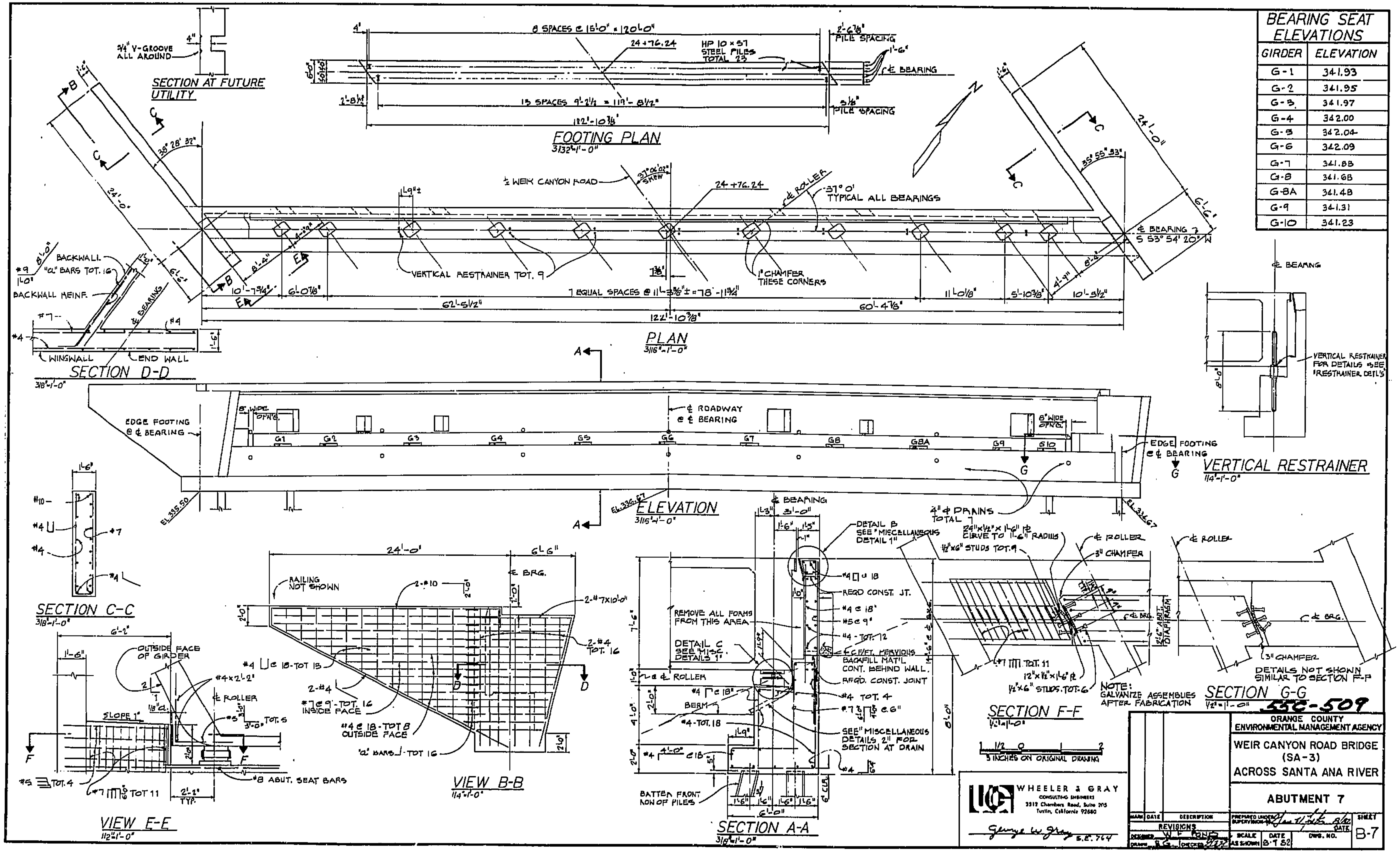
DATE 8/2/84 SIGNATURE Donald Blackford TITLE SUPERVISOR OF MICROFILM SERVICES

DAS-SS-78



## BEARING SEAT ELEVATIONS

| GIRDER | ELEVATION |
|---|---|
| G-1 | 341.93 |
| G-2 | 341.95 |
| G-3 | 341.97 |
| G-4 | 342.00 |
| G-5 | 342.04 |
| G-6 | 342.09 |
| G-7 | 341.88 |
| G-8 | 341.68 |
| G-8A | 341.48 |
| G-9 | 341.31 |
| G-10 | 341.23 |

55C-509

WHEELER & GRAY
CONSULTING ENGINEERS
2512 Chambers Road, Suite 205
Tustin, California 92680

George W Gray R.E. 764

ORANGE COUNTY
ENVIRONMENTAL MANAGEMENT AGENCY

WEIR CANYON ROAD BRIDGE
(SA-3)
ACROSS SANTA ANA RIVER

ABUTMENT 7

| MARK | DATE | DESCRIPTION |
|---|---|---|
| REVISIONS | | |

PREPARED UNDER SUPERVISION OF 8/82 DATE

DESIGNED W. F. FONG
DRAWN R.G. CHECKED

| SCALE | DATE | DWG. NO. | SHEET |
|---|---|---|---|
| AS SHOWN | 8-9-82 | | B-7 |

AS BUILT PLANS
Contract No. UNKNOWN
Date Completed
Document No. 7000 8532

12X

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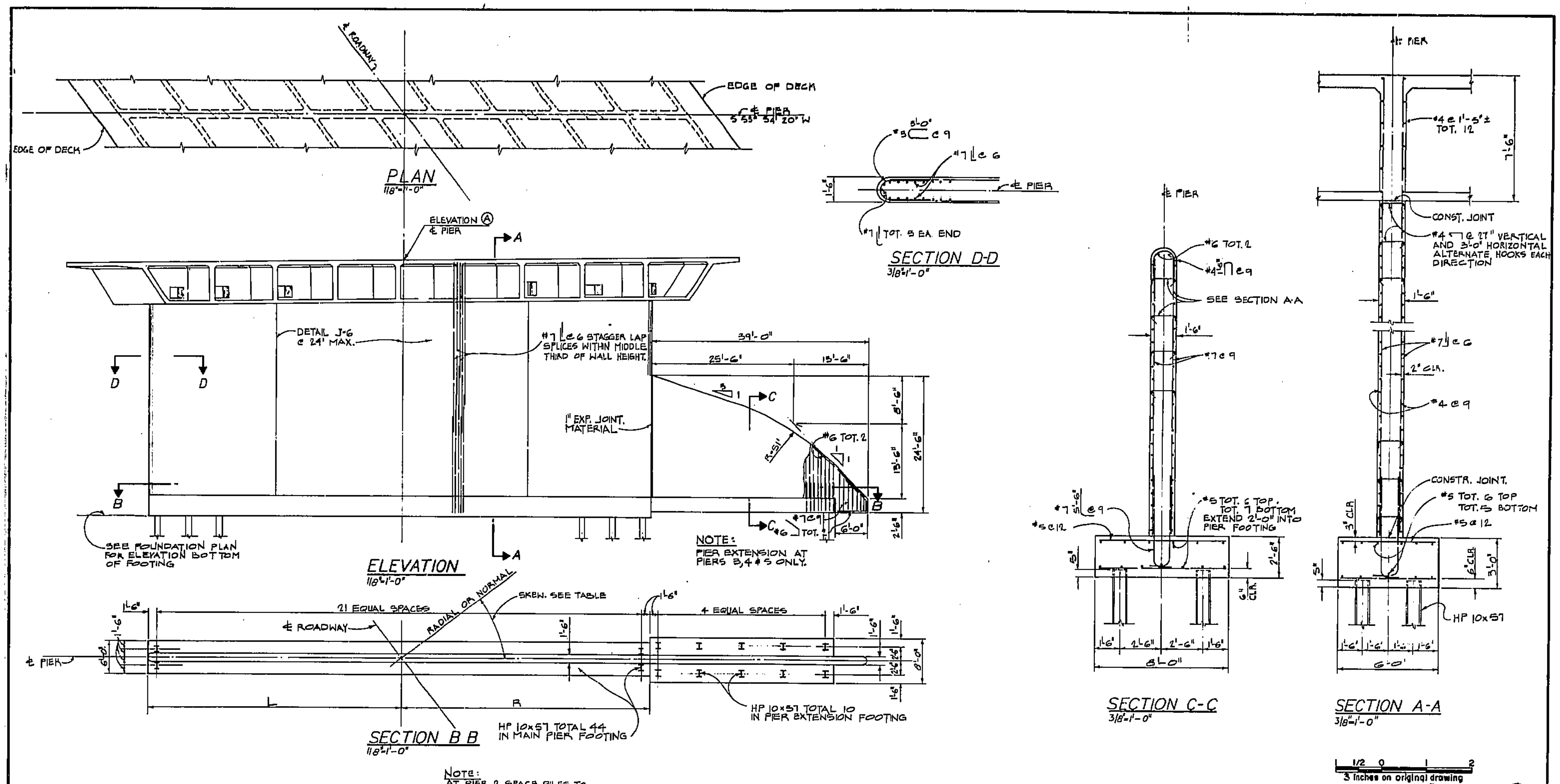
DATE 8/2/84 SIGNATURE Donald Blackford TITLE SUPERVISOR OF MICROFILM SERVICES

DAS-33-78



NOTE:
AT PIER 2 SPACE PILES TO CLEAR 78" WATER LINE AND 5" SEWER LINE BY 1'-0".

| PIER | STATION | SKEW | PIER WALL |  | ELEVATION Ⓐ TOP OF PIER |
|---|---|---|---|---|---|
|  |  |  | L | R |  |
| 2 | 18 + 52 | 22° 44' 23" | 38'-2" | 38'-0" | 346.18 |
| 3 | 19 + 83.5 | 27° 26' 55" | 39'-9" | 39'-6" | 346.95 |
| 4 | 21 + 15 | 32° 09' 28" | 41'-10" | 41'-6" | 347.73 |
| 5 | 22 + 46.5 | 36° 52' 00" | 44'-6" | 44'-0" | 348.51 |
| 6 | 23 + 78 | 37° 06' 02" | 48'-6" | 46'-0" | 349.28 |

55C-509

WHEELER & GRAY
CONSULTING ENGINEERS
2512 Chambers Road, Suite 205
Tustin, California 92680

George W Gray S.E. 764

| MARK | DATE | DESCRIPTION |
|---|---|---|
| REVISIONS |  |  |

DESIGNED W. F. POND
DRAWN U. G.
CHECKED

ORANGE COUNTY
ENVIRONMENTAL MANAGEMENT AGENCY

WEIR CANYON ROAD BRIDGE
(SA-3)
ACROSS SANTA ANA RIVER

## PIERS

PREPARED UNDER SUPERVISION OF
DATE
SCALE AS SHOWN
DATE 8-9-82
DWG. NO.
SHEET B-8

AS BUILT PLANS
Contract No. UNKNOWN
Date Completed
Document No. 7000 8532

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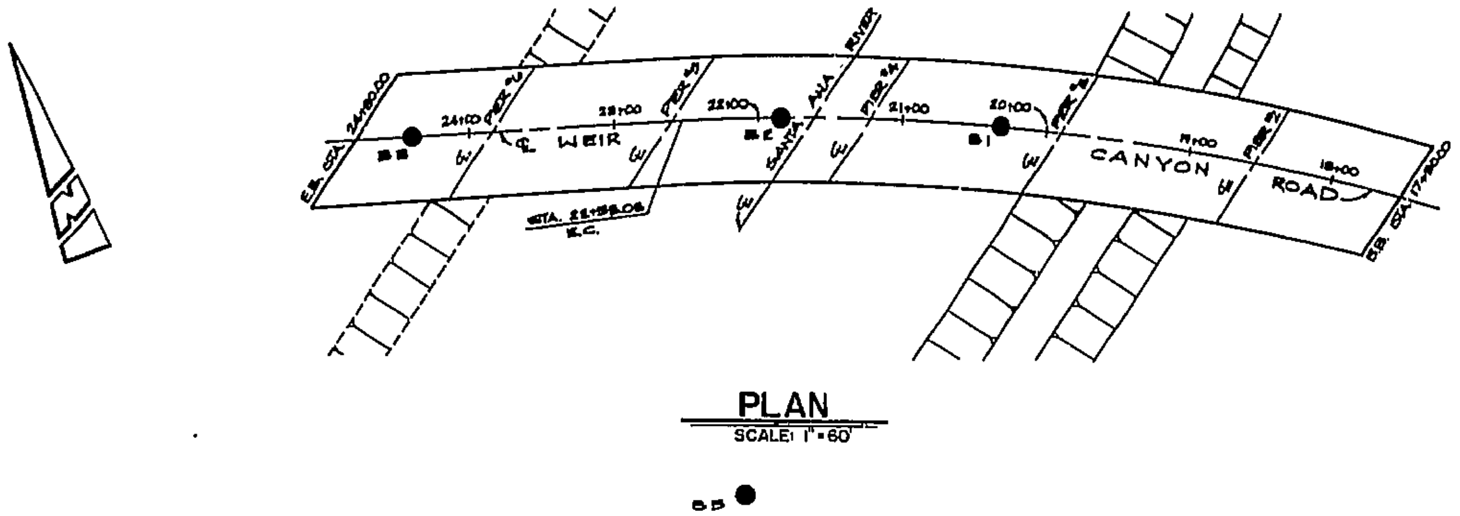
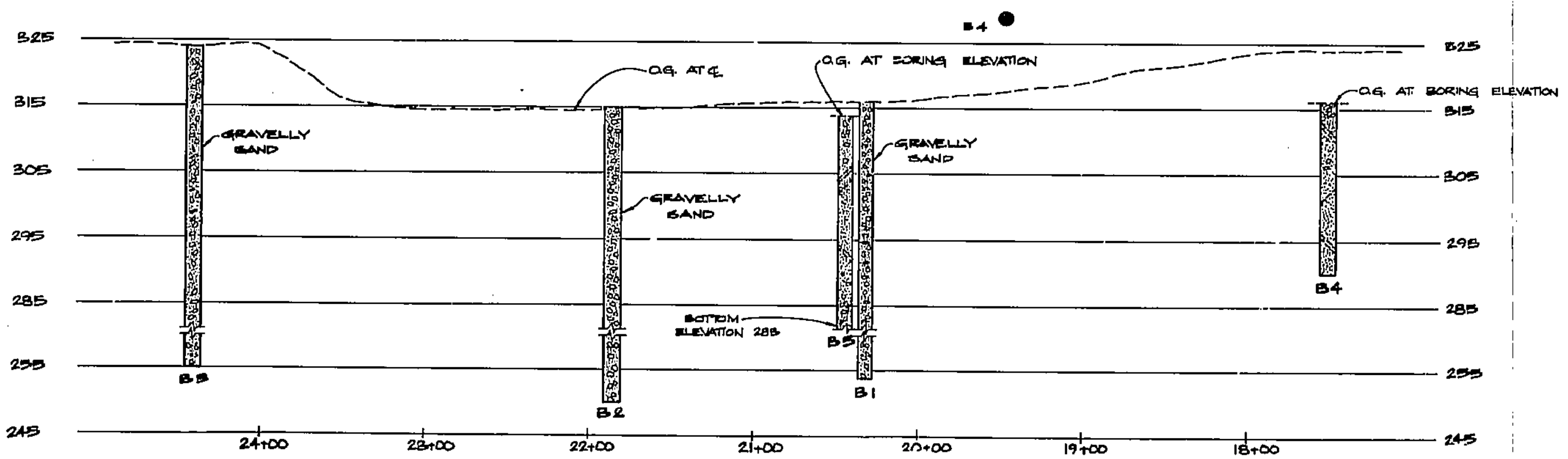
DATE 8/2/84
SIGNATURE Donald Blackford
TITLE SUPERVISOR OF MICROFILM SERVICES
DAS-OS-78



## PLAN

SCALE: 1" = 60'



## SOIL PROFILE

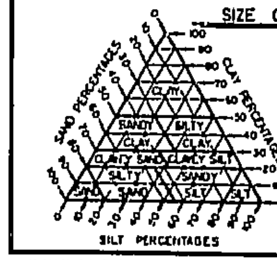
SCALE: HORIZ. 1" = 40'
VERT. 1" = 10'

1/2 0 1 2
3 inches on original drawing

55C-509

## LEGEND OF EARTH MATERIALS

### SIZE CLASSIFICATION



CLASSIFICATION OF EARTH MATERIAL SHOWN ON THIS SHEET IS BASED ON MECHANICAL ANALYSIS UNLESS OTHERWISE INDICATED.

### MATERIAL SYMBOLS

- ▨ GRAVEL
- ▨ SAND
- ▨ SILT
- ▨ CLAY
- ▨ SANDY CLAY OR CLAYEY SAND
- ▨ SANDY SILT OR SILTY SAND
- ▨ SILTY CLAY OR CLAYEY SILT
- ▨ PEAT OR ORGANIC MATTER
- ▨ FILL MATERIAL
- ▨ SHALE
- ▨ SANDSTONE
- ▨ LIMESTONE
- ▨ METAMORPHIC ROCK
- ▨ IGNEOUS ROCK

### CONSISTENCY CLASSIFICATION

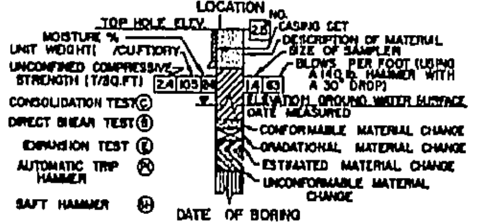
ACCORDING TO THE STANDARD PENETRATION TEST

| NO. OF BLOWS | GRANULAR | COHESIVE |
|---|---|---|
| 0-5 | VERY LOOSE | VERY SOFT |
| 6-10 | LOOSE | SOFT |
| 11-20 | SLIGHTLY COMPACT | STIFF |
| 21-35 | COMPACT | VERY STIFF |
| 36-70 | DENSE | HARD |
| 70+ | VERY DENSE | VERY HARD |

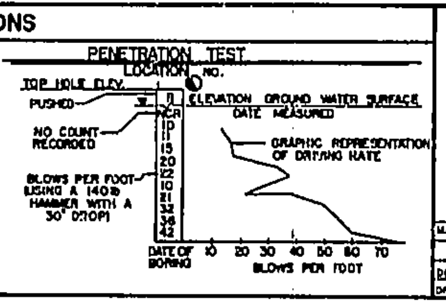
## LEGEND OF BORING OPERATIONS

- ● PLAN OF ANY BORING
- ◐ STANDARD PENETROMETER
- ● 2.5" CONE PENETROMETER
- ☐ ROTARY BORING
- ☐ AUGER BORING
- ▯ SAMPLE BORING
- ▯ JET BORING
- ◊ DIAMOND CORE BORING
- ⧗ TEST PIT

### ROTARY BORING



### PENETRATION TEST



| MARK | DATE | DESCRIPTION |
|---|---|---|
| | | |

REVISIONS

DESIGNED ____
DRAWN ____ CHECKED ____

ORANGE COUNTY
ENVIRONMENTAL MANAGEMENT AGENCY

**WEIR CANYON ROAD BRIDGE**
**(SA-3)**
**ACROSS SANTA ANA RIVER**

**LOG OF TEST BORINGS**

PREPARED UNDER SUPERVISION OF Glenn W. Foster 8/82
DATE

| SCALE | DATE | DWG. NO. | SHEET |
|---|---|---|---|
| AS SHOWN | | | B20 |

AS BUILT PLANS
Contract No. UNKNOWN
Date Completed ____
Document No. 7000 8532

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DATE 8/2/84 SIGNATURE Donald Blackford TITLE SUPERVISOR OF MICROFILM SERVICES

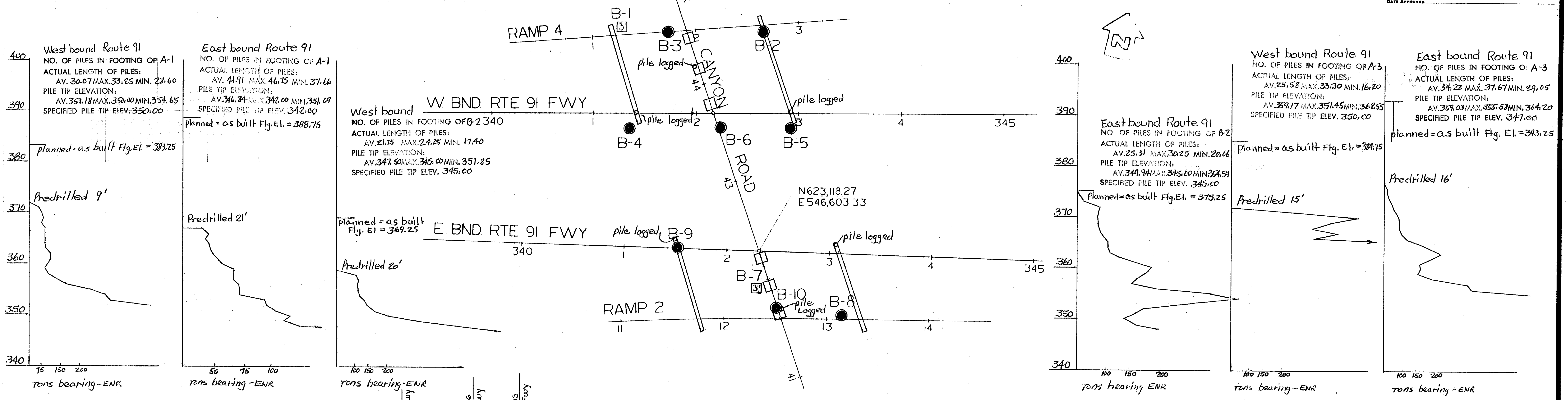
DAB-55-78

| FED. ROAD DIV. No. | STATE | F. A. PROJECT No. | SHEET No. | TOTAL SHEETS |
|---|---|---|---|---|
| 7 | CALIF. | | | |

| DIST. | COUNTY | ROUTE | SECTION | SHEET No. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 07 | ORA | 91 | 14 5 | | |

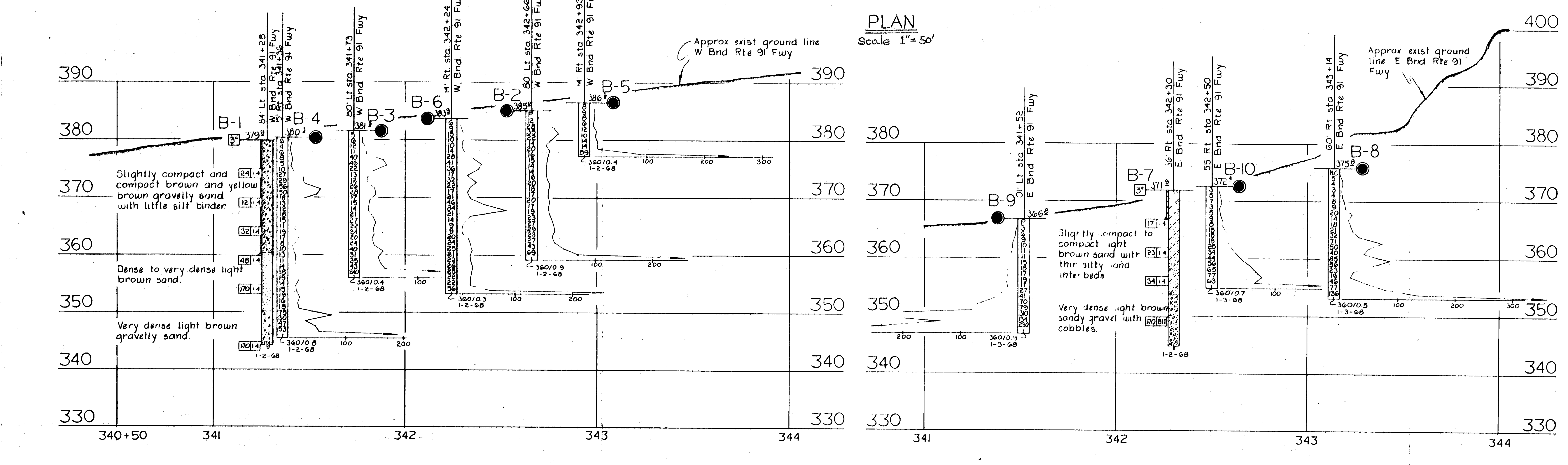
BRIDGE ENGINEER CIVIL ENGINEER—LICENSE

DATE APPROVED



PLAN

Scale 1" = 50'



PROFILE (W BND RTE 91 FWY)

Scale: Vert. 1" = 10'
Horiz: 1" = 30'

PROFILE (E BND RTE 91 FWY)

Scale Vert. 1" = 10'
Horiz. 1" = 30'

PILE DATA
TYPE OF PILE driven Concrete
HAMMER DATA Kobe K-22
PILE DIAMETER: TIP 12" BUTT 12"
PILE DESIGN LOAD = 70 Ton
FOR THE STRUCTURE:
NUMBER OF PILES = 86
EST. LENGTH OF PILING = 2790
ACTUAL LENGTH OF PILING = 2362.65

AS BUILT
CORRECTIONS BY W. A. Hodge
CONTRACT NO. 07-040024
9-13-71

BENCH MARK

BM "Mark" Elev. 357.59
Set 2" I.P. & Br. cap mon. in P.C.C.
32' No. of W. Bnd. Rdwy at Sta. 341+50
Marked "Mark".

GEOLOGY

NO GROUND WATER ENCOUNTERED
DURING THIS INVESTIGATION BY
BRIDGE DEPT. GEOLOGY SECTION
DATE JANUARY 1968

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

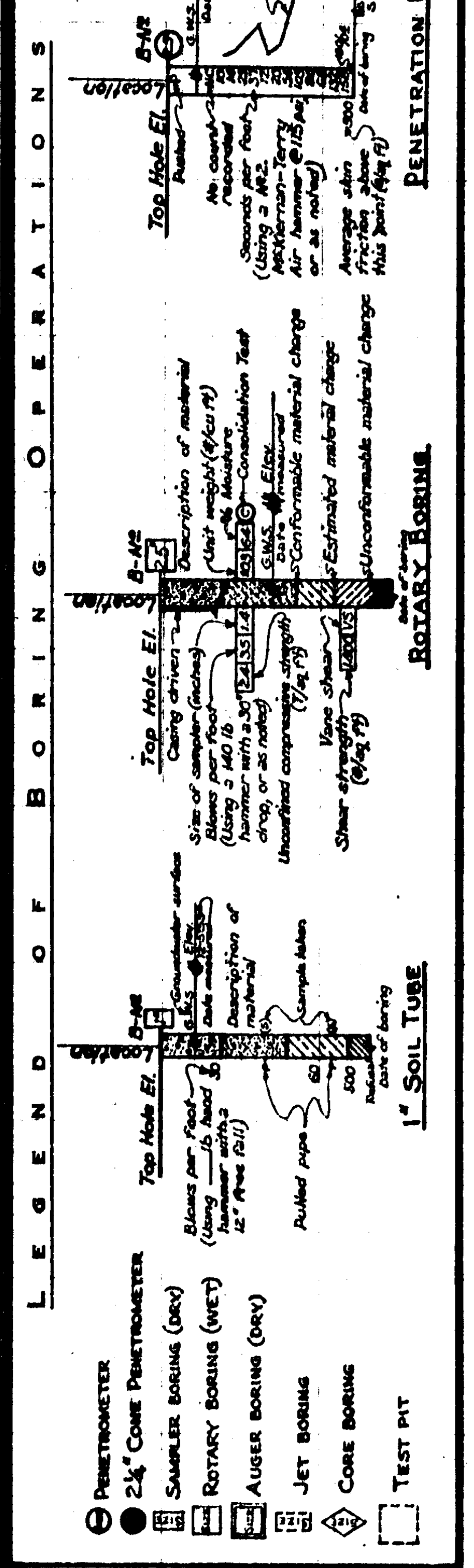
WEIR CANYON ROAD UNDERCROSSING

## LOG OF TEST BORINGS

SCALE As Noted | BRIDGE 55-505 R/L | FILE | DRAWING

Chg 07210
WA 040021

Disregard prints bearing earlier numbers → PREL. DRAWING No. PR-



LEGEND OF EARTH MATERIALS

| | |
|---|---|
| Gravel | Silty clay or clayey silt |
| Sand | Peat and organic matter |
| Silt | Fill material |
| Clay | Igneous rock |
| Sandy clay or clayey sand | Sedimentary rock |
| Sandy silt or silty sand | Metamorphic rock |

CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS

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

| | | |
|---|---|---|
| FIELD STUDY | By O Mikes | 1-8-68 |
| DRAWN | By J Lerma | 1-12-68 |
| CHECKED | By O. MIKES | 1-19-68 |

Approval Recommended by
Engineering Geologist

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

PRINTED ON 1025 PAPERCLOTH

| DIST | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No | TOTAL SHEETS |
|---|---|---|---|---|---|
| 12 | Ora | 91 | | | |

REGISTERED GEOTECHNICAL ENGINEER 8-10-10

PLANS APPROVAL DATE

Gamini Weeratunga
No. GE2403
Exp. 9-30-10

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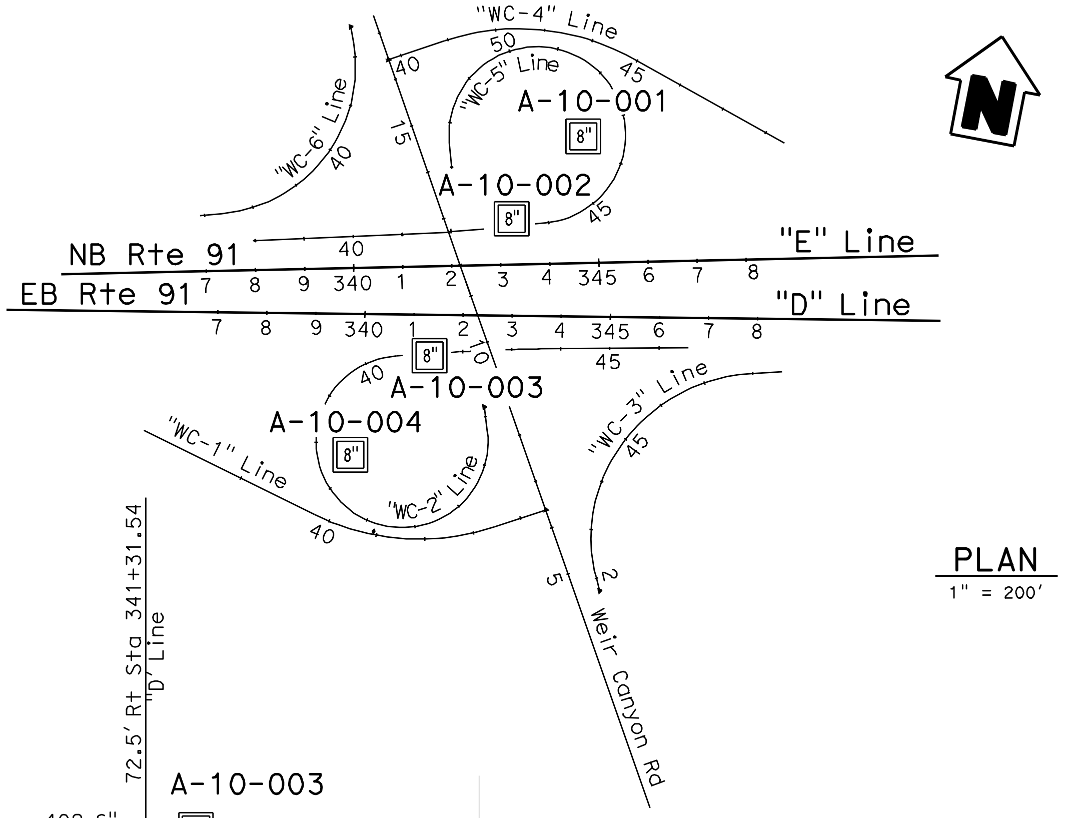
This LOTB sheet was prepared in accordance with the Caltrans Soil & Rock Logging, Classification, & Presentation Manual (2010 Edition).

## BENCH MARK

DESCRIBED BY OCS 2003 - FOUND 3¾" OCS ALUMINUM BENCHMARK DISK STAMPED "3KK-27-85", SET IN THE SOUTHWESTERLY CORNER OF A 4.5 FT. BY 22 FT. CONCRETE CATCH BASIN. MONUMENT IS LOCATED IN THE NORTHEASTERLY CORNER OF THE INTERSECTION OF WEIR CANYON ROAD AND SANTA ANA CANYON ROAD, 64 FT. NORTHERLY OF THE CENTERLINE OF SANTA ANA CANYON, 111 FT. EASTERLY OF THE CENTERLINE OF WEIR CANYON. MONUMENT IS SET LEVEL WITH THE SIDEWALK.

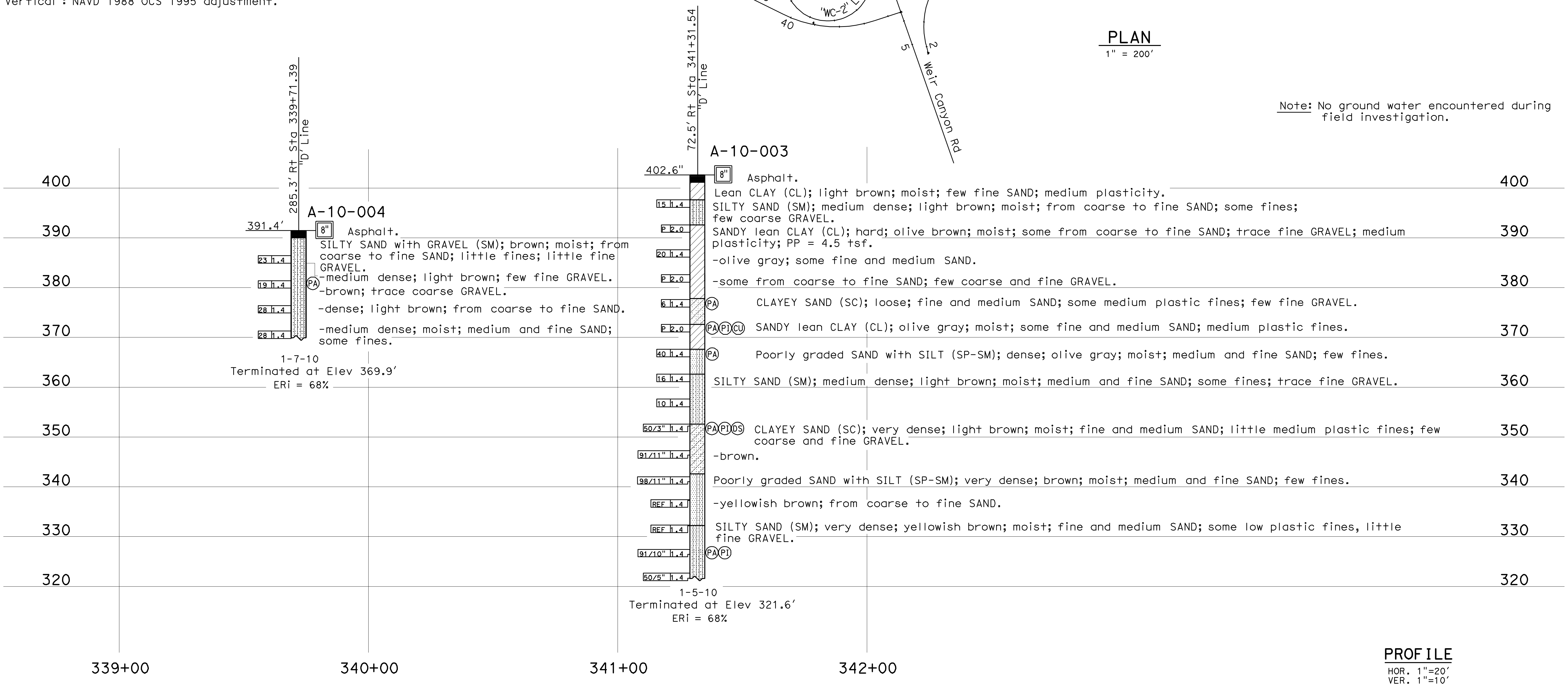
Horizontal datum : (CCCS83) zone 6 1983 NAD (1991.35 epoch OCS adjustment).
Vertical : NAVD 1988 OCS 1995 adjustment.



## PLAN

1" = 200'

Note: No ground water encountered during field investigation.



A-10-004

8" Asphalt.

SILTY SAND with GRAVEL (SM); brown; moist; from coarse to fine SAND; little fines; little fine GRAVEL.

-medium dense; light brown; few fine GRAVEL. (PA)

-brown; trace coarse GRAVEL.

-dense; light brown; from coarse to fine SAND.

-medium dense; moist; medium and fine SAND; some fines.

1-7-10
Terminated at Elev 369.9'
ERi = 68%

A-10-003

8" Asphalt.

Lean CLAY (CL); light brown; moist; few fine SAND; medium plasticity.

SILTY SAND (SM); medium dense; light brown; moist; from coarse to fine SAND; some fines; few coarse GRAVEL.

SANDY lean CLAY (CL); hard; olive brown; moist; some from coarse to fine SAND; trace fine GRAVEL; medium plasticity; PP = 4.5 tsf.

-olive gray; some fine and medium SAND.

-some from coarse to fine SAND; few coarse and fine GRAVEL.

(PA) CLAYEY SAND (SC); loose; fine and medium SAND; some medium plastic fines; few fine GRAVEL.

(PA)(PI)(CU) SANDY lean CLAY (CL); olive gray; moist; some fine and medium SAND; medium plastic fines.

(PA) Poorly graded SAND with SILT (SP-SM); dense; olive gray; moist; medium and fine SAND; few fines.

SILTY SAND (SM); medium dense; light brown; moist; medium and fine SAND; some fines; trace fine GRAVEL.

(PA)(PI)(DS) CLAYEY SAND (SC); very dense; light brown; moist; fine and medium SAND; little medium plastic fines; few coarse and fine GRAVEL.

-brown.

Poorly graded SAND with SILT (SP-SM); very dense; brown; moist; medium and fine SAND; few fines.

-yellowish brown; from coarse to fine SAND.

SILTY SAND (SM); very dense; yellowish brown; moist; fine and medium SAND; some low plastic fines, little fine GRAVEL.

(PA)(PI)

1-5-10
Terminated at Elev 321.6'
ERi = 68%

## PROFILE

HOR. 1"=20'
VER. 1"=10'

| ENGINEERING SERVICES | | GEOTECHNICAL SERVICES |
|---|---|---|
| FUNCTIONAL SUPERVISOR | DRAWN BY: W. Tang 06/10 | FIELD INVESTIGATION BY: |
| NAME: S. Karimi | CHECKED BY: T. Halda | K. Lai, A. Mehrazar |

STATE OF
**CALIFORNIA**
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH

BRIDGE NO. 55-0505RL
POST MILES 14.5

# WEIR CANYON ROAD UC WIDENING
# LOG OF TEST BORINGS 1 OF 6

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12
EA 0G3301

DISREGARD PRINTS BEARING EARLIER REVISION DATES → ~~08-04-10~~ 08-09-10

REVISION DATES | SHEET | OF

FILE => weir-canyon1of6.dgn

USERNAME => s116982 DATE PLOTTED => 05-NOV-2010 TIME PLOTTED => 12:34

| DIST | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No | TOTAL SHEETS |
|---|---|---|---|---|---|
| 12 | Ora | 91 | | | |

8-10-10

REGISTERED GEOTECHNICAL ENGINEER

REGISTERED PROFESSIONAL ENGINEER
Gamini Weeratunga
No. GE2403
Exp. 9-30-10
GEOTECHNICAL
STATE OF CALIFORNIA

PLANS APPROVAL DATE

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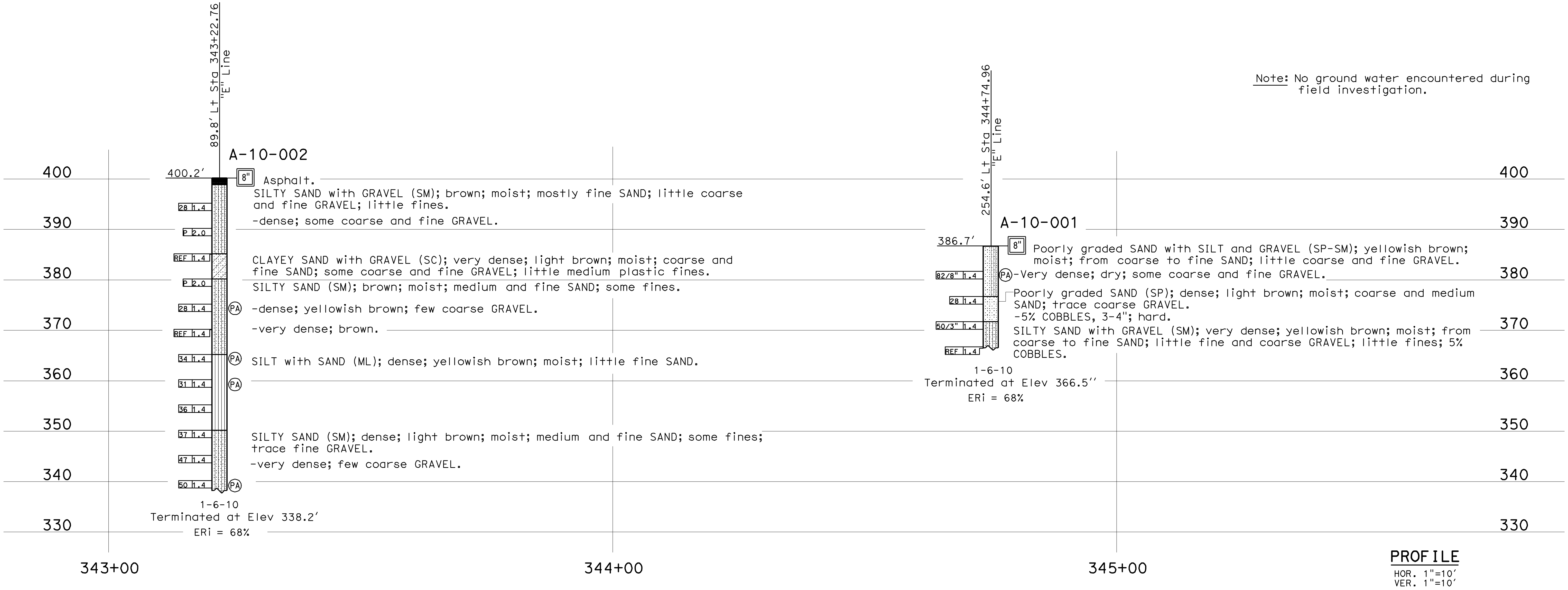
FOR PLAN VIEW, SEE
"LOG OF TEST BORINGS 1 OF 6"

Note: No ground water encountered during field investigation.



**A-10-002**

Asphalt.

SILTY SAND with GRAVEL (SM); brown; moist; mostly fine SAND; little coarse and fine GRAVEL; little fines.

-dense; some coarse and fine GRAVEL.

CLAYEY SAND with GRAVEL (SC); very dense; light brown; moist; coarse and fine SAND; some coarse and fine GRAVEL; little medium plastic fines.

SILTY SAND (SM); brown; moist; medium and fine SAND; some fines.

-dense; yellowish brown; few coarse GRAVEL.

-very dense; brown.

SILT with SAND (ML); dense; yellowish brown; moist; little fine SAND.

SILTY SAND (SM); dense; light brown; moist; medium and fine SAND; some fines; trace fine GRAVEL.

-very dense; few coarse GRAVEL.

1-6-10
Terminated at Elev 338.2′
ERi = 68%

**A-10-001**

Poorly graded SAND with SILT and GRAVEL (SP-SM); yellowish brown; moist; from coarse to fine SAND; little coarse and fine GRAVEL.

-Very dense; dry; some coarse and fine GRAVEL.

Poorly graded SAND (SP); dense; light brown; moist; coarse and medium SAND; trace coarse GRAVEL.

-5% COBBLES, 3-4"; hard.

SILTY SAND with GRAVEL (SM); very dense; yellowish brown; moist; from coarse to fine SAND; little fine and coarse GRAVEL; little fines; 5% COBBLES.

1-6-10
Terminated at Elev 366.5′′
ERi = 68%

PROFILE
HOR. 1"=10′
VER. 1"=10′

**ENGINEERING SERVICES**

FUNCTIONAL SUPERVISOR
NAME: S. Karimi

**GEOTECHNICAL SERVICES**

DRAWN BY: W. Tang 06/10
CHECKED BY: T. Halda
FIELD INVESTIGATION BY: K. Lai, A. Mehrazar

**STATE OF CALIFORNIA**
**DEPARTMENT OF TRANSPORTATION**

**DIVISION OF ENGINEERING SERVICES**
**STRUCTURE DESIGN**
**DESIGN BRANCH**

BRIDGE NO. 55-0505RL
POST MILES 14.5

## WEIR CANYON ROAD UC WIDENING
## LOG OF TEST BORINGS 2 OF 6

OGS CIVIL LOG OF TEST BORINGS SHEET

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS
0 1 2 3

CU 12
EA 0G3301

DISREGARD PRINTS BEARING EARLIER REVISION DATES

| REVISION DATES | | | | | | | | | | SHEET | OF |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ~~08-04-10~~ | 08-09-10 | | | | | | | | | | |

FILE => weir-canyon2of6.dgn

USERNAME => s116982 DATE PLOTTED => 05-NOV-2010 TIME PLOTTED => 12:34

| DIST | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No | TOTAL SHEETS |
|---|---|---|---|---|---|
| 12 | Ora | 91 | | | |

REGISTERED GEOTECHNICAL ENGINEER 8-10-10

Gamini Weeratunga
No. GE2403
Exp. 9-30-10

PLANS APPROVAL DATE

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REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

## 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. |

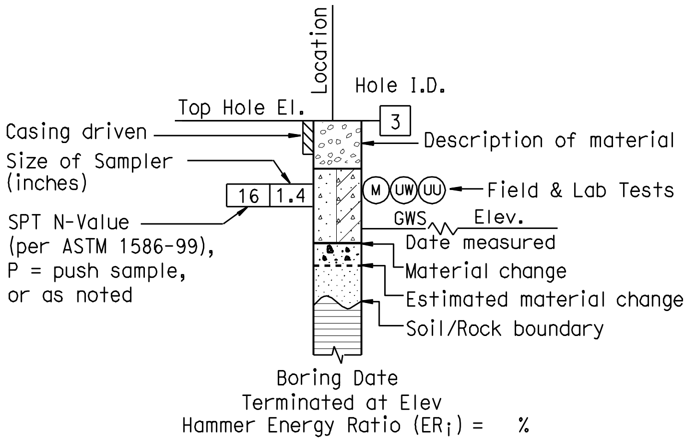
## BOREHOLE IDENTIFICATION

| Symbol | Hole Type | Description |
|---|---|---|
| Size | A | Auger Boring (hollow or solid stem bucket) |
| Size | R<br>RW<br>RC<br>P | Rotary drilled boring (conventional)<br>Rotary drilled with self-casing wire-line<br>Rotary core with continuously-sampled, self-casing wire-line<br>Rotary percussion boring (air) |
| Size | R | Rotary drilled diamond core |
| Size | HD<br>HA | Hand driven (1-inch soil tube)<br>Hand Auger |
| ● | D | Dynamic Cone Penetration Boring |
| ▲ | CPT | Cone Penetration Test (ASTM D 5778) |
| ⬚ | O | Other (note on LOTB) |

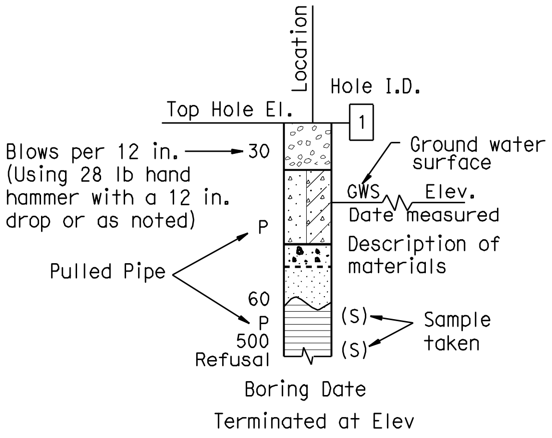
**Note: Size in inches.**

## CONSISTENCY OF COHESIVE SOILS

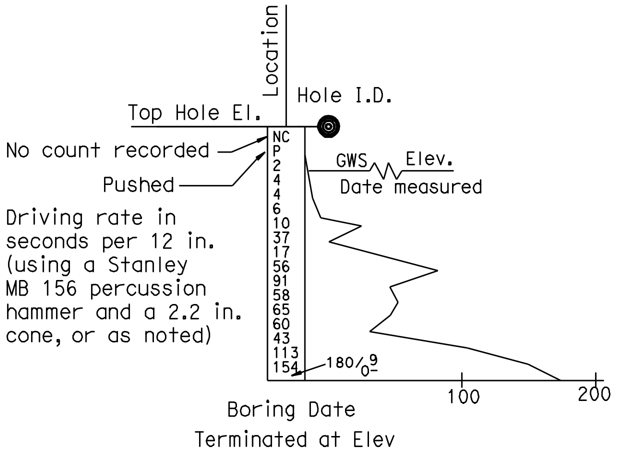
| Description | Shear Strength (tsf) | Pocket Penetrometer Measurement, PP, (tsf) | Torvane Measurement, TV, (tsf) | Vane Shear Measurement, VS, (tsf) |
|---|---|---|---|---|
| Very Soft | Less than 0.12 | Less than 0.25 | Less than 0.12 | Less than 0.12 |
| Soft | 0.12 - 0.25 | 0.25 - 0.5 | 0.12 - 0.25 | 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 |



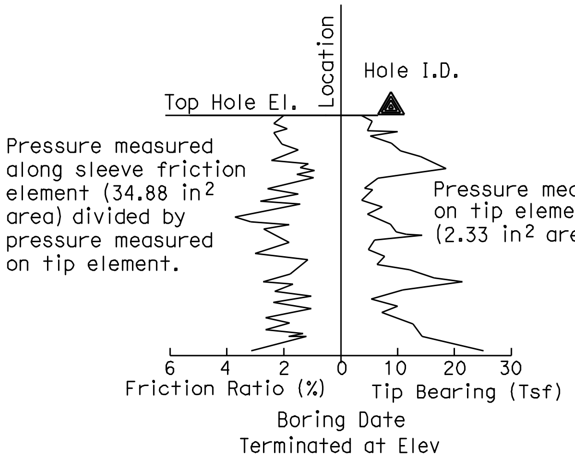
**ROTARY BORING**



**HAND BORING**



**DYNAMIC CONE PENETRATION BORING**



**CONE PENETRATION TEST (CPT) BORING**

| ENGINEERING SERVICES | | GEOTECHNICAL SERVICES |
|---|---|---|
| FUNCTIONAL SUPERVISOR: S. Karimi | DRAWN BY: W. Tang 06/10<br>CHECKED BY: T. Halda | FIELD INVESTIGATION BY: K. Lai, A. Mehrazar |

STATE OF
CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES
STRUCTURE DESIGN
DESIGN BRANCH

BRIDGE NO. 55-0505RL
POST MILE 14.5

# WEIR CANYON ROAD UC WIDENING

# LOG OF TEST BORINGS 3 OF 6

GS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12
EA 0G3301

DISREGARD PRINTS BEARING EARLIER REVISION DATES

REVISION DATES SHEET OF

FILE => weir-canyon3of6.dgn

USERNAME => s116982 DATE PLOTTED => 05-NOV-2010 TIME PLOTTED => 12:34

| DIST | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET No | TOTAL SHEETS |
|---|---|---|---|---|---|
| 12 | Ora | 91 | | | |

REGISTERED GEOTECHNICAL ENGINEER 8-10-10

Gamini Weeratunga
No. GE2403
Exp. 9-30-10

PLANS APPROVAL DATE

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REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

## GROUP SYMBOLS AND NAMES

| Graphic/Symbol | | Group Names | Graphic/Symbol | | Group Names |
|---|---|---|---|---|---|
| ▨ | GW | Well-graded GRAVEL<br>Well-graded GRAVEL with SAND | ▨ | CL | Lean CLAY<br>Lean CLAY with SAND<br>Lean CLAY with GRAVEL<br>SANDY lean CLAY<br>SANDY lean CLAY with GRAVEL<br>GRAVELLY lean CLAY<br>GRAVELLY lean CLAY with SAND |
| ▨ | GP | Poorly-graded GRAVEL<br>Poorly-graded GRAVEL with SAND | | | |
| ▨ | GW-GM | Well-graded GRAVEL with SILT<br>Well-graded GRAVEL with SILT and SAND | ▨ | CL-ML | SILTY CLAY<br>SILTY CLAY with SAND<br>SILTY CLAY with GRAVEL<br>SANDY SILTY CLAY<br>SANDY SILTY CLAY with GRAVEL<br>GRAVELLY SILTY CLAY<br>GRAVELLY SILTY CLAY with SAND |
| ▨ | GW-GC | Well-graded GRAVEL with CLAY (or SILTY CLAY)<br>Well-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND) | | | |
| ▨ | GP-GM | Poorly-graded GRAVEL with SILT<br>Poorly-graded GRAVEL with SILT and SAND | ▨ | ML | SILT<br>SILT with SAND<br>SILT with GRAVEL<br>SANDY SILT<br>SANDY SILT with GRAVEL<br>GRAVELLY SILT<br>GRAVELLY SILT with SAND |
| ▨ | GP-GC | Poorly-graded GRAVEL with CLAY (or SILTY CLAY)<br>Poorly-graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND) | | | |
| ▨ | GM | SILTY GRAVEL<br>SILTY GRAVEL with SAND | ▨ | OL | ORGANIC lean CLAY<br>ORGANIC lean CLAY with SAND<br>ORGANIC lean CLAY with GRAVEL<br>SANDY ORGANIC lean CLAY<br>SANDY ORGANIC lean CLAY with GRAVEL<br>GRAVELLY ORGANIC lean CLAY<br>GRAVELLY ORGANIC lean CLAY with SAND |
| ▨ | GC | CLAYEY GRAVEL<br>CLAYEY GRAVEL with SAND | | | |
| ▨ | GC-GM | SILTY, CLAYEY GRAVEL<br>SILTY, CLAYEY GRAVEL with SAND | ▨ | OL | ORGANIC SILT<br>ORGANIC SILT with SAND<br>ORGANIC SILT with GRAVEL<br>SANDY ORGANIC SILT<br>SANDY ORGANIC SILT with GRAVEL<br>GRAVELLY ORGANIC SILT<br>GRAVELLY ORGANIC SILT with SAND |
| ▨ | SW | Well-graded SAND<br>Well-graded SAND with GRAVEL | | | |
| ▨ | SP | Poorly-graded SAND<br>Poorly-graded SAND with GRAVEL | ▨ | CH | Fat CLAY<br>Fat CLAY with SAND<br>Fat CLAY with GRAVEL<br>SANDY fat CLAY<br>SANDY fat CLAY with GRAVEL<br>GRAVELLY fat CLAY<br>GRAVELLY fat CLAY with SAND |
| ▨ | SW-SM | Well-graded SAND with SILT<br>Well-graded SAND with SILT and GRAVEL | | | |
| ▨ | SW-SC | Well-graded SAND with CLAY (or SILTY CLAY)<br>Well-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL) | ▨ | MH | Elastic SILT<br>Elastic SILT with SAND<br>Elastic SILT with GRAVEL<br>SANDY elastic SILT<br>SANDY elastic SILT with GRAVEL<br>GRAVELLY elastic SILT<br>GRAVELLY elastic SILT with SAND |
| ▨ | SP-SM | Poorly-graded SAND with SILT<br>Poorly-graded SAND with SILT and GRAVEL | | | |
| ▨ | SP-SC | Poorly-graded SAND with CLAY (or SILTY CLAY)<br>Poorly-graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL) | ▨ | OH | ORGANIC fat CLAY<br>ORGANIC fat CLAY with SAND<br>ORGANIC fat CLAY with GRAVEL<br>SANDY ORGANIC fat CLAY<br>SANDY ORGANIC fat CLAY with GRAVEL<br>GRAVELLY ORGANIC fat CLAY<br>GRAVELLY ORGANIC fat CLAY with SAND |
| ▨ | SM | SILTY SAND<br>SILTY SAND with GRAVEL | | | |
| ▨ | SC | CLAYEY SAND<br>CLAYEY SAND with GRAVEL | ▨ | OH | ORGANIC elastic SILT<br>ORGANIC elastic SILT with SAND<br>ORGANIC elastic SILT with GRAVEL<br>SANDY ORGANIC elastic SILT<br>SANDY ORGANIC elastic SILT with GRAVEL<br>GRAVELLY ORGANIC elastic SILT<br>GRAVELLY ORGANIC elastic SILT with SAND |
| ▨ | SC-SM | SILTY, CLAYEY SAND<br>SILTY, CLAYEY SAND with GRAVEL | | | |
| ▨ | PT | PEAT | ▨ | OL/OH | ORGANIC SOIL<br>ORGANIC SOIL with SAND<br>ORGANIC SOIL with GRAVEL<br>SANDY ORGANIC SOIL<br>SANDY ORGANIC SOIL with GRAVEL<br>GRAVELLY ORGANIC SOIL<br>GRAVELLY ORGANIC SOIL with SAND |
| ▨ | | COBBLES<br>COBBLES and BOULDERS<br>BOULDERS | | | |

## FIELD AND LABORATORY TESTING

| | |
|---|---|
| Ⓒ | Consolidation (ASTM D 2435) |
| (CL) | Collapse Potential (ASTM D 5333) |
| (CP) | Compaction Curve (CTM 216) |
| (CR) | Corrosivity Testing (CTM 643, CTM 422, CTM 417) |
| (CU) | Consolidated Undrained Triaxial (ASTM D 4767) |
| (DS) | Direct Shear (ASTM D 3080) |
| (EI) | Expansion Index (ASTM D 4829) |
| Ⓜ | Moisture Content (ASTM D 2216) |
| (OC) | Organic Content-% (ASTM D 2974) |
| Ⓟ | Permeability (CTM 220) |
| (PA) | Particle Size Analysis (ASTM D 422) |
| (PI) | Plasticity Index (AASHTO T 90)<br>Liquid Limit (AASHTO T 89) |
| (PL) | Point Load Index (ASTM D 5731) |
| (PM) | Pressure Meter |
| Ⓡ | 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)<br>Unconfined Compression-Rock (ASTM D 2938) |
| (UU) | Unconsolidated Undrained Triaxial (ASTM D 2850) |
| (UW) | Unit Weight (ASTM D 4767) |

## APPARENT DENSITY OF COHESIONLESS SOILS

| Description | SPT $N_{60}$ (Blows / 12 in.) |
|---|---|
| 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 |

**ENGINEERING SERVICES**

FUNCTIONAL SUPERVISOR: S. Karimi

DRAWN BY: W. Tang 06/10

CHECKED BY: T. Halda

**GEOTECHNICAL SERVICES**

FIELD INVESTIGATION BY: K. Lai, A. Mehrazar

**STATE OF CALIFORNIA**
**DEPARTMENT OF TRANSPORTATION**

**DIVISION OF ENGINEERING SERVICES**
**STRUCTURE DESIGN**
**DESIGN BRANCH**

BRIDGE NO. 55-0505RL

POST MILE 14.5

# WEIR CANYON ROAD UC WIDENING

## LOG OF TEST BORINGS 4 OF 6

GS LOTB SOIL LEGEND

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

CU 12
EA 0G3301

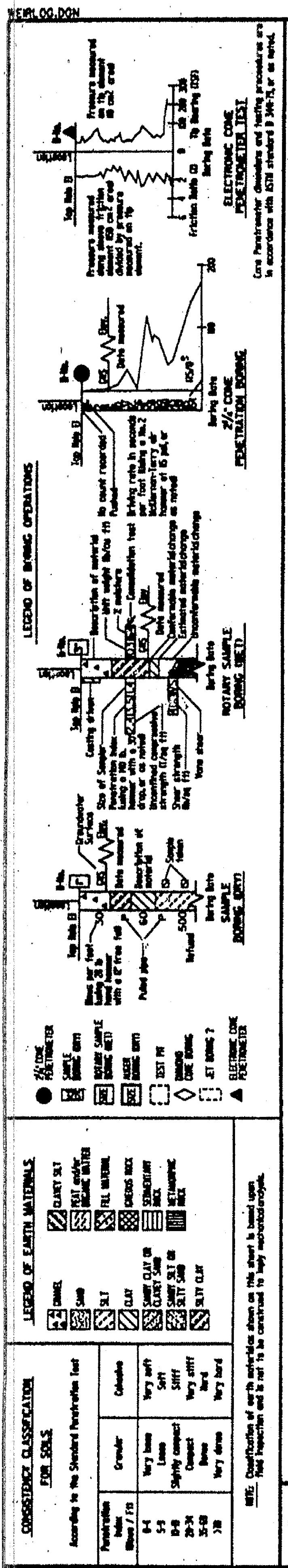
DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES | SHEET | OF

FILE => weir-canyon4of6.dgn

USERNAME => s116982 DATE PLOTTED => 05-NOV-2010 TIME PLOTTED => 12:35

WEIRLOG.DGN

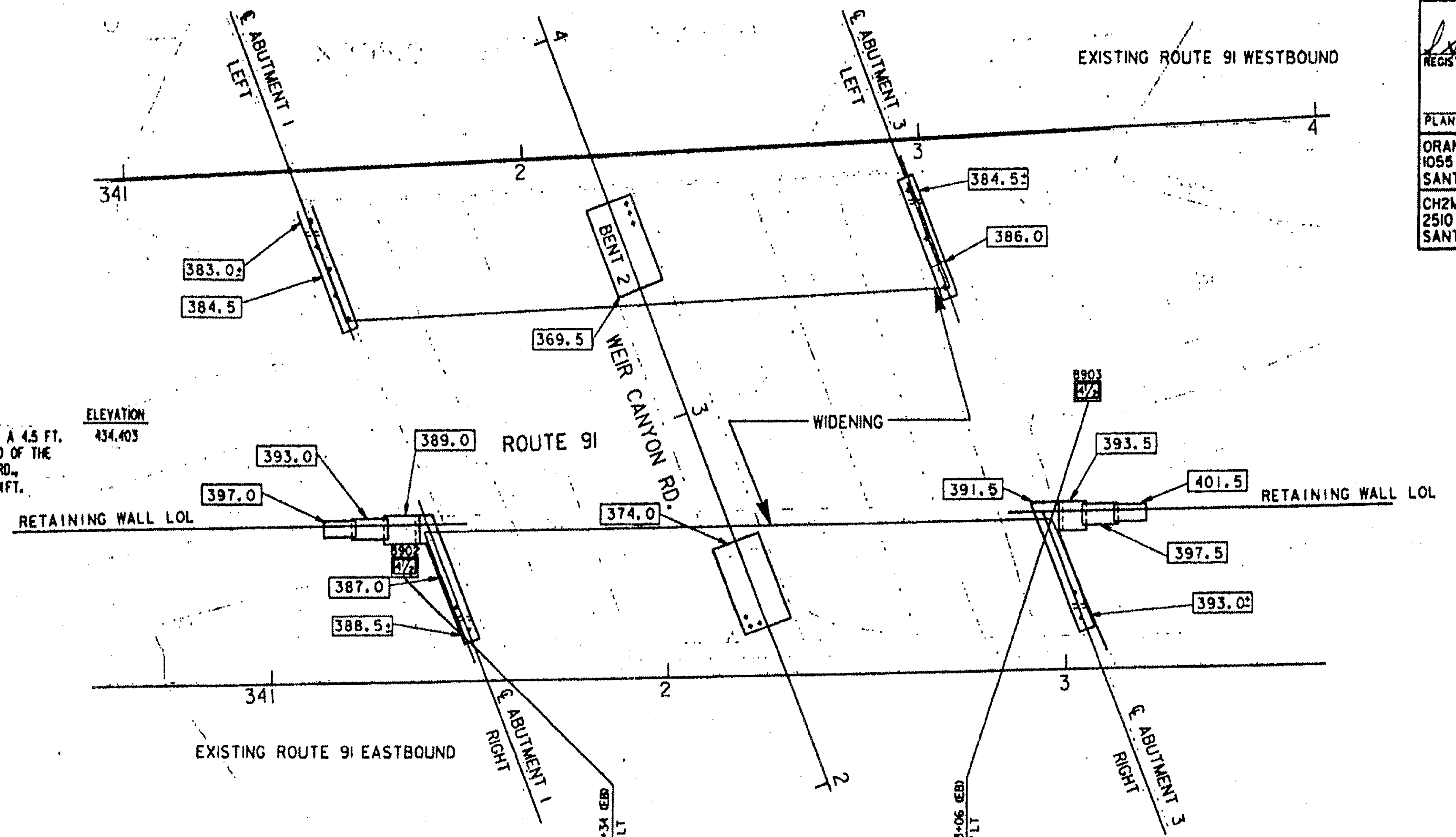


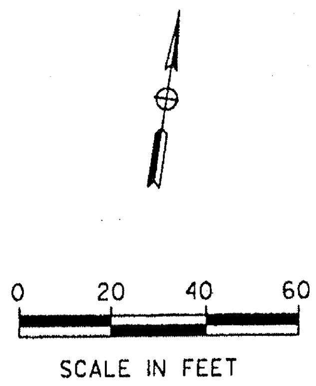
**NOTES:**

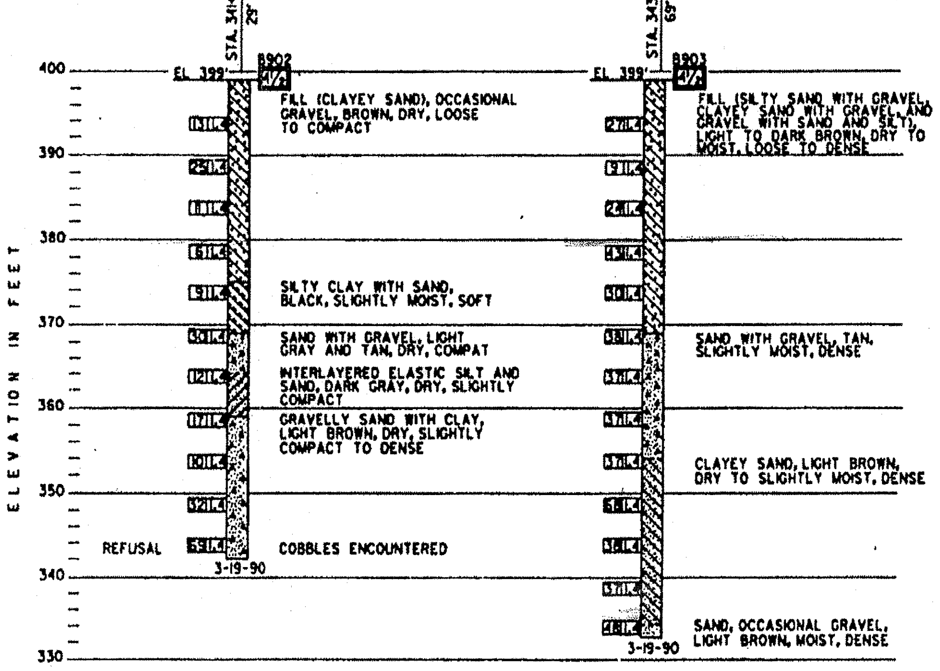
1. THE BORING LOGS AND RELATED INFORMATION REPRESENT THE OPINION OF THE GEOTECHNICAL ENGINEER AS TO THE CHARACTER OF THE MATERIALS AT THE LOCATIONS SHOWN. SOIL AND GROUNDWATER CONDITIONS BETWEEN ADJACENT TEST HOLES AND AT OTHER LOCATIONS MAY DIFFER FROM THOSE SHOWN. GROUNDWATER CONDITIONS MAY CHANGE WITH PASSAGE OF TIME. ALL LOCATIONS AND ELEVATIONS ARE APPROXIMATE.
2. AUGER BORINGS WERE DRILLED WITH A CME 75 DRILL RIG.
3. ELEVATIONS ARE BASED ON TOPOGRAPHIC BASE SHEET MAPPING PREPARED FOR THIS PROJECT. TEST BORING ELEVATIONS ARE IN FEET AND ARE REFERENCED TO MEAN SEA LEVEL DATUM.
4. DETAILED BORING LOGS ARE INCLUDED IN THE JULY 1990 GEOTECHNICAL BRIDGE FOUNDATION REPORT PREPARED BY CH2M HILL. FILE NO. LA028364.EI.II
5. ELEVATIONS SHOWN ARE BASED UPON OCS DATUM 1976.
6. BASIS OF BEARINGS IS CALIFORNIA STATE PLANE COORDINATE SYSTEM (1983 N.A.D.)

| BENCH MARK | DESCRIPTION | ELEVATION |
|---|---|---|
| 3KK-27-85<br>(PM R 14.5) | STD. OCS BM DISK IN TOP OF SW'LY CORNER OF A 4.5 FT. BY 22 FT. PCC CATCH BASIN, IN THE NE'LY QUAD OF THE INTERS. OF WEIR CYN. RD. AND SANTA ANA CYN. RD., 64 FT. N'LY OF THE ' OF SANTA ANA CYN. RD., ■FT. NE'LY OF THE ' OF WEIR CYN. RD. (OCS VERT. CON. REV. 1986 PG 09-4) | 434.403 |

7. ☐ INDICATES BOTTOM OF FOOTING ELEVATION. FOR PILE LAYOUT SEE OTHER SHEETS.
8. NO GROUNDWATER ENCOUNTERED DURING DRILLING OF BORINGS B902 AND B903.







| DIST | COUNTY | ROUTE | POST MILES TOTAL PROJECT | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|---|
| 12 | Ora | 91 | R10.1/R18.9 | | |

REGISTERED ENGINEER-GEOTECHNICAL

S. Stuart Williams
No. CE 896
Exp. 12/31/92
GEOTECHNICAL

PLANS APPROVAL DATE

ORANGE COUNTY TRANSP. COMM.
1055 N. MAIN ST., SUITE 516
SANTA ANA, CALIFORNIA 92701

CH2M HILL
2510 RED HILL AVE, SUITE A
SANTA ANA, CALIFORNIA 92705

**AS BUILT**

RESIDENT ENGINEER

CONTRACT NO. 12-926004

COMPLETION DATE: 07-26-1996

James Pinheiro

DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES

As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. It does not attest to the accuracy or validity of the information contained in the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party.

| DIST. | COUNTY | ROUTE | POST MILES-TOTAL PROJECT | Sheet No. | Total Sheets |
|---|---|---|---|---|---|
| 12 | Ora | 91 | | | |

REGISTERED GEOTECHNICAL ENGINEER — 8-10-10 DATE

Gamini Weeratunga
No. GE2403
Exp. 9-30-10
GEOTECHNICAL

**WEIR CANYON ROAD UC WIDENING**

**LOG OF TEST BORINGS** 5 OF 6

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

CU: 12
EA: 0G3301

BRIDGE No. 55-0505RL

Sheet of

The elevations shown are based on NGVD 29 Datum, adjusted in 1976. +2.41 feet should be added to these elevations for converting to elevations based on current NAVD 88 Datum.

DESIGN OVERSIGHT
5/6/92
SIGN OFF DATE

| DRAWN BY | M. REICHERT | E. M. SMITH<br>FIELD INVESTIGATOR | APPROVAL RECOMMENDED BY<br>L. PERKO |
|---|---|---|---|
| CHECKED BY | E. M. SMITH | REGISTRATION NO. | REGISTRATION NO. CE44359 |

PREPARED FOR THE
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

KENT CORDTZ
PROJECT ENGINEER

CU 12207
EA 000971

BRIDGE NO. 55-505 R/L
POST MILE 14.43

# WEIR CANYON ROAD U.C. (WIDEN)
# LOG OF TEST BORINGS

DISREGARD PRINTS BEARING EARLIER REVISION DATES —

REVISION DATES (PRELIMINARY STAGE ONLY)

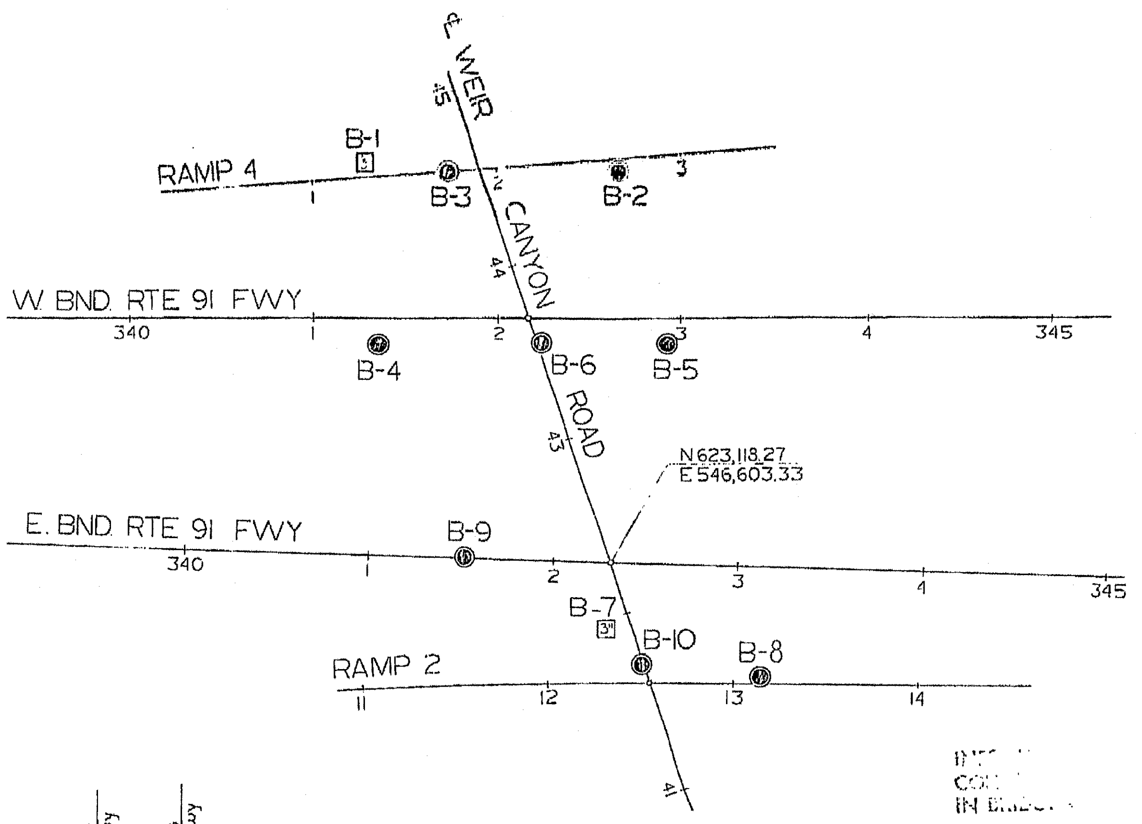
SHEET 11 OF 12

| FED. ROAD DIV. NO. | STATE | F.A. PROJECT NO. | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|---|
| 7 | CALIF. | | | |

| Dist. | County | Route | Section | Sheet No. | Total Sheets |
|---|---|---|---|---|---|
| 07 | Ora | 91 | 37.3-37.7 | 179 | 213 |

## BENCH MARK

BM "MARK" Elev 357.58
Set 2" I.P. & Br cap mon in P.C.C.
32' No of W Bd Rdwy. at sta. 341+50
marked "MARK".



## PLAN

Scale: 1"=50'

| DIVISION OF ENGINEERING SERVICES - GEOTECHNICAL SERVICES | | | | | |
|---|---|---|---|---|---|
| As-Built Log of Test Borings sheet is considered an informational document only. As such, the State of California registration seal with signature, license number and registration certificate expiration date confirm that this is a true and accurate copy of the original document. It does not attest to the accuracy or validity of the information contained in the original document. This drawing is available and presented only for the convenience of any bidder, contractor or other interested party. | | | | | |
| DIST. | COUNTY | ROUTE | POST MILES-TOTAL PROJECT | Sheet No. | Total Sheets |
| 12 | Ora | 91 | | | |

REGISTERED GEOTECHNICAL ENGINEER 8-10-10 DATE

**WEIR CANYON ROAD UC WIDENING**

**LOG OF TEST BORINGS** 6 OF 6

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

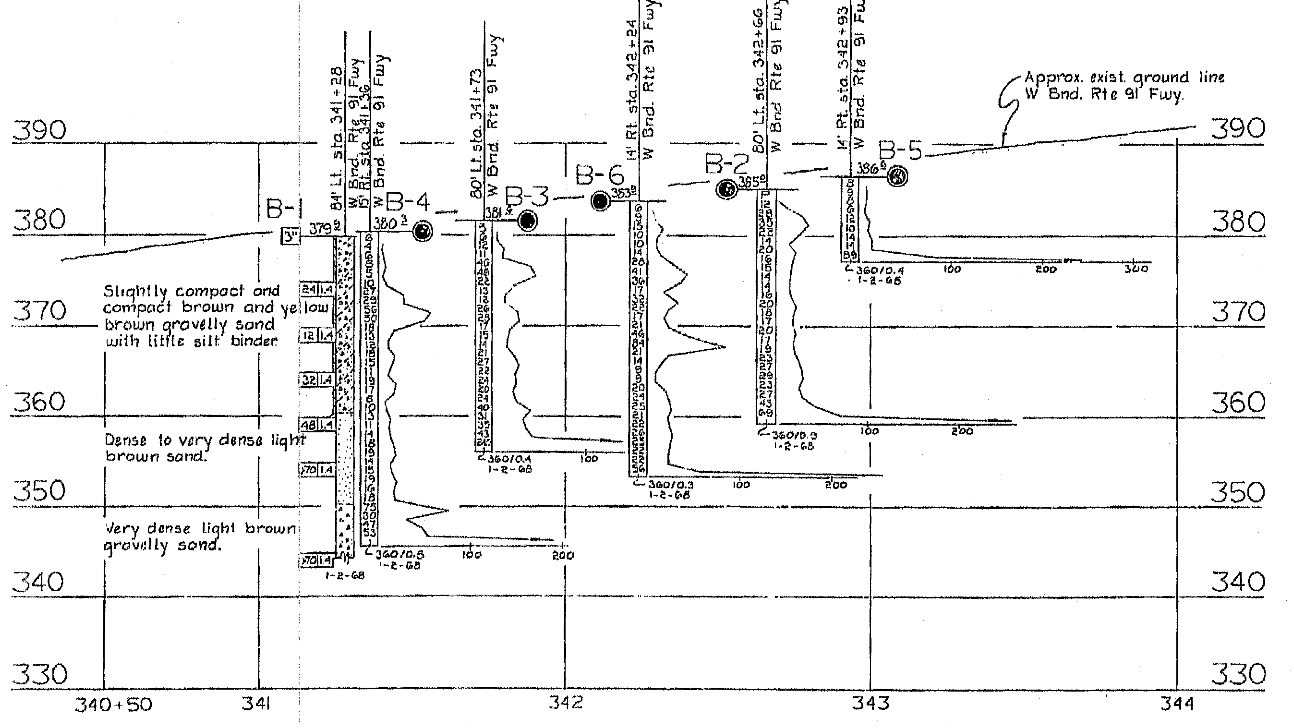
CU: 12
EA: 0G3301

BRIDGE No. 55-0505RL

Sheet of

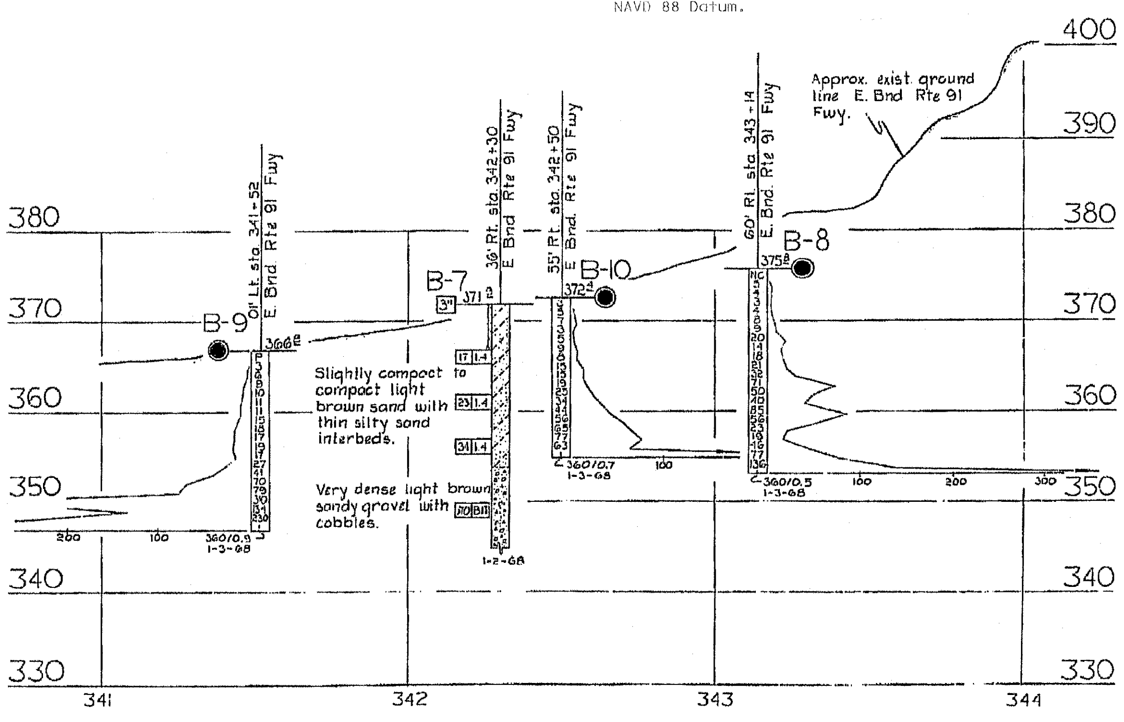
Gamini Weeratunga
No. GE2403
Exp. 9-30-10

The elevations shown are based on NGVD 29 Datum. +2.41 feet should be added to these elevations for converting to elevations based on current NAVD 88 Datum.



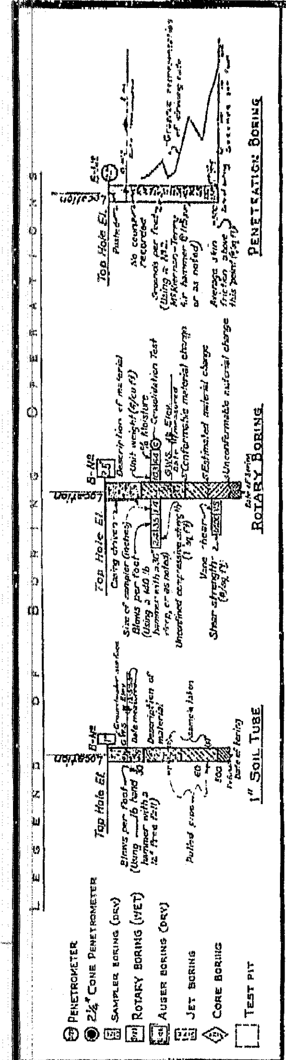
## PROFILE (W. BND. RTE 91 FWY)

Scale: Vert: 1"=10'
Horiz: 1"=30'



## PROFILE (E. BND RTE 91 FWY)

Scale: Vert: 1"=10'
Horiz: 1"=30'



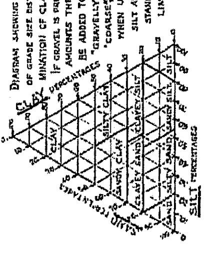
**LEGEND OF EARTH MATERIALS**

- ▨ GRAVEL
- ▨ SAND
- ▨ SILT
- ▨ CLAY
- ▨ SANDY CLAY OR CLAYEY SAND
- ▨ SANDY SILT OR SILTY SAND
- ▨ SILTY CLAY OR CLAYEY SILT
- ▨ PEAT OR ORGANIC MATTER
- ▨ FILL MATERIAL
- ▨ IGNEOUS ROCK
- ▨ SEDIMENTARY ROCK
- ▨ METAMORPHIC ROCK

**CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS**

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

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



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

BRIDGE DEPARTMENT
ENGINEERING GEOLOGY SECTION

Approval Recommended by

JANUARY 1968

# AS BUILT PLANS

Contract No. 07-040024
Date Completed
Document No. 70005928

| SHEET | OF |
|---|---|
| 15 | 15 |

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

## WEIR CANYON ROAD UNDERCROSSING

## LOG OF TEST BORINGS

| SCALE As Noted | BRIDGE 55-505 R/L | FILE | DRAWING |
|---|---|---|---|

Eng 07210
WA 040021

Disregard prints bearing earlier revision dates →

PREL. DRAWING No. PR-