FOR CONTRACT NO.: 06-471904

INFORMATION HANDOUT

MATERIALS INFORMATION

REVISED FINAL FOUNDATION AND SEISMIC REPORT #3 (AVENUE 24 UNDERCROSSING BR. NO. 49-0268)

FOUNDATION REVIEW (AVENUE 24 UNDERCROSSING BR. NO. 49-0268)

ROUTE: 06-Tul-99-2.9/3.3

FOUNDATION REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

To: **Structure Design**
1. Design
2. R.E. Pending File
3. Specifications & Estimates
4. File

Geotechnical Services
1. GD - North ; South ; West
2 GS File Room

Date: 3/4/10

Avenue 24 UC
Structure Name

06 - TUL - 99 - 30.6
District County Route ~~km~~ Post mi.

District Project Development
District Project Engineer

06-471909 46-0268
E.A. Number Structure Number

Foundation Report By: W. Bartucci Dated: 3/4/10

Reviewed By: I. Yalan (SD) R. Price (GS)

General Plan Dated: 2/11/10 Foundation Plan Dated: 1/19/10

☒ No changes. ☐ The following changes are necessary.

FOUNDATION CHECKLIST

Pile Types and Design Loads
✓ Pile Lengths
✓ Predrilling
✓ Pile Load Test
✓ Substitution of H Piles For Concrete Piles ☐ Yes ☑ No

___ Footing Elevations, Design Loads, and Locations
___ Seismic Data
___ Location of Adjacent Structures and Utilities
___ Stability of Cuts or Fills
___ Fill Time Delay

___ Effect of Fills on Abutments and Bents
___ Fill Surcharge
___ Approach Paving Slabs
___ Scour
___ Ground Water
___ Tremie Seals/Type D Excavation

I. Yalan 9
Structure Design Bridge Design Branch No.

Geotechnical Services

Rev. 06/02

Memorandum

Flex your power!
Be energy efficient!

To: GORDON DANKE
Design Branch Chief, Branch 9
Structure Design
Division of Engineering Services

Attention: Isaias Yalan

Date: March 10, 2010

File: 06-Tul-99- PM 3.06
EA 06-471901
Br. #46-0268
Ave. 24 UC Replacement

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

Subject: Revised Final Foundation and Seismic Report #3
(Replaces all previous Final Foundation Reports)

Introduction

The Office of Geotechnical Design – North has prepared this Revised Final Foundation and Seismic Report for the Avenue 24 Undercrossing Bridge replacement on Route 99 post mile (PM) 3.06 in unincorporated, Tulare County, California. The project proposes to replace the structurally deficient existing three span continuous RC girder bridge with a wider (closed center gap) concrete slab bridge. This revised report is based on details regarding the proposed staged bridge construction, associated changes in the foundation loads and cut-off elevation changes that were not available prior to submittal of our previous report. It is our understanding that the bridge is to be constructed in three stages in the following sequence: Stage 1 (Center Gap Bridge), Stage 2 (Right Bridge) and Stage 3 (Left Bridge).

Pertinent Reports and Investigations

The following documents and maps were utilized in preparing this report.

- California Seismic Hazard Map 1996, Caltrans, Lalliana Mualchin, 1996.
- Generalized Geologic Map and Cross Sections of San Joaquin Valley area, California, Paper 1501, Compiled by many between 1975 and 1987, the last compiling by J.A. Bartow 1986 and 1987.
- As-built Log of Test Borings, Avenue 24 Under crossing, Bridge No. 46-0169), Bridge Department, Stamped December 13, 1955 and Stamped November 20, 1997.
- As-built Plans, Ave 24 Under Crossing (Widen) dated November 20, 1997.

- General Plan No.1 and No. 2 for the Ave 24 Avenue Under crossing, last revision date, June 23, 2009.

Field Exploration

Based on the evaluation of the original Log of Test Borings (2-rotary wash borings and 4-dynamic cone penetrometer (DCP) soundings the soil data derived from them is considered adequate to design the bridge foundations, therefore no further exploration was necessary. Geotechnical Services, Office of Geotechnical Support, Branch D – Contracts, Graphics & Records, will incorporate the original Logs of Test Borings (LOTB), in the project plans. Irma Gamarra-Remmen of the Contracts, Graphics & Records branch may be contacted directly for information on the LOTB.

Site Geology and Subsurface Conditions

The Bridge site is situated within the Southern Sierran structural block of the Central Valley geomorphic province (CVGP) of California. The CVGP consists of an approximately 400 mile long asymmetric structural trough that is filled with upper Mesozoic and Cenozoic sediments up to 29,000+ feet thick. This province stretches from the Cascade (Ranges) geomorphic province to the north to the Tehachapi Mountains to the south and it is bound on the east by the Sierra Nevada Geomorphic province and on the west by the Coast Range geomorphic province. Recent and Pleistocene soils that underlie the Central Valley province are composed of interbeds and lenses of gravels, sands, silts and clays eroded from the Sierra Nevada and the Coast Ranges.

The as-built log of test (rotary wash) borings (B-1 and B-4) and interpretation of the DCP soundings (B-2, B-3, B-5 and B-6) indicates that the subsurface materials near Abutment 1 Right and Bents 2, Bent 3 left, Right and including the center gap area consist predominately of loose to medium dense silt, and silty sand to depths of about 20 (Elevation 276 ft), followed by a medium dense to very dense medium to coarse sand to the maximum depth explored (Elevation 248 ft). Near the other support locations, Abutment 1 Left and Abutment 4 Left and Right the soils are probably similar to what was noted above except that they may not exceed medium dense in consistency. An Alternative interpretation of the soundings (B-2 and B-5) for these support locations would be based on the possibility that the soundings were done with different DCP equipment. The curve plots do show an increasing trend with increasing depth that may indicate the soils may continue to increase in density with increasing depth although these curves are not as pronounced as B-3 and B-6 soundings curves.

Groundwater

Department of Water Resources records for the spring of 2004 show that the unconfined aquifer groundwater level under the site was at Elevation 200 feet, MSL (depths of approximately 100 feet below the ground surface at the site). The as-built LOTB were 46 feet deep and no indication of groundwater was noted. Ground water conditions may have changed since the time of the above groundwater level recordings and will vary according to variations in rainfall, well pumping, and other activities.

Laboratory Testing

No laboratory test data from the original investigation was available. Since the soils at the site were cohesionless, insitu field standard penetration tests shown on the LOTB (B-1 and B-2) were used for foundation design.

Corrosion

The corrosion test is omitted from for this project since groundwater is reported over 40 feet below the pile tip elevations and is not likely to reach or get close to the pile tip elevations within the life span of the proposed bridge (See the section on groundwater above), and the site mainly consists of sandy materials. Per information we received from Structure Design, the existing bridge had no indication of foundation corrosion problems. Therefore, the site may be treated as non-corrosive.

Seismic Study

Based on the Caltrans California Seismic Hazard Map 1996, the ground motion is estimated to be controlled by the Coast Ranges Sierran Block Fault with a maximum credible earthquake moment magnitude of M=7 (this is considered to be reverse including thrust). This fault is located about 45 kilometers south west of the bridge site. The peak bedrock acceleration based on the attenuation equation by Geomatrix 97 is estimated to be 0.2g (rounded up from 0.1g).

The potential for surface rupture at the site due to fault movement is considered insignificant since there is no known faults projecting towards or passing directly through the project site.

Based on the soil profile, a final Caltrans Seismic Design Criteria Acceleration Response Spectrum (ARS) curve corresponding to soil profile Type D is recommended for design. Since groundwater was not encountered within the depth of the foundation, the potential for soil liquefaction is considered to be none existent. The recommended ARS Curve is attached.

Foundation Recommendations

Based on the available information we are providing the following revised foundation recommendations for the proposed bridge replacement. 16-inch Class 140 CIDH piles at the abutments and 24-inch CIDH Piles (pile extensions) at the bents are selected for foundation support. Pile specifications are presented in Tables 1, 2 and 3 below.

Table 1, Abutment Pile Data

Support Location	Pile Type	Cut-off Elev (ft)	LRFD Service-I Limit State Load per Support – Compression (kips)		LRFD Service-I Limit State Load per Pile-Compression (kips)	Nominal Resistance (kips)	Design Tip Elevation (ft)	Specified Tip Elev (ft)
			Total	Perm.				
Abut 1 Stage 3 Left Bridge	16-in CIDH	305.0	725	725	60	120	268	268
Abut 1 Stage 1 Center Gap Bridge	16-in CIDH	305.0	620	620	62	124	269	269
Abut 1 Stage 2 Right Bridge	16-in CIDH	305.0	725	725	60	120	270	270
Abut 4 Stage 3 Left Bridge	16-in CIDH	305.0	725	725	60	120	265	265
Abut 4 Stage 1 Center Gap Bridge	16-in CIDH	305.0	620	620	62	124	265	265
Abut 4 State 2 Right Bridge	16-in CIDH	305.0	725	725	60	120	265	265

The following controls design tip elevations:

1. Abutment recommendations are based Working Stress Design (WSD) and load data provide by the Structure Designer on the Foundation Design Data Sheet. Each abutment has 10 piles (Stage 1) and 14 piles (Stage 2 and Stage 3).
2. The "nominal resistance" is the resistance per pile or drilled shaft in compression. The "nominal resistance" is obtained by multiplying the total "service limit state I load" by a minimum safety factor FS = 2, and is taken as equal to the ultimate axial load capacity defined in BDS (200).
3. "Design tip elevations" include the effects of group interaction, down drag and liquefaction, as applicable. Liquefaction induced down drag and other effects of liquefaction, when present, are considered in combination with the service load and a factor of safety, FS=1.0, to evaluate the foundation capacity.
4. "Design tip elevations" are controlled by compression.
5. The "specified tip elevation" shall not be raised if controlled by tension, lateral load or settlement.
6. Skin friction was used to for determine the compression control tip elevations.

Table 2 – Bent Pile Data

Support Location	Pile Type	Cut-off Elevation (Ft)	Permanent Load Service-I Limit State Load per Support (kips)	Total Permissible Support Settlement (inches)	Required Factored Nominal Resistance (kips)				Design Tip Elevations (ft)	Specified Tip Elevation (ft)
					Strength Limit		Extreme Limit			
					Comp. (φ=0.5)	Tension (φ=0.5)	Comp (φ=1)	Tension (φ=1)		
Bent 2 Stage 3 Left Br.	24-in CIDH	296.0	1548	1	2430	N/A	1652	N/A	245 (a-I) 270 (a-II)	245
Bent 2 State 1 Center Gap Br.	24-in CIDH	296.0	1354	1	2140	N/A	1446	N/A	240 (a-I) 270 (a-II)	240
Bent 2 Stage 2 Right Bridge	24-in CIDH	296.0	1548	1	2430	N/A	1652	N/A	248 (a-I) 273 (a-II)	248
Bent 3 Stage 3 Left Bridge	24-in CIDH	295.0	1548	1	2430	N/A	1652	N/A	246 (a-I) 270 (a-II)	246

Table continued on next page

Table 2 Bent Pile Data (Continued)

Support Location	Pile Type	Cut-off Elevation (Ft)	Permanent Load Service-I Limit State Load per Support (kips)	Total Permissible Support Settlement (inches)	Required Factored Nominal Resistance (kips)				Design Tip Elevations (ft)	Specified Tip Elevation (ft)
					Strength Limit		Extreme Limit			
					Comp. (φ=0.5)	Tension (φ=0.5)	Comp (φ=1)	Tension (φ=1)		
Bent 3 Stage 1 Center Gap Br.	24-in CIDH	295	1354	1	2140	N/A	1446	N/A	238 (a-I) 266 (a-II)	238
Bent 3 Stage 2 Right Bridge	24-in CIDH	295	1548	1	2430	N/A	1652	N/A	244 (a-I) 269 (a-II)	244

The following controls design tip elevations:

1. Design tip elevations are controlled by compression: (a-I) Strength Limit State,), (a-II) Extreme Limit State.
2. Bent recommendations are based on Load Factor Resistance Design (LFRD) and load data provided by the Structure Designer on the Foundation Design Data Sheet. Each Bent has 5 piles (Stage 1) and 7 piles (Stage 2 and Stage 3).
3. The "service limit state I load" is either the total or permanent load per pile or drilled shaft in axial compression, whichever is used for settlement computations.
4. "Design tip elevations" include the effects of group interaction, down drag and liquefaction, as applicable. Liquefaction induced down drag and other effects of liquefaction, when present, are considered only with Extreme Event 1 Loads. "Design tip elevations" are controlled by compression.
5. The "specified tip elevation" shall not be raised if controlled by tension, lateral load or settlement.
6. Skin friction was used to determine the compression tip elevations.
7. A resistance factor (Φ) of 0.5 was used to calculate the available geotechnical resistance to the pile.

Table 3 – Pile Data Table

Location	Pile Type	Nominal Resistance Per Pile (kips)		Design Tip Elevation (ft)	Specified Tip Elevation (ft)
		Compression	Tension		
Abut 1 Stage 3 Left Bridge	16-in CIDH	120	N/A	268	268
Abut 1 Stage 1 Center Gap Bridge	16-in CIDH	124	N/A	269	269
Abut 1 Stage 2 Right Bridge	16-in CIDH	120	N/A	270	270
Bent 2 Stage 3 Left Bridge	24-in CIDH	700	N/A	245 (a) 270 (b)	245
Bent 2 Stage 1 Center Gap Bridge	24-in CIDH	860	N/A	240 (a) 270 (b)	240
Bent 2 Stage 2 Right Bridge	24-in CIDH	700	N/A	248 (a) 273 (b)	248

Table continued on next page

Notes:

1) Design tip elevations are controlled by compression: (a) Strength Limit State, (b) Extreme Limit State.
2) Structure Design Typically provides Design tip elevations for Lateral Load.
3) There is no design tip elevation for Settlement.

Table 3 Pile Data Table (Continued)

Location	Pile Type	Nominal Resistance Per Pile (kips)		Design Tip Elevation (ft)	Specified Tip Elevation (ft)
		Compression	Tension		
Bent 3 Stage 3 Left Bridge	24-in CIDH	700	N/A	246 (a) 270 (b)	246
Bent 3 Stage 1 Center Gap Bridge	24-in CIDH	860	N/A	238 (a) 266 (b)	238
Bent 3 Stage 2 Right Bridge	24-in CIDH	700	N/A	244 (a) 269 (b)	244
Abut 4 Stage 3 Left Bridge	16-in CIDH	120	N/A	265	265
Abut 4 Stage 1 Center Gap Bridge	16-in CIDH	124	N/A	265	265
Abut 4 Stage 2 Right Bridge	16-in CIDH	120	N/A	265	265

Notes:

1) Design tip elevations are controlled by compression: (a) Strength Limit State, (b) Extreme Limit State.
2) Structure Design Typically provides Design tip elevations for Lateral Load.
3) There is no design tip elevation for Settlement.

General Notes to Designer

1. The structure engineer shall show on the plans, in the pile data table, the minimum pile tip elevation required to meet the lateral load demands.

2. Should the specified pile tip elevation required to meet lateral load demands exceed the specified pile tip elevation given within this report, the Office of Geotechnical Design North should be contacted for further recommendations.

3. Support locations will not be plotted on the Log of Test Borings, in plan view, as stated in "Memos to Designers" 4-2. Additional borings were not required for this project, only original borings were provided. There is a conversion table placed of the original boring sheet that converts those boring locations to the present stationing an offset distances.

Construction Considerations

1. Slight to moderately difficult pile installation is anticipated due to the presence of localized zones of very dense soils and sloughing soils. Temporary casing may be used as needed.

2. Prior to placement of concrete, the interior surface of the shaft including the bottom should be cleaned of residue from drilling operations.

3. The drilling of the CIDH piles, the placement of the rebar cage, and concrete pour shall be completed in a continuous operation.

4. Excavated materials shall be handled and disposed of in accordance with the Special Provisions.

Project Information

Standard Special Provision (SSP) S5-280, "Project Information", discloses to bidders and contractors a list of pertinent information available for their inspection prior to bid opening. The Following is an excerpt form SSP S5-280 disclosing information originating from Geotechnical Services. Items listed to be included in the information Handout will be provided in Acrobat (.pdf) format to the addressee(s) of this report via electronic mail.

Data and information attached with the project plan are:

A. *Log of Test Borings for Avenue 24, Bridge No. 46-00169 (As-built Drawings dated December 13, 1955).*
B. *Acceleration Response Spectrum Curve (present investigation).*

If you have any questions, please call William Bertucci at (916) 227-1045 or John Huang at (916) 227-1037.

for Bill

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Attachment: ARS Curve

C: RBibbens, JStayton, R.E. Pending, GDN file, GS File Room

Avenue 24 Undercrossing Bridge
Br. No. 46-0268
06-471901

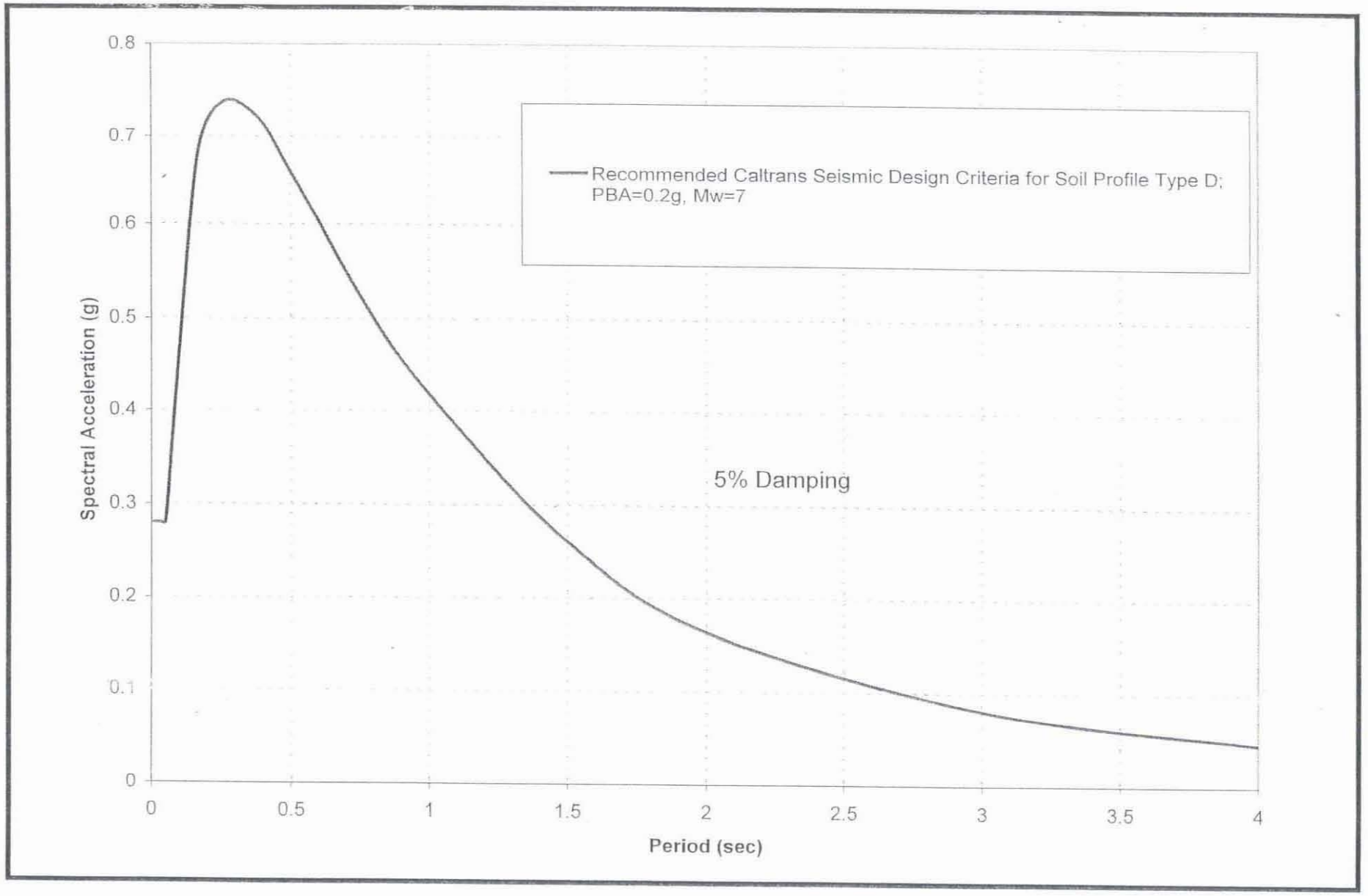

Figure 1. Acceleration Response Spectrum Recommended for Design