FOR CONTRACT NO.: 08-478604

INFORMATION HANDOUT

MATERIALS INFORMATION

REVISED FOUNDATION RECOMMENDATIONS

ROUTE: 08-RIV-86S, PM R16.0/R16.7

State of California

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: HOWARD NG
Branch Chief
Bridge Design Branch 20

Date: February 25, 2009

File: 08-RIV-86S PM 15.6
08-478601
Airport Blvd. OC (New Bridge)
Bridge No. 56-0833

Attn: Feiruz Aberra

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
Geotechnical Services MS 5
Office of Geotechnical Design – South 2

Subject: Revised Foundation Recommendations

This Revised Foundation Recommendations Memorandum supersedes the Foundation Recommendations dated January 8th 2008. This memo includes changes made to pile and footing dimensions, which reflect the revised Foundation Design Data Sheet, which this Office received from Feiruz Aberra by e-mail on February 23, 2009.

As requested October 7, 2008, and updated by email on December 2, 2008, the Office of Geotechnical Design – South 2 has prepared this Foundation Recommendations Memorandum for the proposed new bridge project located at the intersection of State Route 86S and Airport Boulevard (Avenue 56) in the City of Coachella, Riverside County. All elevations referenced in this memo are in feet, and are referenced to the 1929 NGVD Datum + 500 feet, as shown on the foundation plan sheet. Apparently 500 feet was added to the Datum elevations by the surveyors to alleviate negative elevations.

The following recommendations are based on a review of available bridge records including:

- Concept Bridge Plans, dated January 2005, as provided in your request.
- Foundation Study for Bridge #56-71, dated March 20, 1969 prepared by O. Mikes.
- Foundation investigation for new bridge November 11, 2008 prepared by this Office.
- Foundation Design Data Sheet dated November 15, 2008 prepared by your Office.
- Bridge Foundation Report for Bridge No. 56-767, by CH2M Hill dated November 1990.

General Geologic Information

The Geology of this project site is composed of alluvial plain and lake deposits consisting mostly of very fine to medium-grained Sand, Silt, and Clay. Up to 20,000 feet of these deposits overlie bedrock in the project vicinity (U.S.G.S. Professional Paper 787. Sharp, 1972). Local groundwater is typically found within 15 feet of the ground surface.

Site Specific Subsurface Information

The subsurface investigation, performed by our Office, drilled 3 boring to a maximum depth of 100 feet below ground surface. These borings confirmed the existing geotechnical information contained in the CH2M Hill report, which also had three boring extending to a maximum depth of 70 feet below ground surface. The subsurface material at the location of the proposed Avenue 56 Over Crossing is composed of interbedded layers of Sand, Silt, silty Sand, Silty Clay and Clay. Soils encountered within 25 feet of the ground surface are composed primarily of soft to stiff clays and loose silty sand. Below a depth of 25 feet, the material appears to become stiff to hard Clay and dense to very dense silty Sand.

Groundwater

Groundwater was shown on the existing boring logs, dated 02/08/1990, at depths ranging from 7 to 17 feet below an approximate ground surface elevation of -120. Our 10/11/2008 subsurface investigation found groundwater at approximately 17 feet below existing ground surface elevation of 382. Fluctuations in the groundwater level may occur due to seasonal variations, changes in rainfall, local irrigation and or other factors. For our analysis we assumed the groundwater surface to be at 10 feet below existing ground surface of approximately 382 feet.

Seismic Data

According to the Preliminary Seismic Design Recommendations for Airport Blvd OC dated 11/10/2008 from our Office, the proposed bridge site is located approximately 3.8 miles west of the San Andreas S/W Fault (SAW, Mw = 7.75 strike-slip), within the peak horizontal bedrock acceleration (PBA) zone of 0.6g. The value of PBA was verified using Sadigh et al. (1997) attenuation relation.

Liquefaction

A liquefiable silty Sand layer was identified in Boring CH – 106 from 17 to 22 feet. This layer may liquefy when subjected to an M = 7.5 earthquake, according to the method proposed by Seed and Idriss (1982). Liquefaction of this layer may cause settlements of up to 3 inches. For more seismic information, please see Attachment A - Preliminary Seismic Design Recommendations for Airport Blvd OC.

Corrosion Analysis

The corrosion test results presented in the 1990 CH2M Hill report indicates soil samples from the site are considered to be Non-corrosive by Caltrans Standards. Corrosion test results from soil samples taken during our 2008 subsurface investigation were also considered to be non-corrosive and are shown below in Table 1.

Table 1. Summary of Corrosion Test results

Boring No.	Sample Depth (ft)	Minimum Resistivity (ohm-cm)*	PH*	Sulfate Content (ppm)	Chloride Content (ppm)
R-08-1	10-15	9505	8.28	N/A	N/A
R-08-1	26-30	2622	8.79	N/A	N/A
R-08-3	40-42	1383	8.59	N/A	N/A

**Note: Caltrans defines a corrosive soil as having a pH less than 5.5 or a Resistivity less than 1000 (ohm-cm).*

Foundation Recommendations

Due to the relatively poor foundational materials at the site, and the potential for up to 3 inches of seismically induced settlements, this Office concurs with your Office's proposed deep foundation design consisting of Class 200 driven concrete piles. Our Office recommends Caltrans Standard Class 200, 14-inch square precast concrete piles for foundation support at the abutments and bent.

Consolidation settlement due to fill placement at the proposed abutments is estimated to be 10 to 13 inches. It is estimated that 80 percent of the primary consolidation settlement should occur within 2 months of completion of the embankment to grade, and 95 percent should occur in 3 months. Primary settlement at the bent is estimated to be less than 1 inch and should take place during construction.

The information for pile foundations shown in Table 2 and Table 3 below has been provided by Structure Design and was used to determine the Foundation Recommendations provided in Table 4 and Table 5 below. Elevations in Tables 2, 4 and 5 are referenced to NGVD 29 +500 feet.

Table 2

Foundation Design Data Sheet (provided by Structure Design)								
Support No.	Design Method	Pile Type Pre- Cast Concrete	Finished Grade Elevation (ft)	Bottom of Footing Elevation (ft)	Pile Cap Size (ft)		Number of Piles Per Support	Permissible Settlement under Service Load (in)
					B	L		
Abut 1	WSD	200	395.68	391.18	8	73.5	22	1"
Bent 2	LRFD	200	381.24	375.24	13.5	13.5	16 @ each column	1"
Abut 3	WSD	200	396.51	392.01	8	73.5	22	1"

Table 3

Foundation Design Loads (provided by Structure Design)											
Support No.	LRFD Service-I Limit State (kips)			LRFD Strength Limit State (Controlling Group, kips)				LFRD Extreme Event Limit State (Controlling Group, kips)			
	Total Load		Permanent Loads	Compression		Tension		Compression		Tension	
	Per Support	Max. Per Pile	Per Support	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile	Per Support	Max. Per Pile
Abut 1	2606	174	2060	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bent 2	2814	176	2159	3939	246	0	0	2743	171	0	0
Abut 3	2606	174	2060	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 4

Foundations Design Recommendations for Abutments									
Support No.	Pile Type	Bottom of footing el. (ft)	LRFD Service-I Limit State Load per Support (kips)		LRFD Service-I Limit State Total Load (kips per Pile) Compression	Nominal Resistance (kips)	Design Tip el. (ft)	Specified Tip el. (ft)	Nominal Driving Resistance Required (kips)
			Total	Permanent					
Abut. 1	Class 200	391.18	2606	2060	174	350	347(a)	347	370
Abut. 3	Class 200	392.01	2606	2060	174	350	347(a)	347	370

Notes:

1) *Design tip elevations are controlled by: (a) Compression (Service Limit).*
2) *The nominal driving resistance required is equal to the nominal resistance needed to support the factored load, plus driving resistance from the proposed embankment fill, which does not contribute to the design resistance.*

Table 5.

Foundations Design Recommendations for Bent										
Support No.	Pile Type	Bottom of footing el. (ft)	Service-I Limit State Load per Support (Kips)	Total Permissible Support Settlement (in)	Required Factored Nominal Resistance (kips)				Design Tip el. (ft)	Specified Tip el. (ft)
					Strength Limit		Extreme Event			
					Comp. φ=0.7	Tension φ=0.7	Comp. φ=1	Tension φ=1		
Bent 2	Class 200	375.24	2814	1	246	0	171	0	331 (a)	331

Notes: Nominal Driving Resistance Required for class 200 driven piles at the bent location is 350 kips.

Table 6

Pile Data Table					
Support No.	Pile Type	Nominal Resistance (kips)		Specified Tip Elevation (ft)	Nominal Driving Resistance (kips)
		Compression	Tension		
Abut 1	Class 200 Concrete	350	0	347	370
Bent 2	Class 200 Concrete	350	0	331	350
Abut 3	Class 200 Concrete	350	0	347	370

Construction Considerations

1. The abutment embankment fill shall be placed and compacted in accordance with Standard Specifications, Section 19-6 "Embankment Construction".

2. Construction of the abutment foundation is not to begin until 95% of the primary consolidation settlement of the underlying clay soils has taken place. It is estimated that 95% of primary consolidation settlement will require a 90-day waiting period to take place. With the Engineers approval, the waiting period may be reduced if the contractor provides settlement-monitoring evidence to the Engineer, that 95% of the primary consolidation settlement has taken place.

3. Fill embankment settlement shall be monitored. Monitoring devices shall consist of settlement platforms placed on top of the abutment fill, or on existing ground prior to any fill placement.

4. A dense sand layer may be encountered between a depth of 25 to 40 feet below ground surface at the bent location, the Contractor may pre-drill to 40 feet below ground surface if specified pile tip elevation is not being achieved.

5. The Contractor may use an embankment surcharge to reduce the time required for primary consolidation settlement to take place. Any embankment surcharge shall be placed in accordance with Standard Specifications, Section 19-6.01 "Embankment Construction", and the Standard Plan A62B "Bridge Embankment Surcharge".

6. The footing concrete at the support locations shall be placed neat against undisturbed soil at the bottom of the footing excavation. If the soils at the bottom of the excavation are disturbed or loosened, they shall be re-compacted to 95% relative density prior to placing any concrete or steel.

7. It is not anticipated that groundwater will be encountered during excavation for the bent

footings, although, due to seasonal fluxuations of groundwater elevation, the Contractor should be prepared to dewater the excavation should groundwater be encountered.

8. The calculated geotechnical capacity of the driven concrete piles is based on a combination of skin friction and end bearing. Driven piles shall not spaced closer then 3 pile diameters center to center.

9. Any pre-cast concrete pile that achieves refusal within 5 feet of the Specified Tip Elevation may be considered satisfactory and cut off with written approval from the Engineer. Refusal shall be defined as a pile achieving two times the required nominal resistance in compression as shown on the Contract Plans. Two times the required nominal resistance in compression shall be 700 kips.

10. Prior to pile installation a wave equation of the Contractor's pile hammer and cushion assembly should be conducted to indicate the suitability of the pile driving assembly for the design pile type and capacity. The analysis would also provide information on the recommended maximum allowable driving resistance that would not over stress or damage piles.

Any questions regarding the above recommendations should be directed to Brian Gutierrez, (916) 227-1222, or Shawn Wei, (916) 227-5252, of the Office of Geotechnical Design – South 2, Branch C.

Prepared by: Date:

2/25/09

Brian Gutierrez, P.E.
Office of Geotechnical Design- South 2
Branch C

Attachment A – Seismic Design Recommendations for Airport Blvd OC. Dated 11/10/2008

cc: AAbghari – GDS2
SWei – GDS2
Geology Project file
Specs and Estimates – John Stayton
RE Pending File

State of California

Business, Transportation and Housing Agency

Memorandum

To: HOWARD NG, Chief
Bridge Design Branch 20
Office of Bridge Design South
Division of Engineering Services

Attention: Feiruz Aberra

Date: November 10, 2008

File: 08-478601
08-RIV-86S-PM 16.73

Airport Blvd OC
(New)
Bridge 56-0833

From: MAHMOUD KHOJASTEH
Office of Geotechnical Design South 2
Geotechnical Services - MS 5
Division of Engineering Services

Subject: **Preliminary Seismic Design Recommendations**

Introduction

This memorandum is in response to your request of October 7, 2008 and presents preliminary seismic design recommendations for the design of the above bridge. The nearest existing bridge is Wasteway No. 2, Bridge No. 56-0759. The information regarding location of the bridge was provided by Brian Gutierrez and was used to locate the bridge on the seismic hazards map.

Seismicity

From the 1996 Caltrans California Seismic Hazard Map, the site is located about 3.8 miles (4.5 km) west of San Andreas/S/W Fault (SAW, Mw = 7.75, strike-slip), within peak horizontal bedrock acceleration (PBA) zone of 0.6g. The value of PBA was verified using Sadigh et al. (1997) attenuation relation. A copy of the local seismic hazard map is attached.

Site Profile

From the log of test borings (LOTB) conducted by CH2M Hill in 1990, the site is classified as soil profile type D as defined in Table B-1 of Caltrans Seismic Design Criteria (SDC).

Design Response Spectrum

Standard SDC acceleration response spectrum for $M_w = 7.75$, PBA = 0.6g and soil profile type D (SDC Figure B-9) is recommended for preliminary design. ARS curve was

modified for near fault directivity effect, as per SDC Version 1.4 Section 6.1.2.1. A copy of the acceleration response spectrum is attached for your reference.

Liquefaction

Based on 1990 subsurface investigations, the site is underlain by layers of loose to dense silty sand, sandy silt with clay layers. The depth of borings varies from about 60 to 70 ft. Ground water surface has seasonal fluctuations and was measured at an Elevation of about 376 ft (about 8 ft below ground surface) in February 1990. Note that the elevations reported in the LOTB were corrected based on the information provided by Brian Gutierrez. The depth of loose to medium dense soils is about 20 ft and has potential for soil liquefaction and lateral spreading under strong ground shaking. Further subsurface investigation may be needed to verify the percentage of fine contents.

Seismic Settlement

The amount of settlement of granular soils due to strong ground shaking is estimated about 3 inches.

Surface Fault Rupture Hazards

The site is not located within Alquist-Priolo Fault Rupture Hazard Zones. The potential for surface rupture hazards is considered negligible.

If you have any question please contact Mahmoud Khojasteh at (916) 227-7211.

M. Khojasteh

MAHMOUD KHOJASTEH
Senior Materials and Research Engineer

Attachments: 2

c: B. Gutierrez –GDS2
S. Wei – GDS2
File

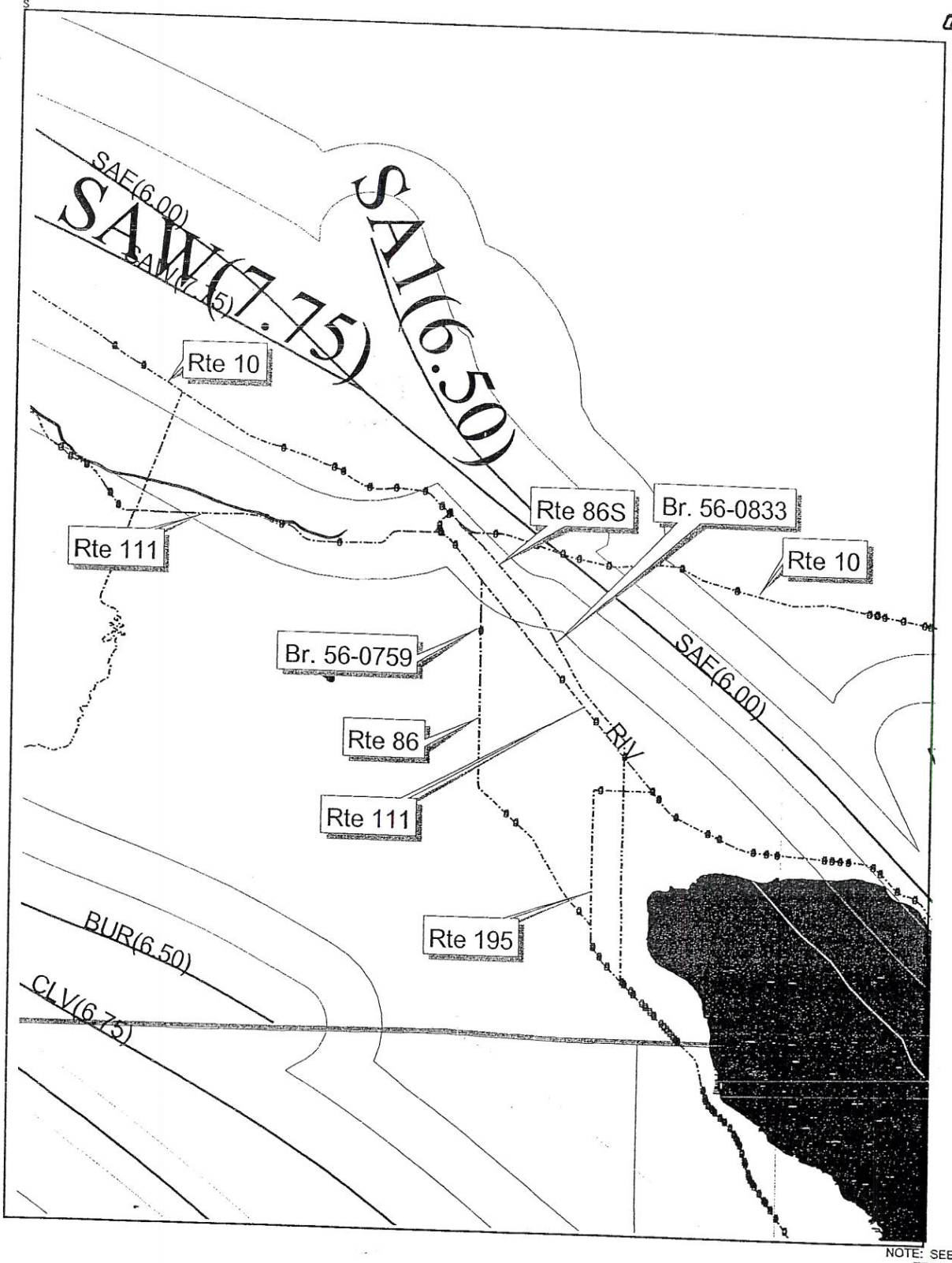
DEPARTMENT OF TRANSPORTATION

STATE OF CALIFORNIA
BUSINESS, TRANSPORTATION AND HOUSING AGENCY

ENGINEERING SERVICE CENTER

CALIFORNIA SEISMIC HAZARD MAP 1996 - DETAIL AREA

BASED ON MAXIMUM CREDIBLE EARTHQUAKES (MCE)



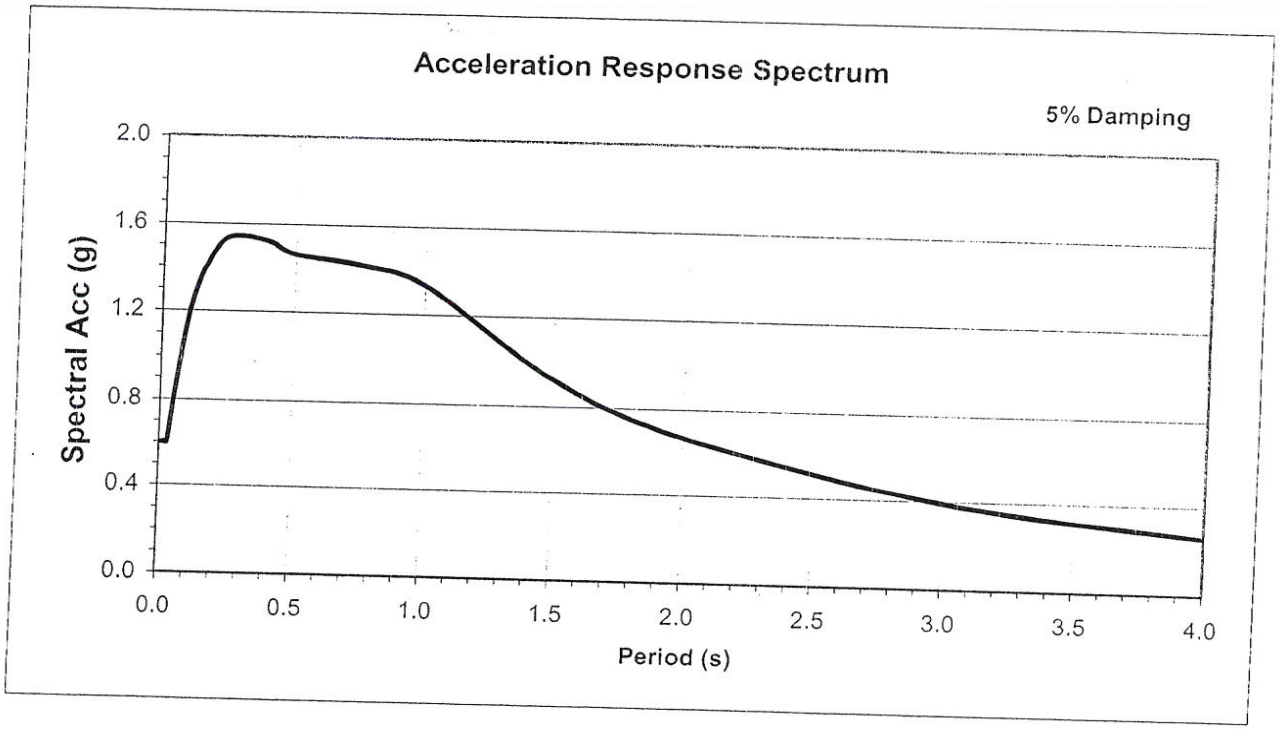
LEGEND:

NOTE: SEE ACCOMPANYING TECHNICAL REPORT FOR NAMES OF FAULTS CORRESPONDING TO FAULT CODES

Airport Blvd OC

Bridge No. 56-0833

Period (s)	ARS (g)
0.010	0.600
0.020	0.600
0.030	0.600
0.050	0.798
0.075	1.002
0.100	1.177
0.120	1.272
0.150	1.373
0.170	1.418
0.200	1.484
0.240	1.535
0.300	1.544
0.400	1.518
0.500	1.461
0.750	1.419
1.000	1.331
1.500	0.923
2.000	0.668
3.000	0.393
4.000	0.258



Fault	**San Andreas/S/W**
Style	**Strike-Slip**
Magnitude	**7.75**
R (km)	**4.5**
PBA	**0.6g**
Soil Type	**D**
Note:	ARS curve was modified for Near Fault Directivity Effect (SDC Ver. 1.4 Section 6.1.2.1)