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To: MR. TOM OSTROM, CHIEF
OFFICE OF EARTHQUAKE ENGINEERING

Date: September 12, 2013

File: 07-LA-210, PM R5.96
0000001016 6SSCN
E210-W118 Connector OC
Bridge No. 53-2105G

From: DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
Materials Engineering and Testing Services and Geotechnical Services
Office of Geotechnical Support – Geotechnical Instrumentation

Subject: Evaluation of Fault Rupture Potential, E210-W118 Connector OC, LA County, CA

SUMMARY

E210-W118 Connector OC, Bridge No. 53-2105G, is approximately 100 feet south of the Caltrans-active Tujunga fault, part of the Sierra Madre Thrust Fault Zone, San Fernando section. The total vector offset expected is 2.3 feet on a plane dipping north 35 degrees and trending east-west. This offset corresponds to 1.3 feet of vertical offset (north side up) and 1.9 feet of horizontal movement to the south. No further geologic work is recommended.

INTRODUCTION

This evaluation was prepared as part of the statewide evaluation of fault rupture potential at Caltrans bridges. Caltrans' policies regarding fault rupture at bridges are described in Memo to Designers (MTD) 20-10. Caltrans requires a fault rupture evaluation if a bridge is located within an Alquist-Priolo (AP) Earthquake Fault Zone (EFZ) or within 1,000 feet of an un-zoned fault 15,000 years or younger in age. The E210-W118Connector OC (OC) (aka Foothills Blvd UC) is situated within the EFZ established for the Tujunga fault in 1979 in the San Fernando 7-1/2' Quadrangle; therefore a fault evaluation was required (Figure 1).

The OC was built in 1975 and is a continuous three spall RC box girder with RC open end diaphragm abutments and single column bents, all supported on spread footings. The bridge is 233 ft long and 42 feet wide. The Route 118/210 Interchange was in the final stages of design when the Feb 9, 1971, **M**6.6 San Fernando Earthquake occurred. During this earthquake, "geologic upheaval" occurred in the interchange vicinity in the form of faulting, horizontal compression of alluvium and numerous landslides with corresponding soil cracking and displacement (Prysock and Egan, 1981).

FAULT RUPTURE EVALUATION/POTENTIAL FOR FAULT RUPTURE

This evaluation consisted of a review of faulting that occurred during the 1971 San Fernando Earthquake. This bridge is located near the 1971 San Fernando Earthquake rupture of the Tujunga fault. The San Fernando Earthquake has been associated with a **M**6.6 (SCEC Earthquake Catalog, 2010). The **M**Max for this fault is currently estimated at **M**6.6 (USGS, 2008). Therefore we can assume that the offset measured in 1971 is representative of offset expected during the **M**Max event. According to the legend for the 1:18,000 scale map completed for the area (prior to OC construction), the fault trace is, "Positively identified and accurately located" (Barrows, 1975).

Measurements taken 300-400 ft west of the bridge location after rupture of the Tujunga fault during the 1971 earthquake (considered a **M**Max size event) were 2.8 feet (0.85 m) vertical and less than 1 foot (.3 m) left lateral (Barrows, 1974). This vertical displacement corresponds to 4 feet of horizontal movement south and 2.8 feet uplift, with the vector sum of 4.9 feet of displacement occurring on a thrust plane dipping 35 degrees north. Note that these values are larger than those obtained using empirical formulas such as those provided in Wells and Coppersmith (1994) or Moss and Ross (2011), but are preferable because they are based on local measurements (Hecker and Abrahamson, 2013).

Since the bridge is located 110 ft south of the accurately mapped fault trace, I performed a fault displacement hazard analysis based on mapping quality (Petersen et al, 2011). These values are reduced to 2.3 ft of net offset which corresponds to 1.3 ft vertical offset and 1.9 ft horizontal offset at the bridge. These values on an east-west trending fault should be used for design. Offset tapers off to half the above values 100 ft from the north end of the bridge.

RECOMMENDATIONS FOR ADDITIONAL INVESTIGATION

No additional work is recommended. If you have any questions, please contact Martha Merriam at (916) 227-7135/316/3925.

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Figure 1. Location map, showing OC, AP EF Zone boundaries (black), rupture traces from the 1971 San Fernando Earthquake (red), and where 1971 fault offset measurements were taken (red circle) (see Figure 4). Note that the fault crosses beneath nearby Bridge 53-2102G (see memo also dated 9/13/2013).

Tujunga Segment of the San Fernando Fault Zone

Surface expression. In the region between Little Tujunga Canyon and Pacoima Wash, the most spectacular and continuous surface effects of the earthquake lie along the Tujunga segment of the San Fernando fault zone. Surface breaks extend from the vicinity of the San Fernando Industrial Park eastward along Foothill Boulevard where, just east of Vaughn Street, the northeast sidewalk and curbing were lifted abruptly 85 cm (2.8 feet) relative to the pavement (90) (photo 1). The breaks continue across the

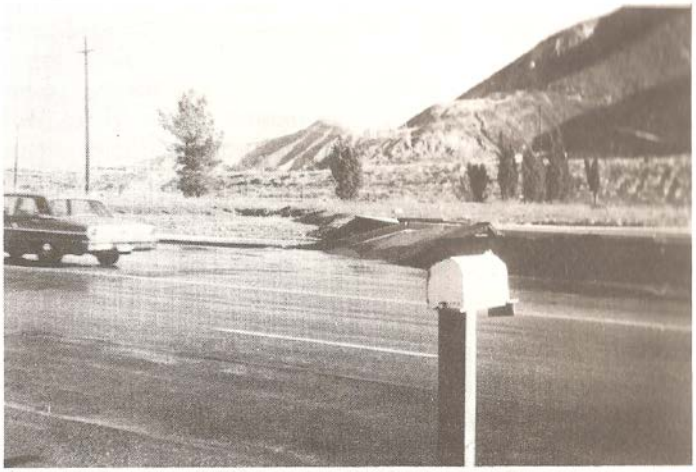

Photo 1. Frontal fault scarp of the Tujunga fault segment on Foothill Boulevard just west of the Foothill Nursing Home, which has since been razed (locality 90, plate 3). Note water in street from ruptured water mains. ***Photo taken by F. Harold Weber, Jr., at 9:00 a.m., February 9, 1971.***

Figure 2. Location where 2.8 feet of vertical offset was measured after 1971 San Fernando Earthquake (looking northeast). See Figure 1 for location with respect to Connector. (Barrows, 1975).

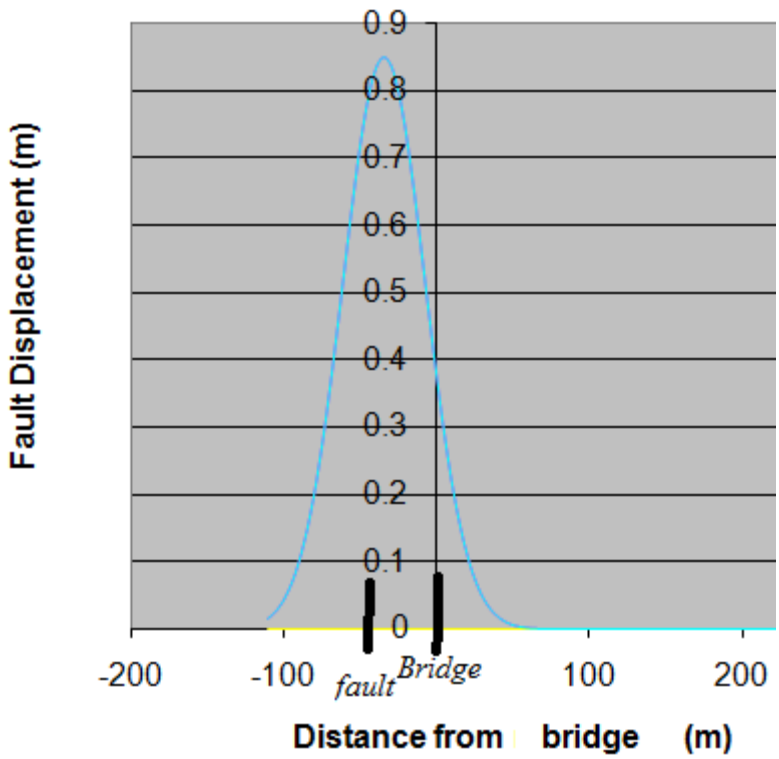

Figure 3. Vertical fault displacement away from main trace. Displacement is estimated at half the value at the north end of the bridge at a distance of about 100 feet south along the bridge alignment..