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August 9, 2013

In Reply Refer To:
HDA-CA

Mr. Steve Heminger
Chair, Toll Bridge Program Oversight Committee
Department of Transportation
Office of the Director
1120 N Street
P.O. Box 942873
Sacramento, CA 94273

Subject: FHWA's Response to Review Requests of the San Francisco-Oakland Bay Bridge

Dear Mr. Heminger:

This letter is in response to two reviews that the Toll Bridge Program Oversight Committee (TBPOC) asked the Federal Highway Administration (FHWA) to perform of the San Francisco-Oakland Bay Bridge East Span (SFOBB) Seismic Replacement Project. One review was for the disposition of the Galvanized ASTM 354 Grade BD bolts/rods, and the other for the Pier E2 interim installation of bearing shims to allow opening the bridge while the shear key retrofit progressed.

We have concluded both reviews and agree with the approaches. We concur with the disposition of the bolts/rods and the recommended course of action described in the TBPOC's final report dated July 8, 2013, as shown in Table ES-2 and subsequent language on pages ES-16 and 17. FHWA also agrees with the strategy for an interim shim proposal to temporarily restore the shear capacity lost, allowing the bridge to be open to traffic prior to and during the retrofit of the S1 and S2 shear keys. In addition, FHWA has reviewed and agreed that the post-tensioned retrofit of the Pier E2 S1 and S2 shear keys will adequately replace the function of the failed anchor rods. The following paragraphs describe our review observations:

The first request, made on May 8, 2013, asked for "FHWA to conduct an independent review of our (TBPOC) findings and recommendations concerning the galvanized high strength bolts…". These high strength bolts or rods consist of Galvanized ASTM A354 Grade BD material and are located on the Self-Anchored Suspension (SAS) span totaling 2,306 in number and listed in 17 different locations. The TBPOC's July 8, 2013 final report classified the bolts into the following categories:

1. Rods whose clamping capacity is to be replaced before opening the bridge to traffic;
2. Rods that are to be replaced after opening the bridge, as a precautionary measure to address concerns of longer-term stress corrosion;

3. Rods that are subject to mitigating actions, such as reduced tension, dehumidification or other corrosion protection systems; and
4. Rods that are acceptable for use, will meet performance expectations, and will undergo a regular inspection schedule.

The FHWA's independent review to determine the disposition of the bolts/rods consisted of:

- Site visits to see first-hand where the different categories of bolt/rods were located, with particular focus on Pier E2 where over one-half of the bolts/rods are located (locations 1-6), the tower base (locations 12 -13), the suspension cable anchorages (location 7), the east saddle anchor and tie rods (locations 14 and 15), and the cable band strong back anchor rods (location 16).
- Review of contract documentation, including but not limited to special provisions, quality assurance audit documentation of fabricators and sub-contractors, material acceptance testing (including chemistry, average hardness, and tensile strengths), heat treating, cleaning, and galvanization processes, contract drawings, grouting procedures, and bolt/rod installation and tensioning.
- Review of testing documentation post failure of the Pier E2 S1 and S2 shear key masonry plate anchor rods. This included interviews of project staff and experts as well as presentations of tests performed with results of those tests, including comparisons between the rods supplied in 2008 and rods supplied in 2010. Tests included Rockwell hardness values across ends of the bolts/rods, Charpy V-notch toughness tests, tensile capacity tests, and metallurgical evaluations of failure planes.
- Review of the retrofit of the Pier E2, S1 and S2 shear key masonry plate anchor rod retrofit plan sheets and special provisions. The team also visited the site to view the preparatory work of the pier cap to accommodate the retrofit, interviewed the designer of record and project staff to discuss our observations, and participated in technical update discussions. We discussed the placement of the concrete and mix type as well as PL2 corrosion protection practices. We also discussed post-tensioning stages and strength requirements prior to post-tensioning, including projected losses at release with the project engineer and designer of record. In conclusion, the team was satisfied with the review material and the resulting discussions regarding the retrofit and concurs with this approach as a solution to replacement of the failed anchor rods.

Throughout our review of the Galvanized A354 Grade BD bolts/rods, we asked many questions, all of which were answered. Many of our discussions resulted in tasks to perform during the next few weeks as the bridge nears completion. For example, project staff and consulting engineers continue to perform testing, such as the Townsend and baseline ultrasonic testing, which can be used to develop and implement long-term monitoring, maintenance, and replacement strategies. One of our observations resulted in a recommendation that project staff begin dehumidifying applicable bolt/rod locations as soon as practical.

Your second request, dated July 12, 2013, asks FHWA to "conduct an independent review of the Seismic Safety Peer Review Panel (SSPRP) proposal to shim the bearings at Pier E2" of the self-anchoring suspension span.

FHWA's review included an assessment of the proposal documentation, a site visit to see first-hand where bearing translation would be limited to engage seismic forces through use of translation "limiters" (also referred to as "shims"), and technical discussions with project engineers and the designer of record.

The FHWA review team was impressed with the level of expertise used to fashion this interim means of limiting the movement of the bearings so they engage and safely transfer seismic forces while the installation of the Pier E2 S1 and S2 shear key retrofit continues. Once the Pier E2 bearing movement limiters are properly installed, this interim solution will restore the capacity lost prior to and during the retrofit of the S1 and S2 shear keys and provide a comparable level of seismic performance. As such, we see no reason to delay opening the bridge to traffic prior to the shear key retrofit being completed.

We want to thank your staff, consultants, and construction workers for their professionalism during our review.

Should you have questions, please do not hesitate to contact me at (916) 498-5001 or by email at Vincent.Mammano@dot.gov.

Sincerely,

Vincent P. Mammano
Division Administrator