

TOLL BRIDGE SEISMIC SAFETY PEER REVIEW PANEL

April 12, 2013

Dr. John Fisher
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To: Toll Bridge Program Oversight Committee (TBPOC)

Ref: SAS T1 Foundation Review and the new Benicia-Martinez Bridge

The Toll Bridge Program Oversight Committee (TBPOC) met on December 28, 2011 and on February 6, 2013 with the Toll Bridge Seismic Safety Peer Review Panel (TBSSPRP) to discuss the integrity and safety of Toll Bridges in the Bay Area following the discovery of data manipulation by one Caltrans employee of the Foundation Testing Branch. The TBSSPRP was asked to review all pertinent documents and information concerning the involvement of this particular employee on any toll bridge project and the potential impact on the safety of these important bridges. Due to the staged availability of the supporting technical investigations and documentation, the review by the TBSSPRP was conducted in three phases and a first letter report was submitted to the TBPOC in March 2012. With the availability of new data, the TBSSPRP conducted follow-up reviews in February, March, and April of 2013 and the combined findings are documented in this letter report.

Phase 1 Review:

It was agreed that as a first step the new San Francisco – Oakland Bay Bridge East Bay Spans should be reviewed. The only foundation of the new East Bay Spans this employee in question was involved with is the foundation of the tower of the Self Anchored Suspension Bridge (SAS), referred to as T1.

To assist in this review, a draft report dated February 2012 was prepared for the TBPOC and the TBSSPRP by Earth Mechanics Inc. (EMI) under the direction of and with support from the Toll Bridge Program staff, to investigate the Design, Construction, and Nondestructive Testing of the T1 foundation. This draft report entitled “*Review of the San Francisco – Oakland Bay Bridge Self-Anchored Suspension Span T-1 Foundation Design, Construction, and Nondestructive Testing*”, (February 2012, Draft), was reviewed and commented on by the TBSSPRP.

A copy of the revised final report entitled “*Background and Supplemental Information Relating to the San Francisco-Oakland Bay Bridge Self Anchored Suspension Bridge T1 Foundation Design, Construction, and Nondestructive Testing, Prepared for the Toll Bridge Seismic Safety Peer Review Panel and the Toll Bridge Program Oversight Committee, March 2012*”, was provided to us on March 20, 2012. The revised report reflects our comments and the discussions with the Toll Bridge Program Technical Management. This final report, dated March 2012, is referred to as the “*T1 Foundation Report*” in the remaining pages of this letter.

Phase 2 Review:

Additional documentation on Gamma-Gamma testing was received by the TBSSPRP in February 2013 and subsequently reviewed as it pertains to the seismic safety of the Toll Bridge Program. The TBSSPRP was provided with the following three new documents:

- 1) **Final Report of the Gamma-Gamma Logging Data Integrity (GamDat) Team January 17, 2013**
- 2) **GamDat Cases Structural Evaluation Report, January 31, 2013**
- 3) **Gamma-Gamma Logging Peer Review California Department of Transportation by Federal Highway Administration, January 31, 2013**

Jointly these three reports that are the subject of the phase 2 review will be referred to in the following as the “**GamDat Evaluation**”.

Phase 3 Review:

In late March 2013 the TBSSPRP received the California State Auditor's Report "California State Auditor March 2013, California Department of Transportation, Caltrans Employees Engaged in Inexcusable Neglect of Duty, Received Overtime Payment for Overtime, Falsified Test Data, and Misappropriated State Property, Report I2009-0640", a document that deals largely with personnel actions and is referred to in this report as the **State Auditor Report**. The **State Auditor Report** agrees with and supports the findings in the **GamDat Evaluation** that Caltrans addressed all identified data falsification issues and their possible structural consequences.

This revised letter report from the TBSSPRP to the TBPOC responds to the specific questions asked by the TBPOC as they pertain to the T1 foundation of the SAS Bridge and the new Benicia-Martinez Bridge where three piers were found to have questionable Gamma-Gamma data in one of their piles, respectively. No other Toll Bridge issues related to the potential data falsification were found. The TBSSPRP's responses to the questions posed by TBPOC are given below.

Question 1: Please respond to reported questions on the Self-Anchored Suspension Span (SAS) pile design, structural capacity and seismic safety. Specifically respond to redundancy in design, rebar congestion, testing requirements (e.g. gamma test pipe clearances and spacing), and use of gamma-gamma logging versus cross-hole sonic logging.

Response: As summarized in the **T1 Foundation Report**, the T1 foundation consists of thirteen 2.5m diameter cast-in-steel shell and rock socketed concrete piles. The foundation technician in question participated in the Gamma-Gamma Log (GGL) nondestructive testing on 8 of these 13 piles. For all of these 8 pile tests, other Caltrans foundation testing technicians or supervising engineers were present. Since discovery of the falsification of data at other bridges, the test records for the T1 piles were investigated by Caltrans Engineers for inconsistencies in data and time stamping and no inconsistencies were found as shown in the January 17, 2013 Final report of the Gamma-Gamma Logging Data Integrity Review (GamDat) Team. FHWA ran the data through an algorithm that is designed to detect duplicate data strings and spliced data strings and again no inconsistencies were discovered for the SAS T-1 foundation. The performed GGL testing showed

good results and was strictly not even required for these steel shell and rock socketed piles for the SAS. In addition, Cross-hole Sonic Log (CSL) testing conducted independently by the T-1 foundation contractor showed the expected good construction quality. The TBSSPRP believes that the cross-hole sonic logging is more reliable than the gamma-gamma logging for testing piles similar to those installed in T1.

From these investigations we conclude that it is highly unlikely that any data falsification occurred in the nondestructive GGL testing of the T1 foundation piles. Furthermore, after review of the design of the T1 foundation, we find that the foundation design contains a significant amount of redundancy and has a large margin of safety against unforeseen events.

Reinforcement congestion that can cause rock or air pockets in the piles due to concrete flow constriction were addressed by the concrete mix (self consolidating, high slump and small aggregate size). The pile construction test by Caltrans with full scale reinforcement detailing and prototype aggregate sizes and mix designs confirmed the desired flow characteristics of the concrete through the rebar cage and the quality of the resulting concrete was confirmed using GGL and CSL testing as well as visual inspection following the formwork removal.

Design review of the most critical seismic assessment of the piles in tension and compression showed that even conservative estimates of individual pile capacities in tension and compression significantly exceed the highest demand estimates.

Thus, we are confident that the design and construction of the T1 foundation piles fully meet the performance requirements and will provide the required seismic safety.

Question 2: Please review the design of foundations in the Toll Bridge program, including on the new Benicia-Martinez Bridge, and identify, if any concerns with the testing of those foundations.

Response: The only Toll Bridge foundation where Gamma-Gamma data anomalies were detected was the new Benicia-Martinez Bridge. These anomalies were reported in the January 17, 2013 Final report on the Gamma-Gamma Logging Data Integrity Team. These anomalies were rationally

assessed in the January 31, 2013 GamDat Cases Structural Evaluation Report.

Based on the provided **Gam Dat Evaluation** documents the TBSSPRP is satisfied that the testing performed on the Benicia-Martinez foundation piles was consistent with the state-of-practice. Again, it should be noted that Gamma-Gamma testing is just one of numerous quality control mechanisms during the construction of pile foundations. Furthermore with the steel jacketed and rock socketed piles at Benicia-Martinez, the applicability and importance of Gamma-Gamma testing is questionable in the first place. The TBSSPRP believes that the cross-hole sonic logging is more reliable than the gamma-gamma logging for testing piles similar to those installed at Benicia-Martinez.

***Question 3:** Please review all materials provided by Caltrans related to Wiles testing allegations, including: Caltrans QA/QC test results; Contractor QC test results; audits by various agencies, including but not limited to the Department of Transportation Office of Inspector General, Federal Highway Administration, and the Bureau of State Audits; and any additional testing information, research or study data available that provides more in-depth analysis and/or clarity to the testing allegations.*

Response: The TBSSPRP has reviewed all available information as provided in the above referenced **T1 Foundation Report** for the SAS, the **GamDat Evaluation** for Benicia-Martinez, and the **State Auditor Report**. We were not provided to date with any investigation reports by the Department of Transportation Office of Inspector General.

***Question 4:** Is there any evidence that the testing was improperly conducted?*

Response: There is no evidence that GGL testing at the T1 foundation was improperly conducted. GGL testing at the T1 foundation was observed by multiple qualified technicians and engineers. The GGL data are consistent in regards to locations of known “artificial anomalies” and known defects. Defects of the kind encountered are common in pile testing and were dealt with in accordance with established Caltrans mitigation measures where necessary.

The only evidence of inconsistent GGL testing was on three piers of the Benicia-Martinez Bridge where one of 8 or 9 piles at each of these piers was found to have potential pile anomaly as found and reported in the Final Report of the Data Integrity Team. These were identified in pile 5 of 9 at Pier 6, pile 6 of 8 at Pier 12 and pile 8 of 8 at Pier 14. Both GGL testing and cross-hole sonic testing (CSL) were performed on all of these marine pier piles in question. During construction various anomalies were detected in these three piles at various depths. They were reviewed, analyzed and either accepted without repair or repaired per contract. The structural evaluation of these three piles is provided in the GamDat Cases Structural Evaluation Report of January 31, 2013. The structural evaluation found only a small decrease in bending capacities for all three piles as there were no interior core anomalies found by CSL testing. The moment capacity of the 1⁵/₈in. steel casing was assumed to be non-composite with the reinforced concrete core. The two sections were assumed to contribute separately to the total moment. This is very conservative as composite action will substantially increase the moment capacity at the footing and along the pile below the footing, in addition to the higher strength steel provided for the steel pipe which was identified in the Structural Evaluation Report.

While the **GamDat Evaluation** clearly identified three cases of Gamma-Gamma testing inconsistencies, the subsequent structural evaluations based on conservative reduced capacity estimates show that, even with the worst case assumptions of unreliable test results, the seismic design intent for the bridge has been met.

Question 5: *Based upon your review, is there any remedial testing, research, or other investigation or physical reconstruction needed?*

Response: No remedial testing, research, or other investigation or physical reconstruction is necessary at the T1 foundation to ensure full compliance with the design intent. Neither is remedial testing, research or other investigation necessary for the three piers of the Benicia-Martinez Bridge as these piers are in full compliance with their design intent and have been assessed in a conservative manner.

Question 6: Are the bridges safe?

Response: As stated above, the T1 foundation was designed, constructed, and NDE tested in a way that meets or exceeds the state-of-practice; it will provide the needed support to the bridge and result in a safe and reliable seismic performance. The Benicia-Martinez Bridge pier foundation piles were also designed, constructed, tested and repaired in a way that even hypothetically reduced capacities fulfill the design intent; they meet or exceed the structural capacity required for a safe and reliable performance of the bridge.

Respectfully Submitted

A handwritten signature in black ink, appearing to read "Frieder Seible". The signature is written in a cursive style with a large initial 'F' and 'S'.

on behalf of the Toll Bridge Seismic Safety Peer Review Panel (TBSSPRP)

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TBSSPRP