

FY 07/08 Research Initial Scope of Work

I. Project Title: S043

Utilization of Strong Motion Data for Toll Bridge Damage Assessment

II. Background:

Caltrans, with the assistance of CGS, has been instrumenting bridge structures throughout California to record movement during an earthquake. This data will be used to advance our understanding of how bridge structures react to seismic input and to validate our dynamic modeling techniques. This data can also be processed in near-real time to be used for post event damage assessments. There are currently 68 bridge structures throughout the state instrumented with strong motions sensors. Data from some of those bridges could be processed in near-real time for use in post-event damage assessments. Caltrans should develop a plan to utilize strong motion data in real time. The strong motion instrumentation can be combined with other sensors and instruments to turn important bridges into smart infrastructures. Caltrans can then monitor and manage them remotely and on-line as a resource to be used for post-earthquake reconnaissance and decision-making.

III. Project Problem Statement:

This project will use strong motion data from sensors placed on toll bridges for immediate damage assessment following a large earthquake. After identifying the vulnerable components, the project will develop demand-to-capacity charts or other tools for key components of the structures. These charts will be used to compare the recorded relative deflections to the system capacity after a seismic event. Also, this project will provide a means to coordinate with the California Geological Survey (CGS) to prioritize processing and distribution of strong motion data following a major earthquake. In addition, an avenue will be created to provide the toll bridge maintenance inspection group with this information after an earthquake.

IV. Objective:

Provide estimates of the condition of the toll bridges after seismic events utilizing strong motion data.

V. Description of Work and Expected Deliverables:

- Review existing reports on toll bridge seismic analysis to determine vulnerable regions of various structures.

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- Review existing dynamic model runs and compare output with the strong motion sensor layout to determine the sensors that will need to be processed for this study.
- Coordinate with Caltrans and CSMIP as to how to process and report the recorded data.
- Create a computer program that automatically downloads seismic data after a seismic event and use the data to populate charts that compare the recorded data (relative deflection) to the yield deflection and ultimate deflection determinations.
- Demonstrate the completed damage assessment system using example data and existing data.
- Prepare final report and user manual for developed software.

VI. Estimate of Duration:

36 months

VII. Related Research:

This project will utilize the work accomplished over the last fifteen years in which strong motion sensors have been placed on toll bridges. Hundreds of seismic sensors have been placed on these structures during the retrofit work or during the new construction.

VIII. Deployment Potential:

This system would be applied to remaining bridges in the Toll Program as well as other critical bridges in the state.

IX. Date: July 18, 2007