DRISI

Caltrans Division of Research, Innovation and System Information

Research Notes

Bridge Rapid Assessment Center for Extreme Events

Real-time estimates of toll bridge damage during major earthquakes

Geotechnical/ Structures

AUGUST 2020

Project Title:
Strong-Motion Instrumentation of Bridges and Geotech Arrays

Task Number: 3703

Start Date: August 1, 2020

Completion Date: January 31, 2023

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WHAT IS THE NEED?

The California Department of Transportation (Caltrans) operates 7 toll bridges in the San Francisco Bay Area. Each of these bridges includes seismic sensors that are mounted at key locations on the bridge. During an earthquake, these sensors measure horizontal and vertical acceleration and transmit this data to the California Geologic Survey (CGS) for processing. CGS creates data reports for major events and Caltrans later uses this data to validate the structural model used to design or seismically retrofit the bridge.

There are several areas for improvement with our current practice. First, the transfer and processing of seismic data is too slow to utilize in the immediate assessment of a bridge following an earthquake. Second, sensor and telemetry technology is rapidly advancing. While the sensors used on Caltrans toll bridges are very rugged and reliable, they are very expensive to install and maintain. Finally, validation of a bridge's structural model using CGS recorded sensor data requires a substantial effort usually involving contracting with engineering consultants.

WHAT ARE WE DOING?

Through the PEER-Bridge Program, Caltrans is contracting with UC Berkeley to develop the Bridge Rapid Assessment Center for Extreme Events (BRACE2), a center that will monitor Bay Area toll bridges 24/7. During this research, communication and processing infrastructure will be established that enables monitoring in real-time. State-of-the-art structural models will be developed for each bridge and will be used to develop simpler fragility algorithms that can provide damage estimates in real-time. These estimates will be provided to Caltrans via a limited access web site to support decision-making regarding bridge closure and inspection. Efficient updating of bridge models using recorded sensor data will also be developed.

Caltrans

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WHAT IS OUR GOAL?

The primary goal of BRACE2 is to demonstrate the viability of the Rapid Assessment Center concept through trial implementation on Bay Area toll bridges.

WHAT IS THE BENEFIT?

Toll bridges represent a major public investment and the closure of one or more of these bridges has a substantial detrimental impact on regional travel times. BRACE2 will use state-of-the-art communication, computation, and sensor technology to provide real-time assessment of the structural condition of toll bridges immediately following an earthquake. These assessments can help avoid unnecessary closures when damage is light and identify the location and severity when damage is heavy.

Sensor data will also be used to validate and update structural models and possibly result in improvements in bridge design. If the trial implementation proves successful, the techniques and technologies can be applied to other important bridges.

WHAT IS THE PROGRESS TO DATE?

BRACE2 was executed through the PEER-Bridge Program. Project started on August 01, 2020 and will continue for 30 months.

IMAGE

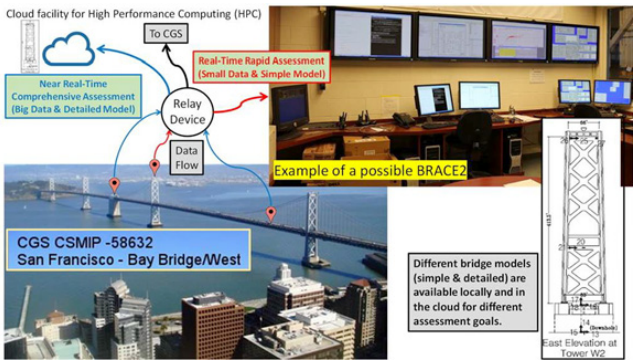

Image 1: Illustration of monitoring center operational framework

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