



Research Project Summary

Development of Bridge Rapid Assessment Center for Extreme Events (*BRACE*²)

PEER-Bridge 2024

Principal Investigator

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Research Team

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Start-End Dates:

Phase I: 08/01/2020 – 01/31/2024

Phase II: 05/01/2024 – 09/30/2026

Abstract

Caltrans is collaborating with UC Berkeley through the PEER-Bridge Program to continue development of the Bridge Rapid Assessment Center for Extreme Events (*BRACE*²). The project establishes infrastructure for real-time structural health monitoring and is being deployed to continuously monitor 22 key bridges in the California Highway network. The project will leverage advanced structural models, together with data-driven algorithms for damage assessment to automatically generate reports to support bridge closure and inspection decisions following seismic events. These reports will be streamed in real-time to stakeholders through a secure web application. Special attention will be given to four representative bridges in the network, which will serve as testbeds for the development and refinement of various health monitoring procedures.

Deliverables

The primary project deliverables include the web application implementing the health monitoring platform, as well as several software libraries which are being open sourced. The results of this project will be presented in a Caltrans report, PEER report, at least one journal paper, and presentations at the PEER annual meeting and other technical conferences. In addition, there will be a fully developed and operational monitoring center with an established hardware, software, data communication infrastructure, and a real-time sensor data transfer system from the bridge sites to the monitor center at PEER headquarters, enabling the reception and processing of sensor data for bridge condition assessment.



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Research Impact

Highway bridges are a significant public investment, and their closure can have a profound impact on regional travel times. However, assessing the condition of these critical infrastructure components is a complex and challenging task. *BRACE²* addresses this challenge by establishing a cutting-edge bridge monitoring platform, leveraging state-of-the-art communication, computation, and sensor technologies to provide real-time assessments of the structural condition of the trial bridges following earthquake events. This enables avoiding unnecessary closures when damage is minimal and pinpointing the location and severity of damage when it is extensive. Findings from the project will be incorporated into the open source [mdof](#), [sees](#), and [sdof](#) Python packages, as well as the newly redesigned and optimized [OpenSeesRT](#) framework for nonlinear structural analysis. Other commercial computational platforms like [CSiBridge](#) and [DIANA FEA](#) are also explored in this research project.

Project Image



BRACE² Platform.