

Geotechnical /Structures

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Project Title:

Caltrans Risk-Based Seismic Design
(CT-RBSD) for Bridges

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Caltrans Risk-Based Seismic Design (CT-RBSD) for Bridges

Bridge research to improve the California Department of Transportation's (Caltrans) performance-based bridge design procedure to enhance transportation network reliability and reduce overall costs.

WHAT IS THE NEED?

A long-term goal of Caltrans is the adoption of performance based seismic bridge design concepts. The primary benefit of this approach is the creation of a uniform level of seismic performance throughout California. This uniformity will enhance transportation network reliability and reduce costs through more efficient seismic design.

In support of this effort, Caltrans bridge engineers have developed a prototype performance-based design procedure called Caltrans Risk-Based Seismic Design (CT-RBSD).

WHAT ARE WE DOING?

Through the PEER-Bridge Program, Caltrans is contracting with UC Irvine to investigate ways to assess the newly developed CT-RBSD method. The objective of Caltrans is to incorporate Risk-Based Seismic Design (CT-RBSD) to enable the customized seismic performance and risk assessment of bridges. This approach is intended to improve the reliability and resilience of the transportation network while minimizing overall costs. In the initial stages of this initiative, previous project under Contract #65A0774 TO 003, a thorough methodology for integrating CT-RBSD, along with implementation tools, was established. The current endeavor seeks to further enhance RBSD implementation by leveraging complete bridge models and refining column fragility models through analytical methods.

WHAT IS OUR GOAL?

The goal is to quantify the variability in nonlinear structural



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response and assess whether this variability is affected by bridge geometry and regional factors. A comparative analysis will be conducted between Risk-Based Seismic Design (RBSD) and designs based on the Risk-Targeted Ground Motion (RTGM) intensity measure. Additionally, the evaluation of column damage fragility curves developed in the previous project will be addressed.

WHAT IS THE BENEFIT?

Bridges play a critical role in our transportation system in enhancing California mobility and economy. For most bridges (approximately 80%) seismic loading is their dominant load case. Transitioning to a performance-based design framework will result in equal risk of bridge damage and closure statewide. The benefit of this uniform performance will be increased network reliability and cost efficiency. The quantification of performance has the added benefit of providing Caltrans and stakeholders critical information for decision making and future planning of California's transportation network.

WHAT IS THE PROGRESS TO DATE?

This project is being initiated as a task order through the PEER-Bridge Program. This project started on March 1, 2024 and will continue for 12 months.

Bridge columns response and risk assessment designed per SDC and Risk Targeted Ground Motions have been completed.

Archetype bridge of various bridge models were developed. The goal of the bridge model analysis is to compare the total risk of bridge under 3D analysis vs. simplified isolated single column analysis.

Simulation of a pool of preselected of archetype bridge is ongoing.

IMAGES

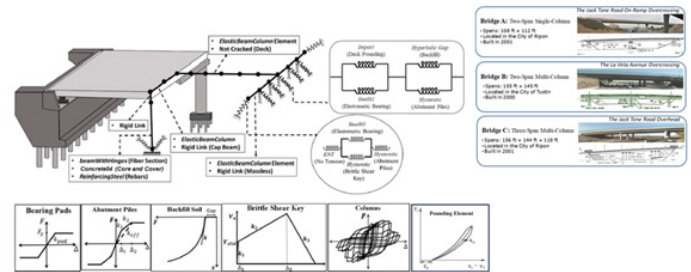


Image 1: Sample archetype bridge model (courtesy of UCI).