Research Project Highlight

Aftershock Seismic Vulnerability and Time-Dependent Risk Assessment of Bridges

Project # 1137-NCTRHB

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Start-End Dates:
12/15/17 – 12/14/18

Abstract
Decisions about the structural integrity and functionality of earthquake-damaged bridges is a critical step in post-event response and recovery. Currently, the California Department of Transportation uses a set of bridge system-level damage states as the basis for classifying the post-earthquake operability of bridges. The damage states are based on the HAZUS classifications (minor, moderate, extensive, and complete), and each one is assigned a "likely post-event traffic state." For example, a bridge that has been classified as having "moderate" damage is deemed "open to limited public traffic with speed, weight, and lane restrictions." Despite HAZUS being the primary tool used to inform post-earthquake decisions regarding the partial or complete closure of bridges, the extent to which knowledge of residual structural capacity and time-dependent aftershock hazard and risk inform these damage-traffic-state relationships is unclear. Moreover, while there has been significant research on the seismic vulnerability and risk to bridges posed by mainshocks, recognized research to quantify the vulnerability and time-dependent risk in the aftershock environment is still in its infancy. The proposed research will implement the performance-based earthquake engineering framework to assess the aftershock vulnerability and time-dependent risk of earthquake-damaged bridges, with the goal of informing decisions regarding the appropriateness and timing of post-event closure (partial and complete).

Deliverables
A PEER report and several conference and journal papers describing the ground-motion hazard characterization, structural modeling, and response history analyses needed for vulnerability and risk-based assessment of mainshock-aftershock performance.

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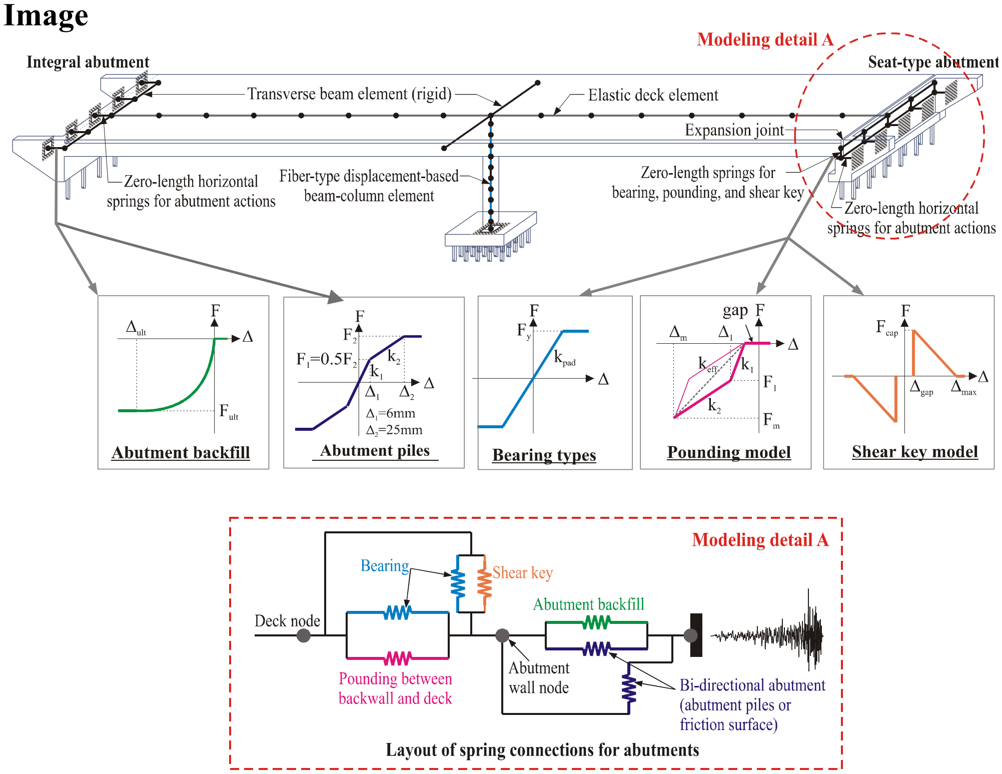
Research Impact

Bridges are an essential part of the transportation system in California and other parts of the United States. This is especially true during the period immediately following a major earthquake when the mobility of emergency responders is highly dependent on a functioning transportation network. As such, decisions regarding the structural integrity and functionality of earthquake-damaged bridges are a critical step in post-event response and recovery. The development of quantitative and comparable measures of aftershock bridge performance will ultimately lead to more informed post-earthquake decisions related to bridge closures, which has direct implications to the functionality and recovery of transportation networks.

Project Image



Numerical modeling of bridge

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