Research Project Highlight

Modeling Bay Area Transportation Network Resilience

Project # 1136-NCTRBA

Principal Investigator
Jack Baker, Associate Professor, Stanford University

Research Team
Rodrigo Silva, Graduate Student Researcher, Stanford University
Gitanjali Bhattacharjee, Graduate Student Researcher, Stanford University

Start-End Dates:
3/1/2018-2/28/2019

Abstract
The goal of this project is to build a model that links individual bridges' earthquake-damage-induced traffic capacity loss and restoration with network-level performance over time (e.g., additional travel time and loss of critical connections). The research objectives are to quantify how individual bridge performance contributes to network-level resilience, and to understand how resilience can be improved through mitigation actions at the individual-bridge level. We will build on our prior work to simulate regional-scale seismic hazards, bridge damage, and network disruption (Figure 1). To this we are adding models to characterize the restoration over time of bridge traffic capacity and network functionality. We plan to relate individual bridge risk to community resilience, and to efficiently quantify the impact of changing component performance (e.g., via retrofit) on that resilience assessment.

Deliverables
In addition to documenting our analysis approaches and results in scholarly publications, we will provide the software used to perform these analyses to the PEER community to aid follow-on studies. This is in keeping with the research team's goal of open-sourcing analysis tools (e.g., our current network data and models are available at https://web.stanford.edu/~bakerjw/infrastructure.html).

Research Impact
Community resilience is the focus of significant attention from a number of civic and research agencies. Common activities include the setting of resilience goals and the development of frameworks for describing resilience. This project aims to develop predictive models that relate individual bridge performance to those broader resilience goals. One aim of the project is thus to provide a link between PEER's work on enhanced bridge systems and the broader world's interest in enhanced disaster resilience. We also aim to identify key transportation network components and corridors whose functioning is deemed critical to regional resilience.

By quantifying the benefits of improved bridge technology for community resilience, this project will help make the case for investing in higher-performance bridge systems (similar to the way that PEER's

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PBEE has helped make the case for investing in higher-performance building systems). By using performance metrics more closely aligned with those of relevance for resilience assessments, this project will also position PEER's research to more directly play a role in regional resilience planning efforts, such as SPUR's work with San Francisco and those of the region's Chief Resilience Officers.

References

Miller M., Baker J.W. (2013). A framework for selecting a suite of ground-motion intensity maps consistent with both ground-motion intensity and network performance hazards for infrastructure networks, 11th International Conference on Structural Safety and Reliability, New York, NY, 8 pgs.

Project Image

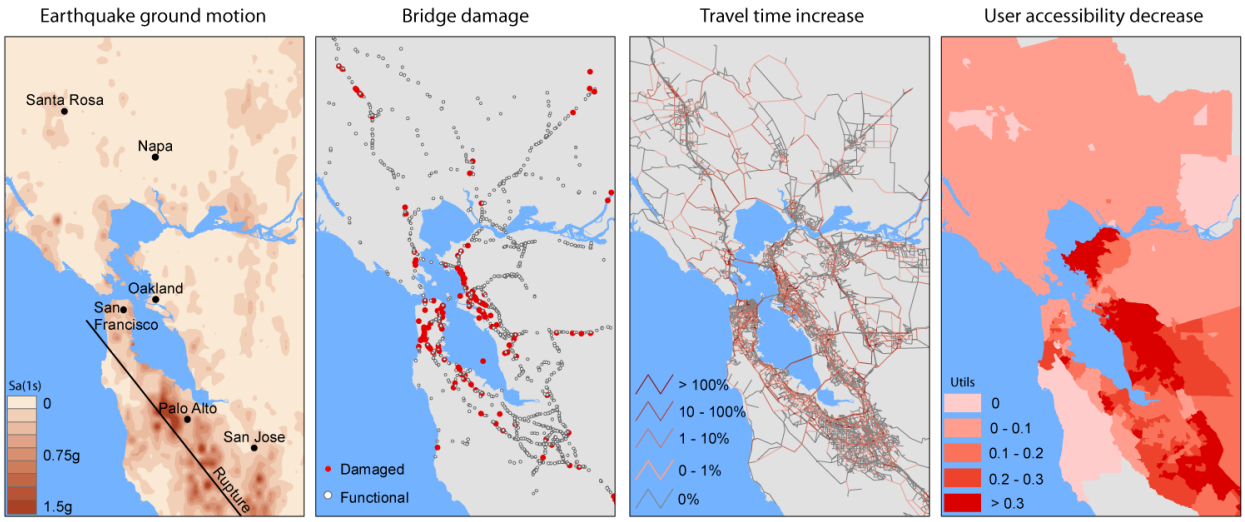

Figure 1 Illustration of the stages in transportation network risk analysis (from Miller and Baker [2014]).

PEER Center – 325 Davis Hall, UC Berkeley, CA 94720 | peer_center@berkeley.edu