Geotechnical / Structures

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Project Title:
UCLA Geohazard Program

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Task Manager:
Qiu Zheng
Research Engineer
Qiu.Zheng@dot.ca.gov

DRISI provides solutions and knowledge that improves California's transportation system.

UCLA Geohazards Program

Improved hazard characterization results in more cost-effective and reliable bridge design.

WHAT IS THE NEED?

Seismic events pose significant challenges to the structural integrity and functional longevity of California bridges. The unpredictability of ground shaking intensity, a direct consequence of seismic activities, underscores the need for the development of more reliable predictive models. Moreover, ground shaking can induce liquefaction in loose, saturated soil, significantly increasing the risk of bridge foundation failure, severe column damage, and superstructure unseating. With over 500 California bridges identified as susceptible to liquefaction, there is a compelling need for improved models to predict liquefaction onset and lateral displacement.

Furthermore, approximately 100 to 200 California bridges span active earthquake faults, where uncertainty regarding fault locations and potential offsets could lead to disastrous outcomes, including bridge collapse. This situation necessitates focused efforts to develop models that accurately predict the extent of fault ruptures, enabling Caltrans to implement specialized design measures to mitigate such events. Collectively, these concerns highlight the urgent need for the Geohazards Program, aimed at strengthening California bridges against the unpredictable and often destructive forces of nature.

WHAT ARE WE DOING?

The Geohazard Research Program is set to concentrate on several key areas of study. It aims to refine ground motion modeling techniques to improve predictions of ground shaking severity at specific project sites, considering earthquakes of varying magnitudes. Additionally, the program is dedicated to developing innovative design methods that utilize earthquake records coupled with nonlinear structural analysis, with the goal of predicting different levels of damage likelihood. In addressing liquefaction, the program seeks to

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create novel methods for predicting its onset and evaluating potential consequences. Lastly, the program endeavors to refine prediction models for fault displacement along fault lines and in areas adjacent to mapped faults. Through these focused research areas, Caltrans is committed to enhancing the resiliency and safety of California bridges and infrastructure in the face of seismic hazards.

WHAT IS OUR GOAL?

The program aims to enhance the characterization of earthquake related hazards such as strong shaking, ground failure and fault rupture. Improved prediction models will be integrated into performance-based design methods, emphasizing the attainment of reliability targets.

WHAT IS THE BENEFIT?

All earthquake-related hazards exhibit significant variability. Past seismic events have demonstrated that two bridges located at similar distances from a rupturing fault can experience dramatically different levels of shaking. Similarly, while some bridges withstand liquefaction with minimal damage, others suffer catastrophic consequences. The Geohazards Program is dedicated to enhancing our understanding of this variability, enabling us to predict high seismic demands more accurately. With this knowledge, the California Department of Transportation (Caltrans) can focus more precisely on preventative mitigation measures, leading to increased reliability and cost-effectiveness in bridge design and construction.

WHAT IS THE PROGRESS TO DATE?

Research activities are complete, and the research team is preparing the final report for submission.