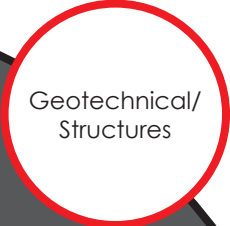




Caltrans Division of Research,
Innovation and System Information

Research



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Project Title:
PEER - Bridge Program (Pacific
Earthquake Research Center)

Task Number: 3745

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PEER - Bridge Program (Pacific Earthquake Research Center)

Bridge research to improve seismic performance and reduce construction and maintenance costs

WHAT IS THE NEED?

Bridges are a major component of California's transportation network. Caltrans owns over 12,000 highway bridges with cities and counties owning a similar number. Each year, Caltrans spends approximately \$500 million on new bridge construction and/or widening of existing bridges. At the same time, an increasing fraction of Caltrans' bridge inventory is reaching their design service life. Approximately 30% are older than 50 years and this percentage is expected to increase to 45% over the next decade. The need to extend bridge lifespan and, when necessary, replace them with minimal disruption, has never been stronger.

In addition to our aging infrastructure, the risk of an earthquake is an everpresent concern. Over 70% of Caltrans bridges are within 10 km of a mapped fault. While our first priority is to ensure that earthquakes don't lead to bridge collapse, being able to carry traffic post-earthquake, even if in a limited capacity, is increasingly important as it supports emergency response and longterm social and economic recovery.

To address these challenges strategically, Caltrans should pursue innovative solutions through an active program of bridge research. This program should be guided by end-users, with strong coordination between different research teams to leverage resources and maximize project quality.

WHAT ARE WE DOING?

Caltrans is creating a bridge research program to be administered through the Pacific Earthquake Engineering Research Center (PEER) at UC Berkeley. Through this program, approximately 4 to 5 new research projects will be initiated each year based on problems and needs identified by Caltrans



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

engineers. Caltrans will select projects from research proposals developed by PEER affiliated universities that best align with Caltrans' problem statements and research objectives. Caltrans engineers will participate in project advisory panels and spearhead deployment efforts.

Topic areas and research objectives the PEER-Bridge Program will address include the following:

- **Bridge Sustainability and Maintenance**
Objectives: Develop cost effective methods for assessing the structural health of a bridge. Create repair techniques to prolong a bridge's service life. Assess innovative design and material options that will minimize lifecycle costs.
- **New Materials**
Objectives: Perform evaluation and trial application of new construction materials such as high strength reinforcing steel, stainless steel, ultra-highperformance concrete, light-weight concrete, and composite materials.
- **Bridge Modeling and Analysis**
Objective: Develop improved methods for assessing structural demand and performance.
- **Accelerated Bridge Construction (ABC)**
Objective: Develop techniques and structural systems that increase the speed of construction and minimize disruption to the traveling public.
- **Performance Based Earthquake Engineering (PBEE) and Bridge Reliability**
Objectives: Develop bridge design methods that include seismic performance targets at different hazard levels. Investigate how different performance targets impact the performance of the transportation network following a major earthquake.
- **Bridge Foundations and Retaining Walls**
Objective: Improve the geotechnical design of bridge foundations and retaining walls to improve performance and cost efficiency.
- **Intelligent Design Tools and Bridge Design Aids**
Objective: Develop new tools and methods that take advantage of artificial intelligence to accelerate the bridge design process.

WHAT IS OUR GOAL?

Objective: Develop new tools and methods that take advantage of artificial intelligence to accelerate the bridge design process.

WHAT IS THE BENEFIT?

Since bridges play a critical role in our transportation system, ensuring their safety and reliability is paramount. As most of California must contend with the potential for strong shaking resulting from earthquakes, achieving good bridge performance is challenging, especially considering the increasingly advanced age of many of our bridges. The PEER-Bridge Program will help Caltrans address this challenge through cutting-edge research that is guided by Caltrans engineers. This research program will focus on addressing major bridge design and performance issues during the planning, design, construction phases of a bridge project, and operational and maintenance issues during a bridge's service life. The net result will be better bridges at lower cost, a safer and more reliable transportation system at an overall lower life-cycle cost.

WHAT IS THE PROGRESS TO DATE?

The PEER-Bridge Program began on November 1, 2019. Four problem statements have already been selected as the basis for the first four tasks:

- Rapid assessment of bridge condition using sensors and analysis
- Implementation of Performance Based Earthquake Engineering (PBEE) bridge design
- Improved bridge deck design and analysis
- Accelerated Bridge Construction (ABC) for bridge abutments

Detailed work plans for each task will be developed as part of a PEER administered request for proposal process.