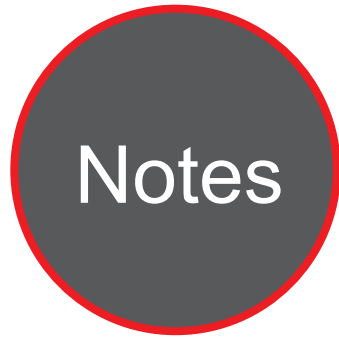




Research



MARCH 2023

Project Title:
Develop a Seismic Risk Matrix to Rank Caltrans Tunnel Inventory

Task Number: 4039

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Task Manager:
Anna Sojourner
Senior Engineering Geologist
anna.sojourner@dot.ca.gov

Develop a Seismic Risk Matrix to Rank Caltrans Tunnel Inventory

Research potential tunnel seismic damage by grouping tunnels by tunnel type and seismic hazards, then ranking tunnels in each group by potential seismic risks to the safety and operability of each tunnel.

WHAT IS THE NEED?

The California Department of Transportation (Caltrans) owns and operates 65 tunnels on the State Highway System. California's high seismicity means tunnels may be at risk of damage or shutdown in an earthquake. This research will help identify the tunnels at high seismic risk. Caltrans has compiled preliminary information about potential seismic hazards for the tunnel inventory, including ground shaking, fault offset, liquefaction, and landslides due to earthquakes. This research will identify ways that tunnels can be damaged in earthquakes and the way the tunnel interacts with the ground during earthquakes. Damages can vary depending on the severity of the earthquake, the secondary effects of shaking (such as liquefaction or other seismic hazards), the nature of the ground the tunnel lies in, and the structure type, age, and construction quality of the tunnel.

This work will be used by Caltrans to prioritize the retrofit of tunnels at the highest risk of damage from earthquakes.

WHAT ARE WE DOING?

This research will use a literature search of tunnel damage from earthquakes all over the world to identify potential damage that could occur in similar tunnels on the State Highway System. The research will then analyze, specific to Caltrans tunnels, the tunnel structures and the potential tunnel interactions with the ground. Finally, the research will develop a matrix ranking of tunnel types and potential damage in the Caltrans tunnel inventory. This matrix will be used to prioritize seismic response and funding for further investigations and retrofit of Caltrans tunnels at risk from seismic damage.



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WHAT IS OUR GOAL?

This research will provide Caltrans with a report summarizing types of tunnel damage that could occur in earthquakes. The report will be used to decide how to prioritize spending on retrofitting Caltrans tunnels at high seismic risk. Caltrans engineers can use the information in the report to determine the risk to each tunnel due to earthquakes and prioritize future retrofits.

WHAT IS THE BENEFIT?

This work will provide a ranking in risk exposure for tunnels in California, expediting the response to the specific tunnels at higher risk. This work will enhance the safety of California highways, and help to ensure that Caltrans tunnels remain safe and operational after an earthquake.

WHAT IS THE PROGRESS TO DATE?

Caltrans has compiled information about potential seismic hazards in our tunnel inventory. This information will be used by the researchers to understand how the tunnels may interact with the ground during seismic hazards, and what types of potential damage are the most urgent for Caltrans to address. In addition, Caltrans has compiled specific information about the tunnels, such as: age, construction methods, design, and whether and how they were originally designed to withstand earthquakes. This will help the researchers focus on the most critical tunnels and potential damages.