

**Geotechnical/
Structures****March 2026****Project Title:** Determination of Recovery Bridge Corridors by Comparing Post EQ Network**Task Number:** 3798**Start Date:** June 1, 2022**Completion Date:** February 28, 2025**Task Manager:**Sharon Yen
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Determination of Recovery Bridge Corridors by Comparing Post EQ Network

Bridge research to develop design heuristics that can be used to determine whether a bridge should be designed to a Recovery Bridge performance standard or an Ordinary Standard Bridge performance standard.

WHAT WAS THE NEED?

The recently adopted Seismic Design Criteria (SDC) 2.0 introduce an optional, higher seismic performance level designated as a Recovery Bridge (RB). Bridges designed to this standard are expected to remain functional with minimal damage during a moderate earthquake (Functional Evaluation Earthquake, FEE) and sustain only moderate damage during a major design-level event (Safety Evaluation Earthquake, SEE).

From the perspective of Caltrans' Division of Engineering Services (DES), the decision regarding the desired post-earthquake performance level is made at the District level, where project-specific costs and benefits are evaluated. While guidance exists on how to design Recovery Bridges, there is limited knowledge on when they should be selected. It is generally accepted that RBs are appropriate when extended downtime would result in severe consequences; however, establishing an objective measure of severity is challenging.

To address this gap, regional highway network traffic models are needed to develop simple, reliable design heuristics that can guide engineers in determining whether a bridge should meet the RB standard or the Ordinary Standard Bridge (OSB) performance criteria.

WHAT WAS OUR GOAL?

The goal of this project is to develop simple yet reliable design heuristics to determine when a bridge should be designed to the Recovery Bridge (RB) performance standard rather than the Ordinary Standard Bridge (OSB) standard.



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

WHAT DID WE DO?

Through the PEER-Bridge Program, Caltrans partnered with the University of California, Berkeley to develop a traffic simulation model of the District 4 (San Francisco Bay Area) highway network (Figure 3). The project identified various types of post-earthquake traffic corridors, including those providing primary access to critical facilities.

Key activities included:

- Collecting data on the regional highway and major road network, bridge inventory, critical facility locations, bridge characteristics, and site-specific hazard conditions.
- Identifying critical corridors that support emergency response and essential mobility immediately following an earthquake.
- Establishing a framework for selecting essential routes and analyzing how network performance is influenced by post-earthquake bridge functionality using simulation results.

WHAT WAS THE OUTCOME?

The project produced a framework for identifying essential routes in District 4 that support access to critical facilities such as hospitals, fire and police stations, Caltrans maintenance facilities, airports, seaports, and ferry terminals (Figure 2). Essential routes were identified using a shortest-path methodology, which mapped routes from each zip-code-defined zone (Figure 1) to its nearest critical facility. Route usage was quantified to provide a ranking metric.

Additionally, the project delivered an easy-to-use, web-based simulation tool that consolidates key information in a centralized platform. Stakeholders can use the tool to evaluate route importance and determine whether bridges along those routes warrant design to higher seismic performance standards.

WHAT IS THE BENEFIT?

Bridges are vital components of California's transportation network and economy. Assessing traffic network performance under uncertain, earthquake-induced bridge damage is complex. This project enhances understanding of:

- Post-earthquake traffic demand, which differs significantly from typical day-to-day patterns.
- How spatially correlated ground motions influence regional bridge damage.
- How bridge performance affects the operational capacity of the transportation network during emergency response.

The resulting framework supports more informed decision-making on appropriate bridge performance levels, contributing to improved resilience of the transportation system.

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IMAGES

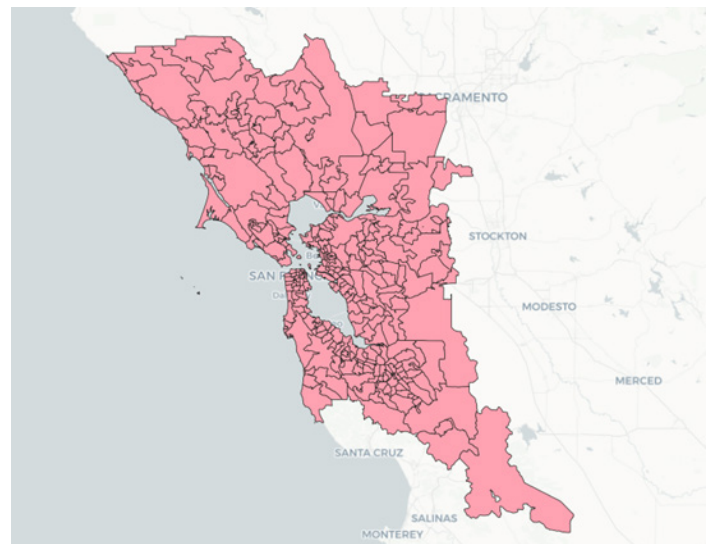


Image 1: Zip-code defined zones

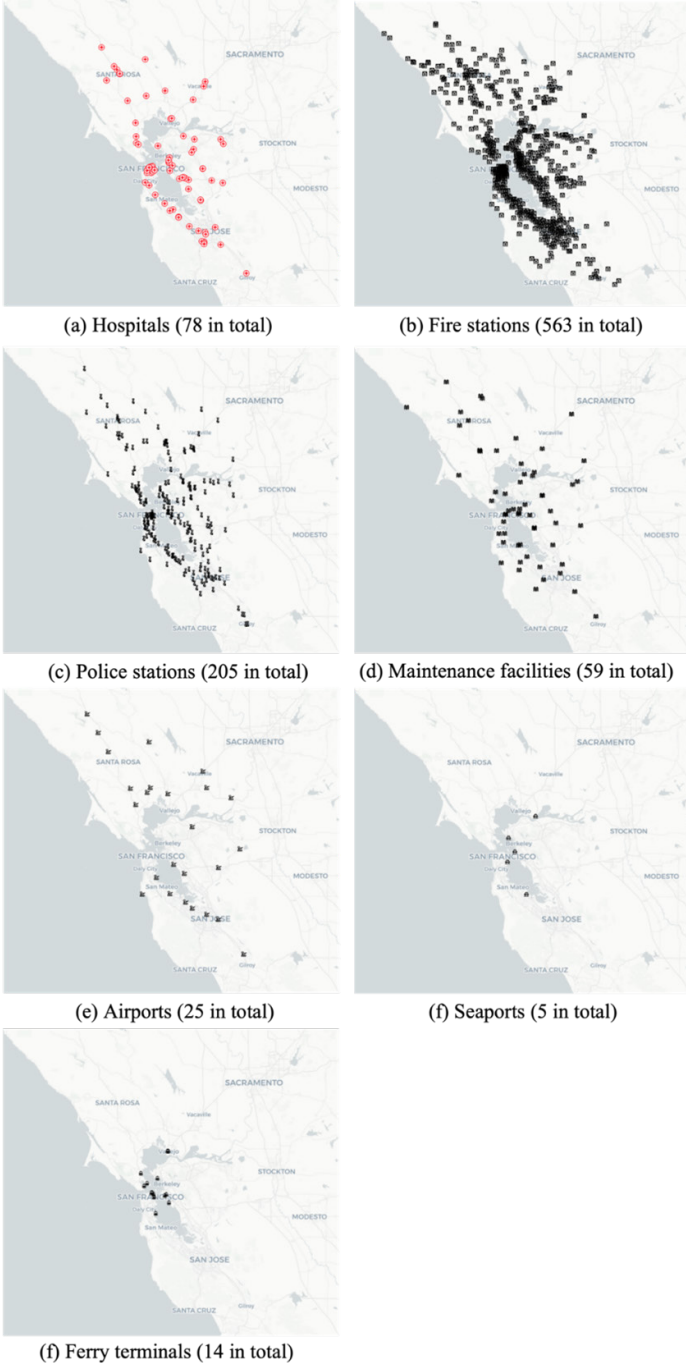


Image 2: Identification of critical facilities in District 4



Image 3: Project defined corridors in District 4

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