DRISI
CALTRANS DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION

Research Notes

Planning, Policy and Programming

Improving Public Safety through Spatial Synthesis, Mapping, Modeling, and Performance Analysis of Emergency Evacuation Routes in California Localities

WHAT IS THE NEED?

Extreme events in 2021 cost the United States approximately $145 billion, with the western wildfires accounting for 8% of those costs. California's wildfire impacts in 2018 totaled $148.5 billion including capital losses, health costs, and indirect losses such as disruptions to supply chains. Wildfires have also been more devastating in California during the last decade. Between 2017 to 2019, there were about 11 large-scale wildfires requiring the evacuation of at least ten thousand people each, resulting in more than one million people ordered to evacuate in three years, mostly from wildland-urban interface (WUI) areas. Because a significant number of people live in WUI areas and the increasing frequency of climate-driven wildfires, impacts are expected to increase. Different agencies are developing preparedness, mitigation, and adaptation plans, but for short- or no-notice fast-moving wildfire events, evacuation is critical. Evacuation processes usually rely on the road network and one of the characteristics of evacuation scenarios is the heavy bottleneck and slow traffic speed due to the high volume of vehicles that are using a limited and capacitated set of roads.

California has recognized the need to strengthen disaster response through Assembly Bill 747, which requires cities and counties to adopt a comprehensive long-term general plan that includes safety elements for the community. Local jurisdictions are required to identify evacuation routes and their capacity, safety, and viability under a range of emergency scenarios. Caltrans has an important role to play regarding these safety elements, the maintenance and strengthening of evacuation routes, and ensuring public access to the same. These routes must be identified in advance and maintained so they can provide transportation during evacuations. However, there is no centralized database of these routes or a general performance assessment.

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

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WHAT ARE WE DOING?

This research project is responding directly to Caltrans's research priority "GIS Mapping of Emergency Evacuation Routes." The research team proposes a four-part effort to: 1) collect evacuation routes from different jurisdictions, create a centralized database, and conduct a general assessment of their potential performance considering the latest evacuation research; 2) perform quantitative network and performance analyses for a set of case studies; 3) assess how well these evacuation routes align with the State Highway, bus and rail systems, and how well they compare with actual evacuation events in a series of case studies that use data or findings from previous evacuations in California; and 4) analyze different metrics about the performance of the evacuation routes themselves for different segments of the population (e.g., elderly, mobility constrained, non-vehicle households, and disadvantaged communities).

WHAT IS OUR GOAL?

The goal of this research is to help centralize and assess evacuation routes, and assess their capacity for successful evacuation in the event of a wildfire. It will help inform infrastructure investment priority decisions, as it will identify the road segments with the largest impact on the evacuation route/ network performance. The research products will include a GIS database of safety elements from local jurisdictions, an evaluation of the degree to which the State Highway System (SHS) and bus and rail lines contribute to the evacuation system, and a screening of the SHS to identify the most critical parts of the network and areas of potential shortfall or lack of evacuation infrastructure.

WHAT IS THE BENEFIT?

This research will assist county planners, Metropolitan Planning Organizations , Regional Transportation Planning Organizations , fire response and other emergency responders,

and residents of the areas studied with a comprehensive resource to aide with evacuations. The product of this research will inform planners and emergency response teams with a calculation of the performance of the evacuation routes, the road network, and the performance of the evacuation routes for different segments of the population. Finally, the team will recommend how to improve efficiencies and promote safe evacuation routes.

WHAT IS THE PROGRESS TO DATE?

First quarter progress for this project is that the research group has started gathering the safety elements data from municipalities in California. They have also developed preliminary analyses for the interaction between multi-hazard risk and network characteristics. In addition, they have started training the graduate students and the undergraduate student involved with the project and analyzed the potential for a database and web-based version for data repository. Second quarter progress includes: 1. Continued gathering information from municipalities
2. Developed a risk index for the road network for about 400+ municipalities in the California
3. Started to create a relational database to organize the data
4. Started the development of a dashboard to display the data
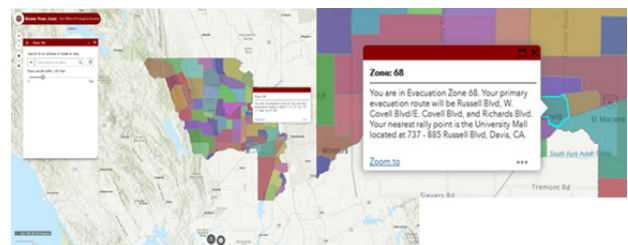
IMAGES

Image 1: Yolo county evacuation routes ArcGIS (Yolo Office of Emergency Services, 2022)