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Authors

Soga, Kenichi, PhD
Comfort, Louise, PhD
Li, Pengshun, MSc
[et al.](#)

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A Case Study: Testing Wildfire Evacuation Strategies for Communities in Marin County, California

Kenichi Soga, Ph.D., Louise Comfort, Ph.D., Pengshun Li, MSc., Bingyu Zhao, Ph.D.,
Paola Lorusso, MSc
Department of Civil and Environmental Engineering, University of California, Berkeley

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Issue

Many small, resource-strapped communities located in areas vulnerable to wildfire don't have resources to conduct dedicated evacuation studies and many do not consider the impact of background traffic (i.e., normal traffic rather than evacuating traffic) on evacuation. In response, we explored the performance of several generalizable evacuation strategies with background traffic for representative communities in Marin County, including the Ross Valley, Woodacre Bowl, Tamalpais Valley, and an area near Highway 101 and Ignacio Boulevard in Novato (hereafter referred to as 'Novato Neighborhood'). The strategies we explored include vehicle reduction (i.e., evacuees share a vehicle), phased evacuation (i.e., evacuees in different zones have different departure times), and off-street parking (i.e., street parking is prohibited on a high-fire Red Flag Day to increase overall road capacity in the event of an evacuation). We then tested each strategy using a wildfire-traffic simulation framework.

Key Research Findings

Encouraging evacuees to share a vehicle is a promising evacuation strategy. Across all communities, the vehicle reduction strategy where evacuees share vehicles performed well in both daytime and nighttime evacuation scenarios. For example, if each vehicle in an evacuation is shared by 2 people, the travel time of each evacuee is reduced by 19% to 57% and the exposure time is

reduced by 14% to 61%, compared with everyone driving a vehicle. With more people sharing each vehicle, in some cases, the travel time continues to decrease; however, in the other cases, the travel time remains unchanged due to low volume of evacuees. In reality, it is hard and time-consuming to coordinate people from different households to share one vehicle in emergency situations. However, it may be easier to encourage people within one household to share a vehicle rather than everyone in the household driving a separate vehicle.

Phased evacuation will reduce travel time but may increase exposure for some residents. For phased evacuations, residents in areas farther from the fire will start to evacuate after residents in areas closer to the fire are evacuated. Across all communities, our analysis shows that phased evacuation can reduce the travel time by 14% to 74%. When the time interval between phased evacuations increases, the reduction in travel time also increases. However, as the fire moves dynamically, the fire may quickly reach areas that are initially not close to the fire. Therefore, for phased evacuations, it is important to not only focus on travel time but also consider exposure time since longer waiting time in risk areas brings a higher risk to residents in later evacuation phases.

Prohibiting street parking on a Red Flag Day produces varying results. For some communities, such as the nighttime scenario of Ross Valley and the daytime scenario of Woodacre Bowl, prohibiting street parking has little

impact on evacuation travel times. While in the other cases, prohibiting street parking can significantly reduce travel time. The impact of prohibiting street parking is primarily a reflection of the number of evacuees and number of exits. When the number of evacuees is relatively small compared to the number of vehicles in background traffic and the number of exits to leave the dangerous area is high, the effect of street parking is small. Yet, if there are more evacuees and fewer exits, the impact of street parking is high. Overall, the prohibition of street parking on Red Flag Days can effectively reduce the travel time of evacuees. If possible, this strategy should be implemented in all cases. If it is difficult to implement in all cases, prohibition of on-street parking is recommended for the morning case of Ross Valley, the midnight case of Woodacre Bowl, both daytime and nighttime scenarios of Tamalpais valley, and

the midnight case of Novato Neighborhood. Prohibiting street parking in these cases can significantly improve the evacuation performance, compared with other cases.

More Information

This policy brief is drawn from the report “Testing Wildfire Evacuation Strategies and Coordination Plans for Wildland-Urban Interface (WUI) Communities in California” authored by Kenichi Soga, Ph.D.; Louise Comfort, Ph.D.; Pengshun Li, MSc; Bingyu Zhao, Ph.D.; and Paola Lorusso, MSc, with the University of California, Berkeley. The report can be at www.ucits.org/research-project/2022-34. For more information about findings presented in this brief, please contact Kenichi Soga at soga@berkeley.edu.

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