

# The Development of a Simple Engineering Calculation Method for Wildfire Scenarios

This project developed a prototype model to calculate vehicle movement evacuation time during a wildfire.

*Muthia K. Jaelani*

*In a world with an increased wildfire risk, how can an engineering tool help communities to better prepare for an evacuation?*

The increasing wildfire risks due to environmental pressures from climate change threaten communities living close to or intermixing with wildland. In the past, wildfire hazards caused a significant loss of life and property to communities across the globe. Communities previously vulnerable to wildfire events are now more exposed. On the other hand, new communities are becoming vulnerable as people move to wildland-urban interface locations - given a social preference for access to nature and work.

Wildfire is therefore becoming an increasing problem, requiring community planning and response. To do this, we need simple methods (i.e., engineering tools) to quantify the problem, enabling community planners to assess their community's vulnerability. We need to understand not only wildfire development (its spatiotemporal coverage) but also communities' response to wildfire. One of the most common responses is evacuation. Wildfire evacuations are formed from the interaction between people (and their response) and physical and environmental elements.

How to assess the community's evacuation performance during a wildfire? The assessment can be done by adopting the performance-based design approach in fire engineering for the built environment—by calculating the total evacuation time of a community during wildfire scenarios and then comparing it with the time until the fire front reaches the community. The evacuation time can be obtained through a computer simulation or a simpler approach such as an engineering calculation. An engineering calculation may provide access to a broader group of practitioners, especially those unfamiliar with computer simulations. However, until the study was conducted, there was no publicly available engineering calculation for wildfire scenarios.

This study attempted to address this gap by developing a method to calculate vehicle movement time during wildfire evacuation scenarios. This work combined our current understanding of normal traffic flow, factors that influence community response, and road network capacity to produce a simple engineering hand calculation to estimate the time to evacuate a community. Through a series of literature reviews, an existing traffic model (i.e., the Highway Capacity Manual model) was enhanced to better reflect traffic performance during wildfires. The model is then applied to test cases to demonstrate the evacuation time estimate calculation.