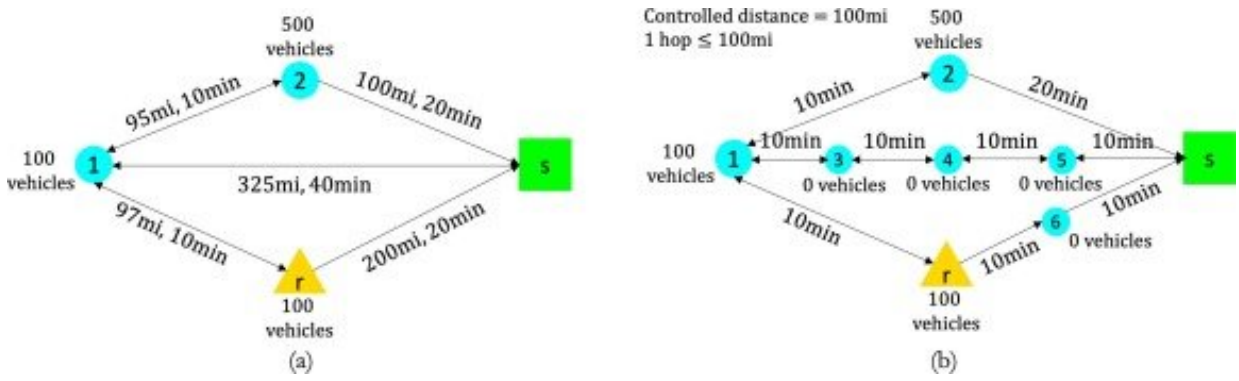
Can we evacuate from hurricanes in electric vehicles?

September 1 2022



Example of (a) network topology with link distance parameters and (b) modified hop-distance network topology. Credit: *Transportation Research Part C: Emerging Technologies* (2022). DOI: 10.1016/j.trc.2022.103837

As emergency coordinators across the U.S. prepare for the upcoming hurricane season, they are busy planning evacuation routes. Currently, these plans don't anticipate the needs of people driving electric vehicles, which have shorter driving ranges than gas vehicles and require recharging at stations with charging ports.

University of Illinois Urbana-Champaign civil and environmental engineering professor Eleftheria Kontou spoke with News Bureau physical sciences editor Lois Yoksoulian about this issue and her newly published study in *Transportation Research Part C: Emerging*

Technologies.

What issues can we expect to see from the increased number of electric vehicles on the current evacuation routes?

Due to limited driving range and sparse charging infrastructure networks, electric vehicles are more susceptible to being stranded during evacuations. The existing evacuation routes do not account for the frequent charging needs and the long charging times of electric vehicles, posing barriers to evacuation and reaching shelters.

Electric vehicles may need to be rerouted to access charging stations and deviate from the shortest path to safety, increasing the evacuation time. Charging is time-consuming and also increases the time to reach shelters during evacuations. Due to the limited number of charging stations and ports, long queues are expected to form, leaving electric vehicle drivers more exposed to danger. Additionally, power outages can render both gasoline and charging stations inoperable, challenging the ability of drivers to escape other hazards like wildfires and flooding.

What changes or improvements can be made to the current infrastructure to address this problem?

Because the current charging infrastructure was built to suit the day-to-day needs of electric vehicle travelers, emergency coordinators will need to reevaluate its capacity to manage the peak demands of a natural catastrophe-related evacuation. For example, designating specific evacuation routes for electric vehicles will provide reliable access to charging while reducing total evacuation times and charging station crowding.

What are some of the steps your research group is taking to address this issue?

We have developed a model that designates different evacuation routes for gasoline, electric and other alternative-fuel vehicles, which can be followed concurrently by these vehicle technologies during evacuations. We recommend that evacuation coordinators design routes that minimize the system's evacuation time, are seamless in that they eliminate forking and confusion, apply traffic contraflow principles so that each road in the network can be used at maximum capacity, and provide reliable access to charging and refueling infrastructure.

What can emergency coordinators and electric vehicle drivers do right now, while these new routes are being developed, to ensure safety during an evacuation?

We suggest that evacuation coordinators design routes to shelters and safe zones that pass through charging and refueling stations. They also should develop maps and information campaigns to communicate their preemptive and emergency evacuation plans with alternative fuel-vehicle drivers. Also, emergency planners should collaborate closely with charging infrastructure providers and utilities to identify locations that are critical for charging during evacuations.

Electric vehicle drivers need to review existing evacuation routes and assess their charging options in a hypothetical evacuation scenario. If it is infeasible to reach safety with their electric vehicles, they might need to coordinate with neighbors or use a secondary vehicle with a larger driving range.

More information: Denissa Sari Darmawi Purba et al, Evacuation route planning for alternative fuel vehicles, *Transportation Research Part*

C: Emerging Technologies (2022). DOI: 10.1016/j.trc.2022.103837