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POLICY BRIEF

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Leveraging Robotaxis to Support Transit Riders in Emergencies

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Issue

Transportation systems are vulnerable to disruptive events. Rail transit systems are particularly vulnerable because their vehicles operate on fixed tracks, making it difficult for them to safely and efficiently bypass each other or disrupted sections of the rail network.

To improve the resilience of transit systems in the future, we explored the use of shared automated vehicles (SAVs), also called robo-taxis, to pick up stranded passengers and deliver them to their homes or other drop-off locations, such as an unaffected transit stop. For example, transit agencies could have a contract with one or more SAV fleet operators that would allocate a certain number or percentage of their vehicles to provide transportation between stations in the transit network. The transit agency would pay a recurring fee (e.g., quarterly or annually) to ensure access to SAVs during a disruption. The transit agency will agree to pay the SAV fleet provider based on either (i) the number of travelers served during a disruption, or (ii) the cumulative vehicle-hours the SAVs provide exclusive service to transit riders.

To explore this concept, we developed a simulation model that shows how SAVs could help riders during major transit disruptions. The model is based on three real events that disrupted service on the Santa Clara Valley Transportation Authority (VTA) Light Rail Transit (LRT) system in California.

Scenario 1: A bicycle-train collision that temporarily shut down a single station.

Scenario 2: Flooding that temporarily shut down an entire rail line.

Scenario 3: A mass shooting in a rail yard that caused a complete, long-term shutdown of the entire rail network.

For each scenario, we tested different SAV fleet sizes and tracked how vehicles were used throughout the day; for example, whether they were idle in the network, serving disrupted transit riders, in regular service, or parked at a depot. Figure 1 shows this breakdown for a fleet of 6,000 vehicles in Scenarios 2 and 3. The results show that in Scenario 3, a much larger share of vehicles was devoted to helping transit riders, reflecting the extensive resources needed during a full system shutdown. We also measured performance outcomes, including how long riders waited for a vehicle and how much delay they experienced when transit service was disrupted.

Key Research Findings

SAVs significantly reduce passenger delays, especially during major disruptions. In Scenarios 2 and 3, delays were significantly reduced by SAVs, with most passengers reaching their destinations in less than 25 minutes, compared to delays extending multiple hours without SAVs.

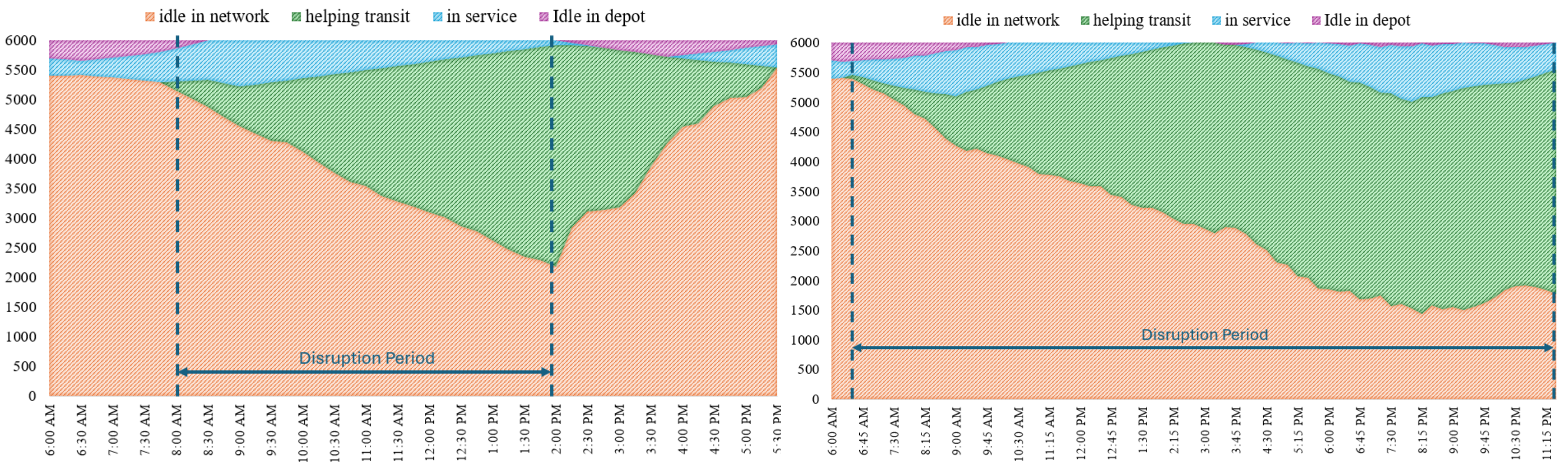

Figure 1. Distribution of SAVs statuses for a single-line shut down represented by Scenario 2 (left), and complete network shut down represented by Scenario 3 (right). Each scenario assumes 6000 SAVs in the network (y-axis).

Larger disruptions require a larger SAV fleet to maintain reasonable service quality to travelers. Figure 1 displays the difference in fleet size (in green) apportioned to serving disrupted transit travelers in Scenario 2 (single line) and Scenario 3 (entire system). To this point, transit agencies may need flexible contracts with SAV fleet operators to ensure there are adequate vehicles to serve transit travelers when events disrupt large portions of the network.

Policy Implications

While SAVs remain in the early stages of commercial rollout, they are expected to become a more common mobility option in major metropolitan areas in the near future, with the potential for widespread adoption after 2030. To prepare for this transition, strengthening collaboration between SAV operators and transit agencies will be essential for integrating these services into existing transportation systems, streamlining deployment, and reducing costs. Investments in advanced dynamic allocation algorithms can further enhance SAV operations and deployment, enabling fleets to respond rapidly to real-time conditions as explored through our simulation modeling. Additionally, continued pilot programs will be critical for refining deployment strategies and demonstrating how SAVs can effectively meet travel needs—both during routine operations and in times of service disruption.

More Information

This policy brief is drawn from the preprint "Improving Transit System Resilience using Shared Autonomous Vehicles (SAVs)" which can be found at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5251869. For more information, contact Michael Hyland at hylandm@uci.edu.

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