Mobility and Accessibility Resilience of Transportation Infrastructure to Natural Disasters

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Center Name: Pacific Northwest Transportation Consortium (PacTrans)

Research Priority: Improving the Mobility of People and Goods

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Research Project Funding: $195,000 federal; $195,000 non-federal match

Project Start and End Date: 8/16/2023 – 8/15/2025

Project Description: This project aims to tackle the practical challenges of mobility and accessibility following natural disasters, specifically focusing on post-earthquake scenarios. The primary objective is to provide actionable insights and solutions that can be directly implemented in real-world transportation systems. Leveraging available data from state Departments of Transportation (DOTs) and employing analytical techniques, our research endeavors to bridge the gap between theoretical research and practical application, ultimately benefiting the transportation community in the region. By investigating the impact of post-earthquake mobility on evacuating nearby populations and facilitating access for emergency responders, the project seeks to address critical questions regarding evacuation routes and responder access. Through this analysis, valuable insights will be gained into the challenges and potential obstacles faced during post-earthquake responses around critical facilities, contributing to enhanced emergency preparedness and the development of strategies for effective evacuation and responder access in critical scenarios.

US DOT Priorities: The project aligns closely with the strategic priorities of the U.S. Department of Transportation (USDOT) and its Research, Development, and Technology (RD&T) strategic goals. Specifically, it addresses the imperative of enhancing transportation resilience in the face of natural disasters, a key priority for USDOT. By focusing on the vulnerability of transportation infrastructure in the Pacific Northwest and Region 10 to seismic events and flooding, the project directly supports USDOT's commitment to ensuring the reliability and resilience of transportation networks in disaster-prone regions.

Furthermore, the project engages in breakthrough, advanced, and transformative research by developing a prototype disaster response plan tailored to urban areas in the northwest region, including examples in Alaska and Oregon. This plan will not only assess the impact of natural disasters on mobility and accessibility but also provide actionable recommendations for integrating resilience-enhancing design strategies into current transportation practices. By combining infrastructure analysis, traffic analysis, and transportation planning, the project aims to develop likely scenarios of road network disruption during major disaster events, enabling stakeholders to proactively plan and prepare for such eventualities.

Moreover, the project's focus on critical infrastructure, such as healthcare facilities and fuel terminals, underscores its transformative potential in aiding local agencies in prioritizing future projects to account for emergency conditions. By guiding evacuation routes, relief supply lines, and the integration of highway elements, the project will contribute to defining evacuation relief measures and enhancing access to critical services during natural disasters. Overall, the development of this prototype plan serves as a method and framework for communities to create similar transportation-based plans, thereby advancing the resilience and preparedness of transportation systems in disaster-prone regions.

Outputs: The outputs of this research project are expected to encompass several key deliverables that will significantly enhance the resilience of urban transportation infrastructure in the face of natural disasters. These outputs include integrating natural disaster scenarios and highway elements into comprehensive urban planning strategies, enabling state and local agencies, Metropolitan Planning Organizations (MPOs), Departments of Transportation (DOTs), and federal agencies to prioritize future projects with due consideration to local disaster risks. Additionally, the project will facilitate agencies in planning, building, and strategically siting critical public services such as healthcare centers and emergency warehouses within urban areas, thereby enhancing preparedness and response capabilities.

Through effective communication with first responders and the public, the project will raise awareness about the risks associated with mobility and accessibility during natural disasters, empowering decision-makers with informed scientific input at both state and local levels. These outputs will be disseminated through guidelines embedded within infrastructure planning and design processes, complemented by traditional project deliveries such as reports, publications, workshops, presentations, and other knowledge-sharing platforms, ensuring widespread adoption and application of the research findings. Moreover, the project is anticipated to foster new partnerships outside of the UTC consortium, potentially involving collaboration with emergency management agencies, community organizations, and other stakeholders invested in enhancing disaster resilience in urban areas.

Outcomes/Impacts: The outcomes of this research project are poised to catalyze transformative changes in the transportation system, regulatory frameworks, and policy landscape, fostering enhanced resilience and preparedness in the face of natural disasters. By integrating natural disaster scenarios and highway elements into urban planning strategies, the application of the project outputs will result in more robust and adaptive transportation systems capable of withstanding and recovering from seismic events and flooding. This integration will lead to tangible improvements in safety, reliability, and durability, as transportation infrastructure becomes better equipped to withstand the impacts of disasters, minimizing disruptions and ensuring continued access to critical services.

Moreover, the provision of information to state and local agencies, including MPOs and DOTs, will inform decision-making processes related to prioritizing future projects, thereby optimizing resource allocation and infrastructure investments to mitigate local disaster risks effectively. This shift in practice towards a more proactive and risk-informed approach to infrastructure planning and development will yield long-term cost savings by reducing the likelihood and severity of infrastructure damage during natural disasters.

Additionally, by facilitating the planning, construction, and strategic siting of essential public services such as healthcare centers and emergency warehouses within urban areas, the project outputs will enhance the resilience and responsiveness of emergency response systems. This will lead to improved coordination among first responders and more efficient mobilization of resources, ultimately enhancing public safety and community well-being.

Final Research Report: *will be provided upon completion of the project*