



NITC Research Roadmap: A decade of transportation resiliency research

Recent decades have seen an increase in catastrophic environmental events that trigger concern for resiliency in our communities and transportation systems. Transportation professionals need to understand how to prepare, respond and recover from these events, and adapt to mitigate the impacts.

In a series of NITC Research Roadmaps, we surveyed the state-of-knowledge and where we're headed across six areas of transportation. Here we share the contributions of a decade of transportation resiliency research from the National Institute for Transportation and Communities (NITC). Download the full literature review from this roadmap here: <https://nitc.trec.pdx.edu/nitc-research-areas>

Disaster Phases: Preparation, Recovery, and Long-Term Resiliency

Our studies focus on the preparedness and response phases of a disaster, as well as recovery, mitigation, and adaptation. The studies in preparedness and response focus on engineering assessments for rapid response or mobility and access in the post-disaster moment. Studies on mitigation, recovery and adaptation covered a broad range of topics: from seismic retrofitting of transportation infrastructure to climate action planning in transportation agencies. Case studies on long-term post-disaster recovery are an opportunity for future NITC work to increase resiliency in transportation systems.

Transportation Infrastructure

About a third of NITC's work in resiliency has focused on the engineering and maintenance of transportation infrastructure in the face of environmental change. One study [prioritized the retrofitting of highway bridges in Oregon](#) based on their seismic vulnerability, determining which needed to be retrofitted soonest. NITC funding has also supported diversifying the workforce by funding university student researchers and providing the unique opportunity

to learn technical skills that are desperately needed by local consultants in the Pacific Northwest, such as [assessing the liquefaction potential of regional soils and effects on bridge foundations](#).

Planning Support Tools

NITC research produces decision-making tools to support evidence-based transportation resilience engineering, planning and policymaking. Several studies have assessed the performance of structures (such as bridges, culverts and highways) during hazard events like earthquakes, flooding, and wildfires. Others have focused on different aspects of the transportation system, such as governance needs and supply chain management. One team of NITC researchers published [Rethinking Streets During COVID-19](#), a book in a series of three on repurposing street space to better meet community needs. This edition compiles examples of street improvements from cities across the U.S., to help planners and engineers, local elected officials, and other city staff visualize how other communities responded to travel changes brought about by the COVID-19 pandemic and related lockdowns.

Mobility and Accessibility

In the aftermath of hazard events, improving mobility and access to services is one of the first priorities to help a community recover. NITC research has improved our understanding of how communities respond to hazards; not only physical disasters like earthquakes, fires and floods, but also public health events like the COVID-19 pandemic. One study examined [how households acquired food and other necessities during the first two years of the pandemic](#), and

identified the most common barriers faced by vulnerable subgroups, which include lack of access to a credit or debit card, smartphones, internet, a secure place to receive deliveries, and to a vehicle.

The climate crisis is another focus of transportation resiliency research, and NITC researchers have begun to examine how infrastructure can impact public health as global temperatures rise. With road pavement being a known contributor to the urban “heat island” effect, one NITC study is [evaluating a pilot program in Tucson, Arizona where the city is applying engineered pavement coatings to reflect light and reduce the thermal load of roads](#). The same study also investigated the public health consequences of drive-through COVID-19 vaccination sites, where people spent many hours waiting in line in a high heat-risk environment with idling vehicles.

Governance and Policy

The NITC community has used survey and qualitative approaches to enhance our understanding of governance and policymaking in transportation resiliency. One study worked with local agencies in Salt Lake City to [develop a collaborative university/community framework](#) that can help small and medium-sized enterprises recover from supply chain disruptions after an earthquake. They surveyed 130 local businesses within the top 10 worst-affected industrial sectors in Utah to understand how they navigated supply chain disruptions. They investigated how universities and local governments could support their efforts, in order to promote collaborative resilience planning. The exchange of ideas between policymakers and administrators in other regions promotes cross-learning, which helps to establish policies for resilient transportation systems.

Equity and Justice

Environmental change events can have a heavily disproportionate impact on low income, socially vulnerable, and otherwise marginalized community groups. While many resiliency studies mention or address equity in some measure, fewer have equity as their primary focus. One study conducted a flood vulnerability assessment with special reference to low-income and minority neighborhoods in Tucson, Arizona. The research team identified priority locations for Tucson to make [transportation improvement](#)

[investments for the purpose of mitigating urban transportation system flooding](#) where it is needed most. They found that building comprehensive neighborhood-scale green infrastructure in the right-of-way is effective at increasing multimodal access in moderate flooding conditions. Another project [developed a new accessibility measure to support older adults in the post-pandemic world](#), identifying and quantifying the unique challenges faced by older people to help decision makers integrate equity into future policy frameworks.

It’s important to note that this literature review reveals a lack of research emphasis on the intersection of equity and transportation resiliency across all university transportation centers (UTCs). This is a major blind spot and needs to be critically addressed in future research.

Conclusion

The recently passed Infrastructure Investment and Jobs Act (2022) and the Justice40 Initiative present significant opportunities to improve resilience in our transportation systems, and consequently in our communities. What is needed now is actionable research that allows transportation planners and policymakers to make sound, evidence-based decisions on resiliency both quickly and confidently. NITC research has made contributions to this goal by engaging multiple disciplines, bringing together diverse communities of practice, and bridging the research-practice divide. Researchers at the six NITC partner universities have undertaken numerous studies funded by other organizations in the area of transportation resiliency, and are poised to apply that expertise to future NITC-funded research.

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The National Institute for Transportation and Communities (NITC) is one of seven U.S. Department of Transportation national university transportation centers. NITC is a program of the Transportation Research and Education Center (TREC) at Portland State University. This PSU-led research partnership also includes the Oregon Institute of Technology, University of Arizona, University of Oregon, University of Texas at Arlington and University of Utah. We pursue our theme — improving mobility of people and goods to build strong communities — through research, education and technology transfer. Learn more at <https://nitc.trec.pdx.edu/>

