

NATURAL HAZARD ADAPTATION AND RESILIENCE IN REGIONAL TRANSPORTATION PLANNING

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INTRODUCTION

Natural hazard adaptation and resilience in transportation planning focuses on how communities can prepare their transportation systems to better withstand and recover from natural disasters such as floods, wildfires, hurricanes, and extreme weather events.

Natural hazards can directly or indirectly affect many aspects of society in potentially disruptive ways. The hazards significantly impact transportation by increasing the damage to infrastructure and disrupting operations across various modes.

A well-functioning transportation system is the lifeblood of our national and local economies, but a vast array of natural disaster events—such as landslides, wildfires, ice storms, and floods—can disrupt the transportation system with little to no warning. Communities are often caught off guard by these disasters. Natural hazard planning considers the potential risks and effects of a natural disaster event so that agencies can implement strategies to increase resiliency.[1]

Transportation agencies including Regional Transportation Planning Organizations (RTPOs) are taking action to make themselves and the transportation systems of their service regions more resilient. RTPOs operate in non-metropolitan areas to conduct outreach to public and local officials and generally provide transportation planning support under contract to state departments of transportation (DOTs).[2] [3]

Hazard Mitigation Planning

Mitigation planning is the foundation for guiding risk reduction investments. These investments build community resilience to future natural hazard events. The local mitigation planning process brings partners together to inform a risk reduction strategy that can be implemented using a wide range of public and private resources. Local mitigation plans demonstrate the commitment to mitigation across multiple sectors, such as infrastructure and economic development, to reduce natural hazard risk.2

Federal Emergency Management Agency (FEMA) requires state, local, tribal and territorial governments to have approved and adopted hazard mitigation plans to be eligible for certain types of non-emergency disaster assistance, including funding for mitigation projects. Jurisdictions must update their hazard mitigation plans and resubmit them for FEMA approval every five years to remain eligible.3

In many states, RTPOs/RPOs help with developing and updating local hazard mitigation plans.

A Governor may establish and designate federally recognized RTPOs to enhance the planning, coordination, and implementation of the long-range statewide transportation plan and STIP, with an emphasis on addressing the needs of nonmetropolitan areas of the State. Whether formally designated or not, regional rural planning partnerships can benefit state and local stakeholders. Sometimes, such organizations are also called Rural Planning Organizations

(RPOs), and some states may refer to them as Regional Planning Affiliations, Regional Transportation Planning Agencies, or simply as general-purpose Councils of Governments or Regional Planning Commissions. Regardless of how they are identified, these organizations typically operate some form of ongoing rural transportation planning program which benefits local communities.

Communities expect transportation agencies to keep the transportation system working efficiently day-to-day, and to return the system to full operations as soon as possible after any disruption. Delays in restoring operations can inflict significant damage to the economy by inhibiting freight movement and citizens access to work and businesses. When the disruptions are extreme and prolonged in duration enough to significantly limit access to medical care and services, some communities have observed a temporary increase in mortality rates.

This issue brief will address the importance of natural hazard adaptation and resilience on transportation projects and regional initiatives in smaller communities.

POLICY FRAMEWORK

As outlined in 23 CFR § 450.206 – "Scope of the statewide and nonmetropolitan transportation planning process", the following ten planning factors need to be considered.[4]

> (1) Support the economic vitality of the United States, the States, metropolitan areas, and nonmetropolitan areas, especially by enabling global competitiveness, productivity, and efficiency.
>
> (2) Increase the safety of the transportation system for motorized and non-motorized users.
>
> (3) Increase the security of the transportation system for motorized and non-motorized users.
>
> (4) Increase accessibility and mobility of people and freight.
>
> (5) Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns.
>
> (6) Enhance the integration and connectivity of the transportation system, across and between modes throughout the State, for people and freight.
>
> (7) Promote efficient system management and operation.

(8) Emphasize the preservation of the existing transportation system.

(9) Improve the resiliency and reliability of the transportation system and reduce or mitigate stormwater impacts of surface transportation; and

(10) Enhance travel and tourism.

Hazard mitigation planning reduces the likelihood of loss of life and property by minimizing the potential impact of disasters. It begins with state, tribal and local governments identifying natural disaster risks and vulnerabilities that are common in their area. The level of risk can be developed using local references to historical instances of events like flooding, tornadoes, hurricanes, wildfires or other extreme weather events. After identifying these risks, communities can develop long-term strategies for protecting people and property from similar future events. Mitigation plans are key to breaking the cycle of disaster, damage, and reconstruction.[5]

The State and Local Mitigation Planning Policy Guides and the Tribal Mitigation Plan Review Guide detail the process to complete an approved mitigation plan under applicable laws and regulations (see 44 Code of Federal Regulations (CFR) Part 201 Mitigation Planning).[6]

Local hazard mitigation plans help identify vulnerabilities that could affect the physical transportation network and demand for transportation if a disaster or incident occurs.

TRANSPORTATION PROJECTS: HAZARD RESILIENCE AND ADAPTATION

The network of transportation infrastructure is a complex system of various connected components like bridges, roads, tunnels, embankments, retaining walls (in case of a highway system), wharfs, cranes, buildings, and utility systems (in case of port facilities). Due to their large physical extent, they are exposed to and vulnerable to natural hazards such as earthquakes, tsunami or landslides.

Experience from past disastrous events illustrates that transportation infrastructure is quite vulnerable due to the lack of redundancy, long repair times, rerouting challenges, overall cascading failures due to interdependencies. Any level of physical damage leading to diminished capacity could be greatly disruptive in terms of safety of life, business disruptions, access to emergency services, utility access, rescue operations and other difficult to anticipate and measure socio-economic impacts. In order to build the capacity of resilience, it is important to recognize and quantify the risks and global losses associated with damage of transportation systems and to establish sufficient risk mitigation strategies. These include, among others,

enhancement of emergency preparedness, strengthening of existing structures and improvement of recovery planning.[7]

Despite proactive resilience planning, events like Hurricane Helene still demonstrate the immense challenges posed by extreme weather. Resilience planning aims to supplement and reinforce transportation systems to withstand both current and anticipated disruptions caused by factors such as extreme weather, rising sea levels, and temperature fluctuations. This forward-thinking approach helps ensure the continued functionality, safety, and efficiency of transportation networks under adverse conditions.

Nevertheless, Hurricane Helene in 2024 devastated communities across the Southern United States, with North Carolina and Tennessee bearing the brunt of the destruction. The storm has ominously been dubbed the "Katrina of the Mountains," highlighting the depth of the damage and disruption. While repairs are ongoing and recovery efforts are in motion, life for many residents remains in limbo until they can return to work and local businesses, especially those dependent on tourism—can reopen.[8]

CASE STUDIES

CASE STUDY #1: IMPACT OF FLOODING EVENTS- COUNTY NATURAL HAZARD MITIGATION PLANS AND EAST CENTRAL IOWA PRIORITY CLIMATE ACTION PLAN; EAST CENTRAL IOWA COUNCIL OF GOVERNMENTS (ECICOG) IOWA.

ECICOG serves six counties in Eastern Iowa with a total population of 500,000 residents. The region is characterized by two urban areas with numerous small towns and rural countryside. The Priority Climate Action Plan (PCAP) was prepared by ECICOG with direction from the East Central Iowa Climate Pollution Reduction Grant Program (CPRG) Technical Advisory Committee. PCAP was prepared with financial support from the Environmental Protection Agency (EPA) grant and establishes eligibility for cities and counties in the region to apply for implementation funding. Some examples of implementation projects include wastewater treatment facility improvements, public building energy efficiency improvements etc.,[9]

The PCAP along with the individual County natural hazard mitigation plans considered major hazard events in developing priorities for future implementation. Many East Central Iowa communities have a history of flood disasters. The planning processes represented another step in the decades-long initiative to reduce vulnerability to the risks posed by extreme weather

events such as flooding. Outreach and engagement processes for both these plans included webinars, multiple surveys, project webpage, and meetings.

Priorities for implementing flood related projects included efforts to protect critical infrastructure including redesigning roadways and bridges to lessen occurrence/impact of flooding, replacing and repairing bridges damaged by flash flooding, and enhancement of local natural hazard mitigation plans.[10]

The table below shows a summary of potential flood vulnerabilities considered for several sectors including people, economy, built environment, infrastructure, critical facilities, and climate that were considered in developing the county natural hazard mitigation plans.

Sector	Vulnerabilities
People	• Residents within the floodplain may need to relocate • Residents with decreased mobility or resources may have trouble evacuating • Increased exposure to harmful waterborne pathogens
Economic	• Business closures and damages may have significant impacts • Agricultural losses; crop and livestock • Closed roads and railways impact the transportation of goods
Built Environment	• Buildings may be damaged
Infrastructure	• Damages to roadways and railways
Critical Facilities	• Facilities (critical and wastewater) within the flood plain are especially at risk • Disruption to health services
Climate	• Change in seasonal and annual precipitation averages will likely increase the frequency and magnitude of flood events

CASE STUDY #2: COMMUNITY RESILIENCY PARTNERSHIP (CRP); ANDROSCOGGIN VALLEY COUNCIL OF GOVERNMENTS (AVCOG)

AVCOG region covers over 4,200 square miles of forested mountains and fields carved by pristine lakes and rivers in Maine. The Twin Cities of Lewiston and Auburn, located in the southern portion of the district, share a combined population of 59,000 people, making it the largest population center in the region. The remaining population of 137,000 is scattered across 75 small towns and townships.

The Community Resilience Partnership (CRP) is a program of the State of Maine. Through grants and other direct support, the Community Resilience Partnership assists communities in becoming more resilient to impacts from extreme storms, flooding, rising sea levels, public health events, and more. Over 200 communities throughout Maine are participating in this program. Municipal governments, Tribal governments, and unorganized territories in Maine are all eligible to enroll in CRP.[11]

As part of CRP, AVCOG has been selected as one of the service providers to provide capacity to local communities participating in the partnership beyond enrollment and pursuing a Community Action Grant and other funding opportunities.[12]

Enrolled communities can access state-funded Community Action Grants, along with technical assistance. This technical assistance can include help with coordinating projects, and assistance with applying for a myriad of other state, federal, and philanthropic grants for eligible resiliency projects. The Community Action Grants fund projects that align with 72 resiliency actions including embracing the future of transportation, modernizing buildings, transitioning energy sources, and protecting lands and waters. No match is required for these eligible projects.

Fifteen out of seventy-two resiliency actions are transportation focused efforts. Awards are $75,000 for individual community projects, or up to $175,000 when two to five communities' partner on a project.

SUMMARY

The U.S. transportation sector faces significant challenges from increased frequency of extreme weather events, higher temperatures, rising sea levels, and precipitation variability. These impacts threaten transportation infrastructure, disrupt supply chains, and impose economic and social costs on users of these systems.

Building upon and integrating resilience into existing decision-making processes allows for a more comprehensive and effective transition to state of constant readiness. By taking steps to anticipate and mitigate risks during the planning processes protects investments, reduces maintenance costs, enhances safety, and supports rapid recovery when disaster strikes.

RESOURCES

- Volpe RDR tool: https://volpeusdot.github.io/RDR-Public/
- Integrating Natural Hazard Resilience into the Transportation Planning Process: https://www.fhwa.dot.gov/environment/sustainability/resilience/publications/Integrating_Natural_Hazard_Resilience_into_Transportation_Planning%20Handbook.pdf
- Integrating Resilience into the Transportation Planning Process: White Paper on Literature Review Findings: https://www.fhwa.dot.gov/environment/sustainability/resilience/ongoing_and_current_research/planning/integrating_resilience.cfm
- Strengthening Transit Systems through a Resilience Planning Framework: https://www.volpe.dot.gov/news/strengthening-transit-systems-through-resilience-planning-framework

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