MARC Natural Hazard Transportation Risk Assessment Project

Project Documentation

prepared for

Mid-America Regional Council

prepared by

Cambridge Systematics, Inc.

with

Hoxie Collective

Burns & McDonnell

April 30, 2025

www.camsys.com

MARC Natural Hazard Transportation Risk Assessment Project

Project Documentation

prepared for

Mid-America Regional Council

prepared by

Cambridge Systematics, Inc.
200 River's Edge, Suite 420
Medford, MA 02155

with

Hoxie Collective
Burns & McDonnell

date

April 30, 2025

Table of Contents

1.0 Project Overview and Documentation

This report documents the activities of the Mid-America Regional Council (MARC) project with Cambridge Systematics team to produce a concept and scope for a Natural Hazard Transportation Risk Assessment. The project spanned the time period of July 2024 through April 2025.

The following project activities are documented in this report:

- Section 2: Stakeholder and Community Engagement, including Steering Committee meetings and Focus Group meetings and Community Survey.
- Section 3: PROTECT Grant Application Narrative.
- Section 4: Factors for Criticality Determination.

2.0 Stakeholder and Community Engagement

The project team actively engaged with an array of groups including a Steering Committee comprised of regional City and County staff from health, planning, and public works departments, Focus Group meetings with community-based organizations and non profits across the region that serve the region's most vulnerable populations, and interested individuals who provided input on a public survey. The process of engagement focused on receiving input from perspectives of both the administrative and operational point of view, as well as the user experience, to create a holistic understanding of the region's transportation network vulnerabilities to extreme weather events.

This engagement process also met and exceeded the requirements of standard transportation grant application processes. Mid-America Regional Council plans to utilize the feedback garnered during this process to inform future grant applications and other targeted initiatives that can help guide regional decision-making on infrastructure investments and resilience improvements.

Following is a summary of Steering Committee meetings, followed by Focus Group meetings.

2.1 Steering Committee Meetings

Two Steering Committee meetings were held during this process. The Steering Committee served as a sounding board for the framework of the Resilience Improvement Plan and assisted in defining not only what resilience means for their communities, but also providing recommendations for the overarching goals of the Plan. Each meeting provided the opportunity for the Steering Committee to receive information on the progress of the Plan as well as providing their input through guided dialogue to define the Plan's goals and desired outcomes. The dates of the Steering Committee meetings were:

- November 5, 2024
- April 21, 2025

2.1.1 Steering Committee Meeting 1

November 5, 2024

In attendance:

- ***Leroy Koehn*** *(District Engineer for District 1, NE KS)*
- ***Michele Silsbee*** *(Deputy City Manager, Osawatomie, KS)*
- ***Shawn Gotfredson*** *(Supervisory Civil Engineer, Overland Park, KS)*
- ***Michael Park*** *(Director of Public Works, Lee's Summit, MO)*
- ***Gunner Hand*** *(Director of Planning and Design, Unified Government, KS)*
- ***Stephen Lachky*** *(Community Development Director, Parkville, MO)*
- ***Alyssa Marcy*** *(Long-Range Planner, Unified Government, KS)*
- ***Sarah Shafer*** *(CMIP Program Manager, Unified Government, KS)*
- ***Andy Savastino*** *(Director of Environmental Quality Health Department of KCMO)*
- ***Bryce Shields*** *(Community Engagement and Affairs Partner, KCATA)*
- ***Wes Minder (****County Administrator, Platte County, MO)*
- ***Karen Clawson*** *(Principal Planner/Air Quality Program Manager, MARC)*
- ***Tom Jacobs*** *(Director, Environmental Programs, MARC)*
- ***Ryan Umberger*** *(Planner II, MARC)*

Team members: ***Richard Denbow*** *(Analyst Sr III, Cambridge Systematics, Suseel Indrakanti (Senior Associate, Cambridge Systematics),* ***Yingfei Huang*** *(Transportation Analyst, Cambridge Systematics),* ***Lily Lowder*** *(Associate Transportation Analyst, Cambridge Systematics),* ***Lisa K. Hummel*** *(Project Manager, Burns & McDonnell),* ***Kylie Clark*** *(Urban Planner, Burns & McDonnell),* ***Christina Hoxie*** *(Founder and Planner, Hoxie Collective),* ***Tianna Morton*** *(Community Planner, Hoxie Collective)*

The first Steering Committee meeting was held for the purpose of identifying vulnerabilities in the transportation network to ultimately build a framework for a more resilient transportation network that can help the community recover from adverse events. The committee's role is to assist in developing tools for decision making that will ultimately help the Mid-America Regional Council (MARC) to improve the longevity of the region's transportation system and make the Resilient Improvement Plan more competitive for federal funding. During this meeting, the Steering Committee was informed about the project scope and transportation resilience concepts and frameworks to provide feedback on how their agencies work on resilience and their priority considerations. Finally, the committee reviewed the engagement plan and provided feedback on specific community-based organizations that should be considered for the Focus Group meetings.

When asked, **"*What does transportation resilience look like in your community?"***, the challenges outlined include addressing flood risks, especially for railroads and major roads in floodplains. The need for resiliency in all forms of transportation including systems of communication were highlighted, as well as the impact of climate change on transportation. The importance of education and public information about transportation closures and the need for a top-down approach to addressing resiliency was discussed. There is a need for equity in addressing resiliency, particularly in areas with limited access to transportation and where physical infrastructure needs maintenance and modernization.

When asked, **"*How is your organization preparing to respond to natural disasters, extreme weather events, and other hazards?*"**, the committee drew significant attention to the necessity of a regional strategy. They stressed the importance of clean and functional water and sewer systems as a priority to ensure community resilience. They talked about the real threat of cyber-attacks, especially towards public transportation systems and the current communications system that relays critical information to the public. Further, understanding the demographics of vulnerable communities is crucial to developing a resilience plan

that best addresses the needs of each community. Environmental Justice advocacy and talking to elected officials can help prioritize the need. Lastly, it was suggested that resiliency should be integrated into the way of building and the maintenance of the built environment as other extreme weather factors worsen over time. To address resiliency, it requires considering all impacts to a community, addressing critical lifelines to transportation systems, and bolstering the funding network.

The committee defined a resilient transportation system as:

- **Flexible**: Users can take a different route or mode (such as transit instead of driving) if one is impacted.
- **Equitable**: One group is not burdened by climate and weather-related hazards impacting their transportation system such as extreme heat or roadway flooding.
- **Robust**: Roads, bridges, and other infrastructure is designed and maintained to resist extreme weather events and climate hazards.
- **Proactive**: The transportation system utilizes smart technology and community partnerships to better predict and communicate potential transportation disruptors to help mobility rebound more quickly.
- **Community-Focused**: Balances community scale needs with a regional vision of resilience.

The committee defined their goals for the Resilience Improvement Plan as:

- **Secure function of and access to necessities:**
  - Communication
  - Clean water
  - Food
  - Shelter
- **Create a community communication platform**
- Conduct a **comprehensive risk assessment** (extreme weather and critical transportation infrastructure)
- **Prioritize assets** that are critical to the use and function of transportation
- **Identify near-term investments** required for maintenance or design of new components based on findings of priority assets.
- **Create an adaptation strategy that is proactive and adaptive** to time and weather changes.
- **Create a plan that integrates MARC resources and can be utilized by each jurisdiction** to improve funding and perseverance.

2.1.2 Steering Committee Meeting 2

April 21, 2025

In attendance:

***Bobby Evans**, (Principal Planner, MARC), **Bryce Shields** (Innovations and Performance Lead, KCATA)**, Evelyn Dubey** (Community Resilience Coordinator, Johnson County Department of Health and Environment), **Gunnar Hand** (Director of Planning and Urban Design, Unified Government of Wyandotte County), **Michael Park** (Director of Public Works, Lees Summit), **Alyssa Marcy** (Long Range Planner, Unified Government of Wyandotte County), **Allison Smith** (Carbon Reduction Program Manager, Kansas), **Stephen Lachy** (City of Parkville), **Kristofer Finger** (Unified Government of Wyandotte County), **Devin Tiebout** (Public Works, Unified Government of Wyandotte County), **Tom Jacobs** (Director, Environmental Programs, MARC), **Ryan Umberger** (Planner II, MARC)*

Team members: ***Richard Denbow*** *(Analyst Sr III, Cambridge Systematics,* ***Suseel Indrakanti*** *(Senior Associate, Cambridge Systematics),* ***Lily Lowder*** *(Associate Transportation Analyst, Cambridge Systematics),* ***Christina Hoxie*** *(Founder and Planner, Hoxie Collective),* ***Tianna Morton*** *(Community Planner, Hoxie Collective)*

The second Steering Committee meeting focused on refining the direction of the Transportation Resilience Plan through updates on the draft PROTECT Grant application developed, feedback on the framework for the draft proposal, and discussion around critical infrastructure prioritization. This meeting also covered insights from the first Steering Committee meeting, survey results, and focus group feedback.

The Steering Committee discussed the balance between data-driven travel-demand models and on-the-ground insights from emergency managers (represented by Public Works). While models are helpful in anticipating climate-related disruptions, emergency managers play a key role in vetting feasible detours and routes in real-time scenarios. In this case, exploring how to utilize trail and sidewalk systems for emergency vehicle access was discussed.

The assets primarily identified as critical infrastructure included bridges– especially for river-crossing communities in Kansas City, Kansas and Parkville, where residents use that particular route to reach employment centers, and especially when the route is a one-way in and one-way out. Redundancy and adaptive capacity emerged as essential resilience criteria. The Committee highlighted challenges in applying resilience principles to low-density and topographically constrained areas.

There was strong interest in developing actionable tools to avoid plans becoming unused. The Committee expressed concerns about creating recommendations without adequate funding or other stakeholder buy-in, suggesting a tiered approach to prioritization within the framework.

Finally, the Committee expressed support for a Transportation Resilience Academy with short, engaging videos and workshops tailored to decision-makers, planning officials, developers, and Public Works staff. Topics of interest included stimulating demand for transit, land use and transit integration, asset management, displacement mitigation, and incorporating vulnerability assessments into planning.

2.2 Focus Groups

The process of Focus Group selection started with mapping socially vulnerable census tracts in the MARC region and after conferring with advisors, the team contacted Community-based organizations that span rural, suburban, and urban areas of the region.

The team met with **New Growth Transit** (Cass Co), **The Whole Person** (Cass, Clay, Jackson, Platte, Johnson, Leavenworth, and Wyandotte Counties), **Crosslines Community Outreach** (Wyandotte Co), **BikeWalkKC** (Metro KC), **Heartstrings** (Olathe + Metro KC), **KC Chapter National Federation of Blind** (KCMO)

This group revealed widespread concern about the accessibility, reliability, and equity of regional transit services, particularly for rural areas, people with disabilities, and low-income or transit--dependent residents. Participants across organizations emphasized that current transit offerings fall far short of meeting demand, especially for essential trips like grocery shopping, employment, and medical appointments.

Severe gaps in ADA-compliant services, inconsistent communication, and limited coverage during extreme weather events leave many without safe, reliable transportation. Each of these organizations stressed the need for expanded on-demand options, better coordination between service providers, improved communication tools tailored to sensory and language access needs, and more inclusive planning processes. Across the board, there was a call for funding structures that prioritize operational support, service frequency, and community-identified needs in addition to more safer and more comfortable stations and clearer consistent communication for all languages, hearing, and seeing levels.

2.2.1 New Growth Transit

Attendees:
Christina Hoxie (Hoxie Collective)
Ryan Umberger and Cy Splichal, MARC (Client)
Taraneh Ardalan (Cambridge Systematics)

Kelly Ast and staff members Stevie Siegismund and Kenney Hutchison

New Growth Transit, an affiliate of West Central Missouri Community Action Agency, is a network of volunteer drivers that provides free rides for residents in west central Missouri. New Growth Transit coordinates and provides rides for doctor appointments, grocery stores, employment, banking, civic events, and many other community resources. The group highlighted that transit demand far exceeds current capacity, particularly in Cass County, where needs are estimated to be ten times higher than what is currently available. There are significant gaps in ADA accessibility, with no wheelchair-accessible services and few alternatives. Transportation options are especially limited for shift workers who require early morning, late night, and weekend service. While medical and employment trips are often prioritized, there is a clear need to support essential errands such as grocery access. Participants also identified a lack of disaster response planning for transportation to FEMA shelters and temperature-controlled facilities. Winter weather leads to more service cancellations, while extreme heat increases demand without corresponding services like cooling shelter access. Funding models were criticized for prioritizing vehicles over flexible operational support. Additionally, recent census updates have left some suburban and rural areas without transit coverage. Stakeholders recommended that trip frequency, not just unique riders, be used to evaluate system performance and called for expanded microtransit, volunteer-based transit, and strategic partnerships with ride-hailing services.

> **“There are severe accessibility gaps for ADA/handicapped riders. While New Growth Transit can minimally accommodate individuals with walkers, service dogs, and oxygen tanks, they cannot transport individuals in wheelchairs due to lack of vehicles equipped for this.”**

2.2.2 Whole Person

Attendees:
Christina Hoxie (Hoxie Collective)
Cy Splichal, MARC (Client)
Antoinette Avorgbedor (Cambridge Systematics)

Clark Corogenes (Deaf) - CC
Halley Korff - HK
ASL Interpreter - Jasmine Velasco

The Whole Person serves multiple counties across Missouri and Kansas, with Missouri counties including Cass, Clay, Jackson, and Platte. The Whole Person provides a range of services for those with varied physical, sensory, and mental abilities. Additionally, the organization connects people with varied abilities to the resources they need by supporting independent choice and advocating for positive change in the community. The participants emphasized that communication barriers in the transportation system disproportionately affect deaf, deaf-blind, blind, and low-vision individuals. Many services still rely on voice calls, which are inaccessible to these communities, and there is a lack of features like real-time text alerts, captioned announcements, or visual signage. Navigation apps were described as overly complex and difficult to use with screen readers or tactile interfaces. Rural transit options remain underutilized, in part due to a lack of familiarity, and service gaps– especially east of Jackson County– further limit access. Weather poses additional barriers, as snow and ice make it unsafe to reach bus stops or crosswalks. Participants called for covered bus stops, improved real-time updates, and better snow removal. Service reliability issues, including penalties for missed paratransit rides often caused by driver error, or lack of communication, raise equity concerns. Stronger community engagement, especially in partnership with disability organizations, and investments in accessible technology and in-person services were cited as key to improving outcomes for disabled riders.

> **"The number one challenge is communication and technology. For deaf-blind/ deaf-low vision individuals, they often use their video phone to call and book a ride, or an app, text message, email, to communicate with transportation services. Often, transportation services will call a voice number, which deaf or deaf-blind individuals cannot answer. This could be to notify of a delay, schedule change, or cancellation, but because if it's not sent to a text or video line, they miss the message."**

2.2.3 Heartstrings

Attendees:
Christina Hoxie (Hoxie Collective)
Ryan Umberger and Cy Splichal, MARC (Client)
Antoinette Avorgbedor (Cambridge Systematics)

Heartstrings Staff - HS
Bunny Higgins - ED
Rebecca Hayes - Director of Operations
Erica - team lead and coordinates transportation at the end of each day

Community Members
Doug Leibbrandt - DL
Sharon Tompkins - ST

Heartstrings is an Employment Service for adults with intellectual and developmental disabilities who desire an employment opportunity where community interaction is a significant portion of their day. Healthy lifestyle choices and volunteerism are important components. They volunteer in the community, providing nursing home visits and meal delivery for Meals on Wheels. The staff and community members described persistent issues with poor communication and coordination among providers like RideKC and ZTrip, leading to delayed or missed rides, last-minute changes, and confusion around scheduling. Riders frequently experience unsafe or unsheltered wait times and limited assistance when boarding or existing vehicles. In many cases, staff members have stepped in to personally transport clients when systems fail. Individuals with disabilities and older adults often depend on door-to-door services, as navigating fixed-route systems can be difficult or

impossible. Transportation failures can result in missed work, medical appointments, or job training programs–particularly damaging for those participating in workforce development initiatives like Heartstrings. Winter weather intensifies these vulnerabilities, and there was a clear call for improved protocols and contingency plans. Further, low wages and lack of benefits for drivers are a root cause of high turnover and inconsistent service quality. Consistent driver training, fair compensation, and unified service standards across RideKC and ZTrip were recommended as immediate priorities to address.

> **"All the individuals that come to Heartstrings are employees and they are learning punctuality and other skills. Late arrival messes up the scheduling of tasks for the employee. The transportation system is making it hard for us to teach these skills to our people to be productive members of society."**

2.2.4 CrossLines Community Outreach + BikeWalkKC

Attendees:
Christina Hoxie (Hoxie Collective)
Ryan Umberger, MARC (Client)

Cross-Lines Staff - CL
Hannah - Community Market, Kitchen, Shower
Katie - Community Outreach - Utility Assistance, Benefits, Housing/Shelter
Jess - Occupational Therapy Student (Field Project)

Bike Walk KC Staff - BW
Avery - Community Organizer

Community Members
Jeff - Market Volunteer
Marlen - Community Correction Officer for UG, teaches youth while they are incarcerated

Crosslines Community Outreach provides people in the Kansas City area affected by poverty with services and opportunities that encourage self-confidence, meet the needs of today, and provide tools for future self-sufficiency. They operate various programs to assist in housing stabilization, hunger relief, and cold weather relief. **BikeWalkKC** is an advocacy-driven non-profit in Kansas City that works to redefine Kansas City's streets as places for people to build a culture of active living through education, training, community planning, and operations of its bike share program.

These two groups made up of staff members and community members emphasized that bus services are infrequent and unreliable, making them difficult to use for everyday needs. Communication about transit services is minimal or hard to understand, with specific needs for language interpretation, visual information for deaf individuals, and text-to-voice options for blind riders. The lack of route maps and scheduled information at bus stops contributes to confusion and frustration. Participants urged the improvement of pedestrian infrastructure, including safer crossings and connected sidewalks. Transit investments should be prioritized in areas of highest need, including food deserts, communities with high numbers of seniors and people with disabilities, and zero-car households. There was strong support for more localized, short-route circulator options using smaller vehicles that reliably connect to regional transit lines. Backup transportation plans using on-demand services were recommended for use during weather events or service disruptions, along with a focus on door-to-door service during extreme conditions and for vulnerable riders.

"My deaf sister navigates public transit everyday to get to her job at KU Med. Her family provides the backup she needs for rides when the bus becomes unpredictable."

2.2.5 National Federation of the Blind - KC Chapter

Attendees:
Christina Hoxie (Hoxie Collective)
Cy Splichal, MARC (client)
Tianna Morton (Hoxie Collective)

Svetlana Ehlers, National Federation of the Blind, KC Chapter President (joined via zoom), Linda, Sarah, Daniel, Ben, Willogene Patterson, Nicole Stevens, Serena, Ben Blight, Christine Jones, Payton Joes, Dave Hutchins

**Some attendees arrived via Z-Trip bus*

The National Federation of the Blind KC Chapter is a 501c(3) nonprofit organization made up of blind people of all ages, their families and friends. They are comprised of strong local chapters and divisions, and well-trained leaders that help newly blind people adjust to vision loss and promote the full participation and integration of blind people in our communities. They bring their collective experiences together and volunteer time to impact change at the state and national level. This group identified the discontinuation of Metro Flex services and cuts to critical routes have reduced access to key destinations like grocery stores and medical facilities, making existing transportation options unreliable and inefficient. IRIS and other rideshare options were reported as unaffordable, inaccessible, or unsafe, while paratransit services were frequently described as inconsistent. Poor pedestrian infrastructure compounds these issues, making it dangerous for users with mobility aids or guide dogs to reach transit stops. Participants raised concerns about poor communication, including lack of notification for service changes and minimal opportunities for public input. Emergency preparedness for transportation-dependent individuals remains inadequate, with little coordination between transit agencies and emergency services. Participants expressed frustration over the misallocation of public funds and called for increased investment, cross-agency accountability, and planning processes that directly incorporate feedback from blind and low-vision riders.

"With the IRIS system, a lot of us don't have the ability to get there in time to catch those– if we can even find it based on the map. Problematic on a good day. On a bad weather day, it's not even an option.

2.3 Survey

There were 181 survey respondents.

Over half of the respondents use a personal or work vehicle to get around and otherwise use rideshare or not make the trip if not available.

Most respondents have experienced challenges getting around their community during severe winter weather. Other challenges can be from severe thunderstorms, flooding, and extreme heat. These challenges are experienced rarely or sometimes, with areas most notably in the Northland and Kansas City as city-wide areas of impact especially in getting to work, store, or social/family.

In times of disruptions, most respondents find it difficult to find an alternate mode or route and rate their community as either somewhat unprepared or somewhat prepared.

Respondents find their main mode of transit (likely vehicle) to be prepared for weather disruptions but want to see better equipped infrastructure and additional travel options and connections.

Other comments from the survey are broken down by category of comment with a direct quote.

Public Transit: Expand streetcar routes, improve bus frequency/reliability, and provide affordable transit for underserved areas and vulnerable populations.

> **"More stops for public transportation not on a general route."**

Infrastructure: Repair aging roads/bridges, incorporate green infrastructure, improve traffic signals, and enhance snow/ice removal.

> **"It doesn't seem feasible, long-term, to continue to put money into infrastructure that supports cars. What does seem feasible and sustainable is shifting away from cars, and putting money into quality public transportation, this includes how we access food."**

Active Transportation: Increase bike lanes, sidewalks, and tree cover to promote walking, biking, and scootering.

> **"There needs to be a greater investment in multimodal options and those options in turn should be more prominently considered in disaster preparation and recovery."**

Communications: Simplify communication, use accessible platforms, and conduct outreach at community hubs.

> **"When a call is being made to a ride share company, or we use apps to book rides, the hold times need to be a lot less longer, and the apps need to be more accessible for people like us with visual impairments."**

Emergency Preparedness: Improve accident response and transit options during severe weather, focusing on non-drivers.

> **"When the weather gets extreme, I wish I could take public transportation, but the system does not allow me to get to work easily"**

Equity & Sustainability: Ensure affordable, accessible transit and prioritize green, resilient designs

> **"More affordable transportation services for older adults and people with disabilities who no longer drive. More options available for residents who live in smaller communities where buses may not be available"**

3.0 PROTECT Grant Application Narrative

Following is the narrative developed for the PROTECT Grant application. The NOFO was rescinded on February 11, 2025.

3.1 Basic Project Information

3.1.1 Scope of Proposed Work

MARC continues to take an integrated and comprehensive approach to regional transportation resilience and therefore proposes Transportation Resiliency KC to address various regional priorities and outcomes. Through the USDOT PROTECT program, Transportation Resiliency KC will advance regional resilience planning by developing a Resilience Improvement Plan, expanding data-driven scenario modeling capabilities, and strengthening technical capacity for local jurisdictions.

1. Conducting meaningful and effective **Stakeholder Engagement and Resilience Communications Plan.**

2. Conduct a **Risk-based Vulnerability Assessment** of MARC's regional transportation infrastructure.

3. Understanding the **Community and Network-level Impacts of Disruptions** to regional transportation infrastructure.

4. Framework for **Resilience-Informed Planning and Investment** for Kansas City Region.

5. Updates to **Regional Resilient Stormwater Management** guidance and Developing **Nature-based Solutions.**

6. **Action Plan** for Transportation Resiliency KC **Implementation.**

The **Transportation Resilience Improvement Plan (TRIP) will create a risk assessment framework** for identifying priority transportation and infrastructure projects that improve regional resiliency by:

- Aligning resilience planning efforts with local, regional, and state goals;
- Identifying vulnerabilities and risks in the transportation network by corridor and asset related to extreme weather;
- Identifying communities that are especially vulnerable to the transportation impacts of extreme weather events;
- Developing prioritized strategies leveraging nature-based solutions to mitigate risks and enhance long-term system resilience; and
- Integrating resilience factors into MARC's project prioritization process for receiving federal funding.

The project will **expand data sets and tools needed to run disruption scenarios** related to how an extreme weather event could impact the transportation network by:

- Enhancing existing data tools to model and analyze the impacts of extreme weather events (e.g., flooding, drought, extreme heat) on the transportation system;
- Conducting scenario-based assessments to evaluate network disruptions, response strategies, and long-term adaptation measures;
- Utilizing big data to conduct link-specific analysis to determine how improving a specific asset or corridor's resiliency would improve the overall system performance and continuity;

- Using tools to conduct a stranded zones analysis at the community level; and
- Providing actionable insights to inform infrastructure investments and emergency preparedness efforts.

Funding will support **technical capacity building efforts to educate local jurisdictions on how to incorporate resiliency** into transportation planning and project development by:

- Sharing evidence-based best practices for incorporating resilience into transportation planning, design, and construction by leveraging a diverse group of experts;
- Facilitating training sessions, workshops, and technical assistance to improve climate adaptation strategies;
- Developing resource guides and decision-support tools to help communities proactively address climate-related transportation challenges; and
- Educating local jurisdictions on the updating project scoring and prioritization process for advancing resilience projects and programs in the region.

By combining a structured risk assessment framework with scenario-driven analysis and robust public and stakeholder engagement, this project will provide communities with the tools, strategies, and collaborative forum needed to proactively address disruptive transportation challenges and enhance regional resilience.

3.2 Merit Criteria

3.2.1 Criterion #2: Planning Activity Approach

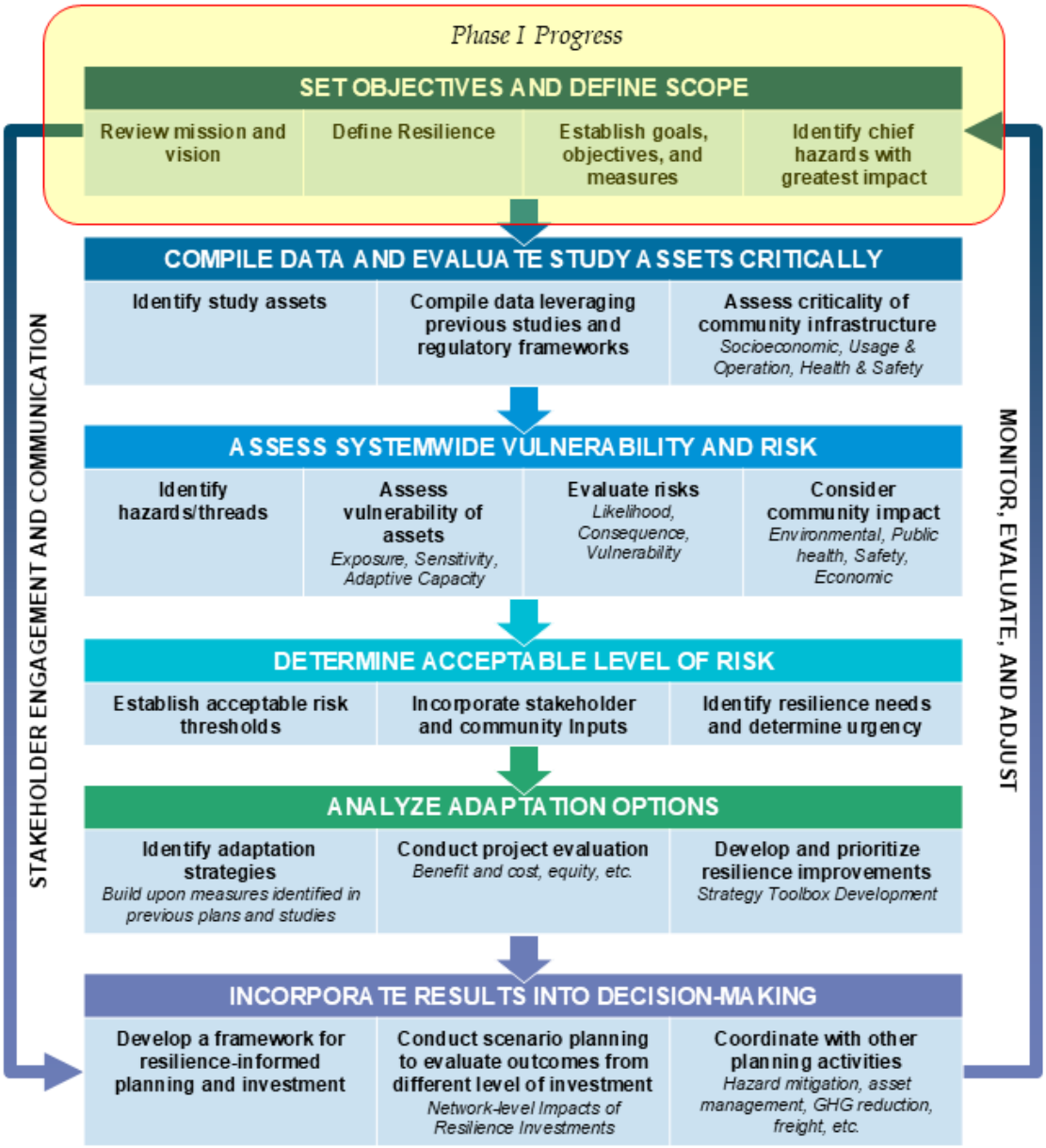
Types of Planning Activity Addressed:

☒Resilience Improvement Plan ☒Resilience Planning, Predesign, Design, or Data Tools

☒Technical Capacity Building ☒Evacuation Planning and Preparation

This project will utilize a comprehensive, data-driven approach to strengthening transportation resilience in the region. By assessing vulnerabilities, analyzing network disruptions, and integrating resilience into long-term planning and investment, the project will provide a framework for collaborative, proactive adaptation to extreme weather events.

MARC has been configuring a resilience framework (Figure AA) through our Phase I scoping effort that addresses PROTECT guidance and requirements outlined in section 176(c) of title 23, United States Code (23 U.S.C.) with specific steps to evaluate multimodal transportation infrastructure, assessing risk, evaluating what is an acceptable level of risk, and estimating benefit and cost of the resiliency improvements. The framework was developed through review of industry best practices and transportation agencies' interviews.



Risk-Based Vulnerability Assessment of Regional Transportation Infrastructure

The foundation of this effort is a risk-based vulnerability assessment, which will systematically evaluate the region's transportation infrastructure to identify high-risk transportation corridors, modes, and communities to prioritize for resiliency interventions. This assessment will include the following:

- **Priority Hazard Identification:** MARC will identify threats such as natural disasters and extreme weather events (such as heat waves, flooding, snow storms, and tornadoes) that could disrupt the transportation system. The project team will use a combination of geospatial analysis, data review, and stakeholder engagement to better understand threats to the region's transportation resiliency. For example, in addition to climate datasets, the team will utilize the hazards identified in the community survey issued by MARC as part of their prior resiliency work (Figure X).

- **Community and Stakeholder Engagement:** In 2020, MARC led the development of the Regional Multi-Hazard Mitigation Plan with the goal of safeguarding lives, preserving property and infrastructure, and building resilient communities. As part of the 2025 Plan Update, MARC is seeking public input from the residents on their hazard-related experiences. The MARC Transportation Resilience Improvement Plan will leverage the regional hazard mitigation plan to identify priority hazards – both current and future – to demonstrate a systemic approach to risk assessment.

- **Asset Inventory and Characterization:** In partnership with relevant stakeholders and peer agencies, MARC will utilize geospatial data to catalog and prioritize transportation assets based on their impact within the community's mobility network. To the extent possible, this assessment will include information about each asset's location, condition, age, and exposure to potential hazards.

- **Vulnerability Assessment:** The asset inventory and hazard identification data will be overlayed in a Geographic Information Systems (GIS) map to identify which assets, corridors, and neighborhoods are most vulnerable to extreme weather events. The project team will determine the assets' vulnerability based on its exposure to stressors, sensitivity based on its geometric design or condition, and ability to recover quickly after an event, consistent with FHWA's Vulnerability Assessment and Adaptation Framework. The consequence value is based off of the owner costs that MARC and its partner agencies would face to maintain, rehabilitate, or replace an asset in the event of a hazard and user costs including travel time.

- **Risk Assessment:** Using a tiered system for evaluating the highest priority threats by likelihood, consequence, and vulnerability, the project team will use quantitative and monetized methodologies to estimate the potential economic, operational, and social costs of infrastructure failures. Incorporating risk means including the probability of the hazard event occurring and the consequences that may result from that hazard should it occur. This assessment would consider, for example, which neighborhoods are most susceptible to the mobility impacts of hazards due to reduced rates of vehicle ownership, limited evacuation routes, high rates of passenger or freight traffic volumes, or connectivity to key services such as medical care or commercial centers. Identifying and understanding risk will help MARC make informed decisions about the costs and benefits of potential adaptation and mitigation options.

- **Recommendations:** By integrating these analyses, the project will generate data-driven recommendations to help local jurisdictions prioritize resilience investments and policy actions. The findings will support decision-making on infrastructure upgrades, emergency preparedness measures, and long-term adaptation strategies, ensuring that transportation systems remain functional and equitable in the face of extreme weather events. The recommendations will be tailored to local conditions, providing actionable steps that align with existing planning efforts while addressing the most pressing climate vulnerabilities. The recommendations framework will use a multi-criteria analysis – consistent with industry best practices – such as the triple bottom-line approach that considers economic, social, and environmental considerations into making decisions that improve the overall sustainability of regions.

Framework for Resilience-Informed Planning and Investment

The project will develop a structured framework to integrate resilience considerations into MARC's project prioritization process. This framework will help determine which projects submitted by local jurisdictions merit funding based on their resilience benefits, ensuring that investments are directed toward the most impactful and forward-looking solutions. Key components include:

- **Adaptation Strategy Toolkit:** As part of the recommendations resulting from the risk and vulnerability assessment, the project team will develop a toolkit that outlines potential resilience strategies and how to select the optimal intervention. These strategies will be organized into policy, planning, infrastructure design and construction, operational & procedural types. This toolkit will draw upon MARC's previous work such as green stormwater design, a stakeholder-driven and proactive approach to regional resiliency. This toolkit will be incorporated into the larger integration of resilience at various functional areas to support MARC's local partners in project planning and development.

- **Connections to Regional and Corridor Planning:** The framework will ensure that resilience strategies are not treated as standalone initiatives but are embedded within regional transportation, land use, and economic development plans. This effort aims to improve linkages between rural areas and regional job centers, medical facilities, and essential services to ensure continuity during disruptions, as well as support infrastructure investments in key rural corridors. By embedding rural resilience into regional and corridor planning, our approach ensures that rural communities are not left behind and that regional transportation systems remain adaptive, connected, and capable of withstanding future disruptions.

- **Multimodal Network:** The asset inventory will be multimodal, encompassing traffic volume on different modes, mobility needs for families and individuals with limited transportation options, and how vulnerable specific modes might be. For example, in our initial community engagement, residents shared that extremely cold weather made waiting for the bus less comfortable and biking or walking more dangerous.

- **Freight Connectivity and Economic Opportunities:** The MARC region is home to several roadways on the FHWA Primary Highway Freight System. Due to its importance to regional, bi-state, and national freight supply chains, MARC is concurrently undertaking a Freight Resiliency Study to minimize the economic impact of disruptive events. As part of its stakeholder engagement for the TRIP, MARC will be collaborating with commercial centers, economic development agencies, and industry partners in the area including Port KC.

- **Agency Integration:** For this purpose, MARC proposes to create a **resiliency flow chart** to illustrate how to integrate resilience into MARC's project planning and management process, which includes potential steps to be taken in planning, project development and environmental review, design and engineering, systems management, operations, maintenance, and asset management.

- **Project Prioritization:** The TRIP will also produce a **project prioritization framework** that guides the MPO in evaluating and ranking proposed projects from local jurisdictions based on their ability to improve resilience, mitigate risk, and enhance community adaptation to climate threats. The framework will establish clear criteria for prioritizing resilience improvements using both the quantitative outputs from the risk-based vulnerability assessment and multi-criteria evaluation for integrating agency priorities (such as asset criticality). This framework will be used in collaboration with the technical capacity building aspect of Transportation Resiliency KC, to ensure that funding, education, and implementation are complementary.

Data, Tools, and Disruption Scenarios

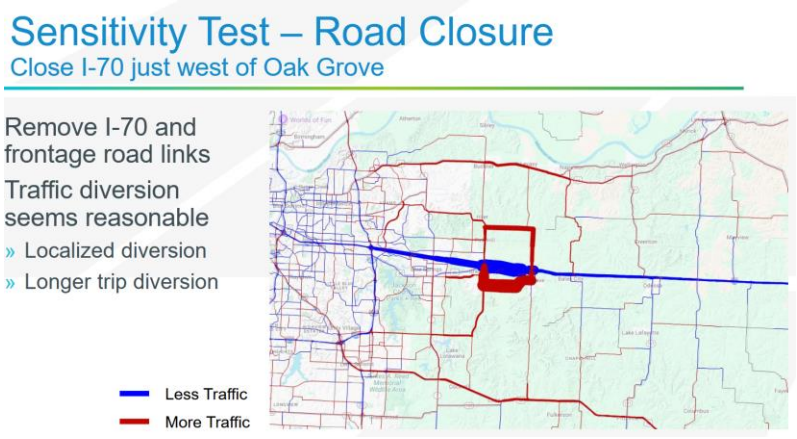
To enhance regional resilience and preparedness, this project will expand the data sets and analytical tools necessary to model and assess the impacts of extreme weather events on the transportation network. These enhanced tools will provide the MPO as well as partner agencies with data to identify critical corridors and

vulnerable assets and communities, that can guide infrastructure investments and help to prioritize emergency response. This will include:

- **Big Data:** A Big Data source such as LOCUS will provide invaluable ground truth information of current travel conditions in the region as well as existing usage characteristics of key assets. LOCUS provides observed personal travel patterns and usage characteristics of key assets across a variety of dimensions, including communities of concern. Further, LOCUS provides robust truck trip flow data both inside and outside the MARC region, including information about where trucks enter the region and their ultimate destination. This information will be used to identify and assess supply chain risks.

- **Enhance Model with Integrated Datasets:** The project will enhance MARC's existing transportation model to integrate climate hazard data, based on the priority hazard identification. This may include flood risk projections or extreme heat impacts. This will include analyzing (and in some cases, purchasing) new data sets that leverage satellite imagery, LiDAR, real-time weather feeds, and historical disaster data to improve predictive capabilities. We will also pair the regional travel model with LOCUS, integrating these data, to accurately represent the impacts of infrastructure risks on travel in the region. This will be critical for the truck model in particular, which has not been updated recently, but will need to be relied upon for truck assessments. The approach to data integration will likely involve model calibration and post-processing applications to ensure model results are properly related against observed patterns.

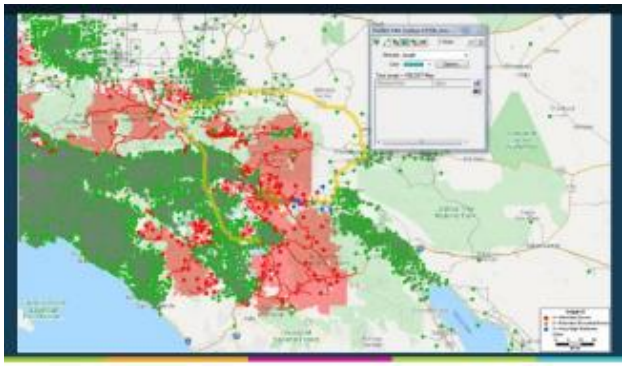
- **Model Link-Level Disruption Scenarios:** This project element will model the potential impacts of extreme weather events at both the link level and the network level; this helps MARC to better understand the intricate network-level impacts of disruptions on the regional transportation system. Current practice of risk assessment evaluates risk-based assessment of vulnerabilities at the asset level and do not account for corridor and system-level interdependencies that impact community and regional mobility. MARC plans to assess recovery sequencing and prioritization of assets while taking these interdependencies into consideration and account for consequences that have implications on regional mobility, supply chain movement through the region, and economic recovery and accessibility after disruptions. This analysis will help MARC and partner agencies to identify and prioritize high-risk network elements that can be prioritized for preparedness to withstand disruptions and maintain mobility, while prioritizing corridors and routes that can accelerate rapid recovery after disruptions and enhance regional resilience.

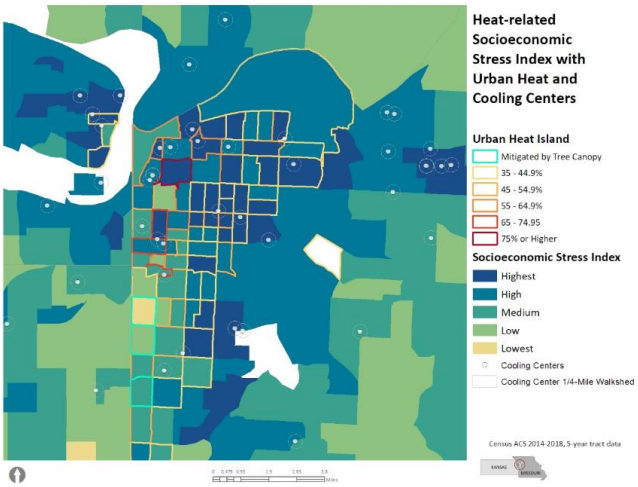


- **Identify Network Disruptions:** At the network level, Transportation Resiliency KC will assess how disruptions to individual assets spread across the broader transportation system, affecting both

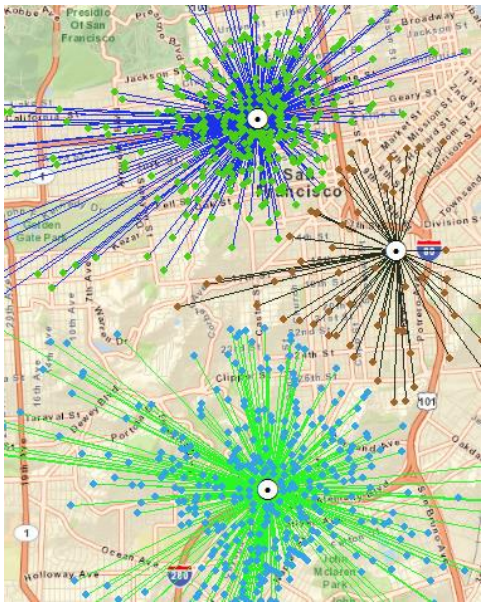
mobility and emergency response capabilities. The enhanced regional model will be used to assess network disruptions. The regional model is particularly useful for analyzing the impacts of multiple events or failures and assessing interdependencies of various network links at a systemwide level. Both immediate and longer term impacts can be assessed with the model by controlling the use of the main feedback loops of the model, which redistribute trip ends on the basis of accessibility measures and thus, provide forecasts more in line with medium or long term impacts. The model also includes tools that can be used to assess the travel flows using specific network links to identify the specific impacted communities. The regional model is capable of generating a variety of metrics for assessment purposes, including changes in Vehicle Miles Traveled (VMT) and increased delay (both regionally and for specific geographies and communities; and both for passenger and truck travel), changes in the distribution patterns of trips (e.g., a regional attraction area may become less popular due to network disruptions), mode shifts, and numbers of trips rerouted. In addition, the analysis will identify chokepoints, impacted evacuation routes, multimodal impacts, and the cascading effects of single or multiple disruptive events (e.g. extreme heat could lead to bridge closures and reduced active transportation, increasing demand on the transit system).

- **Stranded Zones Analysis:** Using the previous modeling analysis and data sets, MARC will identify areas at the highest risk of disruption and severely long detours during an extreme weather event. This will consider a number of factors including the number of egress routes (which are often more limited in rural areas) and the preponderance of affected populations such as disabled, elderly population, and children.





- **Resilience Hub Siting:** Transportation Resiliency KC will identify optimal locations for resilience hubs—community-centered facilities that provide essential services, resources, and shelter before, during, and after extreme weather events. These facilities will be developed based on inputs from regional planning partners on factors that can improve the economic stability of communities where they are sited, by enhancing collaboration, providing enterprise development, and training programs to enable communities minimize economic losses and demonstrate resilience during disruptions.



Technical Capacity Building for Peer Agencies

To ensure long-term, region-wide progress in transportation resilience, MARC will lead a comprehensive technical capacity-building initiative for peer agencies and local governments. This effort will equip planners, engineers, and policymakers with the knowledge and tools needed to integrate resilience principles into planning, project development, and infrastructure investments.

At the core of this initiative is the Transportation Resilience KC Academy, a structured training program designed to build expertise in transportation resilience planning, risk assessment, and adaptation strategies. The Academy will provide:

- Fundamental training on key resilience concepts, including hazard identification, vulnerability and risk assessment, and scenario-based planning.
- Applied learning through case studies, data-driven analyses, and real-world examples of resilience-informed project development.
- Guidance on funding opportunities, helping member agencies understand how to leverage federal and state programs to support resilience investments.

The training topics will be shaped by direct input from Steering Committee members, focusing on the key regional risks and mitigation strategies shared in initial meetings. This includes flooding resilience—with an emphasis on MARC's green stormwater design initiative—as well as proactive communication strategies to engage residents on resilience efforts. Additionally, the training will address how to better serve communities most vulnerable to extreme weather events, ensuring that resilience planning is both effective and fair.

To maximize participation and accessibility, MARC will offer training through a mix of webinars and in-person workshops, allowing agencies to engage in a format that best suits their needs. Additionally, to encourage widespread adoption of resilience principles, agencies that participate in the Transportation Resilience KC Academy will receive project prioritization points when applying for MPO-administered funding, reinforcing the importance of integrating resilience into future transportation investments.

The goal of this capacity-building effort is to establish a strong foundation of resilience knowledge across the region, equipping peer agencies with the tools and expertise needed to address climate-related risks, improve system reliability, and secure funding for critical resilience projects. By incorporating project prioritization incentives, this initiative ensures that the initial PROTECT funding serves as a catalyst for future resilience investments, driving long-term, strategic improvements across the transportation network.

3.2.2 Criterion #4: Public Engagement, Partnerships, and Collaboration

Describe how the project responds to the Public Engagement, Partnerships, and Collaboration criterion.

Pre-Grant Outreach and Engagement

The Planning Activity Approach was informed by a robust stakeholder and public engagement process that ensures resilience planning efforts are informed by a wide range of stakeholders and local expertise. Our approach integrates peer agency collaboration, direct engagement with community organizations, and broad-based public input to develop an innovative, data-driven strategy that aligns with regional planning efforts and responds to the most pressing hazards.

The Steering Committee is composed of municipalities, counties, and transportation agencies representing Kansas and Missouri in various roles including public works, hazard mitigation, city planning, transit, and more. Committee members emphasized the need for a regional, data-driven resiliency strategy that addresses flood risks, outdated infrastructure, and vulnerabilities in transportation and communication systems. The committee recommended prioritizing critical infrastructure – bridges, levees, rail lines, airports, and ports– which require a long-term multisector approach to funding, maintenance, and development. Committee members and other partners also issued Letters of Support for the project found in Appendix X.

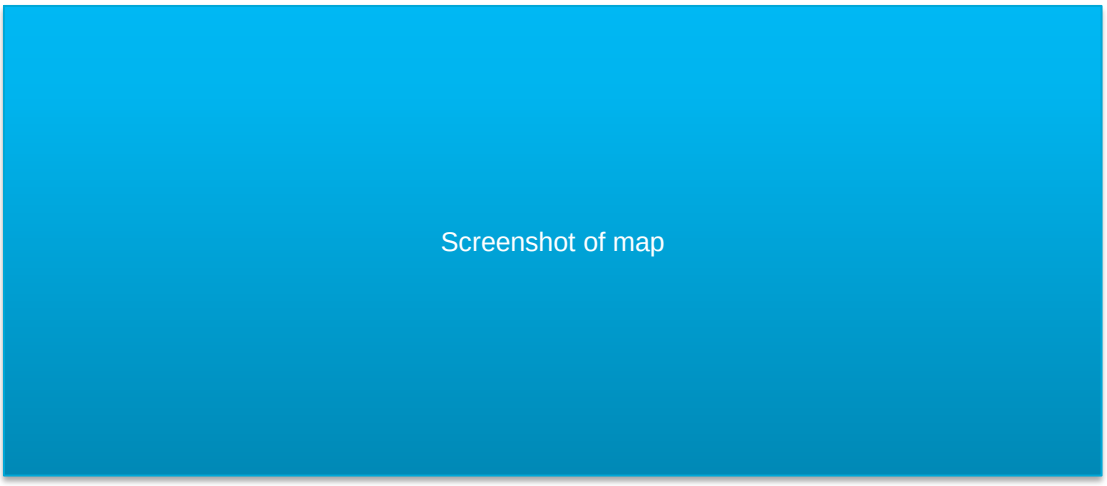
The expertise of the Steering Committee informed the definition of transportation resilience as:

- **Flexible** – Users can take a different route or a different mode if one is impacted.
- **Fair** – One group is not overly burdened by climate and weather-related hazards impacting their transportation system such as extreme heat or roadway flooding.
- **Robust** – Roads, bridges, and other infrastructure are designed and maintained to resist extreme weather events and climate hazards.
- **Proactive** – The transportation system utilizes smart technology and community partnerships to better predict potential transportation disruptors that help mobility rebound more quickly.
- **Community-Focused** – Balances community-scale needs with a regional vision of resilience.

Following the guidance from the Steering Committee, MARC met with several community organizations (Table X) to better understand the needs of urban and rural areas, as well as different population types. The focus group participants shared that modes such as transit were more vulnerable to extreme weather events. Gaps in coordination between transit agencies and persistent safety challenges weaken the reliability of transit, especially during extreme weather events. These issues are further exacerbated in rural areas and for individuals with mobility challenges, where disaster response efforts face additional obstacles. Furthermore, many organizations highlighted workforce development needs, emphasizing that inconsistent access to transportation prevented their clients from reaching their jobs. This feedback prompted the project team to explore Stranded Zones Analysis, to better understand how rural populations and vulnerable groups – such as persons with disabilities – are impacted by extreme weather events.

Organization	Location	Purpose
New Growth Transit	Harrisonville, MO	Volunteer-based microtransit company that provides free rides for residents in rural counties
Heartstrings Community Foundation	Olathe, KS	Employment service for adults with varied intellectual or developmental abilities
Crosslines Assistance Council	Grandview, MO	Offers services to unhoused individuals including job placement, and a food pantry
BikeWalkKC	Kansas City, MO	Advocacy team that works to make streets safe places for people
Whole Person	Kansas City, MO	Provides services for the deaf or hard-of-hearing individuals and blind or low-vision individuals
National Federation of the Blind	Kansas City, MO	Advocacy group that works to raise awareness of the needs of low-vision individuals

MARC supplemented stakeholder and community organization outreach with a public survey and interactive map to gather insights into how our transportation system can better prepare for, respond to, and recover from unexpected disruptions. This survey identified geographic areas where the population has been impacted by the most frequently occurring weather hazards in the region, primarily extreme heat, extreme cold, and flooding (Figure X). In the month the survey was open, 181 respondents provided their feedback representing 51 zip codes in the region. 20 percent of those surveyed were located in a zip code with significant needs. In the event of disruptions, half of the respondents said that they have difficulty finding an alternate mode or route of transportation. When combined, the survey results will help to ground truth large hazard and traffic data sets to produce a more comprehensive and nuanced picture of the region's transportation risks and vulnerabilities.



"More options available for residents who live in smaller communities where buses may not be available. We need to prepare as the baby boomers age up and can no longer drive, who will fill these needs."
– Focus Group Participant

Post-Grant Outreach and Engagement

Our engagement approach will be guided by best-practice principles for effectively communicating resilience, ensuring that stakeholders clearly understand the needs, benefits, risks, and uncertainties associated with

resilience planning. By using clear, accessible, and actionable communication strategies, we will foster informed decision-making, public trust, and stakeholder buy-in throughout the planning process. Our engagement approach will emphasize:

- **Clearly Defining the Need for Transportation Resilience Planning:** Articulate the transportation system's vulnerabilities; use data to demonstrate how extreme weather events disrupt mobility, economic activity, and emergency response.

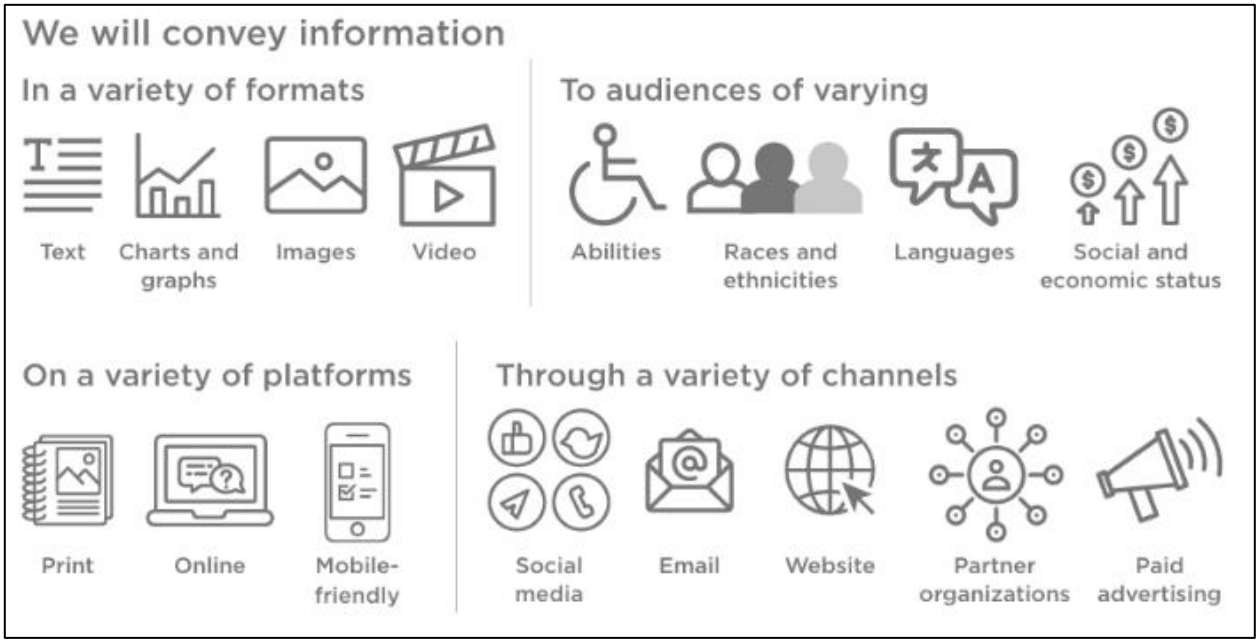
- **Demonstrating the Benefits of Resilience Investments:** Illustrate how proactive investments in resilience reduce long-term costs, enhance safety, and improve overall system reliability; use case studies and scenario modeling to show benefits of resilience strategies.

- **Addressing Risks and Trade-Offs:** Seek stakeholder input on project prioritization and resource allocation; communicate potential trade-offs and uncertainties, weighing short-term costs against long-term benefits.

- **Navigating Uncertainty with Scenario-Based Planning:** Use scenario planning to demonstrate the impacts of potential strategies

The project will continue to be led by the Steering Committee comprised of that provide a dual purpose: offering feedback on MARC's transportation resiliency efforts, and sharing updates on members' own projects that could impact MARC's plans. This forum ensures ongoing coordination with partners in the area to facilitate information and resource sharing regarding other transportation, infrastructure, emergency management, or resiliency projects in the region. It also leverages a diverse range of relevant experts representing a cross-section of communities that will provide a more holistic understanding of transportation resiliency impacts and subsequent initiatives.

MARC utilizes a combination of virtual and in-person events, surveys, and media during development and implementation to inform the community and obtain feedback on the project's direction. This approach leverages MARC's Public Participation Plan which incorporates engagement strategies that are mindful of readability for residents of diverse educational backgrounds; accessibility for residents with physical, auditory, or visual impairments; and other languages as needed. MARC's public engagement approach is also influenced by U.S. DOT's "Promising Practices for Meaningful Public Involvement in Transportation Decision-Making" such as hosting public meetings with accessible event times and locations, and conducting briefings for community organizations affected by specific project activities. Using different engagement methods (Figure X) will ensure that the project's information is accessible to policymakers, stakeholders, and the general public. For example, MARC already maintains a Transportation Resiliency KC webpage that will continue to be updated with project documents, meetings, and opportunities for the public to provide feedback.



4.0 Criticality: Concept, Definitions, and MARC Perspective

4.1 Definitions

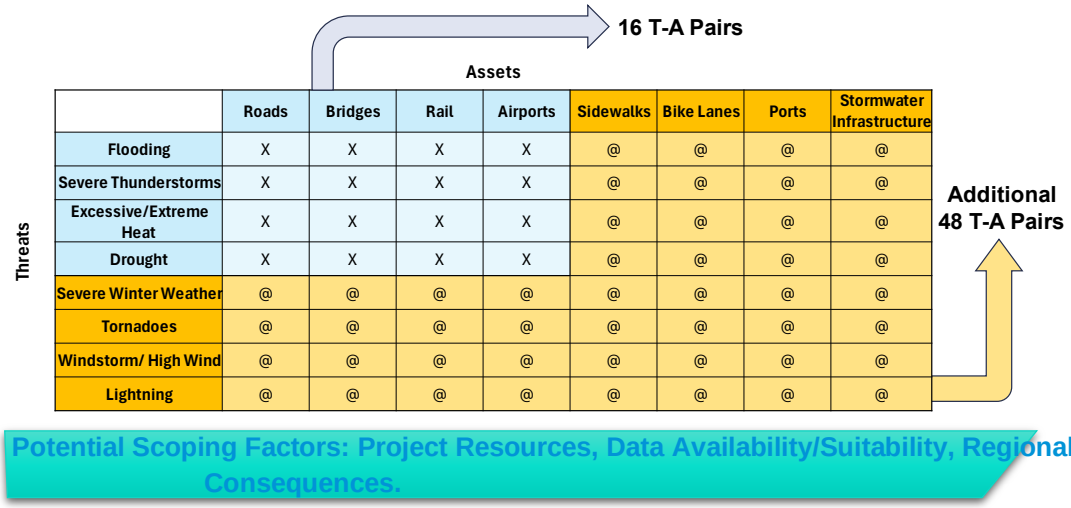
According to USDOT, criticality is defined as the importance of a project in supporting the continued operation or rapid recovery of crucial local, regional, or national surface transportation assets and facilities served by those assets in the community. Criticality factors are custom to each region, address a region's unique priorities, considerations, and strengths. By determining criticality first, analytical resources can be directed to the assets and operations of greatest importance. More information is available here: Evaluating Asset Criticality. Other definitions (more comprehensive) include: NIST Definition - 42 USC § 5195c(e) and DHS Definition.

4.2 Why is Criticality Important?

Criticality determination is a helpful approach for indicating the relative importance of assets being scoped for a risk and resilience assessment. It can be used as a screening tool or a prioritization tool.

- **Screening** – Establishes minimum thresholds or benchmarks (e.g., determining whether local roads or shared-use/bike paths should be included), ensuring that all relevant assets are considered in the assessment.

Figure 1 Screening Example – MARC RIP Scoping Considerations



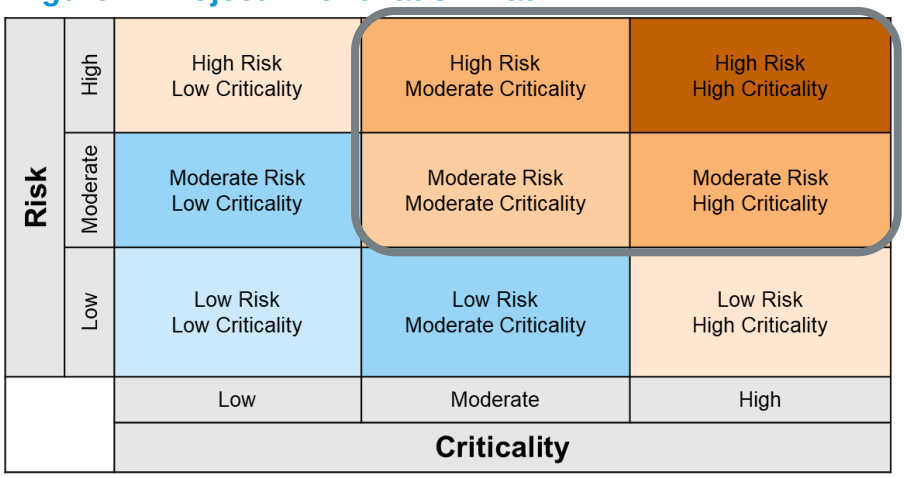
	Roads	Bridges	Rail	Airports	Sidewalks	Bike Lanes	Ports	Stormwater Infrastructure
Flooding	X	X	X	X	@	@	@	@
Severe Thunderstorms	X	X	X	X	@	@	@	@
Excessive/Extreme Heat	X	X	X	X	@	@	@	@
Drought	X	X	X	X	@	@	@	@
Severe Winter Weather	@	@	@	@	@	@	@	@
Tornadoes	@	@	@	@	@	@	@	@
Windstorm/ High Wind	@	@	@	@	@	@	@	@
Lightning	@	@	@	@	@	@	@	@

Potential Scoping Factors: Project Resources, Data Availability/Suitability, Regional Consequences.

- **Prioritization** – Facilitates the comparison and ranking of assets based on their significance. For example, distinguishing between major arterial roads and connectors, or comparing assets with differing traffic volumes, such as an Average Annual Daily Traffic (AADT) of 5,000 versus 50,000.

Criticality determination is an essential step in project prioritization and resilience planning to ensure MARC's infrastructure investments are responsive to the needs of its population. According to FHWA, due to the multitude of climate effects with the potential to impact transportation systems, resource constraints, and temporal complications related to asset design life, it is recommended that agencies limit the asset list at the outset in order to ensure adequate consideration of the assets that are deemed "critical" in subsequent steps (FHWA Assessing Criticality in Transportation Adaptation Planning). For instance, consider a highway that connects hospitals, serves as an evacuation route, and runs through a densely populated area. Such an asset is integral to the region's ability to respond to emergencies and serve its communities. By evaluating criticality, MARC can identify assets with lower risk tolerance that require more focused planning and resilience improvement.

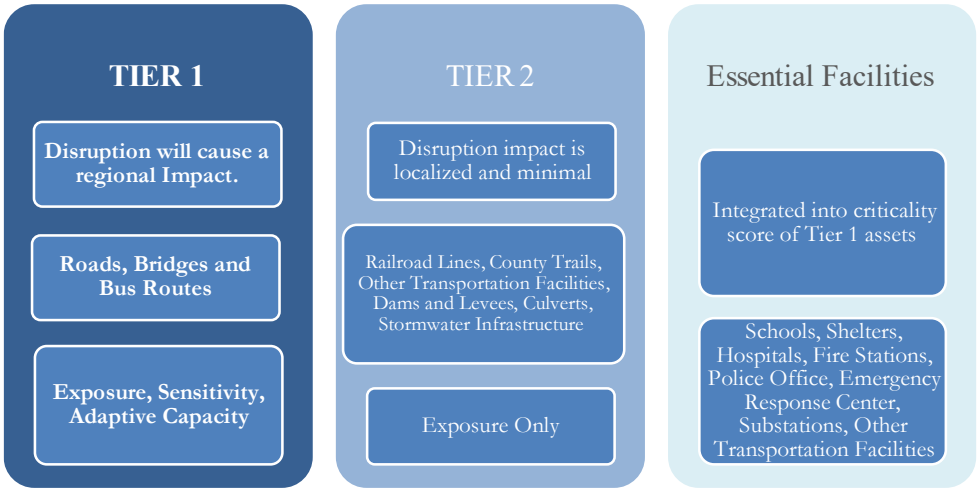
Figure 2: Project Prioritization Matrix



Under the PROTECT program, one of the key elements of a Resilience Improvement Plan (RIP) is a prioritized list of resilience projects, as this enables projects to receive a 7% reduction in non-Federal share costs. Developing a prioritized list of projects involves **establishing criteria for prioritization that combine risk and criticality** considerations.

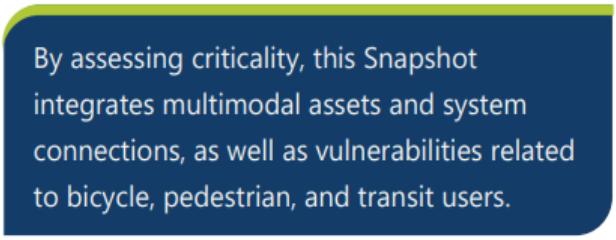
4.3 Examples of Tiering/ Prioritization Application

4.3.1 Ulster County (NY) Transportation Council (UCTC) MPO Example



A tiering approach was adopted to classify UCTC's Transportation Systems into three categories: Tier 1 Assets, Tier 2 Assets and Essential Facilities. The project team, in consultation with the UCTC staff, determined that a comprehensive vulnerability assessment – encompassing exposure, sensitivity, and adaptive capacity – will be performed for the Tier 1 assets. For Tier 2 assets, exposure analysis will be performed. Likelihood and consequence will be integrated into the MARC approach to ultimately result in a risk-based assessment.

4.3.2 Indianapolis MPO Resiliency Snapshot Example



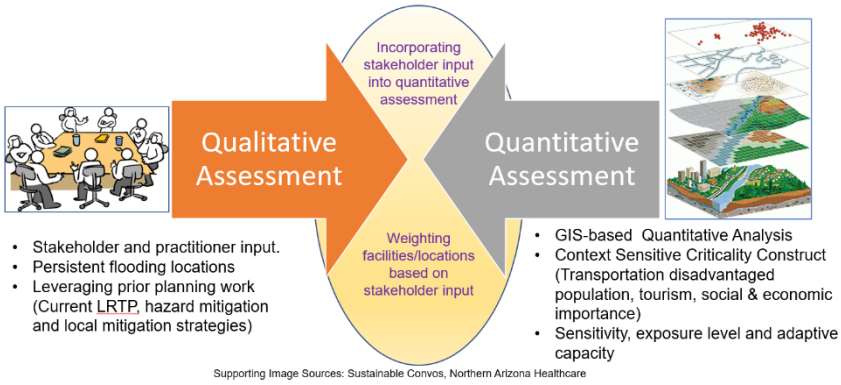
IndyMPO conducted a risk assessment of roadways and bridges as part of their Resiliency Snapshot/Resiliency Improvement Plan. However, the overall Snapshot takes a holistic approach by considering a wide range of regional assets and possible impacts to community capitals (criticality). By assessing criticality, this snapshot takes into account multimodal assets and system connections, as well as vulnerabilities related to bicycle, pedestrian, and transit users. For this snapshot, asset criticality was assessed using these three weighted categories of indicators:

- **Mobility and Use**: Asset usage and operational importance assessed by considering the volume and type of traffic along each transportation asset.
- **Equity and People**: Socioeconomic importance assessed by considering surrounding population and employment composition and density.
- **Connectivity**: Considers how each transportation asset connects to other transportation options and key destinations, particularly those that contribute to a communities and residents' health and safety and means to travel along non-roadways.

4.4 How Can MARC Apply Criticality Determination in the Natural Hazard Transportation Risk Assessment?

To address the limitations of a desk-based criticality determination, we include a consultative element, to create a more hybrid approach (Figure 3), which we have applied to other agencies over the years. This incorporates practitioner input on what is deemed operationally critical and identifies key assets—that may be overlooked due to thresholds in a data-only assessment—that still serve as vital community lifelines.

Figure 3: Integrating Criticality Determination into Vulnerability and Risk Assessment Approach



The project team will work with MARC and stakeholder to select criteria for evaluating asset criticality. Following are some examples of indicators for consideration.

Figure 4: Proposed Indicators that Signify the Importance of MARC's Transportation Assets