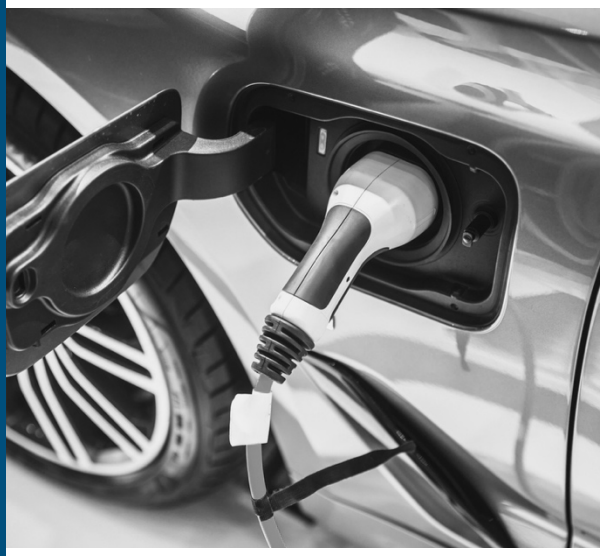
VISUALIZE 2050



Visualize 2050 Planning and Programming Process

Natural Hazards Resiliency

Part 5 of 27

National Capital Region
Transportation Planning Board

December 2025

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OVERVIEW OF TRANSPORTATION RESILIENCE PLANNING

The National Capital Region is experiencing extreme weather events from heat waves to blizzards to severe coastal storms and flooding. The past decade has seen an uptick in the intensity, frequency, and duration of these natural hazards.

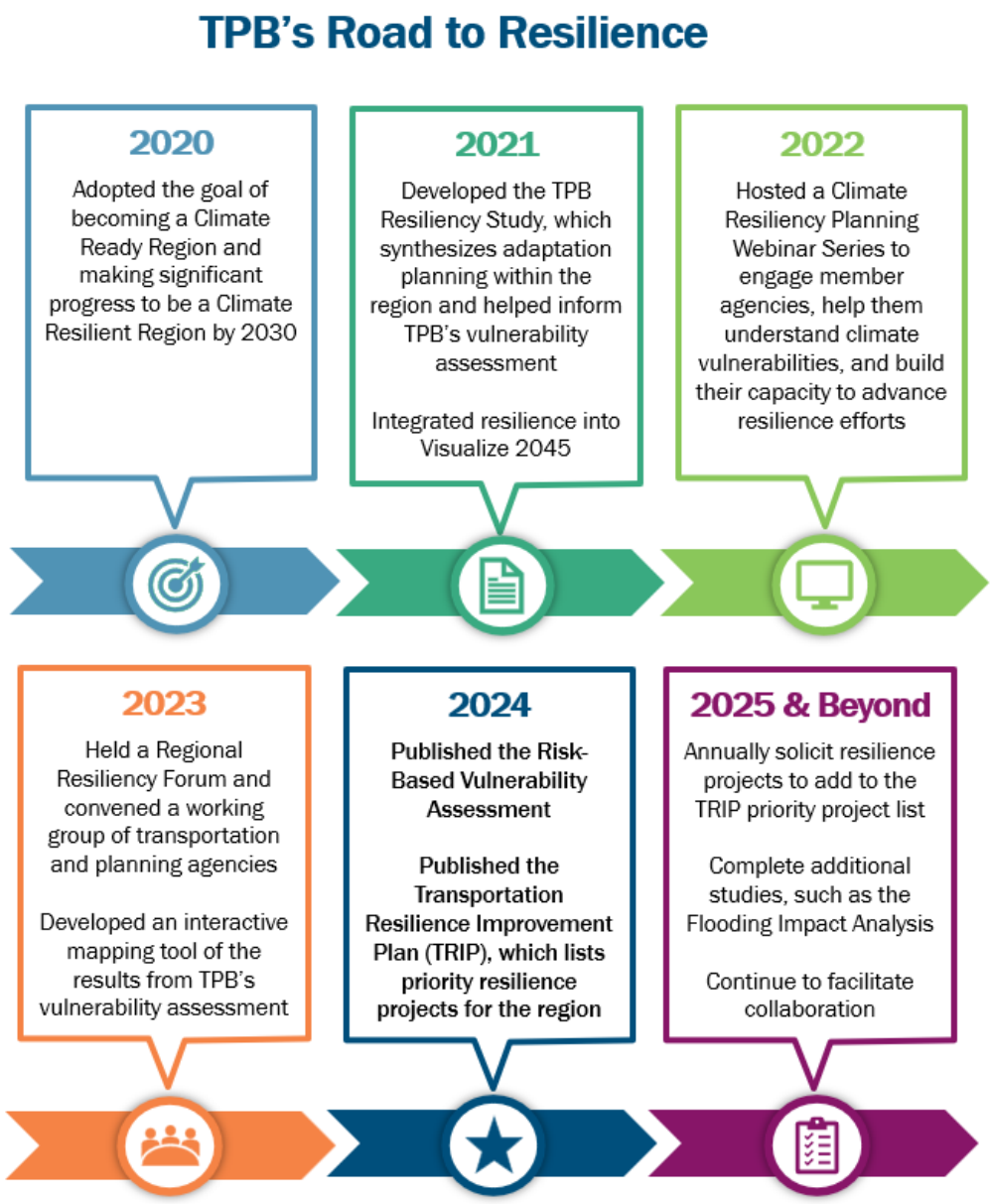
As the region's population and infrastructure investments grow, these natural hazards pose increased risks to people and the economy. Now is the time to get ahead of these risks, and the Transportation Planning Board (TPB) is taking action to support regional resilience efforts through research, engagement, outreach, and more. To improve the preparedness and resilience of the region's transportation system to the impacts of natural hazards, the TPB created a new program at the end of 2022 called the Transportation Resilience Planning Program.

Prior to the creation of the new program, the TPB has embarked on resilience work with the Resiliency Study Phase 1, which benchmarked the region's understanding of its transportation vulnerabilities, outlined actions the TPB could take to increase resilience, and included a series of webinars with tools and resources on transportation resilience for member agencies.[1]

Planning for and adapting to the impacts of natural hazards is critical to ensure the region's transportation system is resilient to these hazards. The TPB's regional resilience planning activities consider vulnerability, risks, and proactive anticipation of natural hazards to maintain service operations and ensure the health and safety of travelers. The TPB collaborates with its member agencies on decision-making for the transportation network and shares resources to help regional stakeholders progress towards increasing transportation resilience in the National Capital Region.

[1] National Capital Region Transportation Planning Board (November 2021). *TPB Resiliency Study.* https://www.mwcog.org/assets/1/28/TPB_Resiliency_WhitePaper.pdf

FIGURE 5.1: TPB'S ROAD TO RESILIENCE



TPB'S ROLE AND KEY STAFF

Regional resilience planning requires interagency coordination to identify priorities, resources, and actions that the TPB and COG jurisdictions and member agencies can take to invest in the resilience of the transportation system. TPB's transportation resilience planning program built upon the extensive resilience work that COG and its member agencies have completed to date, from establishing resilience goals to publishing plans that outline frameworks to advance resilience goals and facilitate the implementation of resilience projects. This program is housed within the Department of Transportation Planning, and currently has one full-time staff member shown in Table 5.1 running the day-to-day activities of the program with consultant support.

TABLE 5.1: KEY STAFF

TPB Staff	Title	Role
Kanti Srikanth	Deputy Executive Director	Staff Director for the Transportation Planning Board (TPB)
Katherine Rainone	Transportation Planner	Program Lead

In October 2024, the TPB approved the creation of a new TPB subcommittee called the Regional Transportation Resilience Subcommittee. The mission of this subcommittee is to provide a forum and framework for the coordination of transportation resilience planning throughout the National Capital Region and to continue to incorporate resilience into the National Capital Region Transportation Plan (NCRTP) and Transportation Improvement Program (TIP). Through collaboration, coordination, and strategic planning, the subcommittee aims to enhance the resilience of transportation systems and infrastructure, mitigate potential current and future risks, and build community resilience with a focus on equity to better adapt to impacts from natural hazards, and potentially in the future, other unforeseen challenges.

ROLE OF KEY PLANNING AGENCIES

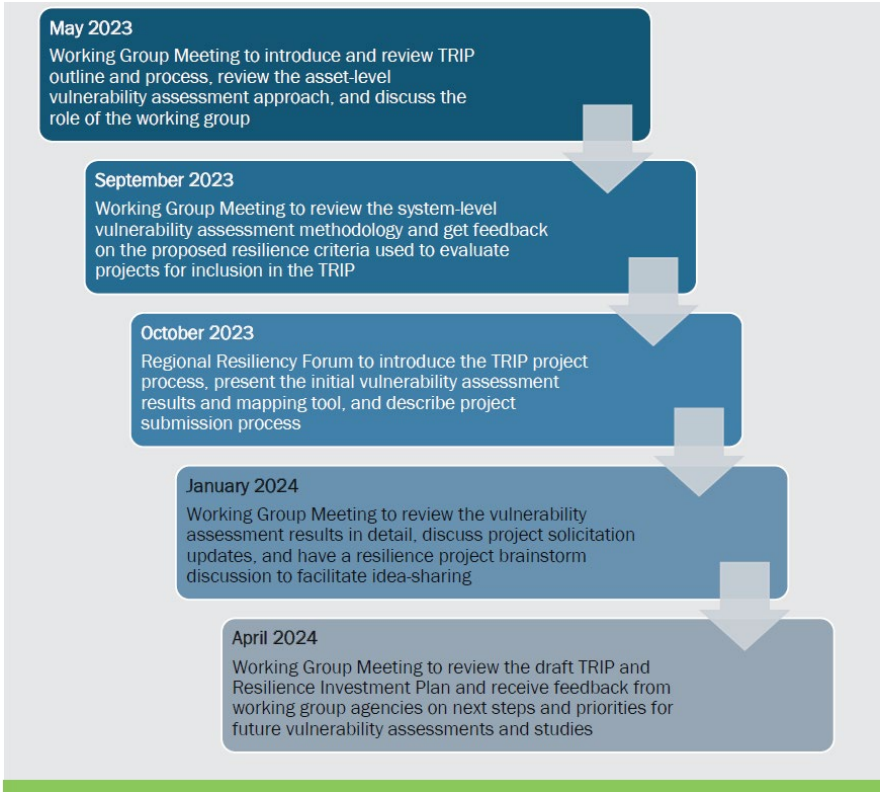
The topic of resiliency is inherently about understanding that issues of natural hazards do not follow jurisdictional or state borders. It is important that a resilient transportation network requires interagency and cross-jurisdictional collaboration. As such, stakeholder engagement was a core component of the Transportation Resilience Improvement Plan (TRIP) development process and will continue to be over the progress of the program. Figure 2 below provides an overview of stakeholder engagement throughout the TRIP development process. A working group was established to engage with agencies in the region and get feedback on process and priorities for the TRIP, including the methodologies behind the vulnerability assessment, the collection of the prioritized project list, and the drafting of the TRIP document itself. The working group consisted of transportation and planning agencies across the District of Columbia, Maryland, and Virginia, including:

1. Charles County, Maryland
2. City of Alexandria, Virginia
3. DC Department of Energy and Environment (DOEE)
4. DC Department of Transportation (DDOT)

5. DC Homeland Security and Emergency Management Agency (HSEMA)
6. Fairfax County, Virginia
7. Maryland Department of Transportation (MDOT)
8. Northern Virginia Regional Commission (NVRC)
9. Prince George's County, Maryland
10. Prince William County, Virginia
11. Virginia Department of Transportation (VDOT)
12. Virginia Railway Express (VRE)
13. Washington Metropolitan Area Transit Authority (WMATA)

The TPB also designed and held a Regional Resilience Forum in October 2023 to engage with a broader set of regional stakeholders and get input on planning priorities and additional considerations.[2] The TPB provided an overview of the TRIP development process and sought input on the approach to the vulnerability assessment and development of the priority project list. Over 60 people attended from agencies and organizations across the National Capital Region and beyond. The forum and the working group meetings facilitated interagency coordination and resource sharing and ensured consideration of regional perspectives.

FIGURE 5.2: OVERVIEW OF STAKEHOLDER ENGAGEMENT DURING THE DEVELOPMENT OF THE TRIP



[2] Metropolitan Washington Council of Governments (October 3, 2023). *Regional Transportation Resilience Forum.* https://www.mwcog.org/events/2023/10/03/regional-transportation-resilience-forum/

In addition to the stakeholder engagement, members of the public had an opportunity to review and comment on the planning documents through the TPB's Community Advisory Committee (CAC) and through public comment opportunities offered at every Transportation Planning Board meeting. The TRIP was presented at the Transportation Planning Board meetings on January 17, May 15, June 20, 2024, and to the CAC in February and March of 2024.

NATIONAL CAPITAL REGION TRANSPORTATION RESILIENCE IMPROVEMENT PLAN (TRIP)

Leading up to the completion of Visualize 2050, the main product developed through the transportation resilience planning program at TPB is the TRIP.[3] The purpose of the TRIP is to serve as a regional resource that describes key transportation asset vulnerabilities in the region identified through a risk-based natural hazards vulnerability assessment and identify priority resilience investments in the context of the region's resilience goals.

The TRIP, developed in coordination with TPB member agencies, is the first comprehensive regional transportation resilience plan for the National Capital Region. It builds on the strong foundation of transportation resilience work in the region and meets the Federal Highway Administration's Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) program requirements for a Resilience Improvement Plan (RIP).[4] The PROTECT program provides a unique opportunity to access increased funding for improving surface transportation resilience to natural hazards, and the TRIP will position the National Capital Region to be competitive for these funds.

The TRIP supports regional natural hazards resilience efforts by assessing current and future risks; streamlining the integration of natural hazards resilience into planning, operations, and communications; and increasing the region's ability to maintain essential transportation functions during events due to natural hazards.

The priority objectives of the TRIP are to:

- Provide a systemic understanding of natural hazard risks to the transportation network in the region.
- Identify and prioritize transportation resilience projects, including projects that meet the requirements for FHWA's Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) program.
- Advance equity and environmental justice by increasing consideration of underserved communities and prioritizing equitable access to affordable and reliable transportation.
- Serve as a resource for the TPB to support efforts to facilitate coordination among infrastructure owners and planning agencies across the region to support a systemic approach to resilience.
- Provide a multi-jurisdictional resource to support regional resilience planning.

[3] National Capital Region Transportation Planning Board (2024). *Transportation Resilience Improvement Plan.* https://www.mwcog.org/documents/2024/06/20/national-capital-region-transportation-resilience-improvement-plan/

[4] U.S. Department of Transportation Federal Highway Administration (2023). *Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Program.* https://www.fhwa.dot.gov/environment/protect/

The PROTECT program provides a unique opportunity to access increased funding for improving surface transportation resilience to natural hazards. State departments of transportation (DOTs) and metropolitan planning organizations (MPOs) that develop Resilience Improvement Plans (RIPs) that meet program requirements reduce the non-federal cost share for projects by seven percent. An additional three percent will be reduced if the RIP is incorporated into the statewide long-range transportation plan or regional metropolitan transportation plan. Additionally, projects that are included in the RIP do not require a Benefit Cost Analysis (BCA) as part of the competitive grant application. The TRIP will serve as the RIP for this region. The TRIP will position the region to be competitive for these funds and help stretch the funding further due to the match reduction.

Vulnerability Assessment

The TRIP vulnerability assessment builds on the TPB's 2021 Resiliency Study to systematically identify high vulnerability transportation assets throughout the region.[5] The 2021 Resiliency Study included a summary of local vulnerability analyses in the region. The most common hazards across these analyses included flooding (both sea level rise and coastal and riverine flooding), extreme heat, extreme winter, and extreme wind conditions. That study recommended TPB overlay natural hazards with transportation assets in the region to create a system-level understanding of vulnerability to natural hazards.

The TRIP vulnerability assessment takes a more systemic approach than the 2021 Resiliency Study and responds to the COG 2030 Climate Risk Vulnerability Analysis finding that EEAs in the region are overburdened with climate hazard risks.[6] The vulnerability assessment includes an equity factor to elevate vulnerable population considerations in the identification of highly vulnerable assets. The results of the vulnerability assessment identify highly vulnerable transportation assets that may need future resilience investments. The vulnerability assessment was conducted in two phases to identify how transportation infrastructure in the region is vulnerable to natural hazards.

- Phase 1 applied a system-level sensitivity analysis to identify priority natural hazard/transportation asset pairs for further analysis in Phase 2.
- Phase 2 applied an asset-level vulnerability assessment (exposure and criticality) to identify specific areas and assets that are particularly vulnerable to natural hazards. This was paired with a literature review to provide information on historical and future trends for each natural hazard.

Phase 1 rated the sensitivity of transportation asset types to natural hazards included in the 2021 Resiliency Study and selected in consultation with the TPB and the working group. Phase 1 of the assessment generated two sensitivity scores for each asset/hazard pair on a low-to-high scale: one score measured infrastructure sensitivity and the other measured service sensitivity.

This dual score is because failures in the physical infrastructure and barriers to usability can impede transportation systems and services. Asset/hazard pairs that received a high sensitivity rating moved forward to Phase 2.

[5] National Capital Region Transportation Planning Board (April 10, 2024). *National Capital Region Transportation System Climate Vulnerability Assessment.* https://www.mwcog.org/documents/2024/04/10/national-capital-region-transportation-system-climate-vulnerability-assessment/

[6] Metropolitan Washington Council of Governments, Climate, Energy and Environment Policy Committee (November 18, 2020). *Metropolitan Washington 2030 Climate and Energy Action Plan.* https://www.mwcog.org/assets/1/28/Metropolitan_Washington_2030_Climate_and_Energy_Action_Plan_FINAL6.pdf

Phase 2 further evaluated the highly sensitive pairs from Phase 1 through a literature review, a region-wide temperature map, and an asset-level geospatial analysis. The asset-level analysis focused on pairs with adequate geospatial data to complete a geospatial analysis. This analysis evaluated the vulnerability of roads and highways, public transit (bus routes, rail stops, and rail lines), and bridges to extreme heat, temporary flooding (coastal and riverine), and permanent flooding (sea level rise) on a low-to-high scale to identify specific assets or areas within the region that are highly vulnerable. The results are summarized in Figures 5.3 and 5.4 below.

FIGURE 5.3: SYSTEM-LEVEL ANALYSIS RESULTS (INFRASTRUCTURE IMPACTS ON LEFT; SERVICE AND CUSTOMER IMPACTS ON RIGHT)

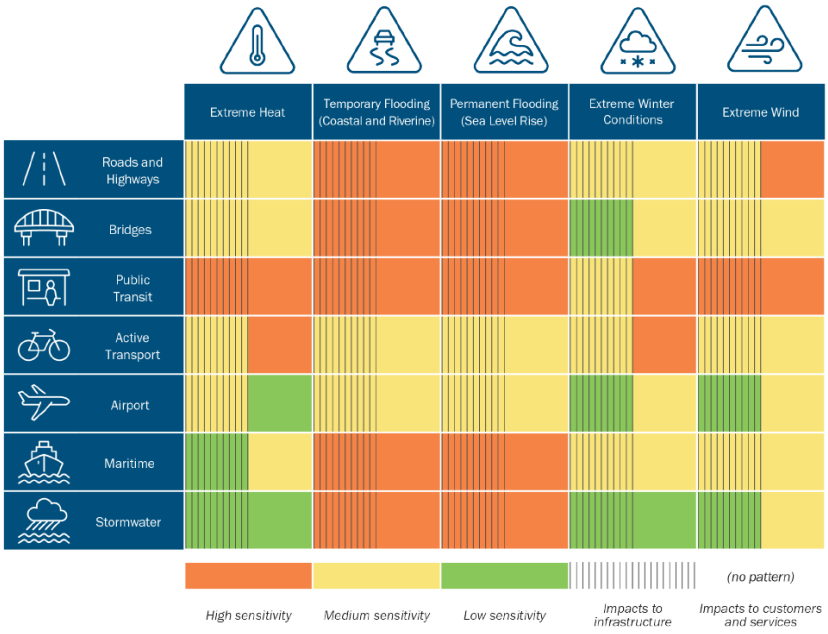


FIGURE 5.4 RESULTS OF VULNERABILITY SCORE ANALYSIS

	Extreme Heat				Temporary Flooding (Coastal and Riverine)				Permanent Flooding (Sea Level Rise)			
Asset Type	High	Medium	Low	Not Exposed	High	Medium	Low	Not Exposed	High	Medium	Low	Not Exposed
Roads/Highways (miles)	Not Assessed				1,097 (4.8%)	1318 (5.8%)	733 (3.2%)	19,754 (86.3%)	50 (0.2%)	17 (0.1%)	14 (0.1%)	22,820 (99.6%)
Bridge	Not Assessed				1 (0.0%)	39 (3.0%)	1,281 (97.0%)	0 (0.0%)	* Bridges were evaluated for flood vulnerability generally based on condition data rather than coastal and riverine vs. sea level rise			
Bus Stops	196 (0.9%)	6,467 (29.1%)	15,560 (70.0%)	0 (0.0%)	173 (0.8%)	336 (1.5%)	377 (1.7%)	21,337 (96.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	22,223 (100.0%)
Rail Stops	0 (0%)	53 (33.1%)	107 (66.9%)	0 (0%)	1 (0.6%)	6 (3.8%)	4 (2.5%)	149 (93.1%)	0 (0%)	0 (0%)	0 (0%)	160 (100.0%)
Rail Line (miles)	18 (1.8%)	352 (34.6%)	646 (63.6%)	0 (0.0%)	115 (11.3%)	154 (15.2%)	128 (12.6%)	619 (60.9%)	19 (1.8%)	42 (4.1%)	2 (0.2%)	954 (93.9%)

Mapping Tool

Results of the geospatial analysis conducted for Phase 2 of the TRIP were integrated into an interactive online mapping tool that was shared with agencies in the region. The mapping tool enabled agencies to use the vulnerability assessment results to assess which transportation assets in their jurisdiction are the most vulnerable to natural hazards and to help them identify projects that could address these vulnerabilities. Agencies are also able to add their own data as a layer in the mapping tool to consider alongside the TRIP vulnerability results to further support their assessment of transportation assets in their jurisdiction.

The interactive map of transportation vulnerabilities includes natural hazard data, transportation assets, and Equity Emphasis Areas and shows calculated flooding and extreme heat risk scores for transportation infrastructure.[7] A document titled Map Companion Text provides more information about how to use the tool.[8]

Prioritized Project List

The Priority Project List outlines the priority transportation resilience projects identified using the results of the vulnerability assessment and input from TPB member agencies.[9] To create this list, we put out an open call for projects via the working group which included a short form for interested parties to fill out and submit transportation resilience projects. A project request guidance document was sent with the form to aid planners in filling out the form, and has since been updated to serve as an overall guide for transportation resilience projects.. Several localities and regional agencies put forward an ambitious set of multimodal strategies to advance regional transportation resilience. Eight localities and transportation agencies in the region submitted a total of 34 projects. All projects fall into PROTECT eligible categories as resilience plans (14 projects) or resilience improvements (20 projects), and one resilience project fits an additional PROTECT eligible category by aiming to improve at-risk coastal infrastructure.

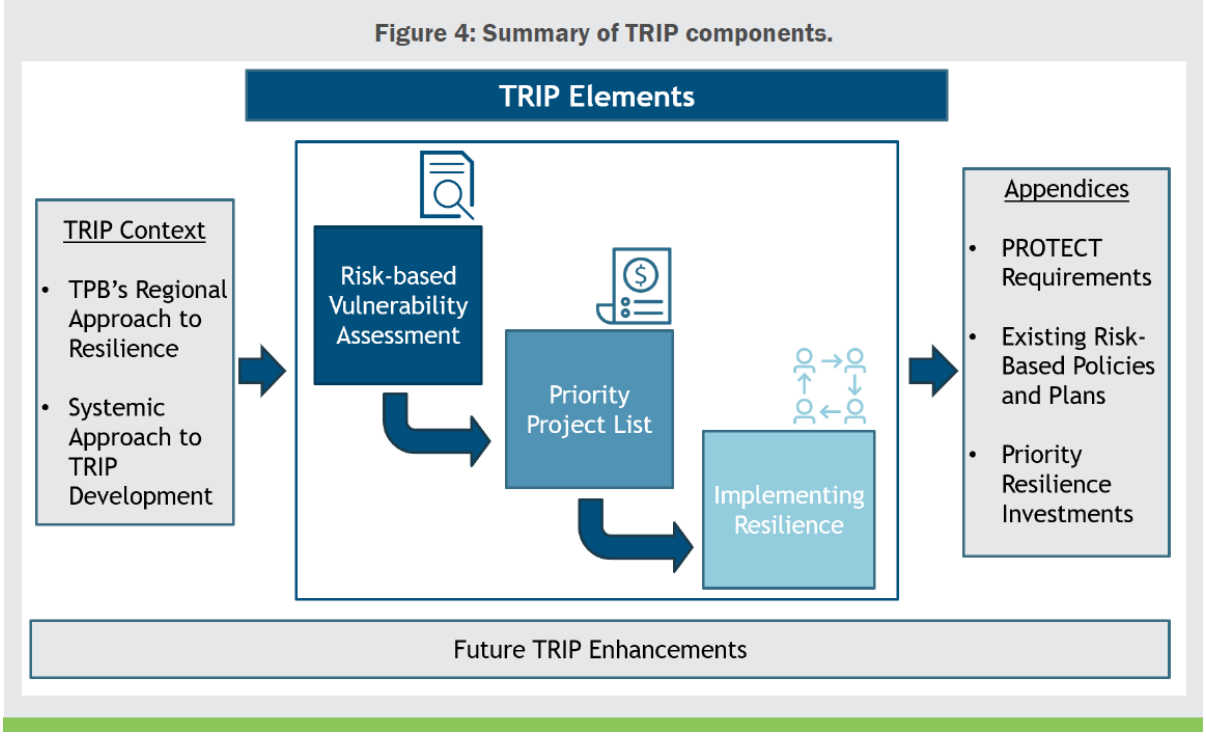
Final and Approved TRIP

The full plan, including executive summary, overview of vulnerability assessment, plan components, prioritized project list, and future planned resilience efforts, can be found at this link: National Capital Region Transportation Resilience Improvement Plan (TRIP).

The TRIP summarizes the systemic approach that the TPB used to assess the vulnerability of the region's transportation system, provides a list of prioritized resilience projects, and identifies focus areas for future resilience assessments. Figure 5.5 below summarizes the components of the TRIP.

[7] National Capital Region Transportation Planning Board (2024). *TPB Transportation Resilience Study Interactive Map.* https://experience.arcgis.com/experience/327843f119204e059fcc50af4154ae67/page/Main/
[8] National Capital Region Transportation Planning Board (2024). *TPB Climate Change Vulnerability Assessment Interactive Mapping Tool Companion Text.* https://www.mwcog.org/assets/1/6/Map_Companion_Text1.pdf
[9] National Capital Region Transportation Planning Board (2024). *Transportation Resilience Project Guidance.* https://www.mwcog.org/assets/1/6/Tranportation_Resilience_Project_Guidance.pdf

FIGURE 5.5: SUMMARY OF TRIP COMPONENTS



Additional Resources

As part of the TRIP, resources were created to provide member agencies and interested parties with information. These resources are in addition to the larger reports, interactive mapping tool, and priority project list.

- Transportation Resilience Project Guidance Document: As noted earlier, the Transportation Resilience Project Guidance document aims to support regional agencies in identifying projects that will enhance the resilience of the region's transportation system and are good candidates for federal and other resilience investment funding. This Guidance document overviews the TPB's processes to support regional resilience coordination, including the development of the TRIP, helps to define a resilience project and provides examples and resources for practitioners, describes the annual project submission process for inclusion in the TRIP Priority Project List, and provides guidance on developing strong project submissions for federal funding programs related to resilience.

- Transportation Resilience Planning Program two-pager: This document summarizes the TPB's regional approach to transportation resilience, including previous work to date on the topic and planned work for future years, as well as examples of natural hazard impacts in the region. It includes links to TPB resilience planning products.

- Updated website: Includes updated information about the transportation resilience planning program and links to all new products, as well as important definitions.