26-33-310 **Transportation Resilience Improvement Plan (TRIP) - Pennsylvania (2 Years)**

Responsible Agency: **Delaware Valley Regional Planning Commission**
Program Coordinator: Christopher Linn
Manager(s): Amy Verbofsky, Karen Cilurso, Karin Morris

Goals:

Identify and prioritize transportation assets that are vulnerable to extreme weather events and chronic weather-related impacts. Identify and prioritize projects that reduce these risks, ensuring the efficiency, safety, and reliability of the region's transportation network.

Description:

Extreme weather events such as flooding, heat waves, and severe storms threaten Greater Philadelphia's transportation system. Our streets, highways, bridges, railroads, transit systems and active transportation facilities already experience costly weather-related impacts, leading to travel delays, disruptions to emergency services, economic losses, and public safety concerns. Extreme weather events and chronic stresses also increase the cost to repair and rebuild vulnerable transportation assets. In the future, these impacts are projected to become more frequent and intense across the region.

Preparation of a Transportation Resilience Improvement Plan (TRIP) is the most effective means to comprehensively understand which transportation assets are vulnerable to extreme weather and prioritize investments that address the region's most pressing needs. DVRPC will work with transportation agencies and local governments to develop a TRIP that identifies vulnerable assets, prioritizes needs, and supports the acceleration of resilience-focused infrastructure investments throughout the Pennsylvania portion of the DVRPC region.

This work will also complement PennDOT's ongoing efforts to develop data-driven strategies to make the commonwealth's transportation infrastructure more resilient to extreme weather-related hazards. These efforts were formally launched with the production and publication of PennDOT's Extreme Weather Vulnerability Study in 2017, and have since continued with projects like the development of hydrologic and hydraulic analyses to assess transportation vulnerabilities, and, more recently, the identification of a series of strategic actions aimed at integrating resiliency concepts into the planning, design, and management of Pennsylvania's transportation infrastructure as part of PennDOT's draft Resilience Improvement Action Plan.

Project Approach:

This project will develop a Transportation Resilience Improvement Plan (TRIP) for the Pennsylvania portion of DVRPC's planning area, which includes Bucks, Chester, Delaware, Montgomery and Philadelphia counties. A complementary project (26-33-300) will allocate PROTECT Formula funds from NJDOT to make this a regional project, and support development of a TRIP for DVRPC's NJ counties.

The TRIP will provide a systematic, risk-based assessment of how extreme weather affects transportation assets and will identify a prioritized list of projects aimed at improving the resilience and reliability of the regional transportation system.

<u>Risk-based Vulnerability Assessment</u>

DVRPC will conduct a risk-based vulnerability assessment to systematically identify and prioritize vulnerable transportation assets across multiple modes that pose the greatest risks to the efficient operation of the transportation system in southeastern Pennsylvania.

The vulnerability of roadways and highways, bridges, stormwater infrastructure (culverts), transit stations and bus stops, fixed rails and catenaries, and dedicated active transportation infrastructure to weather-related hazards will be determined based on a systems- and asset-level evaluation of exposure

and sensitivity. The assessment may also include transit facilities (rail yards and bus garages), airports, and port infrastructure. In addition to the physical assets themselves, the assessment will evaluate the vulnerabilities of users, (e.g. the impacts of a high-heat event on transit users, etc.).

Weather-related hazards to be analyzed will include extreme heat; pluvial, riverine and coastal flooding; extreme storms (wind, precipitation); and freeze-thaw cycling. A qualitative analysis of winter weather, including extreme cold, ice storms, and snowfall, may also be conducted. To support the vulnerability analysis, DVRPC may develop regional-scale HEC-RAS (U.S. Army Corps of Engineers Hydrologic Engineering Center's River Analysis System) fluvial and pluvial flood models to depict current and future flood risks.

The criticality of vulnerable assets will be assessed to determine the risk their failure poses to the transportation system. Criticality will be based on factors such as vehicle volumes, a roadway's functional class or role in important economic activities, evacuation routes, and system redundancy. Criticality may also include community-level factors, such as areas with high levels of transit-dependency and the role key transportation assets play in reversing cycles of disinvestment.

Project Identification and Prioritization

Specific resilience projects are needed to increase system resilience to severe weather events. This section of the TRIP will create a clear and transparent process for identifying priority transportation resilience projects based on the results of the vulnerability assessment and input from DVRPC member agencies. Such projects may include more detailed studies, engineering evaluations and capital improvements. Ultimately, TRIP projects that receive federal funding will be added to DVRPC's TIP.

Overview of Resilience Strategies and Best Practices

The TRIP will also provide illustrative examples of resilience improvement strategies, which will serve as a reference to agency partners as they consider resilience projects, solutions, and interventions for the assets they manage. Major categories of resilience techniques will include gray and green stormwater infrastructure improvements; nature-based solutions; roadway elevation and relocation; asset armoring and hardening; materials selection; vegetation maintenance; cool pavements; and interventions to increase shade and comfort for transit users.

TRIP Timing and Budget Description:

The full period of performance for the vulnerability assessment and TRIP development will be two years. Funding through this project may support consultant services, DVRPC staff time, or materials and supplies, as needed.

Tasks:

1. Convene regional partners and establish a TRIP steering committee
2. Evaluate best practices for transportation vulnerability assessments and TRIP development
3. Identify needed hydrologic modeling and analysis
4. Develop and issue an RFP for consultant servoces to conduct modeling and analysis and support regional TRIP development
5. Collect and gather weather-related hazard data and asset information from partners
6. Gather partner and transportation user input on model assumptions and scoring criteria for the vulnerability assessment
7. Conduct a transportation vulnerability assessment in partnership with transportation operating agencies, member governments, and consultant teams
8. Publish and share the results of the vulnerability assessment
9. Develop criteria and forms for soliciting priority resilience projects for inclusion in the regional TRIP
10. Develop the regional TRIP incorporating analysis, data, and input from all project phases

Products:

1. Hydrologic models (HEC-RAS or similar) simulating fluvial and pluvial flooding under different rainfall-intensity-duration scenarios
2. Historic data on extreme weather events and impacts

3. Data layers detailing the spatial patterns of extreme heat
4. Extreme Weather Transportation Vulnerability Assessment, including maps, analysis, and technical appendices
5. Summary of resilience strategies and best practices
6. Transportation Resilience Improvement Plan

Beneficiaries:

PennDOT, SEPTA, Southeastern Pennsylvania counties, municipalities, and transportation users

Cost and Funding:

FY	Total	Highway PL Program	Transit PL Program	Comprehensive Planning	Other
2026	$500,000				$500,000

FY2026 Other Funding Details:

PROTECT Program IIJA Funds; The Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation (PROTECT) Program.