

# RESILIENCE QUICK GUIDE

Incorporating Resilience Into The MPO  
Long Range Transportation Plan



APRIL 2023

FDOT

# INTRODUCTION

## ***System Resilience***

23 CFR 450.306(b)(9) requires Metropolitan Planning Organizations (MPOs), in cooperation with State and public transportation operators, to “improve the resiliency and reliability of the transportation system and reduce or mitigate stormwater impacts of surface transportation” in the long range transportation planning process. As a result, Florida’s MPOs consider resilience as a planning factor when assessing projects, strategies, and services during the development of their Long Range Transportation Plans (LRTPs).

All of Florida’s MPO planning areas are affected by extreme events and changing conditions including weather, environmental, economic, and operational disruptions. These unexpected disruptions, also known as shocks, and sustained trends or pressures that undermine the stability of a system, known as stresses, vary throughout the state. Shocks and stresses can include increased inland flooding, sea level rise, increased frequency of severe storms with high winds and greater rainfall, increased duration of droughts and wildfires, economic recessions, or even cyberattacks.

Transportation facilities may become damaged, eroded, flooded, weakened, or otherwise impacted as a result of these events and trends. The impacts of these events and trends not only present risks to the immediate and long-term safety and mobility of Florida’s residents and visitors, but they also can result in costly repair efforts and deter trade and business investment.

Since these events and conditions have intensified in duration, magnitude, and frequency, transportation agencies are identifying ways to protect, preserve, and improve their assets to combat extreme events and climate change to protect communities and local economies.

## ***Resilience in the LRTP***

One of the most important responsibilities of an MPO is to identify investment strategies that focus on developing projects and programs to best meet the transportation needs of the area’s residents, businesses, and visitors. The LRTP is a key tool the MPO uses to guide its planning process. To assist with incorporating resilience into the LRTP, the FDOT Office of Policy Planning developed the Resilience Quick Guide which outlines the steps for an MPO to consider throughout the development of the LRTP.



**RESILIENCE IS THE ABILITY OF THE TRANSPORTATION SYSTEM TO ADAPT TO CHANGING CONDITIONS AND PREPARE FOR, WITHSTAND, AND RECOVER FROM DISRUPTION.**

FDOT POLICY - TOPIC NO. 000-525-053



*Image: Disrupted roadway in North Port, FL*

# THE RESILIENCE QUICK GUIDE

*identifies opportunities to incorporate resilience in each step of the LRTP Process:*

SECTION 1  
TRENDS & CONDITIONS

SECTION 2  
REGULATIONS & STATEWIDE PLANS

SECTION 3  
GOALS & OBJECTIVES

SECTION 4  
PERFORMANCE MEASURES & TARGETS

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RISK & VULNERABILITY ASSESSMENTS

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NEEDS PLAN DEVELOPMENT

SECTION 7  
COST FEASIBLE PLAN – INVESTMENTS & PROJECT PRIORITIZATION

This document includes examples of noteworthy practices by MPOs in Florida and agencies around the country.



*Images: Damage and recovery efforts in Florida after Hurricane Ian*

# TRENDS & CONDITIONS

As the 3rd most populated U.S. state, and with our population expected to grow by 6.3 million residents by 2050, resilient transportation infrastructure in Florida is critical. To plan for a resilient transportation future, we need to understand important trends and conditions today. Monitoring current trends and conditions related to resilience in Florida can assist in future planning, funding decisions, and policymaking for transportation projects. MPOs are better equipped to meet the needs of their communities with a better understanding of both present conditions and anticipated trends. Since 2011, more than 32 Federal Emergency Management Agency Declarations have been made in Florida related to hazards ranging from hurricanes, severe storms, flooding, and fire. Some additional trends and conditions related to emergency preparedness and resiliency are identified here.

There are  
**15**  
**MILLION PEOPLE**  
living in Florida's  
**COASTAL COUNTIES**

In Florida,  
**INCIDENTS, WEATHER, CONSTRUCTION, AND OTHER SPECIAL EVENTS**  
account for  
**46%**  
**OF CONGESTION**

## HURRICANE MICHAEL

October 2018

- 35** counties evacuated
- 375,000** residents affected
- \$5.8 BILLION** in estimated insurance loss

## HURRICANE IRMA

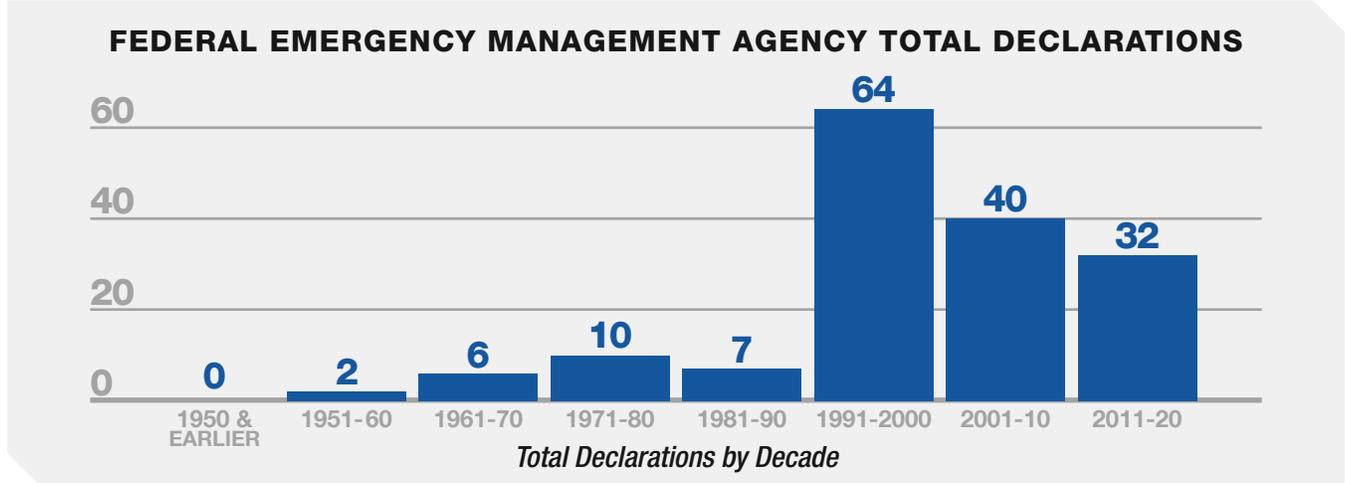
September 2017

- 54** counties evacuated
- 6.8 MILLION** residents affected
- \$11.1 BILLION** in estimated insurance loss

**3 OUT OF 10** Florida Regions have a **SHORTAGE OF SHELTER SPACE** for the general population

**5 REGIONS** have a shortage of shelter space for **SPECIAL NEEDS POPULATIONS**

Since 2000, **TIDAL FLOODING** across Florida has **INCREASED BY 352%** while sea levels are rising about **1 INCH EVERY THREE YEARS**



Source: [http://floridatransportationplan.com/pdf/FDOT\\_EmergingTrends\\_2022\\_Final.pdf](http://floridatransportationplan.com/pdf/FDOT_EmergingTrends_2022_Final.pdf)

## SECTION 2

# REGULATIONS & STATEWIDE PLANS

The Federal government has authorized spending for surface transportation through multiple authorizations over recent years. The 2012 act, MAP-21, introduced requirements to address resiliency in statewide and MPO transportation planning activities. In 2015, the FAST Act expanded the focus on the resiliency of the transportation system, through the addition of a planning factor to improve the resiliency and reliability of the transportation system and reduce or mitigate stormwater impacts of surface transportation. The Infrastructure Investment and Jobs Act (IIJA) places even more emphasis on resiliency and greenhouse gas emissions, particularly through the creation of formula and discretionary funding programs such as PROTECT allowing states to make surface transportation infrastructure more resilient to the effects of extreme weather and natural disasters. The IIJA also identified tackling climate change, equity, and Justice40 as federal emphasis areas, allowed for the use of specified funding programs to include resiliency projects or elements, and created a new Carbon Reduction Program with formula funding to states for energy-efficient transportation projects.

**MPO Planning Requirements:** 23 CFR Part 450 requires MPO and statewide transportation planning processes to improve the resiliency and reliability of the transportation system and reduce or mitigate stormwater impacts of surface transportation.

**PROTECT:** The IIJA established both formula and discretionary funding programs for transportation resilience. These programs, under the umbrella of PROTECT, provides approximately \$70 million annually to FDOT to cover resilience projects and incremental costs to make projects and facilities more resilient. It also provides a set aside for pre-construction activities; guidance is posted at <https://www.fhwa.dot.gov/environment/sustainability/resilience/>. PROTECT discretionary funds will be available through a Notice of Funding Opportunity, which will be posted at <https://www.gfoa.org/iija-notice-of-funding-opportunity-nofo-tracker>.

**Resilience Action Plan (RAP):** Section 339.157, Florida Statutes, requires FDOT to assess vulnerabilities to the State Highway System and identify strategies to prioritize and address those vulnerabilities. The RAP is due to the Governor and Legislature by June 30, 2023 and may be found at [www.fdot.gov](http://www.fdot.gov).

**Resilience Improvement Plan (RIP):** IIJA provides for an increase in federal share of PROTECT funds, including required matching funds for discretionary grants, if a state or MPO has adopted a RIP. FDOT will extend the vulnerability assessment conducted in RAP to include the National Highway System to serve as the RIP, with an expected completion date of December 31, 2023.

**23 CFR Part 667:** This section requires state DOTs to track repeated repairs to transportation facilities due to emergency events. DOTs are also required to evaluate alternatives to repair and reconstruction. These evaluations must be completed before a related project may be included in the State Transportation Improvement Program (STIP). A list of 667 facilities is posted at [https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/planning/performance/part-667-evaluation-report-\(final\).pdf?sfvrsn=3f341f30\\_4](https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/planning/performance/part-667-evaluation-report-(final).pdf?sfvrsn=3f341f30_4).

**FDOT Policy 000-525-053:** FDOT Policy 000-525-053, Resiliency of State Transportation Infrastructure, mandates that resilience be considered and incorporated into the Department's business practices through long range and modal plans, work program, and asset management plans. This policy may be found at [https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/planning/policy/resilience/resilience\\_policy\\_000-525-053.pdf?sfvrsn=4dae64fd\\_2](https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/planning/policy/resilience/resilience_policy_000-525-053.pdf?sfvrsn=4dae64fd_2).

**SLIP:** Florida law requires a Sea-Level Impact Projection (SLIP) Study prior to performing a construction project within the coastal building zone. The Florida DEP oversees the SLIP requirements and has developed and made available a tool with additional resources to help make these studies easy to perform. The SLIP Rule and Tool may be found at <https://floridadep.gov/rcp/florida-resilient-coastlines-program/content/sea-level-impact-projection-slip-study>.



Image: Flooding in North Port, FL after Hurricane Ian

## SECTION 3

# GOALS & OBJECTIVES

### *The Foundation*

Goals and objectives form the foundation of the LRTP, guiding the recommendations and strategies within the Needs Plan and the Cost Feasible Plan that sets the stage for project development. During the creation of goals and objectives, MPOs have the opportunity to integrate resilience into the LRTP. As a planning document, the LRTP must address resilience.

*Integrating resilience into goals allows MPOs to support local communities by:*

- ✓ **MEETING** state and federal requirements
- ✓ **PREPARING** for current and future increases in extreme weather events
- ✓ **PREPARING** for current and future impacts of climate change
- ✓ **PREPARING** for shifting economic conditions and fluctuations
- ✓ **ANTICIPATING** operational challenges and impacts of new technologies
- ✓ **MANAGING** life-cycle costs of the transportation system

In other cases, interweaving resilience among objectives in a broader goal may be more effective. For instance, the MPO's goal may be to improve and preserve the existing transportation system. In this example, the goal may be supplemented by more specific objectives related to resilience.

*Identifying goals and objectives that directly address resilience early in the plan development will help MPOs build a framework to inform the rest of the planning process and support further analysis and decision-making.*



*Image: Damage from Hurricane Ian*

### *Focus on Resilience*

While a number of Florida's MPOs have already incorporated resilience in their long range planning process, continuing to refine goals and objectives will help shape recommendations, inform policy decisions, and facilitate coordination between MPOs and state and federal agencies.

Since resilience is a multifaceted and dynamic issue, each MPO may choose to incorporate resilience into the Goals and Objectives of the LRTP in a unique way that addresses the needs and assets of their planning area. In certain cases, a goal specific to resilience may be appropriate. For example, a standalone goal could be to create a resilient and reliable multimodal transportation system. This goal could include creating infrastructure that provides diverse transportation options that ensure accessibility, provide system redundancy, support evacuation needs, and address social equity.



*Image: Community members weighing in on the Tallahassee Community Resilience Plan that is being incorporated into CRTPA's 2045 Regional Mobility Plan*

## IN ADDITION TO THE PRIOR EXAMPLES GIVEN,

*objectives or strategies related to resilience encompass many other planning areas including:*



### ASSET MANAGEMENT

Evaluating assets for risks, gaps, or vulnerabilities

Creating mitigation actions to address risks, gaps, or vulnerabilities



### ECONOMY

Ensuring that intermodal facilities important to regional economies are integrated into the transportation system

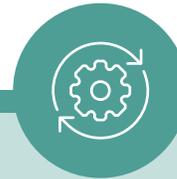
Supporting transportation projects that promote job creation and economic development



### FREIGHT

Prioritizing fuel distribution or recovery plans

Improving freight connectivity and access to Strategic Intermodal System (SIS) and intermodal facilities



### INNOVATION

Supporting new Intelligent Transportation System (ITS) projects to improve operational management and information

Incorporating automated, connected, and electric vehicle technologies

Considering projects with inherent resilience, such as roundabouts



### SAFETY

Participate in evacuation planning

Enhancing equity in decision making and improving safety



### PROJECT IMPLEMENTATION & DELIVERY

Prioritizing and supporting the implementation of projects recommended and identified from plans and studies

Supporting moving projects forward to the next phase, from PD&E into design and construction to ensure project delivery

# NOTEWORTHY PRACTICES



## FLORIDA

### Collier MPO 2045 LRTP

The Collier MPO 2045 LRTP included the goal to “Consider climate change vulnerability and risk in transportation decision making.” The goal is supported by several objectives related to identification of climate impacts, vulnerable assets, and adopting strategies to address these vulnerabilities.

<https://www.colliermopo.org/lrtp/>

### Martin MPO 2045 LRTP

Some MPOs have integrated resiliency into their vision or mission statements as well. For example, the Martin MPO vision statement is, “To create and maintain a safe, efficient and resilient multimodal transportation network to meet mobility and accessibility needs of Martin County’s residents and visitors, while preserving the environment, supporting economic growth and enhancing the quality of life.”

<https://martinmpo.com/long-range-transportation-planninglrtp/>

### Miami-Dade TPO 2045 LRTP

The Miami-Dade TPO’s 2045 LRTP included the goal to “Improve and Preserve the Existing Transportation System.” This goal is supported by several objectives related to increasing the resilience of the transportation system.

<https://www.miamidadetpo.org/long-range-transportation-plan.asp>

### North Florida TPO 2045 PathForward

The North Florida TPO 2045 PathForward (LRTP) sets forth a resilience goal: “Create reliable and resilient multimodal infrastructure.” This goal is supported by the objectives related to incorporating climate risk, resilience, equity, and emergency preparedness into project planning.

<https://northfloridatpo.com/uploads/2045-LRTP-Summary-Report.pdf>

### Okaloosa-Walton TPO 2045 LRTP

The Okaloosa-Walton TPO incorporated resiliency into its mission statement: “To preserve and enhance reliable transportation systems that are safe, efficient, resilient, socially and environmentally responsible, technologically advanced, financially constrained, coordinated with land use patterns, and allow for modal choice.”

[https://www.ecrc.org/programs/transportation\\_planning/okaloosa-walton\\_tpo/plans\\_and\\_documents/long\\_range\\_transportation\\_plan.php](https://www.ecrc.org/programs/transportation_planning/okaloosa-walton_tpo/plans_and_documents/long_range_transportation_plan.php)



## NATIONAL

### Hampton Roads Transportation Planning Organization 2045 LRTP

The Hampton Roads Transportation Planning Organization (HRTPO) created a matrix of federal, state, and regional transportation planning goals and prioritization to help craft their 2045 LRTP objectives.

[https://www.hrtpo.org/page/2045-long\\_range-transportation-plan/](https://www.hrtpo.org/page/2045-long_range-transportation-plan/)

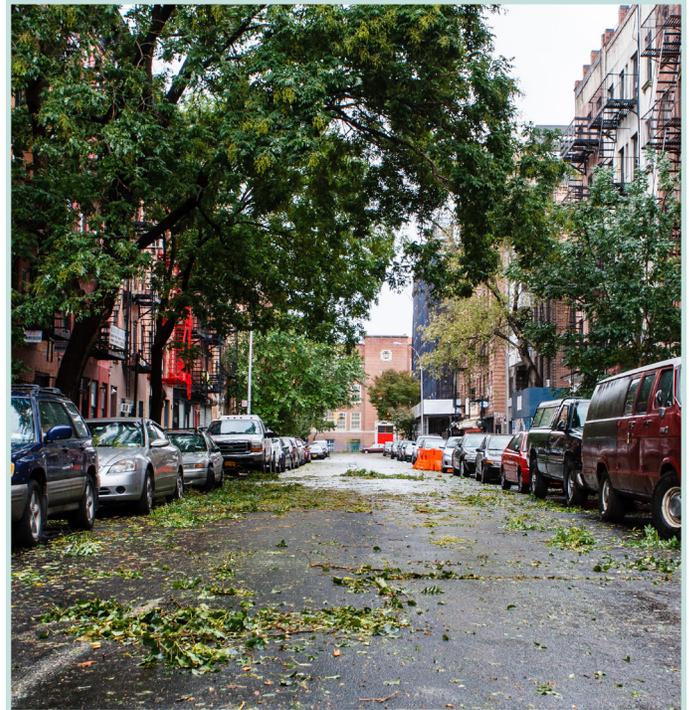


Image: Street debris in New York City, NY after Hurricane Sandy

### New York Metropolitan Transportation Council 2045 LRTP

The New York Metropolitan Transportation Council’s (NYMTC) 2045 LRTP sets forth the goal of “improving the resilience of the regional transportation system.” The goal is further defined as a “system that can better resist disruptions to service and facilities and recover from them when they occur.” NYMTC also identified extreme weather events and resilience as a driving factor in its LRTP, pointing to the use of more sophisticated tools to identify vulnerabilities in the transportation system, ultimately identifying infrastructure for hardening as well as developing emergency response plans.

<https://www.nymtc.org/Required-Planning-Products/Regional-Transportation-Plan-RTP/Plan-2045-Maintaining-the-Vision-for-a-Sustainable-Region>

## SECTION 4

# PERFORMANCE MEASURES & TARGETS

## Measuring Progress

Enacted in 2012, MAP-21 aimed to increase transparency and accountability to ensure that states were collectively making progress toward national transportation planning goals. This surface transportation act is a predecessor of the IIJA. In the IIJA, measuring progress towards resilience has increased in importance.

Since Florida's transportation system needs exceed available funding, resources are invested into the most efficient and strategic ways possible to meet performance measure targets for resilience. MPOs use performance measures as an indicator of progress toward attaining national, state, and local goals and objectives. FDOT utilizes these performance measures in three major ways:

### THE STRATEGIC LEVEL

Performance measures help inform and establish the MPO's goals, objectives, and strategies as well as progress toward goals set forth in the Florida Transportation Plan, the Strategic Highway Safety Plan, and the Freight Mobility and Trade Plan.

### THE DECISION-MAKING LEVEL

Performance measures inform and address financial policies in the allocation of funds across the transportation system.

### THE PROJECT DELIVERY LEVEL

Performance measures help assess the efficiency and effectiveness of projects and inform the Department's Five-Year Work Program.

## Focus on Resilience

While Federal performance measures and targets are guided by the IIJA, MPOs do have the option of going above and beyond the required measures. MPOs can elect to include additional measures that may address preparing for extreme weather events, anticipating abrupt or prolonged environmental changes, shifting economic patterns, or

maintaining connectivity and mobility in order to incorporate planning for resilience. The MPO's performance measures may track the interstate system pavement condition after major flooding events, assess the number of highway lanes within the 100-year floodplain, quantify the number of bridges disrupted after storm surges, or calculate the percent of transit track segments with performance restrictions.

**Ultimately, performance measures are used to track progress toward the achievement of the MPO's goals and objectives and are the drivers of investment and policy decision-making.** Within their LRTP, MPOs have an opportunity to determine what successful resilience planning looks like and how to measure that success for their planning area.

In order to maximize the effectiveness of any new performance measure, it is helpful for the MPO to consider available data to assess progress across both near-term and long-term timeframes. Additionally, conversations with agency partners such as FDOT and FHWA will help align the measure with best practices from other areas. This approach leads to performance measures that can more easily translate between the LRTP and the TIP.



Image: Flooding in Volusia County, FL after Hurricane Ian

# NOTEWORTHY PRACTICES



## FLORIDA

### Broward MPO 2045 MTP

The Broward MPO's Commitment 2045 Metropolitan Transportation Plan (MTP) includes the following performance measure and target: "Miles of Public Roads and Rail Forecasted to be Permanently Inundated by between 1 ft. and 2 ft. of Sea Level Rise. Target: Decrease by 2045."

<https://www.browardmpo.org/index.php/commitment-2045-metropolitan-transportation-plan>

### Hillsborough TPO 2045 LRTP

The Hillsborough TPO LRTP measures progress toward the good repair and resiliency goal using the following measure: Protect 250 lane miles of highly vulnerable and critical roads from heavy rain and storm surge with shoreline protection, pavement hardening, and stormwater drainage improvements.

<https://planhillsborough.org/2045lrtp/>

### Indian River County MPO 2045 LRTP

The Indian River County MPO 2045 LRTP measures progress toward the goal of increasing resiliency of infrastructure for extreme weather and climate trends using the following measure: Percent of new projects incorporating enhanced features (such as higher elevations, increased drainage capacity, and more resilient construction materials as appropriate into new projects). Target: Improve by 2045.

[https://ircgov.com/mpo/LRTP/Documents/2045/LRTP\\_2045\\_Final\\_Report.pdf](https://ircgov.com/mpo/LRTP/Documents/2045/LRTP_2045_Final_Report.pdf)

### Palm Beach TPA 2045 LRTP

In Palm Beach TPA's 2045 LRTP, there are two resilience-specific performance measures listed:

To identify the "percentage of federal-aid eligible mileage susceptible to inundation by 1.2-foot sea level rise and historic storm surge."

To record the "1% chance of annual flooding."

The use of performance measures provides data that is analyzed to determine areas of weakness, highlight future areas of focus and strength, and identify where successful planning has proven to be valuable.

[https://www.palmbeachtpa.org/static/sitefiles/LRTP/2045/LRTP\\_Full\\_Final.pdf](https://www.palmbeachtpa.org/static/sitefiles/LRTP/2045/LRTP_Full_Final.pdf)



## NATIONAL

### Los Angeles County Metropolitan Transportation Authority – Resiliency Indicator Framework

LA County Metro developed projections for climate change, population, land use, technology, and other factors that play a role in how the Metro system is designed, used, and operated. Since 2012, Metro has assessed system resiliency against anticipated and unpredictable impacts and to clearly identify opportunities to strengthen system resiliency. In 2019 and 2020, they developed the All-Hazards Mitigation Plan that pursues flexible adaptation pathways and advances regional resiliency.

<https://sustainabilityreporting.metro.net/resilience-and-climate-adaptation>



Image: Eroded coast shown in Los Angeles County, CA. Source: All-Hazards Mitigation Plan

### North Central Pennsylvania RPO LRTP

The North Central Pennsylvania RPO conducted a risk analysis to develop a list of at-risk assets as a result of increases in risk to extreme weather. An Alternative Routes study was commissioned to ensure mobility in the event the at-risk facilities were disrupted due to flooding.

<https://rpo.ncentral.com/long-range-transportation-plan/>

### Puget Sound Regional Council RTP

The Puget Sound Regional Council's (PSRC) Regional Transportation Plan (RTP) defined its performance-based evaluation in relation to 11 categories known as the Regional Outcomes Framework. The RTP outlined the seismic risks, tsunami impacts, and other climate impacts pertinent to the planning area. It described how resiliency was incorporated throughout the plan's development and how it was incorporated in the creation of the performance measures related to air quality and climate change emission reduction and infrastructure hardening.

<https://www.psrc.org/planning-2050/regional-transportation-plan>

## SECTION 5

# RISK & VULNERABILITY ASSESSMENTS

### ***Mitigating Adverse Impacts***

A risk is a measure of the probability that an asset will experience a particular impact and the severity of that impact. While the probability of an occurrence may be low, the severity may be high or vice-versa. Building on the foundation set by the goals and the data obtained from setting performance measures, an MPO has the opportunity to identify vulnerabilities that may hinder their ability to achieve goals and performance measures. Cultivating an accurate inventory of assets and conditions helps MPOs identify susceptible infrastructure and plan for potential adverse environmental, weather, economic, or operational conditions.

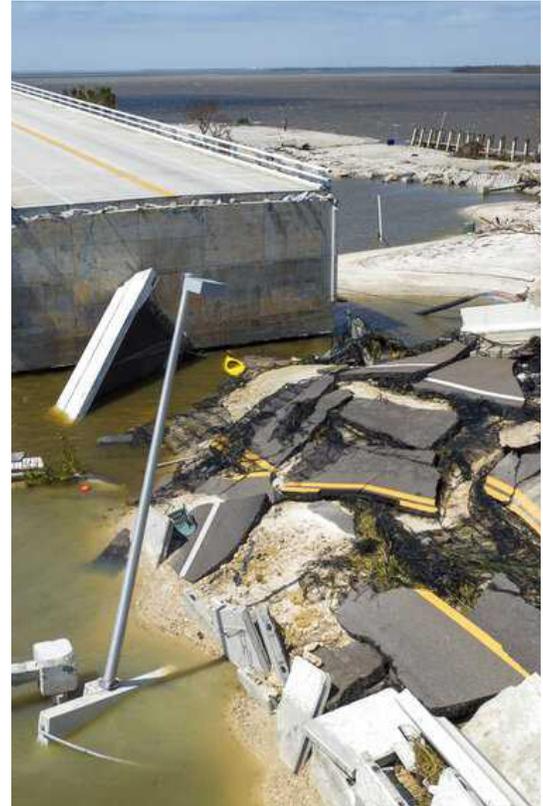
### ***Focus on Resilience***

A risk assessment is a valuable method for establishing a network-wide perspective relative to resilience. The review of established baselines identified as part of the performance measurement process can help MPOs make informed decisions about the costs and benefits of mitigation options.

When assessing vulnerabilities and risks, it is vital to determine where certain weather and environmental conditions such as extreme heat, variations in rainfall, sea level rise, hurricanes, or greater periods of drought will strain the transportation network. Additional vulnerabilities or risks could include economic recessions, gaps in network connectivity, or cyberattacks.

While environmental and weather vulnerabilities are most often associated with resilience, the operational and economic vulnerabilities are often interrelated. For example, after a major hurricane certain roadways and bridges may be disrupted or damaged. While the immediate impacts may be flooded or closed roadways, impacts to local or regional economies may include slower or less frequent product shipments that create sustained economic losses. Additionally, the condition of facilities can degrade over time due to extreme or frequent exposure. The interrelated nature of risk and vulnerabilities is the key reason why risk assessments and resilience planning are so important.

Currently, many of Florida's MPOs are using GIS mapping and analysis and scenario planning capabilities to identify evacuation strategies, prioritize future investments, and integrate climate risk data into policy and decision-making. Determining the risks specific to the MPO may look different depending on the area. Coastal MPOs may identify the impacts of varying levels of storm surge on regional freight mobility or evacuation routes, while inland MPOs may analyze the impacts of extreme rainfall on bridges and roads in low lying, flood-prone areas. Scenario planning and risk assessments provide a holistic, regional approach to large-scale threats and their potential impacts that inform resilience needs in the LRTP.



*Top Image: Collapsed Sanibel Causeway after Hurricane Ian*

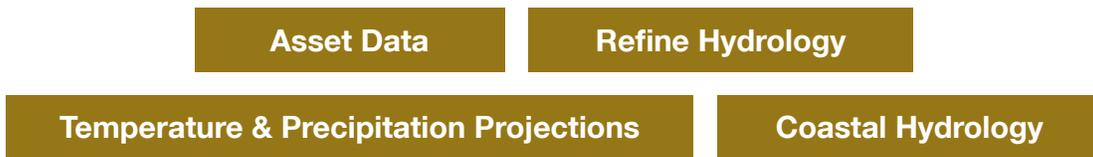
*Bottom Image: Pine Island Road Near Cape Coral, FL after Hurricane Ian*

# VULNERABILITY ASSESSMENT & ADAPTION FRAMEWORK

## Set Objectives & Define Scope



## Compile Data



## Assess Vulnerability



## Analyze Adaptation Options



## Incorporate Results into Decision-Making



Source: FHWA Vulnerability Assessment and Adaptation Framework, Third Edition

Some MPOs have conducted resilience assessments that inform the LRTP and other planning efforts, while other MPOs integrate the results of resilience assessments completed by others into the LRTP. Over half of Florida's MPOs have or plan to conduct a vulnerability assessment. MPOs with limited agency resources may apply for funds, such as the competitive funding through PROTECT, to complete assessments and/or leverage data from existing studies. In addition to leveraging existing studies, MPOs may coordinate with local and regional resiliency efforts to identify vulnerabilities, engage stakeholders, and develop strategies to improve the resilience of transportation systems.

# NOTEWORTHY PRACTICES



## FLORIDA

### Florida-Alabama TPO

The Florida-Alabama TPO used local plans and vulnerability assessments from Escambia County and the City of Pensacola Climate Action Task Force to coordinate on local projects to inform their 2045 LRTP, including the identification of Corridor/Complete Streets studies and projects as well as bicycle/pedestrian projects for emissions reduction.

[https://files.ecrc.org/document\\_center/Programs/Florida%20Alabama%20TPO/2045%20Plan/FL%20AL%20LRTP%20report%2003%2026%2021.pdf](https://files.ecrc.org/document_center/Programs/Florida%20Alabama%20TPO/2045%20Plan/FL%20AL%20LRTP%20report%2003%2026%2021.pdf)



Image: Bicyclists in Pensacola, FL

### Lee County MPO

The Lee County MPO leveraged local and regional studies on flood mitigation, drainage, and regional resiliency to inform their understanding of vulnerabilities and project prioritization. The 2045 LRTP identified a criterion for transportation infrastructure resiliency, scoring projects based on the number of facility closures and/or evacuation zones.

<https://leempo.com/wp-content/uploads/Appendix-D-Project-Prioritization-Criteria.pdf>

### Martin County MPO

The Martin County MPO coordinates with the Martin County Board of County Commission's Resiliency Planning Working Group on local resiliency planning initiatives and will use information from these studies to inform the MPO's transportation network resiliency study.

### Sarasota/Manatee MPO Resiliency Study

The Sarasota/Manatee MPO completed a resiliency study in January 2023 that developed methods and tools to integrate resiliency planning with transportation planning and decision-making. The study built upon the All Hazard Recovery Plan funded by a Federal Transit Administration grant for training on developing an emergency recovery plan. Key study outcomes included methods to identify and prioritize mitigation strategies, as well as a prioritized list of resiliency projects.

<https://www.mympo.org/p/performance-measures/infrastructure-condition/resiliency-vulnerability-assessment>



## NATIONAL

### Ohio DOT

The Ohio DOT has employed FHWA's Vulnerability Assessment Scoring Tool (VAST) to evaluate the relative vulnerability of state-maintained bridges and highways. VAST has also been utilized by the Broward MPO and Miami-Dade MPOs for their first phase vulnerability assessments.

[https://www.fhwa.dot.gov/environment/sustainability/resilience/tools/scoring\\_tools\\_guide/vast\\_users\\_guide.pdf](https://www.fhwa.dot.gov/environment/sustainability/resilience/tools/scoring_tools_guide/vast_users_guide.pdf)



Image: Main Street Bridge in Columbus, OH

### Minnesota DOT

In 2014, FHWA created a pilot program that included nineteen states including Minnesota DOT (MnDOT). The project assessed the vulnerability and risk of increased flooding of the highway system in MnDOT Districts 1 and 6. The vulnerabilities focused on the evaluation of at-risk facilities including bridges, culverts, pipes, and roads. The final score was then used to prioritize projects.

<https://www.dot.state.mn.us/climate/pilotproject.html>



Image: Flood waters washing out bridge in Northeast MN

## SECTION 6

# NEEDS PLAN DEVELOPMENT

### *Considering the Options*

After identifying risks and vulnerabilities, the next step is creating a strategy to address present and future needs. MPOs typically complete a Needs Plan to identify the transportation infrastructure essential to accommodate future travel demand. The Needs Plan is an opportunity to directly assess how projects—even those that are ultimately not funded within the Cost Feasible Plan—would strengthen the planning area against identified risks and vulnerabilities.

**THE NEEDS PLAN IS A TOOL TO MAXIMIZE SYNERGY FOR MULTIMODAL TRANSPORTATION NETWORKS**

As such, some MPOs divide their Needs Plan and tables into categories like roadway, transit or public transportation, non-roadway, and mobility, which may include ITS, bicycle and pedestrian, and Transportation Systems Management and Operations (TSMO) programs. In these tables, MPOs may take additional steps to describe how each project is strengthening the ability of the MPO to address resilience. For example, if certain roadways are plagued with inadequate stormwater management, the MPO may opt to note this as a concern and identify preliminary mitigation efforts to address resilience.

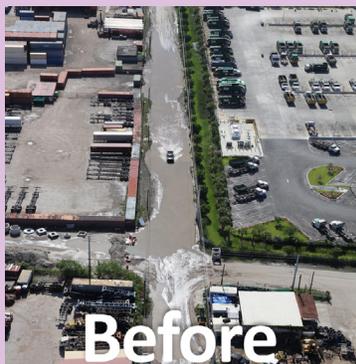
MPOs can consider resilience factors in the prioritization of their Needs Plans to show how projects help fulfill planning goals. For example, an MPO may choose to consider whether a project is along an evacuation route, promotes continuity and connectivity, reduces congestion, is a freight route, or impacts wetlands. Projects may be evaluated based on

anticipated impacts to these items and if the project is fulfilling the MPO's goals and supporting established performance measures. The Needs Plan serves as a key resource for initially reviewing resilience strategies and how they translate into future infrastructure projects.

### *Focus on Resilience*

The Needs Plan can identify resilience needs based on the MPO's goals, objectives, and risk and vulnerabilities assessment. Resilience may be incorporated into the Needs Plan through projects, programs, policies, or other resilience planning efforts. How these elements are identified and evaluated may vary among MPOs. For example, an MPO could approve a specific planning criterion related to emergency response such as measuring routes. This planning factor may be used when evaluating where corridors could be expanded or added to promote expedient emergency response or offer system redundancy in the event of an incident or congested conditions. The MPO could have an environment-specific criterion like identifying if the project is in a floodplain. This planning factor could be used to integrate mitigation strategies in project design to accommodate potential flooding.

Some MPOs consider multiple criteria to both demonstrate how they are working toward their goals and how projects enhance the statewide transportation network. The ability of the MPO to frame resilience in a way that is not fiscally constrained provides an opportunity to show how projects will strengthen and create a more adaptable transportation network and offer valuable comparisons to use when selecting the best projects, programs, policies, and planning efforts.



Images: Flooding on NW 93rd Street in 2019, Town of Medley, FL

# NOTEWORTHY PRACTICES



## FLORIDA

### Broward MPO 2045 MTP

The Broward MPO's Commitment 2045 MTP developed five scenarios, including a "Resiliency Scenario" which responds to sea level rise projections and other climate stressors. In a previous study, the MPO evaluated the risk to the transportation system from extreme weather and climate change. The Resiliency Scenario sought to prohibit future investments to roadways identified as vulnerable in the "Extreme Weather and Climate Change Risk" study. The MPO's 2045 MTP identified six planning factors, and each planning factor had specific criteria to help determine the magnitude of impact or needs a project will have.

<https://www.browardmpo.org/index.php/commitment-2045-metropolitan-transportation-plan>

### MetroPlan Orlando 2045 MTP

The MetroPlan Orlando 2045 MTP included a climate consequences scenario that focuses on rapid population increase due to migration from coastal counties and identifies the need to improve the resilience of critical infrastructure.

[https://metroplanorlando.org/wp-content/uploads/2045MTP\\_TS8\\_ScenarioPlanning\\_Background-and-Development\\_Adopted-20201209.pdf](https://metroplanorlando.org/wp-content/uploads/2045MTP_TS8_ScenarioPlanning_Background-and-Development_Adopted-20201209.pdf)

### Miami-Dade TPO 2045 LRTP

In the 2045 LRTP update, the Miami-Dade TPO explicitly incorporated the results of the South Florida Climate Change Vulnerability Assessment Pilot Project and cited coordination with the county's Local Mitigation Strategy and FEMA mapping for the region to consider flood zones when evaluating projects. Projects located in flood zones should "include adequate infrastructure hardening to prepare for potential impacts."

<https://www.miamidadetpo.org/long-range-transportation-plan.asp>

### River to Sea TPO Sea Level Rise Vulnerability Assessment

In 2016, the River to Sea TPO completed a Sea Level Rise Vulnerability Assessment of their critical facilities and transportation infrastructure. For development of Connect 2045, the TPO used the data from this and other studies to evaluate a Resiliency Scenario. The Resiliency Scenario incorporated sea level rise scenarios from the Regional Resiliency Action Plan to evaluate areas and facilities vulnerable to sea level rise. Inundated areas were compared to projects in the Connect 2045 Needs Assessment to identify vulnerable projects.

<https://www.r2ctpo.org/wp-content/uploads/River-to-Sea-TPO-SLR-Analysis2-Reduced.pdf>



## NATIONAL

### Boston Region MPO LRTP

The Boston Region MPO incorporated resilience in infrastructure that could be affected by climate change through its evaluation criteria. Projects were rated on how well their project's design improves the region's LRTP in areas that are flood-prone or at risk to storm surge and sea level rise.

<https://www.ctps.org/data/pdf/plans/LRTP/destination/Destination-2040-LRTP-20191030.pdf>

### Oahu MPO Regional Transportation Plan 2045

Within the Project and Program Prioritization Process, the Oahu MPO created a specific resilience goal within their Needs Plan that brought into focus safety, resilience, and social equity. Some of these criteria for project selection related to improving emergency access, reducing vulnerability of transportation facilities, and project proximity to concentrations of people who are mobility constrained.

[https://www.oahumpo.org/?wpfb\\_dl=1935](https://www.oahumpo.org/?wpfb_dl=1935)

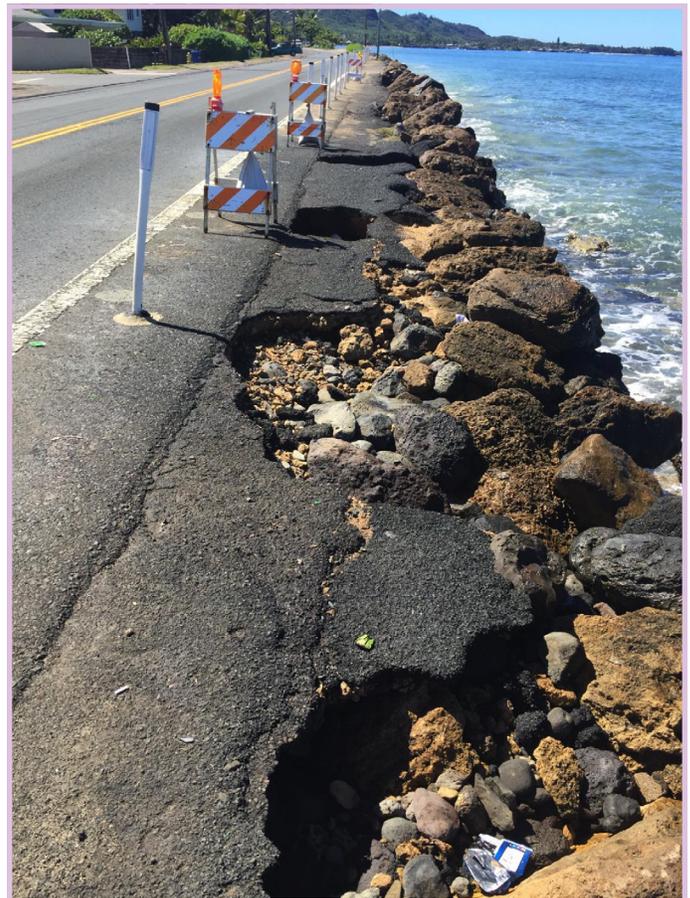


Image: Eroded shoreline in HI

## SECTION 7

# COST FEASIBLE PLAN – INVESTMENTS & PROJECT PRIORITIZATION

### *The Final Step*

The Cost Feasible Plan is a key element of the LRTP. While the Needs Plan can outline any and all projects desired, the Cost Feasible Plan lists the projects that are realistically achievable through the planning horizon due to anticipated funding availability at local, state, and federal levels. Based on funding forecasts, the MPO will allocate funding according to eligible uses and policy direction. These financially constrained projects are prioritized based on the importance of the transportation facility's significance to the planning factors identified by the MPO, state, and federal government.

In the Cost Feasible Plan, the MPO creates a financial summary to show detailed costs over a 25-year period. The Cost Feasible Plan is a section of the LRTP to show how the MPO attempts to leverage available funding to continue to create a resilient, multimodal transportation network. It is also an opportunity to partner with FDOT and local governments to consider on a macro- and micro-level the scale or impact projects have across MPO planning boundaries.

### *Focus on Resilience*

Creating a resilient transportation system is a statewide priority. While each MPO has unique needs in addressing resilience, Florida MPOs are all directed by the same state and federal guidance. As such, the recommendations within the LRTP are tailored to ensure the region's transportation system (whether local, statewide, or other) is best equipped to handle anticipated risks and vulnerabilities.

The IJA created the PROTECT formula program, which provides funding to make surface transportation infrastructure more resilient to the effects of extreme weather and natural disasters. FDOT districts will use the MPO's identified priorities to allocate this funding for resilience planning (assessments, data, tools), constructing resilience improvements, improving evacuation routes, and protecting at-risk coastal infrastructure. The best way to incorporate resilience into the Cost Feasible Plan is to show that MPOs are investing in and prioritizing projects that reflect resilience goals and objectives. For example, by demonstrating that the current transportation network cannot adequately combat aspects of climate change, investments toward creating or upgrading infrastructure to fulfill these needs should reflect the seriousness of resilience as a priority for the MPO.



*Top Image: A1A Scenic & Historic Coastal Byway*

*Bottom Image: Repairs to State Road A1A in Vilano Beach, FL after Tropical Storm Nicole*

Florida's MPOs have been and continue to integrate resilience into their Cost Feasible Plan priorities. Some MPOs invest in conducting studies to identify resilience improvements along certain corridors to compare the cost, feasibility, and impacts of various improvements. These studies are a preliminary step and can set up the MPO to more appropriately design and fund future projects along a corridor. Other MPOs may focus investments including upgrading, expanding, or creating new facilities that promote freight movement, focused economic growth and development, or ITS improvements. Projects may target vulnerabilities to system resilience by upgrading aging infrastructure or incorporating anticipated flood level increases into design standards. However, even if resilience-related projects cannot be implemented with the available funds, MPOs can still list them as unfunded. Including these unfunded projects is important because MPOs may revisit these projects in future LRTP updates or decide a project is no longer relevant or necessary.

Resilience is a multi-faceted concept. With many ways to incorporate resilience into the LRTP, MPOs have the flexibility to define, prioritize, and invest in the types of resilience projects most critical to their respective planning areas. Successful resilience planning outlines goals, defines performance measures, assesses risks and vulnerabilities, showcases needs, and ultimately demonstrates investments in projects that promote resilient communities and transportation networks.

*MPOs integrate resilience into Cost Feasible Plans by:*

- ✓ **CONDUCTING** studies to identify resilience improvements along certain corridors
- ✓ **UPGRADING**, expanding, or creating new facilities that promote:
  - Freight movement
  - Focused economic growth and development
  - ITS improvements



*Image: Road in Arcadia, FL after Hurricane Ian flooded the Peace River*



*Image: Flooding in Florida after Hurricane Ian*

# NOTEWORTHY PRACTICES



## FLORIDA

### Broward MPO Commitment 2045 MTP

The Broward MPO's Commitment 2045 MTP incorporated project prioritization criteria that considered whether an improvement would contribute to sea level rise mitigation and extreme weather resilience as well as how an improvement would impact greenhouse gas emissions. In the Cost Feasible Plan, Broward County showed its commitment to resilience by funding multiple studies to determine resilience improvements.

[http://www.browardmpo.org/images/WhatWeDo/2045\\_MTP/MTP\\_Final\\_Report\\_121219.pdf](http://www.browardmpo.org/images/WhatWeDo/2045_MTP/MTP_Final_Report_121219.pdf)

### Capital Region Transportation Planning Agency

The Connections 2045 Regional Mobility Plan prioritized projects located in a flood area which includes 100-year floodplains and areas susceptible to storm surge.

<https://crtpa.org/wp-content/uploads/RMP-Report-Chapter-4-Project-Evaluation-and-Prioritization.pdf>

### Forward Pinellas

Forward Pinellas incorporated resilience into their annual call for projects by adding a set of resiliency criteria to the multimodal project prioritization, worth up to 10 percent of the total points.

<https://forwardpinellas.org/>

### Lee County MPO 2045 LRTP

The Lee County MPO 2045 LRTP included prioritization for facilities that have been impacted by weather related events such as facility closures and evacuation zones.

<https://leempo.com/programs-products/long-range-transportation-plan/>

### Space Coast TPO 2045 LRTP

In Space Coast TPO's 2045 LRTP, the Cost Feasible Plan included more than 60 centerline miles of improvements on designated evacuation corridors, which is more than 50% of the total investment in the Cost Feasible Plan. The TPO used three security strategies to ensure the capacity necessary for large-scale evacuation was in place in the event of a disaster.

The 2045 LRTP also included prioritization weighting for including adaptation strategies concerning sea level rise, flooding, and extreme weather events and projects that improve treatment of storm water.

<https://www.spacecoasttpo.com/what-we-do/planning/core-work-products/long-range-transportation-plan>



## NATIONAL

### Federal Highway Administration

In 2013, the Federal Highway Administration (FHWA) published the "Assessment of the Body of Knowledge on Incorporating Climate Change Adaptation Measures into Transportation Projects." The report addressed the importance of capturing the cost of "no action" to help show when investment in adaptation measures can demonstrate financial feasibility and significance. While the cost of adaptation can vary project to project, the report explained how to identify costs and benefits, provided methodologies for calculating costs, provided real-world transportation sector examples, and identified best practices, such as developing an information base, improving access to existing data, and monitoring the costs of extreme weather and documenting damages.

[https://www.fhwa.dot.gov/environment/sustainability/resilience/publications/transportation\\_projects/transportationprojects.pdf](https://www.fhwa.dot.gov/environment/sustainability/resilience/publications/transportation_projects/transportationprojects.pdf)

### Southern California Council of Government Regional Transportation Plan

Connect SoCal, the Southern California Association of Governments' (SCAG) Regional Transportation Plan, not only identified \$68 billion to address the preservation, operation, and resilience needs of the state highway system, but also embedded \$6 billion to implement and accelerate strategies that will support transportation system resilience.

<https://www.connectsocial.org/Pages/Connect-SoCal-Draft-Plan.aspx>



Image: Firefighters respond to wildfire in El Dorado County, CA in 2022



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