



U.S. Department of Transportation  
**Federal Highway Administration**

# Integrating Resilience into Transportation Planning

National Transportation in Indian Country Conference

September 3, 2020

Virtual

Heather Holsinger  
Sustainable Transportation and Resilience  
Office of Natural Environment - HQ  
FHWA



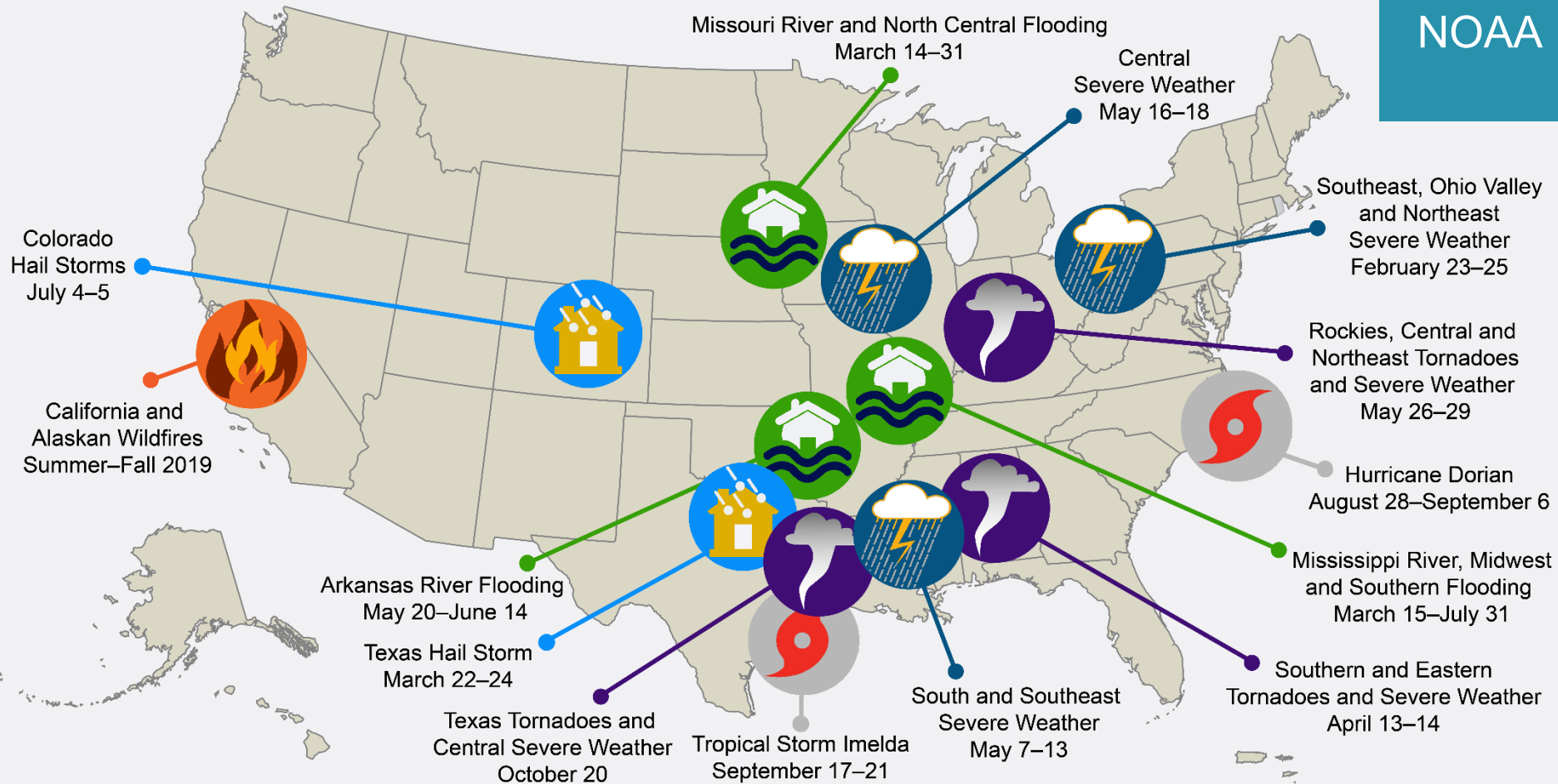
# What is *Resilience*?

**Resilience:** the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions.

# Fourteen Separate Billion Dollar Disasters in 2019

## U.S. 2019 Billion-Dollar Weather and Climate Disasters

Credit:  
NOAA

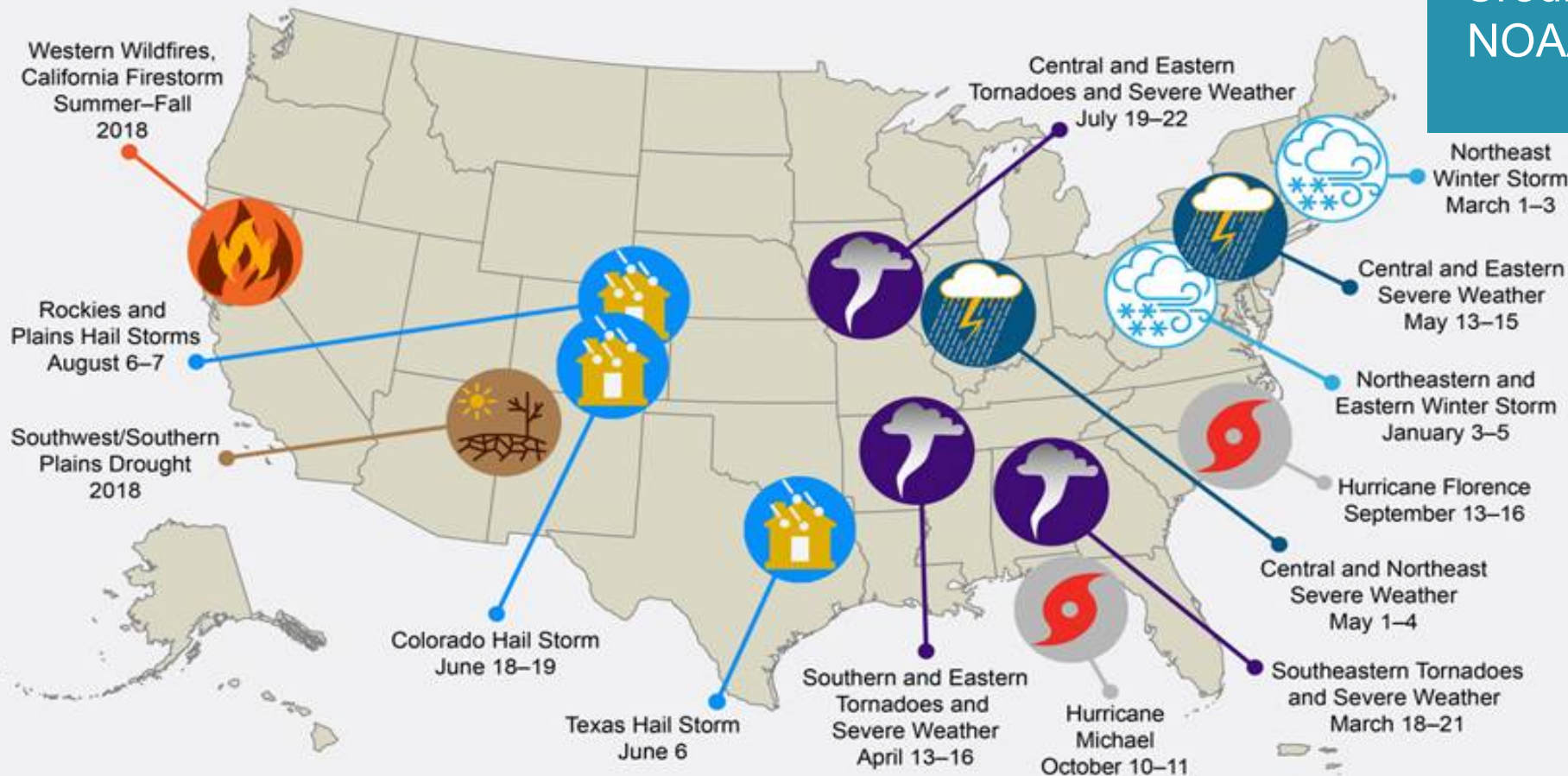


*This map denotes the approximate location for each of the 14 separate billion-dollar weather and climate disasters that impacted the United States during 2019.*

# Fourteen Separate Billion-Dollar Disasters in 2018

## U.S. 2018 Billion-Dollar Weather and Climate Disasters

Credit:  
NOAA



*This map denotes the approximate location for each of the 14 separate billion-dollar weather and climate disasters that impacted the United States during 2018.*

# Transportation System Impacts

USDOT FY 2018-22 Strategic Plan: “DOT will increase its effectiveness in ensuring that infrastructure is resilient enough to withstand extreme weather”



Photo credit: CalTrans



Photo credit: CO DOT



Photo credit: Iowa State Patrol



Photo credit: NYCDOT



# FHWA and Resilience

- Adaptation activities eligible for FHWA funding
- FHWA requires resilience to be considered in:
  - Asset management plans (23 CFR 515)
  - Transportation plans (23 USC 134, 23 CFR 450)
  - Emergency relief (23 CFR 667)
  - FHWA programs and policies (Order 5520)
- Extensive FHWA research and technical assistance available.
- FHWA Resilience Website:  
<https://www.fhwa.dot.gov/environment/sustainability/resilience/>

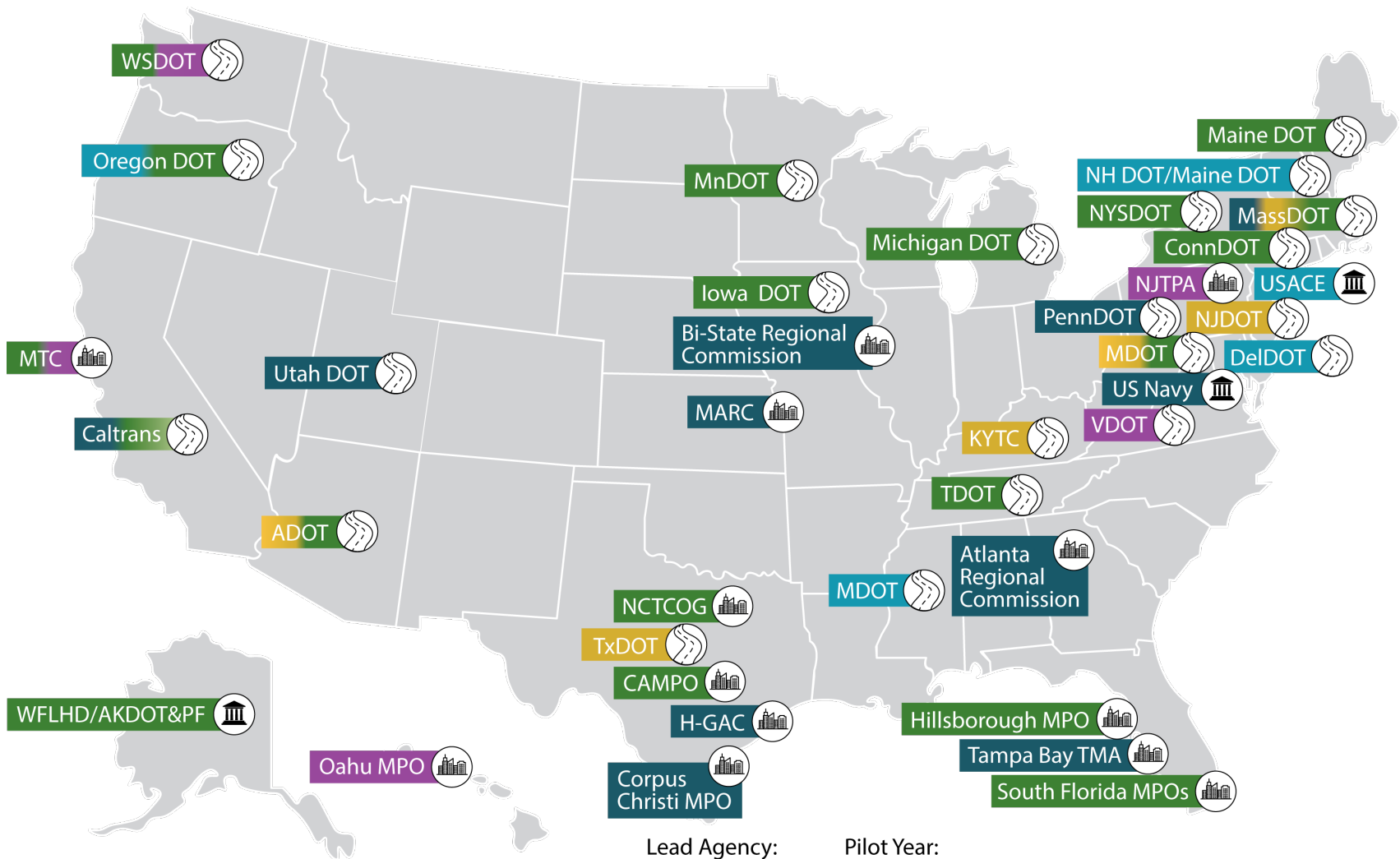


Flooding from Hurricane Harvey, Credit: TTI

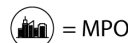


April 2017 flooding in Washington State, Credit: WSDOT

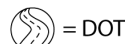
# Working with Partners Across the Country



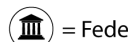
Lead Agency:



= MPO



= DOT

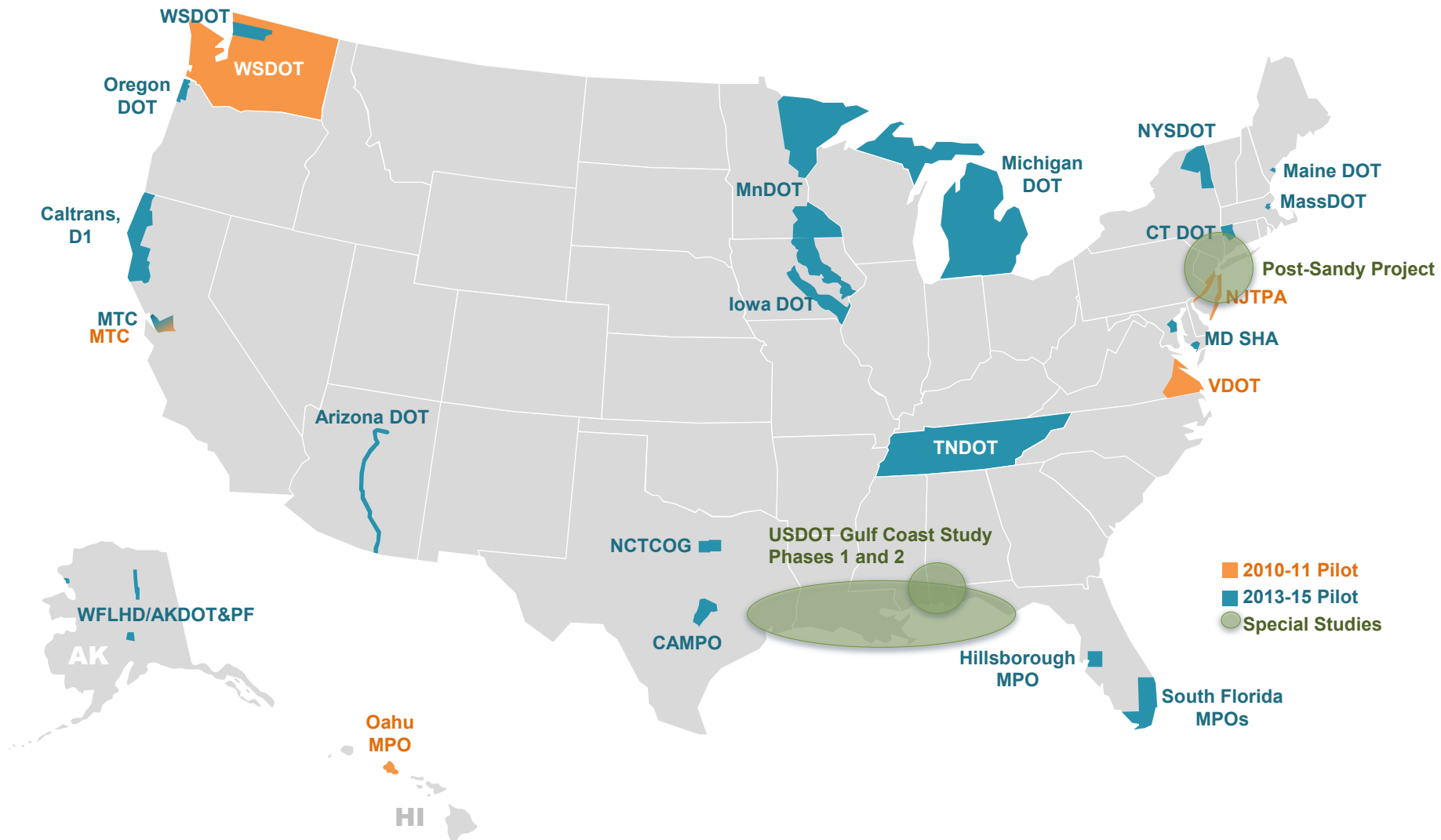


= Federal

Pilot Year:

- = 2010-2011 Vulnerability Assessments
- = 2013-2015 Vulnerability and Adaptation
- = 2016-2017 Nature-Based Resilience
- = 2017-2018 Asset Management
- = 2018-2020/2024 Extreme Weather

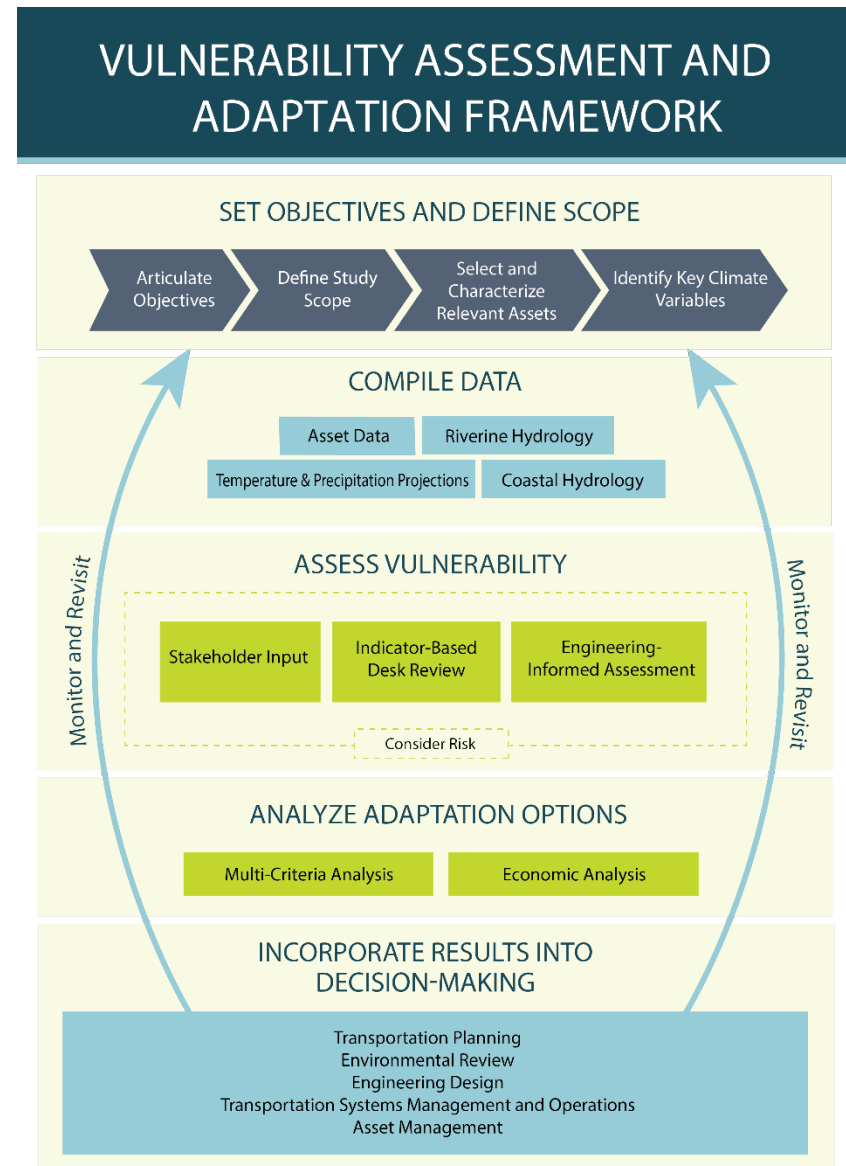
# Vulnerability Assessment Studies





# Vulnerability Assessment and Adaptation Framework, 3<sup>rd</sup> Edition

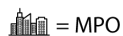
- Provides an in-depth and structured **process** for conducting a vulnerability assessment.
- Features **examples** from assessments conducted nationwide.
- Incorporates information from recent FHWA and other Federal **partner projects**.
- Includes links and references to related **resources and tools**.



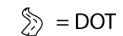
# 2018-2020 Resilience and Durability Pilots



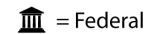
## Lead Agency:



= MPO



= DOT



= Federal

## Type of Project:

= Integrating resilience and durability into agency practices.

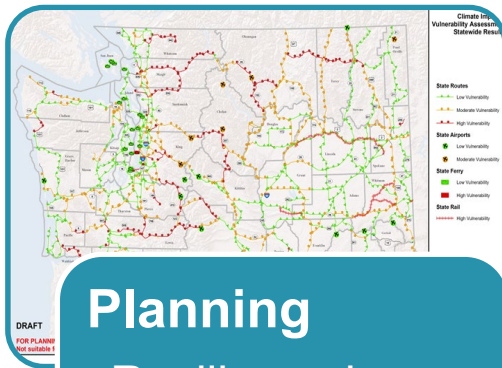
= Using available tools and resources to assess the vulnerability and risk of transportation projects or systems.

= Deploying a resilience solution and monitoring performance.

# Ongoing FHWA Resilience Projects

## Goal: Integrate consideration of resilience in transportation decision making

- In support of 23 U.S.C. § 503(b)(3)(B)(viii), which directs the U.S. Department of Transportation “to carry out research and development activities ... to study vulnerabilities of the transportation system to ... extreme events and methods to reduce those vulnerabilities.”



### Planning

- Resilience in Asset Management
- Resilience in Transportation Planning



### Project Level

- Coastal and Riverine Hydrology Manuals
- Nature Based Resilience for Coastal Highways

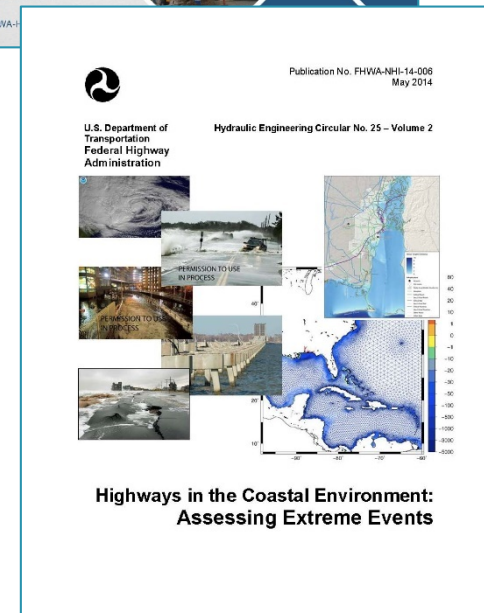
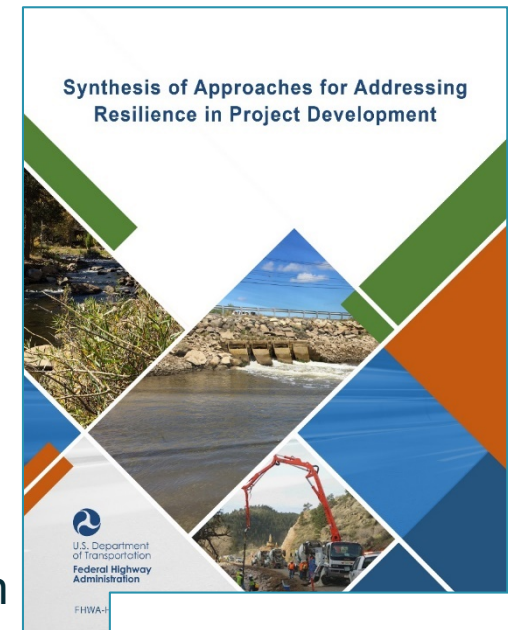


### Operations and Maintenance

- Emergency Response
- Resilient Recovery

# Integrating Resilience at a Project Level

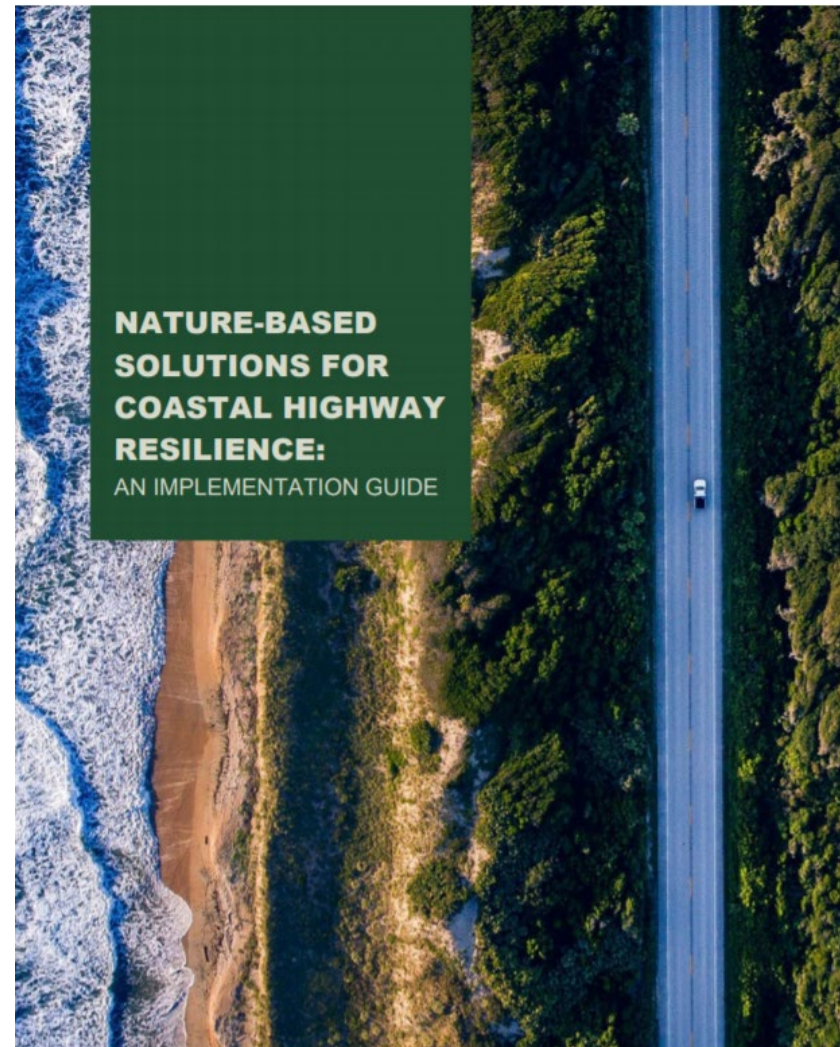
- Transportation Engineering Approaches to Climate Resiliency (TEACR)
  - Overall lessons learned for engineering
  - Coastal Hydraulics
  - Riverine Flooding
  - Pavements and Soils
  - Mechanical and Electrical Systems
- HEC 25: Highways in the Coastal Environment, V2
  - How to incorporate extreme events in coastal design
  - Sea level rise, storm surge, wave action
  - 3 approaches (low, medium, high level of effort)
- HEC 17: Highways in the River Environment
  - Strategies ranging from sensitivity analysis with higher discharges to integrating climate model rainfall projections into local hydrologic models





# Nature-based Resilience Solutions

- **FHWA Goal:** Provide research and technical assistance to transportation agencies on how they can use nature-based solutions (such as wetlands, dunes, beaches, and reefs) to reduce coastal flood and erosion risks to highways.
- **FHWA Products:**
  - 5 pilot projects, 2018
  - Regional peer exchanges, 2018
  - [Implementation Guide](#), 2019
- **Funding Opportunity:** FHWA is collaborating with NOAA on [Effects of Sea Level Rise research grant program](#). 2021 call will include focus on how nature-based solutions can improve transportation resilience.



# Rapid Resilience Assessments

A small team of FHWA, State DOT, and contractor subject matter experts conduct “Rapid Resilience Assessments” of affected locations 6-8 weeks after an event and report on their observations:

- *What appeared to happen?*
- *What were the impacts?*
- *What seemed to demonstrate resilience?*
- *What are some options to improve the resilience of repaired or reconstructed facilities?*



# Resilience in Asset Management

- State DOTs required to develop **asset management** plans that identify and address risks to the National Highway System (NHS) pavements, bridges, and performance (23 USC 119(e))
  - “including risks associated with current and future environmental conditions, such as extreme weather events, climate change, seismic activity, and risks related to recurring damage and costs as identified through the evaluation of facilities repeatedly damaged by emergency events carried out under part 667 of this title.” (23 CFR 515)*
- 6 Resilience in Asset Management Pilots (2017-19): Arizona, Texas, Kentucky, Maryland, Massachusetts, New Jersey
- Forthcoming handbook (expected in 2020):
  - Developing asset inventory informed by natural hazard/vulnerability assessments
  - Identifying and managing risks
  - Conducting life cycle planning
  - Creating resilient investment strategies and financial plans

[www.fhwa.dot.gov/asset/pilot](http://www.fhwa.dot.gov/asset/pilot)

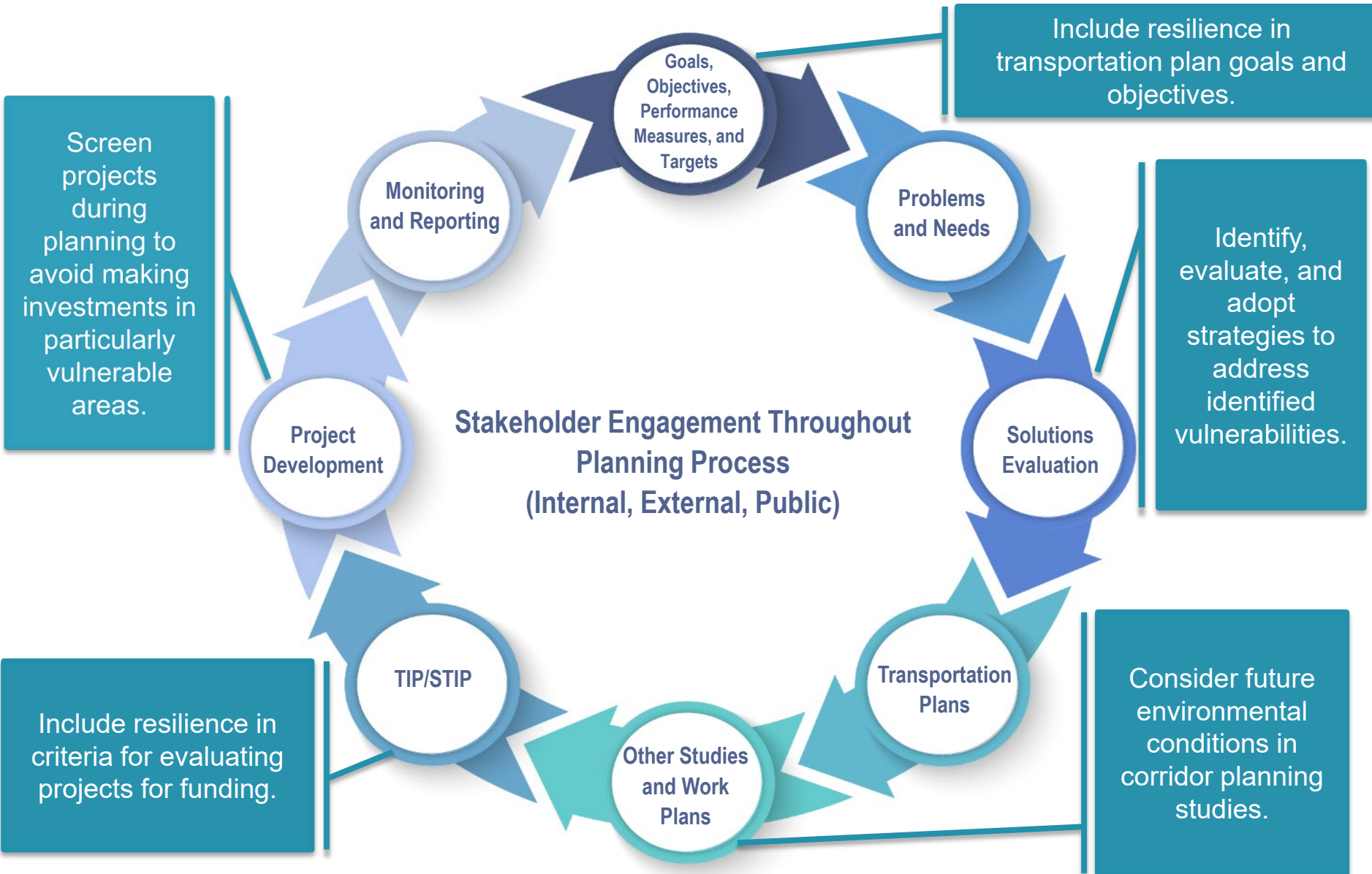
# Resilience in Transportation Planning

- State and metro **transportation planning** include resilience as a planning factor (23 USC 134, 23 CFR 450)
- **Metropolitan transportation plans** shall include an assessment of capital investment and other strategies to... reduce the vulnerability of the existing transportation infrastructure to natural disasters (23 CFR 450.324(f)(7))
- **Project: Integrating Resilience into the Transportation Planning Process**
  - Workshops and Peer Exchanges
  - Fact Sheet (January 2017)
  - White Paper (May 2018)
  - Handbook (Coming 2020)

[https://www.fhwa.dot.gov/environment/sustainability/resilience/ongoing\\_and\\_current\\_research/planning/](https://www.fhwa.dot.gov/environment/sustainability/resilience/ongoing_and_current_research/planning/)



# Consider Resilience in the “Typical” Transportation Planning Process



# Stakeholder Engagement

- Raise Awareness
- Build Support
- Expand Your Network
- Find Resources
- Become a Resource

| Integration Action  | Potential Approaches   |
|---|--|
| Build a culture of resilience   | <ul style="list-style-type: none"> <li>▪ Identify a champion(s)</li> <li>▪ Garner support from leadership</li> </ul>   |
| Enhance internal communication and build support across departments                       | <ul style="list-style-type: none"> <li>▪ Delegate tasks according to expertise</li> <li>▪ Establish resilience goals, objectives, performance measures, and targets</li> <li>▪ Plan for and schedule collaboration efforts</li> <li>▪ Set up committees</li> </ul> |
| Coordinate with and solicit information from external partners, agencies, or institutions | <ul style="list-style-type: none"> <li>▪ Formal avenues of coordination (e.g. interagency workgroups)</li> <li>▪ Ad hoc avenues of coordination</li> <li>▪ Serve as a resource to external stakeholders</li> </ul>   |
| Communicate effectively with the public   | <ul style="list-style-type: none"> <li>▪ Reach out to vulnerable communities</li> <li>▪ Use avenues already in place in your agency</li> <li>▪ Pursue creative engagement strategies</li> </ul>  |

# Consider Resilience When Developing Goals, Objectives, Performance Measures, and Targets

## Developing Goals, Objectives, Performance Measures, and Targets

### Standard Sub-steps

Review existing goals, objectives, performance measures, and targets

Establish goals

Establish objectives

Select performance measures and targets

### Resilience Integration Actions

Determine if natural hazards and changing future environmental conditions will affect existing goals, objectives, performance measures, and targets

Develop an informal resilience goal

Revise an existing formal goal to incorporate resilience

Develop a formal stand-alone resilience goal

Revise existing objectives to incorporate resilience

Develop stand-alone resilience objectives

Develop performance metrics and targets to measure resilience



# Consider Resilience When Evaluating Solutions

## Evaluating Solutions

### Standard Sub-steps

Establish evaluation criteria

Gather relevant strategies identified in existing studies or plans

Release call for projects

Evaluate and prioritize among solutions

### Resilience Integration Actions

Include resilience as a topic in priority-setting discussions

Integrate resilience priorities into evaluation criteria

Gather information on relevant resilience strategies from sources within your jurisdiction

Gather information on relevant resilience strategies from sources relevant to your context

Request resilience ideas in calls for projects

Apply pre-established evaluation criteria that include resilience considerations

Prioritize resilience solutions based on urgency/importance and implementation feasibility





# Consider Resilience in Other Studies and Work Plans

## Other Studies and Work Plans

### Standard Sub-steps

Develop short-term work plans

Develop longer term strategic plans  
or capital investment plans

Conduct corridor planning studies  
or other sub-area studies

Develop asset management plans

### Resilience Integration Actions

Integrate resilience into short-term work plans

Integrate resilience into longer term strategic plans or  
capital investment plans

Integrate resilience into corridor planning studies or  
other sub-area studies

Integrate resilience into asset management plans



# Consider Resilience When Developing the STIP and TIP

## Developing the STIP and TIP

### Standard Sub-steps

Identify revenue and funding sources

Develop the method for identifying project costs

Develop criteria for allocating revenue

Develop a project list from the adopted transportation plan

Prioritize projects for implementation

Adopt STIP/TIP

### Resilience Integration Actions

Identify funds available for resilience improvements

Screen projects to identify facilities repeatedly requiring repair and reconstruction due to emergency events

Prioritize projects using one or more resilience evaluation criteria



# Consider Resilience in Project Development

## Project Development

### Standard Sub-steps

Initiate project planning

Environmental review

### Resilience Integration Actions

Build awareness of the need for resilience considerations in project design

Recommend natural hazard risk screening as part of project initiation forms

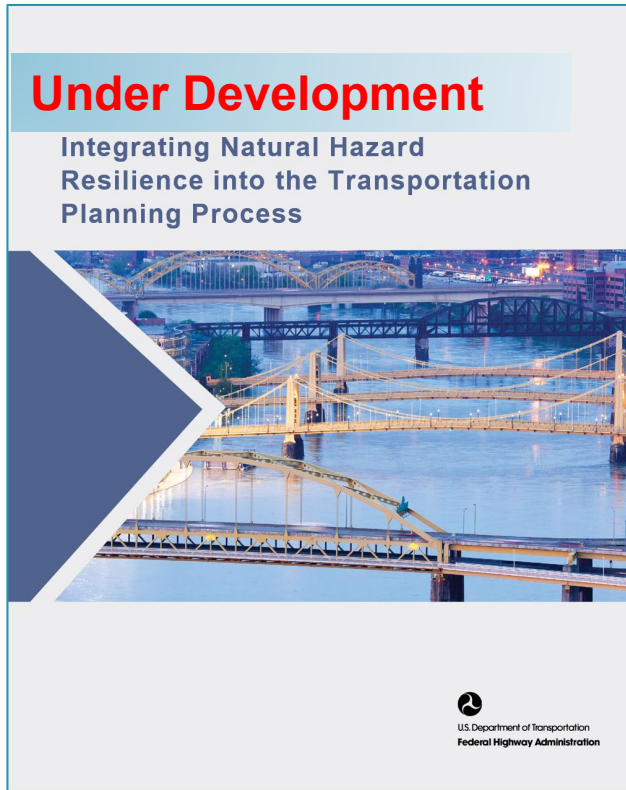
Discuss resilience at public outreach meetings

If appropriate, recommend incorporating resilience into the project purpose and need

Provide relevant planning documentation to streamline environmental review



# What is the Handbook?



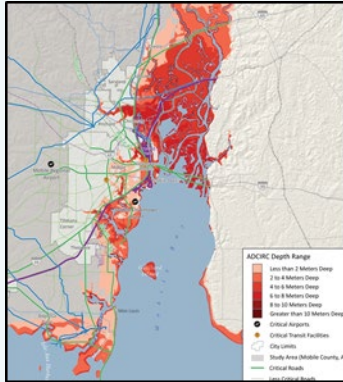
## Resources include:

- A range of options for considering resilience throughout the transportation planning process.
- Information for every step in the planning process, including key resources.
- Real-world examples of how agencies are integrating resilience into transportation planning.

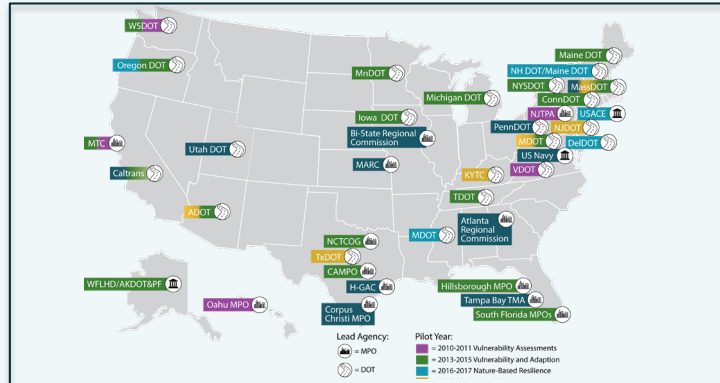


# FHWA Resilience Resources

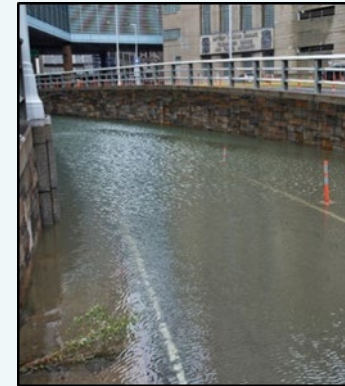
## Gulf Coast 2 Study



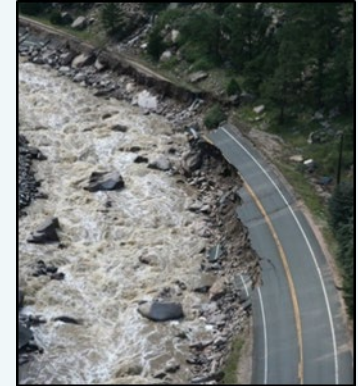
## Resilience Pilots with State DOTs & MPOs



## Hurricane Sandy Project

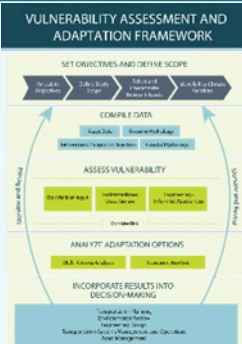


## Engineering Assessments Study

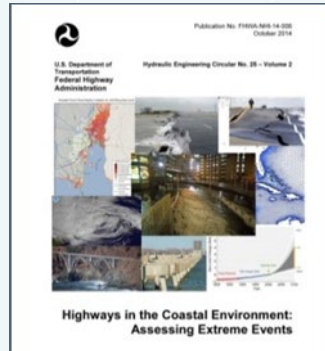


<https://www.fhwa.dot.gov/environment/sustainability/resilience/>

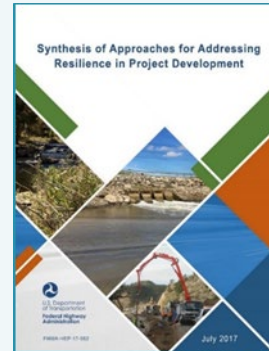
## Vulnerability & Adaptation Framework



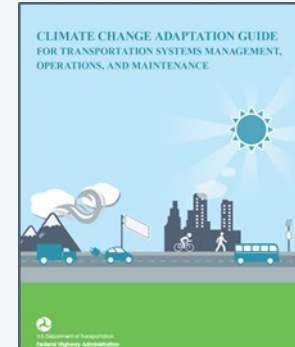
## Engineering Guidance (HEC-25 & 17)



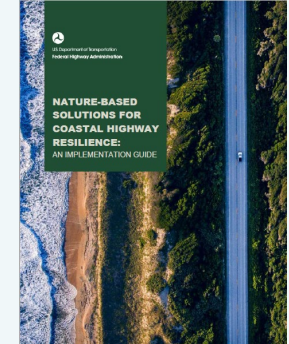
## Project Development



## Operations & Maintenance



## Nature-Based Solutions



# Website, Contact Info, Thank you!

The screenshot shows the FHWA Sustainability website. A red arrow points to the 'Pilots' link in the left sidebar. Another red circle highlights the 'Sign up for Sustainable Transportation and Resiliency updates' link in the sidebar. A third red circle highlights the 'Contacts' section at the bottom of the sidebar, which lists Robert Kafalenos, Robert Hyman, and Rebecca Ludes. The main content area features a 'Resilience Pilots' section with a breadcrumb trail 'FHWA → Environment → Sustainability → Resilience'. It includes a paragraph about FHWA's partnership with DOTs and MPOs, followed by a section for the '2018 - 2020/2024 Pilot Program: Resilience and Durability to Extreme Weather'. This section lists three areas of focus: integrating resilience into agency practices, using available tools to assess vulnerability, and deploying resilience solutions. It also includes a link to 'Resilience and Durability Pilot Project Descriptions and other information'. Below this is the '2017-2019 Pilot Program: Asset Management, Extreme Weather, and Proxy Indicators' section, which mentions six pilot teams and a guidebook, with a link to the 'Asset Management, Extreme Weather, and Proxy Indicators Pilot Program (2017-2019)'. The next section is '2016-2017 Pilot Program: Nature-based Resilience for Coastal Highways', which mentions five pilot teams and a link to 'Nature-based Resilience Pilot Reports and other information'. The final section is '2013-2015 Pilot Program: Vulnerability Assessments and Adaptation Options'.

**Sustainability**

FHWA → Environment → Sustainability → Resilience

**Resilience Pilots**

FHWA has partnered with State Departments of Transportation (DOTs) and Metropolitan Planning Organizations (MPOs) and others to develop and deploy resilience solutions to current and future extreme weather events, reducing future maintenance costs over the full life-cycle of transportation assets.

**2018 - 2020/2024 Pilot Program: Resilience and Durability to Extreme Weather**

FHWA is partnering on eleven projects to address one or more of three areas related to deploying resilience solutions:

1. Integrating resilience and durability into agency practices;
2. Using available tools and resources to assess the vulnerability and risk of transportation projects or systems; and
3. Deploying a resilience solution and monitoring performance.

- [Resilience and Durability Pilot Project Descriptions and other information](#)

**2017-2019 Pilot Program: Asset Management, Extreme Weather, and Proxy Indicators**

Six pilot teams have partnered with FHWA to integrate resilience considerations into their asset management processes. FHWA also plans to develop a guidebook to help other States address resilience considerations in in asset management processes.

- [Asset Management, Extreme Weather, and Proxy Indicators Pilot Program \(2017-2019\)](#)

**2016-2017 Pilot Program: Nature-based Resilience for Coastal Highways**

Five pilot teams partnered with FHWA to assess the potential for natural and nature-based features, such as wetlands, beaches, dunes, and reefs, to protect specific locations along coastal roads and bridges from storm surge, sea level rise, and erosion.

- [Nature-based Resilience Pilot Reports and other information](#)

**2013-2015 Pilot Program: Vulnerability Assessments and Adaptation Options**

**Resilience**

- Adaptation Framework
- Case Studies
- Ongoing & Current Research
- **Pilots**
- Policy & Guidance
- Publications
- Tools
- Webinars
- Workshops & Peer Exchanges
- Related Links

**Sustainable Highways Initiative**

**Energy and Emissions**

**Newsletter**

**Contacts**

**Sign up for Sustainable Transportation and Resiliency updates.**

**Contacts**

For more information, please contact:

- **Robert Kafalenos**
- **Robert Hyman**
- **Rebecca Ludes**

<https://www.fhwa.dot.gov/environment/sustainability/resilience/>

# THANK YOU!

Contact Information: [Heather.Holsinger@dot.gov](mailto:Heather.Holsinger@dot.gov)

Website: <https://www.fhwa.dot.gov/environment/sustainability/resilience/>

# Funding for Transportation Climate Resilience



# Types of Funding Sources

## Eligible for Planning/Research Activities

- Conducting Vulnerability (Risk) Assessments
- Identifying at-risk assets
  - Roads, trails, bridges, culverts, transit facilities, docks/boat ramps
- Identifying threats and climate projections
  - Sea-level rise, extreme storm events, wildfires, increased heat, drought, erosion, permafrost melt

## Eligible for Project Activities

- Construction or other projects to adapt to climate effects



# TTP Funding Sources

- TTP Formula allocation (planning and projects)
  - Formula based
- TTP 2% Planning Funds (planning\*)
  - Formula based
- TTP Bridge Program (projects)
  - Funded based on sufficiency rating for the bridge
  - The lower the rating, the higher likelihood of being funded
- TTP Safety Program (projects)
  - Competitive program

# Other Federal Transportation Sources

- Better Utilizing Investments to Leverage Development - BUILD (projects and planning)
  - Competitive program
  - Minimum award \$1 million (rural) \$5 million (urban), no minimum for planning grants
- Infrastructure for Rebuilding America - INFRA (projects)
  - Competitive program
  - Minimum award \$5 million (small projects), \$25 million (large projects)
- Nationally Significant Federal Lands and Tribal Projects Program - NSFLTP (projects)
  - Competitive program
  - Minimum \$25 million, with priority consideration for projects over \$50 million
  - TTP funds cannot be used as the non-federal share



# Other Federal Transportation Sources, cont.

- Emergency Relief for Federally Owned Roads - ERFO (projects)
  - Funding for repair or replacement after damage by natural disaster or catastrophic failure from external cause
  - Tribal transportation facilities are funded at 100%
  - Essentially replaces what was there before, but betterments may be eligible if determined cost effective. Betterments may also be funded with supplemental sources.
  - Coordination with BIA Region
- FHWA Federal-Aid funding (projects and planning)
  - Coordination with State DOT
  - Local Public Agencies Program

# Federal Non-Transportation Sources

- Bureau of Indian Affairs Resilience Program (Planning)
- Environmental Protection Agency - EPA
  - Smart Growth Grant (Planning and Projects)
- National Oceanic and Atmospheric Administration - NOAA
  - Supporting Resilient Coastal Communities in a Changing Climate (Planning and Projects)
- US Fish and Wildlife Service - USFWS
  - National Fish Passage Program (Projects)
- Federal Emergency Management Agency - FEMA
  - Hazard Mitigation Grant Program (Planning and Projects)
  - Hazard Mitigation Grant Program Post Fire (Projects)
  - Building Resilient Infrastructure and Communities (Projects)
  - Flood Mitigation Assistance Grant (Projects)



# State/Local Sources

- California
  - Department of Transportation (CalTrans) [SB1 Adaptation Planning Grant](#) (Planning)
  - Resilience Challenge 2020 Grant (Planning)
- Minnesota Department of Transportation Flood Mitigation [Program](#) (Projects)
- Massachusetts Coastal Resilience Grant [Program](#) (Planning and Projects)
- Washington Climate Change Planning [Grants](#) (Planning)
- New York State Department of Environmental Conservation Climate Smart Communities Grant [Program](#) (Projects)
- Research climate funding opportunities in your State



# Private Sources

- The Kresge Foundation Environment Program
- Wildlife Conservation Society Climate Adaptation Fund
- Robert Wood Johnson Foundation
- National Fish and Wildlife Foundation
- Various Economic Development Organizations
- Adaptation Clearinghouse
  - The Georgetown Climate Center
- Tribal Climate Change Guide
  - University of Oregon

# Questions and Comments

Terry Schumann

Environmental Protection Specialist

FHWA, Office of Tribal Transportation

360-619-7607

[Terry.Schumann@dot.gov](mailto:Terry.Schumann@dot.gov)