U.S. Department of Transportation

Federal Highway Administration

Addressing Resilience in the Transportation Planning Process

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FHWA Texas Division

June 26, 2019

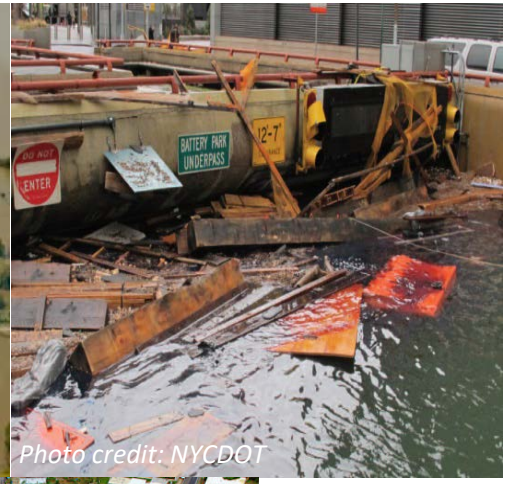
What is *Resilience*?

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


Photo credit: CalTrans


Photo credit: CO DOT


Photo credit: Iowa State Patrol



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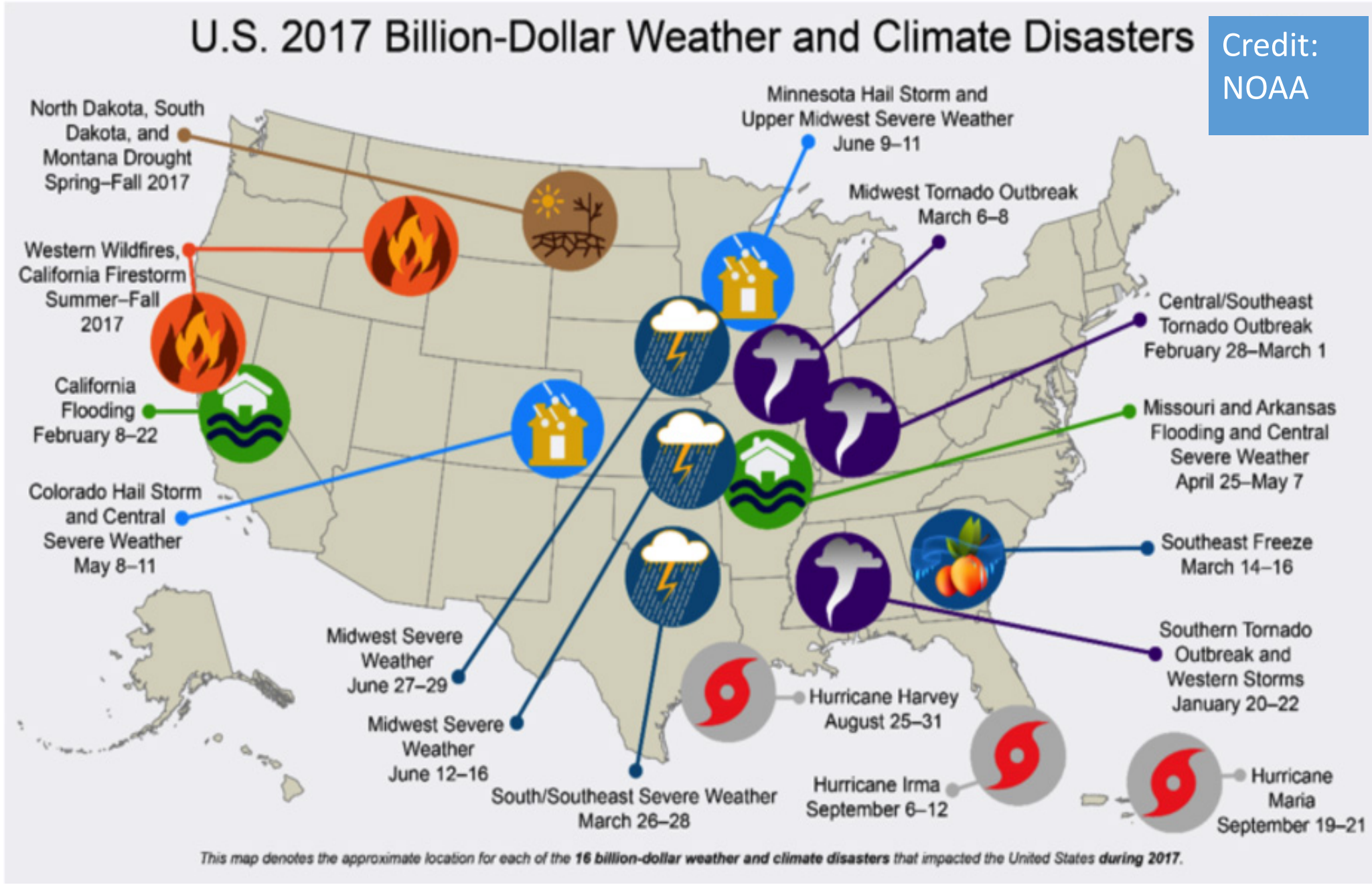

U.S. 2017 Billion-Dollar Weather and Climate Disasters
Credit: NOAA
North Dakota, South Dakota, and Montana Drought Spring–Fall 2017
Western Wildfires, California Firestorm Summer–Fall 2017
California Flooding February 8–22
Colorado Hail Storm and Central Severe Weather May 8–11
Minnesota Hail Storm and Upper Midwest Severe Weather June 9–11
Midwest Tornado Outbreak March 6–8
Central/Southeast Tornado Outbreak February 28–March 1
Missouri and Arkansas Flooding and Central Severe Weather April 25–May 7
Southeast Freeze March 14–16
Southern Tornado Outbreak and Western Storms January 20–22
Hurricane Harvey August 25–31
Hurricane Irma September 6–12
Hurricane Maria September 19–21
Midwest Severe Weather June 27–29
Midwest Severe Weather June 12–16
South/Southeast Severe Weather March 26–28
This map denotes the approximate location for each of the 16 billion-dollar weather and climate disasters that impacted the United States during 2017.

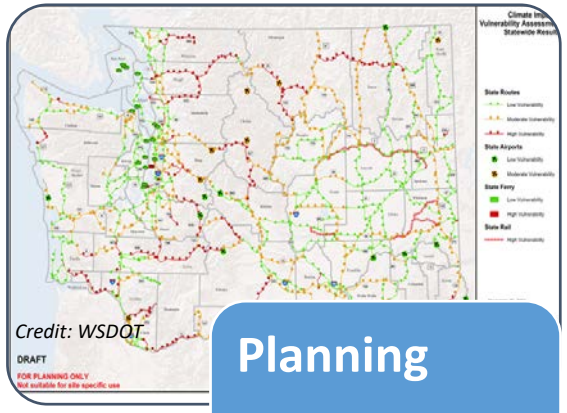
FHWA Resilience Efforts

- FHWA is working with States and metropolitan areas to increase the health and longevity of the Nation's Highways through:
  - Assessing vulnerabilities
  - Considering resilience in the transportation planning process
  - Incorporating resilience in asset management plans
  - Addressing resilience in project development and design
  - Optimizing operations and maintenance practices

Integrating Resilience

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

- Long Range Transportation Plans
- Asset Management Plans

Project Level

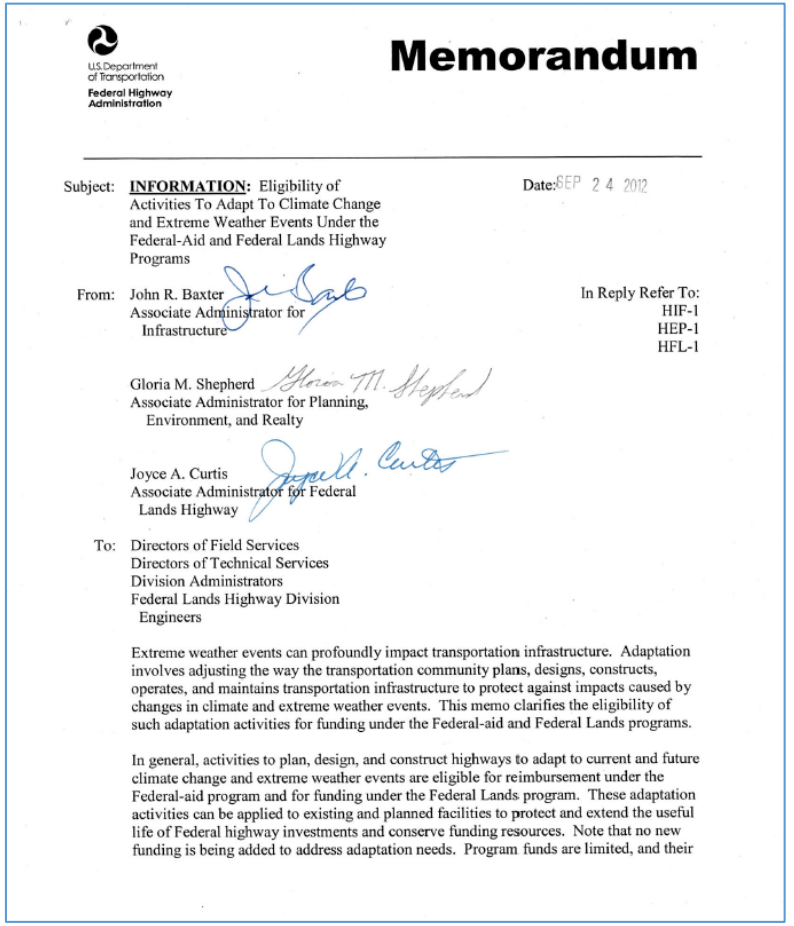
- Environmental Processes
- Engineering
- Design

Operations and Maintenance

- Emergency Response

Extreme Weather Resilience Policy

- USDOT FY 2018-22 Strategic Plan: "DOT will increase its effectiveness in ensuring that infrastructure is resilient enough to withstand extreme weather"
- FHWA Order 5520 commits FHWA to integrating extreme weather risk consideration into programs
- Extreme weather resilience eligible for FHWA funds



U.S. Department of Transportation
Federal Highway Administration

Memorandum

Subject: **INFORMATION:** Eligibility of Activities To Adapt To Climate Change and Extreme Weather Events Under the Federal-Aid and Federal Lands Highway Programs

Date: SEP 24 2012

From: John R. Baxter
Associate Administrator for Infrastructure

In Reply Refer To:
HIF-1
HEP-1
HFL-1

Gloria M. Shepherd
Associate Administrator for Planning, Environment, and Realty

Joyce A. Curtis
Associate Administrator for Federal Lands Highway

To: Directors of Field Services
Directors of Technical Services
Division Administrators
Federal Lands Highway Division Engineers

Extreme weather events can profoundly impact transportation infrastructure. Adaptation involves adjusting the way the transportation community plans, designs, constructs, operates, and maintains transportation infrastructure to protect against impacts caused by changes in climate and extreme weather events. This memo clarifies the eligibility of such adaptation activities for funding under the Federal-aid and Federal Lands programs.

In general, activities to plan, design, and construct highways to adapt to current and future climate change and extreme weather events are eligible for reimbursement under the Federal-aid program and for funding under the Federal Lands program. These adaptation activities can be applied to existing and planned facilities to protect and extend the useful life of Federal highway investments and conserve funding resources. Note that no new funding is being added to address adaptation needs. Program funds are limited, and their

Extreme Weather Resilience Related Regulations

- Risk-based **asset management** plans must address risks associated with current and future environmental conditions (23 CFR 515)
- Assets requiring repeated repair require **evaluation of alternatives** (23 CFR 667)
- State and metropolitan **transportation planning** should now 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))

FAST Act Requirements (Statewide)

"(a) Each State shall carry out a continuing, cooperative, and comprehensive statewide transportation planning process that provides for consideration and implementation of projects, strategies, and services that will address the following factors:
(9) improve the **resiliency and reliability of the transportation system** and reduce or mitigate storm-water impacts of surface transportation." -23 CFR 450.206(a)

Effective Date: June 27, 2016

FAST Act Requirements (Metropolitan)

"(b) The metropolitan transportation planning process shall be continuous, cooperative, and comprehensive, and provide for consideration and implementation of projects, strategies, and services that will address the following factors: (9) **Improve the resiliency and reliability of the transportation system** and reduce or mitigate storm-water impacts of surface transportation;" -23 CFR 450.306(b)

Effective Date: June 27, 2016

FAST Act Requirements (Statewide)

"(c) The long-range statewide transportation plan shall reference, summarize, or contain any applicable short-range planning studies; strategic planning and/or policy studies; transportation needs studies; management systems reports; emergency relief and disaster preparedness plans;" -23 CFR 216(c)

- **Effective Date:** Long-range statewide transportation plans adopted after May 2018

FAST Act Requirements (Metropolitan)

"(f) The metropolitan transportation plan shall, at a minimum, include: 7) Assessment of capital investment and other strategies to preserve the existing and projected future metropolitan transportation infrastructure, provide for multimodal capacity increases based on regional priorities and needs, and **reduce the vulnerability of the existing transportation infrastructure to natural disasters**." -23 CFR 450.324(f)(7)

- **Effective Date:** On or after May 27, 2018, an MPO meets requirements to adopt a metropolitan transportation plan

FAST Act Requirements (Asset Management Plan)

- "(c) A State DOT shall establish a process for developing a risk management plan. This process shall, at a minimum, produce the following information: (6) Risk management analysis, including the results for NHS pavements and bridges, of the periodic evaluations under part 667 of this title of facilities repeated damaged by emergency event."
- "(h) A State DOT shall integrate its asset management plan into its transportation planning processes that lead to the STIP, to support its efforts to achieve the goals in paragraphs (f)(1) through (4) of this section." -23 CFR 515.7 (c)(6) and 515.9 (h)
- **Effective Date:** October 2, 2017

FAST Act Requirements (Periodic Evaluation of Facilities Due to Emergency Events)

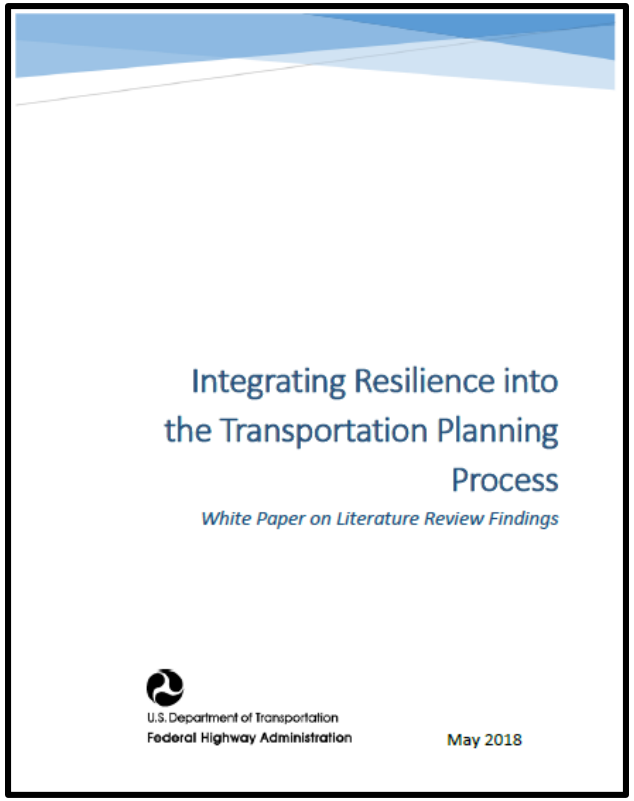
- “State DOTs must evaluate facilities that have repeatedly been damaged in emergency events.” -23 CFR Part 667 - PERIODIC EVALUATION OF FACILITIES REPEATEDLY REQUIRING REPAIR AND RECONSTRUCTION DUE TO EMERGENCY EVENTS

- **Effective Date:** Due by November 23, 2018

Integrating Resilience in Transportation Planning

Project: Integrating Resilience into the Transportation Planning Process
https://www.fhwa.dot.gov/environment/sustainability/resilience/ongoing_and_current_research/planning/

- Workshops and Peer Exchanges
- White Paper
- Q&A Document (February 2019)
- Case Studies (February 2019)
- Handbook (March 2019)



Approaches to Incorporating Resilience in Planning

- Include resilience in transportation plan goals and objectives
- Identify, evaluate, and adopt strategies to address identified vulnerabilities
- Screen projects during planning to avoid making investments in particularly vulnerable areas
- Include resilience in the criteria for evaluating projects for funding
- Consider future environmental conditions in corridor planning studies

Integrating Resilience in Asset Management

Project: Asset Management and Resilience

- Pilot projects and associated reports (Early 2019)
  - Arizona
  - Texas
  - Kentucky
  - Maryland
  - New Jersey
  - Massachusetts
- Guidebook on addressing resilience in Asset Management (Summer 2019)

Approaches to Incorporating Resilience in Asset Management

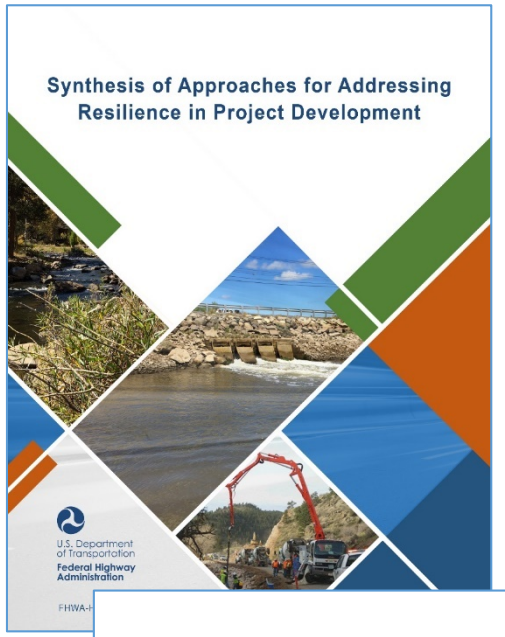
Include resilience focus in two sections of required State Transportation Asset Management Plans (TAMPs):

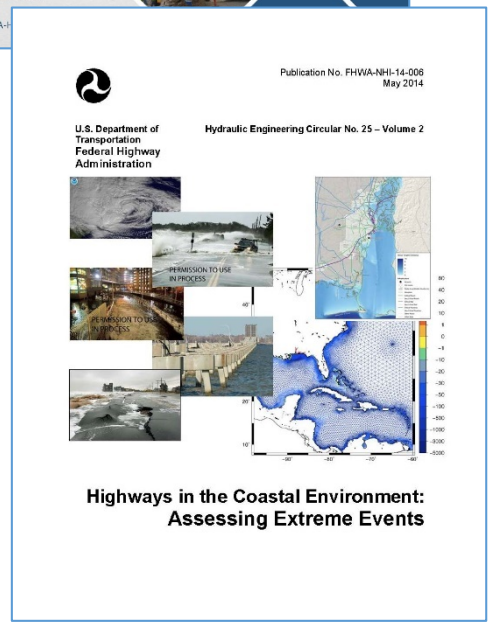
- **Risk management plan**…that identifies at a minimum risks associated with current and future environmental conditions, extreme weather events, etc. (23 CFR Part 515.7(c))
- **Life-cycle planning**, which should include a range of factors that could affect whole life cost of assets, including current and future environmental conditions, extreme weather events, etc. (23 CFR Part 515.7(b)

First complete TAMPs due June 2019

Integrating Resilience in Project Design

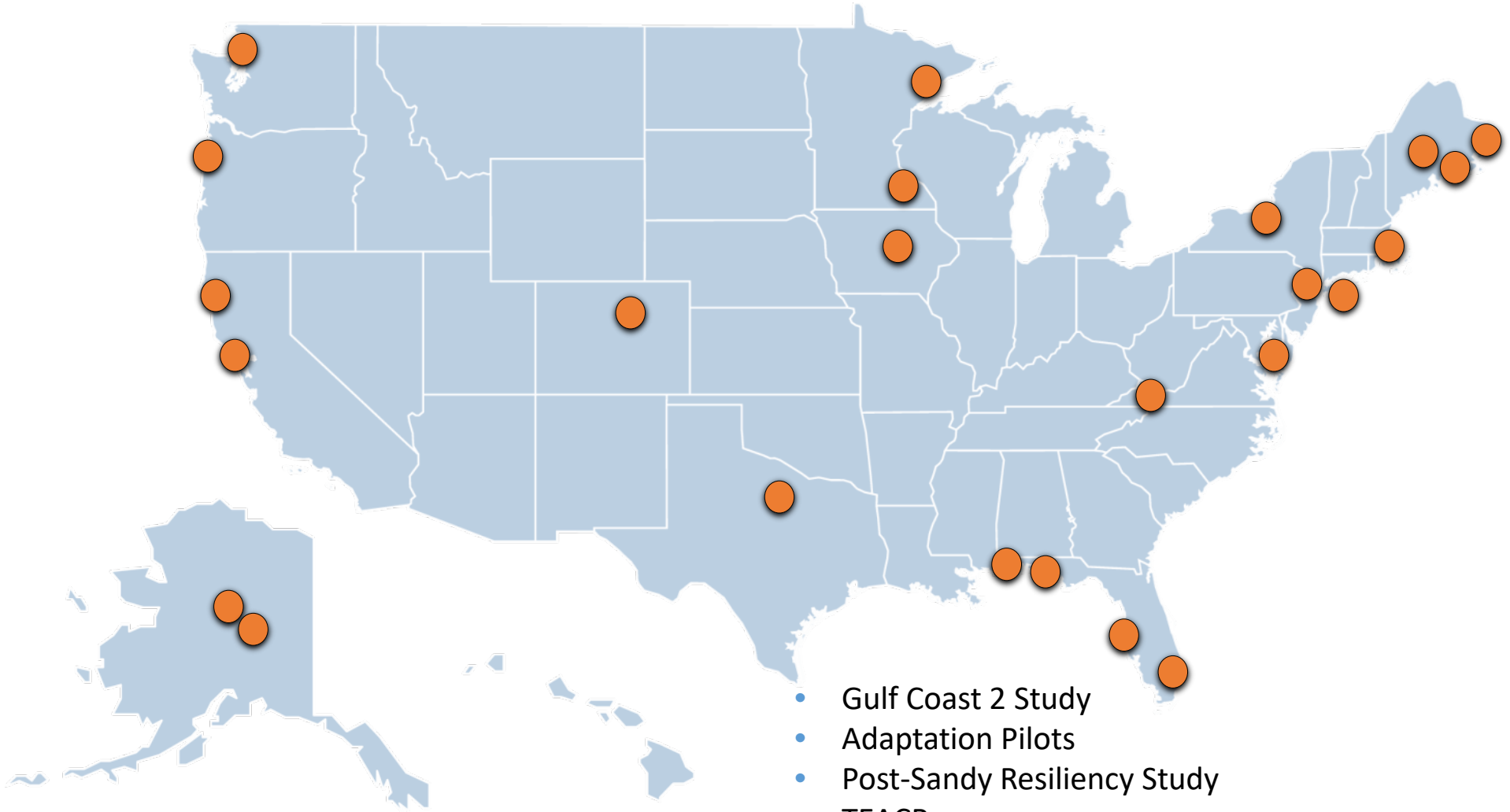
- Transportation Engineering Approaches to Climate Resiliency (TEACR)
  - Overall lessons learned for engineering
  - Coastal Hydraulics
  - Riverine Flooding
  - Pavements and Soils
  - Mechanical and Electrical Systems
- HEC 25: Highways in the Coastal Environment, V2
  - How to incorporate extreme 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





Approaches to Integrating Resilience in Project Design

Engineering-Focused Case Studies



- Gulf Coast 2 Study
- Adaptation Pilots
- Post-Sandy Resiliency Study
- TEACR

TEACR Engineering Case Studies

Assessments:

- I-10 Bridge and wave action (AL)
- Living shoreline and sea level rise (NY)
- Pavement overwashing (FL)
- Pavement and drought (TX)
- Precipitation and slope stability (VA)
- Forest fire and debris loading (CO)
- Pavement and freeze-thaw (ME)
- Pavement, permafrost thaw (AK)
- Economic Analysis (ME)

Integrating Resilience into Emergency Response

FHWA Resources:

- FHWA ER Manual
- ER and Resilience FAQ
- FHWA ER Order
- 23 CFR 667

Two ways ER funds can be used to improve resilience when repairing/rebuilding damaged highway:

1. Bring up to current standards
2. Cost-effective betterment (would save FHWA ER program money over time)

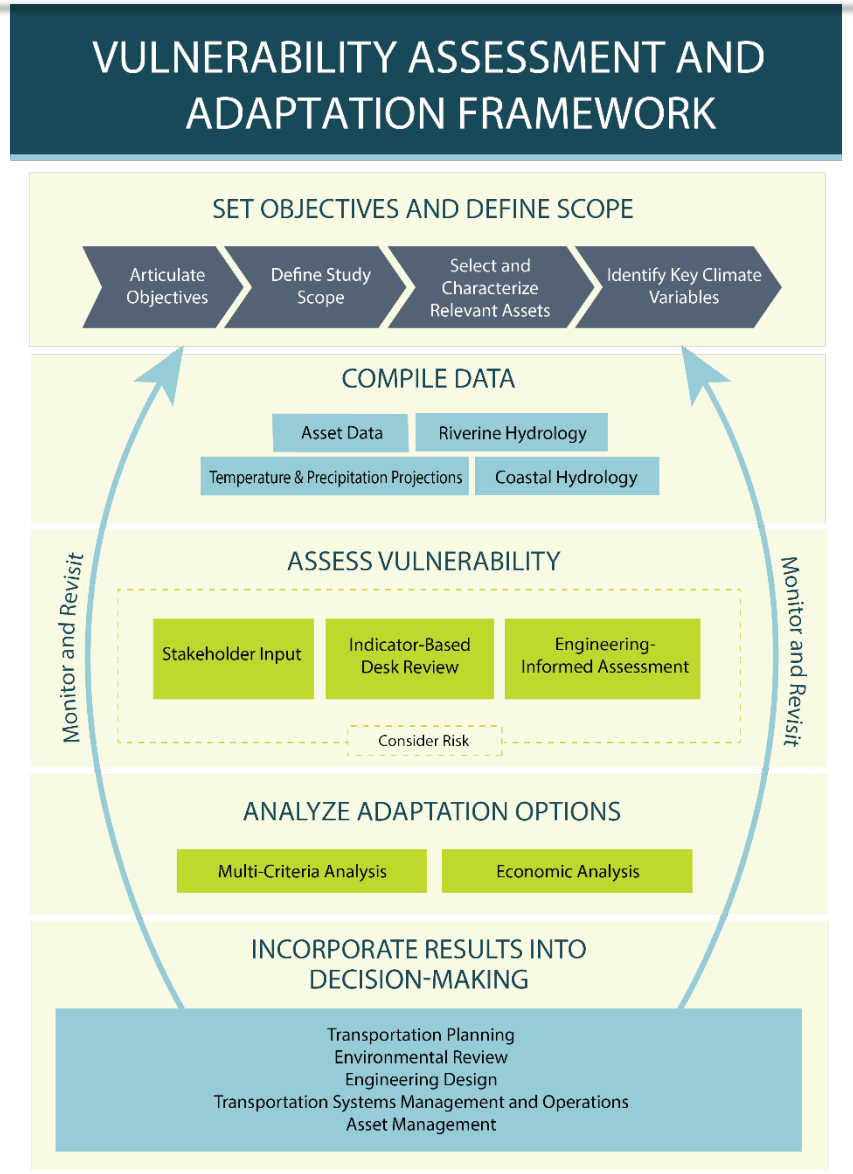
"The FHWA supports planning, designing and constructing highways to adapt to current and future climate change and extreme weather events under the Federal-aid program. Features that will improve the resilience of repaired federal aid highways should be considered and evaluated consistent with risk, cost effectiveness and regulatory conditions. The evaluation should apply the best available scientific and economic information to forecast and assess future risk factors." FHWA ER Manual, p60.

Approaches to Incorporating Resilience into Emergency Response

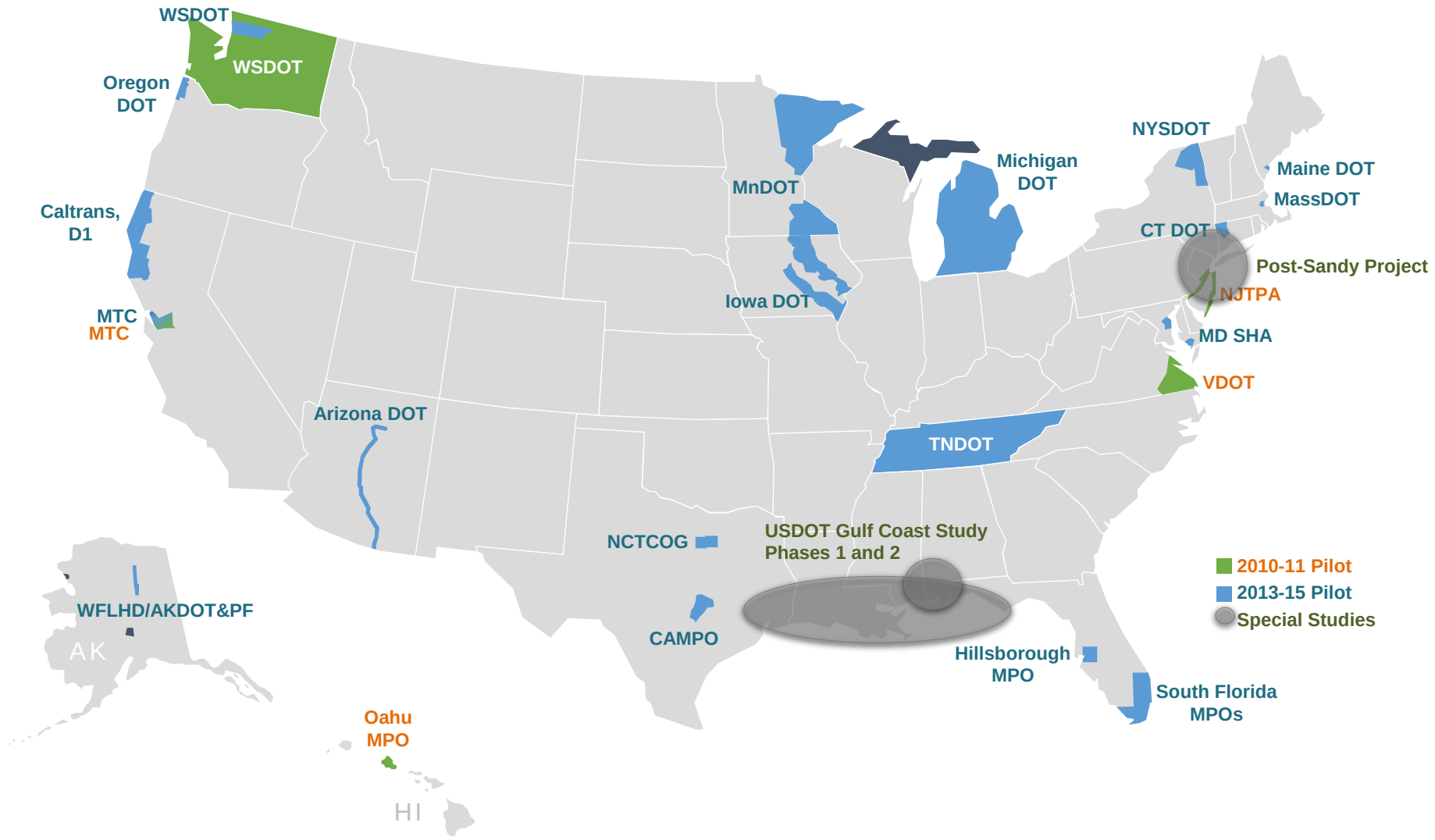
1. Prior to disasters, ensure transportation plans and asset management plans include resilience.
2. Ensure State has completed evaluation of facilities repeatedly requiring repair, as required by 23 CFR 667.
3. When developing Detailed Damage Inspection Reports (DDIR), discuss the cause of the asset failure and likelihood of recurrence. Discuss potential for resilience improvements.
4. Develop and review cost effectiveness analyses for betterments.
5. After the emergency event, ensure the DOT updates the 667 evaluation.
6. Share best practices with other States through FHWA's ongoing technical assistance and information sharing webinars, case studies, and trainings.

Vulnerability Assessment and Adaptation Framework, 3rd Edition

- Provides an in-depth and structured **process** for conducting a vulnerability assessment.
- Features **examples** from assessments conducted nationwide.
- Includes links and references to related **resources and tools**.

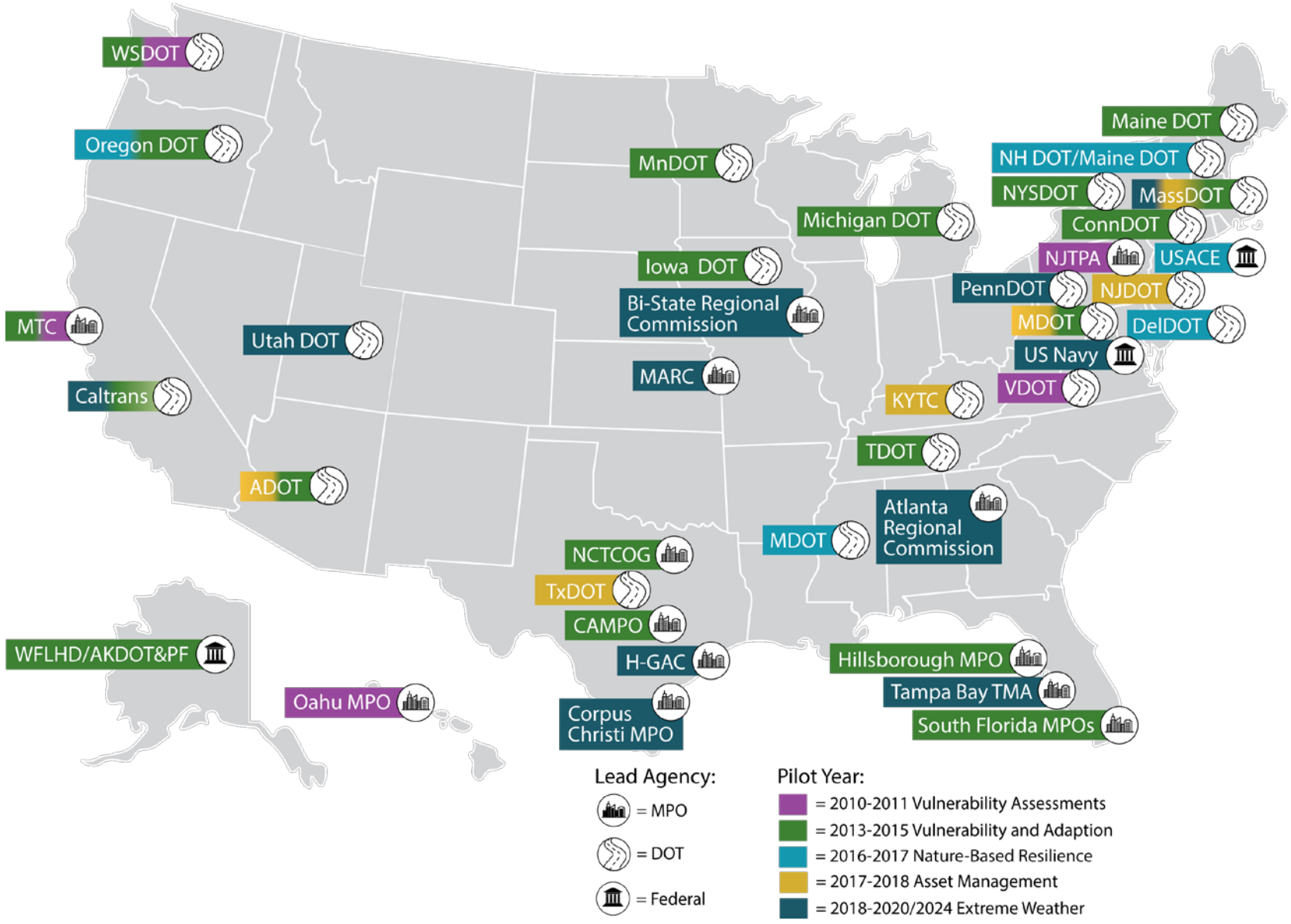


Vulnerability Assessment Studies



2018 Resilience and Durability Pilots

Resilience and Durability Pilots To Date



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Submit your ideas for conference topics and tracks online now at www.TR2019.org

PRESENT

Solicitation for Abstracts will commence in March 2019. More information will be forthcoming from TRB and will be posted on the TR2019 website.

Thank You!

Contact Information: kirk.fauver@dot.gov

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