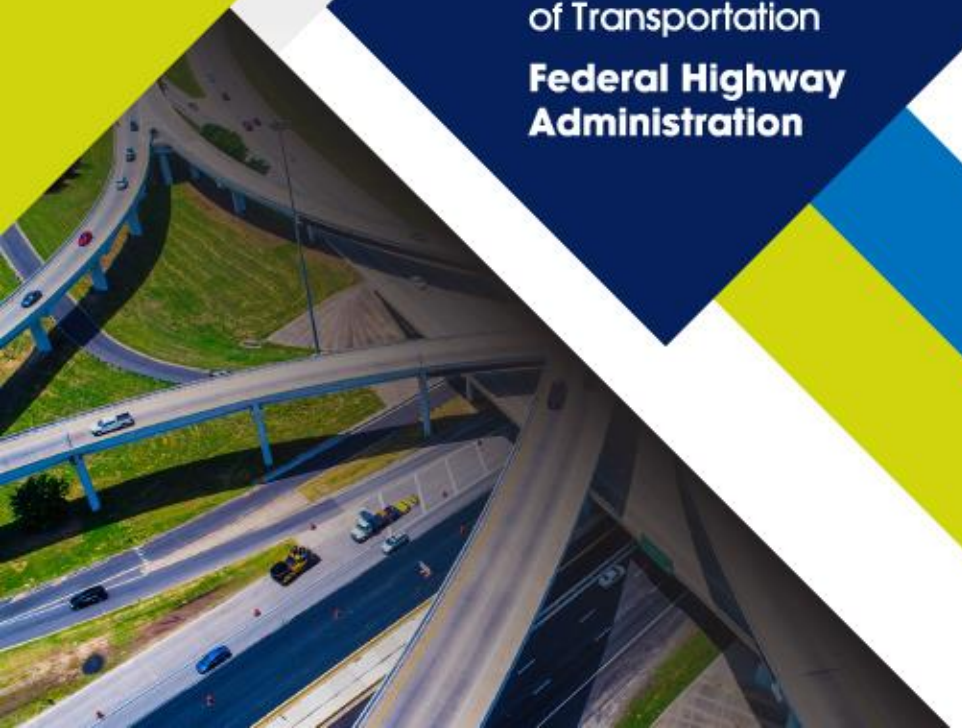
The 19th Arizona Pavements/Materials Conference

FHWA Overview

Extending Pavement Life Through Resiliency and Preservation



U.S. Department of Transportation
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November 16, 2022

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Today's Presentation

- **Resilience & Asset Management**
  - **What it is?**
  - **Resources**
  - **Strategies**
  - **FHWA Ongoing Efforts**
- **Pavement Preservation**
  - **FHWA Program and Activities**
  - **Examples**

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What Is Resilience?

Resilience: The ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions, FHWA Order 5520 (FHWA 2014a).

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Resilience in TAMPs in Regulation

23 CFR Part 515.7

State DOTs are required to develop a risk-based asset management plan to include specific minimum processes, including the following section on lifecycle planning identified in subsection (b)*:

> A State DOT shall establish a process for conducting lifecycle planning for an asset class or asset subgroup at the network level (network to be defined by the State DOT). As a State DOT develops its lifecycle planning process, the State DOT should include future changes in demand; information on current and future environmental conditions, including extreme weather events, **climate change**, and seismic activity; and other factors that could impact whole-life costs of assets.

*Similar requirements are in subsection (c), which addresses risk management plans.

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Addressing Resilience in TAMP Risk Management Analysis

23 U.S.C. 119(e), requires:

- A State shall develop a risk-based ***asset management plan*** for the National Highway System to improve or preserve the condition of the assets and the performance of the system.
- Consider extreme weather and resiliency in the *risk management* analyses of their **TAMPs.**

(23 U.S.C. 119(e)(4)(D))

Resilience and Asset Management Resources

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Current resources:

1. Risk-Based Transportation Asset Management Reports: Building Resilience into Transportation Assets (2013)
2. Guidance on *Incorporating Risk Management into Transportation Asset Management Plans* (2017) (FHWA 2017b).
3. Guidance on *Using a Life Cycle Planning Process to Support Asset Management* (2017) (FHWA 2017f).
4. National Highway Institute (NHI) resilience course: *Addressing Resilience in Highway Project Development and Preliminary Design* (2022).

Coming soon (under development):

- *Addressing Resilience to Climate Change and Extreme Weather in Transportation Asset Management.*

Adaptation Strategies

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1. Monitor Trends

Most predicted changes to environmental variables are projected to occur relatively slowly in relation to a typical infrastructure lifecycle (FHWA 2015).

Key pavement indicators to monitor for climate change impacts.

Asphalt Pavement Indicators	Concrete Pavement Indicators
Rutting of asphalt surface	Blow-ups (JPCP)
Low temperature (transverse) cracking	Slab cracking
Block cracking	Punch-outs (CRCP)
Raveling	Joint spalling
Fatigue cracking and pot holes	Freeze-thaw durability
Rutting of subgrade and unbound base	Faulting, pumping, and corner breaks
Stripping	Slab warping
	Punch-outs (CRCP)

Source: FHWA.
(FHWA forthcoming b.)

CRCP = continuously reinforced concrete pavement; JPCP = jointed plain concrete pavement.

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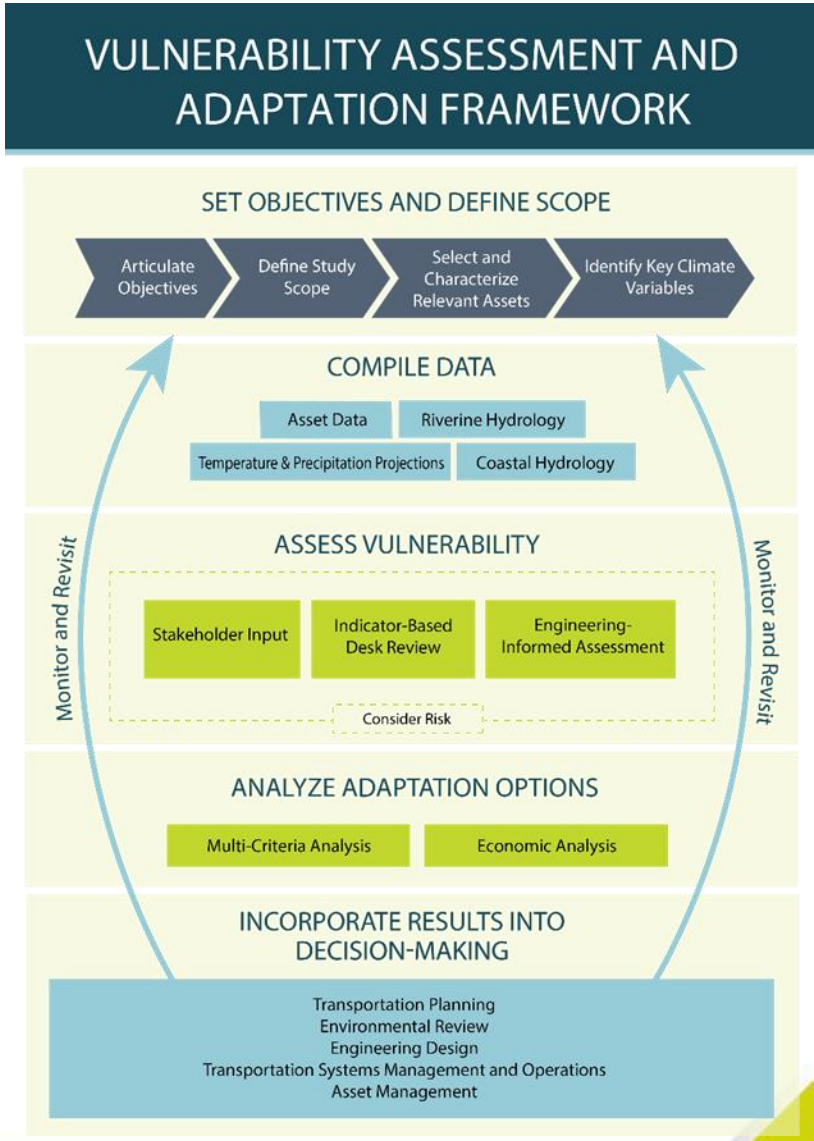
2. When Trends Differ, Evaluate Vulnerability

Objectives:

- Identify whether an asset is more vulnerable than other system assets.
- Prioritize potential vulnerabilities for the system.
- Approach:
- Use the Vulnerability Assessment Scoring Tool (FHWA 2017d).
- Input local asset data.
- Output the relative vulnerability scores per asset.



Source: FHWA 2019

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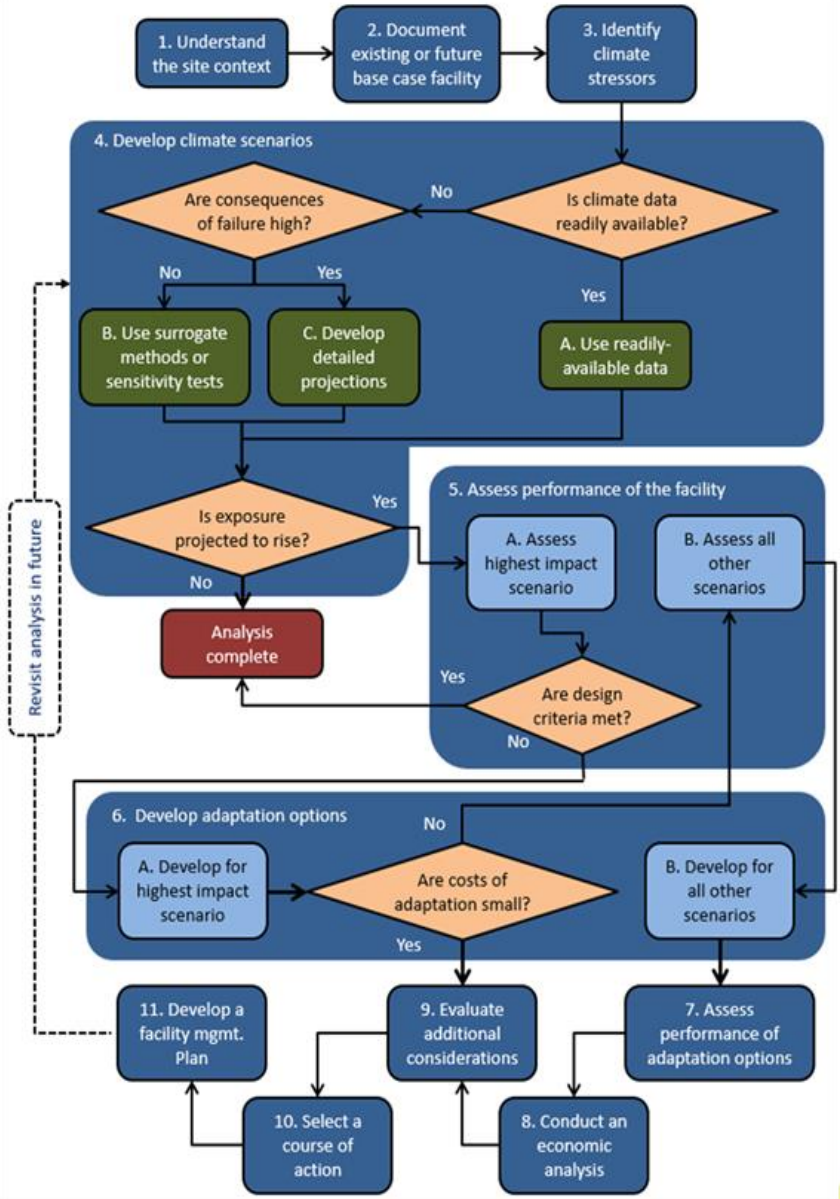
3. Plan and Design Infrastructure to Meet Future Conditions:

- Use the adaptation decision making assessment process (ADAP).
- Use a risk-based approach for planners, designers, or engineers.
- Tailor to each State.
- Aid decisionmakers in determining which project alternative is best (lifecycle costs, resilience, and regulatory and political settings) (FHWA 2021a).



Decision Tree of the ADAP Steps

Source: FHWA.
(FHWA 2016a)

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Environmental Impacts on Pavements

- Environmental factors contribute to pavement distresses, such as blowups, buckling, rutting, and thermal cracking.
- The Long-Term Pavement Performance Program studied environmental factor impacts on pavement performance (FHWA 2016b):
  - There is 36 percent of total damage for flexible pavements.
  - There is 24 percent of total damage for rigid pavements.
- Pavements are designed using climatic data; however, engineers typically assume stationarity.

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FHWA Resilience - Ongoing Efforts

Assessing Flooded Pavements Project

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- **Project objectives:**
  - Develop methods to assess flooded pavements.
  - Assess the capacity to carry traffic during/after flooding.
  - Evaluate emergency or heavy equipment.
  - Evaluate normal traffic.
  - Determine the tradeoff between the user costs of road closure (and detours) versus the costs of increased road damage.
  - Develop a decision support tool.
- **Project deliverables: A report is in publication (FHWA forthcoming)**

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National Oceanic and Atmospheric Administration (NOAA) Project: Effects of Sea Level Rise

- Joint project with the National Centers for Coastal Ocean Science.
- Project goal details: Facilitate informed adaptation planning and coastal management decisions through a multidisciplinary research program that results in integrated models and tools of dynamic physical and biological processes capable of evaluating vulnerability and resilience under multiple SLR, inundation, and management scenarios.

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NOAA Project (Continued)

Two focus areas:

- Coastal resilience.
- Surface transportation resilience:
  - Quantify the vulnerability of surface transportation systems to SLR and inundation.
  - Quantify the social, economic, and/or ecological benefits.
  - Predict the effects of SLR and inundation on surface transportation infrastructure under varying risk mitigation and management strategies.

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New Project: Impacts of Wildfires on Pavements

- Project objectives:
  - Determine the state of knowledge of wildfire impacts on pavements.
  - Define direct and indirect impacts.
  - Identify research gaps and needs.
- Project deliverables:
  - Determine the state of knowledge.
  - Identify how State DOTs deal with this issue:
    - Conduct detailed interviews.
    - Gather information on their experiences, observations, and challenges.

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National Highway Institute (NHI) Course: Addressing Resilience in Highway Project Development and Preliminary Design (2022)

Four 1-h web-based prerequisite courses and one 2.5-d instructor-led Course (NHI 2022):

- **Content:**
  - Addressing resilience in engineering decision-making (pavements and geohazards, inland flooding, coastal hydraulics).
  - Accessing and using climate projections.
  - Integrating resilience into project development.
  - **Audience:**
    Engineering, design, project development/environmental staff, and others.
- **Source material:**
  - *Synthesis of Approaches for Addressing Resilience in Project Development* (FHWA 2015).
  - Project assessments.
  - Hydraulic Engineering Circulars 17 and 25

(Kilgore et al. 2016; Douglass and Webb 2020).

FHWA Resilience Resources

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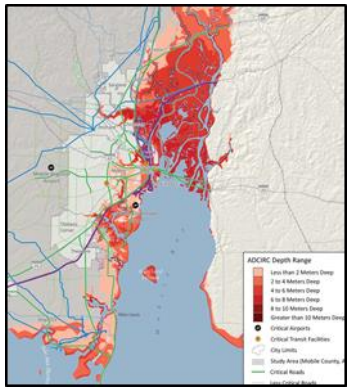
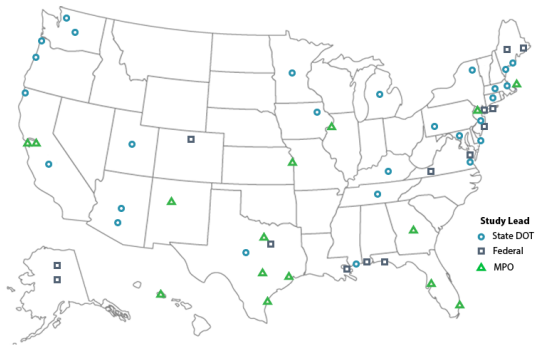
Gulf Coast 2 Study



(FHWA 2019)

Resilience Pilots with State DOTs and MPOs



(FHWA 2021c) MPOs = metropolitan planning organizations.

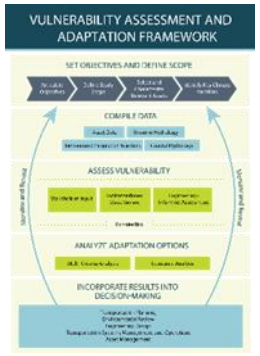
Hurricane Sandy Project

(FHWA 2017b)

Engineering Assessments

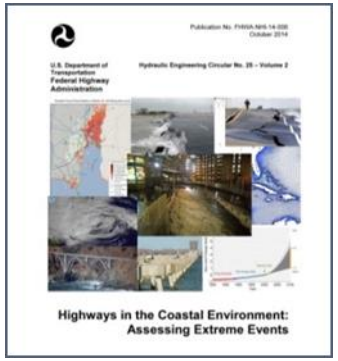
(FHWA 2017c)

Vulnerability and Adaptation Framework

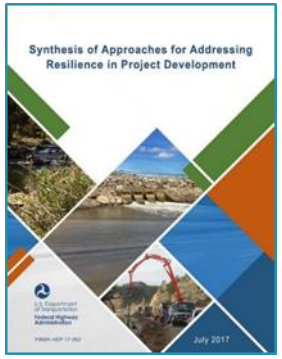


(FHWA 2019)

Engineering Guidance (HEC-25 & 17)

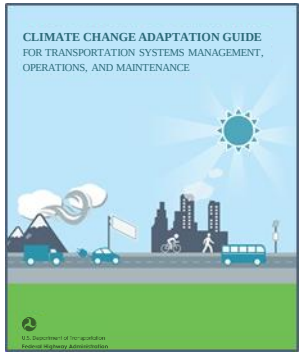


Project Development



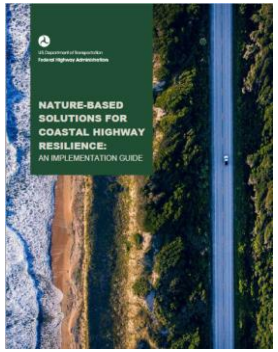
(FHWA 2015)

Operations and Maintenance



(FHWA 2017a)

Nature-Based Solutions



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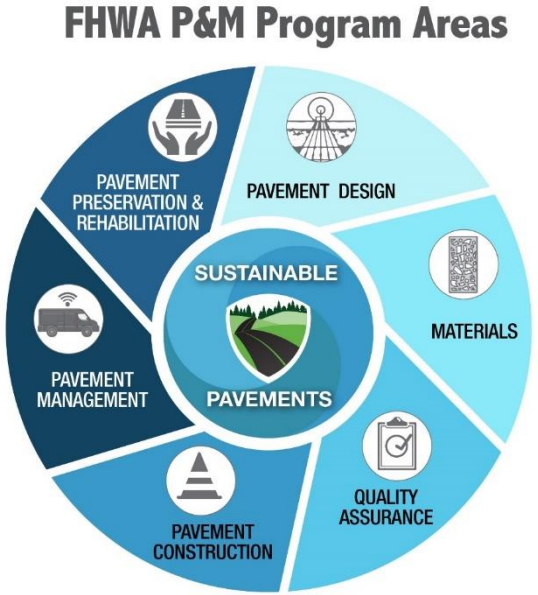
Pavement Preservation

Pavement Preservation

- FHWA definition*:
  - *Work that is planned and performed to improve or sustain the condition of the transportation facility in a state of good repair.*
- ***Keeping good roads good***



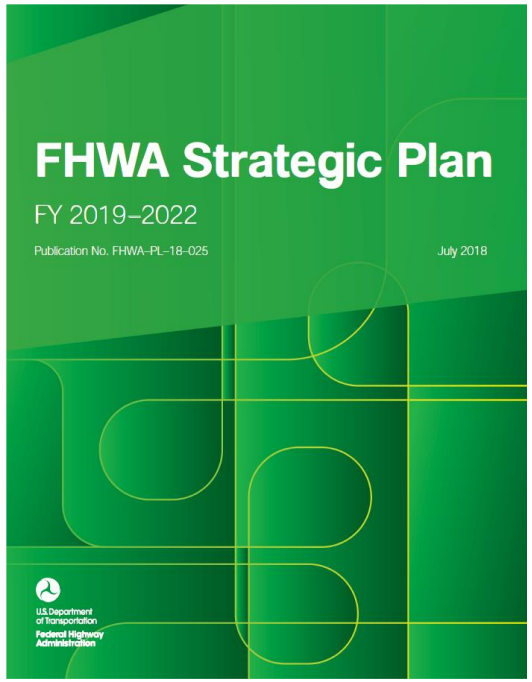
FHWA is the source of all images in this presentation unless otherwise noted.

*Guidance on Highway Preservation and Maintenance memo dated February 25, 2016

FHWA Pavement Preservation Program Linkages to FHWA Strategic Plan

The 2019-2022 FHWA Strategic Plan states:

"The FHWA will continue to raise the awareness of proven strategies, such as performance-based practical design, and the use of preservation techniques to cost-effectively extend the service life of transportation assets that could further improve investment decision making."



FHWA Strategic Framework - https://www.fhwa.dot.gov/policy/fhwaplan.cfm

FHWA Pavement Preservation Program
Role of FHWA

- Provide policy direction and leadership
- Demonstrate benefits
- Conduct and sponsor research

SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

Guidelines for the Preservation of
High-Traffic-Volume Roadways (R26)

every day counts
An Innovation Partnership with States

Pavement Preservation
(When, Where, and How)

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FHWA Pavement Preservation Program Opportunity Areas

- Expand the knowledge and experience and demonstrate the benefits
- Encourage agencies to become more pavement preservation oriented
- Foster collaboration and cooperation amongst stakeholders and partners

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FHWA Pavement Preservation Program Strategic Elements & Activities

1. Expand knowledge and demonstrate benefits by exploring and disseminating pavement preservation fundamentals

Tactics & Activities:

- ❑ Stakeholder outreach activities with Benchmarking Study **(completed)**
  - Evaluate impacts of current programs by surveying State DOTs
  - Outcomes include standard metrics to quantify benefits
- ❑Increase pavement preservation understanding
  - Update website
  - Publish educational and reference materials such as the pavement preservation checklist series
  - Facilitate education and training

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FHWA Pavement Preservation Program Strategic Elements & Activities

2. Encourage agencies to become more pavement preservation oriented Develop & deploy pavement tools

Tactics & Activities:

- ❑ Develop & deploy pavement tools
  - Establish TPF5(478) to demonstrate implementation of pavement preservation programs
  - Identify pavement preservation considerations during pavement design activities
- ❑ Integrate with performance management and asset management
  - Updated NHI course on pavement management systems to include considerations for pavement preservation **(now available)**
  - Developing a new NHI course on pavement preservation design and inspection
- ❑ Leverage industry and other stakeholder resources
  - Co-sponsor monthly webinar with Pavement Preservation and Recycling Alliance (PPRA)
  - Promote construction certification programs
  - Partner on project showcases

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FHWA Pavement Preservation Program Strategic Elements & Activities

3. Foster collaboration and cooperation amongst stakeholders by coordinating research and implementation efforts

Tactics & Activities:

- ❑ Publish and Implement Research Roadmap **(published)**
  - Initiating priority research projects
- ❑ Implement coordinated preservation pavement program
  - Conducting market assessment
  - Engage stakeholders through FHWA participation and sponsorship of various activities such as conferences, workshops, and webinars

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FLH / NPS Pavement Preservation Program

- Annual budget: $20 to $25 million
- Programming and funding based on treating all NPS routes and parking lots over an 8 to 10 year cycle
- Over 3000 miles of roadways and hundreds of parking lots preserved over last 10 years in the NPS Intermountain and Pacific West Regions

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FLH / NPS Pavement Preservation Program

- Efficiency: 89.5% of all funds are invested in construction contracts. PE and CE at 2.8% and 7.6%, respectively, make of the remaining portion.
- Results: The average network pavement condition rating jumped from 73.9 to 83.3 over a 10-year period.
- Procurement: Work is primarily awarded through a Multiple Award Task Order Contract (MATOC). A $150 million MATOC was awarded to 8 contractors in 2018.

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Pavement Preservation Project Example: Point Reyes National Seashore

- Completed in 2021
- Cost: $2.4 million
- Scope: 275,000 square yards of chip sealing. 30,000 square yards of micro surfacing. 2600 square yards of patching.

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FHWA Pavement Preservation Program Resources

FHWA Pavement Preservation Website
https://www.fhwa.dot.gov/preservation/

FHWA Pavement Preservation Strategic Plan
https://www.fhwa.dot.gov/preservation/pdfs/hif_pvmnt_prsvr_strategic_plan_12_10_2020.pdf

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Questions?