

# Transportation Asset Management Webinar Series

Webinar 67

## How Pavement and Bridge Conditions Affect Transportation System Performance

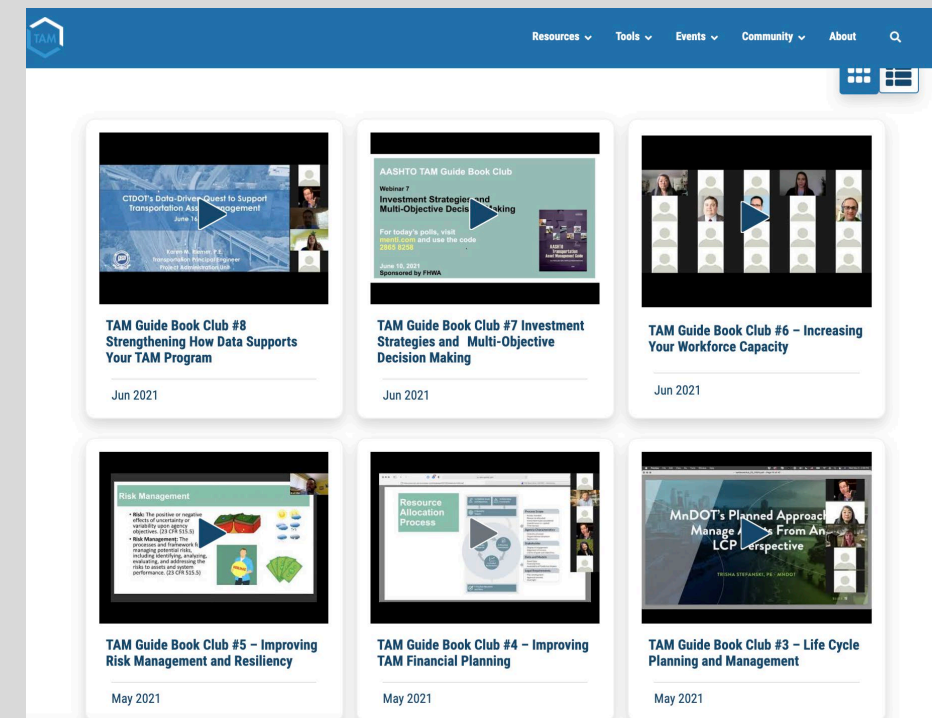
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February 21, 2024

# FHWA/AASHTO Asset Management Webinar Series

- This is the 67th in a webinar series that has been running since 2012
- Webinars are held every two months, on topics such as off-system assets, asset management plans, asset management and risk management, and more
  - 3rd Wednesdays, 2PM Eastern
- We welcome ideas for future webinar topics and presentations
- Submit your questions using Zoom's chat feature



# Welcome

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FHWA and the AASHTO Sub-Committee on Asset Management are pleased to sponsor this webinar series

- Sharing knowledge is a critical component of advancing asset management practice
- FHWA Asset Management Hub: <https://www.fhwa.dot.gov/asset/pubs.cfm>

# Webinar Objectives

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- Highlight how pavement and bridge conditions can contribute to system performance areas, such as highway safety, freight mobility, or reliability
- Learn about work completed for FHWA's Office of Operations conducted by Iowa State University, Gordon Proctor & Associates, and Starisis Corporation
- Review other attributes such as pavement shoulders, pavement friction, or bridge conditions contribute to highway safety, freight movement, noise reduction, and transportation system resilience

# Webinar Agenda

**2:00 Welcome, Overview, and Agenda**

Anna McLaughlin, AASHTO

Tashia Clemons, FHWA

Hyun-A Park , Spy Pond Partners

**3:10 Q&A**

Hyun-A Park, Spy Pond Partners

**2:20 Presentation – How Pavement and Bridge Conditions Affect Transportation System Performance**

Speakers:

- Joseph Gregory, FHWA
- Omar Smadi, CTRE, Iowa State University
- Gordon Proctor, Gordon Proctor & Associates
- Shobna Varma, Starisis Corporation

**3:20 Discussion and Wrap-up**

Hyun-A Park, Spy Pond Partners

# How Pavement and Bridge Conditions Affect Transportation System Performance

Federal Highway Administration

Office of Operations

Joe Gregory, P.E.

February 21, 2024

*Source: FHWA.*



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



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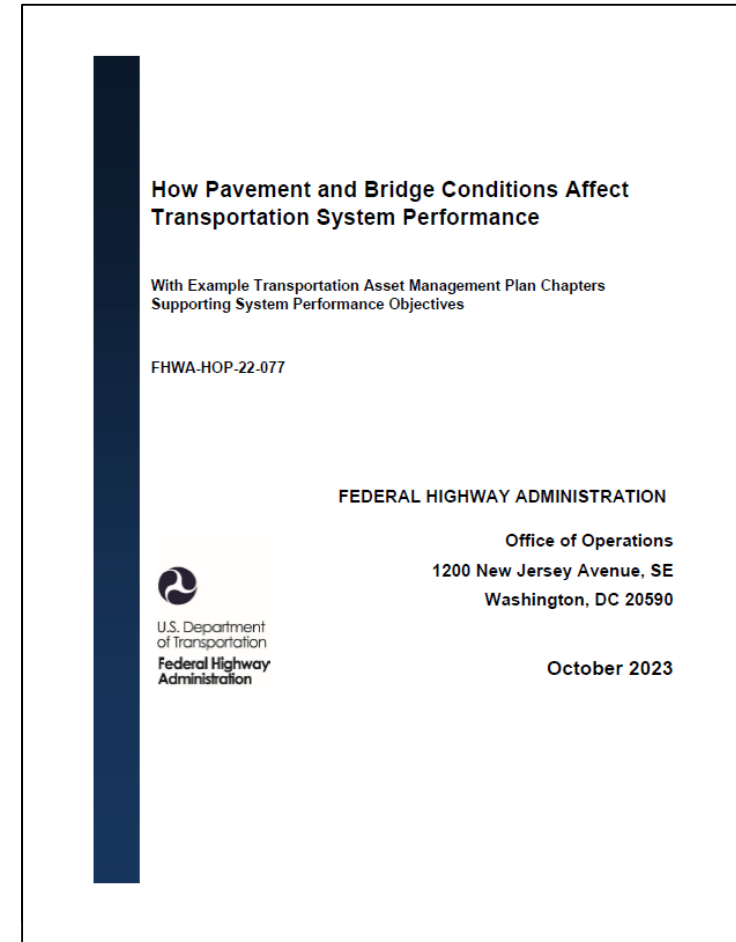
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# Today's Presentation

- FHWA recently published the report *How Pavement and Bridge Conditions Affect Transportation System Performance*
- It is available on the FHWA Asset Management for Operations Website







# How Conditions Affect Performance

- State departments of transportation (DOTs) must balance multiple objectives
- They focus on asset conditions as well as system performance
- This report emphasizes how pavement and bridge conditions influence transportation system performance



Source: iStock.



# The Main Messages

- This report includes several important themes:
  - First, good pavement and bridge conditions contribute to good performance in multiple areas such as:
    - Safety
    - Freight movement
    - Resilience
    - Quality of life
  - Second, State DOTs could define their State of Good Repair (SOGR) to better link condition and performance
  - Third, the Transportation Asset Management Plan (TAMP) can be a vehicle to coordinate the linking of condition and performance



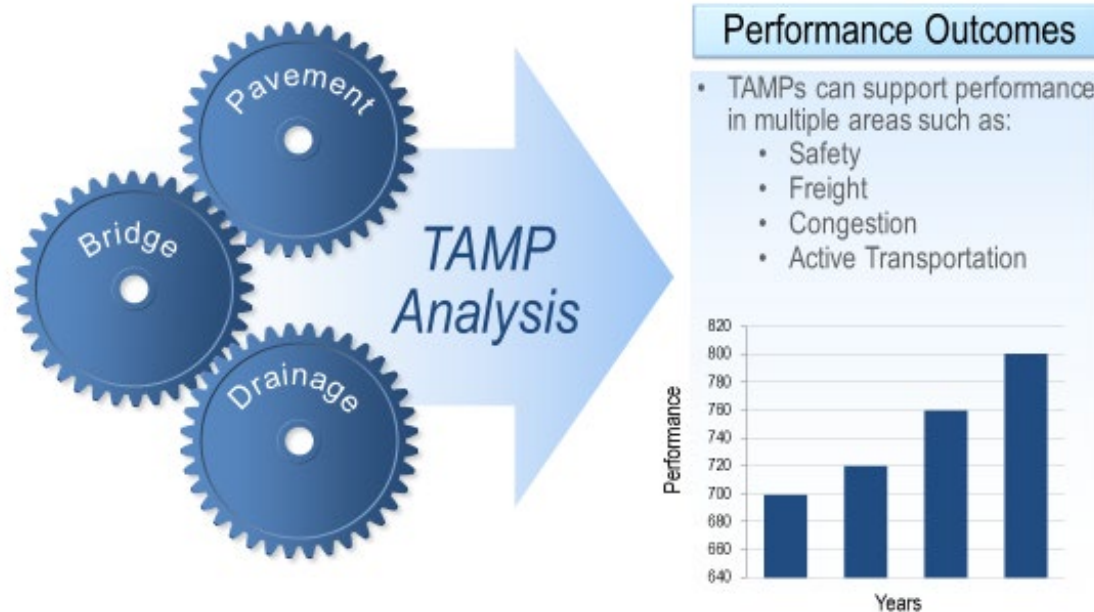
# Report Topics and Organization

1. Linking the TAMP to system performance objectives
2. Pavement condition and safety linkages
3. How pavement conditions affect noise, operating costs
4. How bridge conditions affect performance
5. Pavements, bridges, and a changing climate
6. Drainage and performance linkages
7. Good repair and Complete Streets
8. Good repair and mobility; reliability
9. Linking TAMPs to multiple performance areas

# Chapter 1: The TAMP and Performance



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Source: Crystal Graphics.

- TAMPs can link asset conditions to performance in:
  - Safety
  - Freight mobility
  - Resilience
  - Active transportation
  - Noise, operating costs, and “quality of life” objectives



# Chapter 1: Regulation Supporting Coordination (1/2)

- “A State shall develop a risk-based asset management plan that describes how the NHS will be managed *to achieve system performance effectiveness* and State DOT targets for asset conditions ...” 23 Code of Federal Regulations (CFR) 515.7
- “Performance of the NHS refers to the effectiveness of the NHS in providing for the *safe and efficient movement of people and goods* where that performance can be affected by physical assets.”  
23 CFR 515.5



# Chapter 1: Regulation Supporting Coordination (2/2)

- “Performance gap means the gaps between the current asset condition and State DOT targets for asset condition, and the *gaps in system performance effectiveness that are best addressed by improving the physical assets.*”  
23 CFR 515.5
- A TAMP shall discuss how the plan’s investment strategies collectively would make or support progress toward:
  - Improving or preserving the condition of the assets and the performance of the NHS relating to physical assets
  - Achieving State DOT targets for asset condition and performance of the NHS
  - Achieving the national goals identified in 23 United States Code (U.S.C.) 150(b) 23 CFR 515.9 (f) (2)(3)(4)



# Chapter 1: Performance Gaps

“State DOTs are required to have a process for analyzing gaps in the performance of the NHS that affect NHS pavements and bridges regardless of their physical condition (23 CFR 515.7(a)(2)). Under this provision, State DOTs must address instances where the results or recommendations from other plans, including the State’s Highway Safety Improvement Program, State Freight Plan, etc., may have an effect on NHS pavement and bridge assets. This could occur if the recommendations from the other plans call for additions or changes to the existing pavements, bridges, or other physical assets.”

FHWA. 2018. “Questions & Answers (Q&As)” (web page). <https://www.fhwa.dot.gov/asset/guidance/faqs.cfm>, last accessed January 25, 2024.

# Chapter 1: Defining the State of Good Repair



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Source: iStock.

- Each State defines its own SOGR
- SOGR is not limited to only the State performance targets for the Federal pavement and bridge performance measures
- Good repair could be defined as a condition that supports multiple performance objectives





# Chapter 2: Friction and Highway Safety

- Pavement friction and safety have long been linked
- Pavement friction influences crashes, particularly at curves, intersections, and pedestrian crosswalks



Source: Bigstock.

# Chapter 2: Friction and Pedestrian Safety



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- Pavement friction and pedestrian safety are linked particularly at:
  - Crosswalks
  - Intersections
  - Densely populated areas
  - Environmental justice communities
- Pavement and safety programs could coordinate at these locations

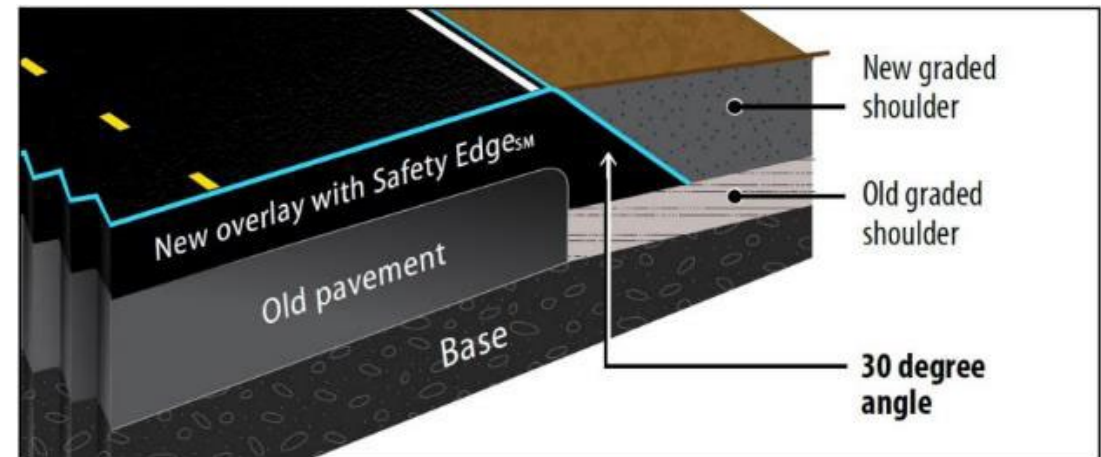


Source: iStock.



# Chapter 2: Shoulders and Safety

- Funding adequate pavement shoulders could provide another benefit to both condition and performance
- Crash modification factors show positive benefits from shoulder treatments
- The Safety Edge<sup>SM</sup> offers a simple and effective option



Source: FHWA.



# Chapter 2: Detailed Analysis

- Coordination and analysis between safety and pavement staff is essential
- Research shows that the pavement-safety link is not always straightforward
- Nuanced analysis and policies may be needed to maximize safety and improve pavement performance



Source: iStock.

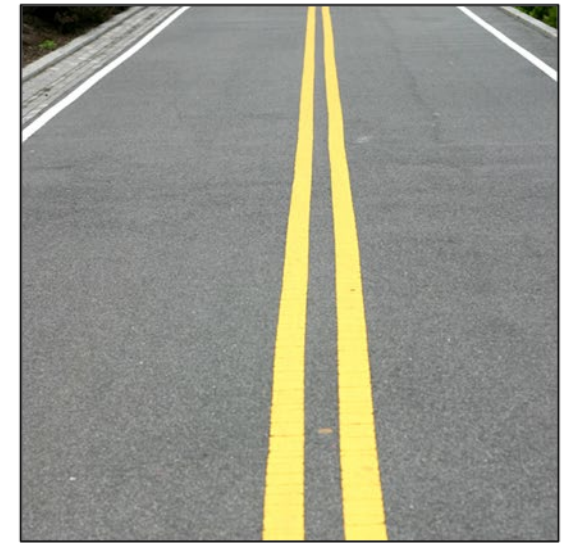


# Chapter 3: Pavement, Noise, and Operating Costs

- Good pavements lower operating costs and noise
- Higher International Roughness Indexes (IRIs) lead to higher fuel consumption, tire wear, and repair costs
- Health effects and sleep disruption are tied to excessive highway noise



Source: FHWA.



Source: FHWA.



# Chapter 4: Bridges and Performance

- Good-condition structures contribute to freight mobility
- They can support mobility when they have adequate width for transit services, active transportation, or travel lanes
- Bridges can enhance communities when they incorporate aesthetic or historic elements



Source: iStock.

# Chapter 5: Condition and Resilience



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- The TAMP could provide the forum to consider how conditions affect resilience
- Each State differs, but resilience can be affected by:
  - Bridge scour
  - Drainage conditions
  - Seismic retrofits
  - Bridge elevation and vulnerability to storm surge
  - Pavement moisture from rising water levels



Source: FHWA.



# Chapter 5: State of Good Repair and Resilience Examples

- Are bridges:
  - Seismically retrofitted?
  - Scour resistant?
- Are roadway elevations subject to frequent flooding?
- Do inventories indicate drainage assets support pavement condition, safety, resilience?



Source: FHWA.

Source: iStock.





# Chapter 6: Drainage and the State of Good Repair

- State DOTs increasingly are including drainage assets in their asset management efforts
- Drainage assets in good condition influence:
  - Pavement condition
  - Highway safety
  - Resilience



Source: iStock.

# Chapter 7: Complete Streets and Pavement Lifecycle Planning (LCP)



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- Lifecycle strategies often include the rehabilitation or reconstruction of pavements at the appropriate point in their lifecycle
- When reconstruction occurs, opportunities for Complete Street components arise



Source: FHWA.

# Chapter 8: Conditions and Reliability



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- The project team found little research linking pavement and bridge conditions with reliability or travel speed
- However, asset management is playing an increasingly important role in keeping transportation systems management and operations (TSMO) assets in good repair to support mobility and reliability



Source: iStock.



# Chapter 8: Managing TSMO Assets

- **Asset Identification**—What are the asset data to collect and why
- **Management Systems for Assets**—What are the collection of processes, procedures, tools, or software systems to help an agency collect and store information while providing analysis to inform asset management decisionmaking
- **Performance Measures and Targets**—What are the practices that agencies can adopt to measure the condition of intelligent transportation systems (ITS) and traffic signal assets, as well as establish targets
- **Maximizing Performance**—What are notable practices for planning and maintaining ITS and traffic signals using asset management strategies
- **Resource Allocation**—What are the recommended approaches for identifying and communicating funding and resource needs for long-term management of ITS and traffic signal assets



# Chapter 9: Linking the TAMP to Performance Goals

- The report explores how the TAMP can:
  - Link to other performance plans such as the:
    - Strategic Highway Safety Plan (SHSP)
    - State freight plan (SFP)
    - Metropolitan transportation plans (MTPs)
    - Long-range statewide transportation plans (LRSTPs)
  - Or support important plans and policies related to:
    - Complete Streets and active transportation
    - State or regional resilience strategies
    - Congestion mitigation efforts



# Chapter 9: Building Bridges to the TAMP

- The report suggests ways to engage multiple stakeholders to develop TAMP investment strategies to support multiple objectives:
  - Review other performance plans
  - Form multidisciplinary groups
  - TAMP staff participate in other plan development, such as SHSP or SFP



Source: iStock.



# Chapter 9: Each TAMP Section Could Contribute (1/2)

- Each component of the TAMP could reinforce the TAMP's support for overall system performance such as:
  - TAMP objectives, measures, and targets could support multiple performance areas such as safety and freight movement
  - Summary listing of bridges and pavements could cite the assets that could most impede other performance objectives, such as pavements lacking sufficient shoulders or friction
  - Performance gaps in areas such as friction or resilience could be acknowledged



# Chapter 9: Each TAMP Section Could Contribute (2/2)

- Lifecycle plans could indicate that when reconstructed, pavements and bridges may consider designs to meet multiple objectives
- The risk management analysis could note how conditions create risks to performance, such as poor drainage assets increasing flood risks
- Financial plans and investment strategies could indicate if funding levels and strategies are allocated to reduce performance risks





# Appendices: Example TAMP Sections

- The report includes three fictional TAMP sections:
  - Performance gap analysis
  - Risk management analysis
  - Investment strategies
- Although fictional, the chapters include data taken from State DOTs but anonymized
- The chapters illustrate how the TAMP chapters can link management of asset conditions to considerations of asset performance



# Summary and Conclusions

- This report includes several important themes:
  - First, good pavement and bridge conditions contribute to good overall transportation system performance
  - Second, DOTs can define their SOGR
  - Third, the TAMP can coordinate crosscutting analysis to link condition and performance objectives



Source: iStock.



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# Questions and Comments

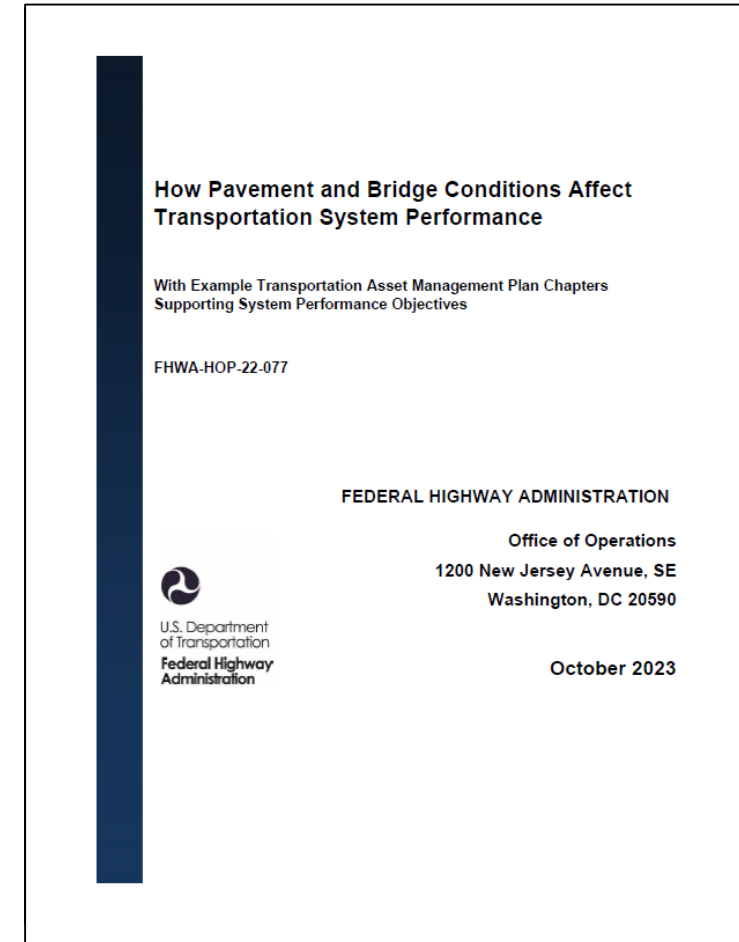
This report is on the FHWA Asset Management for Operations Website:

[https://ops.fhwa.dot.gov/program\\_areas/ops-asset-mgmt.htm](https://ops.fhwa.dot.gov/program_areas/ops-asset-mgmt.htm)

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Source: FHWA.

# Q&A and Discussion

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Topic: Equity and Transportation Asset Management

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