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**Federal Highway
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PAVEMENT MANAGEMENT ROADMAP EXECUTIVE SUMMARY

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16. Abstract The FHWA's update to its Pavement Management Roadmap helps to identify the steps that will address current gaps in pavement management and to establish research initiatives and priorities. Initial gaps were identified based on a literature review, project team knowledge, and a satisfaction survey of Federal, State, and local pavement management practitioners (authorized under Office of Management and Budget [OMB] #2125-0628). They were grouped according to four themes: Theme 1 – Data, Theme 2 – Pavement Management Analysis Tools and Other Applications, Theme 3 – Workforce and Organization Issues, and Theme 4 - Technological Advancements – New Tools, Methodologies, and Technology. The Roadmap was derived from a series of virtual stakeholder workshops in which representatives from State and local agencies, academia, private industry, and FHWA met to discuss and prioritize suggestions for enhancing current practices. The Roadmap contains 72 action items (46 short-term and 26 long-term) in 15 improvement areas across the four themes. The results can be used to determine new research, development, and technology transfer opportunities.					
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INTRODUCTION

BACKGROUND

The Federal Highway Administration (FHWA) published its first *Pavement Management Roadmap* in 2010¹. The document established a 10-year vision for pavement management and outlined 47 short- and long-term research and implementation activities, estimated at \$14.5M, that would collectively advance pavement management practices.

In the years since the first *Roadmap* was released, many of the suggested activities have been addressed to varying degrees of completion through research initiatives, deployment activities, technical assistance programs, and technology transfer activities. Today's pavement management practices reflect the advancements that have been made since 2010 as well as the current environment in which it operates. Within this context, the FHWA initiated the development of an updated *Pavement Management Roadmap* to reflect current capabilities, practices, and resulting gaps. The results include a 10-year pavement management strategy for use by FHWA and other transportation agencies to drive initiatives that will continue to improve pavement management practices.

Pavement Management Roadmap Objective

Present a 10-year strategy that can be used by FHWA and other transportation agencies to guide continued identification of research needs, transformative innovation development, and technology transfer opportunities that will continue to improve pavement management practices.

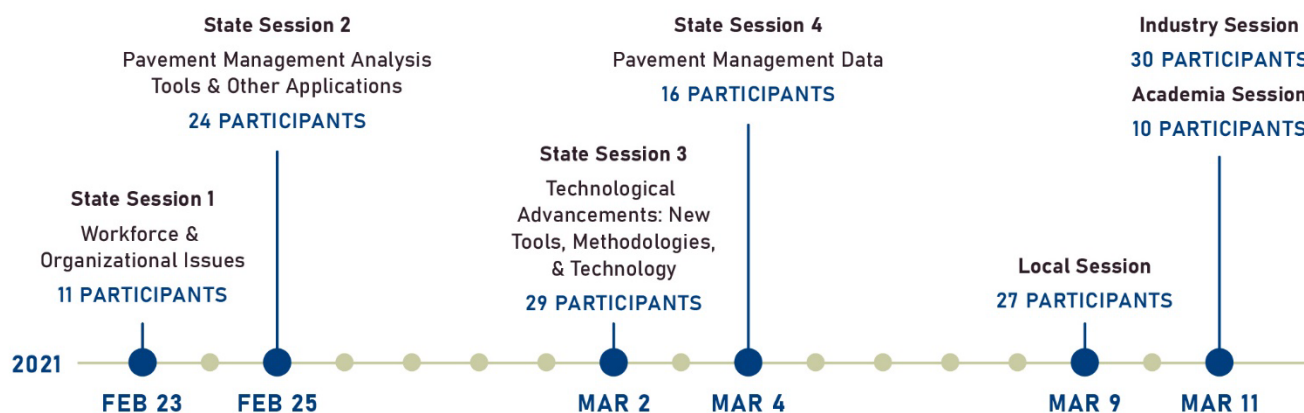
THE ROADMAP DEVELOPMENT PROCESS

The first step in developing the updated Pavement Management Roadmap involved a practice gap assessment. The assessment included three sources of information to identify current gaps.

- An electronic benchmark survey was conducted using Office of Management and Budget (OMB) control number 2125-0628. A total of 61 responses were received, with 53 responses coming from State DOT employees representing all 52 State DOTs and 8 coming from local or regional transportation agencies. The survey provided insight on agency satisfaction with existing pavement management resources, including their ability to support pavement management practices.

¹ <https://www.fhwa.dot.gov/pavement/management/roadmap/>

- A literature review was conducted to identify on-going and completed research and other activities impacting pavement management since the 2010 *Pavement Management Roadmap* was published.
- Virtual stakeholder outreach activities were conducted to define, assess, and prioritize gaps that hinder the full utilization of pavement management principles and practices. A total of 147 Federal, State, local, industry, and academic participants collaborated with one another during the stakeholder outreach web meetings, with some State DOT participants attending several of the State sessions. The meeting dates, topic areas, and participation levels are shown in the graphic.



Following the stakeholder outreach sessions, a separate virtual meeting was held to bring the participants in the earlier sessions together to prioritize the gaps and suggested strategies for closing the gaps. The prioritization session resulted in useful insights into the types of research, guidance, and technology transfer activities from the 54 participants. Their feedback is reflected in this updated *Pavement Management Roadmap*.

THEMES

Based on the information obtained through the activities described earlier, four themes were identified to reflect the present environment and the current interests of the pavement management community. Within each theme, several topic areas were identified to organize the gaps. The resulting themes and topic areas addressed in this *Pavement Management Roadmap* are summarized below.



- **Theme 1: Pavement Management Data** – This theme concentrates on pavement management data needs, including collection, quality control, acceptance, contracting, storage, and management. The gap assessments results and the *Roadmap* suggestions in this theme are organized into the two topics listed below.
 - Topic 1-1: Data.
 - Topic 1-2: Data quality.
- **Theme 2: Pavement Management Analysis Tools and Other Applications** – This theme includes pavement performance modeling and the emerging area of pavement performance measurement. The gap assessment results and the *Roadmap* suggestions in this theme are organized into four topics:
 - Topic 2-1: Modeling.
 - Topic 2-2: Support for Transportation Performance Management (TPM) and Transportation Asset Management (TAM).
 - Topic 2-3: Project selection.
 - Topic 2-4: Other applications of pavement management data.
- **Theme 3: Workforce and Organizational Issues** – This theme addresses workforce and organizational issues with an emphasis on communication, training, and workforce development issues. The gap assessment results and the *Roadmap* suggestions in this theme are organized into the following four topics:
 - Topic 3-1: People.
 - Topic 3-2: Pavement management funding risks.
 - Topic 3-3: Data and technology.
 - Topic 3-4: Communication and outreach.

- **Theme 4: Technological Advancements – New Tools, Methodologies, and Technology** – This theme focuses on future developments that will impact pavement management over the next 10 years. The gap assessment results and the *Roadmap* suggestions in this theme are organized into the five topics listed below.
 - Topic 4-1: Advancements in automated pavement distress data collection interpretation technologies.
 - Topic 4-2: Technologies to assess pavement subsurface characteristics and structural properties.
 - Topic 4-3: Emerging data collection technologies and methodologies for assessing pavement distresses and other surface characteristics.
 - Topic 4-4: Improving pavement management data and analysis tools.
 - Topic 4-5: Next-generation performance measures.

10-YEAR PAVEMENT MANAGEMENT ROADMAP

LONG-TERM VISION FOR PAVEMENT MANAGEMENT

Pavement Management Vision

The vision for pavement management over the next 10 years is presented below. It emphasizes the importance of efficiency and effectiveness in all aspects of pavement management from data collection and analysis to the presentation and use of the data.

PAVEMENT MANAGEMENT VISION

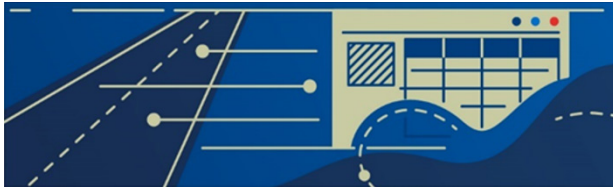
Pavement management supports agency investment decisions using quality data and analysis tools that encourage the consideration of long-term consequences on pavement and system performance in alignment with building safe, sustainable, and equitable transportation systems.

This vision is achievable with the following:

- Efficient and effective data collection and analysis procedures that take advantage of promising new technologies to produce the most reliable and valid data possible within resource constraints.
- Access to data and analytical tools that are robust, comprehensive, and credible.
- The ability to communicate effectively with stakeholders using performance data that consider strategic objectives (such as economic and financial sustainability, risk and resilience, and social equity) in addition to pavement condition.
- Deployment of a well-trained and effective work force with access to resources that build and enrich the skills needed to effectively manage a pavement network.
- Internal and external support for pavement management that recognizes the benefits and value provided through its use in supporting planning, programming, design, construction, and maintenance activities.

STRATEGIES TO ACHIEVE THE VISION

To overcome the challenges and address the gaps identified during the *Roadmap's* development and achieve the long-term vision, a series of activities are suggested. These suggested activities are organized into the 15 Improvement Areas summarized in the graphic.

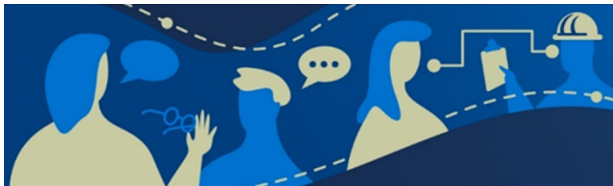


DATA

Data Collection – Improve the efficiency and reliability of existing data collection.

Data Quality – Improve the quality of data collection using traditional processes.

Data Management – Support efforts to improve data processes and management.



WORKFORCE

Training – Develop and deploy content to support workforce development.

Workforce Development – Reduce barriers to ready access to training and information needed to support workforce transitions.

Technical Assistance – Provide support to promote the use of pavement management concepts.

Tools – Support the development of software tools to supplement existing capabilities.

Communication – Develop effective tools for strategies for communicating pavement management results to different stakeholders.

Organizational Challenges – Address organizational challenges that hinder the use of pavement management



ANALYSIS

Performance Modeling – Enhance the reliability and level of confidence in pavement performance models.

Treatment Rules and Impacts – Refine treatment rules and impacts to improve project and treatment suggestions.

PMS Analysis – Strengthen the use of pavement management software to support agency investment- and project-planning decisions.

Performance Measures – Support the expanded use of existing performance measures at the Federal, State, and local levels.



NEW TECHNOLOGY

New Technology – Promote strategies for using new technology to support pavement management data collection and analysis.

Next Generation Performance Measures – Implement next generation performance measures into pavement management programs.

The 15 Improvement Areas represent 72 suggested action items, including 46 short-term activities to be completed within the next 5 years and 26 long-term needs to be accomplished in the next 5 to 10 years. Together, these suggested action items are estimated to cost \$30.225 million. No commitments to funding the suggestions contained in the *Roadmap* are implied by FHWA or any other agency.



The suggested action items include a variety of activities involving:

- Research and development.
- Deployment.
- Technical assistance.
- Syntheses.
- Peer exchanges.
- Training.
- Case studies.
- Tool development.

A summary of the number of action items and their estimated cost are summarized below. The complete *Pavement Management Roadmap* includes action item statements describing suggested objectives, tasks, deliverables, costs, and schedules.



■ **Research** – Action items in this area involve some research and development to put the concepts into practice. A total of 28 research action items were identified. Of the 28 action items, 13 were short-term and 15 were long-term activities. The short-term actions total an estimated \$4.725 million and the long-term actions total \$6.275 million, resulting in a total estimated cost of \$11 million.



■ **Deployment** – This category includes actions that present successful approaches to using the concepts or technology. Action items in this category do not necessarily require research to put the concepts into practice, but agencies would benefit from guidance on how to apply the concepts effectively. A total of 14 deployment topics were identified, with 13 short- and 1 long-term activity. The short-term actions total an estimated \$3.525 million and the long-term action was estimated at \$0.250 million, resulting in a total estimated cost of \$3.775 million.



■ **Technical Assistance** – Action items in this category would benefit from direct technical support to a particular agency that is struggling to adopt a concept. Of the 5 suggested activities, 2 were short- and 3 were long-term activities. The short-term actions total an estimated \$1.0 million and the long-term actions total \$7.9 million, resulting in a total estimated cost of \$8.9 million.



■ **Synthesis** – A synthesis is a summary of current practice. There were four synthesis topics identified, with all of them suggested as short-term activities. The combined cost for these syntheses is estimated to be \$200,000.



■ **Peer Exchange** – Identified by stakeholders participating in the outreach activities as the most effective method of implementation support, peer exchanges provide an opportunity for peer agencies to come together to share practices and ideas. Six short-term peer exchange topics were identified at a total estimated cost of \$450,000.



■ **Training** – Action items in this category include the development of training materials that can be provided through online, instructor-led, or hybrid courses that combine online and in-person training. A total of 10 action items were identified. Of the 10 action items, 5 were short- and 5 were long-term activities. The short-term actions total an estimated \$3.0 million and the long-term actions total \$1.2 million, resulting in a total estimated cost of \$4.2 million.



■ **Case Studies** – Case studies illustrate the application of a concept or methodology in one or more agencies through published material. One short-term case study was suggested at an estimated cost of \$150,000.



■ **Tool Development** – Action items in this area involve the development of public-domain software tools that enhance existing analysis capabilities. Four action items suggest the development of software tools. Of the four action items, two are short-term suggestions and the other two are long-term activities. The short-term actions are estimated to cost \$1.05 million and the long-term actions total \$500,000, resulting in a total estimated cost of \$1.55 million.

IMPLEMENTATION

APPROACH

The *Roadmap's* implementation approach encourages collaborative efforts that leverage relationships with industry, academia, international entities, and transportation agencies at all levels to help reduce unnecessary duplication of effort. The suggestions also address workforce development skills since stakeholders indicated that the availability of college-level and post-graduate training in pavement management is limited.

The implementation plan suggests possible opportunities to support the development of solutions to common issues that will help advance innovative pavement management practices. The implementation suggestions recognize the possible contributions that could be made through initiatives and support from FHWA, the National Cooperative Highway Research Program (NCHRP), the American Association of State Highway and Transportation Officials (AASHTO), Pooled Fund Studies, the Transportation Research Board (TRB), academia, and private industry. No commitments to funding the suggestions contained in the *Roadmap* are implied by FHWA or any other agency.

MOVING FORWARD

This updated *Pavement Management Roadmap* establishes a vision for pavement management over the next 10 years. It recognizes the advancements that have taken place since the publication of the initial *Pavement Management Roadmap* in 2010, and the changes that have influenced the way pavement management is used to support Transportation Performance Management (TPM) and Transportation Asset Management (TAM) activities. The transformative innovations and strategic deployment activities outlined in the *Roadmap* reflect the current environment in which pavement management operates with suggestions provided by practitioners for shaping future developments and accomplishments. Future *Roadmaps* will build on the suggestions outlined, as this *Roadmap* built on the lessons learned from 2010.

Over the next 10 years, as the *Pavement Management Roadmap* is implemented, it is anticipated that practitioners will continue to apply their knowledge and skills to make effective use of available information and tools. Through the collaborative efforts of the organizations suggested in the *Roadmap*, pavement management practices will continue to evolve and advance. The results will help ensure that pavement management continually supports the development of agency investment decisions that consider risk, resilience, and other factors that impact long-term pavement and system performance.