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**CIRCULAR**

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**13<sup>th</sup> National  
Conference on  
Transportation Asset  
Management**

**August 10–12, 2021**

**TRB Virtual Event**

*The National Academies of*  
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TRANSPORTATION RESEARCH CIRCULAR E-C277

# 13th National Conference on Transportation Asset Management

**August 10-12, 2021  
TRB Virtual Event**

**Kathryn A. Zimmerman**  
*Applied Pavement Technology, Inc.*  
*Rapporteur*

**Submitted December 2021**

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## TRANSPORTATION RESEARCH CIRCULAR E-C277

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## Acknowledgments

Any successful conference requires the dedicated effort of passionate professionals who turn an idea into reality, but it would be surprising to find a Conference Planning Committee that had to go through the effort three times before the event could take place! This conference, originally scheduled to be held in 2020, was postponed due to the COVID pandemic, rescheduled for 2021 only to be postponed again, and then converted into a virtual format. The efforts put forth by the Conference Planning Committee, led by Greg Slater (Conference Chair) and Brad Allen (Program Chair), are recognized and commended. The significant contributions from the Transportation Research Board (TRB) staff to make the conference a success is also greatly appreciated. Tom Palmerlee, Claire Randall, Bruce Millar, and Rhonda Levinowsky worked tirelessly to handle all the logistical issues that arise during a conference, but even more so in a virtual environment. Mr. Palmerlee's ongoing support for the asset management community and dedication to the asset management conferences over the years was noted with gratitude by the community he represents.

The conference e-circular was prepared by Katie Zimmerman, Applied Pavement Technology, Inc. (APTech). The rapporteur used materials provided by session reporters and moderators as well as her own notes to prepare this e-circular. She is grateful for the notes provided by the session reporters and recognizes that this summary benefited greatly from their contributions. Any errors in the content presented in this document are unintentional and solely Ms. Zimmerman's responsibility.

This e-circular is a compilation of the presentations and a summary of the ensuing discussions at the event. The Conference Organizing Committee was responsible for organizing the conference, identifying speakers, and facilitating activities during the event. The views contained in the report are those of individual event participants and do not necessarily represent the views of all participants, the planning committee, TRB, or the National Academies of Sciences, Engineering, and Medicine (NASEM).

This e-circular has been reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise. TRB thanks the following individuals for their review of this document: Trish Stefanski, Minnesota DOT; Patrick Cowley, Utah DOT; Emily Burns, Seattle DOT; and Omar Smadi, Iowa State University.

Although the reviewers listed above provided many constructive comments and suggestions, they did not see the final draft before its release. The review of this e-circular was overseen by Karen Febey, TRB's Senior Report Review Officer. She oversaw the review process and ensured that all review comments were carefully considered.

## Conference Overview

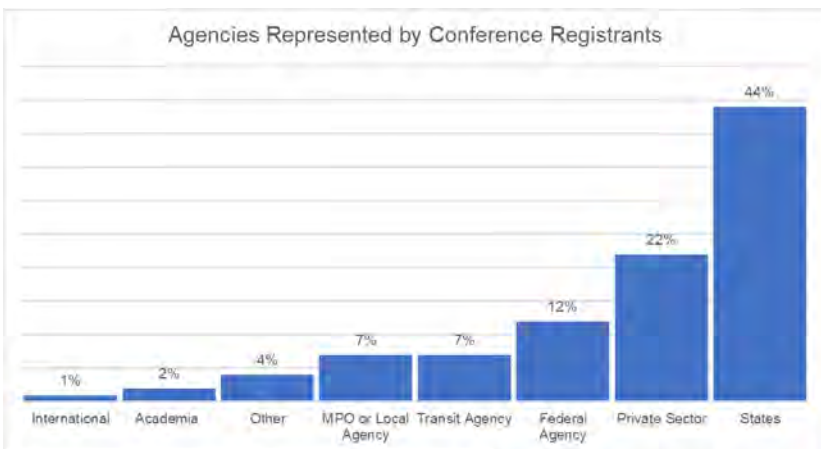
During a time of ever-changing dynamics, there is a tremendous amount happening in the world of asset management. The planning for the 13th National Conference on Transportation Asset Management (TAM) reflected that change. The conference was originally scheduled to be held live in Boston, MA from July 11-14, 2020. Due to concerns with the COVID pandemic, the conference was postponed and rescheduled to be held at the same location in 2021. Due to continued concerns about the pandemic, the Conference Planning Committee made the decision to convert the conference to a virtual event that took place August 10-12, 2021.

The conference program featured a variety of topics highlighting best practices in traditional topic areas as well as emerging issues from the changing world impacting asset management. The traditional topic areas covered topics such as risk management, life cycle planning (LCP), and Transportation Asset Management Plan (TAMP) development. Emerging topics were also featured, addressing subjects such as resilience, sustainability, and equity.

Because of the range of topics covered, the program addressed the needs of practitioners at all levels of experience from planning, maintenance, operations, and organizational and informational management. The program included dedicated sessions that addressed transit asset management, transportation finance, asset data, organizational structure and culture, future-ready planning, resilience to climate change and extreme weather events, equity, and more—all structured by thematic days. Conference sessions each day were organized around the following themes:

- Day 1: Strategic Planning Through TAM.
- Day 2: Supporting TAM Operations.
- Day 3: The Future of Asset Management.

A total of 466 transportation asset management practitioners registered for the virtual conference. Participants represented federal, state, and local transportation agencies; regional planning organizations; transit agencies; academia; and private industry (Figure 1). Representatives from 21 state departments of transportation (DOTs)<sup>1</sup> attended as members of a pooled fund established by the



**FIGURE 1** Affiliations of conference participants.



Iowa Department of Transportation. Many of these participants served as conference moderators and recorders. The pooled fund also sponsored conference summaries for days 1 and 2 that featured highlights from each session summarized by the session moderator. These wrap-up presentations are available online as YouTube videos.<sup>2,3</sup>

The conference was sponsored by Transportation Research Board (TRB) Committee AJE30, Transportation Asset Management, and the American Association of State Highway and Transportation Officials (AASHTO). It provided a great opportunity for practitioners to enhance skills, learn what is being done in other organizations, and share ideas with peers.

## CONFERENCE PROGRAM

The conference program featured plenary and concurrent sessions organized around each day's theme. A total of three plenary sessions and 18 concurrent sessions were offered over the three-day period. A summary of the daily themes and sessions is provided.

- **Day 1: Strategic Planning Through Transportation Asset Management**—In addition to the Opening Plenary Session, the sessions featured the following topics:
  - **Potential Federal Infrastructure Bill and the Current State of Transportation Infrastructure.** This session featured a panel discussion covering the anticipated content and impact of the pending Federal Infrastructure Bill with a focus on highway and transit asset management and transportation performance management (TPM).
  - **Asset Valuation to Support TAM.** There are many different approaches for calculating asset value and different valuation metrics that can help support investment decisions. This session discussed approaches for calculating asset value and related metrics to support TAM. It included presentations on guidance being developed and provided examples of approaches used in the United States, the United Kingdom, New Zealand, and Australia.
  - **Managing Assets for a Resilient Future.** During uncertain times, agencies are more focused than ever on improving the resilience of their infrastructure and business practices. This session provided examples of how agencies are incorporating resilience into network- and program-level decision making and investment priorities.
  - **Getting Actionable Targets in Your TAMP.** A TAMP forms the foundation for defining the strategy and data governance protocols that an agency will follow to implement an asset management program. The next step is to use the information to create a sustainable and transparent process for making decisions and tracking progress toward asset management goals. The presentations in this session provided examples of sustainable processes that improve agency asset management practices.
  - **Breaking Down Silos—Can We Use the Tools We Currently Have, or Do We Need More?** This session featured highway and transit agency personnel who have successfully overcome organizational silos. The presentations featured practical solutions for breaking down silos and producing a TAMP that provides a comprehensive plan to achieve an agency's strategic objectives.
  - **From Cradle to Grave: Life Cycle Planning for Transportation Asset Management Plans (TAMPs).** This session looked at life cycle planning (LCP) from every angle. It included a deep dive into the LCP methodology and higher-level

- presentations from state and local agencies featuring practical solutions that can be implemented in any sized agency.
- **Day 2: Supporting TAM Operations**—Day 2 featured a plenary session on enabling sustainable and equitable mobility by advancing practices in transit asset management. Following the plenary session, concurrent sessions included the topics listed below.
    - **Transportation Finances After the Pandemic, Including Multiple Experiences from Federal, State, Local, and Transit Agencies.** During this session, federal, state, and local highway and transit agencies shared their experiences with managing finances through the pandemic. The presentations also summarized short- and long-term impacts the pandemic was expected to have on their asset management practices.
    - **Integrating Risk Management into Agency Practices: A Roadmap.** This session provided participants with a 3- to 6-year roadmap for integrating risk management into agency practices. The presentations offered tools, practical examples, references, and other recommendations for including risk considerations in existing agency decision processes.
    - **TAMping the Way to the Next Transit Asset Management Plans.** The first generation of Asset Management Plans for transit agencies was completed in October 2018. This session summarized best practices in developing the plans and offered suggestions for incremental changes that could be made by integrating risk, criticality, and data governance into asset management strategies.
    - **2022 TAMP: What Are Agencies Planning?** This session featured presentations and a panel discussion with agencies that are planning significant changes to their 2022 TAMPs. The presenters discussed factors driving the changes, strategies for addressing system expansion needs, and the use of the TAMP to communicate impacts during investment trade-off decisions.
    - **More Than Checking a Box: Making Your TAMP Foundational to Your Agency Practices.** This session was designed to inspire agencies to make their TAMPs an integral component of decision-making processes through presentations that featured real life examples and the benefits that had been realized. The presentations introduced several asset management frameworks that could be implemented immediately.
    - **Effectively Communicating Asset Management Information.** Being able to effectively communicate asset management information to decision makers is an important component to securing funding to maintain system performance. This session featured rapid-fire presentations illustrating effective communication tools used by transportation agencies.
  - **Day 3: The Future of Asset Management**—The third day concluded with a Closing Plenary Session organized around imagining future TAM possibilities. Concurrent sessions held prior to the closing session covered the following topics:
    - **The Future of TAM—Organizational Transformation and Improved Asset Decision Making.** Transportation agencies have had to shift their focus from an emphasis on designing, building, and delivering assets to a system preservation focus. This has prompted agencies to reevaluate the way they do business. This session

- featured presentations from agencies that have begun those transformations and are using asset management to influence decisions from long-range planning to daily operations.
- **Communicating TAM to Expand Public and Agency Buy-In.** This session focused on strategies being used to improve the understanding and use of asset management. Strategies for leading organization culture shifts, communicating effectively, and expanding the reach of asset management were presented.
  - **Exploring the Frontiers of Asset Management Modeling and Analysis.** Asset management runs on data analytics. Through a series of presentations, this session explored the analytical tools and processes used to support the next generation of asset management.
  - **What’s Next for Asset Management?** This session featured executive leaders from highway and transit agencies providing their views on the future of asset management within their agencies and nationwide.
  - **TAM and Equity.** Providing equitable transportation services to everyone is growing in importance to ensure that resource allocation and decision-making processes are fair to all. This session explored elements of equity and TAM and featured presenters who have taken steps to incorporate equity into asset management decisions.
  - **Making Your TAMP Address Resilience to Truly Extreme Weather.** As extreme weather events become more frequent, asset management must provide a framework for decisions that consider these types of events. This session provided strategies for incorporating extreme weather and climate change into asset management strategies.

## CONFERENCE PLANNING

The conference was organized through the volunteer efforts of a Conference Planning Committee led by Greg Slater, Maryland Department of Transportation, who served as the Conference Chair. Brad Allen, Applied Pavement Technology, Inc. (APTech), served as the Conference Technical Program Chair. Other members of the Planning Committee included:

- Holly Arnold, Maryland Transit Administration (MTA)
- Emily Burns, Seattle Department of Transportation
- Anita Bush, Nevada Department of Transportation
- Mildred Chua, New York Metropolitan Transportation Authority
- Patrick Cowley, Utah Department of Transportation
- Louis Cripps, Denver Regional Transportation District (RTD)
- Tamara Haas, New Mexico Department of Transportation
- Matt Haubrich, Iowa Department of Transportation
- Meredith Hill, Maryland State Highway Administration
- Michael Johnson, California Department of Transportation
- David Kraft, New York Metropolitan Transportation Authority
- Nathan Lee, Utah Department of Transportation
- Hyun-A Park, Spy Pond Partners, LLC
- Robert Peskin, AECOM
- Karuna Pujara, Maryland State Highway Administration

- Scott Richrath, Atkins
- Karen Riemer, Connecticut Department of Transportation
- Jack Stickel, Alaska Department of Transportation (retired)
- Laura Zale, Southeast Pennsylvania Transportation Authority (SEPTA)

Marie Benton (APTA), Stephen Gaj (FHWA), Matthew Hardy (AASHTO), Heather Holsinger (FHWA), Robert Kafalenos (FHWA), and Mshadoni Smith (FTA) served as liaisons to the Planning Committee. Tom Palmerlee, Claire Randall, Bruce Millar, and Rhonda Levinowsky supported the conference planning through their positions as TRB staff.

## **ORGANIZATION**

This e-circular is organized by day, with each day representing a separate section. Both plenary and concurrent session summaries for the day are provided. A closing section is included in which common themes and suggested research are summarized.

## Day 1: Strategic Planning Through Asset Management

### OPENING PLENARY SESSION

**Paula Hammond, WSP**

Representatives from nearly 300 unique sites attended the Opening Plenary Session, An Asset Management Blueprint for the Transportation Community of Tomorrow. The session was facilitated by Paula Hammond (WSP) and featured Greg Slater, Maryland DOT and Conference Chair; Nancy Daubenberger, Minnesota DOT; and Randy Clarke, Capital Metro in Austin, TX. Brad Allen, the Conference Technical Program Chair, wrapped up the session with a presentation introducing the three themes and the session schedule. Featured speakers are shown in **Figure 2**.

The moderator invited each of the panel members to summarize their individual TAM journey and to discuss the evolution of agency strategies to meet equity, customer needs, sustainability, and resilience goals as technology changes the world and their roles.

**Asset Management Blueprint for the Transportation Community of Tomorrow**  
Conference Opening Session: Tuesday, August 10, 2021 (11:00AM – 12:30PM eastern)

**Randy Clarke**  
CEO, Capital Metropolitan Transportation Authority

**Gregory Slater**  
Conference Chair, Secretary, Maryland DOT

**Nancy Daubenberger**  
Deputy Commissioner & Chief Engineer, Minnesota DOT

**Brad Allen**  
Conference Technical Program Chair, Applied Pavement Technology

**Paula Hammond**  
National Transportation Market Leader, WSP

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**FIGURE 2** Speakers from the Opening Plenary Session.

## Panel Remarks and Discussion

**Greg Slater**, *Maryland DOT*

**Nancy Daubenberger**, *Minnesota DOT*

**Randy Clarke**, *Capital Metropolitan Transportation Authority*

**Brad Allen**, *Applied Pavement Technology*

Greg Slater took the opportunity to welcome everyone to the conference and thanked the sponsors, members of the planning committee, and TRB staff. Mr. Slater extended a special thank you to Mr. Tom Palmerlee (TRB) for his dedication to the asset management community and his role in making the conference possible.

Mr. Slater noted that throughout his career, data has played a key role in supporting informed decisions. He acknowledged the importance of asset management in all decisions he makes as Secretary of the Maryland DOT, whether he is dealing with roads, bridges, and ancillary assets maintained by the Maryland State Highway Administration or assets across other modes of transportation under the DOT. He observed that the pandemic helped illustrate the importance of asset management, with changing and emerging needs altering the way funding is used. In Maryland, every dollar mattered before the pandemic and the financial impacts experienced during the pandemic only emphasized this point.

These experiences have convinced Mr. Slater that asset management practitioners cannot become stagnant since needs are constantly changing. To illustrate this point, he stressed the importance of equity considerations and building stronger transit programs that improve accessibility and air quality in communities. These priorities must be addressed in tandem with strategies influenced by technology, such as goals to reduce emissions through electrification and improved freight movement, including door-to-door movement of packages and goods. Mr. Slater noted the lessons learned and the successes from the surface transportation industry are now being applied to all modes.

Nancy Daubenberger indicated that throughout her career she has focused on building value into decision making by making sure that the right investments are being made at the right time. At MnDOT, several strategic guiding plans shape its asset management direction and provide the link to the agency's strategic objectives. Recent investments in enterprise systems have helped advance the TAM program and allowed for larger-scale analysis with consideration for equity, resiliency, and sustainability. Ms. Daubenberger indicated several keys to asset management at MnDOT have been using data effectively, integrating asset management into the culture, and evaluating trade-offs between different investment options. MnDOT is currently working on corridor planning, which takes a network approach to addressing economic priorities and key freight routes in the state. The ability to use data to inform others of impacts is important to the success of these efforts. Ms. Daubenberger closed by noting she has a passion for TAM to support agencies' efforts as good stewards of the transportation system and the earth. She joined MnDOT immediately prior to a catastrophic bridge failure and that event has framed her mission ever since.

Randy Clarke moved from the oldest subway system in America (Metropolitan Boston Transit Authority) to the American Public Transportation Association (APTA) and is now with the Capital Metropolitan Transportation Authority (Capital Metro) of Austin, Texas. When he joined Capital Metro the agency had a \$7 to \$8 billion backlog, which helped Mr. Clarke solidify his Fix-It-First foundation for success. He noted a core principle is to examine equitable and

sustainable actions when investing in the transit system, but these initiatives need to consider policy and leader priorities to be successful. He shared how the efforts of elected officials to stand behind safety-first decisions for transit have been instrumental in helping other agencies make decisions to invest in existing systems with safety, preservation, and resiliency.

## Questions

### How Do You Discuss TAM with Policy Makers and Other Stakeholders?

In response to the question, Mr. Slater suggested emphasizing the importance of stretching resources. He mentioned data and analyses are needed to support those decisions to be sure the agency is looking at the right treatments on the right assets at the right time and with the right delivery method. He also noted the importance of recognizing the cost of inaction and shared an alternate delivery approach that was used to address the needs on a heavily traveled bridge. He stressed that agencies have to think about all the tools currently available in the toolbox and recognize that the tools available are changing constantly.

Ms. Daubenberger noted the importance of having quality data to demonstrate consequences associated with different options. She also suggested that bringing the decisions back to their area of interest is also important. She noted that when an individual can discuss a situation with certainty, it is easier to build the case for a particular option. She also noted that technology and innovation are helpful in improving data quality and in confidently communicating the agency's story with stakeholders.

Mr. Clarke noted that there are differences in communicating at older and new transit agencies. In Austin, where he is currently based, the TAM story is told in terms of system expansion. However, in the Northeast, the age of the transit system led to a stronger story for preserving or replacing components of the existing system. Mr. Clarke noted that all transit agencies are now required to have a Transit Asset Management Plan in place to receive federal funding whether the focus is on system expansion or preservation. He also emphasized that a fundamental principle that should always be communicated is that system safety will not be compromised.

The session concluded with Brad Allen's presentation on the conference program and the themes established for each day.

## DAY 1 BREAKOUT SESSIONS

There were six breakout sessions featured on the first day, all related to asset management's role in support agency strategic decisions.

### Potential Federal Infrastructure Bill and the Current State of Transportation Infrastructure

**Matt Hardy**, *AASHTO*

**Katie Zimmerman**, *Applied Pavement Technology, Inc.*

**Tim Henkel**, *MnDOT*

**Art Guzzetti**, *APTA*

Matt Hardy opened the session with a summary of the Federal Infrastructure Bill that had passed in the Senate that morning. The bill includes a 5-year surface reauthorization and additional spending beyond current levels. It also includes new formula programs for bridges and electric vehicle (EV) charging infrastructure as well as new competitive grant programs.

An emphasis area in the new bill is the preservation of existing assets, as demonstrated by the new formula-based bridge program that targets bridges in poor and fair condition. Mr. Hardy noted that there is some industry concern that the emphasis on bridges in poor and fair condition could divert agencies from an asset management philosophy that emphasizes the cost-effectiveness of preserving assets in fair or good condition. He said AASHTO has continued to emphasize the current focus on system preservation among transportation agencies and the limited, but strategic investment that is made in system expansion. Dr. Hardy challenged agency personnel to consider the evolving role of EV infrastructure considerations in asset management.

Dr. Hardy was joined by a three-person panel featuring speakers representing state DOTs, transit, and private industry. Each of the speakers was asked to provide comments on the bill and its potential impact on the asset management community.

Katie Zimmerman mentioned six actionable and strategic pillars that are being emphasized by the administration's Building Back Better strategy that are reflected in the legislation: safety, economic strength and modernization, equity, climate and sustainability, transportation, and organizational excellence. She noted several ways the bill might influence asset management programs:

- Social equity, including programs to address impacts to communities from past highway expansion as well as incorporate equity into long-term asset management objectives and practices. Key considerations for the industry include whether agencies have the right data and metrics to understand and address equity, and to advance collaborative decision making across modes.
- Resilience, including ties to equity, climate change, and sustainability. Ms. Zimmerman noted it seems likely that EVs will be used as a strategy to reduce GHG, and a GHG performance measure will probably be reestablished. For asset management, she suggested that the asset management community needs to explore strategies to make roads and bridges more resilient to climate change.
- Workforce, including the skill sets needed to address technology advancements and analyze big data. Ms. Zimmerman noted that transportation agencies will need to accelerate the pace for deploying innovative techniques and new technologies.
- Safety, including programs that address bicycle and pedestrian safety. She noted that few states are meeting or exceeding their existing safety targets.

Within this framework, Ms. Zimmerman emphasized that existing assets still need to be taken care of using an asset management philosophy. She reinforced the need to implement sound, long-term strategies that preserve past investments while maintaining and improving performance and addressing risk.

Tim Henkel reviewed the bill in context and how it could impact asset management practices moving forward. He noted:

- The bill directs investment to continue asset management, as evidenced by programs such as the discretionary bridge program and continued requirements related to performance-



based planning and programming (PBPP) and asset management. Mr. Henkel suggested that the continued inclusion of these requirements indicates that the Federal PBPP framework is working: targets are being established and worked towards, all state DOTs have developed TAMPs, and all state DOTs are reporting on the same performance measures.

- The bill continues the dynamics of the ongoing state DOT partnership with Congress, U.S. DOT, and other stakeholders.
- Managing the transportation system and its assets appears to remain a core function of the asset owner and operator (e.g., state DOTs). Mr. Henkel said this is important because on average 75 percent of the current surface transportation funding comes from states. He noted state DOTs must manage their entire systems, not only the portions specific to federal requirements or funding sources. He suggested the PBPP provides a framework to maximize benefits across the entire system.
- Mr. Henkel also noted that the final bill may change, but current versions continue to support PBPP as the foundation for understanding and reporting transportation infrastructure needs on a national basis.

Art Guzzetti focused his comments on the five primary areas listed below.

- The bill provides an historic level of funding and will help agencies make significant progress in addressing state of good repair (SOGR) needs. He noted the increase in discretionary programs is a shift away from the direction MAP-21 took when discretionary funding was relatively limited.
- There may be some additional requirements for applicants interested in discretionary grants. For example, agencies could be asked to show progress on TAM SOGR targets or have a zero-emission transition plan for long-term fleet management.
- The Northeast passenger rail corridor will be a major investment along with the rest of the national system. The funding is approximately seven times the typical amount of funding included, which could lead to implementation challenges.
- The climate change goal of a 50 percent GHG reduction in nine years is ambitious. Mr. Guzzetti anticipates a focus on electrification and public transportation and noted that transportation policy must be part of the solution.
- He noted there are connections between the themes of building back better, resiliency, equity, and safety. He noted there are issues to consider in addressing these areas. For instance, transit is often measured in ridership, but accessibility to opportunity and equity are likely more important metrics. He also noted that while the environment will benefit from transitioning the bus fleets to clean-fuel vehicles; it is not clear whether non-clean buses should be replaced before they reach the end of their useful lives.

### **Key Take-Aways**

Following the opening remarks, panelists discussed other aspects of the bill, highlighting the following points:

- Through AASHTO, state DOTs have indicated a preference for continued flexibility in developing state and local partnerships rather than dealing with overly prescriptive

federal requirements. Participants stressed that collaboration between infrastructure owners, infrastructure and modal operations, and the local community and public are extremely important for successful asset management.

- While the federal bill has new emphasis areas that will need research to help fully integrate these areas with asset management, transportation agencies are used to navigating competing priorities. The agencies will incorporate the new emphasis areas into their practices and evaluate trade-offs between options. The panelists stressed that it will be important to understand how selecting a particular project or priority can have unintended consequences on other priorities, infrastructure assets, or services. For example, Mr. Guzzetti mentioned that increasing the number of electric buses is good for reducing GHG and noise, but the buses are heavier than gas vehicles and the extra weight could exacerbate road deterioration.
- Federal regulations can reinforce institutional silos by focusing effort in narrowly defined areas to meet requirement. The panelists suggested that agencies overcome these silos within and between agencies to collaborate on asset management strategies on a system level.
- There is expected to be a requirement for TAMPs to incorporate climate change and resilience in the future. Some recent pilot adaptation studies may provide examples of how to do this, such as incorporating different life cycle strategies in areas that have experienced repeated disasters or prioritizing risk-reduction activities in the investment plan. The panelists noted there are also research studies ongoing in related areas so there should be guidance available soon.
- Communicating the importance of asset management to decision makers and the public remains a challenge. Transportation tends to become a hot topic when something goes wrong, but agencies have expressed interest in finding creative ways to communicate the benefits to an ongoing focus on asset management and maintaining a SOGR. The panelists suggested it would also be helpful to discuss asset management in the context of longer-term outcomes, not just the shorter-term outputs that are easier to define and measure.
- The federal bill represents an historic investment, but it could lead to implementation challenges if projects cannot be developed quickly or if the workforce is not available to plan, design, and construct them. The short-term infusion of additional funding does not resolve the long-term asset management issues and funding needs, so the panelists stressed the importance of ensuring that the message continues to be heard.

In closing, the panelists noted that although the bill is not yet final, it appears likely to have a continued emphasis on performance management and asset management. There will be new emphasis areas added (e.g., equity, resilience, EVs) that will need to be incorporated into asset management practice. They also noted that it appears that TAM requirements in the bill will build on the foundation that currently exists. Overall, the bill presents a clear link to asset management with its emphasis on building back better and focusing on maintaining existing assets rather than building new assets.

## Asset Valuation to Support TAM

Mara Campbell, Jacobs Engineering Group

Mara Campbell served as the moderator for this session, and she opened the session with several polls. The first question asked whether participants were using asset value in investment decisions and responses were relatively close in terms of each possible response [Yes (17), No (13), and Sometimes (14)]. A second poll allowed participants to rate the level of confidence they had in the asset valuation method used by their agency. Using a scale of 1 to 5, with 5 representing complete confidence, the average rating was 2.4. The third question allowed participants to identify the biggest barriers they face in applying asset valuation to their agency. The responses, seen in **Figure 3**, included data issues (e.g., consistency, availability of asset inventory and condition information, and reliability), staff availability, and the lack of guidance.

The final question asked participants to suggest ways that asset valuation could be used to achieve goals. Participants listed life cycle planning, financial sustainability, communication, funding justification, improved investment decisions, prioritization, and TAMP compliance (**Figure 4**).

What do you think is the biggest barrier in applying asset valuation in your agency? (one word or short-phrase)



**FIGURE 3** Summary of barriers participants face in applying asset valuation.

## Using asset valuation can help you accomplish what goals within your agency? (one-word or short phrase)



**FIGURE 4 Summary of goals asset valuation could help participants accomplish.**

### Development of U.S. Guidance for Asset Valuation to Support TAM

**Bill Robert, *Spy Pond Partners***

Bill Robert provided a sneak peek into NCHRP Project 23-06: “A Guide to Computation and Use of System Level Valuation of Transportation Assets.” He explained the uses and challenges associated with asset valuation and described different perspectives in computing asset value, such as cost, market, and economic perspectives. Mr. Robert noted the guide includes a description of supporting measures to enable agencies to use asset valuation, including net present value, asset consumption ratio, asset sustainability ratio, and asset funding ratio. The guide also includes a flowchart and callout boxes for calculating asset value. The guide is expected to be published in 2022 after the methodology is validated by a few state DOTs.

### Asset Valuation: What’s in Your (DOT) Wallet?

**Chad Allen, *Seattle DOT***

Chad Allen presented different perspectives on defining asset value and methods. He began by explaining how asset valuation connects to several of the Seattle DOT’s core values, including excellence, livability, and sustainability. He urged participants to use asset valuation methodologies to help ensure an equitable transportation network.

Mr. Allen introduced asset valuation as the assignment of monetary value to property. Depending on the owner's perspective, value can be generated by the benefit derived from the use or ownership of the asset (as in DOTs) or the benefit obtained through the sale of the asset (as in personal finance). He introduced three different asset valuation perspectives:

- Cost-based approaches, which base the value on the cost of purchasing or constructing an asset with or without adjustments for inflation or depreciation.
- Economic-based approaches in which the benefits yielded to an agency, the users, or society are estimated.
- Market-based approaches in which value is set on the price established by the marketplace.

Mr. Allen stressed the important role asset valuation can play in measuring and reporting financial health, life cycle planning, and addressing issues related to funding stability and flexibility. However, he also stressed that it is just one of the many tools in the toolbox to help communicate results. He also noted that asset valuation is required in federal legislation as part of the state DOT's TAMP for the National Highway System (NHS).

Mr. Allen reported that current replacement and depreciated replacement cost are the two most common approaches to asset valuation. He explained that the Seattle DOT elected to use the ratio of current value to replacement value as a performance measure for individual assets. He highlighted the need for guidance on asset valuation and noted the NCHRP project work being discussed later in the session.

## **Non-Financial Value of Asset Valuations**

### **Julian Watts, KPMG**

Julian Watts provided an overview of asset valuation methodologies used in Australia. There, asset valuation is based on the componentization of the pavement section and other road assets, meaning that different components of each asset can be valued separately. This allows an agency to use separate depreciation curves for each component. Mr. Watts noted that there are non-financial benefits to a well-executed valuation in terms of:

- People—Accepting that data is an asset, facilitating change management, and enabling conversations across departments.
- Process—Standardizing guidance and methods that enable automation, improving consistency, and enabling benchmarking.
- Data—Addressing data quality issues, ensuring asset information requirements are met, and introducing strategies to close data gaps.
- Technology—Enabling more interoperability and solution architecture between different data repositories and automating the transfer of data from Building Information Modeling (BIM) systems.

## Network Rail Structure Assets' Evolution of Strategic Planning

**Sam Luke**, *Jacobs*

Sam Luke wrapped up the session with a presentation on how asset management improved the rail structure in the United Kingdom through better intervention planning. These improvements were realized through the development of a clear policy to set the direction, modeling to forecast future conditions, and a decision support tool to consider different scenarios. The availability of data was key to the improvements and the quality of the data was enhanced through efforts to cleanse the data, clarify its purpose, and establish rules and standards. As a result of these efforts, the traditional asset stewardship approach, which is asset centric, was shifted to a service-based approach that is customer centric and considers the consequences of asset failure.

### Key Take-Aways

Key points that were highlighted by the presenters through their presentations and closing remarks emphasized the following points.

- Asset valuation is an important consideration in life cycle and financial planning. In addition to being required in state DOT TAMPs in the United States, it is regulated in the United Kingdom and in some Australian states.
- Asset valuation is one of the key financial performance measures to communicate the impact of funding allocations and investment strategies on transportation assets.
- The best way to compute asset value depends on how value is generated and how it will be communicated/used.
- NCHRP is publishing an asset valuation guide to help DOTs understand and calculate asset value.
- Data needed to support asset valuation should be treated as a managed asset. Technology provides options to ensure data quality and data sharing.

Enablers to help ensure a successful valuation are listed below.

- The backing of agency leadership and other stakeholders.
- An approach that represents a broad range of team skills and functions.
- Granular policy application guidance for embedment in the organization.
- Stakeholder and public engagement.

Several challenges were also identified, as noted below.

- Overcoming resistance of an agency's ability to model the behavior of long-life assets with confidence. Communicating difficult concepts to stakeholders and the public.
- Data availability and quality.

## Managing Assets for a Resilient Future

**Jack Moran**, *Massachusetts DOT*

Jack Moran served as moderator for this session. He set the stage by saying that transportation agencies seek to find ways to provide safe and effective transportation systems. He suggested that the speakers in this session represent a diverse group of agencies who are all working to make transportation assets more resilient.

### **A Low-Cost, Flexible Process for Assessing Environmental Risks and Resilience of Assets**

**Patrick Cowley**, *Utah DOT*

Patrick Cowley described how Utah DOT used several pilot projects to learn how to apply risk management concepts. A working group was used, and the Geographic Information System (GIS) provided useful in helping the group visualize impacts. The Risk Analysis and Management for Critical Asset Predictions (RAMCAP) process was used and proved to be very helpful. Using this approach, the agency analyzed “threat asset pairs” to look at the types of threats to each asset class. A return on investment (ROI) ratio was used to prioritize the risk. To help optimize ROI, Utah DOT created a process that allowed them to capture existing institutional knowledge associated with each risk. A Resiliency Performance Measure was also developed based on rapidity, resourcefulness, redundancy, and robustness. He concluded by recognizing that the agency will never likely have risk values that are 100 percent accurate; however, the data that is available provides realistic comparisons that support decisions. Together, risk and ROI inform the agency of where they need to focus their attention.

### **Managing Assets for Transit Infrastructure: Resilience and Preparedness at the Metropolitan Transportation Authority (MTA)**

**Porie Saipia-Eaiken**, *New York City MTA*

Porie Saipia-Eaiken discussed the New York City MTA’s efforts to improve the resilience of its assets following Hurricane Sandy. Initiatives included rapid mitigation effort such as manhole inserts, swing gates, sandbags, sidewalk vent covers, and coffer dams. The agency also implemented long-term measures that block entrances and tunnels from taking on water. A major project was raising the substations above the 100-year flood level.

The MTA created a Climate Policy following Sandy and established a Climate Adaptation Task Force. Coordinated geospatial analyses were conducted and GIS supported these efforts. The agency also implemented an early warning system that included weather sensors and gages. More recently, the Authority again had to demonstrate its agility due to the COVID pandemic. One positive impact observed during COVID was the improved air quality due to the reduced number of bus trips. Climate change issues are an ongoing issue for the MTA to reduce future disruptive impacts to riders.

### ***The MassDOT Inland Flood Risk Assessment***

**Shannon Greenwell**, *Massachusetts DOT (MassDOT)*

Shannon Greenwell described steps that have been taken to integrate the results of its flood risk analysis in the capital planning process. The work is being done as part of a 3-year project and Ms. Greenwell indicated the study is about halfway completed. The objective is to gain an understanding of future threats to MassDOT transportation assets from inland flooding and propose recommendations for integrating project results in the capital planning process. The project is focused on NHS pavements and bridges, railroads, MassDOT facilitates, and public-use airports. The tunnel system was not included since it is being addressed through other studies.

The study showed the value to GIS for visualizing locations. The TAMP is one of the resources used for high-level QA/QC checks. The project includes a task to develop recommendations on how project outputs can be integrated into existing decision-making processes. Efforts are also focused on developing a “do nothing” baseline cost to enable the agency to better understand the benefits associated with investments in resilience.

### **Integrating Resilience and Asset Management with Transportation Planning in Texas**

**Jeff Neal**, *North Central Texas Council of Governments*

Jeff Neal discussed the Metropolitan Planning Organization’s (MPO’s) role in taking risk and resilience into consideration during capital planning. He considers resilience as one of the steps that MPOs can take to help state DOTs achieve their performance goals.

Mr. Neal noted the importance of “silo busting” to enable agencies to fully adapt and prepare for these issues from a comprehensive approach. He also recognized the benefit to FHWA-sponsored pilot projects conducted by the Texas DOT in various parts of the state to learn how resilience concepts could be incorporated into planning activities. In addition, Mr. Neal noted that rapidly urbanized areas, such as the North Central area of Texas, face unique challenges around land use that can have a significant impact on resilience issues. A Statewide Resiliency Technical Work Group has been established to continue to meet the region’s needs for resilience.

### **Resilience as an Asset Management Objective**

**Gordon Proctor**, *Gordon Proctor and Associates*

Gordon Proctor closed the session with a presentation on resilience as a core TAM objective as agencies consider asset performance. He noted that the consideration of long-term investments, which is fundamental to TAM, is likely to be impacted by future uncertainties. He also suggested that the magnitude and frequency of recent events related to climate change indicate that weather events will be less predictable in the future. Therefore, any steps an agency can take to improve asset resilience can be expected to have a lasting positive impact on system performance. He also noted that actions may need to be taken sooner rather than later, meaning that investments that improve resilience may have to be applied when assets are in good or fair condition. In other



words, Mr. Proctor suggested that agencies should not wait until assets have reached the end of their useful lives to take action.

### **Key Take-Aways**

The presenters raised several points that are important considerations for agencies interested in improving the resilience of its assets, including those listed below.

- It is important to capture the agency's institutional knowledge so that the full impact of risks can be considered in planning investments in resilience.
- Agencies are increasingly interested in learning more about incorporating resilience into both capital planning and operations.
- It will be important to quantify the benefit to investments in resilience to support long-term investment in these types of activities.

### **Setting Actionable Targets in Your TAMP**

**Noura Akkad, FHWA**

**Michael Johnson, Caltrans**

Noura Akkad moderated this session that featured examples of how agencies have created sustainable processes that have improved their asset management programs. She suggested that an asset management plan provides the foundation for defining an agency's strategy for implementing a sustainable asset management program. Since the program relies on the availability of reliable data, Ms. Akkad stressed the importance of data governance protocols to ensure consistency and protect data.

#### ***Asset Management Target Setting***

Michael Johnson opened the session with a discussion of a partnership Caltrans has established with its local partners to establish the 2022 TAMP targets. This partnership was formed because of the substantial percent of the NHS network owned by local agencies in 18 MPOs. Caltrans sought to create this collaborative approach so the NHS targets would be achievable and reflective of the inventory, conditions, deterioration rates, costs, funding, and project pipelines in each agency. Prior to selecting the collaborative approach described in the presentation, Mr. Johnson said Caltrans had considered several other approaches to target setting, including fixing a target across agencies or setting a target based on percent improvement. The collaborative approach that was selected enables each agency to set its own target. Caltrans rolls up the individual targets to establish the statewide target.

Mr. Johnson reported that Caltrans established an Excel-based target-setting tool to help agencies set reasonable targets. The resulting targets for assets in fair condition were presented to leadership along with a summary graph showing fair condition targets used by other agencies. The comparison to other agencies provided a frame of reference for leadership and the targets were approved.

## **An Exploration of Collaboration Enablers in Group Transit Asset Management Plan Development**

**Janille Smith-Colin**, *Southern Methodist University*  
**Margaret-Avis Akofio-Sowah**, *WSP*

Janille Smith- and Margaret-Avis Akofio-Sowah teamed together for a presentation describing how small transit agencies can work collaboratively to develop their Transit Asset Management Plan, as allowed by the Federal Transit Administration (FTA). A literature review served as the foundation for the conceptual framework. Definitions were established along with factors that would influence success (e.g., roles and responsibilities, relationship building dynamics, and use of time). Impact pathways were also developed to represent optimum levels of collaboration.

Once the framework was established, several case studies were conducted with agencies of varying size and sponsor types. The pilot studies used a common methodology, which involved data collection using interviews and surveys and data analyses. The pilot studies found that some of the most important implications for a successful group process are access to data, a collaborative approach to implement solutions, a certain level of internal expertise and joint learning, common procedures and plans, and clear roles and responsibilities. Future work will expand the groups to build a sustainable framework for asset management.

## **NHS Pavement and Bridge Targets for TPM and TAMP**

**Nelson Hoffman**, *FHWA*

The session concluded with a presentation by Nelson Hoffman who provided an overview of the current TPM regulations. He noted that the 2- and 4-year targets for NHS pavements and bridges must be included in the next TAMP (23 CFR 515.9(d)(2)). He stressed the importance of these near-term targets for reaching the longer-term SOGR. He also reminded participants that state DOTs must coordinate with MPOs to ensure consistency to the maximum extent possible.

Mr. Hoffman said that on October 1, 2022 state DOTs will submit their full performance report for the first performance period (ending 2021) and the baseline performance report for the second performance period (2022-2025) using the online performance management form. He noted that the performance report should explain how the targets support long-range documented plans like the TAMP. Achievement of the 2- and 4-year targets is conducted in a Significant Progress Determination (SPD) on a 2-year cycle since its start in 2020. States that are not making significant progress will have additional reporting requirements that must be met.

Mr. Hoffman wrapped up his presentation by presenting the Performance Reporting Timeline found on the TPM website (<https://www.fhwa.dot.gov/tpm/>).

## **Key Take-Aways**

This session emphasized that target setting is not only data focused, but also people focused. The presentations illustrated partnerships that are occurring to improve collaboration. The also demonstrated that through research and the development of implementation tools, meaningful targets can be developed. The following strategies emerged from the presentations as keys to collaboration.

- Help agencies better tell their stories so their funding goes farther.
- Get them involved early.
- Provide them with data, such as the NHS pavement conditions by county.
- Try not to change the targets late in the collaboration process.
- Include cities and counties as well as MPOs in outreach activities.
- Provide tools, such as the Caltrans target-setting tool.

## Breaking Down Silos—Can We Use the Tools We Currently Have or Do We Need More?

### Steve Gaj, FHWA

Steve Gaj served as Moderator for this session, which focused on building an asset management culture that embraces asset management. Mr. Gaj charged participants to question whether agency goals related to asset management have been established and whether those goals are known within the agency. He suggested that the presentations in this session provide examples of how organizations have overcome organizational silos to produce comprehensive TAMPs.

### New York State DOT Perspective

#### Steve Wilcox and Michael Rossi, NYSDOT

The opening presentation from the New York State DOT (NYSDOT) highlighted the use of a cross-functional team to implement asset management. Steve Wilcox and Michael Rossi shared responsibility for the presentation. In 2011, NYSDOT established a Capital Investment Task Group comprised of teams from Planning, Asset Management, Maintenance, and Engineering. This group worked on asset management principles (i.e., preservation first), the governance structure, programming instructions, and performance metrics. As a result of the emphasis on preservation first, approximately 60 percent of all capital funding is allocated for system preservation. The remaining 40 percent is allocated so that 25 percent goes to major projects that compete on a statewide basis, 10 percent for regional discretion, and 5 percent for special use funds. The shift in funding allocations has incentivized regions to perform preservation activities on a timely basis to keep assets in good condition. Holding the regions accountable to the metrics was a key to success.

Currently, a Comprehensive Program Team is responsible for establishing condition and spending targets. There is significant buy-in into the process because the team cuts across regions, across assets, and across levels of the organizations. Since its inception, funding allocations have shifted to address needs and there is more accountability among the regions. The presenters summarized the roles and responsibilities for each of the teams involved in the process.

## **Baltimore Metropolitan Council Perspective**

**Todd Lang**, *Baltimore Metropolitan Council*

Todd Lang discussed the role of an MPO in serving representatives at all levels of government. In Baltimore, the MPO recognized that pavement condition was not on par with the rest of the state, so a specific regional performance target was established based on peer comparisons with Denver, Pittsburgh, and Tampa.

Mr. Long summarized the advantages to adopting a performance-based planning process, including the flexibility it affords agencies and its multimodal approach to decision making. He noted that MPOs have 25 performance areas required under federal legislation with timelines that he describes as confusing and non-coordinated. This has led to challenges in tailoring programming solutions to improve measures and data sharing. MPOs also face challenges in administering specific targets, such as safety targets that conflict with Zero Death initiatives, asset condition targets based on analyses that are not well understood by agency staff, and transit condition targets that are based on uncertainty in rail condition snapshots. To address these issues, Mr. Long suggested that the timing for target reporting be reset, that non-motorized travel measures be improved, that national data sources be developed, and that consolidated national reporting be established.

## **Michigan DOT Perspective**

**Zack Rable**, *Michigan DOT*

Zack Rable closed the session with a summary of Michigan DOT's asset management journey. For years, Michigan DOT has used Remaining Service Life to drive pavement investment decisions. This metric, and the forecasting of future conditions, did not align with the Federal TPM reporting requirements. Additionally, the agency had difficulty adding non-required assets to its TAMP since some of the federal requirements (such as life cycle planning) had not been performed on those assets. To address these issues and to break down silos in the agency, a new Asset Management position was created. One of the duties of this new position is to develop ways to reliably use the federal performance measure while continuing to use Remaining Service Life to determine where to invest in the highway infrastructure.

Mr. Rable noted that Michigan DOT is currently in the process of updating its Long-Range Transportation Plan, which will inform the 2022 TAMP. This plan will integrate multiple long-range plans, including the DOT's Long-Range Plan with the Freight Plan, Rail Plan, Active Transportation Plan, and the Transit Strategic Plan to ensure consistency and use resources more efficiently. The Long-Range Plan considered several strategies to clarify how investments and resources can be maximized. This new approach to aligning plans is expected to break down organizational silos and ensure that the agency's vision, mission, and goals are aligned.

## **Key Take-Aways**

The presentations emphasized the following points to help agencies foster more collaboration:

- None of the agencies represented by the speakers had a single, dedicated Asset Management Office. These agencies recognized that asset management is a practice that cuts across divisions within the agency and involves various levels of authority and decision making. In the absence of a dedicated office, they successfully used committees and teams to engage their agency in asset management activities.
- It is important to integrate asset management into agency practices to sustain it even when executive leadership changes. Executive leadership's role is to facilitate and coordinate rather than drive asset management. Executive leadership should also stress the importance of asset management to the agency to keep the focus on asset management objectives.
- Agencies have had success with sharing data and tools with local agencies. This has led to consistency in reporting and enabled local agencies to leverage tools they otherwise not have had available to them.

### **From Cradle to Grave: Life Cycle Planning for TAMP**

**Patrick Cowley**, *Utah DOT*

Patrick Cowley served as moderator for a session illustrating the use of life cycle planning for managing transportation assets. He opened the session with polls intended to determine the level of experience with life cycle planning among the participants.

### **Remaining Service Interval**

**Prashant Ram**, *Applied Pavement Technology, Inc.*

Prashant Ram introduced a Remaining Service Interval (RSI) framework that has been developed by FHWA for use in making sound long-term investment decisions. He summarized the RSI process, which uses a structured sequence of treatments that maintain assets above user-set criteria. The process compares multiple strategies to determine how they differ from the optimal life cycle strategy. Mr. Ram noted that key parameters to the analysis include the analysis period (e.g., 30 years), the planning period (e.g., 10 years), and the budget period (e.g., 2 years).

Mr. Ram summarized several benefits to the use of an RSI analysis. For example, treatments are considered based on long-term costs so the impact of deviating from an optimal strategy can be estimated. Another advantage is that the analysis is expressed in terms of dollars, so it provides a common basis for trade-off decisions between assets. He closed by identifying several RSI resources that are currently available for individuals interested in learning more.

### **Indiana DOT Bridge and Pavement Asset Life Cycle Strategies**

**J.P. O'Har**, *KPMG*

**Louis Feagans**, *Indiana DOT*

J.P. O'Har and Louis Feagans co-presented on a gas tax initiative that was passed in Indiana prior to the submittal of its TAMP. The initiative created opportunities for addressing asset management needs and the speakers discussed the resulting life cycle strategies that were

developed for pavements and bridges using software tools. For both pavements and bridges, intervention cycles were established with both capital and operational categories documented. In addition, three investment categories were established for the road network with subcategories and use thresholds based on Average Annual Daily Traffic (AADT). Using this information, 20-year strategies were developed, along with the establishment of data governance and business rules. The results are aligned with the organization's strategic plan and outreach activities have been conducted with the districts and senior leadership to promote implementation.

## **Developing a TAMP for a City**

### **Lauren Gardner, Wood PLC**

Lauren Gardner discussed the development of a TAMP from a local-agency perspective. She noted that as more cities are adopting asset management, and maturing their programs, they have begun using TAMPs to share their story. However, Ms. Gardner suggested that the development of a TAMP in a city has different types of challenges and opportunities when compared to a State DOT. Ms. Gardner identified the following challenges:

- Building buy-in among stakeholders since TAM is new and not mandated.
- Addressing pressure from citizens and politicians to use worst-first solutions.
- Educating stakeholders on TAM as turnover in leadership occurs.
- Keeping field crews focused on the implementation of life cycle strategies.
- Managing budget fluctuations from one year to the next.
- Recognizing the lack of regulations to drive TAM data collection activities.

In addition, Ms. Gardner recognized several opportunities with the implementation of TAMP in a city environment. She noted the use of a TAMP as a great opportunity for cities to tell their story using outputs from different scenarios. She also indicated that cities are often smaller than State DOTs and this may make the implementation of life cycle strategies more feasible because fewer people must be convinced of the benefits. Ms. Gardner also suggested that if regulations were enacted, they may help cities institutionalize the TAMP into agency operations.

Ms. Gardner posed several questions to the audience that would help address the challenges cities face in trying to implement asset management. Her questions are listed below.

- How best can city personnel educate, and keep educated, city leaders when they change frequently?
- What are some viable methods to ensure that funding is available to support TAM efforts in cities?
- What are some of the best strategies for balancing citizen requests with life cycle planning strategies?

## **Pavement Management Program Strategic Plan**

**Matt Haubrich**, *Iowa DOT*

The Iowa DOT is in the process of developing a Strategic Plan for its pavement management program. Matt Haubrich indicated that this plan is needed because the agency is “data rich and information poor.” He noted that asset management is conducted by committee, that good people are overwhelmed by workloads, tools are not being used to their full potential, and communication breakdowns are occurring. To determine how to use its pavement management system more strategically, the Iowa DOT initiated a process to document current practices, assess gaps, benchmark practices to other organizations, set a vision, and establish a plan for how to best use pavement management at the strategic, programmatic, and tactical levels. The results are intended to ensure the agency meets its long-term objectives, to improve investment decisions, provide transparency and accountability, and coordinate efforts in support of the Iowa DOT business plan.

The process has recognized the need for an internal pavement management champion and a sustainable business unit with succession planning. The plan recommends staff dedicated to pavement management and the training needed to support the DOT’s data-driven culture. The next steps are expected to include finalizing the Strategic Plan, hiring a Pavement Manager, and assembling the Pavement Management Unit.

## **Advancing Life Cycle Planning at Minnesota DOT**

**Shannon McGrath**, *MnDOT*

Shannon McGrath presented a summary of the life cycle planning activities at MnDOT using the human life cycle to illustrate her points. MnDOT initiated the development of its first TAMP in 2014, which was before the final Asset Management Rule had been published. At this point, the development was in its infancy, which Ms. McGrath referred to as the cradle stage. During the initial development, MnDOT made the strategic decision to include six ancillary assets to the TAMP in addition to pavements and bridges. Due to the lack of data available to support the analysis of asset needs for some assets, a Markov-based Excel tool was developed and populated in part with input provided by subject matter experts.

During 2018 and 2019, MnDOT’s efforts were represented by the toddler stage (e.g., an early stage in the life cycle), where there was increased reliance on pavement and bridge management systems to support life cycle planning. Multiple scenarios were analyzed, and user costs were added to the analysis. MnDOT also added six more ancillary assets to the TAMP so a total of 12 assets were represented. To illustrate the impact the TAMP had on agency practices, Ms. McGrath noted that the noise wall policy to determine whether a concrete or wood noise wall should be constructed was revised based on the life cycle planning results.

Ms. McGrath reported that MnDOT is currently experiencing the teen years (e.g., a later life cycle stage representing growth and development) and is continuing to enhance its analysis capabilities. With the exception of life cycle planning, where some consultant help is being provided, the TAMP is being developed in house. The same 12 assets will be included in the 2022 TAMP, but new life cycle planning spreadsheet tools have been developed for analyzing ancillary asset needs. The tools take advantage of the Markov approach used in previous years



**FIGURE 5 MnDOT's Life Cycle Cost Analysis game.**

and considers inventory size, conditions, network growth rate, deterioration assumptions, and maintenance/inspection frequency. The results will provide both total and annualized costs for the network.

Ms. McGrath closed by sharing the link to MnDOT's Life Cycle Cost Analysis game that is available online at <https://minnesotago.org/cost-effectiveness/>. The tool was developed to illustrate the types of tools MnDOT uses to manage its assets and introduce users to the different types of treatments used over the life of a pavement (Figure 5). The user is introduced to three different maintenance strategies:

- A minimal maintenance approach that focuses on deteriorated pavements.
- A balanced approach that focuses on keeping good roads in good condition (Figure 6).
- A proactive maintenance approach that applies proactive fixes before there are problems observed.



The user is provided an opportunity to explore each of the approaches and select the approach that they feel makes the most sense. The total costs of each strategy is also provided to support the user's decision. Ms. McGrath said the website represents a fun, interactive way to communicate to stakeholders the considerations MnDOT makes in managing its assets effectively.

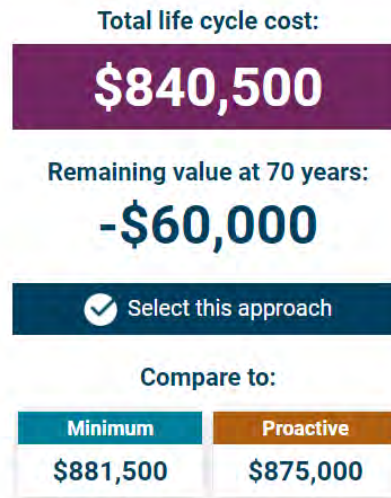
### Key Take-Aways

The speakers were asked whether they were aware of any management systems that are incorporating climate change into the analysis. Mr. Ram noted that the Arizona DOT looked at risks that could be related to climate change and translated those risks into risk scores that are assigned directly to the impacted assets. The degree to which the risk is mitigated by the suggested treatment is taken into consideration in the project prioritization process through the benefit calculation. Mr. Ram suggested that this is an area of interest among other agencies, and he expects risk to become a more common component of analysis tools in the next 5 to 10 years.

Several key take-aways were extracted from the presentations, as noted below.

- Agencies are conducting more robust analyses to support life cycle planning than in previous years. The Remaining Service Interval analysis discussed by the Mr. Ram illustrates the types of analyses that emerging through research efforts. MnDOT's life cycle planning activities also demonstrate that their analyses have evolved with time.
- Organizational culture was recognized by the speakers as an important consideration in building buy-in to support asset management and to ensuring that it becomes integrated into the agency's practices.
- Life cycle planning benefits from the availability of robust data and modeling capabilities, but agencies can use less sophisticated approaches if they are just getting started in asset management or they want to include ancillary assets with limited data available.
- Agencies are engaged in simplifying and translating the results of a life cycle planning analysis to help better tell their asset management story.

*The dollar amounts shown here are costs for one mile of one lane of road. They are illustrative and will vary in real life.*



**FIGURE 6 Sample balanced approach.**

## Day 2: Supporting TAM Operations

### PLENARY SESSION—ENABLING SUSTAINABLE AND EQUITABLE MOBILITY BY ADVANCING TRANSIT ASSET MANAGEMENT

**Greg Slater**, *Maryland DOT*  
**Felicia James**, *FTA*

Day 2 of the conference focused on activities to support asset management operations within different types of organizations. The day began with a plenary session moderated by Ms. Felicia James, the Associate Administrator for Planning and Environment at the FTA. Ms. James was introduced by Mr. Greg Slater, the Conference Chair. Nearly 200 unique sites accessed this plenary session, which provided an opportunity for three panelists to share their insights into issues related to transit asset management. Speakers from the Day 2 Plenary Session are shown in **Figure 7**. Immediately prior to the session, it was noted that TRB had released *Special Report 340: Investing in Transportation Resilience: A Framework for Informed Choices* (2021). This special report presents the results of the work conducted by a committee of 12 appointed transportation experts to determine effective ways to measure transportation system resilience to natural and other potential disruptions.

**Enabling Sustainable and Equitable Mobility  
by Advancing Transit Asset Management**  
Plenary Session: Wednesday, August 11, 2021 (11:00AM - 12:30PM)

**Gregory Slater**  
Conference Chair,  
Secretary, Maryland DOT

**Felicia James**  
Associate Administrator  
for Planning and  
Environment, FTA

**Robert Lund**  
Deputy General  
Manager, SEPTA

**Neil Pedersen**  
Executive Director,  
Transportation  
Research Board

**Gerhard Williams**  
Chief Engineer,  
AMTRAK

**13th National Conference on  
Transportation Asset Management**  
August 10-12, 2021 TRB Virtual Event

**FIGURE 7** Speakers from Day 2 Plenary Session.

## Panel Remarks and Discussion

The presentations made by each of the speakers are summarized along with responses to questions and key take-aways from the panel discussions.

### **Neil Pedersen**, *Transportation Research Board*

Mr. Pedersen's opening remarks focused on two primary topics: building a TAM culture and equity. Mr. Pedersen's experience with asset management began prior to the federal rules so he has witnessed the advancements that have taken place since MAP-21 was passed in 2012. He noted that some of the greatest challenges to building an organizational culture that embraces asset management relate to the difficulty with incorporating maintenance into a life cycle plan and promoting proactive maintenance interventions as sound business investments rather than reactive, worst-first strategies.

Mr. Pedersen also highlighted how asset management investments in bus systems and service contribute to improved equity when service areas and communities are considered in decision making. He stressed the importance of addressing ancillary services in future years to better support the door-to-door experience of transit riders.

### **Robert Lund**, *Southeastern Pennsylvania Transportation Authority (SEPTA)*

SEPTA is the fifth largest transit provider in the United States, serving a tri-state region (including Pennsylvania, Delaware, and New Jersey) with all modes of travel. Because of these characteristics, Mr. Lund stressed the importance of the agency's commitment to safe, reliable, and equitable services to connect people to opportunities. He noted that safety must be protected through trade-off compromises that are made to meet customer, partner, and regulatory needs. He views asset management as one of the important tools that SEPTA relies on to quantify its State of Good Repair backlog and to effectively address system needs with limited funds and a strategic approach to necessary service interruptions.

### **Gerhard Williams**, *Amtrak*

Mr. Williams noted that Amtrak is committed to implementing asset management and integrating it with other systems. He indicated that the organization has an Asset Management Policy that outlines how the Engineering office will address the agency's asset management requirements. The policy defines roles and responsibilities for the asset management program and serves as an important communication tool to help everyone focus on quantifying and addressing the organization's large State of Good Repair backlog.

Mr. Williams reported that the 2017 Asset Management Plan helped Amtrak support a robust inspection program that helped the agency move beyond age-based decisions to a condition-based framework. The inspection data and work order management logs served as important information to help Amtrak reduce its backlog by 33 percent. He also highlighted the benefits to asset management through an example in which geospatial asset class information was used to treat assets efficiently while decreasing the length of system outages.

## Panel Discussion

Following the introductory remarks, Ms. James posed questions to the panel related to their experiences in supporting sustainable and equitable mobility through transit asset management.

### **Question 1: How Do You Build the Case for Asset Management Among Elected Officials?**

- Mr. Pedersen noted that since there is a tendency for politicians to respond to the squeaky wheel, it becomes important for transportation agencies to become the squeaky wheel when it comes to advocating for asset management needs. However, he noted it is equally important to ensure that the technical information is conveyed in simpler terms, such as cost and consequences.
- Mr. Lund said that asset management is a tool for providing safe, reliable service and it takes creativity to communicate and engage with elected officials. Mr. Lund described SEPTA's practices to provide tours of active TAM projects rather than ribbon cuttings since it allows politicians to see progress and hear directly from workers the impact each project is having.
- Mr. Williams stressed the vital liaison role planners play in communicating the value of the technical work performed by engineers and technicians to diverse audiences.

### **Question 2: Can the Transit Representatives Expand on How Investment Allocation Decisions Are Made?**

- Mr. Williams noted that they have an internal Enterprise Asset Management System (EAMS) that has allowed them to increase the factors considered in the analysis, including age, condition, reliability (failure), maintenance condition, and sustainability. Factors impacting safety and criticality are considered first in allocating funding, but there is also significant communication and review with stakeholders to minimize the length of outages.
- Mr. Lund explained that SEPTA takes a corridor approach to managing work and outages. With this approach, the organization considers all activities that can be addressed while working in the corridor. This helps minimize the number and length of outages to an area, which results in a positive outcome for most riders.
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### **Question 3: How Is Maintenance Incorporated into Asset Management Decisions?**

- Mr. Pedersen noted the importance of frequent communication between engineers and maintenance crews when developing life cycle strategies. He suggested that maintenance strategies often provide innovative alternates to extending life with interventions that can delay major costs very cost-effectively.
- Mr. Lund agreed that communication is paramount since maintenance is an important part of an asset management plan. He referenced several examples in which proper maintenance can extend vehicle service life and preserve the safe operation of the vehicle.

**Question 4: How is Equity Considered in Decision Making? Are You Bringing External Data to Inform Equity Decisions?**

- Mr. Lund noted that equity is fundamental to public transit, but there is always more that can be done with the triple-bottom-line approach to master planning, which sets the stage for the deployment of zero-emission vehicles and increased door-to-door accessibility solutions.
- Mr. Williams noted that Amtrak has embarked on a 15-year nationwide expansion plan that will connect communities that do not have passenger rail options.
- Mr. Pedersen suggested that good geospatial data is needed so disadvantaged communities can be identified and new fleet can be allocated to address deficiencies. He also stressed the importance of considering the total trip perspective (e.g., door-to-door), including the availability of safe sidewalks, highway crossings, and bus shelters.

**Question 5: How Are Assets That Are Ancillary but Not Controlled by Transit Agencies Handled?**

- Mr. Lund said that SEPTA is regularly engaged in coordination meetings across more than 100 municipalities. He noted that there are several small counties and municipalities that do not have funding to address American Disability Act (ADA) access and these kinds of issues are addressed through frequent discussions.
- Mr. Williams said that Amtrak has no formal inspection process for assets owned by others so relies on communication to address needs. He illustrated this by saying that when Amtrak is in the field, the organization has a process to elevate the local issues by working cooperatively.

**Question 6: Can You Provide Examples of How Resilience Has Been Incorporated into Transit Asset Management?**

- Mr. Lund said SEPTA is building for extreme weather that is becoming more frequent. For example, replacements are elevated above flood levels.
- Mr. Williams said that resilience is being built into newer facilities. The design specifications for 100-year storm events are driving a sense of urgency and the lessons learned from Super Storm Sandy (and other events) are important inputs.
- Mr. Pedersen listed the use of a risk management approach to address resilience through asset function and criticality.

**Question 7: What Do You Think State and Local DOTs Should Be Doing Differently in This Area to Better Address Transit Connections?**

- Mr. Williams suggested that agencies improve inspection and assessment procedures to better determine remaining life. He also suggested that agencies should take advantage of outages to coordinate work activities.
- Mr. Pedersen explained that this is not a simple issue because there are so many different factors, trade-offs, and interests to consider. However, he pointed out that as part of a life

cycle analysis, it is important to consider whether less expansive interventions could provide a way to extend service life effectively.

### **Question 8: What Key Take-Aways Do You Have for the Audience?**

- Mr. Pedersen stressed that it is important not to let asset management become a technical exercise. He emphasized the importance of communication with internal and external stakeholders, including both politicians and reporters.
- Mr. Williams suggested that asset management cannot be done in a vacuum. Communication is key. He also noted that Amtrak initiated its asset management efforts and improved them as they built their capabilities.
- Mr. Lund closed the session by stressing the importance of asset management as a tool that must always be improved. He also discussed the importance of communication, providing great service to customers, and being a good steward of available funds.

## **DAY 2 BREAKOUT SESSIONS**

The plenary session was followed by the six breakout sessions described here.

### **Transportation Finances After the Pandemic**

The COVID-19 pandemic had a significant impact on both highway and transit organizations. Ms. Tammy Haas (New Mexico DOT) moderated this session in which transportation agencies explained the expected short- and long-term impacts of the pandemic on their asset management programs.

### **Iowa DOT's Interstate Investment Plan**

#### **Phil Mecher, Iowa DOT**

Phil Mecher noted that his agency is recognizing significant funding deficits and tolling has been proposed as a solution for addressing Interstate needs. He explained that without tolls, 75 percent of the available funds would go towards needs on I-80, leaving just 25 percent of the available funding for the rest of the system.

To address this issue, Iowa DOT conducted a 2-day workshop to develop a plan for preserving the Interstate system at its current condition. The focus throughout the workshop was on “right sizing” the plan so the resulting suggestions were reasonable and implementable. A key consideration in addressing system needs involved alternate strategies to address capacity issues. The use of Transportation System Management and Operations (TSMO) solutions illustrated the types of strategies that were considered. Mr. Mecher indicated that when considering corridors for expansion projects, the DOT looks at traffic growth, pavement and bridge conditions, and forecasted conditions.

Iowa DOT is moving forward with its plan and conducting periodic assessments to determine whether adjustments are needed. Mr. Mecher said that project costs are particularly hard to track since they frequently change during construction. The DOT is focused on better managing project budgets to reduce these cost fluctuations.

## Indiana DOT's Project Scoping Application

**Todd Shields**, *Indiana DOT*

A key to managing available budgets at the Indiana DOT is the ability to manage project scopes to control costs. Todd Shields presented a project scoping process that Indiana DOT developed. The process includes a project scoping flowchart that identifies key decision points in project development where pay item scoping is prepared. A scheduling and project management system (SPMS) is used to track project development, but the system was hindered by errors associated with manual data entry processes. To minimize the number of errors, a desktop application was developed to work with a field component built using their GIS system. This application:

- Tracks emergency repairs (such as those due to flooding).
- Allows proposed projects to be compared within the same program.
- Locates assets automatically using GIS data.
- Uses location, traffic, and pay items to develop a scoping-level estimate.
- Identifies environmental issues and other supplemental considerations during the scoping process.
- Scores and ranks projects.
- Provides data for entry in SPMS.

Indiana DOT has recognized several benefits from the use of this application, including the reduction in the number of human errors, the improved accuracy of location and geometry information, and the decreased amount of time required to complete the process. The agency has also realized significant cost savings through a bundling application that was developed to combine multiple projects into a single contract. In answer to a question from the audience, Mr. Shields said that the bundling application is available through FHWA's Every Day Counts (EDC) program.

## TAMPs: Implementation, Institutionalization, and Preparation for the Next Update

**Robert Cooney and Kevin Green**, *eVision Partners, Inc.*

Robert Cooney and Kevin Green provided a summary addressing the implementation and institutionalization of asset management. They indicated that most agencies feel they are making good progress with the implementation of asset management, but noted that issues remain regarding over-commitment, system maturity, and the link between finance, operations, and project development. The pandemic did not appear to have had an adverse financial impact on the TAM implementation, but staff turnover was recognized as an issue that several agencies are dealing with.

The speakers noted that the development and implementation of a TAMP has had a positive impact on the asset management practices being used. The TAMP has helped agencies recognize the importance of a capital plan that reflects the entire life cycle of its assets.

In terms of lessons learned, the speakers noted that agencies need to better integrate financial data into asset management and the next TAMPs need to be more focused and prioritized on addressing agency needs. They suggested that a full-time asset management role is

beneficial and that change management is a critical implementation component that is often overlooked.

## **Arkansas DOT's Approach to Risk-Based Transportation Asset Management**

**Bill Robert**, *Spy Pond Partners*

Bill Robert discussed the risk management approach used by the Arkansas DOT as part of its asset management program. The work described in this presentation represented a new, comprehensive approach to asset management that built on other risk initiatives that had been undertaken, including:

- Manuals and specifications.
- Project risk management.
- Consideration of seismic risk.
- Winter maintenance activities.
- Funding scenario evaluation.
- Auditing.

The new approach resulted in the development of a risk register, risk mitigation strategies, and a risk-monitoring plan. To illustrate the types of changes reflected in the plan, Mr. Robert described the increased use of part-time staff at the Arkansas DOT as a strategy for retaining long-term employees.

## **Implementing Enterprise Risk Management**

**Shobna Varma**, *StarIsis*

Shobna Varma concluded the session with lessons learned from work on National Cooperative Highway Research Program (NCHRP) Project 20-44: "Implementation of the AASHTO Guide for Enterprise Risk Management." She described the use of peer exchanges to promote the three pilots conducted at the Washington State, Utah, and Tennessee DOTs. Particularly relevant to the theme of this session, was Washington State DOT's assessment of the best way to handle financial crises through an assessment of the impacts of potential budget cuts. In addition, Ms. Varma discussed a special webinar that was conducted on the impacts of the pandemic.

Mr. Varma suggested that Enterprise Risk Management (ERM) is most successful when it is integrated into core DOT business processes. She stressed the importance of leadership engagement to help integrate ERM into agency practices. She also recognized potential benefits that can be realized in the areas of safety and resilience.

## **Key Take-Aways**

There were several important take-aways from this session:

- It is important to "right size" investments with constrained budgets rather than attempt to build the "Cadillac" of projects.



- The adoption of ERM as a core business process has emerged as an enhancement to asset management programs.
- Project bundling can help ensure the efficient use of DOT resources.
- It is important to develop innovative ways to retain key agency staff, as the Arkansas DOT did.
- A dedicated asset manager is key to continued progress in the implementation of asset management.

### **Integrating Risk Management into Agency Practices: A Roadmap**

This session was designed to enable agencies to visualize a 3- to 6-year roadmap for integrated risk management, including risks, change management, enterprise system links, and data governance. A practitioner panel introduced tools, research, and other resources that are helpful in considering risk in agency practices and prioritizing risk mitigation strategies. Ms. Emily Burns (Seattle DOT) served as the session moderator.

### **NCHRP 08-113: Effectively Integrating Transportation Performance, Risk, and Asset Management Guidance**

**Mara Campbell, Jacobs**

Mara Campbell started the session with a summary of the work conducted under the NCHRP project referenced in the title. She noted that the guidance document will be published soon<sup>4</sup>. It will provide recommendations and implementation strategies for incorporating performance and risk into agency asset management practices.

Ms. Campbell described the research approach, which focused on an integrated methodology that considered people, process, technology, and data in addressing risk. To help agencies determine next steps in advancing their practices, an Integration Maturity Self-Assessment approach was developed. The assessment looks at five key pillars to integration, including:

- Approach to integration.
- Personnel and skills.
- Resource requirements.
- Policy and agency structure.
- Data and software needs.

Case studies were used to test the guidance. A high-level assessment was conducted on 13 agencies and four more were investigated in more detail. Documentation from the case studies were prepared during the project. A Roadmap for Integration was developed for each of the four “deep dive” agencies. Ms. Campbell stressed the importance of executive support and a collaborative agency culture during implementation.

## Utah DOT: Risk Management in the Organization

**Patrick Cowley**, *Utah DOT*

Patrick Cowley described his agency's involvement in NCHRP 08-113 as one of the four "deep dive" agencies that participated as a case study. Utah DOT was interested in participating in the study to support its efforts to have a more robust approach to risk management in the 2022 TAMP and beyond. The agency recognized that there was overlap between the areas of asset management, performance management, and risk management but had not previously identified the benefits of a fully integrated program. During the study participants developed elevator pitches identifying the advantages and expected positive outcomes from the integration of the three areas, including improved stewardship, acting intentionally for the desired future state, aligning purposes, and clarifying agency understanding.

Mr. Cowley reported that the maturity self-assessment was conducted by a cross section of leadership representing disciplines contributing to at least one of the three areas at the heart of the study. He noted that the results were not surprising, but they provided a good baseline for identifying steps to move forward and gauging progress as changes are implemented. One of the major selling points to the agency was the ability to have access to researchers who would assist with the development of the Implementation Roadmap. The roadmap featured four strategies that are being adopted:

- Utilize the TAMP as the central process tool with actionable goals.
- Focus budget and resources on projects that achieve outcomes supporting agency mission, goals, objectives, and measures.
- Standardize processes that enable continuous improvement and flexibility, and that support innovation.
- Invest in knowledge management, capability building, and staff training.

In addition, their asset management information tiers were established and for each tier, asset information needed for data-driven decisions was identified. A cross-asset analysis approach was used to assess the biggest risk areas so the information could be used to assign assets to each tier.

## Transit Asset Health and Risk Assessment

**Rick Laver**, *Jacobs*

Rick Laver discussed a conceptual framework for assessing transit asset health and risk assessment methodologies. He noted that transit operators manage a wide range of asset types, and each has its own life cycle needs. He suggested that asset assessment approaches typically include visual, condition-based methodologies, which may be okay for some assets, but they are not ideal for complex systems. Mr. Laver offered that an asset health assessment can go beyond a visual condition assessment, but it can suffer from the lack of quality data or the absence of performance metrics.

In this study, Mr. Laver provided an example of a conceptual health index scoring approach for facilities. One approach involves the calculation of a weighted average from the individual scores for each asset component. Since a weighted average could mask potential issues related to

the health of a subcomponent, Mr. Laver suggested that it might be better to use individual health assessment reports. An example using rail cars was provided.

## **U.S. DOT Climate Change and Resilience Efforts**

### **Aimee Flannery, FHWA**

Aimee Flannery introduced the U.S. DOT's commitment to meeting the administration's climate change goals, as evidenced by its efforts to re-institute and expand the existing Center to facilitate intermodal collaboration on climate change activities across the agency. The Center convenes senior DOT career staff and climate change experts to coordinate research, policies, and actions to reduce greenhouse gas emissions and increase transportation system resilience.

Ms. Flannery highlighted several projects to illustrate the range of activities being conducted in this area, including a Resilience and Disaster Recovery Tool Suite to help estimate the return on investment for long-range planning across a range of uncertain scenarios. A second study, *Investing in Transportation Resilience: A Framework for Informed Choices*, was Congressionally mandated to help inform infrastructure investment decisions for surface, marine, and aviation transportation.<sup>5</sup> The study develops recommendations on how metrics can be developed, improved, and applied. Special attention is given to metrics that Congress and other policymakers can use to determine levels of investment in transportation resilience and how to design infrastructure funding programs that prioritize resilience.

In closing, Ms. Flannery noted that six pilot studies were sponsored by FHWA to improve resilience in asset management. A Handbook is being developed to illustrate strategies for improving resilience in risk management, life cycle planning, and investment planning. More information on the resilience pilots is available through FHWA (<http://www.fhwa.dot.gov/asset/pilot>).

### **Key Take-Aways**

There was a lot of interest generated in the presentations and several questions were posed to the presenters. One question sought examples of risks not related to safety. Mr. Cowley used an agency's ability to sustain funding levels sufficient to meet goals and targets as an example of a financial risk. He was also asked whether Utah DOT is changing its priorities based on its participation in the study. Mr. Cowley said they are making changes to better align their methodologies with their TAMP processes as they move forward. He suggested that metrics such as return on investment or cost/benefit ratio can be used to evaluate programs through the planning process, but data is key to being able to do this. Ms. Campbell added that the guidance is intended to support continuous improvement, so the maturity assessment could be used every few years to capture advancements that are taking place.

There were several important take-aways from this session:

- There is a lot of helpful information available to support the integration of risk and performance management with asset management.
- Asset management is about life cycle management that balances risk, performance, and costs to maximize value for the organization. For that reason, it is important that asset management, risk, and performance activities are aligned.

- As transit assets evolve, technology is being used to provide the data and asset information that enables sustainable performance and risk management practices. Because of the increasing reliance on data, data governance and overall data management is becoming a core component to an asset management program.

Several polls were used to obtain input from participants during the session. The results from those polls are included (Figures 8-14).

1. What do you think is the greatest "value add" incorporating risk management into other practices such as performance and asset management?



FIGURE 8 Poll results from question 1.

Which core element would be the most paramount for effectively integrating performance, risk, & asset management within your organization?

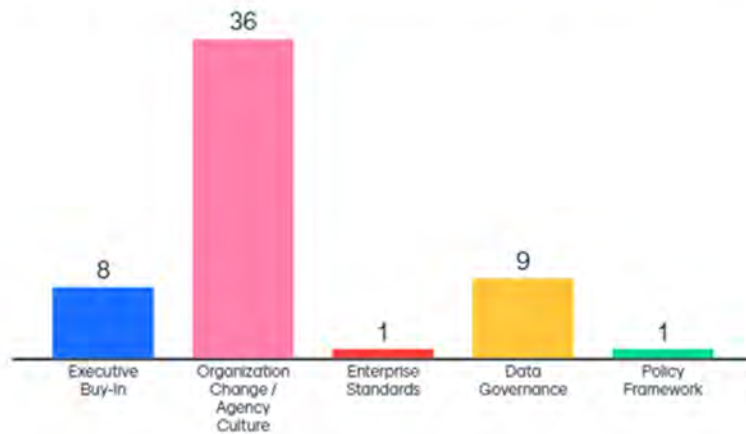


FIGURE 9 Poll results from question 2.

What can YOU do to help your agency do a better job of integrating risk into the management processes?

Mentimeter



FIGURE 10 Poll results from question 3.

What specific skills do you believe are needed to integrate risk management into your agency?

Mentimeter

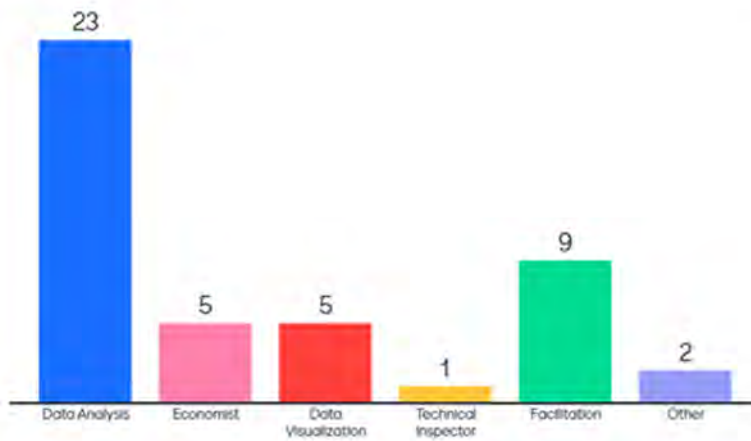
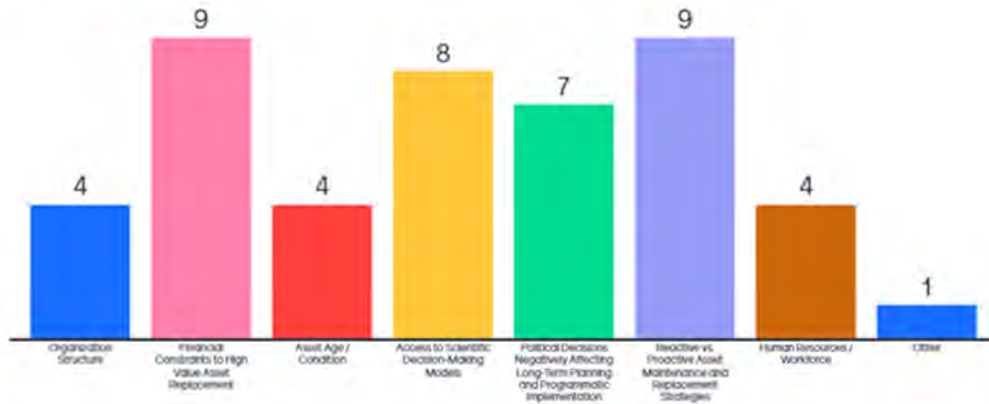


FIGURE 11 Poll results from question 4.

What are the biggest challenges to your agency in building resiliency and addressing climate change events?

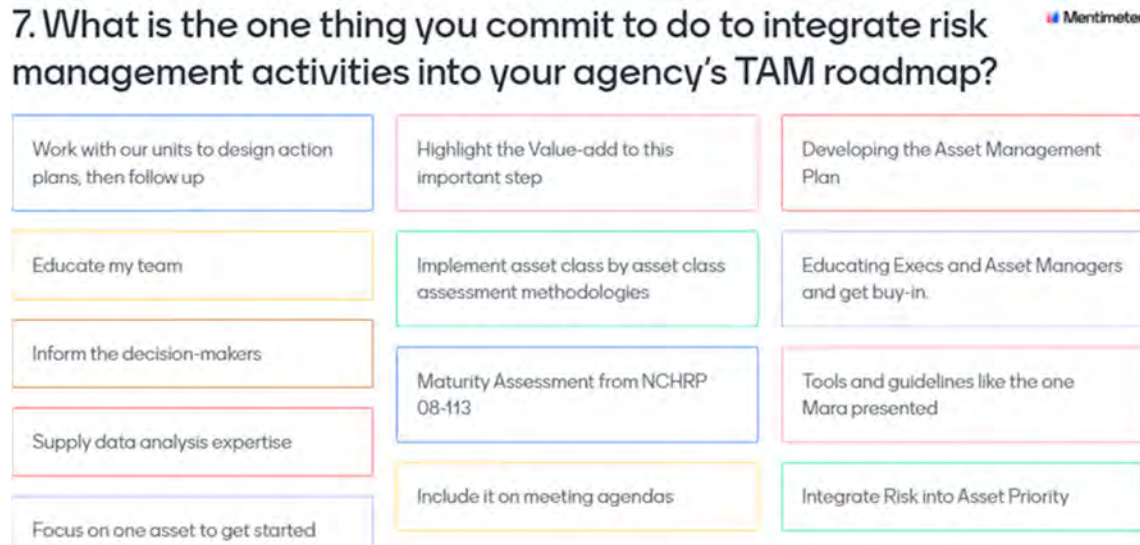


**FIGURE 12** Poll results from question 5.

6. What kind of risk management training does your organization need?



**FIGURE 13** Poll results from question 6.



**FIGURE 14** Poll results from question 7.

## “TAMping” the Way to the Next Transit Asset Management Plans

**Laura Zale**, *SEPTA*

Laura Zale opened this session with an observation that the first generation of transit asset management plans were completed in October 2018. With a 4-year window for updating the documents, she indicated that the material presented during this session will provide agencies with information to help evaluate the 2018 plans and identify incremental improvements for the 2022 plans that add elements of risk, criticality, and data governance.

### Transit Asset Management—The Path Forward

**Lou Crips**, *Denver Regional Transportation District*

Lou Crips presented an example of how his agency follows a plan-do-check-act process with six steps to identify TAMP improvement areas that will lead to the desired level of maturity. The process includes establishing a line-of-sight from asset management objectives to implementation and evaluation. The steps involve:

- Defining success.
- Evaluating and adjusting.
- Communicating the why.
- Executing the plan.
- Evaluating and adjusting.
- Repeating until the desired maturity is achieved.
- He illustrated the process using data quality improvement as the goal.

## **Taming the Beast: Making Your EAM System Work for You**

**Simon Smith**, *AMCL*

Simon Smith presented an overview of an Enterprise Asset Management System (EAMS) using a creative way to describe three steps to success:

- Understand the beast—The first step involves knowing the EAMS anatomy and the components and features it includes.
- Feed the beast—The second step is to load the system with the inputs needed and interface with the plan-do-check-act process.
- Give it a good home—The last stage is establishing a management framework around the EAMS, including asset management activities, asset information standards, and strategy.

## **Beyond Critical: VTA's Asset Risk Management Framework**

**Emily Gretzke**, *Kimley Horn*

**Bruce Abanathie**, *Santa Clara Valley Transportation Authority*

Emily Gretzke and Bruce Abanathie presented on the lessons learned from following the Valley Transportation Authority's (VTA's) first implementation of risk management as part of its asset management program. The effort incorporated asset risks with other ongoing risk efforts that involved enterprise risk management and hazard assessments. Stakeholders were engaged in workshops to identify and score risks following the International Organization for Standardization (ISO) standard. Mitigation strategies were identified for each risk and residual risks were evaluated.

Lessons learned from the effort included:

- The importance of stakeholder engagement in standard communication efforts.
- Various analysis tools are available to support risk assessments.
- Risk matrices need to use common language.

As a result of this effort, the VTA's final risk register evolved from an Excel risk assessment tool to an online risk management tool.

## **The Good, The Bad, and The Ugly: Reflections From the ISO55000 Journey**

**Amy Lindblom**, *Sound Transit*

Amy Lindblom discussed her reflections on the journey to take an agency through the ISO 55000 asset management certification process. She noted the following points:

- An agency can benefit from moving beyond the minimum federal requirements, such as obtaining more funding, reducing operating costs, and reducing agency risks.



- The certification process can lead to improved information maturity and better internal relationships.
- There are challenges to the certification process, such as leadership commitment and competing priorities. Ms. Lindblom noted that certification cannot be achieved without leadership commitment, and it requires significant effort at the senior leadership level.
- Behavioral change and process documentation are both very important to the certification process.

### **Key Take-Aways**

Several questions were posed to the speakers following the presentations. Mr. Smith was asked whether agencies understand the time commitment that goes into finding and implementing an EAMS. He said it is common to see organizations rush into getting a system on board and then try to figure it out after the fact.

Another question asked about VTA stakeholders' readiness for the risk management workshops. The response indicated that two educational and context-setting workshops were conducted, first with executive-level leaders and then with a broader group, to provide a basic understanding of risk management.

The speakers representing transit agencies were asked about the current needs of the asset management community. The following responses were provided:

- Embracing a management system approach industry-wide and focusing on leadership to shift the priority to core asset management principles.
- Limiting the focus on tools, technology, and software solutions. One speaker would like to see more people-oriented solutions to asset management.
- Recognizing the role people have in the process.
- Integrating with other areas in the organization and communicating between these different groups.

The final question asked for a recommendation as to what parts of ISO55000 to start with. Ms. Lindblom said that plan-do-check-act is the backbone of the standard: having clear objectives and plans, then evaluating and readjusting. Once an agency knows its targets and objectives, the plans (including the TAMP) fall from that.

There were several key take-aways from the session as noted below.

- In looking to the next iteration of their TAMPs, transit agencies should evaluate their initial efforts and compare them to the goals established. A plan can then be developed to address any gaps.
- EAMS and risk management are two areas that present opportunities for growth in transit agencies.
- There are benefits to pursuing ISO certification, but there may be some associated challenges that an agency will have to navigate.

## 2022 TAMP—What Are Agencies Planning?

### **Michael Johnson, California DOT**

Michael Johnson introduced the session as its moderator. He said the presentations describe steps that four state DOTs are taking to enhance their 2022 TAMPs based on lessons learned. Mr. Johnson noted that the experiences from these four states can be helpful to other agencies. The speakers were asked to address:

- What factors are driving the changes?
- Are the asset classes changing?
- Are system expansion needs being incorporated into a TAMP?
- How has the TAMP been used to communicate investment decision trade-offs?

### **Todd Lamphere, Washington State DOT (WSDOT)**

Todd Lamphere set the stage by saying the DOT has been managing its assets using asset management concepts for many years and there is a common level of interest across all asset classes to better understand performance. Learning from the agency's early experience in asset management, WSDOT has extended asset management to all its asset classes.

As with other agencies, Mr. Lamphere said WSDOT began a more formal asset management process in 2017 following the legislation and rulemaking that established federal requirements. WSDOT established both a federally compliant TAMP (addressing pavements and bridges) and a Statewide Transportation Asset Management Plan (STAMP) that includes all asset classes. FHWA guidance is followed for all asset classes, but differences in maturity were noted after completing the 2019 documents.

The 2022 TAMP will continue to align with generally accepted practice, but Mr. Lamphere noted the agency will look at risk in more detail. WSDOT is adding resilience for all 21 asset classes and will do the same for pavement and bridge. WSDOT is also looking for ways to include more highway maintenance activities and needs into the pavement and bridge TAMP. In the STAMP, a preservation need is developed, but the agency is attempting to solidify preservation and maintenance.

Mr. Lamphere reported that WSDOT has a great relationship with its local FHWA Division Office and even though there has been some staff turnover, the relationship has not been hurt. He considers this an integral piece to the document development and overall asset management practice. In answer to an audience question, Mr. Lamphere said in hindsight he might have prioritized the asset classes included in the STAMP since it was difficult to develop 21 programs and have them well documented.

### **Dave Solsrudm, Minnesota DOT (MnDOT)**

Dave Solsrud represented MnDOT and reported that the agency had early experience in TAMP development since it served as a pilot agency before the asset management rule was finalized. At that point in time, the agency decided to include both NHS and non-NHS pavements and bridges, but also decided to include noise walls, traffic signals, lighting, pedestrian facilities, buildings,

ITS devices, drainage, deep stormwater tunnels, overhead signs, and high-mast lights. He considers the following to be TAMP highlights:

- Its alignment with the 2017 long-term plan, MnSHIP. Although MnSHIP and the TAMP had been on different cycles, they have informed one another.
- Risk-based performance target setting was done early in the process.
- The life cycle cost examples allowed MnDOT to illustrate cost savings possible between strategies.
- Business process enhancements were identified.

There are many improvements that MnDOT is making in its 2022 TAMP, as described below.

- The agency developed an Asset Management Strategic Implementation Plan (AMSIP) that evaluated what assets to include and how to better communicate asset management internally. Due to COVID, the 2022 TAMP will include the same assets as the previous TAMP, but there is now a prioritized approach for future additions.
- The LCP analysis is shifting to a network analysis that includes maintenance costs.
- The TAMP is being developed simultaneously with MnSHIP to ensure synergy between the planning efforts.
- There is an increased risk focus on sustainability, vulnerability, and resilience.
- Value is being added by better understanding assets and building buy-in for the asset management strategies.
- User-friendly ideas are being implemented to improve the TAMP's use. For example, the one-page asset folios MnDOT first developed in 2018 will be expanded to include more "at a glance" information.

Overall, Mr. Solsrud reported that MnDOT has seen value from the development of the TAMP. The agency has a collaborative relationship with the FHWA Division Office as well as with members of the Steering Committee. It has enabled MnDOT to integrate maintenance and capital decisions and has provided the data needed for staffing and budgeting activities.

**Jack Smith, North Dakota DOT (NDDOT)**

Jack Smith set the stage for his TAMP discussion by reporting that it was developed in the Planning/Asset Management Division, but Maintenance, Bridge, Programming, and District personnel were heavily involved. He noted that NDDOT is a Cabinet agency with a director who reports to the governor. There is no Transportation Commission in North Dakota, but the legislature has a Transportation Committee. NDDOT has a family of plans that include their strategic plans (including the freight and rail plans and the TAMP) that are ultimately connected through the Long-Range Transportation Plan. The initial TAMPs focused on NHS pavements and bridges, but the entire state-maintained network will be included in the 2022 TAMP since that better reflects the way these assets are managed.

NDDOT developed its initial TAMPs in house but will be using a consultant for the 2022 TAMP. The updated TAMP will be shorter than previous TAMPs and there will be a focus on

readability and usability. It is being driven by the scenario-planning process used in updating the Long-Range Transportation Plan.

**Anne-Marie McDonnell, Connecticut DOT**

Anne-Marie McDonnell reported that the Connecticut DOT's TAMP includes seven assets across the entire statewide system. She noted that they currently have an opportunity to expand the TAMP and they are looking at steps to make it stronger and more effective.

An area of emphasis for the Connecticut DOT has been leveraging annual information and processes. Each year the DOT updates the asset fact sheets, which help communicate how conditions are changing. The DOT has also created templates to gather the information needed to create the fact sheets and to document assumptions. The annual consistency review with FHWA has also been used to identify changes that need to be made.

Ms. McDonnell indicated that the DOT is working with a consultant on its TAMP update to provide guidance. In addition, she is meeting with asset stewards to get feedback on where to concentrate efforts. Resulting key focus areas include the financial plan, integration with other plans, integration of risk management, listing investments by work type, and understanding and capturing change. New assets will be added to the 2022 TAMP, including illumination, retaining walls, roadside barriers, drainage, noise walls, fleet, curb ramps, and railroad crossings.

Ms. McDonnell closed with some realizations:

- The TAMP would benefit from more analysis, visualizations, and so on to make sense of the data.
- There is a lot to do and it is complex. Since an agency cannot accomplish everything, priorities have to be set. A current priority at Connecticut DOT is resilience.
- People are busy so it is important to value others' time and input. Connecticut DOT is trying to automate some data collection and analysis efforts.
- What you do now can make a difference.

**Key Take-Aways**

Mr. Johnson posed several questions to the presenters. The first question asked about how collaboration with MPOs is expected to change in the 2022 TAMP and how MPOs are contributing to risk management decision making and planned integration. Responses to this question are summarized below.

- Connecticut DOT: Data is collected from the locally owned NHS and the local agencies have input on the performance targets. MPOs are kept informed through the public information process.
- Minnesota DOT: The agency is connecting enterprise-level risk with program-level risk and working with SMEs on an asset-by-asset basis to identify mitigation levels. There is an MPO coordinator involved from an informational perspective.
- North Dakota DOT: Most trade-off decisions are rural decisions so there is not much MPO engagement there. There is a structure in place to collaborate with MPOs from an overall planning standpoint in performance measure discussion prior to the recommendation going to management.

- Washington State DOT: Leadership and MPOs saw the need to collaborate when the legislation was coming together. This has been the forum where risk and investment discussions have taken place.

Mr. Johnson also noted that several presenters mentioned improving the readability and usability of the TAMP and asked the speakers to discuss how much use the TAMP is getting. Washington State DOT: The DOT's TAMP is large with multiple complex appendices. Mr. Lamphere suggested that the text is readable, but there are ways to make it more user-friendly and consumable. They are working with the Communication Group to make the TAMP more of a document that decision makers can engage with and use.

- Connecticut DOT: The use of the TAMP varies across the agency. The asset stewards who provided the data are not reading it. She would like to make the TAMP searchable.
- Minnesota DOT: Mr. Solsrud said the TAMP data is being used to do analysis and it is also used in capital planning, so he considers it very useful. He also noted there is a lot of work being done to make the TAMP more user friendly and well understood.
- North Dakota DOT: Mr. Smith noted that the answer to the question depends on the audience for the TAMP. He thinks it would be interesting to show the TAMP to people not involved in asset management to gauge their reactions. The public needs to understand the general idea of what is being done to manage infrastructure assets, but currently it is more of a documentation of current practice rather than a strategic document.

### **Key Take-Aways**

The key take-aways from the session are listed below.

- Asset management is evolving beyond the federal requirements. Key focus areas continue to be risk integration, LCP, financial planning alignment with other documents, and communication.
- The programs represented in this session appeared to be well established; however, many agencies are expecting to face resource constraints in the near future due to retirements. It was suggested that it is important to document the way things have been done and any assumptions made to ensure consistency and continuous improvement.
- Technology is influencing decisions in terms of new data that is available to help with the analysis and inform data-driven decision making.
- All speakers expressed interest in making their TAMPs more user-friendly. There is more of an emphasis on communications, fact sheets, and information derived from asset data.

## **More Than Checking a Box: Making Your TAMP Foundational to Your Agency Practices**

**Patrick Cowley, Utah DOT**

Patrick Cowley served as moderator for this session, which was designed to inspire agencies to seek opportunities to use their TAMPs as more than a federal requirement. Mr. Cowley explained to attendees that the presentations will provide examples of implementation practices that help with buy-in and improved communication as well as asset management frameworks that can be implemented immediately.

## **The WSDOT Experience: Challenges a State Transportation Agency Faces When Extending Asset Management Across All Assets**

**Jonathan Fok, WSDOT**

Jonathan Fok discussed the challenges his agency faced in expanding asset management to all infrastructure assets. Assets are organized within four program areas: Inter-Agency, Multimodal, Ferries, and Highways. Each program area has an Executive Steering Committee, a Technical Advisory Group, and Asset Work Groups. The four program area leads meet quarterly as part of the Statewide Asset Management Program.

WSDOT has recognized several benefits from the inclusion of all assets in its program, including a more comprehensive consideration of maintenance and preservation needs. In addition, Mr. Fok said that there is now improved information sharing and more consistency in the agency's messaging. Ongoing challenges have to do with optimizing expenditures within and across asset classes. The agency is also striving to find ways to communicate the comprehensive value of its current funding shortfall to the legislature.

## **Challenges in Implementing TAM at the County Level: Experience of Carver County**

**Bill Robert, Spy Pond Partners**

**Perry Clark, Carver County**

Bill Robert and Perry Clark shared the opportunity to discuss Carver County's experiences in implementing asset management. Public Works is one of six county government divisions and they have a dedicated Asset Management Department. They developed a TAMP for managing assets that includes 13 asset classes using an *Asset Management Guide for Local Agencies* published by the Minnesota DOT as a resource. A consultant was brought on board to assist with this effort. The TAMP is aligned with the agency's 2040 Comprehensive Plan and is modeled on State DOT requirements.

The county has recognized several benefits from the development of the TAMP. For instance, it forced a commitment to performance measures that had just been discussed in the past. It also made good use of existing data, which was helpful with new political office holders. The agency was also able to use the information to identify assets in their right-of-way that the county does not own. Next steps include making inspections a core duty instead of a fill-in task.

## **Engaging Stakeholders to Build an Asset Management Culture**

**Keiva Rodriques**, *Maryland Aviation Administration*

Keiva Rodriques discussed her agency's efforts to build an asset management culture. She observed that previous efforts in asset management focused primarily on the technology and software rather than the people and processes that make asset management successful.

The process used involved the following steps:

- Evaluate where you are—some asset classes had more data and were more organized.
- Create a workable plan—they used the fleet asset class as a model since that group was doing asset management well.
- Involve stakeholders—this includes people at all levels of the organization from executive leadership through field service.
- Leverage technology—Ms. Rodriques advised using mobile technology as much as possible.
- Commit for the long haul—this involves recognizing that continuous improvements will be needed.

Ms. Rodriques cautioned attendees that the ongoing education needs can be consuming. The Maryland Aviation Administration developed a training component to address these needs so knowledge management is now part of the asset management process.

## **More Than Checking A Box: Metro's Experience**

**Jordan Holt**, *Washington Metro Area Transit Authority (Metro)*

Jordan Holt summarized his agency's experience with asset management as a journey that started with asset management as an island, but eventually became the way the agency does business. This evolution has occurred through efforts with asset owners to clarify roles and responsibilities, develop asset data standards, establish work order standards and training, and conduct LCP.

As part of the way Metro does business, asset owners now submit performance measures, inventory information, and a narrative report on improvements being made to meet targets. They have initiated efforts to align the Long-Range Transportation Plan with capital needs forecasts and continue to work closely with asset owners to leverage existing practices as much as possible. Their efforts have enabled Metro to reduce its backlog of unfunded needs.

## **If You Snooze, You Lose: A Strategic Approach to Enhancing TAM Practices**

**Katie Zimmerman**, *Applied Pavement Technology*

Katie Zimmerman introduced a 3-step strategic approach to evaluate the current maturity of asset management, determine the desired maturity level, and identify steps to close the gap. The three steps include: Assess, Plan, and Implement. Ms. Zimmerman highlighted tools that are available to assist agencies with the assessment of current practices, including gap analysis tools and self-

assessment surveys designed to assess an overall level of maturity. The second step involves the development of a strategic implementation plan that clearly identifies roles and responsibilities for accomplishing the goal. Once the plan is complete, the agency moves to the implementation phase. During this phase, Ms. Zimmerman stressed the importance of monitoring progress and holding people accountable. In closing, she explained the benefits to assessing practices periodically (e.g., 3 to 4 years) so progress can be documented. She also suggested that encouragement to regularly assess an agency's asset management capabilities to identify and address gaps is referenced in 23 CFR 515.17.

### **Key Take-Aways**

After the presentations concluded, the speakers were asked to identify the source of motivation within their agency for the improvements they have made to practice. Ms. Rodriques said that change in her agency was mandated by the State DOT Director. Mr. Holt said his agency was spurred by a crisis that served as a wake-up call. For Carver County, Mr. Clark said it was inspired by agency leadership to get a better understanding of budgeting and forecasting. Mr. Fok indicated it was triggered by an Executive Order from the Secretary, but the legislature has also passed legislation promoting preservation activities.

Participants were also asked whether they thought ISO certification would be beneficial to their agency. In general, the presenters noted that ISO 55000 provides a good foundation for asset management, including common terminology and concepts. Speakers noted there seems to be less involvement with certification at the state level and more interest among water, transit, and local agencies.

The final question asked participants to weigh in on the greatest challenge to moving beyond just checking the box. The speakers mentioned the differences in how assets are managed, keeping staff motivated, committing to performance measures and targets, and dealing with change management needed when processes change.

Their key take-aways from the session are listed below.

- Asset management is no longer being used just in State DOTs and transit agencies. The presentations included speakers from an airport agency and a county in addition to the State DOT and transit agency.
- All of the speakers stressed the importance of integrating asset management into the organization's culture so it becomes part of everything that is done.
- Any agency can benefit from a self-assessment to determine the steps needed to evolve its practices and integrate improvements into standard operations.
- There are many resources available to assist agencies in taking their asset management practices beyond the basics.

### **Effectively Communicating Asset Management Information**

#### **Karen Riemer, *Connecticut DOT***

Karen Riemer opened the session by stressing the importance of effective communications to support asset management. She noted that the presentations provide examples of effective



communication tools used by a variety of agencies. The session was set up as a lightning round, which means that seven speakers provided short presentations so there was time for discussion at the end of the session.

### **Communicating Municipal Asset Management Results to the Public in the City of Columbus**

**Andrew Williams**, *City of Columbus*

**Eddie Chou**, *University of Toledo*

Andrew Williams and Eddie Chou described a prototype communication tool developed for the city to support its use of data to make more informed decisions. The tool has been developed to serve as a two-way communication link so the city can communicate with residents and residents can provide input to the city. Mr. Williams illustrated this concept with a 311 example in which potholes can be identified and viewed on a map. The city can overlay the pothole layer with information on pavement condition ratings to better focus investments. Since the tool is available to the public it provides a level of transparency that is important to the way the city does business.

Dr. Chou then used the tool to illustrate how it can be used to identify inequities in the transportation system. For example, he can display the median income of each community, traffic levels, and trip times using various data sources. From this information, he can see that the low-income populations typically have the longest trip lengths and often have more dependence on public transportation. The tool also supports asset management information by linking images with data so decision makers can verify conditions from any location.

### **Using Asset Fact Sheets to Communicate Connecticut's Highway and Transit Asset Management Data**

**David Rudio**, *Connecticut DOT*

David Rudio highlighted the fact sheets the agency has developed for eight different assets. Each fact sheet showcases one asset class, providing information on inventory size, conditions, expected funding levels, and predicted conditions. An important feature of these fact sheets is a confidence "indicator" that provides the reader an idea of the maturity of the data being provided. The fact sheets present asset age (by decade), estimated value, and projected conditions for three scenarios: no funding, current funding, and additional funding.

The DOT is currently working with a consultant to produce digital fact sheets that contain much of the same information but are more interactive. The DOT also demonstrated a dashboard prototype illustrating the filtering and drill-down capabilities on a map that they will be populating soon.

## **InfoBridge Visualization Capabilities**

**Jean Nehme, FHWA**

Jean Nehme conducted a live demonstration of FHWA's portal, InfoBridge<sup>6</sup>. This portal is maintained by the long-term bridge performance program and presents information from the National Bridge Inventory. A user can filter, sort, select, and visualize data based on different criteria. A user can also do ad-hoc querying at the bridge or element level.

Dr. Nehme also demonstrated how the tools can be used on bridges with a political district or MPO. Using the Louisville area MPO, he demonstrated the ability to investigate bridge information whether or not the bridge spans multiple states. A user can access a dashboard with historical performance information, including performance forecasts.

## **Empowering Paving Decisions in DC with Data Visualization**

**Ting Ma, District of Columbia DOT**

Ting Ma indicated that the District's journey with data visualization followed a 2018 initiative established by Mayor Muriel Bowser to eliminate all roads in poor condition. Pavement conditions are collected regularly and a Pavement Condition Index is used to categorize roads into excellent, good, fair, or poor condition. Using an internal tool, various factors can be weighted to generate different scenarios for planning purposes. The tool can also be used to develop a preliminary paving plan that is also used to coordinate work with utility companies. Finalized projects are forwarded to engineers. Design and construction teams use online GIS maps to build the DOT's Pave DC website. The website allows the public to see planned projects and they can monitor construction progress.

In addition, Dr. Ma indicated that the DOT actively uses social media as a transparency tool, but also to provide accountability. As a result of the city's social media presence, the DOT filled 91 percent of the pothole patching requests within 72 hours.

## **Using Performance, Asset, and Budget Dashboards to Convey Asset Information for the City of Seattle**

**Katherine Midkiff, Seattle DOT**

Katherine Midkiff (described the city's approach to communicating asset management information through a dynamic, public-facing website. The website displays information layers so a user can select the information of interest. The tool includes a search feature that allows a user to search for a particular asset ID or by address.

Ms. Midkiff also discussed the city's consent decree (2017) that required the city to create an ADA Transition Plan and hire an ADA Coordinator. The city uses a curb ramp inspection app that feeds data into an interactive dashboard. The dashboard monitors progress on the consent decree and reports ramp construction status. Together, the tools demonstrate Seattle DOT's efforts to track all aspects of asset management and the improved access to data that has resulted from the visualization tools.

## **Utah DOT's Interactive Asset Management and Strategic Direction Tools, Keep Utah Moving**

**Katherine Midkiff**, *Seattle DOT*

Kirk Thornock discussed strategies for communicating effectively with agency leadership. This effort was triggered by Mr. Thornock's realization that agency leadership had done a great job communicating the mission and vision to asset management, but there was not a lot of communication back up to the leadership team.

To address this issue, asset subcommittees were formed as was an Asset Advisory Committee made up of Division leaders that met quarterly. One meeting each year is held with Executive Leadership. In addition, Utah DOT evaluated assets by tier and did an evaluation of programmatic risks to determine whether there was alignment between asset owners, performance managers, and senior leaders. The study found strong alignment in the most important areas. Other initiatives involve increased use of infographics, and changes to the TAMP to make it more useful.

### **Effective Communication: The MPO Perspective**

**Andrew Williams**, *City of Columbus*

**Eddie Chou**, *University of Toledo*

**Paul Flavien**, *Broward MPO*

Andrew Williams, Eddie Chou, and Paul Flavien discussed the MPO's efforts to develop a dashboard to communicate performance targets with its Board. One of the challenges it faced was showing complicated data in a visual, easily understood way. The dashboard that was demonstrated to the audience represents the MPO's third iteration. Mr. Flavien noted that all the data displayed on the dashboard is downloadable.

### **Key Take-Aways**

Using the chat feature available in the web-conferencing tool, questions posed by the audience were addressed. One question explored the department or division within an agency that is responsibility for data visualization and how that group collaborates with the asset management team. Mr. Thornock indicated that the Utah DOT relies on consultant partners to visualize data within each group or division. He noted the DOT also has GIS specialists at the Regions and in the Central office to help. Mr. Williams noted that the City of Columbus has a dedicated Information Management Section for data visualization. Mr. Flavien noted that the Broward MPO also has a GIS specialist on staff.

Another question asked how the large databases are kept current. Ms. Midkiff said the condition information is updated after each inspection through work orders.

Key take-aways from the session are listed below.

- There is a lot of work being done to communicate information effectively.
- Most of the communication tools showcased in this session provide data in a way that is relatable to users, that is public facing, and features a spatial platform.

- Interactive dashboards for public consumption are being used to improve communication, increase transparency, gain agency accountability, and provide data for equitable decision making.
- Effective communication focuses on processes, the use of technology, and analysis of feedback provided by users.

## Day 3: The Future of Asset Management

### OVERVIEW

Rather than start with a plenary session, the final day of the conference began with breakout sessions and concluded with the plenary session. The closing session, *Imagining TAM Possibilities*, served as the conference wrap-up and set the stage for participants to envision asset management from a new perspective based on everything they had learned at the conference. The six breakout sessions all focused on some aspect of asset management's future, from operational transformations to new analytical approaches.

### DAY 3 BREAKOUT SESSIONS

#### **The Future of TAM—Organizational Transformation and Improved Decision Making**

**Lou Cripps**, *Denver's Regional Transportation District*

Lou Cripps set the stage for the session by reminding attendees that many infrastructure owners have focused on the design, construction, and delivery of assets. Maintaining those assets was not considered central to the organizations' purpose. However, as user demands, funding, and legislation have increased the importance of asset management, Mr. Cripps challenged infrastructure owners to question what is really needed from a transportation perspective to meet the needs of today's communities. He noted that the speakers in this session will discuss how organizations have begun to transform themselves by incorporating asset management into their most critical strategies and policies, from long-range planning, through design and construction, and into daily operations.

#### ***Overview of Interesting Developments Across the Globe***

**Ark Wingrove**, *Kompas Development*

Ark Wingrove presented a look at the global challenges and opportunities facing asset managers, the developments in the discipline that may answer them, and where to look for further information. He began his presentation by discussing the many fundamental issues from an asset management perspective, including globalization, climate change and adaptation, United Nation strategic development goals, COVID-19, and the cost of connectivity and data. All of these represent change in stakeholder behaviors where continuous efforts to be better, cheaper, or faster have dominated practices and shaped today's asset management programs.

Mr. Wingrove also discussed trends and developments in asset management such as valuation, resilience, carbon accounting, and digitalization. He noted asset management is being globalized as a discipline, which means there is a mix of cultures and approaches being used to implement and advance asset management. He summarized several areas that continue to need further development within the asset management community, as listed below.

- Costs continue to be acquisition focused. This means that finance personnel still need to be persuaded to consider whole life costs.
- There are gaps in the convergence of qualifications and needed skills.
- There are many disparate and conflicting bodies of knowledge on asset management.
- Risk is not fully being used in decision making.
- Technology is not always used as effectively as possible.
- Customer expectations and demands have not settled following the COVID-19 pandemic. This could lead to further changes in the industry and the services provided.

To help agencies address these challenges, Mr. Wingrove envisioned a “fantasy” asset management team that was comprised of the best skills and capabilities from around the world. He challenged the audience to think globally as agencies are enhancing asset management practices.

### ***Scenario Planning and New Tools for Raining Asset Management Practice Into the Future***

#### **Ruth Wallsgrove, AMCL**

Ruth Wallsgrove focused her presentation on using asset management capabilities and tools to become better decision makers in the future. She stressed that asset management is for building and maintaining an effective management system structure for assets to coordinate and facilitate medium- and long-term integrated asset planning.

Ms. Wallsgrove alleged that most organizations practicing asset management are currently at a strategic level in which they are working to align decisions, building strategies to achieve goals, using whole life cost and risk models for long-term planning, and using data to optimize investments. She noted that these capabilities demand that practitioners have skills in areas such as scenario modeling and performance measurement to ensure the alignment of decisions at all levels of the organization. She promoted the involvement of asset management practitioners during all planning and decision making to connect and integrate all perspectives into investment decisions. She considers involvement in strategy debates as a way to inform agency leadership and to build trust in the data and analysis tools used.

### ***FTA’s Systems Guidebook and Its Application Across All Transportation Modes***

#### **Victor Rivis, Jacobs**

Victor Rivis discussed the challenges, complexities, and opportunities presented when managing a system of assets using performance monitoring, maintenance planning, and investment prioritization. He noted in 2020, the FTA released its *Transit Asset Management Systems Handbook*, which featured practices in several major transit agencies. The practices showcased in the Handbook discussed digitalization and the data needed to use digital systems to support better decision making. The Handbook also provides definitions and covers systems performance management and investment prioritization components, such as life cycle stages, maintenance activities, performance monitoring, and risk-based decision making. Mr. Rivis highlighted other resources that are available through the FTA on its TAM Portal (<https://www.transit.dot.gov/TAM>).

## ***The Past, Present, and Future of TAM***

### **Mshadoni Smith, FTA**

Mshadoni Smith closed the session with a presentation that looked back on asset management's infancy, summarized current practices, and looked forward to the next steps beyond regulation. When looking back, Dr. Smith discussed the TAM Final Rule as a factor that advanced asset management through minimum requirements for compliance. At that time, she reported that 40 percent of all buses and 23 percent of rail transit assets were in marginal or poor condition and there was more than \$98B in deferred maintenance and replacement needs.

Since that time, Dr. Smith has noted a shift from compliance to building a TAM culture that began in about 2019. She said at that time, a total of 23 percent of all assets were not in a state of good repair. Agencies are generally exceeding performance targets in several categories, especially in the facilities area.

For the future, Dr. Smith observed that trends are moving in the right direction. She noted an increase in staff knowledge of asset management practices, better internal communication, and a shift in agencies' focus on life cycle analysis, budget prioritization, and building an asset management culture. Agencies are establishing programs that go beyond minimum requirements and are realizing benefits that include reducing risks, better linking capital planning to asset management priorities, and improved ROI. She also noted that asset management cultures are evolving across agencies, and this is important because it ensures that asset management principles are institutionalized.

### ***Key Take-Aways***

Mr. Cripps wrapped up the presentations with a comment that he finds himself thinking more about the future and the challenge in defining a future that is both plausible and implausible. He noted that the presenters in the session provided actionable steps that agencies can take today to continue their asset management evolution.

Other key points from the session are summarized below.

- Asset management is evolving from a focus on compliance to building a sustainable, organizational culture. The presentations highlighted new directions for agencies to consider.
- The sustainability of an asset management program is embedded in its organizational culture. As the culture embraces an integrated consideration of risk, cost, and performance, it will lead to optimized and aligned decisions that should ensure agency resilience and sustainability over time.
- The availability of technology is making data-driven decisions more common. This puts organizations in the position of developing strategies to onboard new technology to ensure the systems provide the data needed to understand performance and make better decisions.
- Each presentation emphasized the importance of good, quality data and the use of data to communicate with both internal and external audiences. This will continue to be an important consideration in the future.

## **Communicating TAM to Expand Public and Agency Buy-In**

**Jocelyn Jones, FHWA**

Jocelyn Jones served as moderator for this session, which focused on techniques for communicating effectively both internally and externally.

### ***TAMping Our Way to a Stronger Future***

**Laura Zale, SEPTA**

Laura Zale described SEPTA as a legacy transit system that looked for “early wins” as it started its asset management efforts. These efforts involved stabilizing funding, establishing a state of good repair, and needs analysis and target setting for long-range planning. At that time, the organization prioritized the replacement of old transit assets. Today, Ms. Zale said SEPTA looks for “quick wins” that are helping to change the culture and people’s relationships with their assets. The agency is focused on improving data quality since data serves as the foundation for TAM activities.

SEPTA is also identifying ways to strengthen communication with both internal and external stakeholders using white papers developed by APTA as guides. One key to improving communication is the establishment of a network of TAMbassadors, which is currently underway. The program is designed to help prepare engineers and maintenance staff to do their jobs more effectively. As they become more confident in their positions, they can serve as ambassadors for asset management. Asset management data will also be used to inform SEPTA’s next long-range plan and to update the Asset Management Plan in 2022.

Ms. Zale reported that SEPTA has embraced asset management primarily because it is aligned with their strategic goals, it provides a strategy for maintaining a safe and reliable system, and it has helped identify the greatest needs.

### ***Video/Brochure Outreach and Visualization Culture Shift***

**Karen Riemer, CTDOT**

Karen Riemer shared examples of the techniques the Connecticut DOT has been using to expand agency and public buy-in through communication. For agency buy-in, the agency has used asset fact sheets to share information relevant to key assets, asset work groups, lunch and learn sessions, and information portals among other techniques. This level of effort has been especially important since the asset management staff has changed significantly in the past year. As a sign of asset management’s prominence in the agency, asset management is now a part of capital planning meeting agendas. A concern is that stakeholders often feel that asset management is “more work.” Ms. Riemer’s team is striving to address that concern and to build a culture that opposes the perception that the agency is reactive.

The asset fact sheets have also been an important tool for building public buy-in. Buy-in has also been assisted through a collaborative approach to building the capital plan and a focus on longer-term asset programs.



CTDOT has also made several data-driven process improvements to help validate treatment performance. These initiatives are expected to help build buy-in by shifting discussions relying on opinions to those based on data-driven factors.

### ***Advancing Asset Management Through Process Improvement***

#### **Meredith Hill, Maryland DOT**

Meredith Hill provided a pre-recorded presentation so she could showcase several communication tools that have been developed. First, she shared a video about asset management at Maryland DOT. It summarized the benefits to being a good steward of public funding, getting maximum performance from all assets within funding constraints, and the complexity of decisions because of the diversity of the assets the agency manages.

Ms. Hill also discussed the culture shift that took place in the organization, leading to the development of a new Asset Management Office this year. The office will support the agency's shift to more of an asset management focus in decisions. Ms. Hill also discussed the agency's personalized messages that each focus on specific strategies that are in place, including those listed below.

- Sharing why and what—this strategy includes the use of videos to define asset management, share results, and highlight its importance to the agency.
- Adopting an asset management policy—this is addressed in MDOT's Strategic Asset Management Plan and in a brochure that is updated annually.
- Using performance-based planning and programming—this lays the blueprint for all partner owners of the NHS to work together through consensus building and succession planning.
- Creating a communication hub—this strategy involves tools to share asset data with various audiences.

### ***Vermont Asset Management Information System (VAMIS)—Turning Data into Information***

#### **Kevin Marshia, Vermont Agency of Transportation (VTrans)**

Kevin Marshia recapped the agency's efforts to use its previous TAMP to connect people with what the agency is really doing. In addition to the focus on graphics in the TAMP, VTrans created a brochure for non-technical audiences to explain what asset management is and why it is being done. It described the intent of asset management in this way: "VTrans works with communities to make decisions that benefit you and future generations." To help make asset management relatable, they compared it to the way people maintain their homes.

Mr. Marshia also shared the VTransparency public information portal that has been available for nearly a decade. It includes a GIS-based map with project information and documents how much work has been accomplished with the available funding. It also introduces asset management concepts and provides answers to commonly asked questions.

In the future, Mr. Marshia explained that VTrans is focused on corridor management and exploring how projects fit into an entire network. The agency is partnering with external stakeholders to communicate the overall corridor plan using asset management principles. The

goal is to explain why the selected actions are being done. Another tool, VAMIS, is expected to be completed soon. This tool will serve as an asset management information system to help strengthen the connection between the broad agency goals, performance measures, and financial decisions. When it is complete, it will include an asset inventory, budgeting, analysis capabilities, maintenance, dashboards, and performance measures.

### ***Key Take-Aways***

The session provided numerous examples of techniques that have been used effectively to communicate with both internal and external stakeholders. Ms. Jones expanded on the resources discussed by the speakers, identifying other resources that are available.

The key points that were raised during this session are summarized below.

- Several agencies have relatively new asset management offices or functional areas. Presenters discussed the culture change that prompted the new organizational structures and the shift from reactive to proactive decisions.
- Agencies are using a variety of communication tools, including fact sheets, videos, portals, plans, and meetings with stakeholders. There is not one method that works for all stakeholders, so it is important to have several approaches available.
- Communication methods are unique to their audiences, so presenters discussed different approaches used with internal versus external stakeholders.
- All of the agencies represented in the session are on their own journeys, but all have similarities. The session demonstrated that asset management practitioners are always learning from one another.

## **Exploring the Frontiers of Asset Management Modeling and Analysis**

### **Jim Poorbaugh, Idaho Transportation Department**

In this rapid-fire session, various asset management modeling and analysis tools were showcased to illustrate the range of tools available to support the next generation of asset management. Mr. Jim Poorbaugh moderated the session.

### ***Bridge Life Cycle Cost Assessment: From Model Development to Analysis***

### **Dena Khatami, Wood**

Dena Khatami discussed the results of a project to develop and validate element-level deterioration models to support bridge life cycle cost analysis. There were several challenges that emerged regarding data. These challenges including changes in element quantities over time and poor correlations between bridge age and condition. These challenges were addressed before developing the models.

Dr. Khatami noted that a statistically reliable model needs at least 500 element inspection pairs. Where enough data were not available, the data sets were combined to form larger groupings. A total of 11 groups were modeled using probabilistic models. The models were validated to determine reasonableness and the results from the life cycle cost analysis were

presented. The results showed that optimization parameters such as discount rate and indirect costs have a significant impact on results.

### ***Advancing the Value of Your Condition Assessments***

**Jerome Daleiden**, *ARRB Systems, USA*

Jerome Daleiden discussed strategies for advancing condition assessment methodologies. He noted that historically, condition assessments have been sampling based. Today, equipment is available to collect deflection data continuously along with sensor data and digital images. He said that comprehensive safety assessments are also becoming more common to assess pavement friction. GIS tools and other visualization tools make the spatial data useful to pavement management practitioners to support their analyses.

### ***Evaluating Cross-Asset Performance Impacts of Different Investment Strategies Amidst Uncertain Technology and Economic Futures***

**Kevin Ford**, *High Street Consulting*

Kevin Ford discussed strategies for evaluating performance impacts across assets. He described a study that was conducted for the Texas DOT to empower transportation policy makers to better understand the performance implications of different investment strategies under various scenarios (e.g., freight demand booms, travel behavior changes, funding distribution changes, or emerging transportation technologies are adopted). The idea was to identify which of the risks demanded the greatest consideration.

The analysis was conducted using a cross-asset analysis to estimate impacts of each scenario on travel demand and performance. This required a crosswalk to be developed to link all different types of projects to different objectives (e.g., safety, highway preservation, mobility). It also required behaviors to be translated to numbers that could be used in travel demand models. The results from the demand modeling were then used to estimate performance.

Dr. Ford summarized the study findings, noting that technology implications had more impact than freight implications on system performance. Future efforts will further evaluate the sensitivity of the analyses.

### ***Moving Beyond File Cabinets: Development of a Geotechnical Asset Management Program for the Missouri Department of Transportation***

**Lydia Brownell**, *Missouri DOT*

Lydia Brownell described the development of a geotechnical asset management program for the Missouri DOT and the struggles the agency had to overcome. She noted that historically the DOT relied on information in file cabinets, even though it was not always reliable or complete. It also consumed considerable amounts of time to search for information needed.

The Geotechnical Asset Management (GAM) application is focused initially on six asset classes. The field inspection data can be entered using a mobile app that is uploaded nightly into

a database. While they are currently focused on using the tool on the highest-volume roads, the long-term vision is to extend the application to the entire system.

### ***Thoughts on New Data and Methods Available for Asset Management Modeling and Analysis in a Changing World***

**Charles Pilson, Kercher/Mott MacDonald**

Charles Pilson shared his thoughts on modeling and analysis. He covered the areas of data, modeling distribution, artificial intelligence, and the future. In the data area, Dr. Pilson discussed the amount of data available using technology. Using pavements as an example, he discussed the evolution of technology and its impact on improving data accuracy and repeatability so it can be used for studies of crack density and other uses. Dr. Pilson noted that with the detailed data available, agencies can predict performance to find the optimal long-term action strategies.

Dr. Pilson discussed the use of artificial intelligence (AI) to learn from the data. He specifically referenced an AI approach to mining data to determine when treatments are being selected. The results can then be used to improve decisions trees that lead to more optimal decisions. The last area envisioned the future, including connected and autonomous vehicles. He discussed the use of data to set performance targets for things like lane markings to support the new technology in the future.

### ***Thinking Critically: Using Asset Criticality to Improve Asset Management Decisions***

**Simon Smith, AMCL**

Simon Smith recognized that transportation agencies have thousands of different assets to manage so knowing where to focus limited funding and time is challenging. He proposed that by using asset criticality, an agency can make better decisions.

Mr. Smith began by explaining criticality as the relative importance of an asset to an organization so resources can be prioritized. It can be determined in many ways depending on the question an agency is trying to answer. As a result, the same asset can have different levels of criticality. By using likelihood and consequence of failure to determine asset criticality, an agency is introducing risk into the analysis. Mr. Smith introduced a framework for performing a criticality assessment that includes preparing, evaluating, recording, and using.

### ***Markov-Chain Based Pavement Deterioration Prediction Models for Local Street Networks***

**Baris Salman, Syracuse University**

Baris Salman discussed a study to develop probabilistic models for a local street network using Markov chains. The models used pavement inspection data from 15 years of surveys. Transition Probability Matrices were developed for roads, streets, and avenues. The initial models predicted very rapid deterioration rates. To address that, confidence intervals were calculated using a bootstrapping approach.

Dr. Salman concluded that street type did not seem to influence deterioration and that local streets may reach low condition ratings quickly.

### ***Immersive Inspections of Digital Twins to Support Transportation Asset Management***

Bibhuti Aryal (Bentley Systems) focused his presentation on inspections, which he noted are critical to data-driven decisions. There are many challenges that inspectors face, including safety, data quality, costs, and availability. Mr. Aryal offered the use of a digital twin to overcome these challenges. He described a digital twin as a digital representation of a physical asset with engineering information to better understand and model performance.

Mr. Aryal introduced five high-level steps for digital twin success. One suggestion he offered was the use of drones to collect inspection data since they allow very accurate information about location. He illustrated the features of immersive inspections that allow an individual to pick up the bridge image from a browser and bring it into the office. He sees value in the ability to see data in context using this methodology without being dependent on detailed inspection report reviews. Coupled with AI, he sees tremendous potential for analyzing complex data in the future.

### ***Augmented and Virtual Reality for Collaborative Bridge Inspection as Part of Modular and Indicator-Based Asset Management***

**Ralph Holst**, *Federal Highway Research Institute Germany*

Ralph Holst discussed the use of virtual reality and augmented reality for bridge inspections and maintenance planning. He noted several benefits to this approach, including the digital availability of structural data, the visibility of the inspection results, and the use of the results for maintenance planning. Mr. Holst also noted that bridge inspections can be done safer and faster, that safety is improved, and inspection costs are reduced.

#### ***Key Take-Aways***

There was no time for questions and discussion, but several key take-aways were identified.

- There are many different types of tools available to support asset management.
- Technology has advanced the capabilities available to practitioners, including GIS, AI, and immersive inspection tools.
- Augmented and virtual reality appears to be the future for bridge inspections.

### ***What's Next for Asset Management?***

**Robert Peskin**, *AECOM*

Robert Peskin introduced the session as an opportunity for the audience to hear from agency leaders on the future of asset management in their agency and beyond.

## ***Massport—Managing Aging Infrastructure***

### **Luciana Burdi, *Massport***

Luciana Burdi summarized the scope of Massport’s aviation, maritime, and real estate operations. She discussed the impact that the COVID-19 pandemic had on passenger traffic and estimated that complete recovery was expected to be 3 to 5 years away. She noted one of the opportunities provided by the slowed traffic in the past year was the opportunity to accelerate projects involving runway rehabilitation and terminal construction.

Dr. Burdi described Massport’s historical approach to facility maintenance as comprised of the Capital Improvement Program, a Trust Agreement, and recurrent inspections. She noted that improvements and new construction typically constituted 50 to 60 percent of the capital program with renewal projects comprising the remainder of the available funding. She described the agency’s approach to balancing new investments with ongoing maintenance needs.

Future enhancements identified by Dr. Burdi include those listed below.

- The implementation of a comprehensive building condition assessment.
- A data-centric facility management tool integrated with business intelligence to support data-driven decisions.
- Advanced use of Building/Civil Information Modeling (BIM/CIM).
- Integration of the asset collection process with GIS and BIM/CIM.

## ***Process Improvement to Support TAM at MARTA***

### **David Springstead, *Springstead and Associates***

David Springstead formerly served as the Chief of Rail Operations and Assistant General Manager of Capital Programs and Development at the Metropolitan Atlanta Rapid Transit Authority (MARTA). He opened with a summary of MARTA’s successful ISO 550001 certification efforts. He followed that with a discussion contrasting the rapid advance of consumer technology with the comparatively slower pace of technological changes within transportation agencies. He identified four challenges that agencies in the agency will have to deal with in the future.

- Asset management received attention when it was mandated through law to avoid the loss of government funding for non-compliance. To be sustainable, Mr. Springstead emphasized that asset management must be embedded in the agency’s practices.
- Maintaining a state of good repair lacks the “wow” factor of new builds and expansion. Mr. Springstead say operating dollars are often viewed as money pits by public officials. He emphasized the importance of raising TAM awareness to ensure investment in preservation.
- Federal regulations related to Safety Management Systems provided a wake-up call for agencies to prevent hazards from manifesting. He stressed the importance of having the Asset Management Plan inform the Safety Management System.

- Technology is changing rapidly and that brings risks and challenges. Agencies will need to decide when the time is right to make a technology change and should consider it within the context of broader life cycle considerations.

Mr. Springstead then presented principles for advancing asset management to address these challenges, focusing on organizational alignment, quality data, data-driven decisions, and clear communication.

### ***Eastern Transportation Coalition—What’s Next for Asset Management?***

**Trish Hendren**, *Eastern Transportation Coalition*

Trish Hendren began with a brief history of TAM with respect to the Federal-Aid Program, highlighting the FAST Act’s focus on optimizing the use and value of existing infrastructure. She then discussed keys to achieving this optimization, including:

- Integrating TAM and operations.
- Establishing a TSMO strategic plan.
- Communicating TAM in terms people care about.

Dr. Hendren then discussed the promise and challenges associated with new technologies, such as automated vehicles, and their potential impacts on asset management. She also described current funding challenges and the potential impact of new funding mechanisms on TAM. She noted that although people value transportation, they do not realize there is a funding problem. She suggested that future strategies for funding may include paying a fee based on miles traveled, but she noted that when people know they are paying for something their performance expectations may rise. She concluded by noting opportunities for collaboration across agencies to advance common objectives.

### ***Key Take-Aways***

Mr. Peskin summarized the following key themes from the presentations:

- Organization maturity and institutional issues.
- Future mobility and related technologies.
- Information technology.
- Managing risk.
- Spanning tactical short-term operational outlooks with the long-term strategic perspective.
- Funding.

This summary was followed by a question-and-answer session. In response to a question, the speakers discussed how to retain staff skills needed to manage transportation assets. Mr. Springstead noted that MARTA has seen substantial turnover. Dr. Burdi commented that it is critical to manage data so data-driven decisions persist despite staff turnover. Dr. Hendren observed that the transportation sector appears to those looking to apply technical skills in order to make a positive social impact.

Speakers also discussed the power of TAM to help decision makers address long-term strategic challenges, particularly through scenarios illustrating the impact of higher or lower TAM investment. Mr. Springstead described the benefits to ISO 55000 standards, noting the substantial, multi-year effort and in-depth auditing required for certification.

Another topic addressed the benefits of Federal TAM regulations in advancing TAM practice and encouraging adoption while noting some additional burden on agencies that had already adopted its principles. Speakers discussed whether federal regulations drive a short-term outlook. Dr. Hendren described the need for a long-term outlook but noted that it is hard for people to think 20 to 30 years out and that short-term provides a necessary feedback loop. Specifically, she noted it provides an opportunity to assess impacts and evaluate whether an agency is on track to achieve long-term goals.

## TAM and Equity

### **Hyun-A Park, *Spy Pond Partners***

Hyun-A Park moderated this session, which focused on how agencies can make TAM decisions that are fair and equitable for all travelers. She noted that the presentations in this session look at how three agencies representing cities, states, and transit have considered equity in their asset management programs.

### ***Equity Data Tool and Approach***

### **Stephen Barham, *Seattle DOT***

Stephen Barham established the foundation for his presentation by emphasizing the importance of having contextual information about the people and places that are impacted historically, at the time of the analysis, and in the future. He views it as a collaboration between disciplines that requires common intersections between time, location, and measures.

At the Seattle DOT, one of the first steps to address equity was developing maps and data that could be used to slice and compare data across cities and demographics. Their tool allows the DOT to break out data by neighborhood, urban area, or zip code and GIS is used to spatially join data sets. As a result, the DOT can overlay demographic information with asset condition information. A Seattle Race and Social Equity (RSE) Index is used in the DOT's Data Equity Tool to combine socioeconomic data with health factors as well as asset data related to safety, condition, or other features. This allows the DOT to prioritize work and present a composite score by neighborhood. This information has demonstrated that the neighborhoods with the highest RSE index were also high in terms of social vulnerability and displacement. It has served as a valuable tool to support the city's equity initiatives.



## ***The Equity Toolkit—Helping to Advance Equitable Service and TAM at Metro***

### **Laura Moeini, *Metro***

Laura Moeini presented a suite of resources being used by Metro departments to more actively and easily factor transit equity into the way it provides service. These efforts focus on the following six areas:

- Policing.
- Public participation.
- Fares and service.
- Sustainability.
- Contracting.
- Performance reporting.

Metro's Equity Toolkit is a virtual library of standards, datasets, and guidance that support the consideration of equity into projects, reporting, and decision making. The tool was being finalized at the time the presentation was being given and was expected to be shared with senior leadership in fall 2021. An important emphasis area throughout the development was ensuring consistency in the terms and standards used.

Ms. Moeini indicated Metro is currently doing research on the availability of elevators and escalators between people of color at high- and low-income levels. This illustrates how the Toolkit is expected to be used in the future.

## ***Integrating Equity into Caltrans' Planning and Project Implementation***

### **Marlon Flournoy, *Caltrans***

Marlon Flournoy acknowledged that communities of color and underserved communities have been negatively impacted by transportation projects in the past. He provided an example from Oakland in which minority populated areas were classified as hazardous waste and minorities were not able to get home loans because of it. Mr. Flournoy said equity at Caltrans is still a work in progress as the agency strives to develop policies, guidance, tools, and training. He noted that these efforts also rely on cross-functional synergy, culture change, and individual efforts to address any biases, behaviors, or beliefs that limit transportation opportunities for all.

In developing Caltrans' equity program, the agency is focused on how to implement broad equity policy directives, how to plan so that equitable project outcomes are created, and how to build environmental justice in communities. This has led them to realize the following guiding lessons:

- Lesson 1—Incorporate equity from the start in terms of policies, goals and objectives, requests for proposals, etc.
- Lesson 2—Acknowledge past and present impacts in connecting communities' programs.
- Lesson 3—Be intentional in planning and have a solid plan to engage all populations.
- Lesson 4—Be authentic and accessible.

Mr. Flournoy introduced several initiatives underway at Caltrans, including the development of equity performance metrics that are being piloted. Caltrans is also exploring ways to incorporate equity into project selection criteria and determining how to best assess project impacts on various communities. The end goal is to ensure that the agency is meeting community and individual needs.

### ***Key Take-Aways***

The presentations in this session provided evidence that agencies are making concerted efforts to integrate equity into TAM decision making. Key take-aways from the session are summarized below.

- A significant component of making equitable decisions is community engagement. Data only tells part of the story. The rest of the story is best obtained by investing time and effort into identifying stakeholders and determining how they want to be engaged. Staff training is essential in successful community engagement.
- For the most successful implementation of the topics discussed during the session, speakers stressed the opportunity to look at new ways of engaging communities to identify direct benefits to that area. Identifying the right performance measures is also important to ensure accountability. The speakers also noted the importance of working across silos.

## **Making Your TAMP Address Resilience to Truly Extreme Weather**

### **Amir Golalipour, FHWA**

Amir Golalipour set the stage for the session by noting resilience as a focus for the country's new administration. He observed that risk-based asset management and life cycle planning are key components of resiliency so there is a need to incorporate fact-based information and strategies into state asset management planning.

### ***Integrating Climate Risks into TAM Planning and Practices***

#### **Robert Kafalenos, FHWA**

Robert Kafalenos highlighted processes for integrating resilience to climate change and extreme weather into transportation decision making at three levels:

- Planning—for example, in long-range transportation plans.
- Project—for example, in design, engineering, and environmental decisions.
- Operations and Maintenance—for example, snow removal operations and emergency relief.

Mr. Kafalenos identified three key integration considerations. First, he said that risks and mitigation strategies need to be documented in a risk register and TAMPs need to incorporate

these strategies into risk-based scenarios. Secondly, he observed that risks and changing deterioration rates can significantly influence LCP strategies and scenarios, so this needs to be considered in an analysis. Finally, he noted that partnerships at the national and state levels are important. He illustrated this by noting that non-transportation sources may have data that can increase an agency's understanding of resources and risks.

Mr. Kafalenos suggested four approaches for assessing risks associated with extreme weather and climate change:

- Leveraging existing or new vulnerability and engineering assessments.
- Considering the results of risk assessment as defined in risk registers.
- Developing hazard categories.
- Examining assets and relevant hazard categories.

He closed his presentation by offering the FHWA's Office of Planning, Environment and Realty—Sustainable Transportation and Resilience website (<https://www.fhwa.dot.gov/environment/sustainability/resilience/>) as a great resource for finding an adaptive framework, case studies, policy and guidance, publication, tools, and other outreach information. He also noted the FHWA's asset management website has extensive resources on risk-based asset management (<https://www.fhwa.dot.gov/asset/resources.cfm>).

### ***Arizona DOT—Extreme Weather, Climate, and Risk Modeling for Multidecadal Considerations in Asset Management***

**Steven Olmsted, Arizona DOT**

Steven Olmsted highlighted the key steps for a critical infrastructure program, using the Arizona Infrastructure Resilience program as a guide in establishing an efficient, scientifically inferred engineering risk assessment. Mr. Olmsted considers the following activities as critical components to an infrastructure program that considers extreme weather events:

- Forming and using an agency internal working group.
- Looking for partnerships outside the agency, including academia and research institutes.
- Creating impact narratives for weather and natural hazard stresses for communicating the risk and need for mitigation steps.
- Establishing financial decision-making steps for investment planning and providing a feedback loop.
- Tracking resilience-building steps, projects, and priorities.
- Establishing a comprehensive GIS database to define risks and mitigation strategies.
- Assessing measurable climate trends and probabilistic climate risk modeling from multiple sources.
- Ensuring leadership direction.

Mr. Olmsted referenced FHWA Order 5520, *Transportation System Preparedness and Resilience to Climate Change and Extreme Weather* (<https://www.fhwa.dot.gov/legsregs/directives/orders/5520.cfm>), as the FHWA policy on preparedness and resilience to climate change and extreme weather events. He noted it covers

how to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions. He suggested that building transportation infrastructure resilience covers an extended time range that spans several decades. In Arizona, the DOT has created tools that analyze pavements, highway stormwater pumps, and bridges for resilience.

### ***Making the Business Case for Investment in Asset Resilience: The Tennessee Experience***

**Mark Abkowitz**, *Vanderbilt University*

Mark Abkowitz highlighted a study commissioned by the Tennessee legislature to assess communities' ability to prepare and plan for, absorb and recover from, and more successfully adapt to natural disasters and extreme weather during 2025 to 2055. The study was initiated to determine the cost of action and inaction related to community resiliency involving public infrastructure assets. The study involved the following steps:

- Creating a county inventory of public infrastructure deemed critical by specific criteria (e.g., function, value, activity). Critical transportation infrastructure included controlled access highways, class railroads, locks, dams, and airports.
- Examining the interdependency between transportation and other systems.
- Establishing historic frequency and severity of extreme weather events by county and region.
- Applying climate miles to forecast future event scenarios for the planning horizon.
- Performing future impact assessment of extreme weather events.
- Determining the cost of action or inaction.

Impacts were defined and scenarios were developed for damage to roads (e.g., flooding), vehicles (e.g., overheating or tire deterioration), rail (e.g., flooding, buckling, derailments), air (e.g., cargo restrictions, cancellations due to lift loss), and maritime (e.g., weight, navigation, and clearance restrictions).

Dr. Abkowitz presented the following conclusions from the study.

- The frequency and severity of extreme weather events is expected to increase significantly in the future.
- The study focused almost exclusively on property damage, so the monetary estimates are extremely conservative.
- Indirect tangible and intangible losses and damage can outweigh direct losses. These can include the loss of production, traffic disruptions, or loss of life and other health effects.
- Ancillary (i.e., secondary) impacts exist. For example, heavy precipitation followed by very dry conditions impacts the ground's ability to absorb water.
- The cost of inaction is likely to be billions of dollars per year.
- Actions taken by the States to build resistance to extreme weather would provide an ROI of 4 to 1 or higher.
- Prudent investment of resilience resources could save the state a minimum of hundreds of millions of dollars a year in disaster costs.
- The investment in resilience actions can act as an economic stimulus through job opportunities.

- The study approach is transferable to other U.S. jurisdictions.

### ***Integrating Resiliency into TAMPs***

**Shobna Varma**, *Starisis*

Shobna Varma provided a high-level view on incorporating resilience into asset management and how a TAMP can be used as a vehicle for DOTs to enhance resilience. She noted that each section of the TAMP provides an opportunity to emphasize resilience, as summarized below.

- Resilience objectives, targets, and summary descriptions can be included with asset management program objectives.
- Lack of resilience can be considered a performance gap since asset failure or damage can contribute to disruptions to system performance.
- Life cycle strategies can be impacted by different deterioration rates associated with flooding, slope failures, or excessive heat.
- Investments in resilience should be reflected in the financial plan and investment strategies.
- The risk management section should summarize resilience strategies and steps the agency is taking to mitigate risks due to extreme weather.

### ***Key Take-Aways***

Following the presentations, each speaker was asked how future climate change impacts on operations and maintenance are being incorporated into their TAMPs. The discussion included the following points:

- The TAMP is one vehicle an agency can use to demonstrate its efforts to enhance resilience.
- Operations and maintenance are seriously underrepresented in solutions. Individuals working in these areas are knowledgeable of local conditions and how extreme events impact transportation assets, so they need to be included in the discussion of viable mitigation strategies.
- A GIS is a valuable resource for capturing weather-related activities.
- There is still a lot to be done to analyze what mitigation efforts have worked and what has not worked.

Other key take-aways from the session are summarized below.

- Changes associated with extreme weather events are taking place rapidly. Several agencies have developed substantive approaches for assessing and mitigating these risks.
- Integrating resilience into decision making must be done at all levels, including at the planning, project, and operations and maintenance levels.
- A TAMP can identify resilience as a TAM objective and document how extreme weather events impact asset and system performance. It can also document mitigation strategies and planned investments to improve resilience.
- Partnerships at the national and state levels are important.
- Secondary impacts from extreme weather events are becoming increasingly important.

- Indirect tangible and intangible losses and damage can outweigh direct losses.
- Efforts to improve resilience can provide an ROI of at least 4 to 1.

## CLOSING SESSION

**Greg Slater**, *Maryland DOT*

The conference ended with a theme that invited participants to imagine the possibilities for asset management into the future. The session was moderated by the Conference Chair, Greg Slater. Mr. Slater reminded participants of topics that were covered during the first two days of the conference and set the stage for the future of asset management.

Following the invited speaker's presentation, several conference organizers were also asked to share key themes and observations from the 3-day virtual conference. See [Figure 15](#).

**Imagining TAM Possibilities**  
Conference Closing Plenary Session: Thursday, August 12, 2021 (2:30 – 4:00PM)

**Gregory Slater**  
Conference Chair,  
Secretary, Maryland DOT

**Randy Iwasaki**  
Leader of State and  
Local Transportation,  
Amazon Web Services

**Hyun-A Park**  
Co-Founder & President,  
Spy Pond Partners

**Matthew Haubrich**  
Transportation Asset  
Management Administrator,  
Iowa DOT

**13th National Conference on  
Transportation Asset Management**  
TRB TRANSPORTATION RESEARCH BOARD  
August 10-12, 2021 TRB Virtual Event

**FIGURE 15** Speakers from the Closing Plenary Session.

### *Imagining TAM Possibilities*

Randy Iwasaki, Amazon Web Services

Randy Iwasaki, Leader of State and Local Transportation at Amazon Web Services, spoke to the transportation industry's opportunities to modernize to meet industry needs. He shared several examples of technology that are fueling innovation, including the rate at which computer chips double in speed and storage and the potential use of smart phones and connected vehicles to

provide transportation options to the traveling public. Mr. Iwasaki noted that advancements in technology are driving changes in the way people are moving and forcing agencies to retool their workforce to take advantage of these new opportunities.

According to Mr. Iwasaki, the industry is poised to take advantage of innovation. He shared examples of agencies that have taken advantage of these opportunities for innovation. He noted the growth in Uber forced agencies to develop new ways to manage curb space as one example of how innovation often triggers change. He also used COVID as an example of a disruption that forced agencies to be nimble enough to respond creatively. COVID has also impacted the way people work and the way transactions occur. Mr. Iwasaki said that 70 percent of the Maryland's Motor Vehicle Administration transactions are now done online. This disrupter has fundamentally changed how the agency provides customer service and has triggered questions regarding the need for physical facilities and expanded opportunities for recruiting employees.

With that serving as the background, Mr. Iwasaki discussed how Amazon Web Services is taking advantage of the cloud to address mobility and other transportation needs. He envisions it as a way to migrate and free-up resources, ensure security compliance and resilience, adopt modern application development practices, gain faster and deeper insights with analytics, organize for speed and agility, and bridge skills and experience gaps rapidly. The company is currently focused on application development for customer service. Mr. Iwasaki summarized the cloud's benefits to mobility and transportation as the following:

- Agility—since applications can be developed and rolled out quickly.
- Cost savings—since agencies pay only for what is used.
- Elasticity—since agencies only use the resources that are needed.
- Innovation—since changes can adapt quickly.
- Global reach—since solutions are not limited by geography.

### ***Key Take-Aways***

**Hyun-A Park**, *Spy Pond Partners*

**Matt Haubrich**, *Iowa DOT*

**Emily Burns**, *Seattle DOT*

**Laura Zale**, *SEPTA*

**Stephen Gaj**, *FHWA*

Five members of the Conference Organizing Committee were asked to provide their impressions of the primary themes and take-aways to emerge from the conference. These speakers included Hyun-A Park, Matt Haubrich, Emily Burns, Laura Zale, and Stephen Gaj. Their responses are provided as a combined retrospective of how TAM has evolved over the past several years and how it is likely to progress in the future.

- TAM is now the community culture. It is no longer just about regulatory requirements and has become an integral part of agency decision making.
- The development and implementation of a TAMP has helped transportation agencies focus action and drive the changes needed to continually strengthen their TAM programs.

- TAM is no longer focused only on the highway experience and has clearly expanded to other modes of transportation and other transportation agencies.
- There were several topic areas that emerged as near-term focus areas, including equity, sustainability, and resilience<sup>7</sup>.
- The organizational transformations and communications strategies that were presented at the conference recognized that the selected approach had to be tailored to each agency's unique needs. The presentations showed that there are different strategies that can be effective in different situations.
- Partnerships and collaboration are integral to asset management and being able to analyze data across assets and across modes helps agencies better understand the customer perspective from door-to-door.
- The science of asset management is evolving, with data science tools providing opportunities for visualization and asset value emerging as a tool to drive investment priorities<sup>8</sup>.
- Agencies have realized benefits from TAM in terms of asset and system performance. TAM is also being recognized as a tool to support economic development activities and enable agencies to deliver value to its customers.
- It will be important to continue to promote the importance of asset management using innovative approaches that communicate the cost of non-action.

## Closing

Mr. Slater thanked everyone for their participation in the conference and recognized the quality of the speakers and presentations over the past three days. He also thanked the conference sponsors and all the volunteers and staff who devoted their time to making the conference a success. In closing, he encouraged participants to put into practice the most promising ideas from the conference and suggested that they keep the next TAM Conference in mind to share their successes.



# Concluding Thoughts

## COMMON THEMES

Throughout the conference there were several themes that emerged. Some of the more predominant themes noted by the report writers and the rapporteur are listed below.

- The conference was organized around three theme areas, including strategic planning through TAM, supporting TAM operations, and the future of TAM. The presentations illustrated that many of the key focus areas discussed in previous conferences are still important, but there is increasing focus on integrating risk and LCP into agency practices, aligning the TAMP with other documents, communicating investment impacts, and making the TAMP more useful to the agency.
- All State DOTs and transit agencies now have TAMPs in place and these agencies are working on updates that will be submitted in 2022. Agencies are now converting from a focus on meeting legislated requirements to making incremental and strategic changes that involve organizational transformations and the use of technology to better use TAM in investments decisions ranging from long-range planning to daily operations.
- The sustainability of asset management programs was noted in several presentations and the importance of embedding asset management into an organization's culture.
- Agencies have recognized the benefits to TAM and the presentations reflect a better understanding of asset management, stronger internal communication in many agencies, and a shift in culture needed to institutionalize asset management. There also appears to be an increased focus on life cycle strategies for managing transportation assets.
- The prominence of transit in the conference program reflects the maturity of asset management in these agencies. The conference program also included presentations from other types of agencies and transportation modes, including airports, and local and regional transportation agencies.
- Asset management must constantly adapt to changing needs. Emerging topic areas at the conference included equity, resilience, sustainability, criticality, and electrification. One presentation noted that efforts to increase resilience are expected to have a lasting positive impact on performance and an ROI of 4 to 1.
- Innovations and technology are impacting data collection efforts and helping to improve data quality, expand the types of analyses that can be performed, and enhance agencies' ability to use data to communicate effectively. Presentations discussed applications of AI, digital twins to better understand and model performance, and immersive inspection programs. In addition, the presentations showcased the variety of communication tools being used, including digitalization, fact sheets, videos, portals, and other outreach activities. Even with the increase in communication tools, the ability to convey the importance of TAM to maintain a strong focus on system preservation remains a challenge.
- There is evidence that TAM has enabled agencies to overcome organizational silos within and between agencies to collaborate on system-level investment strategies. Several examples of multimodal partnerships across agencies were discussed.

- Agencies have experienced significant transitions in terms of organization leadership and staffing. The importance of ongoing TAM education efforts was identified by several presenters.
- The new Infrastructure Bill that was expected to be signed into law later in 2021 is expected to maintain a strong, ongoing link to TAM and system preservation. The bill is expected to introduce new emphasis areas and agencies will benefit from research and implementation guidance to address these areas.

## SUGGESTED RESEARCH AND OUTREACH ACTIVITIES

Based on the themes, the following areas are suggested as future research areas and deployment activities that would benefit practitioners as they continue to advance their asset management practices in the future. The AASHTO TAM Portal provides a Research Management System (<https://www.tam-portal.com/rms-about/>) for storing problem statements on these future development activities. The TRB Committee on Transportation Asset Management (AJE30) may consider developing new research problem statements, or updating existing problem statements, to reflect the topics areas that emerged from the conference.

- The identification of the right data and measures to understand and address equity in TAM and advance collaborative decision making across modes.
- Successful strategies for linking environmental resilience and sustainability to TAM investment decisions so that pavements and bridges (and other infrastructure assets) are more resilience to climate change.
- The evolving role of electric, connected, and automated vehicles and the infrastructure considerations that are needed in TAM.
- The appropriate time for adopting innovative technology within the broader context of life cycle considerations.
- Strategies for accelerating the pace of innovative in transportation agencies.
- Methods to address the gaps between workforce qualifications needed and available skillsets, particularly in the use of advanced technology, the ability to analyze big data sets, and techniques for communicating using data analytics.
- Creative ways to communicate the benefits to TAM, SOGR, and data.
- Techniques for measuring and reporting financial health, implementing LCP strategies, and modeling funding instability.
- Strategies to build confidence in modeling the performance of long-life assets.

## Notes

1. Arkansas, California, Colorado, Connecticut, Iowa, Illinois, Louisiana, Maryland, Michigan, Minnesota, Mississippi, North Carolina, North Dakota, New Jersey, Nevada, Ohio, Oklahoma, Texas, Utah, Virginia, and Wisconsin.
2. Day 1: <https://www.youtube.com/watch?v=Ra3H8dbcUng>
3. Day 2: <https://www.youtube.com/watch?v=Um7VS9nme64>
4. Now available at: <https://www.trb.org/Publications/Blurbs/182511.aspx>
5. <https://www.nap.edu/catalog/26445/investing-in-transportation-resilience-a-framework-for-informed-choices>
6. <https://infobridge.fhwa.dot.gov/>
7. Research needs on these topics are available in the Research Management System available through the AASHTO TAM Portal (<https://www.tam-portal.com/rms-about/>)
8. The evolving nature of asset management is discussed in the Asset Management Guide available through the AASHTO TAMP Portal (<https://www.tamguide.com/>)

## Abbreviations and Acronyms

The abbreviations and acronyms listed below are used throughout this report.

AADT	Average Annual Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
ADA	American Disability Act
APTA	American Public Transportation Authority
AI	Artificial Intelligence
BIM	Building information Modeling
Caltrans	California Department of Transportation
Capital Metro	Capital Metropolitan Transportation Authority of Austin
CIM	Civil Integrated Management
COAM	Corporate Operationalization of Asset Management
CTDOT	Connecticut DOT
DC	District of Columbia
DOTs	Departments of Transportation
EAMS	Enterprise Asset Management System
EDC	Every Day Counts
ERM	Enterprise Risk Management
EV	Electric Vehicle
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GAM	Geotechnical Asset Management
GHG	Green House Gas
GIS	Geographic Information System
ISO	International Organization for Standardization
LCP	Life Cycle Planning
MAP-21	Moving Ahead For Progress in the 21 <sup>st</sup> Century Act
MARTA	Metropolitan Atlanta Rapid Transit Authority
MassDOT	Massachusetts DOT
Metro	Washington Metropolitan Area Transit Authority
MnDOT	Minnesota DOT
MPOs	Metropolitan Planning Organizations
MTA	Metropolitan Transportation Authority of New York City
NCHRP	National Cooperative Highway Research Program
NCTCOG	North Central Texas Council of Governments
NDDOT	North Dakota DOT
NHS	National Highway System
NYSDOT	New York State DOT
PBPP	Performance-Based Planning and Programming

PLC	Public Liability Corporation
QA/QC	Quality Assurance/Quality Control
RAMCAP	Risk Analysis and Management for Critical Asset Predictions
ROI	Return on Investment
RSE	Race and Social Equity Index
RSI	Remaining Service Interval
RTD	Regional Transportation District
SEPTA	Southeastern Pennsylvania Transportation Authority
SME	Subject Matter Expert
SOGR	State of Good Repair
SPD	Significant Progress Determination
SPMS	Scheduling and Project Management System
STAMP	Statewide TAMP
STIP	Statewide Transportation Improvement Program
TAM	Transportation Asset Management
TAMPs	Transportation Asset Management Plans
TPM	Transportation Performance Management
TRB	Transportation Research Board
TSMO	Transportation System Management and Operations
VAMIS	Vermont Asset Management Information System
VTrans	Vermont Agency of Transportation
WSDOT	Washington State DOT

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