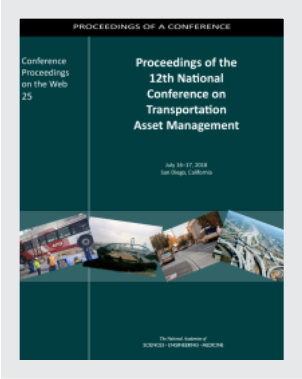


Proceedings of the 12th National Conference on Transportation Asset Management (2019)

DETAILS

0 pages | 8.5 x 11 | PAPERBACK
ISBN 978-0-309-49208-9 | DOI 10.17226/25431

CONTRIBUTORS

Kathryn A. Zimmerman; Technical Activities Division; Transportation Research Board; National Academies of Sciences, Engineering, and Medicine

SUGGESTED CITATION

National Academies of Sciences, Engineering, and Medicine 2019. *Proceedings of the 12th National Conference on Transportation Asset Management*. Washington, DC: The National Academies Press. https://doi.org/10.17226/25431.

CONFERENCE PROCEEDINGS ON THE WEB 25

Proceedings of the 12th National Conference on Transportation Asset Management

Kathryn A. Zimmerman
Applied Pavement Technology, Inc.
Rapporteur

July 16–17, 2018
Westin, San Diego
San Diego, California

Organized by the
Transportation Research Board

Cosponsored by the
American Association of State Highway and Transportation Officials

The National Academies of
SCIENCES · ENGINEERING · MEDICINE
TRB
TRANSPORTATION RESEARCH BOARD
Washington, D.C.
2019

www.TRB.org

Conference Proceedings on the Web 25

Transportation Research Board (TRB) publications are available by ordering individual publications directly from the TRB Business Office, through the Internet at www.TRB.org or national-academies.org/trb, or by annual subscription through organizational or individual affiliation with TRB. Affiliates and library subscribers are eligible for substantial discounts. For further information, contact the Transportation Research Board Business Office, 500 Fifth Street, NW, Washington, DC 20001 (telephone 202-334-3213; fax 202-334-2519; or e-mail TRBsales@nas.edu).

This conference was cosponsored by the American Association of State Highway and Transportation Officials (AASHTO). Any opinions, findings, conclusions, or recommendations expressed in this publication do not necessarily reflect the views of any organization or agency that provided support for the project.

Printed in the United States of America.

Suggested citation: Transportation Research Board. *Conference Proceedings on the Web 25: Proceedings of the 12th National Conference on Transportation Asset Management*. Washington, D.C.: The National Academies of Sciences, Engineering, and Medicine, 2019.

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

The **National Academy of Sciences** was established in 1863 by an Act of Congress, signed by President Lincoln, as a private, nongovernmental institution to advise the nation on issues related to science and technology. Members are elected by their peers for outstanding contributions to research. Dr. Marcia McNutt is president.

The **National Academy of Engineering** was established in 1964 under the charter of the National Academy of Sciences to bring the practices of engineering to advising the nation. Members are elected by their peers for extraordinary contributions to engineering. Dr. C. D. Mote, Jr., is president.

The **National Academy of Medicine** (formerly the Institute of Medicine) was established in 1970 under the charter of the National Academy of Sciences to advise the nation on medical and health issues. Members are elected by their peers for distinguished contributions to medicine and health. Dr. Victor J. Dzau is president.

The three Academies work together as the **National Academies of Sciences, Engineering, and Medicine** to provide independent, objective analysis and advice to the nation and conduct other activities to solve complex problems and inform public policy decisions. The National Academies also encourage education and research, recognize outstanding contributions to knowledge, and increase public understanding in matters of science, engineering, and medicine.

Learn more about the National Academies of Sciences, Engineering, and Medicine at **www.national-academies.org**.

The **Transportation Research Board** is one of seven major programs of the National Academies of Sciences, Engineering, and Medicine. The mission of the Transportation Research Board is to increase the benefits that transportation contributes to society by providing leadership in transportation innovation and progress through research and information exchange, conducted within a setting that is objective, interdisciplinary, and multimodal. The Board's varied committees, task forces, and panels annually engage about 7,000 engineers, scientists, and other transportation researchers and practitioners from the public and private sectors and academia, all of whom contribute their expertise in the public interest. The program is supported by state transportation departments, federal agencies including the component administrations of the U.S. Department of Transportation, and other organizations and individuals interested in the development of transportation.

Learn more about the Transportation Research Board at **www.TRB.org**.

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

Consensus Study Reports published by the National Academies of Sciences, Engineering, and Medicine document the evidence-based consensus on the study's statement of task by an authoring committee of experts. Reports typically include findings, conclusions, and recommendations based on information gathered by the committee and the committee's deliberations. Each report has been subjected to a rigorous and independent peer-review process and it represents the position of the National Academies on the statement of task.

Proceedings published by the National Academies of Sciences, Engineering, and Medicine chronicle the presentations and discussions at a workshop, symposium, or other event convened by the National Academies. The statements and opinions contained in proceedings are those of the participants and are not endorsed by other participants, the planning committee, or the National Academies.

For information about other products and activities of the National Academies, please visit **www.nationalacademies.org/about/whatwedo**.

Conference Planning Committee

The conference was organized through the volunteer efforts of a planning committee led by Laura Mester, Michigan Department of Transportation, who served as the conference chair. Other members of the planning committee included

Brad Allen, *Applied Pavement Technology, Inc.*
Niles Annelin, *Michigan Department of Transportation*
Emily Burns, *Seattle Department of Transportation*
Anita Bush, *Nevada Department of Transportation*
E. Dean Carlson, *Carlson Associates*
Mildred Chua, *Metropolitan Transportation Authority, Bridges and Tunnels*
Paul Edwards, *Utah Transit Authority*
Matthew Haubrich, *Iowa Department of Transportation*
Michael Johnson, *California Department of Transportation*
John McCormick, *Bay Area Rapid Transit District*
Sue McNeil, *University of Delaware*
Scott Richrath, *Atkins*
David Springstead, *Metropolitan Atlanta Rapid Transit Authority*
Andrew Williams, *Ohio Department of Transportation*
Laura Zale, *Southeastern Pennsylvania Transportation Authority*

Liaisons

Stephen Gaj, *Federal Highway Administration*
Matthew Hardy, *American Association of State Highway and Transportation Officials*
Heather Holsinger, *Federal Highway Administration*
Robert Kafalenos, *Federal Highway Administration*
Mshadoni Smith, *Federal Transit Administration*

Transportation Research Board Staff

Tom Palmerlee, *Senior Program Officer*
Mai Quynh Le, *Senior Program Assistant*

Publications Staff for Conference Proceedings on the Web 25

Eileen P. Delaney, *Director of Publications*
Natalie Barnes, *Associate Director of Publications*
Janet M. McNaughton, *Senior Editor*
Jennifer Correro, *Assistant Editor*

Contents

Acknowledgments

These conference proceedings were compiled with the help of the conference chair, the conference planning committee, the track leads, the moderators, and the reporters. Katie Zimmerman of Applied Pavement Technology, Inc., served as the conference rapporteur and prepared these proceedings from materials provided by session reporters, presentations submitted by presenters, and her own notes. These proceedings are a compilation of the presentations and a factual summary of the ensuing discussions at the event. The conference planning committee was responsible solely for organizing the conference, identifying speakers, and activities during the event. The views contained in the report are those of individual participants and do not necessarily represent the views of all participants, the planning committee, the Transportation Research Board (TRB), or the National Academies of Sciences, Engineering, and Medicine.

These proceedings were reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise in accordance with procedures approved by the National Academies' Report Review Committee. The purposes of this independent review are to provide candid and critical comments that will assist the institution in making the published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the project charge. The review comments and draft manuscript remain confidential to protect the integrity of the process. TRB thanks the following individuals for their review of these proceedings: Emily Burns, Trish Hendren, Robert Peskin, and Steve Wilcox.

Although the reviewers listed above provided many constructive comments and suggestions, they did not see the final draft of the proceedings before its release. The review of these proceedings was overseen by Susan Hanson of Clark University (emerita). Appointed by the National Academies, she was responsible for making certain that an independent examination of the proceedings was performed in accordance with established procedures and that all review comments were carefully considered. Responsibility for the final content rests entirely with the authors and the institution.

Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
ACRP	Airport Cooperative Research Program
BART	Bay Area Rapid Transit District
BrM	bridge management
Caltrans	California Department of Transportation
COAM	Corporate Operationalization of Asset Management
DOT	Department of Transportation
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GIS	Geographic Information System
IAM	Institute of Asset Management
IP	intellectual property
ISO	International Organization for Standardization
JTA	Jacksonville Transportation Authority
LCP	life-cycle planning
lidar	light detection and ranging
MODA	multiobjective decision analysis
MPO	metropolitan planning organization
MTA	Metropolitan Transportation Authority
MTC	Metropolitan Transportation Commission
NCHRP	National Cooperative Highway Research Program
NCTCOG	North Central Texas Council of Governments
NHS	National Highway System
NOACA	Northeast Ohio Areawide Coordinating Agency
PTPD	probabilistic treatment path dependence
RCM	reliability-centered maintenance
RTD	Regional Transportation District (Denver)
SB1	Senate Bill 1
SEPTA	Southeastern Pennsylvania Transportation Authority
TAM	transportation asset management
TAMP	Transportation Asset Management Plan
TCRP	Transit Cooperative Research Program
TPM	transportation performance management
TRB	Transportation Research Board

Conference Overview

Nearly 500 transportation asset management practitioners came together at the Westin Hotel in San Diego, California, for the 12th National Conference on Transportation Asset Management (TAM). The conference was sponsored by Transportation Research Board (TRB) Committee on Transportation Asset Management and the American Association of State Highway and Transportation Officials (AASHTO). In addition to the 2-day conference held on July 16–17, 2018, several preconference activities were scheduled on July 14–15, 2018, including the following:

- A peer exchange sponsored by the Federal Highway Administration (FHWA) and AASHTO,
- Six technical half-day and full-day workshops,
- Several TRB committee meetings,
- A joint meeting between the TRB Committee on Transportation Asset Management and the AASHTO Asset Management Subcommittee,
- Several Pooled Fund activities for state transportation agencies, and
- A Transit Asset Management Roundtable sponsored by the Federal Transit Administration (FTA).

A total of 487 participants representing a variety of organizations attended the conference, as shown in Figure 1. The largest number of attendees represented state departments of transportation (DOTs), but many local and regional practitioners also attended. Included in the list of attendees are many transit agencies representing several different types of organizations, including other federal agencies, state DOTs, and local or regional government agencies. Although the majority of attendees were from the United States (93.6%), representatives from nine other countries, including Australia (n = 1), Canada (n = 15), Costa Rica (n = 2), Ireland (n = 1), Japan (n = 2), Mexico (n = 3), South Africa (n = 1), Ukraine (n = 1), and the United Kingdom (n = 5) participated in the conference activities.

Conference Tracks and Sessions

The conference program was organized around the following five tracks:

Track 1: Analyzing and Optimizing Investment Options. This track showcased methods and tools used to support the development of integrated investment decisions within an uncertain financial planning environment.

Track 2: Data Systems to Improve Decisions. This track featured presentations on the development and implementation of data systems, best practices in data collection, methods used to estimate the expected return on investment, and strategies for communicating results.

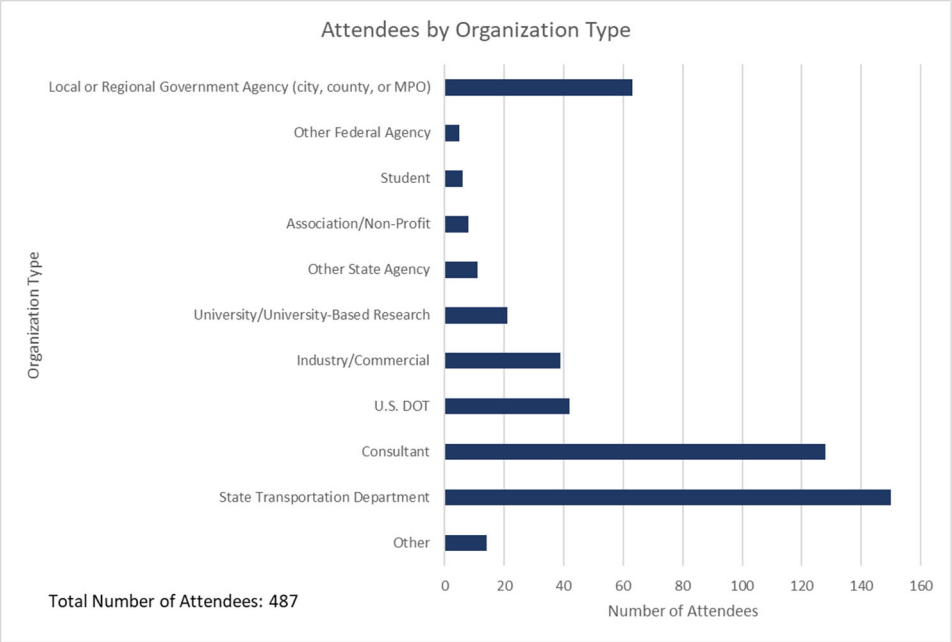


Figure 1. Participant distribution by employer.

Track 3: Implementation. This track highlighted best practices and lessons learned from TAM implementation efforts, including agency experiences in addressing changes to business processes, implementing innovative practices to support TAM, and delivering results effectively.

Track 4: Organization and Workforce. This track provided a forum for practitioners to share organizational transformations and key strategies for building an effective TAM workforce.

Track 5: TAMPs—Setting the Course for Compliance and Beyond. Presentations in this track focused on the development and maturation of agency transportation asset management plans (TAMPs) by exploring lessons learned through initial development and future plans for enhancing the TAMP and integrating it into agency operations.

In addition to the five technical tracks, two cross-cutting tracks on transit and risk and resilience were established to help ensure that each technical track included material relevant to these two cross-cutting topics. The result was a well-integrated conference program that contained sessions addressing the range of interests represented by a diverse audience. The sessions seamlessly integrated transit and resilience issues into each session and illustrated the common needs of transit and highway participants and the importance of incorporating extreme weather events and resilience into asset management planning.

The conference featured several different types of sessions to provide a range of opportunities for the participants. The conference began with an opening session that included a distinguished panel of experts who discussed several asset management challenges for today's transportation community. It ended with a closing session that

provided an opportunity for the track leads to share examples from the conference presentations that illustrated ways in which asset management is evolving and moving toward a more sustainable, multidimensional, and evolved program. Both the opening and closing sessions were plenary sessions for all conference participants to attend.

In addition to the two plenary sessions, there were 30 breakout sessions organized around each of the five tracks. The majority of the breakout sessions featured presentations from practitioners, but several were organized as discussion sessions or rapid-fire sessions. The discussion sessions provided opportunities for peers to exchange experiences through facilitated question-and-answer sessions. In the rapid-fire sessions, many speakers were provided an opportunity to introduce technologies in 5 minutes or less. Participants interested in any of the technologies presented could then interact with the speakers during the poster session or breaks. The poster session, which was held in conjunction with a reception, featured four posters related to data systems to improve decisions and three posters featuring examples for analyzing and optimizing investment options. The poster session format provided an opportunity for conference participants to interact with the authors directly in a relaxed setting.

Preconference Workshops

Immediately prior to the conference, several preconference workshops were offered to participants free of charge. The workshops were well attended and represented a range of topics relevant to practitioners, from those just getting started in asset management to those who have years of experience. These topics included the following:

Bridge Management Applications for Your TAMP (1.5 hours). Presenters in this workshop provided examples of how bridge management systems can be used to support asset management. Paul Thompson (Consultant) provided an introduction to bridge management that was followed by examples from the Indiana (Louis Feagans), Michigan (Dave Juntunen), and New York State (Steve Wilcox) DOTs.

Using New Tools and Processes to Enhance TAM (3.5 hours). This workshop featured products that emerged from several recently completed research projects of the National Cooperative Highway Research Program (NCHRP), as follows:

- Guidance on leading practices (William Roberts, Spy Pond Partners, LLC);
- Data for civil integrated management, TAM, and transportation performance management (TPM) (Frances Harrison, Spy Pond Partners, LLC);
- Metrics, benchmarking, and target setting (Joseph Crossett, High Street Consulting);
- Resource allocation (William Roberts, Spy Pond Partners, LLC); and
- Communication and diagnostics with portals and dashboards (Hyun-A Park, Spy Pond Partners, LLC).

Asset Management 101 (3.5 hours). This workshop provided a foundation for TAM so participants could better understand its role in their organization. An opening presentation

by Carlos Chang (University of Texas at El Paso) set the stage for a panel discussion that included representatives from the Metropolitan Transportation Commission (Theresa Rommel), the Bay Area Rapid Transit District (John McCormick), the City of Seattle, Washington (Terry Martin), and the Nevada DOT (Anita Bush).

What We Learned from the TAMP Development Process (3.5 hours). Several months before the conference, state DOTs submitted their initial TAMPs to their FHWA Division offices for review. This workshop provided an opportunity for panel members to discuss how their experiences would shape the development of their fully compliant TAMPs and for workshop participants to discuss their successes, challenges, and lessons learned. Facilitators included Michael Johnson [California Department of Transportation (Caltrans)], Hyun-A Park (Spy Pond Partners, LLC), Brad Allen (Applied Pavement Technology), and Gordon Proctor (Proctor and Associates). Panel members in the financial planning discussions included Craig Newell (Michigan DOT); Matt Haubrich (Iowa DOT); Locke Craig-Mickel (Washington State DOT). Panelists for the life-cycle planning discussions included Dawn Foster (Caltrans); Trisha Stefanski (Minnesota DOT); and Andrew Williams (Ohio DOT). The risk management panel included Locke Craig-Mickel (Washington State DOT); Chad Allen (Vermont DOT); Travis McGrath (Idaho Transportation Department); and Karen Riemer (Connecticut DOT). The final panel, which focused on successes and challenges, included Brad McCaleb (Arkansas DOT) and Tammy Haas (New Mexico DOT).

Use of Pavement Management Systems for Asset Management (1.5 hours). During this workshop, several pavement management practitioners shared how their systems are being used to support asset management. Presenters included Alan Kercher (Kercher Group), Andrew Williams (Ohio DOT), Tammy Haas (New Mexico DOT), and Steve Wilcox (New York State DOT).

How to Use TAM Information to Grab the Attention of Executives (1.5 hours). This workshop panel shared ideas for how to take data from an asset management analysis and turn it into a useful decision-making tool. The panel members shared approaches that work as well as some that do not work. The panel included William Johnson (Colorado DOT), Paul Degges (Tennessee DOT), and Julie Lorenz (Burns and McDonnell).

Conference at a Glance

An overview of the conference program is provided in Figure 2.

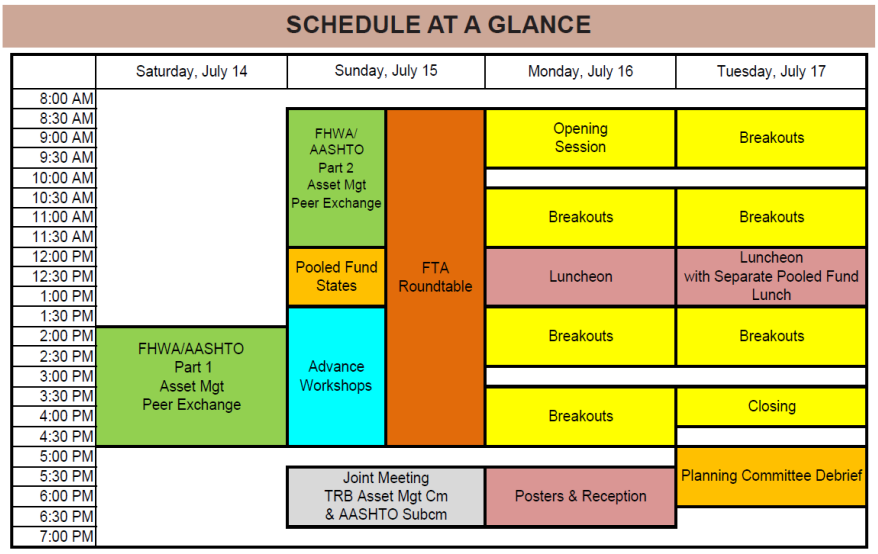


Figure 2. Conference schedule at a glance.

Opening Session

Laura Mester, *Michigan Department of Transportation*, *Chair*

Panelists

Laurie Berman, *California Department of Transportation*
Gregory Kildare, *Los Angeles County Metropolitan Transportation Authority*
Kenneth Petty II, *Office of Planning, Federal Highway Administration*

Following a tradition set at the 2016 TAM Conference, the opening session featured the conference chair and invited keynote speakers who discussed their perspectives on asset management and its impact on today's transportation agencies. **Laura Mester**, the chair, introduced each of the speakers and provided them an opportunity to share their thoughts on the following five themes:

- The role of the federal government in providing stewardship to transportation agencies,
- The demand for increased government accountability,
- The evolution of agency investment priorities to better meet economic and societal demands,
- The need for stronger collaboration across modes and jurisdictions, and
- The growing importance of climate change and extreme weather events in agency decisions.

The major points raised by the panel on each of these themes are addressed in the remainder of this chapter.

Role of the Federal Government to Provide Stewardship to Transportation Agencies

As the federal representative on the panel, **Kenneth Petty II** provided opening remarks on this topic. He emphasized the FHWA's focus on stewardship to help agencies consider comprehensive, performance-based strategies through training, peer exchanges, websites, and other methods of engagement. **Gregory Kildare** noted that he has observed a shift in FTA's role since TAM requirements were issued to help agencies use data-driven decisions. Historically, Kildare noted that resource allocation decisions have been made using ad hoc, expert-focused processes in which those individuals with the best presentations received the most funding. These processes tended to provide funding to customer-focused, reliability issues related to service delivery rather than infrastructure needs (such as ventilation systems). Kildare supported the focus on asset management and recognized that it would take time for agencies to collect the data and implement the systems needed to support these types of decisions.

Demand for Increased Government Accountability

Laurie Berman indicated that Caltrans has been improving its communication efforts with the public for the past 6 to 8 years. These efforts have benefited the agency because the recently passed Senate Bill 1 (SB1) funding package carries with it significant oversight responsibilities to ensure accountability in how the funds are used. The agency's prior asset management efforts helped support the passage of the SB1 funding because Caltrans could present its unmet needs and the potential consequences associated with a lack of adequate funding for infrastructure needs. Berman stressed the ongoing importance of communication so that the public understands funding needs associated with assets and programs that the public does not think about. Caltrans is also working on sharing information with the legislature and the public about steps being taken to reduce agency costs. This differs from past practices in which cost savings were not typically reported externally.

Kildare noted that Los Angeles County voters approved five sales tax revenue increases because Metro demonstrated accountability and stewardship in a way that the public trusts.

Evolution of Agency Investment Priorities to Better Meet Economic and Societal Demands

Kildare noted an evolution in agency investment priorities to meet economic and societal demands. He suggested that within transportation agencies, there is a lot of competition for funding. He would like to see the quality of investment decisions improve, with a focus on activities that increase asset value.

Need for Stronger Collaboration Across Modes and Jurisdictions

Petty pointed out that agencies have limited resources to work with, including human resources. Therefore, he emphasized the importance of working collaboratively and thinking beyond traditional borders to consider freight, transit, and other needs in a region.

Berman stressed that TAM is helping agencies break down the traditional silos. At Caltrans, they are looking at how transit, highways, and other modes work together. For example, in California they have managed lanes and great transit programs, but they still have heavily congested highways. They are looking at multimodal solutions to this problem, such as adding a high-occupancy vehicle lane while also providing more frequent and reliable train service in the area.

Kildare stated that collaboration has always been important to the Los Angeles County Metropolitan Transportation Authority (MTA). Caltrans sits on their Board, so there is a lot of collaboration between these agencies. He stressed that their focus is on the best interests of the region. This involves knowing the needs of other agencies in the region, so funding

can be prioritized to meet the highest needs across the region, even if it means less funding for his agency.

Growing Importance of Climate Change and Extreme Weather Events in Agency Decisions

Berman and **Kildare** both recognized the increased importance of extreme weather events in California and its impact on the transportation system. Berman indicated that they are seeing fires year round and that in the past year, 33 freeways were closed because of floods and Highway 101 was closed for 12 days because of mudslides. Caltrans is addressing these types of events and now includes adaptation plans that consider sea level in their design activities. They also have performance objectives related to reducing greenhouse gases that have involved shifting to an all-electric and hydrogen fleet and installing more charging stations around the state.

Kildare reported that the Los Angeles County MTA has a sustainability function in the organization because of the importance of these issues in all public agencies in California. He said they no longer use diesel buses and have taken other steps to reduce greenhouse gas emissions. **Petty** reported that FHWA also has a team dedicated to resilience and extreme weather events and that weather-related risks are expected to be included in state DOT TAMPs.

Other Discussion Topics

Mester facilitated a question-and-answer session with the panel members. The questions and responses are provided below.

- How are you able to deal with the amount of data needed to support TAM? Do your staff have the skill sets needed to manage the data and how is that changing?
  - **Petty** indicated that succession planning is a key to ensuring that staff are trained when staff turnover takes place.
- How do you determine the value of data?
  - **Kildare** indicated that his agency has made concerted efforts to collect needed data, so they are dealing with much more information than ever before. The data have allowed them to develop maintenance schedules that are being followed. They can also better assess consequences. He indicated that it is difficult to put a dollar value on this information but that he sees direct benefit in being able to describe consequences.
- How should DOTs change their culture to make TAM part of the planning process?
  - **Petty** said this has been a long-running discussion in FHWA and collaboration is an important part of changing the culture. He stressed that it is important to have a common method of discussing the topic to ensure that everyone is thinking holistically about the planning process.

- Is it harder to practice asset management when you have sufficient funding?
  - **Berman** indicated that it would be difficult for her to answer this question, as Caltrans does not have enough funding to meet all its needs. However, she stressed that it is hard to know what you need without a strong TAM program. She feels that having money makes it easier to do the long-term fixes that are needed instead of relying on Band-Aid solutions. It also allows agencies to show elected officials that the agency is using the money effectively to make progress toward goals.
  - **Mester** interjected that when you do not have enough money, TAM provides the context for prioritization. It enables an agency to communicate what they can and cannot do with the levels of funding provided.
- With the increased focus on technology, many of today's transportation jobs will not exist. How are you preparing your workforce for these changes?
  - **Kildare** stressed that there is not a surplus of talent, and within the industry, new jobs are being created that never existed before. He does not expect that people will be completely replaced in transportation agencies, so he sees a continued need for expert knowledge.
  - **Berman** reported that Caltrans is hiring more than 100 engineers each month; however, they are looking at new ways to organize the agency, and TAM is helping with that. She illustrated the changes in jobs with toll booth operators. With the new technology being used to collect tolls, she anticipates that within 5 years, there will be no more individuals serving as toll collectors. However, there will likely be an increased need for electrical engineers. Therefore, it is important to anticipate the kinds of skills that will be needed in the future and work with community colleges and universities to ensure that individuals with these skills will be available.
- How can industry help government agencies implement TAM?
  - **Berman** indicated that the private sector provides a lot of the information [e.g., geographic information system (GIS)] about the Caltrans system. She further emphasized that technology is changing at an incredible pace, so industry needs to work with agencies to build credibility in how the information can be used.
  - **Kildare** suggested that industry should also help steer practitioners toward the future. He indicated that many agency people are "busy working in the now" so they are not as aware of potential future developments that could shape the industry.
- Are agencies really using information on how assets are performing? Is the information feeding into new designs, for example?
  - **Kildare** stated that this is an evolutionary process. There are many agencies that are now collecting and analyzing data and changing their business processes. Some types of data are easier to get than others, so many agencies are focusing on that data for now. Once they have confidence that the data can be kept current and are of good enough quality, they will take steps to expand the number of assets covered and the maturity of the data collected.

Mester closed the opening session by thanking the panel members and inviting all participants to enjoy the remainder of the conference.

Overview of Conference Tracks

The breakout sessions featured a total of 30 different sessions organized by technical track in collaboration with the transit and resilience cross-cutting teams. Each of the tracks sponsored at least five sessions, with at least one session being a discussion. In some cases, sessions were co-sponsored by two tracks if the presentations covered topics of interest to both groups. For the purposes of this report, the session material is organized by track. Following the session are key takeaways suggested by the recorders who took notes during the conference sessions. The session overviews are almost exclusively based on the information provided by the session recorders, whose efforts are very much appreciated.

Track 1: Analyzing and Optimizing Investment Decisions

Investment Trade-Offs: Rapid-Fire Session

In this rapid-fire session, which was moderated by **Scott Richrath** (Atkins), participants made short demonstrations and presentations designed to stimulate discussion and thought exchange about investment trade-off decisions. Participants were encouraged to interact with presenters during the conference to get more detail. Because of the nature of this session, no key takeaways were identified.

Thinking Ahead: A Forward-Looking Approach to Cross-Asset Trade-Off

Prashant Ram (Applied Pavement Technology, Inc.) introduced a forward-looking approach to cross-asset trade-offs that considers the whole life of an asset, innovative performance measures, and a multiyear, multistrategy analysis. He indicated that a whole-life analysis should consider long analysis periods and look at various treatments aimed at lowering whole-life costs. Performance measures should be actionable and should be useful for setting targets. They should also be easy to implement. The analysis should help an agency decide whether they are making the right long-term decisions and whether the plan is financially sustainable. Ram also stressed the importance of visualization to help communicate results.

Cross-Asset Optimization System for Long-Range Investment Planning of Highway Infrastructure Assets

Mahmoud Halfawy (Infrastructure Data Solutions, Inc.) discussed a tool to help agencies balance investments across different asset systems. This asset optimizer considers specific performance measures for each asset type for project selection decisions that consider risk and life-cycle costs. It goes through a two-step process: first, a strategy is developed for each asset class, and then the mix of projects is analyzed across asset classes. The mix of projects that achieves the best target at the lowest cost is recommended.

An Optimization Model to Determine Critical Budgets for Managing Pavement and Safety

Promothes Saha (University of Wyoming) discussed both pavement and traffic safety management systems that focus on low-volume roads. In the tool, crash data and pavement condition data are combined. The pavement management system helps agencies realize that preventive maintenance is more cost-effective than rehabilitation, and the safety

management system demonstrates that countermeasures with higher crash-reduction factors and lower costs are the most cost-effective. The outputs include recommended treatments that fit within a constrained budget.

CROSS-ASSET NETWORK-LEVEL INVESTMENT TRADE-OFF ANALYSIS TOOL

Eddie Chou (University of Toledo) has developed several tools for the Ohio DOT, including a pavement and bridge deterioration forecasting tool that uses a probabilistic modeling approach. He is currently working on a network-level investment trade-off tool that will help maximize network conditions with an available budget.

VALUE-BASED CROSS-ASSET MANAGEMENT FOR TRANSPORTATION ASSETS

Susan Tighe (University of Waterloo) discussed a cross-asset management tool that considers an asset value index as the common indicator. For each maintenance activity, the return on investment is generated and used to prioritize recommended projects.

INCREASING YOUR VALUE THROUGH PRIORITIZATION AND PROJECT SELECTION THAT YIELDS PERFORMANCE

Dan Pitzler (Jacobs) introduced a multiobjective decision analysis approach that supports an agency's project selection process by aligning it with agency goals. Pitzler stressed the importance of leadership commitment to the success of this process. The tool Pitzler demonstrated can be used for multiple applications, and he shared that it is currently being used by both the New Mexico and Colorado DOTs. State DOTs that have used the tool have indicated that it helps create collaboration, is data-driven, and helps the agency better track performance and investments through a robust trade-off analysis that improves both accountability and transparency.

SEATTLE DOT: ALIGNING PERFORMANCE RESULTS WITH MISSION, VISION, AND GOALS

Terry Martin (Seattle DOT) introduced the DOT's *Moving the Needle* report,[1] which presents goals, outcomes, and metrics in several areas. The Seattle DOT currently tracks and reports 96 different types of performance measures. Martin showed how some of the measures illustrate how interconnected the city is (e.g., travel accessibility is increased by having the walk to a bus being no more than 10 minutes). He also said customer satisfaction surveys are sent out to help the city learn more about what is important to its customers. The survey results also provide feedback for continuous improvement.

[1] Seattle Department of Transportation. 2017. *Moving the Needle: 2017 Performance Report*. Seattle, Wash. http://sdotblog.seattle.gov/2017/10/10/check-it-out-sdot-releases-new-performance-report/.

How to Model Dedicated Funding Streams and Asset Eligibility Requirements in FTA's TERM Lite Tool

Nicholas Richter (WSP) discussed the use of FTA's TERM Lite tool for transit asset management. The tool produces 30-year capital needs projections based on an agency's asset inventory and predicts asset performance on the basis of available funding. Richter highlighted several features of the new version of the program, including a scenario manager function that tracks asset eligibility within funding buckets.

Utilization of Strategic Asset Management to Assist in the Allocation of Resources Across Multiple Transportation Asset Classes

Joshua Johnson (Bentley Systems) introduced several decision support tools for TAMPs, including a tool that integrates an asset's life cycle and an information exchange in a central hub. He also discussed a strategic asset management tool that extracts data from multiple sources and allows assets to be edited geospatially through the software.

Integrating Risk Tolerance and Life-cycle Cost Analysis into the Development of TAM Investment Strategies

Richard Boadi (Wood Environment & Infrastructure Solutions, Inc.) discussed a case study of two pavement categories that looked at the impact of performance on risk and asset life-cycle costs. The approach showed promise, but there are challenges in terms of the capabilities of existing tools and stakeholder resistance to change. Future considerations of this approach will explore different cost variables and risk measures.

Connecting Research to Application

This session, moderated by **Rob Kafalenos** (FHWA), focused on finding new ways to improve asset optimization in the future and how outside constraints, such as politics and new policies, can change how agencies optimize for maintenance. The presentations ranged from thinking about the way assets are managed to looking at more efficient ways to optimize and treat pavement assets. Discussions addressed how to better educate the public on TAMPs and how to address fear of change.

Highway Corridors of the Future: What Every Asset Manager Needs to Know

Gareth McKay (WSP) introduced safety and reliability as the two most common priorities in state DOTs. However, changes are being introduced through technology and other advancements that are forcing agencies to begin thinking about how assets will need to be changed to adapt to new transportation practices. To illustrate the point, McKay asked participants to consider whether autonomous vehicles will need different types of signs, lighting, safety systems, and noise walls. He further challenged participants to think about

whether machines read signs differently than humans, whether lighting could be reduced, and whether safety systems can be modified with reductions in human errors. He stressed the importance of considering these types of anticipated changes in standards, policies, and future goals.

Influence of Cost and Deterioration Uncertainties on Maintenance, Rehabilitation, and Reconstruction Allocation Decisions in Pavement Management Systems

Fengdi Guo (Massachusetts Institute of Technology) addressed uncertainties that are inherent in pavement management systems, including uncertainties in the rate of pavement deterioration and treatment costs. In a study, Guo compared the benefit–cost ratio of several treatment options against a probabilistic treatment path dependence (PTPD). He presented a case study illustrating how PTPD incorporates uncertainties to improve predictions to help optimize the use of available funding.

Maximizing Investment Efficiency in Municipal Pavement Preservation Programs

Roozbeh Rashedi (Infrastructure Solutions, Inc.) recognized that in many of the municipalities that he had worked with, there was a lack of effective analytical tools based in solid engineering principles. To overcome this gap, Rashedi conducted a beta test using a simple analysis tool that supported the use of pavement preservation programs in small municipalities. The pilot program showed that optimizing the use of funds through pavement preservation reduced costs by 7% to 17%. The results were packaged in a way that enabled municipalities to better communicate with stakeholders.

A Plan for Every Section of Every Road of Every Island

Goro Sulijoadikusumo (Hawaii DOT) discussed an initiative undertaken by the Hawaii DOT to make better decisions using existing data. The DOT developed an information system for managing its entire highway infrastructure and supported it with lidar to build its inventory and laser crack measuring system to collect pavement information. The agency implemented a preservation-first strategy and put in place a 5-year preservation plan. During this process, the agency learned that it is important to make these practices part of the culture, that it is important to keep the process from getting too complex, and that decisions should be transparent, maintainable, and repeatable. The Hawaii DOT expects to implement pavement management software soon with improved analytical capabilities.

Key Takeaways

- TAM practices are constantly evolving, with changes in technology and how assets are used and defined. For example, agencies will need to adapt assets to meet the needs associated with autonomous vehicles.

- Many new tools are emerging that will help agencies prioritize and manage assets, from new prioritization models to less-complicated systems with shorter processing times.
- Several presenters acknowledged their interest in using TAM and TPM principles to meet agency goals, not just address asset conditions.
- There are challenges associated with changing an organization's culture, accepting new tools, and thinking outside the box to address funding shortfalls.

Tools that Drive Asset Investment Decision-Making

In this round-robin session moderated by **Ted Hull-Ryde** (Atkins), attendees rotated among the presenters to engage in discussions and information exchanges. Because of the nature of the session, no key takeaways were identified.

Integrating Extreme Weather Risk into Asset Management at the U.S. Fish and Wildlife Service

Cassandra Bhat (ICF) discussed the two-way relationship between risk and asset management. She said that asset management informs risk assessment and risk assessment informs asset management. In a project for the U.S. Fish and Wildlife Service, exposure (e.g., geospatial hazards), sensitivity (e.g., remaining service life), and adaptive capacity (e.g., historic status) were considered to determine vulnerability to climate change. The tool presents information in a geospatial format and summarizes information in a way that determines investment priorities.

Using Adaptive Management to Increase Resilience

Brenda Dix (ICF) discussed the need for agencies to have a structured approach to managing climate risks over time and suggested that pairing adaptive management and asset management is a cost-effective way to ensure resilience given an uncertain future. She discussed the commonalities between asset and adaptive management, including the focus on addressing current issues while preparing for the future and minimizing life-cycle costs. Adaptive management provides agencies with an approach to managing evolving risks under uncertainty. Dix then illustrated how adaptive management applies to climate change uncertainty to reduce up-front capital costs, minimize life-cycle costs, define adaptation triggers, and incorporate adaptation planning into asset management.

Integrating Risk Assessment into the Decision-Making Process Within Asset Management Systems

Nima Kargah-Ostadi (Fugro USA Land, Inc.) illustrated a process for considering risks in decision-making processes. He illustrated the process for assessing the risk that an agency will not achieve its pavement-related targets, taking into account variability in condition data, uncertainty in models, and variability in treatment costs. The analysis used a Monte

Carlo simulation, and a sensitivity analysis was conducted to look at the significance of each source of variability. Candidate solutions for mitigating risks were evaluated by using a weighted priority score based on the benefit–cost ratio associated with each treatment. Kargah-Ostadi closed with a discussion of how these results can be integrated into asset management decisions.

Practical Uses of Risk-Based Prioritization for Transit State-of-Good-Repair Investments

Emily Grenzke (Kimley–Horn and Associates) reviewed guidance and standards available on asset management and risk management and presented a practical approach to embedding risk rankings into a condition database and to using risk-based prioritization criteria in long-term project selection processes. For the long-term example, she used the FTA's TERM Lite software and illustrated how it can be modified to support risk-based prioritization scoring. Using a case study from the Washington Metropolitan Area Transit Authority, she was able to produce risk profiles displaying 10-year state-of-good-repair needs that illustrated which tunnels had the highest likelihood of failure due to ongoing water intrusion; however, rail revenue vehicles had the highest consequence of failure.

Spreadsheet Tools for Analysis of Transit Asset Investment Needs and Quality of Service Impacts

William Robert (Spy Pond Partners, LLC) reviewed three different transit investment tools: a transit asset prioritization tool, an effective journey time calculator, and a state-of-good-repair return-on-investment calculator that is under development. The transit asset prioritization tool is a spreadsheet tool that was developed under two Transit Cooperative Research Program (TCRP) projects. It includes asset life-cycle models, a prioritization process, and performance summaries and is now supplemented by a web site external to the TCRP project. The journey time calculator is a set of two spreadsheet tools for relating transit asset conditions to service quality that are detailed in *TCRP Research Report 198*.[2] The state-of-good-repair return-on-investment calculator is currently under development through TCRP Project E-12. It will include guidance development, the return-on-investment calculator tool, and pilot studies.

Considering Socioeconomic and Environmental Criteria on Paved Road Network Investments: The Case of Costa Rica's National Road Network

José David Rodríguez (University of Costa Rica) provided background information on Costa Rica's national paved road network, including the fact that it has traditionally been managed with a worst-first approach. The Costa Rica Road Authority does not have

[2] Spy Pond Partners, LLC; AECOM; McCollom Management Consulting, Inc.; H. Cohen; and S. Silkunas. 2018. *TCRP Research Report 198: The Relationship Between Transit Asset Condition and Service Quality*. Washington, D.C.: Transportation Research Board. http://www.trb.org/TCRP/Blurbs/177448.aspx.

forecasting tools available and investments rely on individual efforts to advance a project. The lab from the University of Costa Rica (LanammeUCR) conducted a research project to consider social and economic competitiveness and environmental costs in evaluating pavement investment options. The research found that the relationship between social and economic indices as prioritization criteria generates outcomes similar to pavement condition indices. The study also found that a comprehensive approach is needed to get close to the national goal for carbon neutrality. Finally, the study suggested that institutional aspects and political support are fundamental next steps to undertake action on pavement management in Costa Rica.

Investment Resources for Asset Managers

This session was well attended, with approximately half the audience representing highway and transit organizations and half representing private-sector participants. The session introduced ideas to help agencies guide their investment decisions. It was moderated by **Tom Wesp** (Data Transfer Solutions LLC).

Determining the Value of Information in Asset Management Decisions

David Luhr (Washington State DOT) discussed the Washington State DOT's process for determining the value of information in making asset management decisions, which was driven by proposed budget cuts the agency was facing. He showed a decision matrix illustrating the variability between age-based decisions and condition-based evaluations and discussed the elements that contribute to the variability between the two approaches. He showed that the use of a condition-based evaluation enables an agency to save a significant amount of money. As a result, the Washington State DOT concluded that good condition information has a significant value with a 13 to 1 return over poor information. He suggested that striving toward having good condition data available is a smart investment for agencies.

A Practical Framework for Managing All Transportation Assets

Shobna Varma (StarIsis Corporation) introduced a five-tier approach to managing assets, with Tier 1 being the most rigorous, with a very detailed inventory and condition assessments, and Tier 5 being the simplest, with a focus on asset replacement at failure. She suggested that the targeted management strategy often has to do with how critical the asset is to the organization. Therefore, she pointed out, it may not be necessary to have a complex approach to managing assets for some asset classes.

Iowa DOT Project Scoping and Prioritization Process

Brad Hofer (Iowa DOT) demonstrated a geospatial approach that the Iowa DOT is using to monitor the status of projects in the development process. Using color coding and drill-

down features, DOT staff can obtain photos, environmental impact reports, right-of-way impacts, and other types of information about a project. The tool is still under development, and the Iowa DOT has created a plan for further developments of the tool to increase its applicability throughout the agency.

KEY TAKEAWAYS

- Several tools are being developed that could be applicable to multiple agencies. Agencies with gaps in a particular area could benefit from tools and processes being used in other agencies.
- Information systems and management systems have both value and cost. Therefore, they should be evaluated before they are implemented.

Optimizing Investments

A standing-room-only crowd listened to four presentations from speakers encouraging strategies to optimize asset investments. The session was moderated by **Scott Richrath** (Atkins).

TRANSLINK'S ENTERPRISE ASSET MANAGEMENT JOURNEY: FACTORS OF SUCCESS AND LESSONS LEARNED

Vikki Kwan (TransLink) reported that TransLink began its enterprise management activities in August 2015. Prior to that, the Capital Asset Prioritization Investment Tool for Advanced Lifecycle Management (Capital-M) had been used to proactively manage its assets. With the asset management program, the focus shifted to using data to clarify investment needs with a 10-year outlook that considers criticality and other factors. TransLink now has an asset renewal program in place for nine of its 31 asset classes and a decision-support framework that is supported with asset management software. There is good buy-in from leadership, which has contributed to TransLink's success.

USING DATA TO MAKE BETTER INVESTMENT DECISIONS: A REVIEW OF THE NY MTA'S 35-YEAR HISTORY OF $118 BILLION WORTH OF INVESTMENT TO RESTORE AND IMPROVE ITS SYSTEM

Stephen Berrang (New York MTA Headquarters) and **Mildred Chua** (New York MTA Bridges and Tunnels) shared their experiences with using data to improve asset decisions. The New York MTA has an asset inventory valued at more than $1 trillion dollars. In the past, system performance had been bad, with derailments, crime, and other issues. Requirements to develop 5-year capital plans, which support the agency's 20-year planning process, helped the agency turn things around. It now has a 5-year plan that maintains assets through sustainable goals, and service has improved considerably.

Chua focused her presentation on the need to integrate resilience into agency practices and design standards. For the New York MTA, this realization was sparked by Hurricane Sandy in 2012. The agency's goal is to include capital, major maintenance, and preservation as well as routine and emergency repairs in an asset management plan that supports its facility master plan for each bridge and tunnel. The capital program considers both performance and resilience needs in a blended approach for making wise investment decisions.

Life-cycle Planning: What It Is and How It Can Be Used

Katie Zimmerman (Applied Pavement Technology, Inc.) presented a network-level approach to life-cycle planning (LCP), which is required in state DOT TAMPs. She introduced a five-step process for conducting LCP based on guidance issued by FHWA and suggested strategies for considering vulnerability (such as coastal and inland bridges) in the process. Zimmerman indicated that the LCP results can be used to set targets, build support for better long-term strategies, and use funds wisely.

Methodology to Enable Full TAM Plan Implementation

Paul Thompson (Consultant) introduced a cross-asset analysis methodology that is being developed under an FHWA research project. He indicated that the methodology will be piloted in at least one agency and that one of the challenges being faced is that current pavement management systems typically evaluate treatment options individually rather than as a life-cycle strategy. Bridge management systems do a better job of considering life-cycle strategies. Thompson reported that the study will identify changes that are needed to existing analysis tools to better support the type of cross-asset methodology being developed under this study. He suggested that future tools could improve their ability to model social benefit and show the impact of different treatments in terms of both structure and social, environmental, and safety impacts. He also provided information for any state DOT interested in being considered as a pilot agency.

Key Takeaways

- Evolution of TAM: Transit providers and state DOTs are progressing with regard to how to do LCP and asset management overall. Tools are improving to help them, and presenters expect the next generation of tools to help answer more questions. However, the tools are not expected to replace staff analysis and interpretation of the results.
- Sustainability of TAM: The sustainability of TAM programs is embedded in organizational culture; it may take time, but mainstreaming TAM practices across relevant parts of an agency is key to success.
- Influence of technology on decisions: Technology is getting better, but more work is needed to improve management systems to support answering more questions.
- How data are used to communicate with multiple audiences: Data are key to winning over stakeholders—particularly management—to fund the right investment priorities. Both the first and second presentations in this session illustrated that point well.

Discussion Session:
Bridging the Gap Between Research and Implementation

A small number of conference participants (approximately 15) participated in this discussion session. They addressed discussion questions prepared by **Sue McNeil** (University of Delaware), who served as the moderator. The questions and the responses are provided below.

What are Factors Preventing Researchers and Contractors from Meeting the Needs of Practitioners?

- The procurement process.
- Agencies are hesitant to try something new or better without another state doing it. Once one state does it, others follow.
- There is not a good understanding of what owners really need. Once needs are better understood, a process for conducting the research can be better developed.
- There is more of a trend to emphasize implementation as part of ongoing research efforts. Several states require an implementation plan up front.
- There needs to be a better understanding of basic research versus applied research.
- It would be helpful to have more multidisciplinary teams working together to address a problem.

What Steps Could Be Taken to Better Align Researchers' Work and Products Provided by Contractors With the Needs of Practitioners?

- Recognize that there are different types of research projects. Some address known gaps while others address improved ways of doing business. The second are often harder to implement, because an agency has to recognize the advantages to the change.
- Get products reviewed by intended users and get transparent feedback.
- Have a champion willing to take the initiative.
- From a researcher's perspective, look into how to better present the findings.
- Look into which research outcomes were implemented and why that happened.
- For each research effort, figure out what is really wanted from the study. It is also important to be able to change the research scope if necessary on the basis of preliminary findings.
- Make technology transfer approaches more practical. Participants did not feel 800-page documents were particularly helpful for promoting implementation.

What Do Practitioners Need to Better Use Research Results to Address Extreme Weather Resilience in Their Asset Management Plans?

- Mandates that require agencies to address these issues are needed.
- FHWA's role is to encourage and help states. Pilot programs are very helpful because they result in best practices that other agencies can use.

- It is important to create demand in some way and make people more aware of the issues.

How Can Practitioners Better Evaluate Options Available to Them to Determine Whether Products or Tools Will Meet Their Needs?

- Demonstrations of new technology often lead to implementation and then standardization. It is helpful to have a plan for this transition.
- Regional face-to-face meetings after a research project ends can help drive the implementation process.
- Full disclosure on research products is needed so that agencies understand what the products can and cannot do.

Other Discussions

The participants discussed other topics, including their ideas for TAM research needs. Among their suggestions were the following:

- Deterioration rates that consider climate differences and other factors;
- Overall sensitivity of findings and results;
- How to incorporate changes in technology, construction, and design into TAM decisions;
- How to link TAM with the transportation planning process;
- How to use big data in asset management;
- Strategies for continuous structural monitoring;
- Techniques for managing a series of pavement treatments from a life-cycle perspective; and
- Applying TAM principles to managing human resources.

Key Takeaways

- Place an emphasis on communication.
- Recognize basic versus applied research.
- Create multidisciplinary research teams.
- Identify champions in agencies to take the initiative to implement the results of research.
- Convert technology transfer into manageable small pieces rather than long reports.
- Use GIS-based simulation or visualization tools to help make the case.
- Create demand in some way. People need to be made aware.
- Put a plan in place to move research from the demonstration phase to the implementation and standardization phases.
- Offer regional implementation face-to-face meetings at the end of a research project to help drive the implementation process.
- Have a good understanding of what research results can and cannot do.

Track 2: Data Systems to Improve Decisions

Data Collection to Support TAM Decisions

This session featured presentations describing data collection activities that were being used to support TAM decisions. The presentations represented different approaches to data collection from high-level data collection and analysis by transit agencies across the nation to state data collection efforts on nontraditional assets. The moderator, **John Puente** (Ohio DOT), opened the session with a short summary of practices at the Ohio DOT regarding TAM audits, policies, and workflows.

Data Governance for Asset Management and Safety: An Integrated Approach at the Connecticut DOT

Karen Riemer (Connecticut DOT) opened her presentation with a timeline that the DOT is using to ensure that asset management and safety requirements are being met. **Frances Harrison** (Spy Pond Partners, LLC) then introduced TAM readiness assessments that had been conducted, including a description of the process, the elements evaluated, and the lessons learned. Riemer followed this with a discussion of data governance at the Connecticut DOT from several perspectives, including basics, structure, owners, stewards, metadata, and guidance for the Transportation Enterprise Database. She also shared challenges, as well as a successful data governance approach that included making decisions together as a group, establishing authoritative data sources, and setting up metadata standards. The presenters also recognized the continuing challenge to maintain data quality.

Management and Practical Uses of Transit Condition Data

Rick Laver (CH2M Hill) shared lessons learned from data collection activities supporting compliance with the FTA's Final Rule on Transit Asset Management, which requires condition assessments of all facilities for transit modes. In this study, they collected high-level measures from 30 agencies of all sizes and transit models. The results were presented to show average conditions, condition distributions, and comparisons of condition to performance. In addition, Laver shared methods of storing and using the condition information.

Selecting Data to Best Support Asset Investment Decisions

Prashant Ram (Applied Pavement Technology, Inc.) presented the reliability-centered maintenance (RCM) approach for determining the most effective maintenance strategy for various types of transportation assets. Ram shared two case studies using the RCM approach, including one from the Indiana DOT (a condition-based approach) and another

from the Nevada DOT (an interval-based approach). He stressed several keys to successfully using this approach, including (1) using performance measures to define and improve agency goals; (2) recognizing risk, changes, and gaps; (3) including all business units in determining what data to collect; and (4) establishing a realistic understanding of the asset's function and the consequences associated with failure.

KEY TAKEAWAYS

- It is important to take steps to plan for data collection, maintenance, and governance before data collection efforts begin.
- Not all assets are best managed by using a condition-based approach. The RCM approach can be used to help agencies determine the best management strategy for any asset.

The Business of Business Intelligence in TAM

This session, moderated by **Ian Kidner** (Ohio DOT), highlighted some best practices for using management systems to analyze information to support decision-making. The presentations included discussion of business intelligence concepts and the advancement of big data to support agency needs.

THE I-70 RISK AND RESILIENCY PILOT: PROACTIVE MANAGEMENT OF THREATS, OPTIMIZING INVESTMENTS FOR IMPROVED RESILIENCY OF COLORADO HIGHWAYS

Toby Manthey (Colorado DOT) introduced a risk and resiliency pilot conducted by the Colorado DOT and explained the motivation for the project. The agency used the Risk Analysis and Management for Critical Asset Prediction (RAMCAP) Plus process to prioritize its critical infrastructure. Manthey's presentation stressed the importance of planning ahead for emergency events and having the tools and resources available to support the collection of data that will be used to inform decisions. The Colorado DOT is currently incorporating the risk analysis into its multiobjective decision analysis to further integrate risk and resilience into agency decisions.

UTILIZATION OF AASHTOWARE BRM TO MEET AGENCY POLICIES AND OBJECTIVES FOR BRIDGE MANAGEMENT

Joshua Johnson (Bentley Systems) and **Harjit Bal** (New Jersey DOT) discussed the implementation of the AASHTOWare Bridge Management (BrM) software at the New Jersey DOT. They discussed the challenges they faced during the implementation and how each of the major BrM components was addressed. Their work helped the DOT realize the importance of data sharing and data transfer across agencies and DOTs. The agency also recognized the need for data-driven methodologies that take into consideration LCP and preservation.

Filling the Tank: How Better Asset Information Fuels Better Asset Management

Simon Smith (AMCL) discussed the importance of data to asset management and suggested that agencies often find they do not have the information needed. Smith suggested a three-step process for improving the potential of the data agencies are collecting: (1) understand what asset information means to your agency and how it is used; (2) identify your asset information needs, challenges, and decisions; and (3) improve your asset information. He stressed that asset information is vital to getting asset management in a position that can truly inform business practices, agency decisions, and how stakeholders interact with assets.

Key Takeaways

- Business intelligence is powerful when used with data-driven information that can inform how stakeholders interact with assets.
- Business processes and decisions that are made by executives need to demand data from operators and staff in other parts of the agency that are information rich.

Data Visualization to Communicate TAM Results

This session had more than 100 participants representing a cross section of agency types. It included two presentations, a panel, and a demonstration on the uses of data visualization. The moderator, **Frances Harrison** (Spy Pond Partners, LLC), opened the session with two quotes:

> The greatest value of a picture is when it forces us to notice what we never expected to see. —John Tukey

> Graphical excellence is that which gives to the viewer the greatest number of ideas in the shortest time with the least ink in the smallest space. —Edward Tufte

System of Engagement (Strategic Data Integration)

Stan Burns (Integrated Inventory, LLC) explained that data are often stored in multiple systems within one organization. These systems can be complex and may require experts to extract the data. The New York State DOT is creating a single, shared, authoritative destination for data and information. The agency has map-based apps that combine data sets and make the information accessible to anyone.

Tostada—It is Not Just for Dinner Anymore, It is More, It is Data Integration

David Schrank (Texas A&M Transportation Institute) stated that many agencies store data in multiple systems that do not talk to each other; however, comparing different sets of

information is valuable. The Texas A&M Transportation Institute is layering asset data and performance data in one location so that systematic problems can be realized and benefits can be communicated across multiple asset and performance categories. To compare unique data sets, Schrank showed an example of how to normalize separate indices to create a combined index.

PANEL DISCUSSION

Panel members included **William Johnson** (Colorado DOT), **Anne-Marie McDonnell** (Connecticut DOT), and **Mathias Burton** (Socrata). The questions posed to McDonnell and Johnson included the following:

- What story have you told through visualization?
- Do you have dedicated staff for data visualization?
- What advice do you have for other agencies practicing data visualization?

McDonnell provided the following responses:

- The Connecticut DOT uses fact sheets about its assets as a tool to convey information quickly.
- Visualization is about illumination and discovery. It can be used to learn things that would not be seen otherwise.
- Agencies should not analyze one variable at a time. They should look at many factors for true success.
- It is important to cultivate a role in transportation organization for creative, agile employees because data visualization will be a tool to help answer some of the complex transportation issues of the future.

Johnson's responses to the same questions are as follows:

- The Colorado DOT created a publication that ranked its DOT against other state DOTs, highlighting all the good things the Colorado DOT is doing with its money.
- Maps are an effective way to visualize data, so they should be used whenever possible.
- Agencies do not always need GIS staff or data visualization experts to create effective graphics. Agencies can use existing resources.
- Agencies can learn from what other state DOTs are doing.

The session concluded with an overview of data visualization best practices by Mathias Burton. He recommended attendees understand their data, define their audiences, and identify the questions they are asking before beginning to visualize their data. He also suggested attendees make their displays minimal, that they be aware of connotations associated with certain colors, and that they include metadata with public-facing data displays. Burton showed several visualizations displaying the Seattle DOT's bridge data that could be used in front of different audiences.

KEY TAKEAWAYS

- Agencies can discover complex, systematic problems by analyzing multiple data sets at one location. This method improves transparency and consistency in decision-making.
- Freeing data from systems that only experts can use creates a new way of thinking about data.
- About 20% of the data are used 80% of the time. It is important to prioritize making the important data available first.
- Administrators come and go, but systems, policy, and strategy leave a long-lasting effect.
- Data visualization with systems such as Tableau, Socrata, and Excel can illuminate discoveries that would not have been realized otherwise.
- Sharing data visually can help to quickly and clearly communicate with multiple audiences.
- Visualizations should be created with the target audience in mind, which will dictate the story that is being told.

Discussion Session: The Data Governance Road Less Traveled: What Did Your Agency Learn Along the Way?

This discussion session began with opening presentations by the two moderators, **Margaret Poteat** (KPMG LLP) and **Anita Vandervalk-Ostrander** (Iteris). Poteat described data governance and a strategy executed through a set of processes that ensures accurate data enabled by technology. She suggested that data governance practices will enable agencies to more easily obtain a cohesive, coherent, timely view of asset information so data can be more readily turned into insights. Poteat introduced a governance framework designed to address structure, components, and roles and responsibilities. She stressed that data governance is a long-term, strategic view that is repeatable, flexible, adaptable, and scalable to allow for continual growth and sustainment of data integrity for the long term.

Vandervalk-Ostrander discussed the importance of business planning to optimize asset management decisions. Following her presentation, the participants addressed a series of questions that had been selected for this session and shared their experiences with data governance.

Is the Sky Really Falling? Communicating TAM Results

This session included a mix of transit, city, and state agency speakers representing a range of experiences. Their presentations focused on the use of GIS for asset data determinations, the process of improving decisions with better data, and the use of sidewalk data to inform maintenance prioritization. The presentations illustrated how in-house, home-grown tools

have enabled agencies to solve problems associated with data collection and reporting to improve decisions.

Smart Use of GIS Data to Determine Asset Age

Royce Greaves (WSP | Opus Canada) discussed the challenges many agencies face regarding the quality of asset age and cost data. He introduced a process that uses records, such as utility installation dates, building permit data, and subdivision consents/permits, as a way to obtain this type of information with the use of GIS. Agencies that have used this approach have seen a significant increase in data quality at a minimal cost. The process highlights the importance of GIS analysts in transportation agencies and the importance of sharing data with other agencies, such as utilities. Greaves encouraged participants to think about data that other agencies might have to help validate data or to build a more complete asset database.

TransLink's Capital Investment Decision Support Journey

Vikki Kwan (TransLink) discussed the agency's enterprise asset management program, which was established to enable proactive asset management and cross-enterprise partnerships. The program is used to answer two key questions: Are we funding what is needed? How do we prioritize capital investment projects? TransLink established scoring criteria for evaluating capital project requests that are not constrained financially. Rather, the process looks at how well the project addresses agency strategy and policy initiatives, the impact on the customer experience, business effectiveness, added safety and security, and other factors. The process has helped drive discussion about what TransLink's corporate priorities should be. Through the development of this process, the agency has recognized strong alignment of corporate goals, buy-in among agency personnel, justification for changes to prior processes, and the importance of increasingly engaged stakeholders.

Seattle's Sidewalk Assessment and Prioritizing Repairs

In a joint presentation, **Colleen Fegley** and **Emily Burns** (Seattle DOT) introduced the sidewalk assessment project implemented by the City of Seattle. Data collected for the project were recorded with a Collector App on iPad minis. The tool development and testing began in January 2017, and data collection conducted by interns on more than 34,000 blocks took place between May and September 2017. The data were processed, summarized, and presented to the City Council in spring 2018 with map displays. In addition to being used in presentations to City Council, the information has been used to communicate with other stakeholders, including citizens, agency partners, engineers, planners, and city crews. Several formats were used to present the information, including media and blogs, presentations to pedestrian advisory boards, a website, and information cards distributed to citizens during the data collection process. The process has enabled the city to allocate its limited budget to provide the best value for the community, it has

enabled city maintenance crews to feel more invested in repairs, and the public has more confidence in the way sidewalk investments are being made.

KEY TAKEAWAYS

- Other agencies (e.g., utility companies) often have data that might be able to be used to validate transportation agency data or to build a more complete picture of the assets.
- Decision support tools that prioritize capital projects and support decision-making can be used to drive the discussion about corporate priorities.
- The success of decision support tools is advanced through strong sponsorship, change management, and stakeholder engagement.
- Agencies should look for partners to deliver improvements such as sidewalk repairs.
- Open-source data collection and in-house tool development can be an effective first step in asset management.

Track 3: Implementation

Implementing Performance Management

This session, moderated by **Michael Johnson** (Caltrans), included a summary of Caltrans' experience in setting up its TAMP from both the headquarters and District 11 perspectives. It also included a presentation on the evolution of the Iowa DOT's experience with asset management over 20 years. The session was well attended, with about 30% of the audience new to asset management.

Implementing a Performance-Based Asset Management Approach in California

Michael Johnson (Caltrans) reported that Caltrans' 10-year State Highway System Management Plan successfully integrates their 10-year rehabilitation and 5-year maintenance plans and is unprecedented in terms of the transparency and degree of integration in the plan. There are 34 objectives that help align the plan around the department's strategic goals. During the plan's development, Caltrans estimated that its unconstrained need totaled $86 billion, but available funding was only $45 billion. To address its highest priorities, the agency developed a trade-off tool that would allow it to evaluate different options across assets to see whether statewide goals could be achieved. The districts are key to implementing the plan, so they received a summary of the state's 34 goals, a comparison of District 11's performance in each goal area, and a list of pipelined and new projects. The information provided districts with the information needed to track projects and monitor their alignment with statewide objectives.

Shopping for Assets

Richard Estrada (Caltrans) followed the previous presentation with a discussion of District 11's perspective on the new process. He indicated that when he thinks back on the process, there have been substantial changes in how project plans are communicated. They now have monthly calls across the state to figure out how to deliver their statewide Plan and they have much more interaction with local agencies.

When the district receives its budget, it identifies which of the 34 objectives it is to address. The estimate from headquarters as to how the specific budget for the district was reached was helpful, but the district personnel also took into account unique challenges across their area, including economy and tourism, the environment, border crossings, and agriculture. From an organizational perspective, there was a disconnect between what people had been doing and the roles and responsibilities needed with TAM. In response to this, District 11 created a State Highway Operation and Protection Program nomination team with new members representing corridor management, planning, environmental, bike and pedestrian, and so on. It also established some new district business practices to support

its efforts. It is hoped that in the future, improvements in how the districts receive credit for the work they are doing will be able to be seen and that improved tools that support the new process will be obtained.

TAM Governance Journey at the Iowa DOT

Matt Haubrich (Iowa DOT) outlined the history of asset management at the Iowa DOT beginning in the 1990s, when the agency first started using asset management concepts. Its efforts were derailed by leadership until a TAM champion was appointed in 2011 at the director level with a vision to build a "world-class" asset management system. One of the first discoveries was that it was hard to find a home for asset management because of its cross-functional nature. As a result, the Iowa DOT recognized that implementing TAM would involve organizational change. The DOT formed the Performance and Technology Division in 2012 and visited four peer states in 2013 to identify success factors and challenges to avoid during TAM implementation. It continues to work on organizational issues and ways to engage agency personnel in helping to create an effective TAMP.

Key Takeaways

- Asset management often involves an agency reorganization and breaking down of silos.
- TAM maturity is growing, and implementation is getting stronger.
- Data are important, but it is not always good to be down in the weeds, especially when communicating with executives.

Discussion Session: Our Initial TAMP Is Done—What Now?

This discussion session, which was cosponsored by the TAMP track, was facilitated by **Heather Holsinger** (FHWA) and provided an opportunity for practitioners to discuss issues related to developing their initial TAMPs and what they have planned for their future TAMPs. Participants were organized in five groups and were asked to discuss their responses to the six questions listed below.

1. What lessons did you learn from the development of your initial TAMP? How will those lessons shape your future TAMPs?
2. What data, information, or analyses do you need to work on to better set targets, plan investments, or manage risks?
3. What steps have you taken to address extreme weather resilience in your risk and LCP processes?
4. How did you address the 23 CFR Part 667 (Periodic Evaluation of Facilities Repeatedly Requiring Repair and Reconstruction Due to Emergency Events) requirements to develop a process for conducting statewide analyses to determine whether there are

reasonable alternatives to assets that have required repair and reconstruction activities on two or more occasions due to emergency events?
5. What steps have you taken (or are you taking) to integrate the TAMP into your transportation planning processes to ensure that you are able to meet your performance objectives?
6. How do you plan to demonstrate to FHWA that your TAMP investment strategies are being followed as part of the annual consistency review?

An excerpt of the comments provided by the participants to each question is provided.

QUESTION 1: WHAT LESSONS DID YOU LEARN AND HOW WILL THEY SHAPE FUTURE TAMPS?

Lessons: A unified vision is still needed in many agencies. Agencies should begin with the goal of being clear about what they want to achieve. There is a need for improved communication, educational processes, obtaining buy-in from all of the parties involved, support from upper management, and clear explanation of the why and how of asset management. Initial TAMP development serves as a valuable experience in identifying the need to improve current processes and the need to document these established processes. Organizations may change as asset management evolves, so agencies need to remain flexible. The TAMP led to organizational development or started the conversation for the need to have a framework for it. The TAMP development process also helped agencies identify the need to have integrated systems that can communicate with one another. Another lesson learned is that it took more time than planned to develop the plan.

Challenges: Agencies face a variety of challenges, including the need for local financial information and information regarding current planning practices, difficulties correlating federal metrics with state metrics and communicating this effectively, lack of clarity in how the TAMP fits within other state planning and business processes, and the nonrelevance of federal requirements and segmentation of the National Highway System (NHS) to decision-making. There were challenges in some agencies when they found that their initial TAMPs did not meet federal requirements. In some cases, there has been evidence of a lack of consistency between comments provided to state DOTs by FHWA division offices, or comments that addressed formatting rather than substance. Other challenges involve the lack of working bridge management systems and remaining confusion about requirements and how the agency should implement TAM.

QUESTION 2: WHAT DO YOU NEED TO WORK ON?

Top answers included bridge management systems and data, accurate life-cycle information, information about the local system (e.g., financial and current management processes), deterioration models, work type costs and impacts, and ancillary asset information.

Question 3: What Steps Have You Taken to Address Extreme Weather Resilience in Your Risk and TAM Planning Processes?

Steps taken: Agencies have identified events to date, considered new design standards after effects of previous events, set money aside for mitigation, considered relocating facilities in locations prone to coastal erosion, established a data-driven risk assessment to address extreme weather and climate change, assessed the vulnerability of large culverts, developed slope stability models, and supported a separate emergency fund.

Challenges: Challenges include issues related to contingency planning for extreme events and how to design a system to predict extreme weather events and respond quickly to the events when they happen.

Question 4: How Did You Address Part 667 Requirements?

Addressing requirements: Agencies spoke directly with maintenance engineers to find out about events, looked at financial information to see where funds had gone to emergency events, correlated emergency federal funds into previous projects via a legacy project database, and developed GIS assessments and maps.

Challenges: Challenges included finding records of information to respond to Part 667 requirements, in particular dating back to required year (because the tracking of data in this way has not been required in the past). Several state DOTs indicated that they do not collect this type of information on the local systems.

Question 5: What Steps Have Been Taken to Integrate the TAMP Into Existing Planning Processes?

Steps taken: Agencies have developed strong connections and iterative approaches to TAMP and state planning and business processes, involved personnel and encouraged different units to work closely, and established processes in which the central office approves projects to make sure they support targets and balance budgets.

Challenges: These included the lack of safety performance measures for the NHS in some states, state DOTs not being ready to integrate TAMP with planning, balancing expansion and maintenance of the existing system, coordinating the TAMP with planning, and aligning all of the stakeholders involved.

Question 6: How Will You Demonstrate to FHWA That Your TAMP Investment Strategies are Being Implemented as Part of the Annual Consistency Review?

Participants indicated they would track investment levels versus strategies, stick to the plan, and align TAMP updates with current state planning process strategies.

KEY TAKEAWAYS

- The comments expressed the different levels of TAM maturity in the participating states, as well as common needs, as listed below.
- There is a need for improved and clear communication to get support from all parties involved.
- There is a need for better integration of management systems.
- There is a need for improved data, analytics, and information (e.g., what data, who is the audience, and how to use it).
- There are also challenges associated with the disconnect between the federal requirements and the way state DOTs manage their systems. Additionally, there have been inconsistencies regarding the TAMP review and certification process.
- Most states showed interest in using the TAMP to improve current management decisions and did not consider it just to be a compliance exercise.
- There were many challenges to address, but the required deadline prompted the conversation and got actions started.

Incorporating Risk in Asset Management Practice

This session with **Niles Annelin** (Michigan DOT) presiding included presentations highlighting the application of asset management techniques to geotechnical and environmental concerns. The speakers raised the point that geotechnical assets are important assets and observed that DOTs are starting to recognize the need to address them.

ASSET MANAGEMENT FOR ROCK SLOPES IN MONTANA

Darren Beckstrand (Landslide Technology) and **Paul Thompson** (Consultant) indicated that the Montana DOT was one of the first states to implement a rockfall hazard rating system, but, although the results were being used, the database had not been updated in 10 years. In 2015 an ArcGIS tool was developed to facilitate the update. Their approach used a rating system of 1 to 5, with 5 representing the worst condition. They applied a risk and economic analysis to the data to monetize risk and interviewed maintenance personnel to learn as much as possible about the frequency of rockfalls and their impacts, largely on the basis of anecdotal information. One district had very complete data that were used for statewide modeling. Mitigation costs were also estimated on the basis of interviews with maintenance personnel. Traditional asset management techniques were applied to predict needs and to put together mitigation strategies.

GEOTECHNICAL ASSET MANAGEMENT IMPLEMENTATION PLANNING FOR TRANSPORTATION AGENCIES

Mark Vessely (Shannon and Wilson, Inc.) emphasized that geotechnical assets are assets rather than risks. They are becoming increasingly important as more are being built.

Vessely reported on draft guidance that is expected to be published from NCHRP Project 24-46, Development of an Implementation Manual for Geotechnical Asset Management for Transportation Agencies.[3] He discussed the types of geotechnical assets that agencies manage (e.g., walls, slopes, and embankments), the importance of managing these assets, and a simple workflow that can be adapted relatively easily.

Practical Steps to Manage Climate Risk Through Asset Management

Beth Rodehorst (ICF) and **Cassandra Bhat** (ICF) presented the results of Airport Cooperative Research Program (ACRP) Project 02-74, Using Existing Airport Management Systems to Manage Climate Risk,[4] which investigated how existing airport management systems and tools could be used to address climate risks. The guidance presents a comprehensive set of options for considering climate risk, and agencies can pick and choose the most applicable options for their situation. On the basis of the study, the presenters thought that asset management was a good response to climate risk and that the consideration of these risks as part of the asset management process provides opportunities to avoid change management costs and to better manage existing priorities.

Key Takeaways

- The practices in this area are evolving, but all of the presenters recognized that geotechnical assets and extreme weather events need to be incorporated into asset management and planning practices.
- Existing tools and practices can be readily adapted to these new focus areas.
- There are simple tools available, such as ArcGIS Online, which will make geotechnical and environmental data collection much more accessible and meaningful to decision-makers.

Making Asset Management Decisions

This well-attended session featured a variety of asset management software solutions to help agencies make TAM decisions. **Brad Allen** (Applied Pavement Technology, Inc.) presided.

Integrating Network-Level Life-cycle Cost Analysis into TAM While Addressing Variability and Uncertainty

Richard Boadi (Wood Environment & Infrastructure Solutions, Inc.) began his presentation by suggesting that although LCP is a federal requirement, most state DOTs do not currently have an established process for it, and the quality of data for use in the

[3] http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=4065.
[4] http://www.trb.org/Main/Blurbs/178312.aspx.

analysis is uncertain. He introduced a framework for a network-level LCP analysis that involved setting goals, understanding the network context, estimating network-level life-cycle costs, analyzing results, and offering recommendations. Boadi stressed the importance of having clear goals, good cost data, and information about asset service lives and investment timing periods. He also pointed out that a network-level analysis relies on average values with data variability, so it is important to understand the impacts this may have on the results. He further suggested that variability and uncertainty can be incorporated into the analysis through either a sensitivity analysis or the use of a probabilistic analysis approach.

Using Technology to Better Communicate the Benefits of Project and Program Level Investments

Donna Huey (Atkins) introduced the use of technology to improve decisions related to asset management, intelligent mobility, and engineering using real-time data. She used three case studies to illustrate how technology can be used. The first case study illustrated how data analytics could be used to provide insights into pavement movement and transportation utilization to better understand what interventions could be introduced to improve mobility options for a regional agency. The second case study illustrated how a web portal and data analytics engine could support the real-time management and communication of planned road closures and diversions to minimize travel disruption to three vital neighborhoods. The last case study illustrated the use of condition data and other information to justify investment decisions on an airport project.

Waterloo Asset Management System Implementation

Milos Posavljak (University of Waterloo) presented an example of an asset management plan that was being developed for the City of Waterloo in Ontario, Canada, to illustrate how the effects of organizational silos could be eliminated without disturbing the existence of the silos. The project goal was to be able to generate asset performance graphs in a timely manner at any point with the city's existing information flow. As part of the study, he identified system constraints and looked at ways to exploit them. Using the application of constraint theory, the researchers applied lessons and processes learned from the manufacturing industry about supply chains. The results were used to determine how much information was needed to make decisions, which was less than what was currently being used. As a result, they were able to develop a process that tapped into existing silos (such as engineering, finance, and administration) before approaching the subject matter experts. The findings had a minimal impact on existing processes and resulted in only minor increases (0.6%) in staff resources to sustain the process.

Planning for Success: Best Practices in Selecting Actionable Asset Management Performance Goals

Don Hills (Parsons) focused on best practices in selecting actionable performance goals to successfully align performance requirements with defined goals and affordability. He offered the following thoughts on the keys to success:

- Know and understand the clients'/owners' expectations and desires: Identify their vision, their risk tolerance, any partners to the process, and roles and responsibilities.
- Define the assets and operations involved: Consider critical operational issues that should be included.
- Define the performance criteria and goals: Start with current practice and look at other similar measures. Focus on the results to be achieved, not how to do the work.
- Define the consequences: Identify what will happen if the asset or component is not maintained or fails. Will safety be jeopardized? Will it upset the public or elected officials?
- Price the action: Keep the price up to date throughout the process so there are no surprises at the end.
- Define who will measure: Develop training programs for implementation and establish a dispute resolution process.
- Be flexible: Conditions, goals, and priorities can change. Provide mechanisms for this.
- Recognize there will be multiple iterations: The process will evolve with time.

Key Takeaways

Common topics within each presentation in the session included the following:

- Focusing on data collection and accuracy—presenters advised starting with what is currently available and enhancing uses in the future.
- Defining the methodology that will be used, the approach, and any assumptions early on in a process.
- Staying flexible throughout the process.
- Communicating assumptions, risks, and any changes to the methodology as the process is under way.
- Keeping things as simple as possible and developing a clear, implementable approach to support TAM decisions.

Cross-Asset Prioritization

This was a very popular session with attendance estimated at about 80 people, primarily made up of representatives from state transportation agencies. The moderator, **Loren Turner** (Caltrans), opened the session by stating the need for tools that support decision-making and project prioritization in a data-driven, unbiased, and equitable way, accounting

for all aspects of maintenance and replacements while still having flexibility for environmental and political factors.

Case Studies in Implementation of Cross-Asset Resource Allocation Tools

William Robert (Spy Pond Partners, LLC) provided an overview of a multiobjective decision analysis (MODA) and stressed the importance of defining the value functions so they align with the agency's goals and performance measures. He reported the advantage of MODA as breaking funding silos and leveraging funds to efficiently deliver projects while creating a fair and transparent framework for project selection.

Robert reported that *NCHRP Report 806: Guide to Cross-Asset Resource Allocation and the Impact on Transportation System Performance*[5] was published in 2015 and provided a tool for use. NCHRP Project 08-103, Implementing NCHRP Report 806: Guide to Cross-Asset Resource Allocation and the Impact on Transportation System Performance,[6] is expected to be completed in 2018 and and the resultant NCHRP Research Report will provide guidance and enhancements to the original tool. Robert also summarized three case studies from the Arizona DOT, the Delaware Valley Regional Planning Commission, and the Maryland DOT.

Implementation of a MODA Approach for Prioritization of Asset Investments for Caltrans

Michael Johnson (Caltrans) presented Caltrans' approach to MODA, which was undertaken because prior processes for funding allocations did not consider project effectiveness at a program level. The new process involves setting objectives and value functions, data compilation and analysis, weighting, scoring, and a sensitivity analysis. They are currently exploring data envelopment analysis as an optimizing approach and validating the logic to their process for implementation.

Moving Toward a Statewide View of Resource Allocation

Tammy Haas (New Mexico DOT) introduced her agency's approach to resource allocation. She indicated that since 2007, funds have been allocated to the districts on the basis of a formula and district targets were focused on implementing a fiscally constrained Statewide Transportation Improvement Program. After the recession, projects were preservation driven and it became more important to maintain assets in a state of good repair. The agency is currently undertaking steps to provide guidelines to the districts to ensure that priorities are aligned across programs to accomplish statewide objectives. At the same time, they are considering factors to balance additional capacity, preservation, and environmental goals. They are working on the development of criteria and a weighting process for project evaluation and establishing a committee for statewide initiatives and district target setting. Haas indicated that one of the biggest challenges they face is data

[5] http://www.trb.org/Publications/Blurbs/172356.aspx.

[6] https://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=4031.

collection, but she expects to learn from practices in other agencies. She reported that her agency sees a perceived value in the MODA process.

KEY TAKEAWAYS

- State DOTs continue to look for tools to help with decision-making.
- The MODA process assumes that asset-level treatments, life cycles, and management systems are already in place and have good reliability levels.
- Data issues are real and the subjective assumptions for lack of data undermine the quality of the MODA process.
- It is important to make up qualitative measures so existing data can be a tangible guide for an equitable measure across all types of projects.
- Assigning weights to value functions requires assumptions or the use of analytical hierarchy processes, but adjustments can be made on the basis of the results of a sensitivity analysis.
- The MODA tool is for guidance and not a complete measure for decision-making. An objective approach can help project prioritization, but in the end, it is influenced by the subjective ability to actually fund a project on the basis of external factors.
- TAM is feeding into decision-making analysis and is one of the objective criteria for MODA value functions.

Building an Inventory and Assessing Condition

Although asset inventory and condition assessment approaches have been established for pavement and bridge assets in many transportation agencies, there is still work to be done to collect data on other physical assets. This session, moderated by **William Robert** (Spy Pond Partners, LLC), included presentations describing the processes used to establish asset inventories and to assess asset conditions.

ASSET MANAGEMENT PROCESS DRIVING A VISION FOR THE FUTURE

John Benda (HNTB) discussed the steps the Florida DOT is taking to obtain data on motor carrier size and weight. The Florida DOT's asset management data collection activities encompass multiple sources of data, including visual observation, record drawings and plans, aerial imagery, lidar, and on-site assessments. Benda discussed the data dictionary and the steps taken to collect geospatial data for major assets. The information is provided online to Florida DOT employees through the Esri ArcGIS software, which has enabled real-time access to information. Raters collecting condition information were trained, and an oversight program was established to ensure quality. Future efforts will be focused on non-Interstate weigh stations and improved methods to manage the asset inventory.

Agency-Driven Transit Asset Management

Herbert Higginbotham (Cambridge Systems, Inc.) described an approach to addressing transit asset management challenges through a collaborative process. Higginbotham grouped typical challenges in transit agencies into three categories: organizational challenges, planning challenges, and technology challenges. He described an FTA State of Good Repair grant that was commissioned by the Virginia and Pennsylvania DOTs to develop an asset management platform that was federally compliant and that addressed capital planning needs. He introduced software developed to address the needs of these agencies and illustrated how it was used. He then described how the Massachusetts transit agencies spearheaded the implementation of the software to find a single source that would provide statewide reporting and FTA reporting.

Enterprise Data Collection—It's Not Just an Asset Anymore

John Puente (Ohio DOT) discussed lessons learned from the Ohio DOT's enterprise data collection efforts. He first provided background information, stating that the Ohio DOT spends 90% of its funding taking care of existing assets. The agency's TAMP outlines goals and preservation strategies that will enable it to achieve its long-term objectives. From a data collection perspective, Puente stressed the importance of standards developed by the Ohio DOT's TAM Audit Group and the role of District TAM Coordinators to enable more consistency across districts to support the work plan development. A TAM Coordinator dashboard was established to support the work of the TAM coordinators, and improved business processes have been developed. One of the tools Puente discussed was the automated GIS functionality provided to the districts. These tools allow data visualization to support district decisions. Puente also discussed the results of the Ohio DOT's asset prioritization process and the development of tools to support data collection activities. The results of the data collection process are available through a data analytics tool and with the Transportation Information Mapping System. Many benefits have been realized by these efforts, including improved communication and stewardship.

What Next? Prioritizing Asset Classes for Inclusion in an Asset Management Program

Brad Allen (Applied Pavement Technology, Inc.) discussed a three-step process that was introduced in federal guidance on prioritizing assets for inclusion in an asset management program. He introduced an asset prioritization process that included getting organized, selecting criteria, establishing a rating system, establishing relative weights, setting rating values, calculating scores, and setting priority tiers. The process is being documented in an FHWA report that should be published soon.

Key Takeaways

- Agencies have well-established inventories for pavements and bridges but less-established inventories for other assets.

- Agencies are establishing processes for data accessibility that make use of GIS, dashboards, and other visualization tools.
- Data are valuable assets that should be managed through collection protocols, data definitions and standards, storage protocols, and other forms of data governance.
- Rater training and oversight are important to maintaining data quality.

Track 4: Organization and Workforce

Advancing Asset Management Research and Education Using Case Studies

This session, moderated by **Anita Bush** (Nevada DOT), addressed issues related to developing the next generation of asset management professionals. The presentations showcased how educators and practitioners are advancing research and education by using case studies that illustrated the use of research outcomes to better manage diverse assets. The case studies highlighted the importance of communication and the role of applied research in practice.

Advancing Asset Management Research and Education Using Case Studies

Gerardo Flintsch (Virginia Tech) introduced the Infrastructure Management Research and Education Workshop, which was first held in 2003, and laid out the need to interest more students in infrastructure management. Since the initial meeting, the involved faculty have continued to meet annually at the TRB Annual Meeting, and students have participated in an annual symposium. In 2010, an intense 2-week boot camp was initiated to provide mentoring, opportunities for teamwork, and practical experience to the students. The participating universities continue to provide a framework for infrastructure management education and to share materials to facilitate teaching.

Role of Case Studies in the Classroom and Academic Research

Milos Posavljak (University of Waterloo) discussed the Corporate Operationalization of Asset Management (COAM) processes that have been used by the City of Waterloo. He demonstrated the differences in the types of information that could be presented once the COAM processes had been established. Prior to the process, the graphs were primarily based on current conditions. Even though the agency had lots of data, there was not much use of the data for comparisons. Once the COAM processes were established, the agency was able to expand the number of asset classes covered and could predict conditions into the future; the data were then used to drive performance targets.

Advanced Infrastructure Management Bootcamp Project Experiences

Sue McNeil (University of Delaware) provided additional insights into the 2-week boot camp introduced by **Flintsch**. She explained that the students meet for 6 hours a day over the 2-week period and work on a central project each day. There are typically 12 to 16 students per class, with a prerequisite of having a background in asset management. Students come from several universities and establish a peer network that benefits them in the future. The material provides opportunities for students to apply the concepts taught in

class by using real or fabricated data and working as a team. The work takes the students outside their comfort zone and stresses the importance of teamwork. Students earn 3 credits for the class.

FROM CLASSROOM TO PRACTICES

James Bryce (Amec Foster Wheeler) discussed how well academic tools meet the needs of industry. He stated that five consultants who had worked on state DOT TAMPs were boot camp graduates and that boot camp has the potential for being a common language and framework for the process. The boot camp material covers each part of a TAMP, so the students were well prepared to assist their clients once they graduated. In a survey of practitioners that Bryce administered, he found that respondents felt least prepared in the areas of risk analysis, trade-off analysis, forecasting, and modeling.

KEY TAKEAWAYS

- It is important to teach students that although data are rarely clean or complete, they must still be used to make hard decisions.
- Both students and practitioners indicate that building teams and professional networks remain valuable endeavors.
- Asset management can be taught in a college setting in a way that allows the classroom knowledge to translate into practical applications.
- Pulling students out of their comfort zone is a critical real-world lesson.

One Size DOES NOT Fit All

This session showcased several approaches to addressing the organizational aspects of implementing a TAM program. The session was well attended and featured a lively discussion about the anticipated talent drain in many transportation agencies and strategies for retention and recruitment. **Ehsan Minaie** (CDM Smith) moderated the session.

ORGANIZATIONAL ASPECTS OF A SUCCESSFUL TAM PROGRAM

Larry Redd (Redd Engineering) began his presentation by stating that the TAM maturity model that is commonly used by transportation agencies is missing the organizational piece that drives change. The organizational piece includes the agency culture, leadership, relationships, and key performance indicators. Redd conducted a study that looked at 12 U.S. agencies and several foreign agencies to learn more about what drove them to change and what role organizational attributes and frameworks had in their success.

As part of the study, agencies scored themselves on factors related to process and technology capabilities and another set of factors related to organizational factors. Redd analyzed the data from several perspectives and found risk management and the risks

associated with the upcoming retirements many agencies are facing in the next few years to be key needs. Other needs that stood out from an organizational perspective were related to TAM training, TAM leadership and vision, and incentives related to the TAM vision.

COLORADO DOT'S CHANGE MANAGEMENT PROGRAM

Gary Vansuch (Colorado DOT) presented a summary of the program the Colorado DOT has undertaken to facilitate change within the organization. He recommended the book *How to Implement Successful Change in Our Personal Lives and Professional Careers*, which he offered to provide to participants via e-mail. He stressed that in most organizations, the existing culture is tough to change; success involves engaging agency personnel in efforts to reshape the culture. The Colorado DOT has engaged change agents to encourage a two-way flow of communication. These change agents have been trained, and more than 100 change agents are currently in place.

Vansuch discussed five elements for successful change: people have to be aware of the change, they have to have the desire to change, they have to have the knowledge to change, they have to have the ability to change, and they need reinforcement of the change. He then went on to discuss each of these elements in more detail.

Questions from the audience prompted a discussion about the talent drain that is anticipated in many agencies. Vansuch suggested putting together an improvement team to address this issue. **William Johnson** (Colorado DOT) indicated that the DOT is preparing employees through mentoring and training to take on new roles earlier in their career than previously was the case.

DEVELOPING ASSET MANAGEMENT ORGANIZATIONAL CAPABILITY USING A MATURITY APPROACH

Richard Edwards (AMCL) provided an international perspective on this issue. He stressed that TAM is a journey and that it is important to put some structure around the journey. He referenced the Institute of Asset Management's (IAM's) Maturity Assessment, which includes 39 subject areas that help agencies assess gaps and compare performance with respect to their peers. Edwards illustrated the value of the Maturity Assessment using a network rail case study. The assessment enabled the agency to identify its areas for improvement. As a result, the agency saw improved asset performance with greater reliability and sustainability. The railway is now the safest major railway in Europe and carries more trains than ever before. Edwards also stressed the benefits of benchmarking with others who might be doing well in a particular area to model improvements in performance.

KEY TAKEAWAYS

- Organizational culture is very important and drives change.
- IAM Maturity Assessment and benchmarking activities provide information on what drives organizations to change and what factors lead to success.
- Change agents within an organization are important to foster two-way communication and to ensure that changes are sustainable.

Transit Executive Communication

This session presented pilot materials that the FTA developed to support transit professionals in communicating the value of transit asset management to executives. **Mshadoni Smith** (FTA) presented a template that TAM professionals can use to report agency-specific information about the benefits of implementing TAM and a vision for a mature TAM program. Following the presentation of the materials, the participants discussed strategies for building executive support for TAM and provided feedback on the presentation materials.

Discussion Session: Getting Started Implementing Your Plan to Make Asset Management Work

Approximately 26 people representing state DOTs, transit agencies, local agencies, and consultants participated in this session. The moderator, **William Johnson** (Colorado DOT), asked each of four tables to address three questions that had been developed by the conference organizers and then assigned two additional questions to each table. Responses provided by the participants are provided below.

HOW IS YOUR AGENCY ALIGNED TO SUPPORT ASSET MANAGEMENT?

All groups answered this question. In general, participants expressed interest in aligning siloed decisions and gathering momentum to become more mature in TAM.

Engineering and planning ownership approaches were similar, with the use of committees. However, an ongoing challenge is keeping the asset owners engaged.

There were various approaches to organizing a TAM. Some agencies had separate TAM organizational units. Some did not think the TAM was located in the right spot in their organization. Others stated that silos exist in their organization, but communication channels are used to overcome the silos.

In some organizations, there was not a strong sense of roles and responsibilities. In some cases, individuals felt they understood their responsibilities, but thought there was less

understanding of the responsibilities across groups. The participants felt roles were clear in terms of deliverables (such as the TAMP) but not for the implementation of the TAM program.

Have You Made Changes, Or Do You Plan To Make Changes, To Better Implement TAM?

The group addressing this question indicated that changes would be made but that it remained to be seen what those changes would be. The participants viewed leadership changes as an opportunity to un-silo their organization.

How Will Your Agency Work to Maintain Support for TAM Once the TAMPs Are Done?

One group reported that the work was being done by full-time employees with other responsibilities, so this is an ongoing issue for several agencies.

A second group indicated that this needs to be explored further. Participants said that pavement and bridge groups are fairly robust, but operations personnel, as well as other areas and assets (such as overhead sign structures, lights, and ITS), need to be integrated.

Will It Be an Exercise That Is Done Every 4 Years, or Have You Taken Steps to Make It Sustainable and Impactful in Your Organization?

For the most part, participants were not sure how this would be addressed in their agency. One group reported that the status of the TAMP as a public document that is reviewed by many people would have an impact on the frequency with which it is updated.

Does Your Organization Have the Skills Needed to Manage Data? Analyze and Manage Risks, Including Future Weather-Related Risk? Optimize Investments? If Not, What Steps Are You Taking To Prepare Your Workforce For The Next Generation of TAM?

All groups answered these questions. The responses varied, but several participants indicated they did not have the skills needed to address all of these areas. They reported feeling comfortable managing home-grown tools but not commercial programs. Several participants indicated that their agencies were bringing in consultants to supplement their agency's knowledge.

Some of the areas in the list presented more challenges than others. For example, extreme weather resilience was thought to be more reactive than a planned activity. Agencies felt comfortable managing bridges and pavements but were less comfortable regarding other asset classes. Most agencies did not have cross-asset allocation tools available. Others indicated that the challenge in engaging external stakeholders made financial planning difficult.

The participants generally felt comfortable managing data.

A few agencies reported that they have key staff retiring within the next 5 years. Several strategies were identified to minimize the disruption, including the development of technical reference guides and other forms of documented procedures.

The group also felt that building communication skills among engineers is critical.

What Were Your Biggest Hurdles in Meeting the FHWA Certification Requirements? What Part of the Federal Requirements Were Challenging to Meet and Why?

The report-out from one group identified general certification challenges, reporting data for nonstate NHS owners, working across pavement and bridge silos, depth required in the risk area, shifting FHWA guidance, and the 10-year forecast.

Another group reported that the agency's lack of understanding of the requirements, the lack of time to devote to TAM, the risk gaps, the variances in planning timeframes, and applying FTA's buckets to agency assets were hurdles that had to be overcome.

Did You, or Are You Planning, to Add More Than the Required Asset Classes to Your Plan? Why or Why Not?

For transit, some agencies indicated that they were expanding the assets that will be included but that they wanted to make sure they could work with the FTA to make these efforts successful.

Most highway agencies that participated in the session did not go beyond pavements and bridges but did expand to the entire state-maintained system. One agency indicated it was adding rockfall predictions.

The participating agencies that had expanded their TAMPs to include other assets included signs, signposts, and pavement markings.

What Did You Learn From Coordinating the TAMP With Your Other Planning Products? What Would You Do Differently?

All groups answered this question. At least one participant indicated that his or her agency would have liked to have better incorporated transit and the highway freight program into its TAMP.

Another participant indicated that his or her agency would have made pavement and bridge conditions part of the prioritization model up front. Other agencies wished they had communicated with regional partners [e.g., metropolitan planning organizations (MPOs)] earlier in the process, so that their partners could support state targets. This agency had to do a lot of work at the end because the initial TAMP was internally focused.

One agency reported that the 20-year timing of its long-range plan was awkward and that its use of multiple consultants for different tasks was challenging. Another agency reported

that since it was focused on the deadline, it did everything in parallel, which was not necessarily the best approach. Still another agency would have liked to have developed a comprehensive communications plan because agency departments were not sure how they are all expected to work together.

KEY TAKEAWAYS

- Better guidance and coordination of federal rules in related areas are needed to facilitate work with local agencies.
- Guidance on how to identify and prioritize other assets would be helpful.

Asset Management Within Transit Organizations

This session, moderated by **David Rose** (Gannett Fleming), provided an opportunity for participants to learn more about asset management practices in transportation agencies and the factors that contributed to their success. A panel that included **Laura Zale** [Southeastern Pennsylvania Transportation Authority (SEPTA)], **Justin Barclay** (Maryland Transit Administration), **Tina Ignat** [Metropolitan Rail Corporation (Metra)], **John McCormick** [Bay Area Rapid Transit District (BART)], and **Matthew Wilson** (Jacksonville Transportation Authority) discussed the transit requirements and their perspectives on implementation. The panel was asked to address the following discussion topics:

- How robust is your agency's asset management?
- Have there been any big revelations or surprises for your organization? What learning tools and resources are your agencies using?
- Is your agency supporting the TAMP as part of strategic or business planning?
- Beyond the October deadline, what will your next iteration look like?

Communicating Asset Management

This session, moderated by **Rob Zilay** (Dye Management Group, Inc.), featured four presentations introducing tools to effectively communicate investment decisions to decision-makers and strategies for facilitating the organizational change that often accompanies a TAM implementation.

USING CORPORATE LANGUAGE TO SELL PUBLIC INVESTMENTS

Gordon Proctor (Gordon Proctor & Associates) defined communication as sending and receiving messages. He stressed that there is a diverse cross section of people that TAM practitioners need to communicate with and that connecting communication efforts to business concepts may help advance TAM efforts. For instance, he suggested that asset managers are portfolio managers, and the Ohio DOT compares the value of assets to the Ohio pension fund. The use of a transportation sustainability index could be compared with

the sustainability of the pension fund to show that the transportation system may actually have a larger value. Proctor also stressed that asset valuation leads agencies to maintain assets so they can be passed on to the next generation in a sustainable condition. He also connected asset value to the book value of a company and suggested that transportation agencies might focus on improving their book value (i.e., owner's equity) through preservation activities. Proctor further suggested that using analogies to the corporate world could help agencies address any communication gaps they are experiencing.

The Key to Convincing Your Stakeholders to Invest in Asset Management

Margaret-Avis Akofio-Sowah (WSP USA) emphasized the importance of communicating at the right frequency to be most effective. She suggested that agencies get a good handle on who their stakeholders are and what is most important to them. She introduced a framework that some agencies have used to facilitate the business changes that often accompany asset management. She also suggested appealing to the self-interests of each stakeholder and using that information to identify anyone who might be a roadblock to advancing an agency's efforts. Once these issues are known, it is important to customize a communication plan for each stakeholder so that practitioners are speaking the right language.

Knowledge and Communication: How Good Training Builds Effective Transit Asset Management

Ruth Wallsgrove (AMCL) stressed the importance of training in successfully transitioning a transit agency to implement TAM. She recognized that one of their revelations about TAM is that it is about people and, in many cases, people are given responsibility without fully understanding what TAM is. She suggested a good training program should help an agency apply examples learned from other organizations and indicated that the programs offered by IAM provide a broad view of TAM with different levels of training and certification. Wallsgrove indicated that some agencies are moving toward professional registration (similar to a professional engineering license) in asset management and that the Ministry of Ontario has legislated TAM for all cities and may be mandating registration for practitioners. Other agencies, such as the Denver Regional Transportation District (RTD) required its employees to participate in IAM training, and the New York MTA is reportedly in the process of training its own staff as in-house trainers. She discussed the many types of training available, including web-based and in-person training, and said she enjoys the lunch-and-learn approach to training.

Using Enterprise Asset Management Principles to Shift an Organization's Operational Focus to a Customer-Centric Service Model for Better Strategic Alignment

The final presenter was **Mildred Chua** (New York MTA Bridges and Tunnels). She began the presentation by introducing her agency and its importance to the region. She showed a video on the agency's Open Road Tolling program and the organizational changes that were required to strategically align the agency. This program eventually led to a new operational

model that uses asset management principles with a primary focus on customer service and safety. This model led the agency to look at risk from a business prospective. The agency also uses a performance management framework to set priorities and measure team performance. Decisions are now on the customer experience, which includes four phases: long before the crossing, soon before the crossing, during the crossing, and after the crossing. Any work on a bridge or tunnel will have an impact on the customer during each of the four phases. These changes have transformed the agency's culture, taken it back to a basics approach, and driven a holistic approach to evaluating organizational needs.

KEY TAKEAWAYS

- Transportation agencies are similar to businesses and should consider using business approaches to present information.
- Communication needs to take place at different levels.
- It is important to identify stakeholders and recognize that all are at different levels of acceptance.
- Agencies need to address the organizational change associated with TAM through a formal program or through education and training.
- Asset managers will always have to deal with people, so communication and training are keys to dealing with ongoing change and keeping up with the times.

Track 5: TAMPS—Setting the Course for Compliance and Beyond

State DOT TAMP Development

During this session, moderated by **Omar Smadi** (CTRE/Iowa State University), several state DOTs shared their experiences in developing their initial TAMPs. In addition, the results of a survey conducted by the Iowa DOT in conjunction with AASHTO were presented.

From Paper to Practices: Putting Risk-Based Asset Management to Work

Anne-Marie McDonnell (Connecticut DOT) described the Connecticut DOT's TAMP journey. She suggested that the agency would not have developed a TAMP without the federal requirement but has found that the process has led it to discover a better way of doing business. In addition to the required chapters, the Connecticut DOT added two additional chapters: one on data management and another on process improvements. Its TAMP incudes all NHS and state-maintained assets. The agency chose to include traffic signals, signs, and several other assets. For each asset class, it developed a two-page fact sheet that describes the asset, defines its state of good repair, and presents information on its average age and performance history. The fact sheets also include an estimated replacement value, performance measures, and performance targets.

One of the successes resulting from the program was the performance projection, which proved useful in advocating for the agency's budget and helped improve transparency. The process has helped build trust between stakeholders and has consolidated asset information. The agency has seen many benefits to having gone through the process, including a focus on data management, better asset tracking, and recognition of risks. It recognizes the need for additional data to help further reduce subjectivity in some decisions and will likely include additional assets in a future TAMP.

Minnesota: Land of 10,000+ Assets

Shannon Foss (Minnesota DOT) indicated that the Minnesota DOT had been one of three pilot states under a TAMP development project for FHWA. However, because the pilot study took place before the rules were finalized, it did not meet the requirements, so a new TAMP was developed by using agency staff. The work was coordinated out of the agency's new asset management project office but was supported by asset expert work groups, the TAMP project management team, the TAMP advisory group, and the asset management steering committee. The TAMP includes 12 assets on both the NHS and state-maintained systems. A variety of tools was used to conduct the analysis, including worksheets and spreadsheets when more sophisticated tools were not available. The TAMP is closely

integrated with the Minnesota State Highway Investment Plan and has been conditionally certified.

VISUALIZING ASSET MANAGEMENT IN NEW MEXICO

Tammy Haas (New Mexico DOT) said the New Mexico DOT hired a consultant to help develop its initial TAMP, and the document was certified by the FHWA Division Office. The New Mexico TAMP takes a different approach than most of the other TAMPs. It is written in three parts: Where Are We Now?, Where Are We Headed?, and How Do We Get There? Because District offices control the money in New Mexico, the central office needed an effective way to present information to get decisions aligned. They are working on a dashboard and are moving toward a web-based TAMP. Haas indicated that she has seen greater buy-in as people are able to visualize the investment plans.

VERMONT'S TAMP

Chad Allen (Vermont Agency of Transportation) presented some background information about the Vermont Agency of Transportation and the process used to develop its TAMP. For the most part, the development was done in-house, except for the use of a consultant to assist with graphics. The process involved a 27-member TAMP work group and a 52-month timeline. The TAMP only includes pavements and bridges, but it covers the entire NHS and state-maintained system. Three deliverables were produced: an executive-level brochure, a federal TAMP submittal, and a practitioner's guide. The TAMP had not yet been certified and Allen indicated that the division office had asked for more detail and fewer pages. Several activities remain to be completed, including the practitioner's guide and the development of a customer pavement expectations mobile app.

STATE DOT USE OF CONSULTANT SUPPORT TO DEVELOP INITIAL TAMPS

Matthew Haubrich (Iowa DOT) presented the results of a survey that was distributed by AASHTO to learn more about which state DOTs used consultant assistance in developing their initial TAMP. The survey results can be found on the AASHTO TAM Portal.[7] At the time of the conference, only 25 states had responded to the survey.

KEY TAKEAWAYS

- State DOT TAMPs vary considerably, even though they all followed the same requirements. Most state DOTs tailored their TAMPs to fit their environment.
- The development of the initial TAMP was a lengthy process, and some of the documents did not satisfy the requirements without additional modification.
- External communication is not very well developed.
- The process of developing the TAMP exposed other issues that DOTs are working through.

[7] https://www.tam-portal.com/.

Transit Agency TAMP Challenges and Opportunities

Since FTA's Final Rule was released in 2016, transit operators have been taking steps to align their TAM practices with the requirements. The presentations in this session provided an overview of the TAM requirements and an opportunity for two transit operators to share their experiences. The session closed with a discussion of how transit agencies can align their practices with international standards. This session, which was moderated by **Laura Zale** (SEPTA), attracted a standing-room-only crowd made up mostly of transit agencies but included consultants as well.

Transit Asset Management: The FTA Perspective

John Giorgis (FTA) opened the session with a presentation primarily focused on compliance with FTA regulations on Transit Asset Management, 49 CFR Part 625, and key technical assistance products that have been released, including the *Transit Asset Management Guide*, a template for small providers, narrative report templates, and a Facility Performance Measure Guidebook; all of which are available on FTA's Transit Asset Management portal.[8] Fact sheets, compliance checklists, timelines, and points of contact are also available from the portal.

Giorgis reviewed the delivery cycle for transit operators and reminded agencies that their data reports need to be provided with the plan being on hand for Triennial Review and that they should share with state DOTs and regional planning organizations. The plan should be updated at least every 4 years, or whenever there is a significant change in priorities. Giorgis also provided a short summary of some of the outcomes from the Transit Roundtable that had taken place during the week, including the importance of a TAM culture, recognizing TAM as a journey, and getting buy-in from across the agency.

Integrating Fixed Asset Accounting and Asset Inventories in a True Enterprise Approach to Asset Hierarchy

David Rose (Gannett Fleming) polled the audience and found that 50% of them were involved in the development of their own TAMP. Using the Jacksonville Transportation Authority (JTA) as an example, Rose stressed the importance of relating asset management to tangible elements that people work with (such as the financial system, the work order system, or capital planning) to make the TAMP relevant. **Matthew Wilson** (JTA) provided background information about the agency, including that it has two systems that use different inventories for the same assets. JTA initiated workshops and met with each department to establish parent–child relationships between assets and identified data fields needed for reporting. These activities resulted in a crosswalk of asset account codes that allowed JTA to resolve its data issues.

[8] https://www.transit.dot.gov/tam.

Maximizing Asset Return on Investment for Self and Clients in a Public-Sector Setting

Jeff Arbuckle and **Ajay Singh** (King County Metro Transit) jointly presented. **Amy Lindbloom** (Sound Transit) and **Emily Burns** (Seattle DOT) joined the presentation to provide an overview and describe the collaboration between the three agencies. The presenters reported that each agency had characteristics that made it unique, but decisions had to consider regional needs. King County Metro was able to establish evaluation criteria for each asset that allowed it to prioritize assets so that they could be better packaged. The agency also implemented data warehousing tools to support its needs and is currently looking into additional efforts related to risk management, knowledge management, and change management. Certification under ISO 55001,[9] an asset management standard developed by the International Organization for Standardization (ISO), is an important goal for the agency to achieve.

ISO 55000[10]—Asset Management State of Readiness Assessment Case Studies

Jason Bittner (ARA) discussed a readiness assessment conducted in Canada that included two transit agencies. The study found that smaller agencies had more sophisticated TAM programs than larger agencies, which seemed to reflect the good understanding people had of their role in relation to TAM in the smaller agencies. Bittner stressed the importance of looking for quick implementation wins and using participatory strategies to be most effective. He indicated that executive buy-in is a key to a successful implementation, as is having clear roles and responsibilities. Lessons learned indicated that it is important to manage the asset inventory, to have a clear succession plan, and to manage with integrity and consistency.

Key Takeaways

- TAM takes time and requires patience.
- Compliance with FTA regulations on Transit Asset Management, 49 CFR Part 625, including certification by the transit agency's accountable executive, is an element of the Fiscal Year 2018 Annual List of Certifications and Assurances for FTA Grants and Cooperative Agreements. Noncompliance places future FTA grants in jeopardy.
- TAM needs to be communicated within the agency constantly.
- Data-driven decisions will happen once agencies get better data and align their software programs.
- Asset data need to be tailored to the audience.

[9] https://www.iso.org/standard/55089.html.
[10] https://www.iso.org/standard/55088.html.

Discussion Session: Are Our Plans and Targets Aligned?

This discussion session was attended by approximately 18 participants, most of whom represented state DOTs. A few representatives from regional planning organizations, local agencies, and FHWA also participated. The tables discussed several questions that were posed to the group by the moderator, **Mara Campbell** (Jacobs). The questions and responses are provided below.

What Strategies Have Your Agencies Taken to Collect Information on National Highway System Needs, Conditions, and Revenues? What Lessons Have You Learned From This Process?

- State DOTs have been collecting data for a long time.
- In one case, a participant indicated that his agency was reevaluating its pavement management system, as it does not project the new federal performance measures for pavements.
- Differences in how agencies are measuring bridges were reported. This does not appear to be done consistently across agencies.
- Agencies are having challenges incorporating public–private partnerships and other types of innovative delivery methods in their TAMPs.
- Several agencies indicated that they are trying to reduce the variation in conditions between districts.
- Some agencies indicated that the national performance measures are not reflective of the total system the transportation agency is responsible for. The national measures have standardized the data, but the measures are not aligned with the TAMP targets and they focus on too short a timeframe.

What Compatibility Issues Existed Between State and Local Condition Data That Had to Be Resolved to Develop Performance Targets?

- There are differences between the desired conditions at the state and local levels. The state DOTs typically expect to maintain higher conditions than the local agencies.
- Different thresholds are being established to represent what is considered to be in good condition on the NHS and on non-NHS roads. Expectations for Interstates are higher than those for local roads.

Have There Been Any Efforts to Share State DOT Analysis Tools at the Regional or Local Level to Support Asset Management?

- For most of the participants there have not been efforts to share tools. The exception was in Michigan, where there is a free pavement management system for the local transportation agencies. All regional planning organizations are required to report pavement and bridge conditions in a consistent manner, but it takes work and training to be able to use the tools effectively.

- Work done at the state DOT level for bridge inspections is helping locals.
- Some state DOTs collect pavement data on the local roads in addition to the state roads. The Iowa DOT is an example of a state doing this. They share the data with the local transportation agencies, but not the analysis tool.

What Efforts are Being Undertaken to Support the Use of Life-cycle Planning in Making Investment Decisions at the Regional and Local Levels?

- The New Jersey DOT is sharing knowledge and specifications with local transportation agencies (both informally and formally) on its pavement preservation program.
- The Connecticut DOT uses its Local Technical Assistance Program to provide training on LCP to local transportation agencies.
- Maricopa County found it hard to coordinate with cities because of jurisdictional issues. As a result, LCP is hard to do.
- The Wyoming DOT uses flat deterioration curves for low-volume roads. Treatments are triggered by factors other than life-cycle needs for this part of the network.
- The Iowa DOT reports that the local transportation agencies are often more innovative than the state in terms of cost-effective treatments.

What Steps Could be Taken to Further Develop a Collaborative and Coordinated Effort to Manage the NHS on a Statewide or Regional Basis?

- Identify the assets in the local and state areas and assess conditions for the entire system.
- Establish a common language.
- Define a common state of good repair.

What Does It Mean for a Metropolitan Planning Organization to Set Its Own Target?

- It is a positive step that both the regional and state agencies are discussing targets.
- It would be interesting to hear from MPOs that cross states to hear what they do.

Key Takeaways

- It is important for state agencies to establish collaboration with local transportation agencies and be on the same page with them. State agencies should communicate with local agencies along the way regarding how to analyze the data and set targets. Several participants found forums to share experiences as very valuable, so agencies can learn what is working and what is not.
- Network.
- Everyone is in the same boat and trying to figure out how to align decisions. It is a complicated issue for all agencies.
- Interaction of state and regional agencies has brought a new perspective on what it means to manage the system.

- It would be helpful to have consistent definitions and measurements to use. Additionally, it would be helpful to benchmark counties to the state.

Group Transit Asset Management Plan Development

Small transit agencies are provided an option to join a group plan for their state of operation. These group plans require strong collaboration between sponsors and operators. This session, modified by **John O'Hara** (KPMG LLP), provided insights on these group plans with several examples.

Tier II Group Transit Asset Management Plan: Lessons Learned in Coordinating with Small Transit Operators

Justin Barclay (Maryland Transit Administration) discussed the lessons his agency learned during its efforts to coordinate TAMP development with small transit operators. He outlined the process used to develop the TAMP and the workshops that were conducted over a 4-year period to address the skills needed. He also described the resources provided to support the effort and the Group Transit Asset Management Policy that was signed by all Tier II accountable executives as part of the process. Several tools were developed to support the TAM processes, including inventory submission forms, a Facility Condition Assessment Guidebook, and a performance dashboard. Barclay also described the group's use of FTA's TERM Lite program to support the TAMP development process.

Regional Group TAMP for 16 Tier II Operators in the San Francisco Bay Area Region

Shruti Hari [Metropolitan Transportation Commission (MTC)] discussed MTC's role in regional asset management and the process used to develop the region's TAMP. Hari explained that MTC had a role in target setting, the development of a TAM plan for Tier II operators, technical assistance for Tier I operators, and regional TAM strategic planning. The TAMP development process included all Tier II operators in the region and followed several guiding principles, including maintaining the region's asset inventory (so as to better invest in a state of good repair), monitoring and improving the condition of the system, investing in a state of good repair, and maintaining a list of investment priorities. Several workshops were conducted to get all operators aligned and to develop procedures for uniformly reporting asset conditions. Hari presented an overview of the TAMP and concluded with lessons learned from the process.

Iowa's Approach to Transit Asset Management Group Plan

Sreeparna Mitra (Iowa DOT Office of Public Transit) discussed the Iowa DOT's approach to developing a group TAMP for rural and small urban transit systems. The process began with a survey of 23 agencies to get a baseline assessment of the asset management practices currently in place. She also described two tools developed to support these

efforts: the Public Transit Management System for revenue vehicles, which prioritizes vehicles to be funded for replacement, and a Transit Asset Management App for Facilities Condition Assessment. The process taught the Iowa DOT the importance of starting data collection efforts early. The most difficult challenge the agency faced was the diversity of skills, data availability, and different internal procedures among group plan participants. Mitra also stressed the importance of educating and coordinating with subrecipients throughout the process.

Risk and Resilience in TAMPs

The presentations in this session explored strategies for considering system resilience in an asset management program and in an agency's TAMP. The session was well attended, with more than 60 attendees. **Scott Zainhofsky** (North Dakota DOT) served as moderator for the session.

Strategies for Improving the Resiliency of Transportation Assets

Prashant Ram (Applied Pavement Technology, Inc.) suggested that all practitioners must be responsive and adaptable to changes that occur regularly. He discussed three major impacts associated with extreme weather events—temperature, precipitation, and sea level—and suggested that an agency's vulnerability to these events is highly context sensitive, depending on the type, condition, and location of the asset as well as the agency's preparedness and adaptive capabilities. Ram offered suggestions for improving resiliency that ranged from addressing vulnerabilities to considering resilience in the planning, design, and project development processes. He reviewed FHWA's guidance for assessment and adaptation and illustrated the concept using two examples. The first example featured a pilot project involving the Minnesota DOT in which vulnerability to flooding in two districts was assessed. The second example came from the New York State DOT and involved a scour-critical bridge study. Ram's conclusion from these two studies is that resiliency needs to be accounted for in asset management planning.

Using Resilience in Risk-Based Asset Management Plans

YuanChi Liu and **Sue McNeil** (University of Delaware) presented a resiliency life-cycle approach that can be applied in mitigation, preparedness, response, and recovery associated with extreme weather events. Three keys to the approach involve robustness, rapidity, and resourcefulness. These three factors are combined to produce an improvement value that can be compared with other scenarios. A second approach was also explored in which vehicle miles or travel time were considered, and this approach provided a way for an agency to move from a qualitative risk framework to a more robust, quantitative assessment based on data.

Approaches for Addressing Extreme Weather Resilience in Asset Management

Stephen Gaj and **Robert Kafalenos** (FHWA) jointly presented on the requirements for considering risk and resilience in an agency's decision-making process. In part, risk was incorporated into the rules because the frequency of extreme weather events is increasing and the cost to the public is expected to grow. The two introduced the plethora of resources that are available to help transportation agencies consider extreme weather resilience in their TAMP LCP. They also mentioned that six asset management resiliency pilot projects are under way and that guidance on this topic should be available early in 2019.

Arizona DOT TAM Risk Management: Extreme Weather—Blending Risk, Science, Technology, Engineering

Steven Olmsted (Arizona DOT) discussed the risk strategies and studies that are being used at the Arizona DOT to influence agency decisions. He said that the agency formalized its resiliency process in October 2015 and that it continues to be tied to the asset life-cycle process. The process compiles data in the agency's GIS. Root cause screening, modeling, proxy indicators (e.g., Twitter reports), and decision trees are used to develop a mitigation strategy. After each event, the agency conducts ground-based and drone lidar to monitor whether treatments are working. The next step in the Arizona DOT process is to develop economic measures and evaluate maintenance expenses associated with extreme weather events as indirect measures.

Key Takeaways

- Resiliency is recognized as a key component in minimizing asset life-cycle costs.
- There are several lead state agencies that are fully engaged in the process and are using the results to support asset management decisions.
- Inconsistencies in terminology hinder efforts to incorporate resiliency into agency practices.

Coordinating Your TAMPs: Addressing Assets You Do Not Own and Local Agencies You Do Not Own

Current legislation set new expectations for interagency coordination that require agencies to work across jurisdictional boundaries to provide the level of mobility expected by the public. The presentations in this session explored these interactives from several different perspectives. The session was moderated by **William Knowles** (Texas DOT).

How Does Asset Management Fit into the Planning TPM Framework of the Overall Performance-Based Programs of States, MPOs, and Other Local Owners?

Harlan Miller (FHWA) introduced the federal requirements for TPM and resources available to support performance-based planning processes. Miller reviewed the TPM rules and effective dates as well as the national goal areas. He introduced the 17 performance measures established in the final rules within the national goal areas. Miller stressed the importance of coordinating state DOT and MPO efforts to set targets and the requirements for MPOs, state DOTs, and public transit agencies to establish written agreements for a metropolitan area that describe the roles and responsibilities for performance-based planning. Miller concluded with a summary of references in this area provided by FHWA.

The NOACA Case Study: Integrating TAM into the Planning Process

Kathy Sarli [Northeast Ohio Areawide Coordinating Agency (NOACA)] summarized the activities conducted by NOACA to support the preservation of transportation assets in the area. Sarli suggested that NOACA has embraced performance-based planning to ensure that region needs are met, to improve project decision-making, to increase accountability and transparency, and to better communicate the region's needs when competing for limited resources. To this end, NOACA adopted a TAMP and required local projects seeking regional funding to demonstrate that the project matches recommendations from the regional pavement management system. NOACA has collaborated with the Ohio DOT on federal performance measures and provides community pavement condition reports to its member agencies every 2 years.

Developing an Asset Management Plan in Washington State Including Locally Owned Roads

Todd Lamphere (Washington State DOT) discussed the development of a state DOT TAMP that includes locally owned roads. Approximately 23% of the pavements on the NHS in Washington and 9% of the NHS bridges are managed by local agencies. To integrate the efforts of MPOs, cities, and counties, the Washington State DOT established a DOT Technical Group for target setting and a Planning Alignment Working Group that ensured common terminology, shared information, and a concurrent planning effort. These coordinating meetings will continue, and the DOT is working with the Planning Alignment Working Group to complete a 2018 work plan. In addition, the Washington State DOT will provide pavement and bridge condition information to locals to help with their planning activities.

Addressing Asset Management Coordination in North Central Texas

Jeff Neal [North Central Texas Council of Governments (NCTCOG)] introduced the context for asset management coordination in the Dallas–Fort Worth metroplex, which includes 16 counties, 160 municipalities, and multiple transportation providers. Existing mobility plans for the region predict that less than one-third of the needed funding will be provided to address congestion and maintain pavement and bridge conditions. At the same time,

climate and extreme weather events are expected to challenge system mobility and functionality further. Therefore, NCTCOG has expanded its local asset management efforts by incorporating a hazard mitigation plan that considers emergency preparedness coordination, flood assessments, and flood warning systems. The agency is also promoting green infrastructure that helps mitigate negative environmental impacts. Other efforts involve delivering critical services, improving land use and sustainability management, and looking for corridor-driven solutions. NCTCOG's performance-based planning efforts are now required by legislation passed in 2015 that requires a performance-based planning and programming process with metrics, measures, and scoring for project selection.

Setting Course for Compliance and Beyond: A Case Study of State, MPO, and Local Agency Coordination for NHS Target Setting

Theresa Romeli (MTC) discussed the challenges associated with state and MPO coordination efforts related to pavement target setting. She stressed that (a) jurisdictions do not differentiate NHS routes in their programs, (b) it is difficult to reconcile performance metric differences, and (c) it is hard to communicate differences in condition assessment approaches. She discussed the approach used to manage local roads in California with the StreetSaver program developed by MTC and the efforts that have been undertaken to reconcile performance metrics and report planned investments in the NHS. MTC is working with Caltrans to work through the statewide needs assessment process and plans to continue efforts to improve target setting and the consistency of communication related to infrastructure conditions. In addition, MTC hopes to strengthen the relationship between the Pavement Condition Index used by many local agencies and the pavement serviceability rating allowed to report roughness on local roads with speed limits below 40 miles per hour.

Advancing Practices in Strategic TAMP Development

This session, moderated by **Matthew Haubrich** (Iowa DOT), featured presentations exploring the future frontiers for TAMP development. The presentations covered a range of topics, including intellectual property concerns, moving from a condition-based assessment to a performance-driven asset management plan, interface opportunities for safety and asset management systems, and chasing excellence through the implementation of asset management standards.

Intellectual Property Concerns in Asset Management Planning

Jason Bittner (ARA) presented the results from a recent NCHRP research project that resulted in the publication of *NCHRP Report 799: Management Guide to Intellectual Property*

for State Departments of Transportation.[11] He began the presentation by introducing forms of intellectual property (IP) that should be protected, including patents, copyrights, trademarks, confidential information, and works for hire. Bittner emphasized that the largest risks to state DOTs with respect to IP include database development, specialty software, reports and graphics, logos and program branding, and third-party claims to DOT IP. He stressed the importance of protecting IP from a risk management perspective to maximize taxpayer value. Bittner shared that the Texas and South Dakota DOTs will be conducting workshops on the implementation of the guide soon.

Moving From a Condition-Based 20-Year Needs Assessment to a Performance-Driven Asset Management Plan

David Kraft (New York MTA Bridges and Tunnels) and **Maxwell Brown** (GHD Inc.) discussed the New York MTA's new performance-based program, which was inspired by the book *Good to Great* by Jim Collins.[12] In the past, 20-year capital needs were established by rolling up needs, conditions, and strategies into a funding need. The new business model focuses on three objectives: customer service, safety, and revenue. Performance criteria are established for each of these objectives along with risk. The new process helps them manage performance (rather than just conditions) and has enabled the agency to make connections between each of its cylinders of excellence (i.e., organizational silos). The process was illustrated by the Bronx–Whitestone Bridge, which had many issues associated with accidents.

Practical Interface Opportunities Between Safety and Asset Management Systems

John Gasparine (WSP) introduced a process for interfacing safety and asset management systems from a transit perspective. He introduced many opportunities for this interface to occur, including the asset inventory (by adding attributes), condition assessment (especially safety-critical assets), capital project prioritization (that consider safety risks), life-cycle management (in partnership with safety staff), competencies/training (including more safety competencies in the training), and technology (using a single system when possible).

Chasing Excellence: How Denver RTD is Transforming its Asset Management Capability through ISO 55000

Lou Cripps (Denver RTD) and **Simon Smith** (AMCL) presented the efforts undertaken by the Denver RTD to transform its asset management capabilities. They introduced the challenges the Denver RTD faced, with more than $5 billion in capital assets but less than

[11] Bradley, J., J. Mallela, K. Chesnik, and T. Wyatt. 2015. *NCHRP Report 799: Management Guide to Intellectual Property for State Departments of Transportation*. Washington, D.C.: Transportation Research Board. http://www.trb.org/Publications/Blurbs/172260.aspx.

[12] Collins, J. C. 2001. *Good to Great: Why Some Companies Make the Leap . . . and Others Don't*. New York: Harper-Collins.

0.3% allocated to maintenance. Because of the funding situation, the Denver RTD shifted its focus from building and system expansion to operating and maintaining existing assets with the ISO 55000 standard to drive the process. The agency established the following key improvement areas:

- Having a functional and effective management system,
- Establishing integrated asset management processes,
- Providing enhanced asset information,
- Improving data quality and performance, and
- Supporting learning and communicating.

The process had a tremendous impact on the agency, allowing it to assess its current position, which provided the information needed to allow the agency to determine what changes were needed to achieve its goals. As a result, the agency changed its focus from managing assets to moving people. Lessons learned included taking a generational approach to the process, starting with a standard to drive the process, and bringing in outside assistance sooner to facilitate change management within the organization.

KEY TAKEAWAYS

- TAM principles can be applied to manage transportation system service (or performance) targets, as well as physical condition.
- Agencies are beginning to recognize IP as an important risk that needs to be managed.
- A strong interface between safety and asset management is important to transit agencies.

Closing Session

Laura Mester, *Michigan Department of Transportation*, *Chair*

Panelists

Scott Richrath, *Atkins*
Andrew Williams, *Ohio Department of Transportation*
Michael Johnson, *California Department of Transportation*
Anita Bush, *Nevada Department of Transportation*
Matthew Haubrich, *Iowa Department of Transportation*
Laura Zale, *Southeastern Pennsylvania Transportation Authority*
Niles Annelin, *Michigan Department of Transportation*

The closing session followed a format established at an earlier TAM conference, with the conference chair presiding over a panel made up of track leads from the conference planning committee. The track leads shared highlights from their sessions related to ways in which

- The practice of asset management is evolving,
- Agencies are creating sustainable asset management programs that are embedded in their organization's culture,
- Technology is influencing the way decisions are made, and
- Data are being used to speak to multiple audiences.

The session concluded with a discussion of gaps that would benefit from further research or technology transfer efforts. The track leads, who participated in the closing session, and the tracks they led are as follows:

- Scott Richrath, Track 1: Analyzing and Optimizing Investment Options;
- Andrew Williams, Track 2: Data Systems to Improve Decisions;
- Michael Johnson, Track 3: Implementation;
- Anita Bush, Track 4: Organization and Workforce;
- Matthew Haubrich, Track 5: TAMPs;
- Laura Zale, Cross-Cutting Track: Transit; and
- Niles Annelin (Michigan DOT), Cross-Cutting Track: Risk and Resilience.

Track Discussions

Laura Mester (Michigan DOT), the conference chair, began the session by asking each of the track leads to share some key takeaways from the presentations in their sessions.

KEY TAKEAWAYS

Track 1: Analyzing and Optimizing Investment Options

- There was no way to avoid the word "risk" in finance presentations; the concept was much more present than in past conferences. Risk and finance are intertwined, as are TAM planning and long-range planning.
- What are the right data needed to support TAM? Agencies have lots of data, but they need to be sure that they are comparing apples with apples and that they are analyzing the data correctly.
- Transit has made leaps and bounds in terms of the state of the practice.

Track 2: Data Systems to Improve Decisions

- Agencies are collecting data to make decisions from a life-cycle perspective.
- Data have become more important to agencies and people are asking for it. As a result, more people are getting involved in collecting and managing agency data.
- Every session and topic had a data element to it.
- Agencies need to have a strong communication plan in place and need a corporate framework with business processes to support TAM.
- There were several presentations on data visualization, and industry partners are providing applications to help in this area. Agencies can help educate industry as to their needs.
- Agencies should have a data governance framework in place so that data are managed as an asset.
- There is a need for more discussion and peer exchanges on data governance.

Track 3: Implementation

- The sessions were standing room only, which shows how far the industry has moved forward.
- Several themes for success emerged from the presentations, including communication, collaboration, flexibility, the importance of documenting processes, keeping it simple, establishing practices that sustain leadership changes, data, continuous improvement, using good methods of communication, using established practices to start, and planning for turnover.

Track 4: Organization and Workforce

- Change was a common theme. Agencies are changing the way they do business, organizations are changing, and the workforce is changing. Training is needed to address these changes.
- One size does not fit all. Agencies need to be careful how they set up their TAM programs, and they need to make sure the right people are in key positions. Agencies also need to have a plan for staff transitions.
- As an industry, agencies are getting good at addressing the federally legislated part of the TAMP, but it is not the same situation with TAM as a holistic process.
- Communication is a key. Agencies need to communicate at the right frequency.

Track 5: TAMPs

- Just 6 years prior to the conference, the Moving Ahead for Progress in the 21st Century Act (MAP-21) had not been passed and the TAMP requirements were unknown. What has taken place in the industry in the past few years is amazing, and there are many new people involved in their fields.
- Transit is getting much more involved in TAM, as are regional and local transportation agencies.
- Getting the TAMP done was the easy part; the process has awakened organizations to what else needs to be accomplished.

Cross-Cutting Track: Transit

- Transit had 81 participants at its roundtable earlier in the week. There were 35 transit agencies at the conference plus attendees from regional and local agencies. The sharing and collaboration between agencies were very beneficial.
- The conference sessions related to transit had the letter "C" as their theme: compliance, communication, culture, and consequences for not investing. There was lots of sharing with internal and external stakeholders during the week, and many agencies were focused on how to make their programs sustainable.
- Transit agencies were very focused on the October 1 deadline for their TAMPs.

Cross-Cutting Track: Risk and Resilience

- Weather events increasingly are damaging assets, so this topic is becoming more and more important to agencies.
- Many presentations addressed the need to incorporate risk and resilience into processes; risk and resilience are not stand-alone processes.
- There is a need for more standardized terminology.
- There are many resources available to help agencies in this area.
- Planning for risk is required, but it does not have to be done right away—changing the culture takes time.

EVIDENCE THE PRACTICE OF ASSET MANAGEMENT IS EVOLVING

Track 2: Data Systems to Improve Decisions

- As little as 6 years ago, the TAM conference was focused on pavements and bridges. Now, agencies are talking about ITS technology, smart cities, and smart boundaries.
- Agencies are sharing information across counties and agencies, essentially removing artificial boundaries. This is influencing how they do TAM.

Track 3: Implementation

- Risk and resiliency were more prominent. The sessions included two presentations on geohazards that pushed beyond the traditional coverage.
- With regard to decision analysis, multiobjective decision analysis presentations were hot, with standing-room-only crowds.

- Many agencies talked about adding asset classes to their program, and one presentation introduced guidance to help prioritize the assets to include.
- Data are being collected in new ways. There was a presentation talking about using sensors to monitor mobility after construction, for example.

Track 5: TAMPs

- Several state DOTs, including the Minnesota DOT, included many assets in their TAMP.
- The New Mexico DOT featured an online TAMP, which became a living document that was shared with others.
- In the discussions, there was evidence of more alignment across owners. The Michigan DOT presented some informative examples of training documents.

EXAMPLES OF SUSTAINABLE ASSET MANAGEMENT PROGRAMS

Track 1: Analyzing and Optimizing Investment Options

- The presentations provided evidence of better coordination of planning, maintenance, and construction.
- Agencies are hiring different types of people and responding to changing workforce needs. At the Colorado DOT, there is now a requirement that job postings be evaluated to ensure that the job is still needed organizationally. The New York MTA discussed the rapid evolution that is taking place and the resulting changes in job descriptions. The organization is focused on being nimble enough to meet new responsibilities as they emerge.

Track 4: Organization and Workforce

- The Colorado DOT is an example of an agency that is changing its organizational culture and workforce skills. It has embraced the idea that each employee will be successful and has established programs to ensure employees have the skills they need by using statewide and regional change agents.
- In many organizations, TAM is an extra duty on top of other jobs. Agencies are recognizing that the job is changing and are updating job duties and responsibilities in response.

Track 5: TAMPs

- There was evidence that state DOT interaction with local agencies has expanded, as evidenced by a presentation by the New Jersey DOT.
- The Texas DOT gave a presentation showing that broader discussions are taking place to build an organizational understanding of how projects are selected and programmed.
- There is also more coordination regarding assets that the state DOTs do not manage, including the development of working groups for target setting and alignment.
- Several presentations also talked about transforming their organizations to break down silos and about helping the organizations move from good to great.

Cross-Cutting Track: Transit

- The first transit track at a TAM conference was just 6 years ago. The people who attended the conference at that point in time were assigned TAM as an extra duty. Today, the industry has made tremendous strides very quickly.
- Participants talked about how they had made the TAM transition, such as finding TAM enthusiasts, putting policies and training in place to make TAM sustainable, and building cross-divisional teams to foster collaboration. BART gave a presentation on its training program.
- For many transit organizations, ISO 55000 is a chasing excellence project.

EXAMPLES SHOWING HOW TECHNOLOGY IS INFLUENCING DECISIONS

Track 2: Data Systems to Improve Decisions

- In some cases, asset managers do not like TAM efforts because technology exposes problems with data. Technology also allows agencies to do things quickly and efficiently. This provides opportunities to do forensic work on the data.
- Technology allows agencies to harness good practices and identify areas for improvement.
- Technology such as lidar allows agencies to capture data that agencies did not realize could be captured.
- Technology can also cause problems if an agency does not have the skill set and resources to manage it and keep it sustainable.

Track 3: Implementation

- There is a range of tools and technology available to support the collection of asset inventory and condition information.
- Mobile computing is really growing for data collection, training, and field referencing.
- Some of the technology available to support transit asset management made highway folks envious, but the presentations showed the crossover potential in these tools.

Cross-Cutting Track: Transit

- The presentations showed all kinds of technology applications, including drones, ground-penetrating radar, and helicopter data collection. Agencies need to have processes in place to use and manage the data gathered.
- Agencies are using visualization software to develop innovative ways to collect and use data.
- There were also discussions about technology from a procurement approach and the importance of having the right people at the table.

Cross-Cutting Track: Risk and Resilience

- The presentations showed that a lot of technology is already available to support TAM efforts. Agencies can evaluate what is out there and build from that.

EXAMPLES SHOWING HOW DATA ARE BEING USED TO COMMUNICATE WITH MULTIPLE AUDIENCES

Track 1: Analyzing and Optimizing Investment Options

- It is important to know the audience. One presentation focused on business intelligence and business analytics to enable agencies to tell their stories.
- The City of Seattle stressed that sometimes, less information can be more. It had 200 performance metrics initially but reduced those to 96 to avoid conflicts and confusion caused by too many performance measures.

Track 2: Data Systems to Improve Decisions

- The Ohio DOT hired a marketing firm to help the agency communicate and tell its story. With this assistance, the DOT put together a full tool kit for communicating with different audiences. There were several sessions that spoke to the need for this type of approach.
- Agencies recognize that they have to talk to people at different levels, and a communication plan can help agencies be successful in communicating effectively at each level.

Cross-Cutting Track: Risk and Resilience

- Agencies are recognizing that it is important to be able to use the data they already have to help decision-makers make their decisions.

GAPS AND RESEARCH IDEAS

- Guidance is needed in how best to communicate the information in a TAMP to carry it forward, as in the Ohio DOT's communication plan.
- Assistance in sharing practices across agencies, including transit agencies, is needed.
- There needs to be more standardized terminology in risk and resilience.
- It would be interesting to explore the interface between safety and asset management, especially from a transit perspective.
- Efforts focused on how to turn research into implementation would be helpful. These efforts could evaluate the value of user groups and the benefits to communities of practice and establish strong requirements for an implementation plan.
- There is a need for efforts to investigate the gaps in performance beyond what is required under Performance Measure Rule 2 (or the PM2 rule) and how it goes into the TAMP. For instance, the safety goals target zero deaths, but agencies cannot fund that. Therefore, agencies need help in how to address these issues in a political arena.
- Life-cycle planning is not a mature practice yet, so specific steps and guidance in this area would be helpful.
- Additional guidance on incorporating risk with performance trade-offs is needed.
- There is evidence of gaps between generations when talking about TAM. The younger generation likes technology, but the older generation relies more on pen and paper. There may be opportunities for mentoring or other programs to bridge this gap.

- Data mining is becoming a critical piece of TAM, so additional guidance on how to do data mining would be beneficial.
- Data governance is also becoming a more important issue. Regional peer exchanges on data governance would be helpful so that conversations at the 2020 TAM conference will have advanced further.
- Transit agencies would like to have additional guidance in communicating with regional partners, and the guidance should recognize the many different relationships that can exist between agencies.
- There is a need to help agencies better communicate TAM information. Agencies have not been able to build traction for backlog, but see potential in using a return-on-investment metric. Agencies would like to see a compilation of best practices for articulating this type of information to boards or to the public.

Closing Discussion

The session ended with an open discussion about the key themes anticipated for the 2020 TAM conference. Track leads suggested that the conference themes at that point in time will include the following:

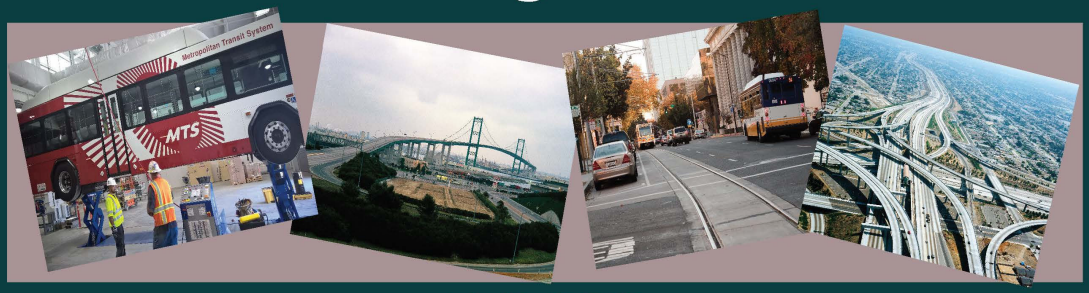
- Return-on-investment discussions and the economic impact on customers;
- Public-facing asset management practices;
- Integrated highway and transit programs;
- Changes in the way transportation agencies do business, with a focus on mobility;
- Changes in the types of assets and management approaches used to align with changes in technology;
- Increases in public–private partnerships and design–build models in DOTs; and
- Impacts of third-party data, including how to get, use, and manage that data.

Mester thanked everyone for their participation in the conference and wished them a safe journey home.

APPENDIX A
Program Agenda

TRB FINAL PROGRAM

12th National Conference on Transportation Asset Management



July 14–17, 2018
Westin, San Diego
San Diego, CA

Organized by
Transportation Research Board
Cosponsored by
American Association of State Highway and Transportation Officials (AASHTO)

http://www.trb.org/conferences/AssetMgt2018.aspx

The National Academies of
SCIENCES • ENGINEERING • MEDICINE
TRB
TRANSPORTATION RESEARCH BOARD

CONFERENCE SESSIONS

SESSIONS SUMMARY

Monday Sessions

Time/Room	Crystal I Ballroom	Crystal II Ballroom	Diamond 1	Opal Room	Topaz Room
10:30 AM	Data: Data Collection to Support TAM Decisions	Implementation: Performance Management	Investments: Rapid Fire Session: Investment Tradeoffs	Org/Workforce: Advancing Asset Management Research and Education Using Case Studies	TAMPs: State DOT TAMP Development
1:30 PM	Data: The Business of Business Intelligence in TAM	Implementation: Discussion: Our Initial TAMP is Done – What Now? (TAMP & Implementation)	Investments: Connecting Research to Application	Org/Workforce: One Size DOES NOT Fit All (Organizational Setup - DOT)	TAMPs: Transit Agency TAMP Challenges and Opportunities
3:30 PM	Data: Data Visualization to Communicate TAM Results	Implementation: Incorporating Risk in Asset Management Practice	Investments: Round Robin–Tools that Drive Asset Investment Decision Making	Org/Workforce: Tools for Communicating with Transit Executives	TAMPs: Discussion: Are All Our Plans and Targets Aligned? (TAMP)

Tuesday Sessions

Time/Room	Crystal I Ballroom	Crystal II Ballroom	Diamond 1	Opal Room	Topaz Room
8:30 AM	TAMPs: Risk and Resilience in the TAMPs	Implementation: Making Asset Management Decisions	Investments: Investment Resources for Asset Managers	Org/Workforce: Discussion: Getting Started Implementing Your Plan to Make Asset Management Work	TAMPs: Group Transit Asset Management Plan Development
10:30 AM	Data: Discussion: The Data Governance Road Less Traveled – What Did Your Agency Learn Along the Way?	Implementation: Cross Asset Prioritization	Investments: Closing Session - Panel on Optimizing Investments	Org/Workforce: Asset Management within Transit Organizations	TAMPs: Coordinating Your TAMPs: Addressing Assets You Don't Own and Local Agencies You Don't Own
1:30 PM	Data: "Is the Sky Really Falling "Communicating TAM Results	Implementation : Building and Inventory and Assessing Condition	Investments: Discussion: Bridging the Gaps Between Research and Implementation	Org/Workforce: Communicating Asset Management	TAMPs: Advancing Practices in Strategic TAMP Development

	Data Track		*Organization/Workforce Track*		*Resilience*
	Implementation Track		*TAMP Track*		*Communication/Discussion*
	Investment Track		*Transit*		

Monday, July 16, 2018

7:30 a.m.– 5:00 p.m., *Perm Reg Desk*
Registration

7:30 a.m.– 8:30 a.m., *Ballroom Foyer*
Continental Breakfast

8:30 a.m.–10:00 a.m., *Emerald Ballroom*
Opening Session: Asset Management Challenges for Today's Transportation Community
Laura Mester, Michigan DOT and Conference Chair, *presiding*

An interactive panel will address the following themes:

- The role of the federal government to provide stewardship to transportation agencies,
- The demand for increased government accountability,
- The evolution of agency investment priorities to better meet economic and societal demands,
- The need for stronger collaboration across modes and jurisdictions, and
- The growing importance of climate change and extreme weather events in agency decisions

Keynote Speakers:
Laurie Berman, Director, Caltrans
Gregory Kildare, Chief Risk Safety and Asset Management Officer, LA County MTA (Metro)
Kenneth N. Petty, II, Director, Office of Planning, FHWA

10:00 a.m.–10:30 a.m., *Ballroom Foyer*
Break

10:30 a.m.–Noon
Breakout Sessions

Data Collection To Support TAM Decisions  *(AICPCredits)*, *Crystal I Ballroom*
John Puente, Ohio DOT, *presiding*
Guanying Lei, FTA, *recording*

This session will center on advances in data collection used to support TAM, more specifically the data needed to support decision making. How, When, and What to collect will be explored. Presentations include: why the data was collected, collection methods, best practices, how it will be used, and how the data will be maintained.

Management And Practical Uses Of Transit Condition Data
Rick Laver, Dan Bisers, CH2M

Selecting Data to Best Support Asset Investment Decisions
Prashant Ram, Brad Allen, Katie Zimmerman, Applied Pavement Technology

Data Governance for Asset Management and Safety: An Integrated Approach at the Connecticut Department of Transportation
Frances Harrison, Spy Pond Partners, LLC; Karen Riemer, Connecticut DOT

Implementing Performance Management  , *Crystal II Ballroom*
Michael Johnson, Caltrans, *presiding*
Heather Holsinger, FHWA, *recording*

This session will facilitate the implementation of asset management; ensure executive and legislative support, foster inter-agency collaboration: DOT's, MPO's, RTPA's, local owners/transit owners, and facilitation of change management, communication and training.

Implementing a Performance–Based Asset Management Approach in California
Michael Johnson, Hamid Sadraie, Caltrans

Shopping For Assets
Richard Estrada, Caltrans

TAM Governance Journey at Iowa DOT
Matthew Haubrich, Peggi Knight, Iowa DOT

Rapid Fire Session: Investment Tradeoffs *(AICPCredits), Diamond 1*

Scott Richrath, Atkins, *presiding*
Michelle Stracener, Atkins, *recording*

This opening session for the track on Analyzing and Optimizing Investments will feature a series of short demonstrations and presentations designed to stimulate discussion and thought exchange throughout the conference. Presenters will demonstrate how agencies align resources and select projects that align with organization priorities. We encourage attendees to engage with presenters over the lunch that follows and throughout the two days.

Thinking Ahead: A Forward-Looking Approach Cross-Asset Trade-Off
Prashant Ram, Katie Zimmerman, Brad Allen, Applied Pavement Technology; Paul Thompson, Omar Smadi, Iowa State University

Cross-Asset Optimization System For Long-Range Investment Planning Of Highway Infrastructure Assets
Mahmoud Halfway, Infrastructure Data Solutions, Inc. (IDS)

An Optimization Model to Determine Critical Budgets for Managing Pavement and Safety
Promothes Saha, Khaled Ksaibati, University of Wyoming; Timothy McDowell, Wyoming DOT

Cross-Asset Network-Level Investment Trade-off Analysis Tool
Eddie Chou, University of Toledo; Andrew Williams, Ohio DOT

Value-Based Cross Asset Management for Transportation Assets
Zaid Alyami, Susan Tighe, University of Waterloo

Increasing Your Value through Prioritization and Project Selection that Yields Performance
Mara Campbell, Dan Pitzler, CH2M

Seattle Department of Transportation: Aligning Performance Results with Our Mission, Vision, and Goals
Terry Martin, Seattle DOT

How to Model Dedicated Funding Streams and Asset Eligibility Requirements in FTA's TERM Lite Tool
Nicholas Richter, WSP

Utilization of Strategic Asset Management to Assist in the Allocation of Resources Across Multiple Transportation Asset Classes
Josh Johnson, Russell Page, Bentley Systems

Integrating Risk Tolerance and Lifecycle Cost Analysis into the Development of TAM Investment Strategies
Richard Boadi, Jonathan Groeger, Amec Foster Wheeler

Advancing Asset Management Research and Education Using Case Studies , *Opal Room*

Anita Bush, Nevada DOT, *presiding*
Martin Kidner, Wyoming DOT, *recording*

This session will showcase how educators and practitioners are advancing research and education by using case studies which utilize research outcomes to better manage diverse assets. The case studies will highlight the importance of communication and the role of applied research in practice.

Advancing Asset Management Research and Education Using Case Studies
Gerardo Flintsch, Virginia Tech; Susan Tighe, University of Waterloo

The Role of Case Studies in the Classroom and Academic Research
Milos Posavljak, University of Waterloo, City of Waterloo

Advanced Infrastructure Management Bootcamp Project Experiences
Sue McNeil, University of Delaware

From Classroom to Practice
James Bryce, Amec Foster Wheeler

State DOT TAMP Development  *(AICPCredits)*, *Topaz Room*

Omar Smadi, Iowa State University, *presiding*
Matthew Hardy, AASHTO, *recording*

In this session we will hear from several states about their experiences developing their initial TAMPs. We will also hear a summary of data collected through the AASHTO Subcommittee on Asset Management about the use of consultants in support of TAMP development. This session will be structured to allow plenty of time for questions and discussion among the session participants.

From Paper to Practice: Putting Risk-Based Asset Management to Work
Anne-Marie McDonnell, Karen Riemer, Connecticut DOT

Minnesota: Land of 10,000+ Assets
Shannon Foss, Minnesota DOT

Visualizing Asset Management in New Mexico
Tamara Haas, New Mexico DOT, Hyun-A Park, Spy Pond Partners, LLC

Vermont's Transportation Asset Management Plan
Chad Allen, Vermont Agency for Transportation

State DOT Use of Consultant Support to Develop Initial TAMPs
Matt Hardy, AASHTO; Matthew Haubrich, Iowa DOT

Noon–1:30 p.m., *Emerald Ballroom*
Lunch

1:30 p.m.–3:00 p.m.

Breakout Sessions (cont.)

The Business of Business Intelligence in TAM  , *Crystal I Ballroom*

Ian Kidner, Ohio DOT, *presiding*
Ursula Wright , FTA, *recording*

This session will highlight some best practices of utilizing management systems to analyze data for decision making purposes. The session will feature presentations and discussions focused on Business Intelligence and the advancement of "Big Data" and how it can support agencies' decision making efforts.

The I-70 Risk and Resiliency Pilot: Proactive Management of Threats, Optimizing Investments for Improved Resiliency of Colorado Highways
Toby Manthey, Colorado DOT; Aimee Flannery, Michael Krimmer, AEM Corp

Utilization of AASHTOWare BrM to Meet Agency Policies and Objectives for Bridge Management
Joshua Johnson, Bentley Systems; Harjit Bal, New Jersey DOT

Filling The Tank: How Better Asset Information Fuels Better Asset Management
Simon Smith, AMCL

Discussion: Our Initial TAMP is Done – What Now?  , *Crystal II Ballroom*

Heather Holsinger, FHWA, *presiding*
Ister Morales, Gannett Fleming Inc., *recording*

Now that the initial TAMPs have been submitted, it's a good time to assess any feedback received and plan for the analyses required in the fully-compliant submittal. During this discussion session, state DOT practitioners and other participants will have the opportunity to share their experiences with developing their initial TAMPs and their plans for what's next on the TAMP horizon.

Connecting Research to Application , *Diamond 1*

Rob Kafalenos, FHWA, *presiding*
Scott Gordon, DTS/Atkins, *recording*

How does the research we conduct influence the ways owners of transportation infrastructure make decisions? This panel will discuss different ways that asset management research can be applied to help support the right investment decisions. The session will set the stage for a Discussion Group on Day 2 centered on "Bridging the Gaps Between Research and Implementation."

Highway Corridors Of The Future: What Every Asset Manager Needs To Know
Gareth McKay, Thomas Goodyer, WSP

Influence Of Cost And Deterioration Uncertainties On Maintenance, Rehabilitation, and Reconstruction Allocation Decisions In Pavement Management Systems
Fengdi Guo, Omar Swei, Massachusetts Institute of Technology

Maximizing Investment Efficiency In Municipal Pavement Preservation Programs
Roozbeh Rashedi, Infrastructure Solutions Inc.; Michael Maher, Golder Associates Ltd.

Setting Level of Service and Allocating Maintenance Funds Using a Linear Optimization Model
Teresa Adams, Javier Luis Vidal Carreras, University of Wisconsin - Madison

A Plan for Every Section of Every Road of Every Island
Goro Sulijoadikusumo, Hawaii Department of Transportation; Stan Burns, Integrated Inventory, LLC

One Size Does Not Fit All (Organizational Setup - DOT) , *Opal Room*

Ehsan N. Minaie, CDM Smith, *presiding*
Mylinh Lidder, Nevada DOT, *recording*

This session will showcase several approaches to transitioning individuals, teams, and organizations redirecting the use of resources, business process, budget allocations, or other modes of operation that significantly reshape a company or organization.

Organizational Aspects of a Successful Transportation Asset Management (TAM) Program
Larry Redd, Redd Engineering; Brian ten Siethoff, Cambridge Systematics

Colorado Department of Transportation's Change Management Program
Michelle Malloy, Gary Vansuch, Colorado DOT

Developing Asset Management Organizational Capability using a Maturity Approach
Richard Edwards, AMCL

Transit Agency TAMP Challenges/Opportunities , *Topaz Room*

Laura Zale, SEPTA, *presiding*
Tina Ignat, METRA, *recording*

Since the FTA Transit Asset Management Final Rule was released in 2016, transit operators have been challenged to align their TAM practices to the requirements. Many agencies are developing their initial asset management plans, which are due in October 2018. In this session, the FTA will give an overview of the TAM requirements. Two transit operators will share lessons learned through the process of developing TAMPs and incorporating asset management into business practices. Finally, we will discuss how agencies can assess alignment with international TAM standards.

Transit Asset Management: The FTA Perspective
John Giorgis, Federal Transit Administration

Integrating Fixed Assets Accounting and Asset Inventories in a True Enterprise Approach to Asset Hierarchy
Matthew Wilson, Jacksonville Transportation Authority; David Rose, Gannett Fleming

Maximizing Asset Return on Investment For Self and Clients in a Public-Sector Setting
Ajay Singh, Jeff Arbuckle, King County Metro Transit

ISO 55 000 Asset Management State of Readiness Assessment Case Studies
David Hein, Jason Bittner, Applied Research Associates, Inc.

3:00 p.m.–3:30 p.m., *Ballroom Foyer*
Break

3:30 p.m.–5:00 p.m.
Breakout Sessions (cont.)

Data Visualization to Communicate TAM Results *(AICPCredits)*, *Crystal I Ballroom*
Frances Harrison, Spy Pond Partners, LLC, *presiding*
Colleen Fegley, Seattle DOT, *recording*

This session will focus on how to visualize data to support the decision-making process. The session will feature a panel discussion and practical demonstrations.

System of Engagement (Strategic Data Integration)
Steve Wilcox, NYSDOT; Stan Burns, Integrated Inventory, LLC

Tostada – It's Not Just For Dinner Anymore, It's More, It's Data Integration
David Schrank, Texas A&M Transportation Institute; Subrat Mahapatra, Maryland State Highway Administration

Panel
Mathias Burton, Socrata; William Johnson, Colorado DOT;
Anne-Marie McDonnell, Connecticut DOT; Terry Martin, Seattle DOT

Incorporating Risk in Asset Management Practice , *Crystal II Ballroom*
Niles Annelin, Michigan DOT, *presiding*
Will Duke, Spy Pond Partners, *recording*

This session focuses on aligning planning to asset management, focusing on asset performance outcomes, project prioritization methodologies, and asset management framework.

Asset Management for Rock Slopes in Montana
Darren Beckstrand, Aine Mines, Landslide Technology; Jeff Jackson, Scott Helm, Bret Boundy, MDT; Paul Thompson, Consultant

Geotechnical Asset Management Implementation Planning For Transportation Agencies
Mark Vessely, BGC Engineering Inc.;

Practical Steps to Manage Climate Risk through Asset Management
Beth Rodehorst, Cassandra Bhat, Tommy Hendrickson, Amanda Vargo, ICF

Round Robin–Tools that Drive Asset Investment Decision Making ,*Diamond 1*
(AICPCredits)
Ted Hull Ryde, Atkins, *presiding*
Goro Sulijoadikusumo, Hawaii DOT, *recording*

From simple spreadsheets to sophisticated software, the business of managing transportation investment requires in depth analysis of data and often the quantification of qualitative observations. Using a round robin format, attendees will circulate in groups among the following topic "hosts" to engage with each of the presenters in a setting aimed to encourage discussion and feedback.

Integrating Extreme Weather Risk into Asset Management at the U.S. FWS
Cassandra Bhat, Susan Asam, Hannah Wagner, ICF

Driving Bridge Infrastructure Investment Decision Using Stochastic Condition Deterioration Models
Mohammad Sayar, Abhishek Bhargava, AgileAssets

Using Adaptive Management to Increase Resilience
Brenda Dix, Beth Rodehorst, Cassandra Bhat, ICF

Integrating Risk Assessment into the Decision-Making Process within Asset Management Systems
Jose Menendez, Nima Kargah-Ostadi, Jerome Daleiden, James Sassin, Fugro USA Land, Inc

Practical Uses of Risk-Based Prioritization for Transit State of Good Repair Investments
Emily Grenzke, Kimley-Horn

Spreadsheet Tools for Analysis of Transit Asset Investment Needs and Quality of Service Impacts
William Robert, Spy Pond Partners

Considering Socioeconomic and Environmental Criteria on Paved Road Network Investments: The Case of Costa Rica's National Road Network
José David Rodríguez-Morera, Rodrigo Arias-García, University of Costa Rica

Transit Executive Communication  , *Opal Room*

Mshadoni Smith, FTA, *presiding*
Laura Zale, SEPTA, *recording*

This session will focus on pilot materials that FTA has developed to support transit professionals in communicating the value of Transit Asset Management (TAM) to executives. The presentation materials serve as a template that TAM professionals can edit to incorporate agency-specific information, and cover topics such as key benefits of implementing TAM, an overview of the federal rule and TAM requirements, and a vision for a mature TAM program. This focus group-like session will include a presentation of the materials followed by a group discussion regarding agency experiences with gaining executive support for TAM, as well as feedback on the presentation materials.

Discussion: Are All Our Plans and Targets Aligned?  *(AICPCredits)*, *Topaz Room*

Mara Campbell, CH2M, *presiding*
Matt Hardy, AASHTO, *recording*

Requirements for developing a TAMP and target setting require a "collaborative and coordinated effort" to collect the data needed for performance and asset management from other NHS owners. This discussion group will explore the processes that state, regional, and local agencies have established to collect and report performance data, as well as their approaches to target setting.

5:00 p.m.–6:30 p.m., *Emerald Ballroom*

Poster Session and Reception

Data Systems to Improve Decisions

Prioritizing Maintenance Activities Using an Analytic Hierarchy Process (AHP)
Teresa M Adams, Javier Luis Vidal Carreras, University of Wisconsin - Madison

Developing and Integrating Customized Decision Trees for Local Agency's Pavement Management Systems
DingXin Cheng, California State University, Sui Tan, Metropolitan Transportation Commission

MnDOT's Innovative Approach to Earth Retaining System Inventory, Inspection and Management
Barritt Lovelace, Collins Engineers; Stefanski Trisha, Minnesota Department of Transportation

Pavement Asset Management Software (PAMS) Implementation
Ilisel Espinal, John Helwig, GHD; Pamela Worley, Pennsylvania Turnpike Commission

Analyzing and Optimizing Investment Options

Keep Fixing the Station Wagon, or Splurge on a Flashy New Sedan? Transportation Management System Device Replacement Cost Analysis: A San Francisco Bay Area Case Study
Kaki Cheung, Metropolitan Transportation Commission; Kwasi Akwabi-Ameyaw, Kimley Horn Associates; Joseph Arroyo, Sean Eagen

Linking River Port Organizational Goals with Asset Management Execution
Elizabeth Collins Burkhart, Collins Engineers, Inc.; Greg Pritchett, Henderson County Riverport Authority

Rural County Pavement Preservation Planning
Craig Vaughn, SRF Consulting Group, Inc.

Tuesday, July 17, 2018

7:30 a.m.– 4:00 p.m., *Perm Reg Desk*
Registration

7:30 a.m.– 8:30 a.m., *Ballroom Foyer*
Continental Breakfast

8:30 a.m.–10:00 a.m.
Breakout Sessions (cont.)

Risk and Resilience in the TAMPs *(AICPCredits)*, *Crystal I Ballroom*
Scott Zainhofsky, North Dakota DOT, *presiding*
Martin Kidner, Wyoming DOT, *recording*

Asset risk assessments are a requirement for Transportation Asset Management Plans. A part of these risk assessments revolve around accounting for system resiliency. These presentation focus on various aspects of resiliency in TAMPs.

Strategies for Improving the Resiliency of Transportation Assets
Prashant Ram, Brad Allen, Katie Zimmerman, Applied Pavement Technology

Using Resilience in Risk-Based Asset Management Plans
YuanChi Liu, Sue McNeil, University of Delaware

Arizona DOT TAM Risk Management–Extreme Weather: Blending Risk, Science, Technology, Engineering
Steven Olmsted, Arizona DOT; Alan O'Connor, Trinity College in Dublin Ireland; Constantine Samaras, Carnegie Mellon University

Making Asset Management Decisions *(AICPCredits)*, *Crystal II Ballroom*
Brad Allen, Applied Pavement Technology, Inc., *presiding*
Ister Morales, Gannett Fleming Inc., *recording*

This session includes Asset management software solutions, information management (BIM: Better Information Management, CIM: Civil Integrated Management), and cross-asset data structures for asset management.

Integrating Network-Level Lifecycle Cost Analysis Into Transportation Asset Management While Addressing Variability And Uncertainty
Richard Boadi, Jonathan Groeger, James Bryce, Amec Foster Wheeler

Using Technology to Better Communicate the Benefits of Project and Program Level Investments
Shourya Shukla, Donna Huey, Atkins

Waterloo Asset Management System Implementation
Milos Posavljak, Susan Tighe, Cassandra Pacey, University of Waterloo, City of Waterloo

Planning for Success–Best Practices in Selecting Actionable Asset Management Performance Goals
Don Hillis, Parsons

Investment Resources for Asset Managers *(AICPCredits)*, *Diamond 1*
Tom Wesp, Atkins, *presiding*
Paul Edwards, Utah Transit Authority, *recording*

Much like an individual investor planning for retirement, the owner of transportation infrastructure draws from an assortment of resources to determine the right projects, treatment selections, and program funding levels. These presenters will provide ideas to help guide your investment decisions.

Determining the Value of Information in Asset Management Decisions
David Luhr, Jianhua Li, Washington State DOT

A Practical Framework for Managing All Transportation Assets
Shobna Varma, StarIsis, Corp; Gordon Proctor, Gordon Proctor & Associates, Inc.

Iowa DOT Project Scoping and Prioritization Process
Matthew Haubrich, Brad Hofer, Iowa Department of Transportation

Discussion: Getting Started Implementing Your Plan to Make Asset Management Work

, *Opal Room*

William Johnson, Colorado DOT, *presiding*
Anita Bush, Nevada DOT, *recording*

This discussion session focuses on getting the most of your agency's asset management efforts by providing an opportunity to share organizational and workforce changes that led to an improved asset management culture. Suggestions for making asset management work through improved communication, streamlined business processes, and focused workforce development will be generated through the peer discussions.

Group Transit Asset Management Plan Development

, *Topaz Room*

John O'Har, KPMG, *presiding*
Janice Williams, VIA Metropolitan Transit, *recording*

Smaller transit agencies are given the option of joining a group plan for their state of operation. These group plans require strong collaboration between sponsors and operators. This session will provide insights on these "group plans" with examples from the transit agency, MPO, and State agency perspective.

Lots Group Asset Management Plan
Justin Barclay, Maryland Transit Administration

Regional Group TAMP for 16 Tier II Operators in the San Francisco Bay Area Region
Shruti Hari, Metropolitan Transportation Commission

Iowa's Approach to Transit Asset Management Group Plan
Sree Mitra, Iowa Department of Transportation

10:00 a.m.–10:30 a.m., *Ballroom Foyer*
Break

10:30 a.m.–Noon
Breakout Sessions

Discussion: The Data Governance Road Less Traveled–What Did Your Agency Learn Along the Way?

, *Crystal I Ballroom*

Anita Vandervalk, Iteris; Margaret Poteat, KPMG, *presiding*
Andrew Williams, Ohio DOT, *recording*

This session will feature two short presentations followed by a facilitated workshop discussion. The presentations to set the stage focus on a) the state of the practice with respect to data business planning within states and b) an international view of data governance techniques. The workshop will include breakouts to explore core aspects of a data management and government framework for successful asset management. Takeaways for participants will include a clearer, applicable plan of action for addressing gaps and refinements for each agency's journey towards effective and sustainable data governance and management practices.

Data Business Planning to Optimize Asset Management Decisions
Anita Vandervalk, Iteris

Cross Asset Prioritization *(AICPCredits)*, *Crystal II Ballroom*

Loren Turner, Caltrans, *presiding*
Shalini Chandra, Caltrans, *recording*

Dollars should follow system performance. These presentations illustrate various approaches to cross-asset allocation.

Case Studies in Implementation of Cross-Asset Resource Allocation Tools

William Robert, Spy Pond Partners; Craig Secrest, High Street Consulting

Implementation of a Multiple-Objective Decision Analysis (MODA) Approach for Prioritization of Asset Investments for Caltrans

Michael Johnson, Caltrans; William Robert, Spy Pond Partners

Strategic Asset Management in the U.S. Public Port Industry—Exploring Opportunities for Increased Engagement

Erik Stromberg, Lamar University

Moving Towards a Statewide View of Resource Allocation

Tamara Haas, New Mexico DOT; Hyun-A Park, Spy Pond Partners, LLC

Panel on Optimizing Investments , *Diamond 1*

Scott Richrath, Atkins, *presiding*
Rob Kafalenos, FHWA, *recording*

Before a final discussion group that will help "Bridge the Gaps Between Research and Implementation," let's round out the track on Analyzing and Optimizing Investment Options.

TransLink's Enterprise Asset Management Journey - Factors of Success and Lessons Learned

Vikki Kwan, TransLink

Using Data to Make Better Investment Decisions: A Review of the NY MTA's 35-Year History of $118 Billion Worth of Investment to Restore and Improve Its System

Stephen Berrang, New York MTA HQ; Mildred Chua, MTA Bridges and Tunnels

Life Cycle Planning: What It Is and How It Can Be Used

Kathryn Zimmerman, Applied Pavement Technology, Inc.

Methodology to Enable Full TAM Plan implementation

Paul Thompson, Consultant

Asset Management within Transit Organizations , *Opal Room*

David Rose, Gannett Fleming, *presiding*
Cecilia Crenshaw, FTA, *recording*

This session will showcase structured best practices and lessons learned session involving transit agency asset managers. The session provides the attendees the opportunity to learn first-hand about the success factors and pitfalls to avoid when improving asset management practices – on route to meeting the federal requirements and advancing organizational goals.

Panel Discussion

Laura Zale, SEPTA
Holly Arnold, Maryland Transit Administration
John McCormick, Bay Area Rapid Transit District
Matthew Wilson, Jacksonville Transportation Authority

Coordinating Your TAMPs: Addressing Assets You Don't Own and Local Agencies You Don't Own  , *Topaz Room*

William Knowles, Texas DOT, *presiding*
Steve Gaj, FHWA, *recording*

MAP-21 and the FAST act set some new expectations for inter-agency coordination. Effective Performance Based Planning and Programming as well as Transportation Asset Management require working across jurisdictional boundaries to provide the mobility that the public desires. This session will explore these issues from a number of perspectives.

How Does Asset Management Fit into the Planning TPM Framework of the Overall Performance-Based Programs of States, MPOs, and Other Local Owners?
Harlan Miller, FHWA

The NOACA Case Study: Integrating Transportation Asset Management into the Planning Process
Kathy Sarli, Northeast Ohio Areawide Coordinating Agency (NOACA)

Developing an Asset Management Plan in Washington State Including Locally Owned Roads
Todd Lamphere, Washington DOT

Addressing Asset Management Coordination in North Central Texas
Jeff Neal, North Central Texas Council of Governments

Setting the Course for Compliance and Beyond–A Case Study of State, MPO, and Local Agency Coordination for NHS Target-Setting
Theresa Romell, Sui Tan, Metropolitan Transportation Commission

Noon–1:30 p.m., *Emerald Ballroom*
Lunch

1:30 p.m.–3:00 p.m.

Breakout Sessions (cont.)

"Is the Sky Really Falling?" Communicating TAM Results  , *Crystal I Ballroom*

Julie Lorenz, Burns & McDonnell, *presiding*
Emily Tritsch, Portland Bureau of Transportation, *recording*

What does the data say about results from your TAM program? This session will focus on some best practices for communicating results effectively to ensure proper decision making throughout your organization.

Seattle's Sidewalk Assessment and Prioritizing Repairs
Emily Burns, Collen Fegley, Seattle Department of Transportation

TransLink's Capital Investment Decision Support Journey
Vikki Kwan, TransLink

Smart Use of GIS to Determine Asset Ages
Royce Greaves, WSP

Building an Inventory and Assessing Condition  , *Crystal II Ballroom*

William Robert, Spy Pond Partners, LLC, *presiding*
Jennifer Duran, Caltrans, *recording*

Asset inventory and condition assessment approaches are well established for assets for such as pavement and bridges, but much work remains to determine what data to collect for other physical assets, and how best to assess their condition. This session includes a series of presentations describing approaches different agencies have followed to improve their asset inventories and condition assessment processes. It includes presentations on inventory and condition assessment for state DOTs, metropolitan areas, and transit agencies. It also includes discussion of recent research regarding inventory and condition data needed when including additional assets besides pavement and bridges in a highway asset management plan.

So You Think You Want Asset Management
Elizabeth Young, Richard Martinez, City of Fort Worth

Asset Management Process Driving a Vision for the Future
Paul Clark, Florida DOT; John Benda, Adam Horn, HNTB Corporation

Agency-Driven Transit Asset Management
Herb Higginbotham, Reagan Lynn, Nathan Higgins, Cambridge Systematics

Enterprise Data Collection–It's Not Just An Asset Anymore
John Puente, Ohio DOT

What Next? Prioritizing Assets Classes for Inclusions in an Asset Management Program
Brad Allen, Prashant Ram, Katie Zimmerman, Applied Pavement Technology

Discussion: Bridging the Gaps Between Research and Implementation  , *Diamond 1*

Sue McNeil, University of Delaware, *presiding*
Prashant Ram, APTech, *recording*

There are many tools available to support the analysis and optimization of investment options that vary in terms of ease of use, cost, and practicality. Innovative ideas are available, but they often don't match the needs of practitioners. This discussion session provides an opportunity to identify ideas and strategies that better link innovation and analysis tools with the day-to-day needs of asset management practitioners.

Communicating Asset Management  , *Opal Room*

Rob Zilay, Dye Management, *presiding*
Tamara Haas, New Mexico DOT, *recording*

Tools to Effectively CommunicateInvestment Decisions

Using Corporate Language to Sell Public Investments
Gordon Proctor, Gordon Proctor & Associates, Inc.; Shobna Varma, Starisis, Corp.

The Key To Convincing Your Stakeholders To Invest In Asset Management
Margaret Akofio-Sowah, WSP

Knowledge And Communication: How Good Training Builds Effective Transit Asset Management
Ruth Wallsgrove, Amcl; Tom Elner, Asset Management Academy

Using Enterprise Asset Management Principles to Shift an Organization's Operational Focus to a Customer: Centric Service Model for Better Strategic Alignment
Wayne Francisco, GHD Inc.; Mildred Chua, David Kraft, MTA Bridges & Tunnels

Advancing Practices in Strategic TAMP Development  *(AICPCredits)*, *Topaz Room*

Matthew Haubrich, Iowa DOT, *presiding*
Peggi Knight, Iowa DOT, *recording*

What are the future frontiers for TAMP development? This session aims to address this question with presentations across multiple topics and asset types. Be prepared for an interactive session with plenty of opportunity for discussion.

Intellectual Property Concerns in Asset Management Planning
Jason Bittner, Hannah Silber, Kevin Chesnik, ARA

Moving From a Condition-Based 20 Year Needs Assessment to a Performance-Driven Asset Management Plan
David Kraft, MTA Bridges & Tunnels; Maxwell Brown, GHD Inc.

Practical Interface Opportunities Between Safety And Asset Management Systems
John Gasparine, WSP

Chasing Excellence: How Denver RTD Is Transforming Its Asset Management Capability Through ISO 55000
Louis Cripps, Regional Transportation District; Simon Smith, AMCL

3:00 p.m.–3:30 p.m., *Ballroom Foyer*
Break

3:30 p.m.–5:00 p.m., *Emerald Ballroom*

Closing Session

Laura Mester, Michigan DOT and Conference Chair, *presiding*

The conference presentations demonstrate the evolution that is taking place in asset management today. Just a few years ago, most agencies were identifying an asset management champion and focusing on building an asset management culture. Today, agencies are moving towards a more sustainable, cross-cutting, and evolved program.

In the closing session, each of the Track Chairs will share highlights from their sessions related to ways in which:

- The practice of asset management is evolving,
- Agencies are creating sustainable asset management programs that are embedded in the organization's culture,
- Technology is influencing the way decisions are made, and
- Data are being used to speak to multiple audiences.

The session will conclude with a summary of gaps that would benefit from further research or technology transfer efforts.

Track Leads:

Analyzing and Optimizing Investment: Scott Richrath, Atkins
Data Systems to Improve Decisions: Andrew Williams, Ohio DOT
Implementation: Michael Johnson, Caltrans
Organization and Workforce: Anita Bush, Nevada DOT
TAMPs: Matthew Haubrich, Iowa DOT
Transit: Laura Zale, SEPTA
Resilience: Niles Annelin, Michigan DOT

5:00 p.m.–6:00 p.m., *Pearl Room*

Planning Committee Debriefing *(Invitation Only)*

APPENDIX B
List of Registrants

Bruce Abanathie
Santa Clara Valley Transportation Authority

Camille Abou-Fadel
California Department of Transportation

Margaret-Avis Akofio-Sowah
WSP USA

Kwasi Akwabi
Kimley-Horn and Associates

Mohammed Alam
Maks Inc

Sirous Alavi
Fugro

Ahmed J. AlBughdadi
Iowa State University

Monte Aldridge
Utah Department of Transportation

Nicholas Alexander
New Hampshire Department of Transportation

Brad Allen
Applied Pavement Technology, Inc.

Chad Allen
Vermont Agency of Transportation

Jason Amadori
Data Transfer Solutions LLC

Aisha Anders
WSP USA

Teri Anderson
California Transportation Commissioner

Stephen Andrle
Transportation Research Board

Niles Annelin
Michigan Department of Transportation

Joseph Anthony
Pathway Services

Jeff Arbuckle
King County Metro Transit, Power & Facilities

Arturo Arias Fernandez
District Department of Transportation

Holly Arnold
Maryland Transit Administration

Stephen Arrants
CGI

Joseph Arroyo
Kimley-Horn and Associates

John Auble
TomTom

Tim Babich
SRF Consulting Group, Inc.

Harjit Bal
New Jersey Department of Transportation

Jean Banker
Mott MacDonald

Justin Barclay
Maryland Transit Administration

Chuck Bartlett
Alfred Benesch & Company

Martin Batistelli
Los Angeles County Metropolitan Transportation Authority

Bahareh Bazargani
Institute for Transportation at Iowa State University

William Beatty
Federal Highway Administration

Darren Beckstrand
Landslide Technology

Basak Bektas
Iowa State University

Deanna Belden
Minnesota Department of Transportation

Josh Bench-Bresher
South Dakota Department of Transportation

John Benda
HNTB

Bob Benstead
Infor Public Sector

Laurie Berman
California Department of Transportation

Stephen Berrang
Metropolitan Transportation Authority

Cassandra Bhat
ICF

Andrew Bickmore
Maine Department of Transportation

Terry Bills
Esri

Daniel Bisers
Jacobs

Anna Biton
Volpe National Transportation Systems Center

Jason Bittner
ARA

Steve Blair
California Department of Transportation

Jeannie Bland
Illinois Department of Transportation

Richard Boadi
Wood Environment & Infrastructure Solutions, Inc.

Larysa Bodnar
DerzhdorNDI SE

Mark Boenke
PILLAR, Inc.

Johnny Bofilios
Copperleaf

Jeremy Borrego
Federal Transit Administration

Gary Bosinger
California Department of Transportation

Eric Botting
ARRB Group Inc.

Bill Boyd
California Department of Transportation

Dale Brantley
Wood E&I

Daniel Brescia
Sixense

Michael Bridges
Mott MacDonald

Grant Brodehl
Rio Metro Regional Transit District

Charles Brooks
PILLAR, Inc.

Maxwell Brown
GHD, Inc.

Justin Bruner
Pennsylvania Department of Transportation

James Bryce
Amec Foster Wheeler

Drake Builta
Texas Department of Transportation

Rebecca Burkel
Wisconsin Department of Transportation

Elizabeth Burkhart
Collins Engineers, Inc.

Emily Burns
Seattle Department of Transportation

Stan Burns
Integrated Inventory, LLC

David Burrows
Gannett Fleming

Jerry Burrows
PILLAR, Inc.

Mathias Burton
Socrata

Wendi Burton
Michigan Department of Transportation, Bureau of Planning

Anita Bush
Nevada Department of Transportation

Jonathan Camp
California Department of Transportation

Mara Campbell
Jacobs

Todd Campbell
Numetric

E. Dean Carlson
Carlson Associates

Charles Carr
Minnesota Department of Transportation

Nieves Castro
California Department of Transportation

Shalini Chandra
California Department of Transportation

Laura Chaney
Oklahoma Department of Transportation

Carlos Chang
University of Texas at El Paso

Mara Chaudhari
California Department of Transportation

Kaki Cheung
Metropolitan Transportation Commission

Eddie Chou
University of Toledo

Chi Chow
Golden Gate Bridge, Highway & Transportation District

Mildred Chua
New York Metropolitan Transportation Authority, Bridges and Tunnels

Annette Clark
California Department of Transportation

Perry Clark
Carver County

Mike Coldrick
Bentley Systems

Nathaniel Coley
Federal Highway Administration

Gregory Collins
Washington Metropolitan Area Transit Authority

Thomas Collins
Collins Engineers, Inc.

Matthew Connelly-Taylor
Fugro

Locke Craig-Mickel
Washington State Department of Transportation

Cecilia Crenshaw
Federal Transit Administration

Louis Cripps
Denver Regional Transportation District

Joseph Crossett
High Street Consulting Group

Jerry Daleiden
ARRB Group, Inc.

Andrea d'Amato
Massachusetts Department of Transportation

David Davila
Asset Management Academy/AMCL

Meg Davis
Bentley Systems

Peter Davis
HDR

Carlos De La Torre
Miami-Dade Transit

Paul Degges
Tennessee Department of Transportation

Amanda DeGiorgi
Jacobs Engineering

Stacey DeLorenzo
University of Illinois at Urbana–Champaign

Donna DeMartino
San Joaquin Regional Transit District

Erin Dey
Maryland State Highway Administration

Tammy Dickens
Miami-Dade Transit

Brenda Dix
ICF

Peter Doan
Federal Highway Administration

Missy Doedtman
Illinois Department of Transportation

Sean Dolan
Esri

Thomas Donahue
Jacobs

Eric Dorsey
Connecticut Department of Transportation

Andy Doyle
Georgia Department of Transportation

William Duke
Spy Pond Partners, LLC

Jennifer Duran
California Department of Transportation

Jim Edgerton
AgileAssets Inc.

Paul Edwards
Utah Transit Authority

Richard Edwards
AMCL

Butch Eley
DBi Services

Tom Elner
Asset Management Academy Ltd

Kelley Ernsdorff
AssetWorks

Ilisel Espinal
GHD, Inc.

Laura Espinoza
California Department of Transportation

Richard Estrada
California Department of Transportation

Louis Feagans
Indiana Department of Transportation

Colleen Fegley
Seattle Department of Transportation

Brandon Fitt
California Department of Transportation

Aimee Flannery
AEM Corporation

Gerardo Flintsch
Virginia Tech

Mike Flood
Washington State Department of Transportation

Kristi Folse
Louisiana Department of Transportation and Development

Shannon Foss
Minnesota Department of Transportation

Dawn Foster
California Department of Transportation

Wayne Francisco
GHD, Inc.

Tracey Frost
California Department of Transportation

Amy Frye
Golden Gate Bridge

George Fuller
AMCL

Stephen Gaj
Federal Highway Administration

Rachel Galton
Volpe National Transportation Systems Center

Joseph Garcia
AEM Corporation

Joe Garvey
AgileAssets, Inc.

John Gasparine
WSP

Judy Gates-Kilpatrick
Maine Department of Transportation

David Gaylord
New Hampshire Department of Transportation

Taylor Gilmore
Bentley Systems

John Giorgis
Federal Transit Administration

Dana Glover
Texas Department of Transportation

Craig Gooding
Continental Mapping

Randy Goodman
Louisiana Department of Transportation and Development

Thomas Goodyer
WSP

Scot G ordon
Data Transfer Solutions LLC

Yonel Grant
Kimley–Horn and Associates

Danielle Graves
New Jersey Department of Transportation

Royce Greaves
WSP | Opus Canada

Brien Green
Decision Lens

Kevin Green
eVision Partners, Inc.

Emily Grenzke
Kimley–Horn and Associates

Susan Gresavage
New Jersey Department of Transportation

Jonathan Groeger
Wood Environment & Infrastructure Solutions, Inc.

Hannah Groshong
Spy Pond Partners, LLC

Fengdi Guo
Massachusetts Institute of Technology

Sherwin Gutierrez
Regional Transportation Commission

John Guymon
Numetric

Tammy Haas
New Mexico Department of Transportation

Elizabeth Habic
Maryland State Highway Administration

Samuel Haffner
Ohio Department of Transportation

Mahmoud Halfawy
Infrastructure Data Solutions, Inc. (IDS)

Johnny Halman
Jacksonville Transportation Authority

Matthew Hardy
AASHTO

Shruti Hari
Metropolitan Transportation Commission

Chris Harris
Tennessee Department of Transportation

Frances Harrison
Spy Pond Partners, LLC

Yolande Harrison
Dallas Area Rapid Transit

Jacob Hassard
Valley Regional Transit

Matthew Haubrich
Iowa Department of Transportation

Les Hawker
Transport for London

Jamie Hendrickson
Hennepin County Transportation, Operations

Timothy Henkel
Minnesota Department of Transportation

Tom Hershberger
Mandli

Herbert Higginbotham
Cambridge Systematics, Inc.

Darron Hill
California Department of Transportation

Meredith Hill
Maryland Department of Transportation

Don Hillis
Parsons

Ryan Hixson
Federal Highway Administration

Brad Hofer
Iowa Department of Transportation

Daniel Hofer
Utah Transit Authority

Ian Holme
Suburban Mobility Authority for Regional Transportation

Heather Holsinger
Federal Highway Administration

Jordan Holt
Washington Metropolitan Transit Authority

Feng Hong
Texas Department of Transportation

Adam Horn
HNTB

Amir H. Hosseini
Iowa State University

Patricia Hu
U.S. Department of Transportation

Michael Hubbell
Lone Star Transit Asset Management

Stuart Hudson
AgileAssets, Inc.

Donna Huey
Atkins

Ted Hull-Ryde
Atkins

Thomas Humphrey
Metro Transit

Nick Hutton
Esri

Allen Ibaugh
Data Transfer Solutions LLC

Marisa Ideta
City and County of Honolulu Department of Transportation Services

Tina Ignat
Metra

Megan Inouye
City and County of Honolulu

Victor Iwuoha
Strathcona County

Braporh Jacobs
Colorado Department of Transportation

Shaina Alitzel Jimenez Nuñez
Semic

David Johnson
Chicago Transit Authority

Joshua Johnson
Bentley Systems

Leif Johnson
Bentley Systems

Michael Johnson
California Department of Transportation

Patrick Johnson
Sound Transit

William Johnson
Colorado Department of Transportation

Lisa Joiner
Federal Transit Administration

Jocelyn Jones
Federal Highway Administration

Samuel Jordan
California Department of Transportation

David Juntunen
Kercher Group, Inc.

Robert Kafalenos
Federal Highway Administration

William Kalt
Federal Transit Administration

Shyam Kannan
Washington Metropolitan Transit Authority

Nima Kargah-Ostadi
Fugro USA Land, Inc.

Muthiah Kasi
Alfred Benesch & Company

Amy V. Kaufman
Jacobs

Robert Kellner
HDR

Alan Kercher
Kercher Group, Inc.

Maiser Khaled
Federal Highway Administration

Raymond Khoury
Virginia Department of Transportation

Ian Kidner
Ohio Department of Transportation

Martin Kidner
Wyoming Department of Transportation

Gregory Kildare
Los Angeles County Metropolitan Transportation Authority

Kristen Kingsley
California Department of Transportation

Alan Kirkpatrick
City of Hamilton

O. Kitaguchi
Central Nippon Expressway Company Limited

Peggi Knight
Iowa Department of Transportation

William Knowles
Texas Department of Transportation

Chip Knowlton
Arcadis–SEAMS

Susan Ko
Federal Transit Administration

Jeremy Koonce
Collins Engineers, Inc.

David Kraft
New York Metropolitan Transportation Authority, Bridges and Tunnels

Benoit Kroely
Sixense

Vikki Kwan
TransLink

Aaron Lam
San Mateo County Transit District

Chris LaMacchia
Federal Transit Administration

Randy Lamm
Los Angeles County Metropolitan Transportation Authority

Todd Lamphere
Washington State Department of Transportation

Richard Laver
CH2M HILL

Philip Law
Southern California Association of Governments

Mai Quynh Le
Transportation Research Board

Caroline Leary
Dye Management Group, Inc.

Doris Lee
WSP

Nathan Lee
Utah Department of Transportation

Peter Lee
Bay Area Toll Authority

Alan Lehto
TriMet

Guanying Lei
Federal Transit Administration

Andrew Lemer
Transportation Research Board

Manny Leon
New York Metropolitan Transportation Authority, Bridges and Tunnels

Shawnessy Leon
Alaska Railroad Corporatioan

Brian Leshko
HDR

Wade Lester
Louisiana Department of Transportation and Development

Simon Lewis
AECOM

Ning Li
Virginia Department of Transportation

Mylinh Lidder
Nevada Department of Transportation

Wane-Jang Lin
Maryland Department of Transportation

Amy Lindblom
Sound Transit

YuanChi Liu
University of Delaware

Ryan Long
Federal Transit Administration

Denise Longley
Los Angeles County Metropolitan Transit Authority

Carlos Antonio Lopez Hernandez
Semic

Sharline López Ramírez
University of Costa Rica

Julie Lorenz
Burns & McDonnell

Angela Louie
Metropolitan Transportation Commission

Barritt Lovelace
Collins Engineers, Inc.

Justin Lucas
ACHD

David Luhr
Washington State Department of Transportation

Ali Maher
Rutgers University

Michael Maher
Golder Associates Ltd.

Deanna Maifield
Iowa Department of Transportation

Wolde Makonnen
District Department of Transportation

Jagannath Mallela
WSP USA

Stephen Maller
California Transportation Commission

Toby Manthey
Colorado Department of Transportation

Mark Marienfeld
TreadMark

Eileen Mark
City & County of Honolulu Department of Transportation Services

Kent Marquardt
Texas Department of Transportation

Terry Martin
Seattle Department of Transportation

Richard Martinez
City of Fort Worth

Corwin Matthews
Mass Transportation Authority

Brad McCaleb
Arkansas Department of Transportation

John McCormick
Bay Area Rapid Transit District

Anne-Marie McDonnell
Connecticut Department of Transportation

Timothy McDowell
Wyoming Department of Transportation

A. J. McGauley
Sound Transit

Travis McGrath
Idaho Transportation Department

Gareth McKay
WSP

Todd McLeod
HDR

Sue McNeil
University of Delaware

Jim McNulty
BLUEFIN, LLC

Laura Mester
Michigan Department of Transportation

Matthew Mestre
Ohio Department of Transportation

Alexi Miller
Houston METRO

Carl Miller
COMPASS

Harlan Miller
Federal Highway Administration

Karen Miller
Missouri Department of Transportation

Ehsan Minaie
CDM Smith

Agata Miszczyk
Minnesota Department of Transportation

Gary Mitchell
Fugro

Sreeparna Mitra
Iowa Department of Transportation, Office of Public Transit

Robert Moen
Metro Transit

Ister Morales
Gannett Fleming

Carolyn Morehouse
Alaska Department of Transportation and Public Facilities

Kristy Morter
Hennepin County

Robert Mosbey
City of Fort Collins

Greg Moyer
San Mateo County Transit District

Alma Mujkanovic
Georgia Department of Transportation

Daniel Muller
North Carolina Department of Transportation

Karim Naji
Federal Highway Administration

Jeffrey Neal
North Central Texas Council of Governments

James S. Nelson
Iowa Department of Transportation

Craig Newell
Michigan Department of Transportation

Thanh Nguyen
PILLAR, Inc.

Jennifer Nicewander
Public Works, City of Dallas

Azni November
Western Cape Government, Department of Transport and Public Works

Tracy Nowaczyk
Kentucky Transportation Cabinet

Kingsley Nwosu
AgileAssets, Inc.

Alan O'Connor
Trinity College Dublin

John O'Hara
KPMG LLP

Toshiyuki Oka
Central Nippon Expressway Company Limited

Jon Olivier
California Department of Transportation

Steven Olmsted
Arizona Department of Transportation

Harwell Ontoy
California Department of Transportation

Elizabeth Orr
Federal Transit Administration

Russell Page
Bentley Systems

Charlene Palmer
NCE

Thomas Palmerlee
Transportation Research Board

Hyun-A Park
Spy Pond Partners, LLC

Seri Park
Villanova University

Sarah Partap
MENG Analysis

Satyen Patel
MBTA

Alex Payne
Copperleaf

Mohsen Pazooki
California Department of Transportation

Robert Peskin
AECOM

George Peterson
Stahl Sheaffer Engineering, LLC

Kenneth Petty II
Federal Highway Administration

Charles Pilson
Kercher Group, Inc.

Dan Pitzler
Jacobs

Wendy Platanitis
Valley Metro

Lisa Pohlmeyer
Central Texas Regional Mobility Authority

James Poorbaugh
Idaho Transportation Department

Milos Posavljak
University of Waterloo

Margaret Poteat
KPMG LLP

Greg Pritchett
Henderson County Riverport

Gordon Proctor
Gordon Proctor and Associates

Jorge Pubillones
State Road and Tollway Authority

John Puente
Ohio Department of Transportation

Karuna Pujara
Maryland State Highway Administration

Charlie Purcell
Iowa Department of Transportation

David Putz
Iowa Department of Transportation

Prashant Ram
Applied Pavement Technology, Inc.

Lisa Randall
Federal Highway Administration
Resource Center

Roozbeh Rashedi
Infrastructure Solutions, Inc.

Tammy Ratliff
Federal Highway Administration, Eastern Federal Lands Highway Division

Teresa Ray
Metropolitan Atlanta Rapid Transit Authority

Susanna Reck
Federal Highway Administration

Larry Redd
Redd Engineering

Andrew Reovan
Volpe National Transportation Systems Center

Scott Richrath
Atkins

Nicholas Richter
WSP

Karen Riemer
Connecticut Department of Transportation

Barbara Ritter
Maricopa County Department of Transportation

Victor Rivas
Jacobs Engineering

J. Shawn Rizzutto
California Department of Transportation

William Robert
Spy Pond Partners, LLC

Neil Roberts
Infrastructure Solutions, Inc.

Michael Robson
Fugro

Robert Rockefeller
Gannett Fleming

Beth Rodehorst
ICF

Geoffrey Rodriguez
Louisiana Department of Transportation and Development

José David Rodríguez
University of Costa Rica

Maddalena Romano
New York City Department of Transportation

Theresa Romell
Metropolitan Transportation Commission

David Rose
Gannett Fleming

Ian Ross
BLUEFIN, LLC

Jesse Rothkopf
Life Cycle Engineering

LaDonna Rowden
Illinois Department of Transportation

Gary Ruck
Deighton Associates Ltd

Nastaran Saadatmand
Federal Highway Administration

Hamidreza Saadatnejadi
California Department of Transportation

Hamid Sadraie
California Department of Transportation

Promothes Saha
University of Wyoming

Toshiki Sakakibara
Central Nippon Expressway Company Limited

Gloria Salazar
San Joaquin Regional Transit District

Michael Salvato
Mott MacDonald

Marco Sanchez
California Department of Transportation

Carlos Sanchez Peñaloza
Servicios Mexicanos de Ingenieria Civil

Kathleen Sarli
Northeast Ohio Areawide Coordinating Agency

Mohammad Sayyar
AgileAssets, Inc.

Margaret Schilling
Federal Transit Administration

David Schrank
Texas A&M Transportation Institute

Dan Schriever
Booz Allen Hamilton

David Schwartz
Kansas Department of Transportation

Stacey Schwartz
AppGeo

Daniel Scott
SEAMS Ltd.

Emily Selby
Wyoming Department of Transportation

John Selmer
Iowa Department of Transportation

John Senger
Illinois Department of Transportation

Mohsen Shahandashti
University of Texas at Arlington

Justin Shell
Wisconsin Department of Transportation

Ajay Singh
King County Metro

Tracinda Sisk
Illinois Department of Transportation

Nadarajah Sivaneswaran
Federal Highway Administration

Omar Smadi
CTRE/Iowa State University

Michael Smallcombe
AgileAssets, Inc.

Jack Smith
North Dakota Department of Transportation

Mshadoni Smith
Federal Transit Administration

Nick Smith
WSP USA

Simon Smith
AMCL

Timmy Smith
Harrison County

Janille Smith-Colin
Southern Methodist University

Edwin Sniffen
Hawaii Department of Transportation

Sheldon Soleyn
Federal Transit Administration

Dave Solsrud
Minnesota Department of Transportation

Darryl Spencer
Dallas Area Rapid Transit

David Springstead
MARTA

Trisha Stefanski
Minnesota Department of Transportation

Pamela Steinbach
Delaware Department of Transportation

Michelle Stracener
Atkins

Rolf Erik Stromberg
Lamar University

Mark Suarez
Louisiana Department of Transportation and Development

Goro Sulijoadikusumo
Hawaii Department of Transportation

Hamid Tabassian
Jacksonville Transportation Authority

Adam Tamayoshi
Oahu Transit Services, Inc.

Sui Tan
Metropolitan Transportation Commission

Donald Tebben
Iowa Department of Transportation

Brian ten Siethoff
Cambridge Systematics, Inc.

Shahna Thomas
California Department of Transportation

Susan Thomas
Draycott Consulting, Inc.

Wesley Thomas
Sentient Science

Melissa Thompson
California Department of Transportation

Paul Thompson
Consultant

Paul Thompson
Lane Council of Governments

Susan Tighe
University of Waterloo

Georges Tippens
South Carolina Department of Transportation

Hanh Tran
Metropolitan Council/Metro Transit

Lauren Tran
Pathway Services Inc.

Kelly Travelbee
Michigan Department of Transportation

Brian Travis
California Department of Transportation

Emily Tritsch
Portland Bureau of Transportation

Ranae Tunison
Federal Transit Administration

Loren Turner
California Department of Transportation

Shane Tymkowicz
Iowa Department of Transportation

Cheryle Tyson
Federal Transit Administration

Amy Van Doren
Marin Transit

Anita Vandervalk-Ostrander
Iteris, Inc.

Gary Vansuch
Colorado Department of Transportation, Office of Process Improvement

Shobna Varma
StarIsis Corporation

William Varnedoe
Kercher Group, Inc.

Billy Varney
West Virginia Department of Transportation

Allan Venema
Fugro

Mark Vessely
Shannon and Wilson, Inc.

Valentin Vulov
Federal Highway Administration

Jean Wallace
Minnesota Department of Transportation

Ruth Wallsgrove
AMCL

Richard Weaver
APTA

Roger Wentz
ATSSA

Tom Wesp
Data Transfer Solutions LLC

Kenneth White
Rhode Island Department of Transportation

Matthew Whitley
North Carolina Department of Transportation

Steve Wilcox
New York State Department of Transportation

Andrew Williams
Ohio Department of Transportation

Janice Williams
VIA Metropolitan Transit

Chris Williges
HDR Engineering, Inc.

Matthew Wilson
Jacksonville Transportation Authority

Ben Witter
Bentley Systems

Butch Wlaschin
Kercher Group, Inc.

Mark Woods
Tennessee Department of Transportation

Pamela Worley
Pennsylvania Turnpike Commission

Ursula Wright
Federal Transit Administration

John Xie
Foothill Transit

Roger Yoh
California Department of Transportation

Elizabeth Young
City of Fort Worth

Scott Zainhofsky
North Dakota Department of Transportation

Laura Zale
Southeastern Pennsylvania Transportation Authority

Youwei Zhou
California Department of Transportation

Rob Zilay
Dye Management Group, Inc.

Kathryn A. Zimmerman
Applied Pavement Technology, Inc.