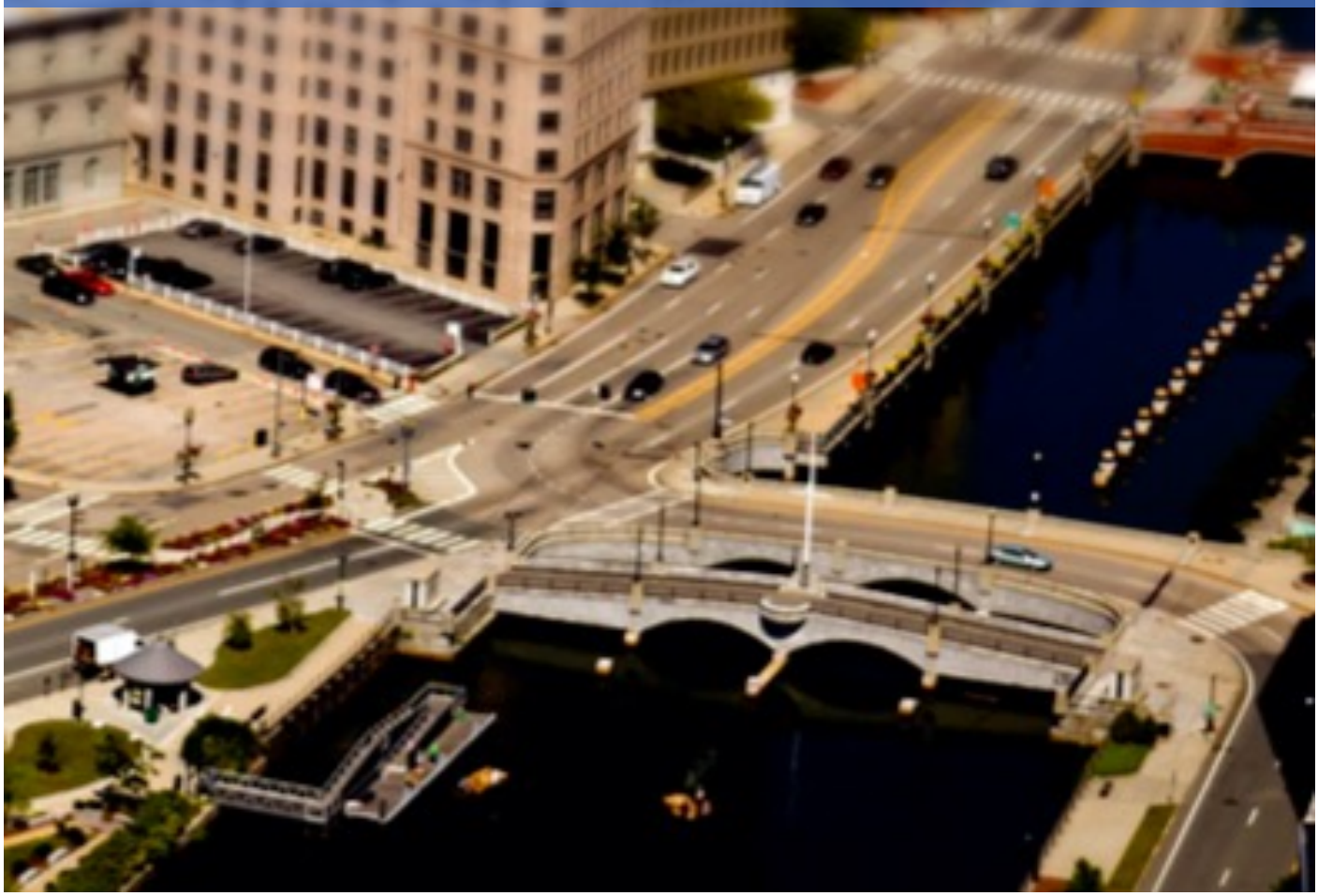
AASHTO's 2022 Performance-Based Management, Planning, and Data Conference Proceedings



Conference session content, including slides and recordings, are available at https://www.tpm-portal.com/2022conference/

Providence, Rhode Island
December 5-9, 2022

2022 Conference on Performance-Based Management, Planning, and Data
AASHTO

AASHTO Planning/Performance/Data Conference Proceedings Table of Contents:

8:30 a.m.–8:55 a.m.	Improve Your Planning & Programming Decisions With Asset Management	TRACK 1	Envisioning and Preparing for the DOT of the Future	TRACK 2	Data Management	TRACK 3
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9:00 a.m.–9:25 a.m.		TAM: Seize the Day-ta		Describing the Vision for the Next Era of Transportation		Joint Subcommittee on Data Standards—What's Going On?
9:30 a.m.–9:55 a.m.		TAM: The Past, Present, and Future Walked into a Bar... It Was Tense		Implementing the Vision for the Next Era of Transportation		Data Management Strategy for the Enterprise
10:00 a.m.–10:30 a.m.	BREAK					
10:30 a.m.–10:55 a.m.	Data Analytics and Visualization	TRACK 4	Performance Management	TRACK 5	Plans, Plans, Plans... They're Everywhere!	TRACK 6
		Data Visualization for Transportation Performance		VDOT SMARTSCALE: Funding the Right Transportation Projects		Data Management Plans
11:00 a.m.–11:25 a.m.		Teaching Old Data New Tricks		Using Complete Trip Data		EV Charging and Alt-Fuel Infrastructure Planning
11:30 a.m.–11:55 a.m.		Alaska PBPP: The Next Frontier		Coordinating the Measures that Matter—Federal, State, and Local		Linking Your TAMPs and RIPs

WEDNESDAY

TAM: Can't We All Get Along (Range Plan)?
TAM: Seize the Day-ta
TAM: The Past, Present, and Future Walked Into a Bar… It Was Tense
Planning for the Technological Disruption
Describing the Visions for the Next Era of Transportation
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EV Charging and Alt-Fuel Infrastructure Planning
Linking your TAMPs and RIPs

THURSDAY

The Unconference Sessions: Adding Breadth and Depth to the Transportation Issues of Today
- Map Fatigue: Data Dashboards
- Freight Planning
- Bridges
- Third Party Data
- Data Collection, Data Management, Data Governance
- More Data! Data literacy, Data Integration
- Safe System Approach: What Are We Doing Now?
- NHTSA Tough Day for Pedestrians
- Complete Streets: Coordination with Locals & Measuring Performance

Data Governance Workshop: Actionable Insights for Data Management, Analytics, and Governance

Workshop on Complete Streets

Session Overview

Presentation: A Primer on Complete Streets

Christina Leach of FHWA's Resource Center presented a description of complete streets and their value to the traveling public. A complete street is one that is safe and feels safe for all users. Achieving complete streets means routinely improving safety and access for all users, including pedestrians, bicyclists and transit riders as well as freight carriers and automobiles. She outlined a variety of key factors to consider in developing complete streets, such as speed, the number of lanes, traffic volume and composition, conflict points, visibility, proximity, pavement condition and connectivity. She shared information demonstrating that walking and transit ridership are growing, and most people want to live in a community with those travel options. Complete streets provide equity for people of all ages and abilities, as well as for marginalized communities and low-income populations. The approach to developing complete streets relies heavily on context, as there are all kinds of complete streets, and there is no one-size-fits-all solution. Leach provided real-life examples of complete streets efforts in urban, suburban and rural settings. She also shared tools and informational resources available at the federal level to assist other agencies in their efforts to develop complete streets.

The attendees split into three groups to facilitate breakout sessions to consider the various road users and land use impacts on complete streets. Attendees rotated through three different breakout topics.

Presentation: Complete streets Performance Measures

Eric Pihl of the FHWA Resource Center and John Chiarenza of the USDOT Volpe Center presented information on the federal focus on complete streets, including funding, data collection and performance measurement. There are specific federal funds available for planning and development of complete streets. Pihl shared the variety of performance considerations related to complete streets, including elements like traffic stress for cyclists and pedestrians, traffic composition and speed, safety data, and contextual information, but above all emphasized sociodemographic data disaggregation as necessary to measure the performance of complete streets. The Volpe Center shared the mapping capabilities they have developed to assess the connectivity and effectiveness of complete streets efforts based on available data.

Jessica Griffen of New Mexico DOT moderated a panel of state DOT speakers describing complete streets efforts in their respective states.

Elise Bremer-Nei, Bicycle-Pedestrian Coordinator at New Jersey DOT, presented information on organizational efforts at NJDOT that elevate consideration of complete streets concerns in planning, policy, and project development, as well as the wide variety of efforts being undertaken to improve complete streets throughout the state.

Cassandra Gascon of Massachusetts DOT presented information on that agency's state funding program for complete streets, largely passed through to local agencies.

Mikael Pelfrey of the Kentucky Transportation Cabinet discussed Kentucky's complete streets policy and the manual the agency developed to guide the development of complete streets and facilitate equitable transportation efforts.

Kerri Woehler of Washington State DOT provided information on complete streets development efforts across the state, including local policy adoption and the state's Active Transportation Plan.
Participants then broke into three groups to discuss accessibility, safety/equity, and transit connectivity/equity.

What did we learn?

- The public and communities want more complete streets
- Developing complete streets requires focus throughout the planning and project development process
- Complete streets generally have to compete for funding with other aspects of transportation projects.
- Developing and analyzing the right types of data can help measure the success of complete streets efforts.

Future Actions

- Identify potential funding sources for complete streets
- Identify appropriate data and sources to better measure the effectiveness of complete streets
- Partner with local agencies and advocacy groups to more effectively identify where complete streets can improve their development.

Implementation of the Performance Management Program: What Have We Learned and What Does the Future Hold?

Session Overview
Presentation: Welcome, Opening Remarks on Behalf of AASHTO
Matt Hardy from AASHTO provided a brief welcome to the workshop on behalf of AASHTO. He highlighted AASHTO's great partnership with FHWA.

Presentation: Welcome, Opening Remarks

Christos Xenophontos of Rhode Island DOT gave opening remarks on behalf of the TPM Pooled Fund and host state DOT. He thanked participants, AASHTO, and FHWA, for their partnership. He provided an overview of the history of the TPM Pooled Fund and a few of its accomplishments:

- TPM Portal (https://www.tpm-portal.com) resources, tools, events, and community pages
- Capacity-building training resources available on the AASHTO Store (https://store.transportation.org/) and the TPM Training Hub (https://www.tpm-portal.com/training-hub/)
- TPM Webinar Series (https://www.tpm-portal.com/tpm-webinars/)
- TPM Newsletter (https://www.tpm-portal.com?s=newsletter)

Presentation: FHWA Welcome

Nelson Hoffman of FHWA provided a brief welcome on behalf of Mshadoni Smith-Jackson, the new Team Lead of FHWA's Transportation Performance and Asset Management Team. He praised the ongoing commitment from state DOTs in carrying out the Federal TPM requirements.

Presentation: Icebreaker and Workshop Purpose

Hyun-A Park of Spy Pond Partners, LLC moderated the icebreaker exercise, which asked participants to develop a ranked list of "wishes for TPM" within their tables. These included:

Table 1

- Useable BM, better target setting for bridges
- Streamline pavement metric to resonate with agency practices
- More TPM monitoring case studies
- Interactive dashboard for different scenarios
- How metrics interact with each other (safety/reliability)

Table 2

- Clean up existing regs and rules eg TPM/TAMP due date assignment
- FHWA calculates PM3 measures for states
- Coordination between state and federal performance measures
- Balance emerging performance measures with AM condition measure

Table 3

- Keep assets in a state of good repair
- Proper fiscal funding
- Asset management/proper implementation

Table 4

- Adequate staffing for TPM
- Understanding the interactions of TPM components
- State DOT leadership support for TPM

Table 5

- Complete data for every road
- National measures scalable to the locality
- Specialized staff to focus on a single project, not multitasking
- More accessible UPACs system for reporting

Table 6

- An accessibility performance measure that is easy to implement/understand
- TPM is how work is at all levels of government
- Emissions measures that are more comprehensive and less fragmented
- Performance measures encourage the expansion of active transportation
- Operations/maintenance leadership part of implementing TPM

Table 7

- Integrate TAM/TPM/RM
- Line of sight tying action to outcome
- Not generalize measures for communication purposes
- Usable, accessible, transparent portals
- Better identify project impacts and needs

Table 8

- Implementation - TPM informs decision-making
- More data access - air quality/freight
- Create department-wide internal PMs
- Buy-in
- Department-wide training for TPM comprehension

Table 9

- No prescriptive targets
- replicate partnership/consistency/flexibility of FHWA at division offices
- TAM certification program

- No national GHG performance measures
- National report card for transportation system

Table 10

- Specific FHWA guidance and coordination with HQ/division offices
- Ultra flexibility of funds
- Insight on how to use good practices
- Pavement NPM to identify/prioritize treatments, forecast performance
- CMAQ forecasting tools

Table 11

- Increased training
- Data sharing within the agency
- Accessibility measure - KPI for measure
- Shared job board/recruiting tool

Table 12

- TPM helps DOTs forecast assets to improve project development and public participation efforts
- Connect program with outcomes - "move the needle"
- MPO involvement in TPM - NHS-only roads disconnect MPOs from TPM
- National platform for data collection/analysis
- Indexed targets / remove variations like economic cycles, etc.

Table 13

- Matt Hardy in charge
- Interaction between data, AM, and TPM to improve project delivery
- Connect people with questions to people with answers
- Collaborate to identify the right PM for the right outcome
- Help agencies see beyond infrastructure to customer experience/public societal/social value

Table 14

- Actionable and impact-driven measures
- Wish it was a school curriculum
- Performance dictates financial decisions

Table 15

- Guide on organization structure for successful AM and TPM

Note that the results of this exercise were used, along with other inputs throughout the day, to develop the list of future actions at the end of the workshop. Next, **Lori Richter** of Spy Pond Partners, LLC provided the workshop's purpose and reviewed the day's agenda. Participants introduced themselves and their roles within their agencies.

Morning Session #1 - Reflections on TPM Implementation

Presentation: Implementation of TPM Program

Karen Miller provided an overview of MoDOT's organizational structure, award-winning and collaborative planning framework, and the Tracker performance management system and emphasized how these made TPM implementation a relatively straightforward process for the agency. Karen shared her thoughts on things that went well with TPM implementation and areas for improvement. She praised FHWA's TPM DC Office and noted that FHWA division offices could be improved by providing the same flexibility and consistency. She highlighted the need to improve several aspects of the target-setting process: choosing the right target time horizon; coordinating target deadlines with MPOs; coordinating target-setting with the planning process; and making safety targets meaningful again (since BIL was enacted which only allows for improving targets). She wrapped up with the positive impact on partnerships due to increased communications, coordination, and collaboration around TPM.

Presentation: Reflections on TPM Implementation

Deanna Belden of MnDOT shared what has gone well in their TPM implementation. There have been more idea-generating conversations for federal safety measures (PM1) because of target-setting requirements. However, annual targets and reconciling target-setting methods with the Department of Public Safety (DPS) have posed some challenges.. For federal infrastructure measures (PM2), the agency has experienced an increased awareness of pavement condition forecasting. However, the federal pavement measure is substantially different and expected outcome targets don't comport with the agency's view of targets. For the federal freight and reliability measures (PM3), the NPMRDS data have enabled MnDOT to perform a useful freight bottleneck analysis, develop a combined interstate and non-interstate NHS reliability measure, and improve tracking of non-SOV data. However, the Peak Hour Excessive Delay (PHED) measure has not been a focus for MnDOT, they found the emission measure to be too rigid, and it doesn't consider external emission sources that are out of the control of the state DOT.

Presentation: TPM Implementation

William Johnson of CDOT highlighted increased data collection and leveraging that data with more tools and dashboards (CDOT Performance Page, National Performance Measures Distilled into Tables, Various Dashboards) as successes of TPM implementation in CDOT. In general, these tools were better able to leverage predictive analytics and distill complex data/processes for target setting into easily digestible information to engage external stakeholders better. William noted increased collaboration with MPOs. However, Willian identified guidance as an area of improvement for TPM implementation, including help establishing targets around CMAQ forecasting. William also noted that while TPM implementation has increased coordination with MPOs, there is still a great need for more, including strategies related to locally-owned NHS pavements and bridges, affecting local travel time and delay, and coordinating the use of CMAQ investments.

Presentation: TPM Overview

Nelson Hoffman of FHWA's Transportation Performance and Asset Management Team began by identifying some FHWA TPM resources (TPM FHWA website, National Performance Dashboard, TPM Essentials Videos). He then listed the seven MAP-21 National Goals as key to TPM implementation. He noted that the TPM Webinar from May 2021 documents FHWA's stance and efforts to support TPM implementation while delivering on congresses laws and regulations. After completing the first performance period and reporting through the PMF for the final progress report, FHWA emphasizes the importance of concise, clear, complete descriptions in the narrative questions. Deanna Belden asked, "What has changed in the PMF?" (unclear in the audio), and Nelson clarified that the PMF questions are

broader to try to get more consistent responses from states. Deanna responded that she doesn't believe the broadness will necessarily lead to more consistent answers between states because there's more room for variable interpretation. Deanna asked, "How is the PMF used?" Nelson answered that there's no one PMF report, but it is used internally to funnel to other reports. Some participants raised questions about FHWA public reporting on state PMF data and that it may not be very clear to constituents who cannot identify which organization within their state is responsible for which assets. Nelson noted that the complete reporting of performance measures for all 52 State DOTs, accountable, data-informed targets, and consistent reporting are successes of TPM. There is accountability for each state. FHWA is now in the second round of Significant Progress Determination (SPD), but that determination doesn't include two CMAQ traffic congestion measures, one CMAQ emission measure, optional targets states may set or any MPO targets. Nelson provided a link to the FHWA guide for the SPD procedure, which may be helpful to state DOTs.

Presentation: Large Group Discussion and Morning Wrap Up

The presentations were followed by a large group discussion moderated by **Hyun-A Park** from Spy Pond Partners, LLC. Nelson Hoffman from FHWA asked participants what they needed from FHWA to assist them. William Johnson responded that he feels like he's being heard by FHWA but that little is being done with that feedback, perhaps because of limitations within what FHWA can do because of the rigidity of federal law and regulations. In this conversation, some states noted that the FHWA HQ office has better information than division offices, which are often unable to help state DOTs. Some states also raised the issue of PMF questions changing without formal notice. States want to be engaged in FHWA's process to implement the requirements from the start of the process. Paul Degges from TnDOT reflected on the need for flexibility to address different state DOT contexts and a range of TPM implementation needs. Hyun-A asked attendees what this session prompted for them based on the presentations. Ed Block from CTDOT raised the topic of state vs. federal measures and effective communication's importance.

Christos Xenophontos wrapped up the morning discussion by challenging participants to consider how we can build upon successes and replicate or expand leading practices, overcome missteps and put those lessons into practice, and think about ways the new AASHTO Technical Service Program (TSP) can be of assistance.

Afternoon Session #2 - TPM Innovations at Your Agency

Presentation: TPM Innovations at UDOT

Patrick Cowley from UDOT highlighted how UDOT is implementing several recommendations from NCHRP 08-113 "Integrating Effective Transportation Performance, Risk, and Asset Management Practices" ("Modalopoly"). This started with a self-assessment, which was used to develop individualized road maps for Risk, AM, and PM. Strategies of the roadmaps include targeting TAMP utilization with actionable goals, focusing limited resources (time and budget) on projects highly aligned with stated missions and goals, defining a standardization process that also values flexibility and innovation, and providing training to close knowledge gaps in employees' contributions toward organizational objectives. Patrick also discussed the TAM Data Guide as generalizable to any data, not just asset data (for example, using the TAM data guide for PM). He noted that logging all the assets in the TAM Data Guide can help visualize and better communicate with upper leadership where gaps are and what to prioritize. Patrick described Utah's Performance Index Model and Performance Management Task Sheet as useful tools for internal communication and meeting performance targets.

Presentation: TPM Innovations at WVDOT

Gehan Elsayed from WVDOT shared several TPM tools WVDOT has developed, noting that they visualize and interpret performance outcomes, and then other tools drive the decision-making process. The first tool is the Performance Connection Dashboard, which allows users to view and download performance data from 2016-2020 for individual assets at the statewide, district, MPO, and county levels; it also enables users to compare performance against established targets. The main page of the WVDOT Performance Connection groups performance for assets between FHWA, Non-Federal, and Non-FHWA Federal measures. The Bridge Management Tool is designed to be a system vetting and mapping tool, which was especially helpful when collecting information for the TAM submission. Ten bridge engineers at WVDOT input their anticipated bridge programs into this centralized system.

Afternoon Session #3 - Future Vision for TPM

After an introduction by Christos Xenophontos, **Matt Haubrich** from IADOT talked about the achievements of the TPM Pooled Fund since the 2020 St. Paul Peer Exchange (such as capacity-building related to visualization) and the importance of continuing to work collaboratively going forward to set the stage for establishing a future vision for TPM.

Presentation: Fishbowl Discussion

Hyun-A Park moderated a fishbowl discussion around a vision for TPM. Guiding questions for the Fishbowl exercise include: "What does the future of TPM look like; what needs to be in place to make this happen; what can AASHTO, FHWA, and the Pooled Fund do to support and improve the implementation of this future vision?" The Fishbowl discussion is listed such that each bullet represents one participant's response:

- We should take stock of what we've done so far and fully incorporate that moving forward.
- We must compete against ourselves in performance management, with the north star being how we add public value and benefit society.
- We need some policy tweaks that make sense, benefit everyone, and maximize resources.
- One of my fears for TPM is enacting "point-specific" performance measures that don't benefit everyone across the transportation industry.
- How can TPM be nimble enough to keep up with the increasing and sometimes overwhelming volume of data to make improvements to the transportation system?
- How can we set bounds and targets for performance and understand the reliability that we expect from the data, predictions, and targets we're setting?
- We want leaders to want to make decisions with the data we have before asking for more data.
- We should advance in making decisions using qualitative data, especially with equity.
- There's a communication breakdown between data/data experts and management; we need to resolve who owns the data, what data they have, and how we can use it.
- MPO and public involvement are critical in target-setting, so how do we make advancements in including the public and MPOs in this process?
- With increased vulnerability to climate risks, how do we incorporate resilience into our planning for projects being built now, especially when those projects, like a bridge, will last for 50 years?
- FHWA maintains a TAM contacts list within every state and division, which has been very valuable. I'm unsure if there's a TPM contacts list for those working on TPM at each state (Hyun-A noted that there is an existing tool on the TPM Toolbox, but it would need to be updated and maintained).

- What are best practices and guides for states who are newer to TPM so that they don't have to scramble every two years and can continually keep on TPM internally?
- How do we build institutional knowledge in performance forecasting to narrow margins of error and improve forecasting methods over time? How do we improve our reflecting on our historical forecasts using after-action reports and other practices? How do we improve our institutional knowledge to build the capacity for retrospection?
- Performance Measures are a uniting thread for MPOs, state DOTs, and FHWA.
- There needs to be more communication between FHWA division offices and the state DOT district offices, and improvements would enhance TPM.
- Planning is often separate from operations and implementation. This organizational structure can inhibit the implementation of PBPP and TAM.
- Maintaining a safe space to be entrepreneurial, innovative, and take measured risks without feeling limited within the confines of a fiscally-constrained environment is critical.
- FHWA and the state DOTs should work more effectively in partnership to tell a national TPM story while honoring differences among states.
- How do we advance in measuring things that are not tangible infrastructure assets? How do we improve the provision and understanding of data with non-traditional partners?
- TPM implementation requires coordination, broad input throughout the agency, and additional guidance from FHWA and its division offices.
- It takes time and resources to close the feedback loop between forecasting and implementation to reflect on performance outcomes; see NCHRP 08-170 "Post-Implementation Evaluation of Transportation Projects." Undergraduate Engineering Curriculum is lacking in incorporating Transportation Performance Management and Asset Management principles. Could AASHTO (CPBM, in partnership with FHWA) develop a certification training program (similar to AICP/PTOE)?
- (Adapted from Steve Jobs). "We're all in the same boat. TPM is like a ship with a hole in the bottom, and water is leaking in. We're also on fire with the threat of additional regulation. Our job as TPM leaders is to point the ship in the right direction."
- We continue to have disconnects in implementing TPM and using the data for decision support. We need secondary education to continue advancing transportation-focused programs.
- We are entering an era of unprecedented funding in our programs. TPM is critical for us to have a multi-modal data set that allows us to defend our programs. Forums like this ensure we have connectivity with our peers.
- This week is my immersion in TPM. I plan to use the learnings to educate and empower my staff.
- We need to enhance communication around TPM topics to support folks who could not attend this session; for example, is it possible to reach out to people listed on the PMF reports? A timeline would also be helpful in assembling TAMPs and completing the TPM requirements.
- We need stronger data protocols so that when things change, our numbers don't change. This is a major risk to achieving our targets. (Matt responded that the TSP could be used to help with this). We could also partner with other committees with depth in pavements, bridges, safety, etc. The TSP could help coordinate that.
- We need to improve the dissemination of knowledge. Collaboration on workforce development among states can help maximize resources, assist less mature states, and assist less-tenured staff in implementing TPM.

Hyun-A Park asked, how do we ensure that the available resources can reach a broader audience? William Johnson mentioned a recent survey sent as part of the research roadmap for the Committee on KM, asking for people in specific KM roles to respond. Contact Frances Harrison or Hyun-A Park at SPP if you still need to get that survey. This information will be used for further outreach. Hyun-A brought the participants back to earlier in the day when Patrick Cowley talked about the TAM Data Assistant and how UDOT is using it. Getting folks connected across the board is critical. Patrick Cowley added that UDOT took this resource developed through research so they didn't have to create something similar from scratch. Kelly Travelbee asked whether anyone has considered changing roles in the future as technology changes.

Afternoon Session #4 - Moving Forward with TPM

Presentation: Iowa DOT: Next Steps for Sustaining TPM

Matt Haubrich described IADOT's TPM Framework. He told some of the agency's several of the agency's successes. In the safety area, these include setting aggressive safety targets and establishing partnerships to achieve them, and improving safety data analytics and visualization. They have created a new pavement management unit, analyzed full-system pavement data, and improved their bridge management. On system performance, they have participated in TPM TSP to purchase RITIS data and have improved their congestion and reliability analysis. They have also developed several supporting performance management initiatives within the agency. IADOT has an annual employee engagement assessment. The agency created a Chief Operating Officer position to focus on executive leaders working "on the business" instead of "in the business." They started a new entrepreneurial operating system (see TPM Webinar series) for managing strategic initiatives and a Resilience Working Group. Finally, they adjusted their LRTP to focus on system objectives and using data to right-size investments.

Presentation: NDDOT Performance Measure Next Steps

Jack Smith from NDDOT highlighted his agency's efforts on federal performance measures to use MIRE analysis tools to help set safety targets and monitor PM3 measurement results to support decision-making. He described state performance measurement improvements in evaluating how well the agency is telling its story and automating its dashboard. NDDOT is in the process of developing and using bicycle and pedestrian measures. Jack wrapped up by discussing sustaining TPM, stressing the importance of ensuring performance measures are used in decision-making by focusing on data quality, timeliness, and accessibility.

Presentation: Moving Forward with TPM: Kansas

Dave Schwartz from KSDOT highlighted recent achievements in his agency's Pavement Online Tool and BrM implementation. Dave then provided an overview of KSDOT's Performance-Based Budgeting and Internal PMs related to safety and security, economic vitality, system management, asset preservation, stewardship, and workforce.

Presentation: 2022 Connecticut DOT Report

Edgardo Block from CTDOT shared the BI performance measures dashboard comparing state and federal measures on CTDOT's Performance Management site. He described the agency's 2022 efforts and 2023 plans related to state TPM standing committee activities, federal TPM full performance period coordination on reporting, PBPP project prioritization, and GHG VMT reduction Executive Order. He talked about the complexity of coordinating within the

state on PM3 measures. In relation to the state TPM in 2023, CTDOT is working on improving internal performance measures for project delivery and the environmental impact of projects. They will continue a coordinated PBPP effort and implementation and reporting of GHG. Related to federal TPM, they are moving from extrapolation to a forecasting model for system reliability to enable better alignment between actions and outcomes, calibration and validation of models, manage performance when they don't have complete control over performance, and align their PBPP with their LRTP. The agency plans to use an incremental approach, first isolating the factors that influence performance and then breaking trends into their component parts using appropriate techniques and risk management approaches.

Presentation: Alaska's TPM

Michelle Duncan from AK DOT&PF described the current state of TPM within the agency. TPM has only been widely accepted or used for crash data in project selection and pavement and bridge performance through the TAMP. Going forward, the strategic planning roadmap describes how they will implement PBPP and roll up to the LRTP. This roadmap includes actions to improve data governance, business plan, data synthesis, staffing competency, etc., related to resource allocation, improving project prioritization, enhancing reporting capabilities, target setting, project delivery, and training. She talked about the agency's new STIP Manager and how it will support the development of project selection criteria to align with performance goals and monitoring measures. Michelle wrapped up with how data analytics and associated dashboards will support TPM in the future, highlighting its role in project/program selection, progress determination, and equity discussions.

Presentation: Illinois Performance Measures
William Morgan from ILDOT shared the agency's current manual PM2 target-setting process. He provided an overview of findings from the first reporting period, including initiatives to assess differences between PM2 and its TAMP, understand and make adjustments for increased funding through RBI and BIL, account for the lag time from implementation to results, and refine its target-setting approach. Next, the agency will fully implement the TAMP, incorporate additional assets, work to bring dTIMS to production, and improve its communication on federal and state TAMP measures.

Wish List Exercise

Hyun-A Park led an exercise to rank the "Wish List" items to develop possible actions based on six categories. The rank order for each category is listed below (starting with 1st ranking in each category) and can be referenced at Wish List Ranking for scale.

1) Improve Federal TPM
    a) Provide more flexibility, including funding
    b) Tweak federal rules and regulations
    c) Better support/clearer guidance for regulations (explain what to do)
    d) Better alignment of federal and state measures
    e) Mechanism for states to provide feedback to FHWA
    f) Have FHWA calculate PM3 measures for states
2) Improve Data and Tools
    a) Better predictive analytics

    b) Better guidance/tools for estimating targets
    c) Better scenario planning tools
    d) Figure out how to get complete data needs for the transportation system
    e) Better data tools
    f) Need standards that help
    g) Better data sharing within department
    h) Better bridge management
    i) CMAQ forecasting tool
3) Capacity-Building and Workforce
    a) Get adequate staffing for TPM
    b) More sharing best practices
    c) TPM certification
    d) Make it easier to have people connect with each other
    e) TAM certification
    f) Training for the entire department
    g) Integrate organizational measures
    h) More TPM trainings
    i) Create a TPM job board
4) Improve Measures Alignment
    a) Integrate TAM, TPM, and Risk
    b) Connecting measures across programs
    c) Emerging measures with existing measures
    d) Accessibility measures, KPIs
5) Communication and Leadership Support
    a) Use TPM for decision-making
    b) Make it easier to communicate complicated information
    c) How are we moving the needle
    d) Get buy-in for TPM
    e) Guidance on how to raise policy needs
6) Partnering/MPOs/Locals
    a) Agencies partnering within department, across DOTs, with external partners
    b) National measures scalability for locals
    c) Support bi-state MPOs

TPM Wishlist Ranking: Overall:

1) Improve Data and Tools
2) Improve Capacity Building and Workforce
3) Improve Communications and Leadership Support
4) Improve Federal Resources
5) Improve Measures Alignment
6) Improve Partnering/MPOs/Locals

What Did We Learn?

- Themes around communication, collaboration, coordination

- Needs
    - Continued partnerships and coordination
    - Connect people with questions
    - Integrate organizational measures
    - Workable accessibility measure
    - Support for regulations, what to do
    - Staffing support
    - Support for bi-state MPOs
    - Flexibility and workable solutions when possible
    - Mechanisms for states to provide feedback to FHWA
    - More data tools
    - Predictive analytics
    - Continued advancements in making complex information easier to digest
    - CMAQ forecasting
    - Guidance and tools for establishing targets
    - Clear guidance from FHWA and its division offices
    - Guidance on raising policy needs
- Successes
    - Communication in telling the national story of performance
    - Enhanced transparency
    - Collaboration - stronger relationships with MPOs, other states, and federal partners
    - Development of performance management systems
    - Mobilization of priorities through TPM Pooled Fund
    - FHWA TPM Office partnership
    - Data visualization advancement
    - Safety target setting has led to good conversations
    - Showing Federal and state measure comparisons
    - Opening data to partners
    - NPMRDS data set
    - Hybrid meetings to share information with partners
    - Dashboards
    - Enhanced pavement forecasting
    - New combined interstate and non-interstate NHS reliability measure
    - Additional years of data
    - Accountability
- Challenges and Learnings
    - Safety targets under BIL
    - Due dates are not aligned
    - Staffing resources
    - Understanding requirements
    - Short-term targets are not meaningful
    - PHED measure
    - Rigid rules for emissions

- Reconciling target-setting methods (aspirational/expected outcomes)
- Misalignment between state and federal pavement measures
- The NHS system does not equal the state transportation system
- States are partners AND stakeholders
- Data does not equal information
- TPM for all states is a good thing
- Implementation means growing pains will happen
- Data is foundational
- Transit partner collaboration
- We need to tell our own story about performance, or others will do it for us
- Provide context for measures
- Connections are critical

Future Actions

- See the Wish List exercise above, as well as the Wish List Ranking

Data Literacy for Transportation Data

Session Overview
Presentation: Data Literacy Workshop

Denise Whitney Dahlke, Oregon DOT and Frances Harrison, Spy Pond Partners facilitated the workshop and moderated the panel discussion. Included on the panel were **Chad Baker**, Caltrans (and CDMA Research Subcommittee Chair), **David Freidenfeld**, Texas DOT; **Peggi Knight**, CDMA Policy and Guidance Subcommittee Chair; **Cindy Owens-Hutchinson**, Maine DOT; and **Michael Pipp**, Montana DOT.

The first session of the day-long workshop began with a description of good organizational data literacy, and how it differs for creators and consumers. Examples from California and Oregon of efforts to better understand data literacy were presented to the group.

The Data Literacy Training Program at Caltrans is an effort to improve data literacy at the organization. Its goals are to provide employees with a basic understanding of the importance of data management; to build awareness of best practices for documenting data and ensure data accuracy, completeness, and consistency; help managers identify opportunities to improve data-based decision-making; improve employees' ability to assess and interpret data and apply the information they receive; ensure that employees know how to find and obtain data, prepare data for analysis, identify and visualize patterns and trends and effectively communicate results; and increase the number of analysts who can work with large and dynamic datasets and perform advanced analytics.

Whitney-Dahlke from Oregon DOT described different types of data literacy, from a basic ability to work with numbers to identifying needed data, interpreting and visually depicting data, statistical analysis, computer modeling, and data management.

The consequences of poor data literacy also differ for creators and consumers. A lack of data literacy can lead to poor communication and bad decision-making, among other consequences. Fortunately, there are a variety of options for improving data literacy within an agency, including courses from the federal Data Skills Catalog. An agency seeking to improve data literacy should begin by assessing the roles and skills of personnel with regard to data, to identify the various data literacy "personas." These include sponsors, ambassadors, enablers and operational roles, analysis and data scientists, and data architects/engineers and implementers. Identifying the personnel roles helps identify the competencies they need to develop.

Participants then split into small groups to discuss the types of learning objectives needed for personnel in different roles.

Baker shared the results of a Caltrans agency-wide data literacy survey. Although the survey had some limitations, it was sufficient to determine at a high level some of the gaps in data literacy. The majority of those surveyed were staff who collect, enter or analyze data, although managers, executives and users also took the survey. The survey identified sizable gaps in all categories of data literacy, but the largest gap was in the area of awareness of data governance principles. The strongest area of data literacy was assessing data quality, but even that area had a sizable gap among survey participants.

The panelists described the variety of data literacy training options that exist, and shared some case studies from the federal CDO Council data skills training program.

Freidenfeld presented information about TXDOT's Data Literacy and Analysis Learning Path, created to improve data literacy at that agency. It is a fluid effort that will expand over time as new data needs and gaps are identified. Skills to be developed include data analysis, visualization and presentation, database and data storage, project management and process improvement, and options for professional certification.

Panelists discussed the pros and cons of the various off-the-shelf training options and concluded that different audiences could benefit from different training options. They also discussed a number of Technical Service Programs (TSPs) offered by AASHTO and others.

A proposed AASHTO Data TSP would manage the many initiatives of the CDMA that cannot be handled by committee work, including creating a repository for the outcomes of previous and future transportation data research and implementation efforts, including interactive tools, templates, and other outputs; developing shared national data standards; research and training development; managing the proposed membership in buildingSMART International (bSI); and meetings and workshops to advance DOT data program practices. The fee structure is still under development.

What Did We Learn?

- **Data literacy gaps are common to many DOTs**
- **There is a great need for data literacy at all levels of transportation organizations**
- **There are good existing models for data literacy training that agencies can share**
- **There is support for developing data literacy training using the proposed CDMA TSP – but more discussion about the scope is needed.**

Future Actions

- **Encourage participation in the Data TSP**

Safe System Approach in the Decision-Making Process

Session Overview
Presentation: The Safe System Approach

Chimai Ngo of FHWA's Office of Safety opened the Safe System Session with an overview of the Safe System Approach, which is a framework rooted in the understanding that "In road injury epidemiology, kinetic energy is the pathogen" leading to 42,000 plus fatalities last year, 7,300 of which were pedestrians. Safe System works to reduce impact speeds to minimize the kinetic energy transferred to passengers and pedestrians alike in the event of an accident. Safe System implores a paradigm shift to human-centered rather than vehicle-centered. The Safe System target of zero fatalities, and its human-centered paradigm shift has been demonstrated to reduce traffic fatalities significantly in other countries. "Zero is our goal. Safe System is how we get there."

Spencer Stevens of FHWA's Office of Planning connected the Safe Systems approach with a planning perspective. He recommended starting early in the planning process and incorporating it into Long Range Plans (LRPs) as well as reflecting it within project prioritization methods. He also recommended periodic assessments to identify successes as well as areas for improvement or needs in safety.

Presentation: AASHTO Safe System Approach Implementation Support

Matt Hardy of AASHTO filled in for Kelly Hardy to present on AASHTO's support for the Safe System Approach implementation. Matt noted that while the Committee on Safety is AASHTO's safety lead, other AASHTO committees have important roles to play as well. AASHTO has started to map committees that have stake in the Safe System approach and at what part of the project life cycle those committees are involved

Presentation: NCHRP 17-81: Macro-Level Safety Planning Analysis

Ian Hamilton of VHB presented on NCHRP Project 17-81: Macro-Level Safety Planning Analysis, addressing the question: "How does macro-level planning fit into the broader conversation about how planning and accounting for safety fits into a Safe System?" Macro-level crash prediction models (CPMs) predict at a zonal level, supporting system-level safety analyses and scenario planning. The objective of NCHRP Project 17-81 was to develop a suite of quantitative macro-level CPMs and an accompanying chapter in the Highway Safety Manual (HSM). Research products include a set of CPMs tailored to jurisdiction, crash type, and crash severity. Guidance on the CPMs will be included in the next HSM (HSM2 coming 2024).

Presentation: Safe System Approach in the Decision-Making Process at MoDOT

Karen Miller from MoDOT presented on Missouri DOT's implementation of the Safe System approach. For context, she provided an overview of the MoDOT organizational structure: the agency is led by an independent commission, which oversees seven districts. MoDOT's Statewide Asset Management Plan (AMP) drives every project into their State Transportation Improvement Program (STIP), including safety related projects. MoDOT developed the Safety Assessment for Every Roadway (SAFER) Guide for considering Safe System principles in every project programmed into the STIP. This Guide formalizes the process and ensures consistency in approach as staff turnover occurs. MoDOT

developed an accompanying SAFER Guide for legislators, stakeholders, and safety advocates to highlight the legislative initiatives needed.

Presentation: Safe System Approach - Minnesota

Jean Wallace of MnDOT presented on Safe System implementation in Minnesota. She noted that Minnesota has been a Towards Zero Deaths (TZD) state since 2003. MnDOT is updating its 20-year Statewide Multimodal Transportation Plan and has a new strategy that aligns with the Safe System approach to emphasize accommodation of all modes of transportation. Minnesota also factors safety into its 5-year Minnesota State Highway Investment Plan (MnSHIP). MnDOT is creating a task force to investigate how to further connect Safe System principles with existing MnDOT processes.

Presentation: RIDOT – Incorporating the Safe Systems Approach

Steven Pristawa of RIDOT presented on RIDOT's approach to Safe System implementation. The agency is working to reduce crash impact speeds at a systemic level. Their wrong-way guardrail projects consider the severity of a head-on crash at high speeds and prioritize eliminating these types of crashes. RIDOT also looks at the similarities between curves to predict which have the potential for the most severe crashes, making them high priority for guardrail installations. RIDOT partners with Rhode Island State Police in a program to discourage impaired driving. RIDOT established a call to action for implementing Safe System principles day-to-day and in long-term planning through stakeholder workshops, State Highway Safety Plan (SHSP) quarterly meetings, and related activities.

Following the presentations, a participant asked the panelists about what is being done about safety concerns related to autonomous vehicles. Chimai responded that as part of the HSM update process, FHWA has brought automobile manufacturers into the conversation about safety for the first time.

What Did We Learn?

- Integrate the Safe System approach within long range planning, project prioritization and STIP development
- Stakeholder engagement is a key part of the Safe System approach
- Creating formal guidance for safety analysis is a recommended practice which helps to sustain consistency as workforce turnover occurs
- Macro-level crash prediction models are a useful tool supporting system planning and scenario analysis.

Future Actions

- Investigate how changes in the automobile industry factor into state and federal Safe System approaches— i.e., what do we know and what can we do about increasingly "autonomous" vehicles?

Measures for a Better World: Emerging Performance Measures

Session Overview

Deana Belden of Minnesota DOT moderated the Emerging Performance Measures session.

Presentation: Advancing Transportation Equity in Minnesota Measures

Philip Schaffner of Minnesota DOT began his presentation on advancing equity in Minnesota measures by explaining its roots in the Advancing Transportation Equity Initiative in Minnesota established in 2015/16. MnDOT's approach to equity was informed by an extensive outreach effort that engaged over 1,000 stakeholders from community organizations and partner agencies. MnDOT views equity as the fair and just incidence of benefits and burdens of transportation. Achieving greater equity requires ensuring that underserved communities (especially BIPOC individuals) participate in transportation decision-making processes. MnDOT is developing equity-first performance measures that reflect multi-modal access/impact and transportation cost. Schaffner explained that while quantitative performance measures are helpful, qualitative data plays an important role in shaping the context and understanding of how underserved communities interact with the transportation system.

Presentation: UDOT and the Quality of Life Framework

Patrick Cowley of Utah DOT presented on UDOT's Quality of Life (QOL) framework, which was developed as a result of 2018 state legislation SB 136. This legislation required UDOT to develop a statewide initiative across all modes of transportation in collaboration with local, regional, and statewide partners. The QOL framework defined four initiatives: Better Mobility, Good Health, Connected Communities, and Strong Economy. UDOT further broke down each of the four initiatives into three areas and defined a performance measure for each area to systemically target QOL. For example, the Good Health Initiative has target metrics for safety, public health, and the environment. One goal of the QOL framework is to maximize quality of life through planning by aligning contributors to the project in planning, delivery, and maintenance.

Presentation: Access to Destinations

Andrew Owen of the University of Minnesota presented on the National Accessibility Evaluation pooled fund project, which is measuring multimodal accessibility nationwide. Owen defined access as the ease of reaching destinations. Owen noted that access is mode agnostic, and is a function of transportation and land use, and the connection between transportation system benefits and communities/specific places. Owen posed the question: why measure access? Transportation exists to connect people to the destinations that matter to them, and therefore state DOTs should measure how well they're meeting this fundamental goal. Once access is being measured, it can be viewed through an equity lens. Owen described a multi-modal ranking of access for American metropolitan areas. These rankings could lead to some cross-comparative insights between various metro areas at the modal level. Owen explained that in planning it is important to forecast how planned improvements will improve access, and to prioritize improvements based on anticipated accessibility benefits. He acknowledged that agencies face challenges in doing this, including data gaps and lack of standardized approaches for incorporating access in planning.

Rich Taylor of FHWA previewed his upcoming presentation on complete trip data in the context of emerging performance measures. Taylor explained that complete trip data is about accessing and leveraging the kinds of rich data we have for automobile transportation for the other modes of transportation.

Following the presentations, the attendees split into four groups for breakout discussions about emerging performance measures and takeaways from the presentations. They reported the following:

Group 1: How do we prioritize different performance measures, and how do we incorporate them into a plan? There are multiple areas of sometimes competing performance measures to target: resilience, equity, accessibility, efficiency, carbon reduction etc. One approach to prioritizing these different performance measures could be based on cost benefit. A cost benefit analysis rooted in equity, resilience, and accessibility could help to balance different priorities. ,

Group 2: How do we advance the practice of developing new performance measures? The biggest issue is data governance and being able to pull all the data together in a meaningful way. Maryland has a level of traffic stress (LOTS) measure for bicycles across the network. One area where advancement is needed is developing resiliency performance measures (and supporting data) - "We want to spend our time preventing fires, not running around and putting them out." The new IAJA bill considers both equity and resiliency as criteria for awarding discretionary grants to states.

Group 3: How do we address the need to have a more strategic approach to categorize evaluations? How can we think about the LRTP as a statewide vision? In an LRTP we can list out our goals and the performance measures that map to those goals. That mapping can be used as a check and balance for individual projects. By connecting the LRTP with your TAMP, Freight Plan, etc, you can better coordinate adjustments across the different plans. Emerging transportation measures are difficult to develop — it could be useful to have a federally standardized set of measures or templates for designing measures.

Group 4: Continue the discussion. There is currently a lot of innovation in performance measurement and management supporting investment decision-making. Equity is a major emphasis area in the IAJA, and it's a precursor for what's to come. Colorado SB 260 set up an office for equity. Measures related to greenhouse gas (GHG) emissions is another important area to be considered within state and regional planning processes.

What Did We Learn?

- Transportation agencies are working to put performance measures in place that go beyond automobile-centric views of the system and consider multimodal accessibility, incidence of benefits and costs of transportation investments to underserved communities, resiliency, public health, and other quality of life measures.
- Agencies are incorporating use of these measures within LRTPs and other planning documents; a coordinated approach across plans is important.
- Continued work is needed to obtain, manage and govern data supporting these new measure

Future Actions

- Produce guidance to facilitate development and use of emerging performance measures
- Produce guidance on how to balance across different performance measures
- Continue to provide opportunities for peer to peer sharing of approaches given the level of interest and activity in this area

Drowning in Data

Session Overview

Anant Dinamani from Deloitte kicked off this session with an overview of the current "data imperative" for transportation (and other) organizations. On the one hand, the volume and variety of data is increasing and there is the promise of getting more value from data via more sophisticated analytics. On the other hand, agencies are at a relatively low level of maturity with respect to data management and analytics. Data quality is uneven, creating a situation where data scientists spend nearly half of their time wrangling data to get it into a form suitable for exploration and analysis. Dinamami provided basic definitions of data types (unstructured versus structured; internal versus external) and different classes of analytics (descriptive, diagnostic, predictive and prescriptive.) He outlined key challenges including siloed data repositories, legacy technology, privacy and security concerns, and the costs of data storage. He underscored the importance of data governance to define data management roles and responsibilities and processes. He noted that privacy protection requires a mix of technical, functional and human elements.

Following the introduction, a three-member panel offered remarks on activities and challenges they are seeing at their agencies.

Denise Whitney-Dahlke, Chief Data Steward at the Oregon Department of Transportation (ODOT) shared that ODOT recently launched a Data Solutions Office. The agency's Chief Data Officer conducted a listening tour and heard that the ability to trust that data is of sufficient quality for use was a big issue for people. ODOT is working to address this by setting expectations for managing data quality and providing the processes and tools that enable people to do this. They have created a standard template for a Data Quality Management Plan (DQMP), providing a framework to define data quality, understand data quality dimensions (e.g., accuracy, completeness, timeliness), set objectives, assess the current state, identify root causes of data quality issues, and a structure for identifying and tracking data quality improvement activities.

Suvani Gautam, Chief Data Officer at the Nevada Department of Transportation (NDOT) reviewed the origins of her agency's Enterprise Data Governance program. Undocumented processes and poor data quality were key motivators for this program. She noted that more data isn't necessarily better – the key question is the value it is adding. She stressed the importance of understanding how data is serving business objectives and determining its necessity (must have versus nice to have). She shared some lessons learned: (1) It is critical to have leadership support for data governance initiatives – make sure they understand the purpose and need; (2) Don't rush into buying tools/software – work on refining your needs and processes first; (3) Devote resources to identify the agency's critical data and understand its content and quality; (4) Information Technology and business stakeholders need to work together to improve data quality – a common misconception is that data quality is IT's responsibility; (5) Data Literacy is critical to the success of agency efforts to gain more value from data; and (6) It is important to define roles and responsibilities for data management so that everyone understands their part.

Matthew Modarelli, Chief Information Officer at Washington State Department of Transportation (WSDOT) provided an information technology (IT) perspective on data management, noting that IT complements and enables data management and analytics. Key concerns of DOT IT functions include growing cybersecurity threats, and the convergence of IT and Intelligent Transportation Systems (ITS), necessitating strong partnerships between IT and

Transportation Systems Management and Operations (TSMO) functions. At WSDOT, IT seeks to enable business by providing accessible, secure and resilient data management systems. They work with data scientists and analysts on supporting systems and services. Modarelli stressed the importance of governance for both technology and data – this ensures that everything you are doing is providing value. WSDOT has an Enterprise Technology Board and a well-defined process for bringing on new IT systems that will connect to the enterprise. The system intake process - Implementation Renewal and End of Life Evaluation (IRAE) provides an opportunity to revisit the technology strategy at each step of the system lifecycle. The process has recently been augmented to include a review of data requirements for new systems. They emphasize starting with the business problem to be solved, and then examine alternative technology solutions – including opportunities to leverage existing technologies. The process also identifies who will be accountable for the new system and what other systems will be accessing its data.

In response to audience questions, panelists offered the following additional remarks:

Q1: Tell us more about ODOT's Data Solutions Office and roles
A1: Whitney-Dahlke - We fairly recently established the CDO role. The Data Solutions Office is just getting started, but is envisioned to include data governance support, data architecture, data engineering, and data analytics. Data analytics support will be provided using a "hub and spoke" model – there will be analysts embedded within business areas. We are working to formalize data stewardship roles and clarify the specific tasks each role will be responsible for. In designing the roles, we sought to minimize friction – we looked at what people were already doing and incorporated these activities within the responsibility definitions. We established only one new role – a Coordinating Data Steward, designated at the Division level. We have a Data Steering Team that is helping to set agency expectations for data management and use. We are also working on our first data inventory, and our data stewards will be helping to validate the entries as their first task.

Q2: How is NDOT addressing change management?
A2: Guatuam – We have worked to shift the mindset from "my data" to "our data" and establish core values around data quality and integrity, with an understanding that if the data is good then we all succeed. This is a long process requiring significant engagement from leadership, IT and business. Agency executives and sponsors are starting to be more proactive and involved, asking questions about the data. Governance is key to success – we have established governing bodies, designated roles including data subject matter experts (SMEs). We are working to have data analysts within business functions who can "speak the same language" as IT. We have also elevated the importance of training to build data literacy and analysis skills.

Q3: Can you say more about the relationship between data and IT governance?
A3: Modarelli: Data and IT governance can't be disconnected; it is important to integrate the two. Governance ensures that we are making the right decisions at the right time and following the strategic goals of the agency. At WSDOT we have sub-governance for portfolios within our major business areas. At each step, there are architecture reviews and questions pertaining to accountability for the data. There are also steering committees for each major project. There are multiple approaches to governance – but the bottom line is that IT and data governance need to work together.

Q4: How does one approach setting a data quality target?
A4: (Panel + Audience) – there is no set approach to this. For some types of issues that are easy to identify (e.g. inconsistent data formats), the target can be to fix 100% of the issues. For others that are more difficult to identify and

fix, you need to recognize that it can be costly to achieve perfection and settle for a less ambitious target. The key is to keep improving.

Q5: What data improvement initiatives are you pursuing?
A5: NDOT is implementing a Multi Application Geographic Information Center (MAGIC) – enterprise data warehouse. We just selected a vendor. We intend to avoid creating a "data dump" and ensure sound data quality processes. We will involve business from early on and follow an agile methodology.
WSDOT is collecting mobile LiDAR data. We used strong governance from the outset to establish a portfolio of projects, provide clarity of intent and guide implementation of future LiDAR platforms around the state. Governance has worked well in making large investment decisions.

Q6: In many cases, governance is perceived as reducing flexibility and innovation, and creating roadblocks – how can you avoid this?
A6: (Panel) - Need to try to walk the middle path. Not everything needs to go under oversight – have a dialog with the business on what is needed. Don't use governance processes where they aren't needed. Pay attention to enabling new processes and practices – make it easy to do things, communicate that you are improving their lives, improving data, addressing pain points.

Following the Q&A, participants were engaged in table exercises to explore data and analysis needs for various use cases. Key take-aways from the exercises included:

- Importance of a centralized data hub supporting operations
- Recognize the variety of available tools for data analysis - GIS, travel demand models
- Ensuring clarity of intent prior to selecting a dataset
- Need for collaboration processes and tools

What Did We Learn?

- The volume and variety of data is increasing and agencies are working to get more value from this data through maturing their data governance and analytics capabilities
- This involves a long process to change mindsets, formalize roles and responsibilities and implement new processes
- Data quality is a key concern; poor quality data detracts from trust in and use of data, and creates a burden for data analysts and scientists to spend valuable time on data wrangling rather than analysis
- IT and Data governance are intertwined and should be implemented in a coordinated manner

Future Actions

- NA

Using Scenario Planning to Drive Change

Session Overview

Steve Woelfel of Massachusetts DOT opened the Scenario Planning session with a reminder that scenario planning is simply about planning well for the future.

Presentation: Major Takeaways from the 2022 Scenario Planning Conference

Professor Alyssa Ryan of the University of Arizona began her presentation with a summary of the 2nd Conference on Scenario Planning in Transportation. This conference brought together practitioners from state DOTs and MPOs to discuss planning for potential future disruptions including major weather events, pandemics, and rapidly changing technologies. Planning for various extreme scenarios goes beyond regular risk assessments and has implications for performance measures and planning for all time horizons. There is potential to leverage scenario planning to address flood risk, continued adoption of automated vehicles, extreme weather, equity and other concerns. Professor Ryan posed a question from the scenario planning conference: How can scenario planning help to achieve more equitable outcomes? Scenario planning can be applied to examine the robustness of strategies for addressing needs of underserved populations and to incorporate more public engagement/outreach in the planning process. Professor Ryan repeated a question that was asked at each session of the recent conference: How can scenario planning help transportation professionals make tough decisions? She recapped a key takeaway of the prior conference: scenario planning has utility in balancing risk and values, prioritizing projects, and conducting quantitative analyses.

Presentation: Scenario Planning for Resilience

Kerri Woehler of Washington State DOT presented on scenario planning for resilience. She emphasized the need for whole-system stewardship and stated that scenario planning and resilience go hand in hand; resilience ("Safe, Sound, and Smart") is the "how" and scenario planning around climate change, disasters, equity, and economy is the "why". Scenario planning is about being nimble and flexible to what comes our way. She noted that scenario planning provides an opportunity to facilitate discussion of controversial issues. It begins with the premise that the future is uncertain, and shifts the discussion from predicting the future to developing an effective plan for responding to a range of possible futures.

Presentation: Orange Line Scenario Plan

Carrie Lavallee of Massachusetts DOT presented an extreme scenario that Massachusetts faced recently that involved a form of operational scenario planning. The MBTA announced a 30-day closure of the Orange Line with a two week notice. This required providing 150+ shuttle buses for 100,000+ passengers in coordination with stakeholder agencies to keep traffic moving and maintain safety for vulnerable road users.. MassDOT staff engaged in daily coordination with 15+ stakeholder groups to maintain system accessibility for all users. MassDOT also established and coordinated four topic-specific working groups: Traffic Operations, Vulnerable Road Users, Public Safety and Police Details, and Communications. This coordination required scenario planning to look at adjustments to communications, shuttle routes and traffic management activities in response to operational issues that arose. Carrie shared what worked well and continues to work well from this extreme scenario: constant information sharing, an openness to real-time adjustments to strategy, ongoing coordination and collaborative relationships between stakeholders, and increased public engagement.

Presentation: The Scenario Planning Mindset

Julie Lorenz of Kansas DOT began her presentation by emphasizing that scenario planning should be viewed as a mindset as opposed to a standard format or template. Effective scenario planning involves being open to listen to other people, trying on different lenses and stepping into various perspectives. Rather than seeking a single answer, scenario planning involves back-casting from a variety of futures and leveraging the insights to make decisions moving forward. Good scenario planning draws upon both data/facts and narratives/stories and balances the two. Lorenz pointed to the ALICE dataset (Asset Limited Income Constrained Employed) as a useful resource for understanding the growing population of households that have incomes above the federal poverty level but cannot afford to buy essentials in their communities. She provided an example story about a mechanic who has to go to work during the pandemic because his work is always in-person. She recommended the book, Think Again by Adam Grant for those interested in learning more about the scenario-planning mindset.

After presenting, Steve Woelfel moderated a panel discussion with questions from the audience:

Q1: How does scenario planning fit into traditional university civil engineering programs?
A1: Educators can prioritize teaching how to be flexible and nimble in thinking. DOT upper management can communicate the importance of scenario planning skills to the future civil engineering workforce to university chancellors.

Q2: Is there a cadence to scenario planning?
A2: Conduct scenario planning before a major initiative e.g. a long range transportation plan (LRTP).

Q3: How do you communicate the need for accommodating all contingencies to technical staff?
A3: Ask enough questions of the technical staff so that they arrive at an understanding of the inherent uncertainty in long range planning. Explain that it's not about the future we want but what could happen and how to best position our organizations to manage it.

Q4: Since the pandemic, what kind of scenario planning are we doing now?
A4: There has been an emphasis on what's the future of work from home nationally, regionally, locally, and how does that impact our LRTPs?

Q5: How can scenario planning be used in programming?
A5: Scenario planning is used before programming to consider where the money is needed most and what the budget needs to be for various projects.

Q6: How can scenario planning identify actions and practices that can be discontinued or phased out?
A6: It's the right question to ask, everyone is thinking it, and we should be open to making changes and tweaks or at least dialoguing about the potential to change.

Q7: How do we get connected to funding for needs when scenario planning?
A7: Answering the question "what are my needs" is difficult but a prerequisite. Then, getting connected with grant writers is key. To access federal funds, make sure you work with federal agencies to ensure eligibility and compliance with applicable requirements.

Q8: How do you work with various agencies when there is tension between constraints, operations, culture, etc.?
A8: Approach from a perspective of partnership. Facilitate discussion.

What Did We Learn?

- Scenario planning is a problem-solving mindset not a formula or template.
- Scenario planning is about facilitating dialogue.
- Scenario planning needs early and regular communication among stakeholders. This can create a positive feedback loop of communication and collaboration.
- Scenario planning should be incorporated into any LRTP or major planning initiative
- The pandemic has underscored the importance of scenario planning and raised awareness of its value.
- Scenario planning can be leveraged to facilitate conversations about controversial topics that are increasingly top of mind in transportation planning (climate, equity, electrification, etc).

Future Actions

- AASHTO white paper on the national vision for transportation and range of strategies
- Incorporate scenario planning into LRTP's and all major initiatives moving forward.

Effective Methods for Setting Transportation Performance Targets Workshop

Session Overview

This workshop provided an opportunity for participants to learn about effective methods for setting transportation performance targets, based on the results of National Cooperative Highway Research Program (NCHRP) Project 23-07. The workshop was conducted in two parts and provided opportunities to engage with peers from around the country and learn from other agencies about target setting practices. The workshop was held in two parts:

- Part 1: Overview of Target Setting Methods and Selecting a Target Setting Method, and
- Part 2: Making the Target Setting Process Most Effective

Part 1: Overview of Target Setting Methods and Selecting a Target Setting Method

Part 1 of the workshop focused on highlighting analytic methods for setting targets for the national performance measures (safety, infrastructure condition, travel time and freight reliability, and congestion measures), including information on different types of methods, procedures for applying methods, issues to consider, and examples of different methods.

Michael Grant from ICF kicked off the workshop with a welcome and introduction to the NCHRP Target Setting Guide. He noted the overall workshop purpose is to: 1) Raise awareness of the results of the research effort which is the Guide to Effective Methods for Setting Transportation Performance Targets; 2) Provide useful information to help transportation practitioners understand effective methods for setting transportation performance targets, how to implement these methods, and what issues to consider in selecting a method, drawing on the research conducted through this study; and 3) Help transportation practitioners to engage in dialogue on target setting methods to learn from the results of this study and from each other.

Michael walked through the Guide, noting it includes three sections: 1) Target Setting Overview and Tips; 2) A Menu of Target Setting Methods, which includes information on different methods that can be used for specific performance areas; and 3) Target Setting for Non-Required Measures. He then described five overarching types of target setting methods:

- Policy-Based (generally designed to align targets with the agency's vision or broader goals, such as setting an annual 3% decrease in fatalities);
- Historical Trends (a simple data-driven approach, using the historical trendline to forecast future performance);
- Probabilistic and Risk-based Approaches (approaches involving statistical analysis to explore likely variations in performance levels and develop an estimated range of potential future performance to inform setting a target);
- Multivariable Statistical Models (using statistical techniques to account for explanatory factors that influence performance, typically using regression equations to forecast future performance); and
- Other Tools and Models (which include pavement management systems, bridge management systems, and travel demand forecasting models).

Michael then discussed factors that may be considered to make a target setting method effective, including ease of application, technical robustness, ease of communication, and allowing for policy consideration.

Anna Batista from High Street Consulting then discussed target setting philosophies: conservative to realistic/predictive to aspirational, and some of the pros and cons of using these different philosophies.

Brad Allen from Applied Pavement Technology then introduced a set of scenarios for participants to work through. Participants then worked at tables to explore scenarios focused on setting a target for safety, pavement conditions, reliability, and non-single occupant mode share. The scenario exercise required participants to identify what type of target setting method they would use, at what level they would likely set the target, and what type of philosophy they would use in setting the target. The session then wrapped up with report backs from the groups and a discussion about the different factors that agencies need to consider in setting a target.

Part 2: Making the Target Setting Process Most Effective

Part 2 of the workshop focused on process issues, such as different philosophies associated with setting targets, effective practices in setting targets, and ways to make the target setting process more valuable.

To start off the session, **Michael Grant** from ICF provided a brief recap of different types of target setting methods and philosophies, and then participants were instructed to participate in a "dot voting" exercise to identify what factors are most important to them in selecting a method – ease of application, technical robustness, ease of communication, or allowing for policy considerations. Boards focused on safety, infrastructure condition, reliability, and congestion/non-single occupant vehicle mode share. He then facilitated discussion, which revealed that for different performance areas, different factors are important to participants.

Anna Batista from High Street Consulting then provided some Tips for Selecting a Target Setting Method, including understanding the complexity of methods, combining results from multiple methods, and learning from past experience and the experiences of others. She then discussed Strategies for Making the Target Setting Process More Effective, including connecting short-term targets to long-term aspirations, levering the target setting process to create a shared sense of responsibility, and leveraging dissatisfaction with worsening performance. She then facilitated a discussion about how agencies connect near-term targets to long-range goals, aligning federal measures with state measures, and using the target setting process to support decision making.

Brad Allen from Applied Pavement Technology then closed out the session highlighting the importance of coordination in target setting – internal within an agency, between the State department of transportation and metropolitan planning organizations, and between infrastructure owners. Participants then held small group discussions focused on safety, infrastructure, and reliability/congestion to discuss coordination challenges, an ideal target setting coordination process, and strategies to improve coordination.

Michael Grant from ICF then wrapped up the session highlight again tips for selecting a target setting method and the ultimate lesson that effective target setting is not so much about having the most accurate target, but is about how well the process of setting a target informs investments and strategies by providing information about factors driving performance and motivating stakeholders and decision makers to engage in discussions about actions to meet targets.

Leveraging Data for Decision Making

Session Overview

Aubrey Gunnels and Steve Hardy from Deloitte moderated this session on leveraging data for decision making. They began with a presentation on basic principles. Key points were that (1) data are the basis for data-driven decision making but organizations may not be taking advantage of all available data – including both structured and unstructured, internal and external; (2) business and mission questions drive the appropriate level of analytical complexity. There is a progression from descriptive analytics (what has happened), diagnostic analytics (why did this happen), predictive analytics (what is likely to happen), and prescriptive analytics (what actions do I need to take to achieve my goal?). Questions rather than available data should drive analytics design for decision making; (3) agencies should build and update a suite of analytics techniques and deploy them via an agile and iterative approach. Techniques include statistics, machine learning, simulation, and optimization.

Jenine Miller, Planning Director at the Georgia Department of Transportation spoke about her agency's Strategic Plan Framework, Freight Plan, and the I-85 Planning and Environment Linkage (PEL) Study, covering how data was used in each initiative. Multiple internal and external data sources were tapped and used to understand existing conditions, identify issues and screen and evaluate improvements. For the PEL study, the FutureScape simulation model was used to evaluate alternative HOT lane configurations based on corridor and community impacts delay, emissions, average speeds, throughput, reliability, and how benefits would accrue to disadvantaged populations. Miller's key point was that it is necessary to first formulate the right set of questions, and then determine the right data and tools that can be used to answer them.

Following the overview, three panelists provided their perspectives on data-driven decision making.

Megan Haggerty, Chief Administrative Officer at the Massachusetts Department of Transportation, Highway Division (Mass Highways) observed that the biggest needs to advance data-driven decision making are (1) quick, efficient access to the right data, (2) advancing staff data skills, and (3) translation of highly detailed and technical data and information into a more digestible form that provides a narrative – i.e. getting the "so what" out of the "what".

Sandra Rosenberg, Planning Assistant Director at the Nevada Department of Transportation (NVDOT) spoke about the use of data in an inherently political environment. While politics will always be a factor in transportation decision making, it is important to use available data to describe the likely impacts of different choices – "the more you tell the story, the better you are". NVDOT has a data-driven process for prioritizing projects and communicating aggregate impacts of programming decisions. They produce information that addresses the question of "am I getting my fair share?" based on different geographic distribution indicators and maps of proposed project locations. They use this information to engage regional transportation commission members in a conversation about where the dollars are going and why. Rosenberg observed that while more complex data and tools are becoming increasingly available to support decision making, this complexity comes at a cost – they can be more difficult to explain to people.

Jenine Miller, Planning Director at the Georgia Department of Transportation (GDOT) shared a success story of data-driven decision making. There was pressure from the business community to raise revenues for transportation projects, but the Governor wasn't convinced of the need for additional funding. GDOT staff presented data compiled

both from other countries and from Georgia that showed increases in Gross Domestic Product (GDP) following transportation investments. This convinced him that transportation investments could contribute to future economic growth in the state. She provided a second example of how GDOT used available economic data to identify locations for new EV charging stations.

Following their remarks, panel members took questions from the audience:
Q1: Do you have thoughts about whether "data-informed" decisions is a better term than "data-driven" decisions?
A1: Yes – data alone doesn't provide the whole picture; need to rely on other contextual factors to get to the right solutions.
Q2: Do you have success stories or challenges to share in using private data sources which aren't transparent in terms of the methodology for creating them?
A2: (1) We use many sources and avoid relying on just one. (2) Sources based on cellular data aren't reliable for rural areas when coverage is spotty or nonexistence. (3) Sometimes the product is a tool rather than a data set – and in that case, it is important to understand input data requirements and the level of effort needed to get reasonable answers out of the tool – especially given very limited staff resources.

Participants were engaged in an exercise to identify solutions that would "move the needle" for using data for decision making and what was needed to best leverage these solutions.

Key tools/techniques/data products of interest included: data visualization, GIS, BI, predictive analytics, machine learning, maintenance management systems, RITIS, private sector data integrated with agency networks and databases, digital twins, IoT data feeds, mobile LiDAR. Resources and processes needed to best leverage data for decision making included: clear vision, data leadership (e.g. a CDO), resources, change management, IT support for data integration (including private data sets), a trained and data literate staff, knowledge retention, and an ability to collaborate around shared datasets.

What Did We Learn?

- Transportation agencies are leveraging data for a variety of decisions: supporting transportation revenue increases, selecting preferred alternatives within planning studies, prioritizing projects for programming, and identifying locations for electric charging stations.
- A variety of datasets and tools are available to support data-informed decision making. A best practice is to begin by articulating the questions to be answered and then identify appropriate data sources, techniques and tools to use.
- Advancing practices for data-informed decision making will require leadership, strategic planning, change management, workforce development (to build data literacy and analysis skills), and IT partnerships on building shared, integrated, accessible repositories of data for analysis.

Future Actions

- N/A

Equity in Decision-Making and Planning Processes

Session Overview

Presentation: Equity in Decision-Making and Planning Processes

John Kaliski of Cambridge Systematics opened the Equity session by revisiting a group-generated word map of words associated with equity. Community and human-centered were standouts in this transportation equity word map. Kaliski reviewed the definition of equity from the AASHTO Equity Task Force: the benefits and burdens of transportation are fair and just for all individuals, emphasizing underserved and marginalized communities. Kaliski highlighted three areas where equity fits into the planning process from a recent webinar on equity: organizational management/culture, data, and public involvement. The panelists introduced themselves.

William Johnson of Colorado DOT explained how equity has become a focus of his role in recent years. State legislation passed in 2021 (SB 260) ensures that project planning is focused through an "equity lens." This lens examines how benefits and burdens are distributed across communities. Equity 360 is a CO initiative that looks at equity outcomes externally from CDOT work but also internally among staff at CDOT— equity is systemic.

Philip Schaffner of Minnesota DOT differentiated between equity initiatives at MN and CO. There is no equity office at MN, but equity work at MnDOT goes back a decade to equity in contracting agreements. In 2015/16 an office of Equity and Diversity was created for internal workforce equity efforts at MnDOT. MN also launched an Advancing Transportation Equity Initiative to evaluate equity outcomes for transportation system users.

Spencer Stevens of FHWA pointed to a whole-of-government equity target of the Biden administration which targets at least 40% of initiative benefits flowing to underserved/marginalized communities. This target kicked off the FHWA top-down equity conversation and led to developing a USDOT Equity Action Plan. In each opportunity for federal discretionary funding, there is a focus on equity. How is the program or grant you're proposing going to benefit "equity communities," and how does that tie into meaningful public engagement?

Lisa Tepper-Bates of the United Way of Connecticut explains the ALICE project, which stands for Asset Limited Income Constrained Employed. The ALICE project can help us understand equity gaps, especially among the working poor, that aren't captured by federal poverty lines. ALICE methodology calculates an alternative poverty line that accounts for cost of living at a county level. ALICE has implications for transportation, which is in the top 4 costs for most individuals in both urban and rural settings. How do we make public transportation more affordable and accessible to those who need it most in dense, urban areas, but also how do we make it affordable for people to live rurally and commute to work by car when that's the only choice?

Kaliski noted that 2 out of 5 households fall below either the federal poverty line or the ALICE poverty line. He asked the panelists how ALICE or other data sets are being used to make equity decisions at state DOTs. Stevens pointed to FHWA's Screening Tool for Equity Analysis of Projects (STEAP), which helps to understand the equity status quo along demographic lines, and FHWA's Planning Equity Analysis Tool, which highlights disadvantaged communities on a map, as two FHWA tools available to states. Johnson shared that CDOT isn't using ALICE specifically but a very similar dataset that also accounts for historical inequities with implications for transportation planning such as

environmental racism, anti-indigenous projects, anti-black projects, etc. Johnson also noted that CDOT wants to use the Community Resilience Estimate to see how access to healthcare, housing, etc factor into equity decisions in transportation planning. Schaffner emphasized that MnDOT has found proximity datasets useful for engaging communities that have been historically left out of the planning conversation. Tepper-Bates noted that families who fall below the ALICE threshold are less likely to engage with traditional forums of public engagement because they are constrained by working multiple jobs, lack of childcare, etc. Tepper-Bates encouraged state DOTs to partner with groups like United Way to help convene these ALICE families for the planning conversations.

Kaliski asked what states are doing to target equity in their public involvement strategies. Schaffner revisited many points previously discussed— going to people, partnering with advocacy groups, etc. Schaffner said that the goal is to move from transactional relationships (only talking to community members when a project is planned) to continuous, mutual relationships. Kaliski opened the panel to audience questions.

Q1: As you prioritize equity, do you see more collaboration among agencies at the federal, state, and local levels?
A1: It's so variable state to state, but in general there's a willingness to collaborate but not a lot of traction because of resource constraints. Colorado's SB-260 requires state officials to collaborate across the county and local levels.

Q2: How do you communicate tradeoffs between addressing equity needs and population needs?
A2: The tradeoff conversation is nascent, but it includes considering the scope and magnitude of a project's benefits and burdens.

What Did We Learn?

- There is lots of untapped potential to leverage ALICE

Future Actions

- NCHRP 08-169 EDI (Equity, Diversity, and Inclusion) and Other Indicators to Improve TAM Impact and Outcomes

Is the Juice Worth the Squeeze for Better Data?

Session Overview

Presentation: Is the Juice Worth the Squeeze for Better Data?

David Winter of FHWA presented information on the agency's efforts to implement a Data Quality Management System. Data quality is important because quality data adds value, reduces risk and enhances the agency's reputation.

FHWA's data systems include HPMS, NHTS, and ITIL (data warehouse). The organization's data quality initiative is led by its Chief Data Officer (CDO), who provides recommendations to FHWA's Highway Data Council on improving data quality. Winter acknowledged that different FHWA divisions are at different levels of data quality. To address that, FHWA's approach to improve data quality involves leveraging its data asset inventory, using a risk-based approach to set priorities; encouraging data providers to analyze their own data quality; and using a standard process and methodology for assessment. This standard process includes scoring overall data quality of assets taking into account metadata and data element documentation as well as year over year trending thresholds and QA/QC sampling. Solutions for data quality problems include data profiling, cleansing, matching, monitoring, rule creation, analytics, parsing, standardization, workflow, and collaboration.

FHWA is evaluating establishing Service Level Agreements (SLAs) for data quality for major data programs. It is also developing standard processes and methodologies, moving data to the cloud, and reporting on data quality levels. The HPMS scorecard was the first effort in that regard.

FHWA is working to change the culture and adopt a data quality mindset. The effort is viewed as a data quality program, not just a project. The agency's CIO and CDO are emphasizing a focus on data quality and are working together to develop appropriate procedures.

Following the presentation, participants were asked a general question about the primary data quality issues they face, and the approaches they are taking to improve data quality. Responses included training for end users putting data into the system; working on timeliness through implementing dynamic dashboards; discouraging static PDF reports; linear or location referencing quality issues which can cause problems for data usability and integration; completeness issues, such as establishing domains to standardized data; and quality control over submitted data.

Michael Pipp of Montana DOT presented information on MTDOT's Data Quality Process. MTDOT uses a Data Quality Objectives process to assess whether the data is fit for its intended purpose. The agency's seven step data quality process is part of a quality assurance program that informs the type, quantity and quality of the data required. The process was inspired by work done by EPA for environmental studies that relies on statements to define the data and data quality required to support project objectives and decision-making.

MTDOT's seven step process involves: (1) state the problem, (2) identify the decision needed, (3) identify the inputs needed, (4) define the boundaries of study, (5) develop a decision rule and analytical approach, (6) specify tolerable limits on decision errors, and (7) develop a plan for obtaining the data.

Pipp went on to discuss data quality indicators including accuracy (whether the data represents the actual values); completeness (whether there is enough valid data for the purpose), validity (whether data values are within accepted domain values), coverage (whether samples represent the target population), and accessibility (ease of access and use).

Following the presentation, participants were asked to discuss their own data planning processes, their data quality indicators, and their thoughts on whether the benefits outweigh the costs of these efforts. Some participants did have data quality plans, or at least target-setting, in place. Some felt their efforts were too new to know if the benefits exceed the costs; one noted that beyond a certain point there are diminishing returns to striving for 100% error-free data. Errors related to Linear Referencing Systems came up more than once; one agency had developed a "map of shame" so people could see the impact of the data errors. The importance of training for data quality control was noted, as well as the need to review older data that has been migrated into new systems.

Ted Trepanier of INRIX presented information for public agencies on Evaluating Contracted Data/Services. The key is to understand the data vendor's approach to data quality and whether it meets clients' needs. He described INRIX' holistic approach to data quality through its use of the ISO 9001 continuous improvement process. The organization relies on a three-tiered product quality escalation process that produces technical summaries for each data product. INRIX also conducts independent client evaluations and shares these with its new customers.

Participants were then asked to discuss what they expect from their data service providers to demonstrate quality and whether agencies need to do their own quality assurance with regard to contracted data. Limited resources were a determining factor for many agencies with regard to the level of quality assurance, with some agencies relying on the opinion of their subject matter experts as to the data quality, and others largely relying on the ISO certification of the private sector providers.

The panel then opened the floor to questions from the participants.

Q1: Does INRIX provide penetration data?
A1: No, because this is subject to misinterpretation. INRIX provides proxies that allow customers to identify where there are locations/times with limited data.

Q2: What does INRIX recommend states do for quality control on private data?

A2: It depends – start with your vision for how this data will inform your decisions/questions. This will determine the required accuracy. Newer data products that haven't been subject to years of testing, use and refinement need more review than established products in widespread use for many years.

What Did We learn?

- Efforts to ensure data quality are worthwhile - they ensure that data are fit for their intended purpose, which reduces risk that decisions will be made based on faulty information - which can damage an agency's reputation
- Data quality doesn't happen by accident; it requires planning, standardized processes, and an organizational culture that recognizes the importance of quality data.

Future Actions

- Consider future research to provide benchmark levels for different dimensions of data quality.

TAM: Can't We All Get Along (Range Plan)?

Session Overview

Presentation: The North Dakota DOT Family of Plans

Jack Smith from North Dakota DOT gave an overview of their 4 strategic plans: Transportation Connection (LRTP; 25-year plan), ND Moves (public-facing; 4-5-year plan), ND Freight and Rail Plan (4-year plan), and the ND TAMP (4-year plan)— the longer the time horizon, the broader the scope of the plan. NDDOT requested consultant help for rewriting 2022 TAMP and linking it to their LRTP. ND's 2022 TAMP is broken down into three investment classes: Pavements, Bridges, and Functional Capacity. Of note, ND's Functional Capacity asset class gauges whether a road is functioning the way users need it to function. Functional Capacity considers roadway and bridge width, clearance and load carrying capacity, etc. How does TAMP support the LRTP? To meet regulation 23 CFR 515, ND's LRTP considers four scenarios for the state: Rural Renaissance (move to rural); Cities and Center (move to urban); Smart and Connected (high innovation/tech-driven future); Ghost Towns (economic downturns). The TAMP generates a fifth blended scenario that is a blend of Rural Renaissance/Cities and Centers as a function of expected revenue, risk analysis, and moderating extreme predictions. Smith took questions from the audience.

Q1: Did solely level of service dictate the scenario, or did you consider level of funding?
A1: The plan development is unconstrained from a funding standpoint.

Q2: If you need to create a new LRTP, will this TAMP development process inform that?
A2: Probably not since the family of plans is structured for top-down development.

Q3: What led to the "aha!" moment for organizing/connecting your plans in this hierarchy?
A3: It came from frustration of feeling like the LRTP was just a box to check and disconnected from other plans.

Q4: How does the 5th scenario you generated dovetail with federal 2-year and 4-year targets?
A4: It doesn't. The models aren't built off federal performance measures. We set federal targets conservatively, and our statewide plans set aggressive targets.

What Did We Learn?

- Organizing plans from longer to shorter range and broad to less-broad scope is a naturally hierarchy to avoid conflicts between plans.

Future Actions

- N/A

TAM: Seize the Day-ta

Session Overview

Presentation: Right-Sizing the Management of Ancillary Assets

Trisha Stefanski from Minnesota DOT started her presentation with a definition of right-sizing from NCHRP Research Report 917: "a process by which a transportation agency can make intentional decision to adjust the size, extent, function, and composition of its existing or planning infrastructure and service portfolio in response to changing needs over time." Stefanski traced the growth of MnDOT's Enterprise Asset Management System from 2016 to 2022. She then pivoted to MnDOT's Asset Management Strategic Implementation Plan (AMSIP). Stefanski highlighted the Asset Data Work Group in AMSIP which is a spreadsheet "matrix" for categorizing asset classes into priority tiers. AMSIP identified 78 asset classes to include in the Asset Data Work Group. AMSIP defined generalized maintenance approaches for assets ranging from Minimum Maintenance (e.g. trails) to Condition Driven Plus (e.g. pavement/bridges). MnDOT decided not to inventory a variety of asset classes based on feedback from an AMSIP workshop with stakeholders; this is what right-sizing is about, Stefanski explained. Finally, Stefanski points to MnDOT's TAM Portal as the point of access to the resources she discussed in her presentation.

Q1: How did using inventory data save $19k in staff time?
A1: With signage specifically, just by verifying the data and updating the GPS coordinates we saved so much time. This can be expanded to other assets.

Q2: Are you using change detection algorithms?
A2: No—it's something we're interested in, but currently we use conflation and GIS tools to detect change over time.

Q3: How will you use Asset Tiers from the AMSIP in Risk Management?
A3: We're not currently using them, but the tiers would be good for identifying risk impact magnitude/scope.

What Did We Learn?

- Including new assets in an asset management program can help identify areas for cost savings
- Right-sizing in TAM is about being strategic in deciding what not to inventory

Future Actions

- Potential to use AMSIP Asset Tiers to identify magnitude/scope of risks

TAM: The Past, Present, and Future Walked Into a Bar… It Was Tense

Session Overview

Katie Zimmerman of Applied Pavement Technologies moderated the panel. Panelists included **Michael Johnson** of Caltrans, **Matthew Haubrich** of Iowa DOT, **Louis Feagans** of Indiana DOT, and **Mshadoni Smith-Jackson** of FHWA. Before taking questions, panelists gave an overview of the state of Asset Management and what the future of TAM looks like at their organization. Johnson shared how California is beginning to leverage Asset Management to improve safety performance. Feagans shared how Indiana is leveraging machine learning to process large volumes of TAM data and make better Asset Management decisions at various time horizons. Haubrich shared how Iowa has been using Asset Management at a network level to identify gaps in workforce; for example, Iowa is now looking to hire an Asset Management "champion" for pavement specifically. Smith-Jackson detailed the chronology of Asset Management from the past of silos and pet projects to the present of standardized measurement, regulation, and terminology. The first cycle of TAMPs just concluded and the takeaways from that is collaboration is increasing, between departments and entities. Smith-Jackson identified right-sizing and the continued evaluation of time/money spent as the future of TAM.

Q1: How do you decide to add more assets to your TAMP? What level of maturity is required?
A1: **Johnson:** Good question— we have a spectrum of assets from very mature to very immature. It's a work in progress; **Feagans:** Indiana didn't add anything to our TAMP other than what was required because of funding and staffing constraints; **Haubrich:** There's an instinct to collect more data, but it's important to ask what we're going to do with the data first and who is going to manage it.

Q2: What are one or two words to describe the future of TAM?
A2: **Mshadoni:** Collaborate, collaborate; **Feagans:** Exciting, scary; **Johnson:** Broader, more technology; **Zimmerman:** Equitable, sustainable.

What did we learn:

- Refer to question and answer.

Future Actions

- Increase resources for right-sizing
- Increase TAM collaboration between state DOTs

Planning for the Technological Disruption

Session Overview

Presentation: Planning for the Technological Disruption

Nate Higgins from Slalom presented findings from case studies on the impact of disruptive technologies on transportation agencies. Such disruptive technologies include electrification, automation, digital asset management, growing IoT networks, micromobility services, etc. Nate presented a case study report recently published by the World Road Association in collaboration with 12 transportation agencies from around the world on the role of transportation administration in shaping disruptive technologies and service models. It was undertaken as part of NCHRP 08-127. The working group proposed a vision of the Future Mobility Ecosystem as a combination of new technologies, systems, infrastructure, data, and services that are integrated to deliver an automated, personalized, and sustainable mobility system. This future mobility ecosystem implies radical changes to the functions, objectives, and operations of transportation agencies. Agencies are adapting various organizational approaches to prepare for imminent technological changes. Disruptive technologies are split into agency owned technologies, public-private partnerships, and non-agency owned technologies.

One interesting example from the case study report was Madrid Mobility 360, which offered mobility as a service through its modally integrated app. For example, a user parks in a paid lot outside of the city center; they pay for the bus through the app, and via geofencing the app is able to give the user free parking. Integrating across modes of transportation and offering mobility as a service unlocks unique incentive structures like this.

Another highlight is Mobilidata developed as an enterprise data management system to collect, store, and process transportation data for Flanders. Mobilidata leverages machine learning techniques to analyze large volumes of data. Massachusetts DOT is building a similar enterprise data management system for its highway and signal data to begin sharing large volumes of data internally for machine learning analysis.

Singapore is a good model for building partnerships and regulations in the area of Connected Autonomous Vehicles (CAV). Singapore balances collaborating with private industry, for example by providing test beds, while still maintaining improvements in safety and meeting safety benchmarks. Connecticut is preparing to release a fleet of Autonomous buses in 2024.

What Did We Learn?

- A learning mindset is key to scaling innovation and adapting to changes agilely.
- Private sector wants to work with transportation agencies— they just need to know how they fit into the puzzle.
- Offering mobility as a service by integrating transportation modes, as in the Madrid 360 example, unlocks potential to deliver on promises and meet targets.
- Being open to organizational adaptations and macro-reorganization will be key to success as an organization.
- Build transparency about uncertainty into your business case to manage expectations; many of these disruptive technologies won't enter the mainstream in the near term, and there is uncertainty around how disruptive each will be. Planning for and investing in disruptive technologies may not payoff on any individual technology, but the overall program will pay dividends.

Future Actions

- The work group is finishing the technical report currently; it will be published soon along with the current case study report.
- This conversation continues at the upcoming 2023 World Road Congress in October in Prague.

Describing the Visions for the Next Era of Transportation

Session Overview

Presentation: Envisioning and Preparing for the DOT of the Future

Secretary Julie Lorenz of Kansas DOT presented on Describing the Vision for the Next Era of Transportation. Lorenz highlighted NCHRP 20-24 (138) which is about envisioning and subsequently implementing the future of transportation. Why define a new vision now? Changing demographics, converging challenges (technologies and environmental changes), shifting work trends (hybrid and WFH) and the unprecedented resources available (in large part from IIJA/BIL). Lorenz highlighted the ALICE dataset; 42% of Americans are income constrained and working and transportation costs take up a disproportionate part of their income. How can we drive down the cost of transportation in the US? Lorenz surveyed technological changes like increased IoT networks and AI. She also highlighted the Water Supply Sustainability Risk Index for 2050. All of these future risks have systemic implications for transportation. What can state DOTs do to ensure the future vision for transportation is implemented? They can use budgetary might and convening powers to bring a variety of public and private partners in to work together. The vision Lorenz described is Community-Centered Transportation, i.e., people-centered. Moonshots for the vision included: making aggressive progress towards Vision Zero (reducing fatalities to post-WWII levels); reducing the share of ALICE households who are disproportionately burdened by transportation cost,s thus helping to close gaps in access to healthcare and education; and changing how we operate and manage the nationwide transportation system (for example, could interstates be conduits for broadband and next-gen technologies?). Lorenz stressed, if we made significant progress on these Moonshots, there would be large benefits to society and people, even if we don't get all the way to goals.

Q1: How do we address tensions between addressing today's needs (LOS) and longer term challenges like climate change?
A1: Recognize that it's not a binary choice. Have facts and be able to tell the story. You may not be able to invest as heavily in the future (e.g. non vehicular modes of transportation) as you think you should at this moment, but something is better than nothing and it builds momentum. Push back on binary thinking. Understanding how humans relate and the psychology of transportation is also important; look to the UK for examples of using psychology to improve collaboration, communication, better transportation outcomes, etc.

Q2: Stakeholders have competing interests, so how do you best engage them? Together? Individually?
A2: Individually is usually not a good idea. Bring regions together, and ask about everyones' needs. You don't need to make a decision in the moment. You're there to listen and reflect back and sometimes that means providing people with the hard truth that resources are limited and everyone will have to make compromises.

What Did We Learn?

- Refer to questions and answers.
- The future vision of transportation will require a broadening of thinking from transportation officials to address issues of equity, environment, and technological changes. It's about serving the public's needs, not the infrastructure itself.

Future Actions

- Communications and rollout (ongoing)
- Phase 1 report (December 2022)
- Further engage with partners through Challenge Networks
- Advance moonshot concepts through demonstration projects
- Identify state DOT actions in collaboration with partners

Implementing the Vision for the Next Era of Transportation

Session Overview

Presentation: Implementing the Vision or the Next Era of Transportation

Kirk Steudle of the Steudle Executive Group emphasized that partisan congressional gridlock precludes the legislation necessary to enforce the implementation of the vision for the next era of transportation. Ergo, the responsibility falls to transportation officials to work individually and collectively to advance said vision. The vision is designed so everyone can see themselves in it. The DOT CEOs never intended it to be everything to everyone, but rather something everyone could get behind and work toward. It's important to remember that state DOT directors "sit on a trap door," and some of those trap doors are more easily triggered than others. Additionally, that "trigger pressure" changes at different times on each trap door. Sometimes a DOT CEO can just do things and other times must be cautious. The key for staff supporting them is to be ready with actionable advice when the CEO can just do things. Steudle re-emphasized the centrality of "community-centered" transportation to implementing this vision. Steudle elaborated on the moonshot goal of making progress towards Vision Zero: The short-term goal is to get below 30k traffic-related fatalities a year; the peak was 52k in 1972. Elaborating on the moonshot goal of supporting the working poor, Steudle indicated DOTs may not be able to eliminate poverty, but we can ensure a lack of adequate transportation is never the reason someone is poor. Levers of change are categorized into external and internal actions for states to take. Externally, states can advance the vision through partnerships, communications, customer service, land use coordination, multi-state/regional coordination. Internally, states can advance the vision through policies/regulations, plans, programs, assets, right of way, investments, technology, data, human resources, organizational and governance changes. States should choose the highest leverage actions to make progress based on their particular legislative/political context.

What Did We Learn?

- Context matters— state DOT directors "sit on a trap door," some of which are more easily sprung and each varies at different times. Career staff can best support CEOs by knowing the options that can be done and the external resources/support available to help advance the goals, when the trap door is "welded shut."

Future Actions

- N/A

Managing Data Collected with Mobile Devices

Session Overview

Presentation: Managing Data Collected with Mobile Devices

Greg Ciparelli of Connecticut DOT presented the basics on collecting data with mobile devices, as well as some real life examples. He emphasized the need to consider people, process and technology for implementing mobile data collection solutions. He noted the importance of knowing the system and its architecture, as this is an important driver for developing data collection solutions such as interfaces to read or write data, handling data edits and versions. He further noted the importance of knowing your resources. He outlined three categories of resources: 1) technology, such as types of devices and their compatibility with available software, access to devices, and the ability to enable location services; 2) people or personnel, including a list of users and their roles and how that fits with their job descriptions; and 3) licensing, such as how to handle access, how to log in, and to enable that licensing at appropriate level.

He pointed out the need to understand existing processes as mobile data collection is undertaken, and whether they could be made leaner. An agency would want to pursue a different approach for completely rebuilding a process rather than just upgrading technology to support a mature process. Fortunately, currently available tools do enable quick development of such applications.

Ciparelli noted the need to identify and address gaps in processes – for example, creating a communication pipeline to inform people about data changes, or providing an embedded google maps link to help maintenance staff more easily find traffic signals. He also noted the importance of understanding and appreciating the user environment, recognizing the time involved, the risks, the safety challenges, and the need for connectivity; bringing users on board requires showing that the effort has clear value and providing training, as well as identifying advocates of the approach who can act as change agents. To be successful and achieve management buy-in, the agency needs to use an agile approach that avoids scope creep, one with a clear goal that focuses on the essentials, and that provides target dates for different deployment stages, and appropriately manages data requests. To help fully engage all parties, the agency needs to treat data collectors as "customers," and try to meet their needs.

Ciparelli explained how important it is to demonstrate value early on in the process and help people understand how the data collection makes their life easier – collect the data once, make it accessible, and use it many times; giving access to decision-makers will help provide high visibility of the critical work being done every day will help justify additional funding based on the information.

Ciparelli then provided some real-life examples. The Roadway Data Mobile Collection (MAVRIC) is a browser-based system with LRS built in, and has the ability to update multiple attributes at once, interface with Exor (AWLRS), and cache data so it can work without connectivity. The data is reformatted from the Esri application and is sent to Exor via CSV. CDOT's Maintenance 88 form replaces a paper process to track and manage signal maintenance work; it is a web- or mobile device-based form that uses Esri Collector to provide the ability to access information about the signal components including prior inspection info, previous as-builts, and records any work done.

What Did We Learn?

- **Consider people, process and technology when planning a mobile data collection effort**

- Roll out initiatives incrementally

Future Actions

- Agencies seeking to implement new mobile data collection efforts should check in with others to learn about successful techniques

Joint Subcommittee on Data Standards - What's Going On?

Session Overview

Presentation: Joint Subcommittee on Data Standardization: What's Going On?

Mike Bousliman of Montana DOT made a presentation on recent activities of AASHTO's Joint Subcommittee on Data Standardization (JSTAN). He provided some history about AASHTO's data activities, including long-standing work by the Joint Technical Committee on Electronic Engineering Standards (JTCEECS) on the technical aspects of data standards and the 2019 action by the Board of Directors (BOD) to facilitate interoperability so that data can be shared across applications. JSTAN was formed to further this effort. Its mission is to champion and coordinate implementation of open data standards, and the subcommittee will include representatives from other AASHTO committees including CDMA, Design, CPBM, AASHTOWare, Bridges and Structures, and Construction. JSTAN's strategic goals are to coordinate and educate committees and other groups, ensure representation and participation by state DOTs, explore options for funding standards development, participate in the buildingSMART organizations, and engage with industry, academia, and other organizations. The AASHTO BOD approved the subcommittee's membership, so AASHTO now has a seat at the table for both buildingSMART USA and buildingSMART International. It is expected that Bousliman will be AASHTO's representative for buildingSMART USA and that Mike Kennerly of Iowa DOT, chair of JTCEECS, will represent AASHTO for buildingSMART International.

The subcommittee's current activities involve defining its role in buildingSMART International, attending that group's meeting last year in Montreal, developing a scope of work and charter to define its operating model, developing a process to seek input on the buildingSMART USA Strategic Plan, and participating in a joint meeting with the BIM for Infrastructure Transportation Pooled Fund (TPF), JTCEES and JSTAN in March 2023.

In addition, Bousliman noted that buildingSMART International is seeking AASHTO's input by March, and encouraged attendees to be on the lookout for regional meetings and webinars seeking that input. He also noted two pooled-fund studies – one on Bridges and Structures which is near completion, and another on Infrastructure which is in the process of being awarded – are further refining BIM concepts and processes, providing important input to the standards process. He encouraged participants seeking more information to visit the website for buildingSMART International or find the JSTAN information on CDMA's website.

He then opened the discussion for questions.

Q1: Chad Baker (Caltrans) spoke about an effort at Caltrans that seems aligned with this effort - Caltrans Lifecycle Management System: TRIMBLE, Autodesk and Esri collaborative effort to share data across life cycle, do digital as-builts.

A1: Bousliman noted that staff at Montana DOT are storing digital models in different environments and that 400+software packages have been approved for an IFC standard.

What Did We Learn?

- A new AASHTO Joint Subcommittee has been charged with coordinating data standards development to facilitate interoperability across common DOT applications.

Future Actions

- Interested parties should visit the AASHTO CDMA's website for further information about activities and how to get involved.

Data Management Strategy for the Enterprise

Session Overview

Presentation: Data Management

Mark Floersch of CATCH Intelligence provided an overview of their professional service offerings. The focus is on enterprise data management, data governance, and analytics. CATCH has completed 300+ strategic plans, 400+ BI implementation engagements. They offer a series of 10 fixed price engagements including data driven analytics strategy development, analytics visioning, data governance, etc. Services include capability maturity assessments, future state design, gap analysis recommendations and roadmaps, conceptual data model (CDM) development, predictive models, etc. Customers include Nebraska DOT, Kansas DOT, Kentucky Transportation Cabinet, and Colorado DOT.

Q1: When cleansing data, do you trace it back to the source system?
A1: When a data issue is discovered, it's triaged back to the data governance team to address at the source.

Q2: Where are the champions for this work?
A2: Efforts in Nebraska had executive management sponsorship— the CDO was the lead.

Q3: Can this be business unit specific or enterprise wide?
A3: We recommend an incremental approach, but both are feasible.

What Did We Learn?

- CATCH Intelligence provides professional services for DOTs seeking to enhance their data analytics capabilities.

Future Actions

- Interested agencies should contact CATCH Intelligence for further information.

Data Visualization for Transportation Performance

Session Overview

Presentation: Data Visualization for Transportation Performance

Brittany Gernhard of High Street Consulting defined data dashboards as information management tools to track, analyze, and display key measures and data. The most important connection to your data is the expertise you bring to the metrics that power your organization. Gernhard emphasized the need for good data "storytelling," which sets the context, describes charts (a good title is insufficient), guides the narrative flow, and highlights insights, actions, and key takeaways. Standouts include MnDOT's Performance Scorecard and DelDOT's Communities Toolbox. **Ryan Huff** of Nebraska DOTwalked through the development of itss flood dashboard, which was developed in response to severe flooding in 2019. This dashboard, which was used by the NE governor at every press conference and town hall meeting, was manually updated on a weekly basis. It tracked miles of highways closed over time, provided narrative for its charts, included costs and damage updates, and highlighted the most important figures with visual cues (larger text, colors, etc.). **Gernhard** also provided key findings from a Tableau eye-tracking study found that people look at the left first and longest with their reading following an "F" pattern— left to right, top to bottom, and increasingly narrower; people most read titles and scan for information with maps being the last thing looked at.

Q1: Regarding the 2019 flood, what kind of internal conversations took place to decide which numbers were published? Was public fixation on the first numbers published a worry?
A1: Yes, that was a worry. Communications with the Governor's office helped coordinate the message that numbers are a moving target, and they would be fluid. In the end the public was forgiving, given the situation.

Q2: How did you consider the cost of communications?
A2: There is a real cost to not communicating which outweighs the cost of communications.

Q3: Do you see a value in interactive vs. static documents? What are the pros and cons?
A3: Practical considerations made the documents more static in the NE example; We took a "snapshot in time" approach.

What Did We Learn?

- Peoples' attention while reading follows an "F" pattern. Make sure to organize and prioritize content with this understanding in mind.

Future Actions

- NCHRP 08-167 A Guide for Creating Effective Visualizations

Teaching Old Data New Tricks

Session Overview

Presentation: Teaching Old Data New Tricks

Korey Donahoo of Nebraska DOT and **Kevin Ford** from High Street Consulting Group presented specific examples of how that agency is using data in new ways to solve problems. The first was a seatbelt compliance study which could offer insights into why Nebraska's 80% seat belt use is far lower than the national average of 91%. Using a combination of crash data and survey data, as well as Census data, the agency was able to map those counties where seatbelt use is lowest. That knowledge will help target marketing, engagement and enforcement.

In the second example, Donahoo explained how NEDOT used machine learning to develop a pedestrian crossing database at a cost comparable to a manual survey. The agency needed to inventory pedestrian crossings for a new effort STEP (Safe Transportation for Every Pedestrian.) They used four years of pavement profiler van imagery to detect crosswalk images and geo locate them. Machine learning was vital to the process, recognizing crosswalks despite changes that occur over the years due to painting and plowing. After reviewing more than 240,000 images, 1,303 pedestrian crossings were identified.

Donahoo's final example was a horizontal curve safety study, to help the agency identify locations where narrow shoulders should be widened for safety. The study mapped 2,600 curves over 600 miles, accounting for nearly 1,200 crashes, half of those on roads with shoulders of less than four feet. The study found that widening shoulders to two feet on curves currently without shoulders would reduce crashes by 11%, and widening those shoulders to four feet would reduce crashes by 22%. The locations for improvement were then prioritized based on traffic data.

What Did We Learn?

- New technology and techniques can be paired with existing data to help solve problems
- An (overwhelming) variety of data sources exist; a state DOT doesn't necessarily need to collect all the data

Future Actions

- N/A

Alaska PBPP: The Next Frontier

Session Overview

Presentation: Alaska Performance-Based Planning & Programming (PBPP): The Next Frontier

Kevin Ford of High Street Consulting gave a presentation about the modernization of AKDOT&PF, which has three regional chiefs, who independently evaluate, communicate, and advocate their needs each with their own datasets, metrics, and priorities. Alaska launched a new Strategic Planning and Performance Management division with a Data Analytics unit with the objectives of establishing equitable and accurate sources of data to share between the three regions. The obvious challenge is that Alaska is expansive— literally lots of ground to cover; it's not cost-practical to connect all roads, air travel is commonly used to connect remote locations, which implies data consistency challenges too, and there is a diversity of roads (unpaved, semi-paved, paved) with weather patterns meaning many of them are icy much of the year. Of note, Alaska also has the largest number of federally-recognized tribes requiring respectful consultation. What is PBPP?— a data-informed framework to make progress toward goals and communicate implications of various policy decisions. A successful PBPP framework enables defensible decision-making based on a combined input of data and judgment. PBPP techniques can be integrated into core business processes, including allocating resources, assessing needs, prioritizing projects, programming, target setting, etc. PBPP establishes a link between planning and programming with a focus on decision points; specifically, site/corridor scoring narrows candidate project concepts, concept scoring assists in screening project concepts, project scoring helps select projects for STIP funding, and readiness scoring determines when to schedule STIP projects for construction. The Data Analytics Unit is composed of a lead technologist/business manager, a decision scientist, a business analyst, a spatial analyst, and a data architect/engineer.

Q1: Does the tool make selections or recommendations?
A1: Recommendations.

Q2: When using your models in development, did you see trends/biases towards smaller projects with high benefits?
A2: Generally speaking, yes. Cost is a factor among other criteria.

Q3: Which funding sources does this apply to? What are your funding sources?
A3: We break our program down from the top with national highway funding. It's further broken down with SOGR projects, modernizations projects, and capacity expansions. For example, we don't want small projects competing with capacity expansion projects.

Q4: Regarding the Data Analytics Unit, what backgrounds did hirees have for these new positions?
A4: Data Science, Civil Engineering, basic coding, and analysis skills.

What Did We Learn?

- Refer to the questions and answers.

Future Actions

- N/A

VDOT SMART SCALE: Funding the Right Transportation Projects

Session Overview

Presentation: Virginia's SMART SCALE and VDOT's Accessibility Tool

Peter Ohlms of Virginia DOT presented on VDOT's use of SMART SCALE, which evaluates projects of all modes statewide while accounting for varying needs of urban and rural areas. VDOT is in its 5th round of using SMART SCALE, which weights projects on factors of safety, congestion, accessibility, economic development, environmental quality, and land use; these factors are given different weight regionally according to urban density (4 density categories, A-D). The overall SMART SCALE score for a project is the weighted benefits divided by the amount of SMART SCALE funding the applicant is seeking. VDOT's Accessibility Tool uses HERE dataset, sidewalk and bike data (VDOT collected), GTFS dataset (DRPT), and demographics to score a project for accessibility with and without implementation. Outputs of the accessibility tool are A1 (access to jobs) and A2 (access to jobs for disadvantaged populations).

Q1: How do you determine the accessibility weighting of categories A-D, and how do these change over time?
A1: Politics inevitably come into the weighting process. Weights aren't set in stone, and after each round of SMART SCALE, discussion ensues. Weights are set according to what is prioritized in each category of density.
Another VDOT staff member who worked on the first SMART SCALE iteration: Additionally the weights are "threading the needle" of some state laws.

Q2: Why isn't the denominator of the SMART SCALE score total cost of the project?
A2: Overall score is benefits/SMART SCALE money requested, which does bias projects and planning partners who can bring money to the table, but theoretically they also have more expensive projects, the land is more expensive, more needs, etc.

Q3: VDOT is unique in being responsible for almost every road in the state. Does SMART SCALE breakdown federal, state, and pass through funding that goes into each project?
A3: Intent of SMART SCALE is to have most projects go through it. VDOT is not an applicant of SMART SCALE. Behind the scenes, SMART SCALE accounts for different sources of funding.

Q4: How do you handle SOGR and maintenance? It doesn't seem like SMART SCALE weights account for this.
A4: SMART SCALE is for capital projects. VDOT's maintenance program has to use its budget to make repairs and maintenance through separate processes.

Q5: Environmental Quality is a SMART SCALE factor, but how do you score resiliency (Virginia is on the coast...)?
A5: There's a measure that subtracts up to 5 points from the score based upon negative impacts to natural and cultural resources. VDOT's resiliency planning effort is nascent and will be folded back into SMART SCALE factors.

What Did We Learn?

- Refer to the questions and answers.

Future Actions

- N/A

Using Complete Trip Data

Session Overview

Presentation: Complete Trip Data Research Results

Rich Taylor of FHWA presented on the results of research that's been ongoing since 2016 in response to feedback about Multimodal System Performance Measures from MAP-21 Performance requirements not being sufficiently multi-modal focused or trip/people focused. Multimodal system productivity is a measure produced from this effort (2018) that measures the total number of trips in the system. To measure multimodal system productivity you need complete trip data: "Complete trip data track individual trips across the multimodal network from the point of origin to the destination." A follow-on study completed in September 2022 explores availability of complete trip data. Is it available today? There are numerous providers that could (probably) provide this data (e.g. Google Maps), but how do we access this data and navigate privacy issues? FHWA plans for a study in FY23 to acquire complete trip data and test out the multimodal system productivity measure.

Q1: This sounds great but the potential for privacy issues is daunting. Are you thinking about asking permission?
A1: We haven't thought about a permission mechanism. We also need to look at socio-economic factors, sample sizes, smart phone access, all of which tie into equity. Next steps are to better define obstacles and explore ways to get around.
Q2: It seems like complete trip data would be useful beyond just measuring system productivity. What do you think about using complete trip data to take actions in our organizations?
A2: That's a good point— we talked to Google and Sidewalk Labs about accessing complete trip data for those purposes, but we didn't get very far. We'll need to come back to that.

Q3: Could a nonprofit navigate the privacy issues better than state DOTs and FHWA? Maybe nonprofit groups could serve as a link between private and public sectors for accessing data.
A3: We haven't thought about using nonprofits to navigate privacy issues, but that probably has a lot of potential.

Q4: Have you thought about how complete trip data could give insights into the demand side of the transportation system? It seems like the focus has been on leveraging to better understand the supply side.
A4: We haven't thought about gleaning demand side insights from complete trip data but there is a lot of potential.

Q5: Privacy is an issue and it doesn't seem like we can achieve end to end complete trip data while ensuring privacy. Have you thought about the potential for zone structures that measure multimodal system productivity without capturing every trip E2E? Maybe vendors would be more willing to step up in this setup?
A5: That's a good point that we'll consider in the study moving forward.

Q6: What kind of O-D data similar to complete trip data is available for transportation officials to use right now?
A6: We did use some data in the 2018 study to test origin-destination (O-D) measures, but it wasn't sufficient for the multimodal system productivity measure we're developing. The takeaway question from the studies so far and from this session seems to be: What's the best privacy-respecting dataset we can access that will tell us enough information to be useful?

Q7: Regarding the multimodal productivity measure, how do you account for changes in society that cause changes in system usage, e.g. less trips occuring because of teleworking?
A7: I'm not sure exactly how the multimodal productivity measure accounts for that, but the measure isn't designed to punish states for behavioral changes in system usage. There is a baseline of system productivity that changes over time, and the measure intends to assess against that. The exact calculation mechanisms for the measure are available in the white paper.

What Did We Learn?

- Although mobile devices and geolocationing software seem to be tracking complete trip data, it remains unclear whether FHWA and state DOTs will be able to access complete trip data.

Future Actions

- FHWA is planning a study in FY23 to acquire complete trip data and test the multimodal system productivity measure.

Coordinating the Measures that Matter - Federal, State and Local

Session Overview

Panelists: **Kerri Woehler, WADOT**; **Connie Porter-Betts, LADOT**; **Michael Johnson**, **Caltrans; Scott Zainhofsky, NDDOT**.

Q1: How are your state measures developed, and are they developed in collaboration with any agencies who drive the process?

LADOT: Our state measures are fairly mature. They were developed as a result of a 1997 state statute. They're developed by the five division heads in coordination with section leaders. We don't develop them with any other agencies, they're wholly internal to LADOT but in alignment with our 5-year strategic plan.

NDDOT: From a TPM perspective, our measures were developed through long range and modal planning. We do public outreach with stakeholders to find what matters to them. It's a collaborative process through multiple agencies and entities cross-cutting public and private sectors.

WADOT: Our measures are also developed from a TPM perspective from a place of project delivery. We do quarterly reporting on our measures through our multimodal mobility dashboard. In terms of collaboration, most of our performance reporting stems from the six transportation policy goals set by the State Legislature— we develop measures on those.

Caltrans: It depends on what we're measuring and who we're measuring it for. For external measures, we have input from our Transportation Commission with a formal public process (public hearings etc.). For internal work, how do we measure outcomes regarding sea level rise, cliff erosion, etc.? The short answer is it depends, but we're always considering who is directly affected by what we're measuring.

Q2: Do you look for state and local performance measures to align with federal measures, or do you have other priorities you consider?

LADOT: Since our measures predate the federal measures, we don't necessarily look to align them, but over time they have evolved to be more aligned. Specifically our safety measure has been aligned federally and still is aligned with SHSP.

NDDOT: We don't look for measures to align with federal measures, although we do support them and our goal areas align with federal measures and goals. Our main priorities are what ND customers care about. For example the federal congestion measure doesn't translate well to our state.

WADOT: Federal measures are complementary to what we've been doing, but our focus continues to be the measures that we've developed based on the state legislative goals for our system.

Caltrans: Ideally the measure would always align, but that's just not the reality. It can be confusing to have competing measures that function differently. For example, we don't measure pavement the way that it's measured federally, but we have a protocol for reporting national performance metrics externally while handling competing federal, state, and local metrics internally. We need to ensure that we have the data for the metrics we're trying to measure. In terms of asset management, we want to have one message in terms of performance metrics.

Q3: What do you do when state and federal measures are not in alignment?

Caltrans: We try to look at outcomes. For pavement specifically, the national metric makes it look like our pavement is in much better shape than our state measures, and the state measures are more accurate. One trend among national measures is that they tend to gravitate towards the middle— fair vs. poor.
WADOT: There is a difference between targets, monitoring targets vs. aspirational targets.
NDDOT: One advantage of being in a small state is tighter knit media relationships, so it's easier to explain discrepancies between federal and state measures. Most people are receptive to an explanation.

Q4: How do you communicate your measures— Dashboards? Info on your website? Press Releases? And how do you reach your stakeholders?
Caltrans: All of the above; we have external dashboards for common requests. We use social media and other public information avenues. Other things that are more in depth get published as reports on our website. We try to keep it simple, understandable, and graphic.
WADOT: Same. The teams that work on this have shifted focus to creating compelling infographics. For dashboards, our teams do a lot of work in Tableau.
NDDOT: I wholeheartedly agree. It's about telling the story and using all of the above. Each audience is primed to hear the story in a different way. I like our dashboard— I'd like it to be more automated.
LADOT: We report our measures in a dashboard. It's not very pretty but everything is there.

Q5: We find that outside groups cherry pick data, often from federal reporting, and tell their own story. How do you handle that situation especially when it's sometimes data we can't even duplicate?
Caltrans: We have a writeup on every think tank report that comes out, and we try to be aware before they're even published. First, what data set are they using?— Often they're using old data. Second, what's their methodology?— for the most part their methodology doesn't change year to year, so you can be prepared with a report ahead of time. For example, LA Times picks up on money spent per lane mile per year where California ranks high and appears inefficient. However, in the context of vehicle miles traveled by state, California ranks first. For the size of our system, we have more vehicles and more trucks than any other state by a factor of four, so the former metric makes sense.
WADOT: Our agency message is pretty clear. The WADOT Director addresses the legislature yearly and maintains the stance that underinvestment in preservation is having the largest deteriorating effect on the system. Any time you put yourself out there and share information, there is some chance you'll get something ugly back. It's important to support your communications team. Getting into the details and telling the whole story is the best thing we can do.
NDDOT: These illustrate why federal measures don't always work well across every state.
LADOT: You can use negative reports to your benefit to communicate investment needs to your legislature.

Q6: What is the ideal purpose of a national performance measure? Do they serve you in any way?
NDDOT: It helps to inform Congress, but we need to provide more explanatory info to help them understand the nuance and where measures fall short.
WADOT: It helps highlight areas that are important for the nation and need more attention nationwide.
Caltrans: It helps with consistency and comparison between states; it helps us benchmark ourselves against other states and set targets.

What Did We Learn?

- Refer to questions and answers.

Future Actions

- NCHRP 08-168 Analysis and Assessment of the National Performance Management Data

Data Management Plans

Session Overview

Presentation: Plans, Plans, Plans... They're Everywhere!

Peggi Knight of Iowa DOT presented information on the development of that agency's Strategic Data Business Plan (SDBP). She began by describing some of the data challenges at Iowa DOT, and how better data management could improve outcomes and reduce costs, potentially by up to half a million dollars over ten years. Recognizing the importance of good data governance, the agency created a data governance framework and assessed the maturity of its data. A SWOT analysis and survey identified data strengths and weaknesses across the agency, as well as the key challenges to implementing data management initiatives within the department. The greatest challenge identified was the lack of a clear vision for implementation, followed closely by a lack of funding. Iowa DOT proceeded to develop a vision, mission and key principles for its Data Management Strategy. The agency identified data stewards needed for the various business areas, and created a Data Management Committee reporting directly to the Department's Executive Team.

The purpose of the Data Management Committee is to assist Iowa DOT in developing and improving agency-wide data management programs, through the creation of data business plans, and ensuring compliance with data policies and procedures. The committee serves as the primary data governance body and a resource to assist in new data development. It oversees primary agency-wide initiatives, giving particular attention to projects involving data with agency-wide impact. It also oversees projects focused on data management initiatives, including development of the SDBP and the Data Quality Action Plan. Finally, it oversees systems management and new data collection efforts throughout the agency.

The SDBP targets three specific audiences: 1) executives, 2) domain trustees and tactical level staff, and 3) data stewards and operational level staff. It describes a variety of goals and objectives, and establishes technical strategies to improve data management. The strategies are intended to help create a data standards framework, improve data sharing and integration, and implement improved data management. The plan recommends a number of specific actions to be undertaken toward that end, including identifying data priorities; identifying data standards; defining and naming data consistently; data policy development; a plan for implementing consistent standards; assessing progress, data quality, IT implementation and data flow; data integration; assessing the linear referencing system and data security; improving external collaboration with partners; standardizing procedures; and developing a plan for data sharing and integration across agencies.

Data stewards will be primarily responsible for coordinating efforts moving forward on the action items and training will be provided for various audiences on topics including data management, the value of good data, metadata, and naming conventions.

Knight opened the floor to questions.

Q1: Can you describe the organizational roles of the folks on the Data Management Committee?

A1: Data Management Committee membership resulted from a discussion with the leadership team. It started with the base of the business plan group, and includes a mix of sponsors (Division Directors) and assigned staff, some much more technically-oriented, about 15 folks in total.

Q2: How did you identify the dollar savings?
A2: That was done by a consultant, through a survey they did. Much of the dollar value is based on the cost of time spent searching for or gathering data.

Q3: Who helped create the data plan? Did you reach out to MPOs or districts?
A3: SDBP was developed for that purpose. Districts are represented on the TAM committee, which got this started in the first place. A different mix of people in the organization were consulted, largely those with technical expertise. The benefit of having a consultant on board was that they helped educate folks about the need for better data management.

Q4: How frequently will you update the plan, and what kind of communication plan do you have?
A4: No specific communication plan yet, but it will likely be developed. We use the agency blog post to seek input and share information. No plans to update the SDBP yet.

Q5: Will your slides be available?
A5: Yes, through AASHTO, or please reach out to me. Also willing to share the plans, if you're interested.

Q6: Can you say more about who the data stewards are?
A6: We did an inventory of systems throughout the agency and in that process we identified the data stewards and domain trustees for each of those systems.

What Did We Learn?

- Iowa DOT is in the process of implementing a comprehensive approach to data management.
- Based on an internal survey, their consultant estimated that the agency could save up to $500,000 over ten years through strong data management practices that reduce the amount of time staff spends collecting and searching for data.

Future Actions

- N/A

EV Charging and Alt-Fuel Infrastructure Planning

Session Overview

Presentation: Electric Vehicle and Alt Fuel Planning: Illinois Perspective

Elizabeth Irvin of Illinois DOT presented their EV plan which has a goal of 1 million EVs by 2030; registrations are currently very low and will need to see exponential growth over the next couple of years to meet this goal. Early adopters skew urban while rural areas lag. Efforts to get rural areas up to speed are part of the plan. IDOT identified locations for electric vehicle charging stations (EVCS), and input from stakeholders determined where to put many additional EVCS. The IDOT EV maps sustainability as a function of economic indicators (current EVCS inaccessibility, electrical infrastructure), social indicators (income, traffic proximity), and environmental justice indicators (people of color, PM 2.5 concentration, disadvantaged communities); this sustainability network analysis identified key nodes where charging infrastructure would be needed. Next steps include developing an RFP, convening stakeholder meetings, finalizing procurement methods, flushing out relationships between EV adoption and other state goals e.g. carbon reduction, funding, etc.

Presentation: Electric Vehicle Infrastructure: EV Charging and Alt-Fuel Infrastructure Planning

Alison Stettner of Florida DOT presented on EV Infrastructure in Florida. EV has been a component in their long range plan, which aims to position FDOT as a national leader in EV infrastructure, expand EVCS access to all Floridians, and anticipate changes in travel choices and transportation towards EV adoption. A lot of the focus is on the challenge of developing a future proofed EV charging network centered around resiliency— what does resilient EV adoption look like in (increasingly) hurricane-vulnerable Florida? It's important to consider lots of stakeholders: power companies, utilities, retailers, private EV infrastructure, etc. Florida's program for delivery is now out. Partners want clear criteria like those used for VW grants. Multiple solicitation cycles are needed as well. Grant application goals include designing a competitive selection process, meeting industry's request (clear, competitive, replicable), prioritizing sites that are ready, setting up payment plans, and ensuring FDOT doesn't own or operate EVCS.

Q1: Will sites be on private property?
FDOT: Yes— none will be developed on rest areas because we don't want to own or operate EVCS. We're targeting areas at interchanges. We did look at state-owned properties, but they tend not to be the best sites for EVCS.
IDOT: Similarly, we've heard from stakeholders that people want to be able to stop at a place with other amenities (food, bathroom, retail) and a place that feels safe.

Q2: What kinds of data is being used to determine incentives for rural areas to develop ECVS?
FDOT: We're trying to bundle sites with emphasis on gap analysis. You have to be able to mix the packages so you can mix the profitability across the board. We're working with larger vendors to meet these goals.

Q3: What are some of the positive aspects and lessons learned from VW settlement grants?
FDOT: Lessons learned include site locations. It was hard to get agreements in place on the properties for those VW EVCS and meet all permit requirements. Looking forward, we're aiming to handle permitting in one step. Environmental clearances are also an issue to work through. If it's a lease-permitting scenario we're working closely with FHWA to meet those guidelines.

Q4: What are your goals for state fleet EVs?
IDOT: We're doing statewide efforts for multiple state agencies including installing EVCS at state buildings
FDOT: We're also installing EVCS at state sites, but we're prioritizing getting cruise control and power-windows in our fleet. It's going to be expensive so candidly we're a ways away from building out our EV state fleet. Our transit providers and supply chain industries are working very hard on electrification though, and we work with them on that as part of our carbon reduction strategy.

What Did We Learn?

- Refer to questions and answers.

Future Actions

- N/A

Linking your TAMPs and RIPs

Session Overview

Presentation: Linking TAMP and RIP

William Johnson of Colorado DOT began by highlighting key aspects of CDOT's asset management plan, which has 12 asset classes including geohazards. The Colorado flood of 2013 was the impetus for CDOT's current resiliency efforts— over $700 million in roadway repairs. Johnson emphasized Colorado's size and diverse weather conditions. The Bipartisan Infrastructure Law incentivizes developing a resilience improvement plan (RIP) with 7% match reduction for state DOTs and 3% reduction in matching for MPOs, which frees up funds. CDOT's TAMP includes broader threats than their RIP such as cyber attacks, staff attrition, funding/cost uncertainty, etc. Factoring quantified, annualized risk reduction into your TAMP can be tied back into your RIP.

Presentation: Building Resilience at NMDOT

Jessica Griffin of New Mexico DOT talked about the nascent resilience efforts at NMDOT with the impetus being a 2019 Governor executive order on climate change. In 2021, NMDOT issued an RFP for on-call climate change planning services. Now, NMDOT has a task order to develop an original resiliency study from 2019 into a RIP. Challenges in developing a RIP from the 2019 study include limited data, difficulty establishing vulnerability criteria, and weighing risk to cultural resources. Unlike Colorado, NMDOT's TAMP asset classes include only bridges and pavement currently. NMDOT released its 2022 TAMP rewrite in June 2022 with updates to the vulnerability assessment, completion of the criticality assessment, development of a Carbon Reduction Strategy/Climate Action Plan, tracking of of resiliency and mitigation performance aligned with state/federal goals, and development of a RIP aligned with PROTECT. NMDOT's RIP development has a yearly budget of $13.38M with a planning set-aside.

Q1: Why were climate change and resiliency combined in NMDOT's TAMP rewrite?
NM: We're behind in resiliency, so we're playing catch up. There's more education needed in our organization.

Q2: When did you start to develop your RIP? It looks very mature to me.
CO: Effectively the tools that were developed and folded into our RIP were developed starting in 2013. Our RIP effectively came together a year before federal provisions were released.

Q3: Do resiliency projects with dedicated funding (BCA) compete with overall your system program and capital projects?
CO: PROTECT gave CODOT its first opportunity for resilience-dedicated funding. Before that we built in a policy directive to help with funding decisions, and prior to that we reacted to events. PROTECT funds are intended to be used for resilience, but 40% can be used for new capital capacity. Smart planners recognize the flexibility in PROTECT and know that system expansion looks like redundancy. For CO, it's more about focusing on resilience.

What Did We Learn?

- Refer to questions and answers.

Future Actions

- NCHRP 23-32 Development of the AASHTO Highway Asset Risk & Resilience Manual: Phase 1

The Unconference Sessions: Adding Breadth and Depth to the Transportation Issues of Today

Session Overview
Presentation: Unconference Sessions

Track 1

Map Fatigue: Data Dashboards

Map fatigue inhibits maintenance supervisors with information overload— too many maps and too many data points. Vector-based maps scale and embed well— power outage maps are a good user-friendly example. Requesting a cartographer to facilitate map-work and map user experience (UX) is worthwhile. AASHTO is hosting a 2023 GIS conference in Oklahoma. Write internal process docs for "how to" update maps year to year. How can maps be made digestible for the full spectrum of users?— salient filters (e.g. pre-construction projects, funded projects, projects by phase number, etc.); map purpose statements; providing overarching context in the dashboard. Define processes to engage with customers on the frontend and build in time for mistake-proofing of your maps; alot for a testing period, consider online- accessibility; develop a standardized system for tracking request/bug tickets.

Freight Planning

Some states expressed a lag in FHWA reviewing/approving of their freight plans. States noted that getting involved in monthly AASHTO Freight calls is a good way to get ahead of FHWA guidelines, which are sometimes published later than needed for plan development. One state noted that FHWA provided a reference freight plan from another state upon reviewing their submission. How do you know the demand and real capacity for truck parking? Kentucky DOTcompletes a corridor study every ten years for assessing condition and capacity including truck parking; First, rest areas and truck stops are counted, and then KY uses ATRI data for trucks' GPS to complete the dataset. To help solve the demand for trucking spots, FHWA provides a Truck Parking Development Handbook and Freight Resource Center. Other levers for solving the demand include converting dying malls and bringing more attention to truck parking as a safety issue by folding it into a Strategic Highway Safety Plan (SHSP). States concurred that federal performance measures are sometimes good indicators but not levers themselves for addressing freight planning issues. Some states are developing state performance measures for freight; Washington DOT is developing Freight PMs for environmental impact and environmental justice (EJ). States raised supply chain issues, especially in the "first mile" from farms and other agricultural firms where township-owned rural roads are very old without federal or local funding for maintenance; these "first mile" roads are integral. The Local and Tribal Technical Assistance Program (LTAP) was noted for its usefulness in addressing rural roads relied upon heavily by freight. Florida and New York DOTs provided their Freight & Complete Streets Guidebooks for reference— FL, NY. Email Kyla Elzinga at kelzinga@aashto.org to join AASHTO's freight task force.

Bridges

No notes available

Track 2

Third Party Data

INRIX's data services were referenced. FHWA is looking into the data needed to support its various programs. Any private side data that can be leveraged to cut crash rates is of great value. Some states noted a struggle to get good third party data unless they were willing to throw a lot of money at it. When paying for good quality third party data, it's important to think about how to leverage that dataset cross-functionally— e.g. travel demand forecasting and safety. In urban areas, some states note their use of the Regional Integrated Traffic Information System, RITIS , but how are states using data to analyze congestion outside of major urban areas? A recurring problem that states mention is knowing whether or not third party data is proprietary. Of note, INRIX is proprietary, but RITIS is paid for by FHWA (data paid for, owned, or managed by FHWA is public). One problem that states raise repeatedly is verifying the accuracy/quality of third party data, especially with a precedent of inaccurate data. Why should we risk making multi-million dollar decisions contingent on potentially inaccurate data that's hard to verify? There is room to improve the quality assurance and quality control process that third party data providers follow; maybe some aspects will always be black-boxed but some companies are more transparent and eager to demonstrate good data quality.

Data Collection, Data Management, Data Governance

Data collection and management fall under the umbrella of governance; here we heard from various states about the status of their data governance efforts. Oklahoma DOT's data governance is nascent— 5 or 6 states say they have data governance initiatives, but most states seem to have data governance maturity levels similar to OK. Minnesota DOT has a governance guide and council. The biggest hurdle in getting more full-time data governance positions is communicating the need to upper management; this is linked to workforce constraints as well. Caltrans defines roles and responsibilities for staff assigned as data stewards/custodians. Modeling "duty statements" is upstream of assigning duties to positions; data quality gets baked into job descriptions. Some states have consolidated IT and data governance to alleviate data access issues. When leaning on IT for data governance, add data stewards functions to job descriptions and add an HR rep to executive committee meetings when planning this. States with more mature data governance efforts have found success in a combination of embedding governance across offices and centralizing governance efforts in an enterprise office. No state present had a data catalog of all their available datasets.

More Data! Data literacy, Data Integration

What is a CDO? A few states have Chief Data Officers (CDO) but not the majority. CDO's serve to connect business needs with the appropriate data. CDO responsibilities include identifying duplicate data efforts, increasing efficiency in project delivery, and increasing data ROI; however, monetizing data is tricky (not possible with projects using SPR funds) and shouldn't be a driving force in decision-making. A CDO directs data governance whereas a Chief

Information Officer (CIO) oversees IT responsibilities. What is a data steward vs information steward? Data stewards provide QAQC for data; stewards work to understand needs so that appropriate data is collected and structured sustainably to minimize future hurdles like changing many fields. Information stewards are stakeholders in IT projects to ensure proper data integration, and they carry out information to business areas without performing QAQC. Caltrans has data stewards at various altitudes (business vs enterprise) and liaisons to facilitate communication between districts. What is a data owner vs data trustee? A trustee doesn't own the data but ensures it is correct whereas data owners need to know they have a responsibility/accountability for data security and ownership. Some data owners rely on others to provide QAQC for their data, but they are the business person accountable for storage, detention, etc. A system owner, usually tied to IT, manages the contract/vendor for the data being collected, and business (system) managers own the data.

Track 3

Safe System Approach: What Are We Doing Now?

The Safe System approach consists of five elements: Safe Roads, Safe Users, Safe Vehicles, Safe Speeds, and Post-Crash Care. These tenets are organized by 6 guiding principles: Death and Serious Injuries are Unacceptable; Humans Make Mistakes; Humans are Vulnerable; Responsibility is Shared; Safety is Proactive; Redundancy is Crucial. A discussion took place highlighting a tension between safe vehicles and safe users; as vehicles become safer (read: heavier), pedestrians and bicyclists are more at risk. There seems to be obstacles with actually achieving reductions in speed; none of the present DOTs have speed governors on DOT fleet vehicles and there is no political will to pursue this at large.

NHTSA Tough Day for Pedestrians

What are state DOTs doing related to pedestrian safety? New Mexico DOT is engaging tribal and local communities as part of their 5-year Pedestrian Action Plan. Rhode Island DOT has a Bike Mobility Plan, and sees a pedestrian plan in their future. Alaska DOT updated their active transportation plan, but is lacking a lot of the data needed for a pedestrian-specific plan; one participant suggested that state DOTs lacking data necessary for pedestrian plans should include actions in their active plans to collect and map additional data. Louisiana DOT has regional and statewide pedestrian plans; LA triggered the Vulnerable Road Users (VRU) rule this year and is awaiting guidance. Kansas DOT has an active transportation plan and will begin their VRU study. Florida DOT has a Complete Streets coordinator that combines the pedestrian//bicyclist coordinator position; FDOT convenes a bike/pedestrian coalition of law enforcement, communities, etc. Nevada DOT has a coordinator for their active transportation plan which rolls together pedestrians, bikes, micromobility, and other road users not in vehicles. Florida, Louisiana, Teas, South Carolina, New Mexico, Nevada, California, and Arizona are pedestrian focused states— an FHWA/NHTSA classification for states that meet a threshold of pedestrian/bicyclist fatalities.

Complete Streets: Coordination with Locals & Measuring Performance

What are state DOT doing related to Complete Streets? As Alaska DOT develops their complete streets policy, they're interested in best practices for state-level policy interacting with local policies. New York DOT has a mature complete streets program and is interested in leveraging in the areas of land use, intersections, and greenhouse gas emissions. Kentucky DOT updated their complete streets policy and manual in 2022, but gas tax funds are limited to spending on state highways. Similarly Indiana DOT is constrained in its spending and can't spend state dollars on sidewalks/trails. Michigan DOT is interested in using complete streets in their pavement management. Oklahoma DOT does not have a complete streets policy but completes projects and actions that are de facto Complete Streets. Participants debated about funding primarily recreational facilities; states concurred that safety criteria should come before recreation, but one participant pointed out that adjacent land uses change over time and primarily recreational facilities may become critical paths in the future. Florida DOT uses a context classification system to navigate the urban/rural application of Complete Streets. In general, participants agreed that Complete Streets are not appropriate for all roads and most appropriate for where residential, recreational, and commercial uses intersect with roadways. State DOTS requested FHWA to include language about appropriateness, thresholds, and context-aware solutions. FHWA representatives referred state DOT participants to its cross-cutting Context Sensitivity resources.

What Did We Learn?

- Data governance efforts at states are nascent
- States are looking for context-specific resources
- The Safe System Approach is a rebranding with a more human-centered approach, but the redundancy factor is completely new.

Future Actions

- Potential research project under Freight Planning for solving the demand issue of trucking spots
- Defining standards for metadata in Management Strategy documents to leverage metadata for data-needs classification as part of governance efforts
- Establishing a TPF to help with data literacy and hiring data personnel
- Establishing data catalogs for all available datasets within a state DOT
- GIS-T in Oklahoma City April 2023

Data Governance Workshop: Actionable Insights for Data Management, Analytics, and Governance

Session Overview

Michael Pipp of Montana DOT moderated the panel. Panelists included David David Winter of FHWA, Frances Harrison from Spy Pond Partners LLC, and Davina Faimaon with CATCH Intelligence.

The workshop began with an overview of the **NCHRP 23-23 Listening Session** on **Data Governance Design and Implementation**. When asked about the drivers for data governance, agency representatives responded with a variety of needs, including the need to clarify roles and responsibilities; establish agency-level expectations; to help users understand how to find data and how it relates to other data; to standardize data both internally and externally; to integrate data across systems, breaking down silos; to develop a data dictionary; to improve decision-making and data literacy; to preserve data knowledge in the face of turnover; to reduce errors and duplication; to move beyond descriptive analytics; to coordinate data purchases across the agency or agencies; to meet a growing demand for public facing dashboards and ensure a single version of the truth; to build trust; and to save time and money. The need to standardize, integrate, preserve knowledge, develop a data dictionary, reduce duplication and move beyond descriptive analytics were mentioned by more than one participant.

When asked whether agencies had conducted a data governance maturity assessment, listening session participants also offered a variety of responses. Many agencies worked with a consultant to do their assessments, while some used the NCHRP assessment tool or a combination of both. Some agencies kept their assessment's focus narrow, and others undertook the assessment as part of a broader effort to modernize the department. Some agencies have done the assessment more than once, and a few have yet to do an assessment. The participants noted several outcomes as a result of the assessment, including better direction, learning where gaps existed, the need to better support users, the ability to set goals and create an action plan, and the need to educate management about data issues. Some agencies reported that their ability to move beyond the assessment to address issues is limited due to resources, while others expanded their efforts by creating a new position or positions specific to data oversight.

When asked what products listening session participants would like to see from NCHRP 23-23, at least one agency suggested as a follow-up to the assessment tool that NCHRP should consider incorporating the ability to set short and long term targets and establish priorities. Other suggestions included scoping exercises, examples of marketing and communication materials, examples of how to use the data assessment to drive development of plans, scaled data governance models for smaller states, examples from other states of how and where to start, lessons learned including both success stories and cautionary tales, sample data sharing agreements, information about data security and legal risks, information on how to sustain data management progress through leadership changes, and how to better connect data governance to IT project management.

Strategizing Strategic Strategies

Participants were asked what types of data strategies their organizations have. **Faimaon** noted that often organizations don't have documented strategies, but do have high level ideas, the "what" but not the "how."

In response, the participant from UDOT said they had no formal strategy, but recognized the need to put some controls and standards in place, particularly given the agency's transition from centrally-built and -managed data systems to vendor-supported and cloud-based apps, and the need for standardization and documentation.

The participant from ODOT noted that they had completed a Strategic Data Business Plan in 2016 with goals, objectives, strategies and actions, which they update every 2-3 years.

The representative from the Nebraska DOT said they have a data strategy and data & analytics strategy, but no data collection strategy. The agency needs to require process diagrams for all data coming into the data warehouse, to keep up with updates to processes, and to track new datasets. They also need to verify the true source for outside data and develop a data quality dashboard.

The attendee from Rhode Island DOT said that agency has a spatial data strategy only.

It's important that the data strategy supports the agency's mission. Participants noted that the strategy can support an agency's paradigm shift from building roads to managing and optimizing the transportation system. The data strategy needs to support asset management and safety management, which are key to a transportation agency's mission.

Strategy updates among agency participants varied significantly, from "never" to "as needed" to regularly schedule updates every two to five years.

Responsibility for the data strategy varies as well among agencies, with "ownership" ranging from executives to specific data or risk management offices to independent business units where there is no enterprise oversight.

Policy support for data strategies included policies related to data governance, data extraction, retention, classification, privacy, security, and passive data collection. The drivers behind these policy efforts included the need for transparency, risk mitigation, better data quality, rapid expansion of data systems, a response to expanding technology such as GIS, legal compliance, and the desire to ensure a single source for facts and truth.

Strategies have been implemented and communicated through dedicated stewards and data/information officers, as well as communicated through emails, meetings, employee internet, videos and sharepoint.

With regard to performance measurement related to data strategies, participants noted that those measures are difficult to develop early on, and are often qualitative. It's a challenge to measure cost and savings when there is no "before" measurement to start from. Data quality is one area where performance is being measured by Nebraska DOT.

What Did We Learn?

- Have a strategy driven by top-level policy, supported by procedures, processes.
- Data is important, but people are key.
- Many organizations are overwhelmed by the large nature of the problem. It's important to stay focused, start with pilot projects, capitalize on them, and use the results to educate leadership.

Alternative Realities for Data Analytics Organization

Participants shared their thoughts on what data analytics and data science mean to their organizations. The responses varied from agencies that are just starting to address data analytics and are still learning, to those who use data analytics to visualize data in new ways and improve decision-making.

Individuals noted that data science is more sophisticated than data analytics and requires specialized training. Current analytics practice at DOTs focuses on understanding what's been done; moving to data science would improve the ability to predict what will happen under varying scenarios and determine what should be done, including where and how to mitigate risks.

There may be a perception that data science and analytics is a path to create IT solutions without following the standard process. DOTs need to manage this risk, but also recognize the need to provide the tools and flexibility needed for data analysts and scientists to operate effectively.

To improve or create analytical capabilities with limited staff, DOTs are taking a number of different steps. Some agencies rely on consultants, while others hire staff with specific skill sets right out of school and train them. In Wisconsin, they are including data analytics requirements in the IT project scoping process to bring in appropriate contractors. One participant suggested initiating a pooled-fund project to create a regional data science consortium which could provide access to data expertise.

Faimaon suggested working with universities to build machine learning models, but stressed the need for documentation and a strategy for knowledge transfer once the model is developed.

Winter noted that FHWA has set up "data flex teams" to provide group problem-solving opportunities, providing groups with technical challenges and helping them work together on solutions. The approach has been tested and the intent is that it will evolve into a formal distributed workforce model for doing data analysis. FHWA's CDO, with support from the Highway Data Council (FHWA's data governance group) handles prioritization of the challenges to be assigned. Each challenge is managed as a project with a lead, who can bring in others based on the skills required. Junior staff are being engaged to participate, given that this provides a valuable training opportunity. Prior challenges have involved dashboard creation and some in-depth data analysis. A report on the data flex effort is available; those who are interested should contact David Winter at FHWA.

Most agencies take a hybrid approach to centralization of data analytics, with some centralized and some decentralized. None of the participants' agencies have metrics for analytics, and suggested the FHWA Resource Center add analytics to its team mission.

Data analytics and data science provide new opportunities to change policy based on the information and predictions they can provide.

Most agencies face constraints realizing their data analytics potential, including funding, staff, turnover, and the need to educate management on its importance. In some cases, even with demonstrated value from analytics efforts, there is resistance to changing existing models or methods.

Winter discussed the FHWA Panda lab, a data science lab started in 2019, envisioned as a place to develop and test innovative methods. It is both physical and virtual, with a cloud environment using data bricks. The lab has one

dedicated position, currently a program manager, but the intent is to have a data scientist supplemented by contractors. FHWA is currently working to prioritize projects to be undertaken in this lab.

Agencies are supporting and enabling data analytics and data science in a variety of ways. Some have created new positions, others are working with consultants, and some are doing both. Some are starting with pilot projects while others are undertaking agency-wide efforts to further data improvement and analytics efforts based on recognized return on investment.

What Did We Learn?

- Typically different parts of a transportation agency are at different points in the analytics maturity curve.
- Important to engage the subject matter experts and decision-makers, and ensure they are involved in building the models.
- Data science is a team sport.

Data Analytics – Staffing Skills and Capabilities

The discussion got more specific about whether agencies had established formal positions or roles for data analytics and data science. Most agencies have data analysts; one noted that their state had a data science position specification, but it was based on public health and not applicable to the DOT's needs. Some agencies have been able to reclassify existing positions for data analysts, while others have been able to create new positions and recruit new hires. Some agencies are hiring recent college graduates with specific degrees or skills including GIS or economics, while others are expanding skills by encouraging existing data analysts to train others in the agency. Several agencies noted the importance of providing opportunities for advancement to improve retention. One participant noted that the "low code" capabilities of current GIS and BI tools are geared toward business (non IT) users, but there is tension around including traditional IT skills (e.g. SQL) in business-side positions. There was also concern that Human Resources positions have not kept up to date with data needs. **Faimaon** noted that being a data scientist is a full time job, not a side activity.

It is important to have an agency sponsor or champion for data analytics and data science, which can be an executive or an information management office or officer. Most agencies do not have a formalized data strategy, but participants agreed that development of data analytics capabilities is part of their implicit strategy.

Core skills for data analysts and data scientists differ; they are not the same, but many people don't understand the distinction. Analysts need core SQL skills, but there can be a variety of specializations for analysts, which means they don't all need the same package of skills. Data Scientists need an understanding of the theory behind the model, as well as core math skills. Both analysts and scientists need mentoring and training skills, the ability to articulate ideas, and the ability to understand the difference between a process problem and a technical problem.

Participants were asked what program artifacts their organizations have created to support data analytics. Most have developed standardized templates, either for metadata, maps, or dashboards. One agency had developed a custom application to manage metadata. Some agencies modified business rules to ensure better data, or developed style guides for users to improve data "branding," or created a data catalog with documentation for users.

The Elephant...Culture

In order to successfully change the organization's culture related to data management, participants emphasized the need for communication and education, particularly for leadership. Too often, leadership is unaware of the data problems within the agency, and achieving their support for the effort is critical. Sponsorship at various points in the organization is also critical, from business areas to the executive office, particularly because of potential turnover. It's important to brief new executives early, with an emphasis on return on investment and the ability to respond to questions with solid data.

Frequent and consistent communication is also key to success. To develop a communication plan, involve the agency's communications officer. People most closely involved in data management efforts can serve as change agents and communicate with others about the effort. Start the data management effort with pilot projects or smaller changes that can demonstrate value, then celebrate and communicate those successes to educate leadership and get staff excited about the efforts.

To improve understanding of the skills needed, include a human resources representative in the effort. To ensure consistency and improve the value of the effort agency-wide, create a central website with a library of artifacts related to data governance and analytics.

There are a variety of resources available to help with communications and change management efforts, including resources in the Public Sector Data Leaders website at publicsectordataleaders.net. In addition, there are resources such as ADKAR training (Prosci model for organizational change management), DAMA DMBOK, Dataversity, and the MIT Association of CDOs.

The primary challenges to implementing and strengthening data governance include gaining executive-level support, building data literacy, and having adequate resources such as staff, funding and time. Some organizations face cultural issues associated with dashboards, with a sensitivity to sharing too much information, and a resistance to shifting to data-driven decision-making (often for good reasons).

A few participants talked about how they achieved success in their data management efforts. Oregon and Connecticut DOTs stressed the need for consistent messaging and communications. Nebraska DOT credited its success to starting with a champion and demonstrating value. Once they were able to demonstrate success in one area, others were eager to be involved. They used communications tools to engage staff with data challenges and communicate the different things that could be done with data. They also developed a dashboard to show executive management usage of dashboards and GIS portals.

What Did We Learn?

- Communication and education focused on how data management adds value is essential for changing the culture of a transportation agency towards more efficient data management and data-driven decision making.

Future Actions

- Seek continuing opportunities for transportation agencies to share their experiences with data management, governance and analytics efforts.