NOCoE
National Operations Center of Excellence

NOCoE Asset Management

Virtual Peer Exchange Proceeding Report

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Introduction

On Sept. 11, Sept. 18, and Sept. 25, 2020, the National Operations Center of Excellence (NOCoE) hosted a virtual peer exchange on transportation asset management. The purpose of the peer exchange was to share knowledge between operations practitioners at transportation public agencies and other stakeholder groups.

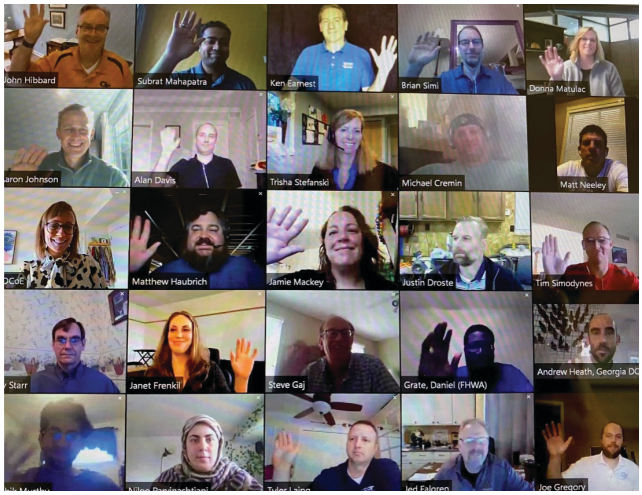

FIGURE 1 Image of participants for the September 25th, 2020, during the asset management peer exchange held in the virtual platform.

The overall theme for this event centered on how Transportation Systems Management and Operations (TSMO) at each agency can be more integrated with its asset management program. Presentations covered the following topics (See agenda.):

- **Topic 1:** Defining Transportation Asset Management (TAM) for TSMO (Presentations: Federal Highway Administration (FHWA), American Association of State Highway and Transportation Officials (AASHTO), Minnesota DOT)
- **Topic 2:** Inventory for TSMO Assets – Developing Inventories (Presentations: Utah DOT, California Department of Transportation (Caltrans), North Central Texas Council of Governments (NCTCOG)
- **Topic 3:** Inventory for TSMO Assets – Maintaining and Operating Inventories (Presentations: Iowa DOT, Minnesota DOT, Michigan DOT)
- **Topic 4:** Operation and Maintenance of TSMO Assets

The last section of the report includes a summary of the roundtable discussions for the last day of the peer exchange. The rest of this report includes a section on each of the topic areas above. Each section includes a high-level summary of the topics followed by a detailed summary of discussion highlights.

NOCoE Peer Exchanges switched to a virtual environment for 2020, with participants joining a virtual platform over a series of days to exchange information and TSMO best practices. Holding the peer exchange virtually, allowed a higher number of agencies to attend, and created opportunities for participation from different departments of each agency. The virtual peer exchange brought together over a dozen agencies from across the country and more than 40 participants per session, many remaining engaged through all three sessions.

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Topic 1: Defining TAM for TSMO

The first topic of discussion in the peer exchange focused on defining Transportation Asset Management (TAM) for Transportation Systems Management and Operations (TSMO). During the presentations, the importance of several aspects of this topic was highlighted including the following:

- Types of Assets (Signals, other ITS Assets)
- Relationship between TAM and TSMO Strategies

The two sub-topics above are described in detail in the section below in **Discussion Highlights for Topic 1**. Highlights include background information and resources related to TAM and TSMO from the FHWA Office of Operations, AASHTO Subcommittee on Asset Management and Transportation Research Board (TRB) Standing Committee on Transportation Asset Management (AJE30), and Minnesota DOT.

DISCUSSION HIGHLIGHTS FOR TOPIC 1

TSMO and TAM business models and philosophies are similar. Both use limited resources to maximize return on investments.

FHWA – Overview of Asset Management Resources

The Federal Highway Administration's presentation of definitions and resources related to asset management was a highlight of the discussion. Asset management is defined as a strategic and systematic process of operating, maintaining and improving physical assets, with a focus on engineering and economic analysis based upon quality information, to identify a structured sequence of maintenance, preservation, repair, rehabilitation and replacement actions that will achieve and sustain a desired state of good repair over the lifecycle of the assets at minimum practicable cost[1]. Under MAP-21, State Transportation Asset Management Plans (TAMPs) need to include National Highway System bridges and pavements[2]. States are encouraged to include all infrastructure assets within the highway right-of-way and other public roads[3]. To minimize congestion, a variety of innovative technology and equipment is introduced to the industry every year but there is not enough conversation on how we can preserve new equipment and technologies. Agencies need to ask five major core questions:

- What is the current state of my assets?
- What is my required level of service/ performance?
- Which assets are critical to sustained performance?
- What are my best "Operations and Maintenance" and "Capital Improvement" investment strategies?
- What is my best long-term funding strategy?

When comparing TSMO and TAM, we observe that they share the same business model and philosophy, which is using limited resources to maximize return on investments. Historically, agencies have prioritized technology deployment in support of TSMO and maintenance has been an afterthought. With the significant investment in technology, a plan is needed to maintain and preserve these assets.

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[1]Reference: 23 CFR 515.5
[2]Reference: 23 CFR 515.9 (b)
[3]Reference: 23 CFR 515.9 (c)

Over the last decade, agencies have started to develop TSMO plans. One way to improve the state of good repair of TSMO assets is to connect TAMPs to other plans such as TSMO plans, State Freight Plans, long-range plans, etc. If TSMO assets are not included in TAMP, there is an opportunity to include TAMP in TSMO plans.

AASHTO – Transportation Asset Management Community and Resources

The second discussion highlight was the TAM Community and Resources. AASHTO defines TAM as a strategic and systematic process of operating, maintaining, upgrading and expanding physical assets effectively throughout their life cycle. It focuses on business and engineering practices for resource allocation and utilization, with the objective of better decision-making based on quality information and well-defined objectives.

Some of the active groups in the community include AASHTO Subcommittee on Asset Management, TRB Standing Committee on Transportation Asset Management, FHWA's TAM Expert Task Group and PIARC (World Road Association) Technical Committee on Asset Management. Peer-to-peer learning opportunities include monthly joint virtual meetings of AASHTO and TRB committees, the Biennial National Conference on Asset Management, annual peer exchanges and the AASHTO/FHWA TAM webinar series. Also, existing training programs and resources include National Highway Institute courses, AASHTO TC3, the AASHTO TAM portal, and the FHWA TAM website. Two other important resources discussed during this presentation included the AASHTO Transportation Asset Management Guide at www.tamguide.com and FHWA's list of asset management contacts at https://www.fhwa.dot.gov/infrastructure/asstmgmt/amcontacts.cfm. Additionally, a new training module is also available from TC3 for multi-objective decision analysis: https://store.transportation.org/Item/TrainingDetail/4506.

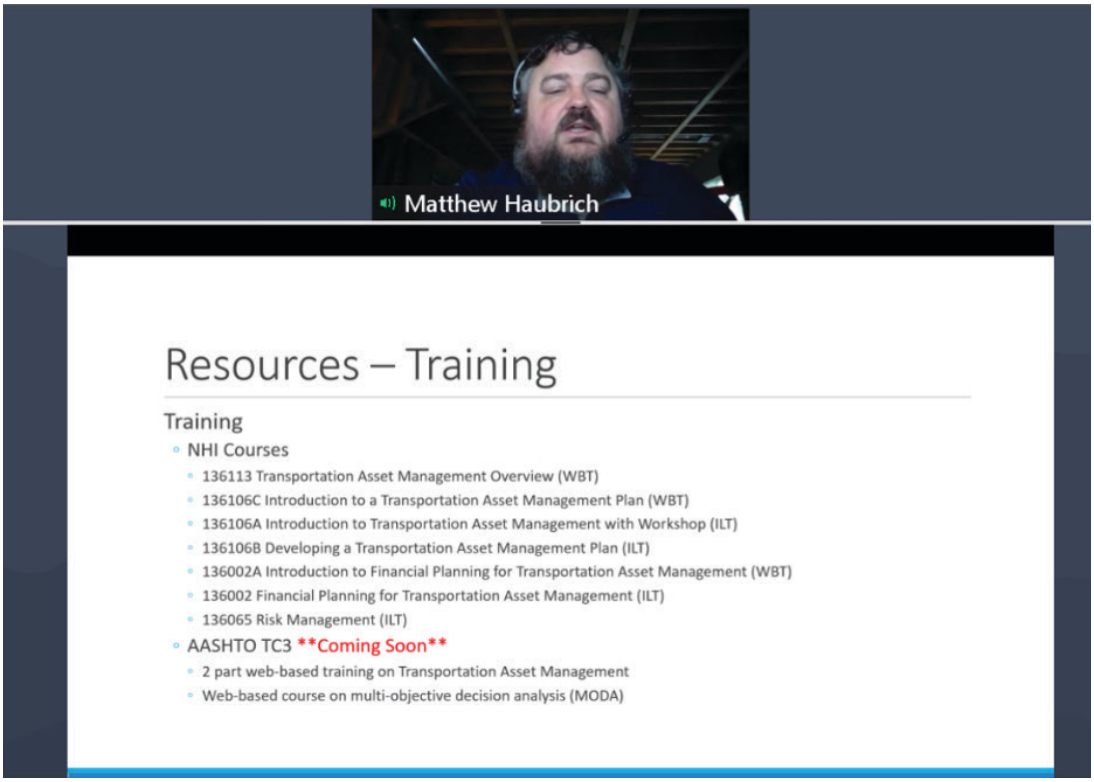


FIGURE 2 Image of Matthew Haubrich from Iowa DOT presenting on behalf of the AASHTO Subcommittee on Asset Management and the TRB Standing Committee on Transportation Asset Management during the Sept. 11th, 2020, session of the virtual asset management peer exchange.

Minnesota DOT – TAM for TSMO Assets

TAM for TSMO Assets in Minnesota was another discussion highlight. ITS and TSMO Assets in Minnesota TAMP include:

Table 1 TSMO Assets included in Minnesota DOT TAMP

Signals	Communication equipment
Fiber communication network	MnPASS toll readers
Fiber network shelters	Reversible road gates
Traffic management system cabinets	Ramp meters
Dynamic message signs	Rural intersection conflict warning systems
Traffic monitoring cameras	Road weather information system sites
Traffic detector stations/site-loops and radar	Automatic traffic recorders
Road closure systems	Weigh-in-motion system sites

Minnesota DOT's asset management and TSMO plans include:

1. TAMP - Transportation Asset Management Plan
2. AMSIP - Asset Management Strategic Implementation Plan
3. TSMO Strategic Plan (Justification for TSMO plus goals and objectives)
4. TSMO Implementation Plan (Recommended strategies/services/projects)
5. TSMO Business Plan (Business processes and organization)

The plans include conditions, performance measures, targets and investment. Having information such as life-cycle costs helps with understanding how much funding is needed annually. The plans also include traffic signal conditions (good, fair, poor and very poor) and the percentage of devices that are in each category.

TSMO strategic plan goals related to TAM include improving reliability, mobility and efficiency; improving safety; and managing transportation operations assets. Relevant objectives include funding life-cycle costs of operating and maintaining assets and managing data. Examples of relevant TSMO strategies include life-cycle management, expansion of systems and Connected and Automated Vehicles (CAV)-ready signals. It is important to keep in mind that the expansion of TSMO systems will put more pressure on the asset management division so in addition to the capital cost, hidden costs exist. Therefore, coordination between an agency's TSMO division and its asset management division is critical.

General Discussion on TAM for TSMO Assets

Following the three presentations, participants engaged in general discussion. The group said TAM in TSMO could draw on lessons from other, more established asset management programs in intelligent transportation systems, bridges and pavement. They discussed initial inventories, figuring out return on investment, sustaining performance and measuring the life cycle in managing assets in TSMO. It was noted that under the Moving Ahead for Progress in the 21st Century Act (MAP-21)/Fixing America's Surface Transportation (FAST) Act, all state DOTs are required to develop TAMP for pavements and bridges, but TAM for TSMO assets is not required.

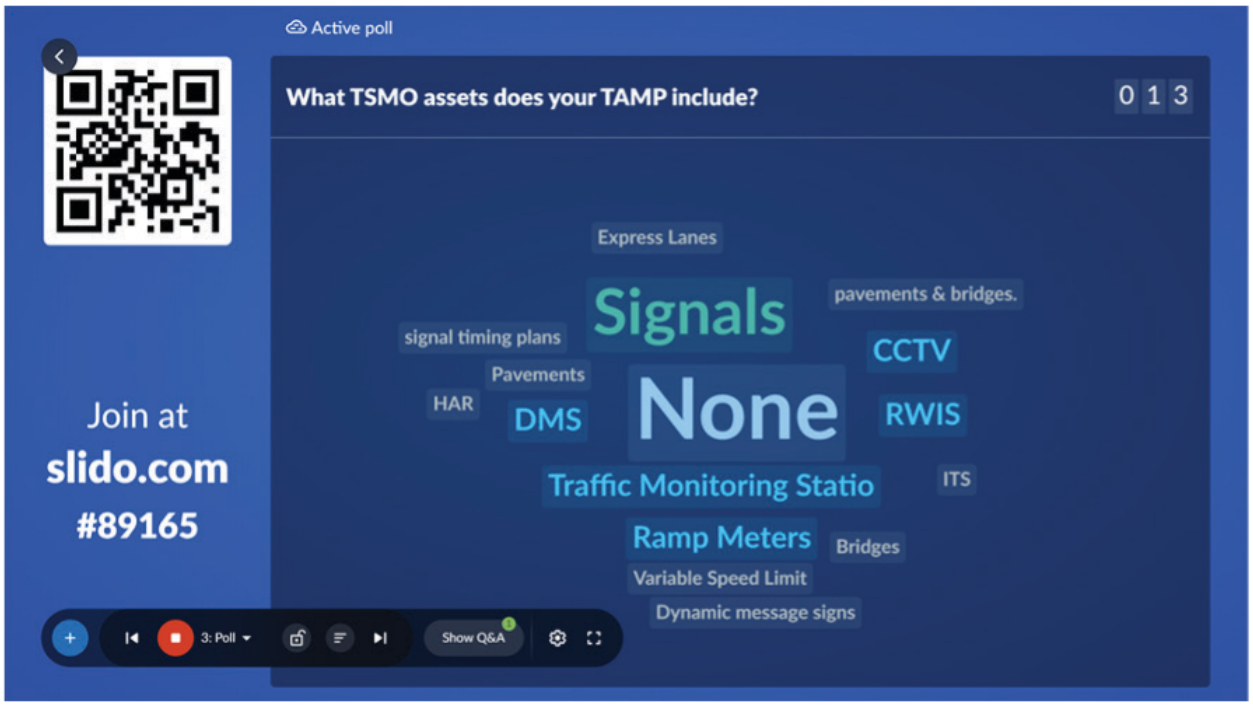


FIGURE 3 During the Topic 1 discussion, participants engaged in a Slido poll to determine TSMO assets included in different agency TAMPs.

Topic 2: Inventory for TSMO Assets – Developing Inventories

The second topic of discussion focused on Inventory for TSMO Assets – Developing Inventories. Group discussions emphasized the importance of data management in the design and construction phase (needs, integration and analysis).

This topic is discussed in detail in the next section, **Discussion Highlights for Topic 2**. Highlights include lessons learned and successes of Utah DOT, CalTrans and North Central Texas Council of Government (NCTCOG).

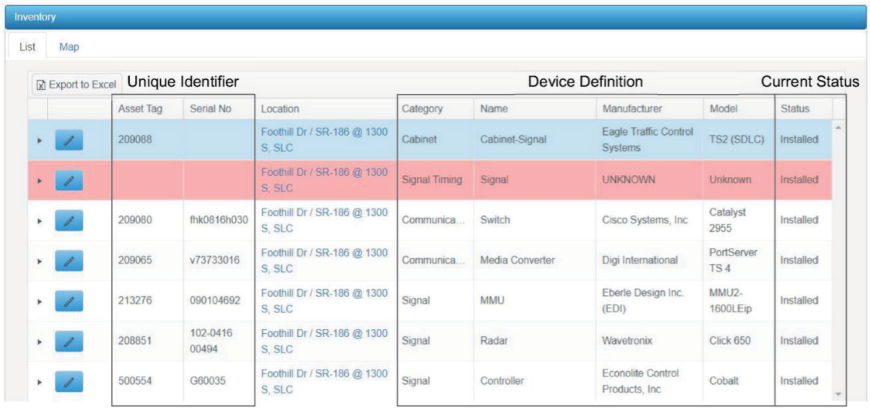
DISCUSSION HIGHLIGHTS FOR TOPIC 2

Utah DOT – Maintaining and Operating Inventories for ITS

Features that are expected from a traditional asset management software versus one designed for ITS support was a focus of discussion. One of the main differences is that traditional assets such as pavement and bridges stay in the same place, but ITS assets move around. Utah DOT asked the developers to create a customized software (AIMS) for the state since none of the off-the-shelf asset management products worked to accommodate state needs for ITS asset management. To address the variable location issue, the software is capable of displaying the location of devices. The software is also used for asset inventory and work orders.

Inventory attributes including status and location help the agency keep track if a device is installed, stored decommissioned or fails and needs to be brought to the lab to get fixed. With inventory tracking, it's important to determine what to inventory and what not to inventory. Anything that might have a warranty is worth tracking. Low-cost assets with high quantities are not a priority to be added to inventory. There are some limitations with the physical sizes of devices, where some devices are too small and hard to track.

Lessons learned for Utah DOT include the importance of database quality control and routine checks to address any inaccuracies. Also, it is important that the logging system be simple for field staff to maintain. The CyberKey system includes controls to give deny/access permission and create a record of who has logged in/accessed the devices. The electronic logbook feature allows for seeing the past work orders from AIMs. Future planned development of the system includes end-of-life attributes, asset condition, quick field inventory check, preventive maintenance model and scheduling, quantity tracking and reports.



Asset Tag	Serial No	Location	Category	Name	Manufacturer	Model	Status
209088		Foothill Dr / SR-186 @ 1300 S, SLC	Cabinet	Cabinet-Signal	Eagle Traffic Control Systems	TS2 (SDLC)	Installed
		Foothill Dr / SR-186 @ 1300 S, SLC	Signal Timing	Signal	UNKNOWN	Unknown	Installed
209080	fhk0816h030	Foothill Dr / SR-186 @ 1300 S, SLC	Communica...	Switch	Cisco Systems, Inc	Catalyst 2955	Installed
209065	v73733016	Foothill Dr / SR-186 @ 1300 S, SLC	Communica...	Media Converter	Digi International	PortServer TS 4	Installed
213276	090104692	Foothill Dr / SR-186 @ 1300 S, SLC	Signal	MMU	Eberle Design Inc. (EDI)	MMU2-1600LEip	Installed
208851	102-0416 00494	Foothill Dr / SR-186 @ 1300 S, SLC	Signal	Radar	Wavetronix	Click 650	Installed
500554	G60035	Foothill Dr / SR-186 @ 1300 S, SLC	Signal	Controller	Econolite Control Products, Inc	Cobalt	Installed

FIGURE 4 Utah DOT uses a customized software for tracking status, location, and condition of ITS assets.

CalTrans – Transportation Management Systems Asset Management

Next, attendees discussed Transportation Management Systems Asset Management in California. California's asset management plan includes TMS unit types, counts and life cycle duration for the following:

Table 2 TSMO Assets included in CalTrans TAMP

Closed circuit televisions	Roadway weather information systems
Changeable message signs	Traffic signals
Traffic monitoring detection stations	Traffic census stations
Highway advisory radios	Extinguishable message signs
Freeway ramp meters	

California also develops the State Highway System Management Plan (SHSMP) every other year. The plan includes a performance-driven and integrated management approach for the State Highway System (SHS) for a 10-year period. The 2019 SHSMP included 19,853 TMS units and indicated the percentage of units in each category of good and poor. A TMS unit's condition is defined based on the expected life cycle and consistent functionality. The state's goal is to increase units in good condition from 67% to 90% by 2027, which will require approximately $2.4 billion.

For performance monitoring, CalTrans uses real-time data collection and monitoring systems for determining functional availability. CalTrans headquarters had to make some assumptions when creating the plans since districts were missing some installation dates and life cycle data. Life cycles were estimated based on district feedback and research. CalTrans also considered that the life cycle lengths provided by the vendor might not be ideal since what is on the paper is consistently different from what is observed in the field.

CalTrans also considered a situation where a unit has multiple elements with different life cycles for each element (split life cycles). For example, the CCTV cameras in the field might need replacement but the poles do not necessarily need to be replaced. In this case, the technology or electronic components may be obsolete/out of life cycle, but the structural components may still be good. Implementing a split lifecycle is more resource-intensive but this allows the agency to fix only the element that needs to be replaced to reset the life cycle. CalTrans made the decision to separate the technology life cycle from the structure life cycle. This separation has doubled the number of units in the database, but will eventually lead to better management of the system.

NCTCOG – Dallas-Fort Worth Region Operational Asset Inventory

The third topic of discussion centered on the Dallas-Fort Worth Region Operational Asset Inventory. NCTCOG is a voluntary association of, by and for local governments, established to assist in regional planning in North Central Texas. NCTCOG does not own and operate assets but has a strong interest in finding the condition of assets to be able to apply for and distribute funding. One major asset that is tracked regionally is the traffic signal database. Currently, entries are manually added to the system and are limited to the following fields: latitude and longitude, street name, city and county. There are some proposed additions to these fields to improve the signal database. NCTCOG plans to add a unique data field that designates land use around a traffic signal. Other ITS assets are collected from TxDOT, the tollway authority and private operators. These includes, DMS, sensor location, satellite buildings and fiber and wireless coverage.

NCTCOG uses data on the condition of assets to be able to apply for funding.

FIGURE 5 Excerpts from slide responses of TSMO asset software used by agencies.

A focus area for NCTCOG is the TSMO strategy around Travel Demand Management (TDM). The NCTCOG's TDM goal includes the implementation of strategies that reduce the demand for drive-alone travel on roadways by offering alternatives to driving alone. One soft asset that NCTCOG values is the demand reduction platform where auto occupancy is tracked by facility type. This platform will help track if/how vehicle trips are reduced in favor of other modes of transportation. When NCTCOG applies for funding, it must provide data about not only about the age of equipment but also its condition.

General Discussion on Inventory for TSMO Assets

Peer exchange participants also compared how their agencies track asset condition, including visually inspecting each of the technology assets and/or estimating remaining service life based on the manufacturer. The presentations led participants toward a discussion on common software available to track assets. The group also discussed how different agencies determine life cycle and end of life on common TSMO and ITS assets. And they talked about how to prioritize assets in the management and resource allocation process, with some agencies having different methods to prioritize asset improvements. During this engaging discussion, participants provided broad responses in a Slido poll (Figure 5) about which software they used for asset inventories.

Topic 3: Inventory for TSMO Assets – Maintaining and Operating Inventories

The third topic of discussion in the peer exchange centered on Inventory for TSMO Assets – Maintaining and Operating Inventories. The following aspects of the topic were discussed:

- Asset conditions (defining and tracking)
- Tools/software
- Reporting

The three sub-topics above are described in detail in the following section, **Discussion Highlights for Topic 3**. The highlights include lessons learned and successes of Iowa DOT, Michigan DOT and Minnesota DOT.

DISCUSSION HIGHLIGHTS FOR TOPIC 3

Iowa DOT and Iowa Communications Network successfully manage and update the fiber optic network system jointly.

Iowa DOT – TSMO and Asset Management Practices

Currently, Iowa DOT does not have a formal ITS asset management plan and management system in place. The agency is working on finding a system that works across departments. The bridge and pavement group has a legacy system in place, so the agency needs to consider how it can move forward with a new system that also works for ITS assets. Among the different ITS assets that Iowa DOT manages, the fiber optic network system is the most robust. Iowa DOT and Iowa Communications Network both use the same system that is called Net Designer to manage the fiber optic network system. The system is shared between the two agencies and tracks all the fiber optic network installments of each agency across the state. Additionally, multiple cities have also agreed to enter their fiber optic network data into this system.

As the assets age and their condition deteriorates, it becomes crucial for Iowa DOT to have a plan in place that will help justify the budget needs for the assets. Some of the key questions that are used for this assessment include:

- What is the current condition of Iowa DOT's ITS assets?
- What is the required level of performance?
- What assets are critical for sustaining performance?
- What are the best operations/maintenance strategies?
- What is the best funding strategy?
- How to turn over the fleet?

Iowa DOT has a maintenance portal which is a good visual tool for quick inquiries. However, it is not the most suitable tool for creating reports. Also, the quality of data shown in the portal is directly dependent on the quality of the data that was collected and whether it is current.

Michigan DOT – TSMO and Asset Management Practices

Michigan DOT's current asset management system does not include any TSMO assets. Historically, Michigan has had good systems/reporting for roads and bridges. One of the legacy data systems from the mid-2000s was the Statewide Physical Feature Inventory (SPFI), which had two issues: (1) complex

data dictionaries (too much info to collect) and (2) inventories that were not easily accessible and not kept up. To fix these issues, Michigan had a growing desire for better asset management that meant the elimination of silos, simple collection and universal accepted data, linear referencing, maintenance work order system with asset interactions, and asset condition.

In 2015, Michigan DOT awarded a contract Transportation Asset Management System (TAMS) with the key components of road network management, asset inventory management, maintenance management and future integration capability. ESRI's Roads and Highways software is used to manage the linear referencing system for all roads in Michigan and is the primary source for asset inventories. Vueworks is a maintenance management system (MMS) for tracking asset and maintenance work activities. Road Analyzer is a straight line diagram tool for viewing asset information for project scoping.

The vendor tools included elements with capabilities of full editing and viewing of spatial/attribute. An example of the data collection and condition assessment guide is the culvert database. The initial data collection included extraction of guardrail and sign data from photolog imagery and contractor "boots on the ground" collection of culvert data. The ongoing data collection includes capture maintenance changes via Vueworks, post-construction stop-gap collection with survey contract, and looking for a self-sufficient post-construction collection (I-94 collection pilot).

In 2014, Michigan DOT ITS developed an asset management system to keep up with growing ITS demands, help reduce ITS operations and maintenance costs, and manage the ITS system more efficiently. The ITS asset management database (AMD) also provides the ability to support the maintenance of ITS devices statewide by generating and tracking work orders. The AMD includes the ability to edit ITS assets, expanded capabilities including enhanced mapping and dashboard functionality, a robust reporting module, and a preventative/corrective work order tracking system. The original data collection was done through the vendor with as-built information and field verification. The ongoing data collection is being captured through new construction projects, updated by ITS maintenance as assets are changed out, and through a region editor role by Michigan DOT staff in each of the regions.

Minnesota DOT – TSMO Assets Inventory: Integration, Innovation, Information

Participants discussed TSMO asset inventory in Minnesota. Minnesota DOT's TSMO system asset inventory focus areas include spatial reporting capabilities and mash up, maintenance management, enterprise asset management, intelligent fiber asset management and active traffic management. The inventory system also has spatial analysis network management, reporting and mapping, and plan production features.

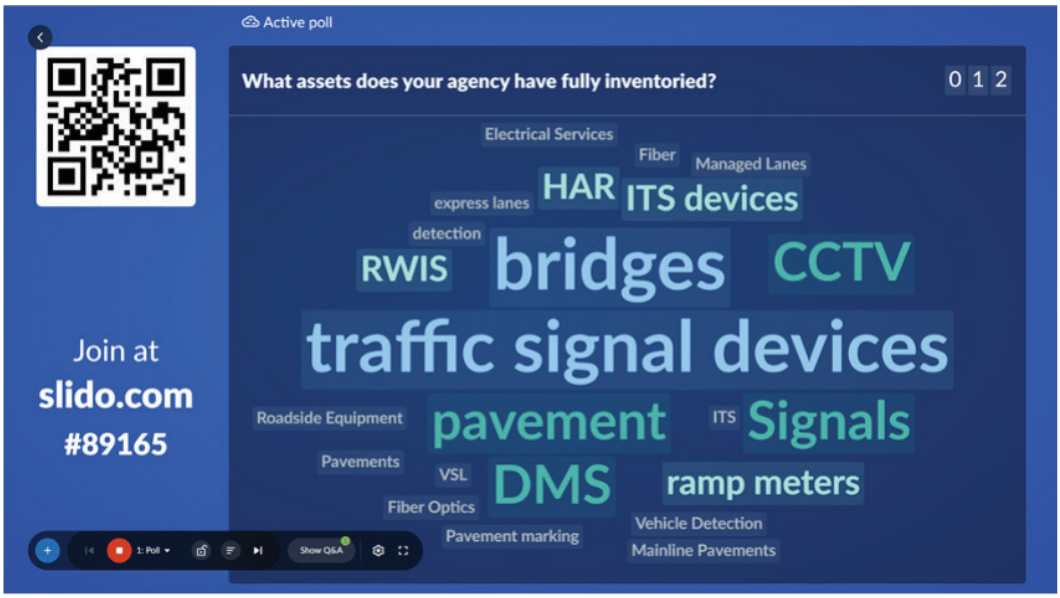
As part of the 2019 TAMP effort, TSMO asset conditions were defined based on the age and life span of each unit. Conditions are assigned to each asset type based on age versus life span including: Good, fair, poor and critical. The TSMO asset condition tracking database includes sections for general information, elements and condition rating, and element checklists. TSMO TAM includes both tabular-graphical reporting as well as Georilla spatial reporting (with a feature to download data into Excel, as well as a feature to view temp MicroStation files).

To keep the asset database up-to-date, Minnesota DOT requires contractors to submit final as-built plans. The agency needs to know what was done and where it was done, especially for underground installation. The templates that standardize the deliverable format for each asset type are listed on Minnesota DOT's As-Built Deliverable website. The documents that can be viewed by the public are

hosted on the Minnesota DOT's eDOCS Public Web that allows easy public access to those documents. Minnesota DOT also has a policy hub webpage that includes a repository of all MnDOT policies by topic. For example, under data management policies, you can find the Data Stewardship policy webpage that is related to asset management.

General Discussion on Maintaining and Operating TSMO Asset Inventories

Participants talked about how they have built relationships with management and senior leaders, and report asset inventories and conditions to them. For the most part, participants agreed that leadership support is important to the success and follow-through of asset management programs. They discussed age as a condition measure for assets, and found it helpful to compare across agencies. The conversation led to a discussion on the distinction between inventory and condition, and how to compare data coming from different sources and updated on different cycles.



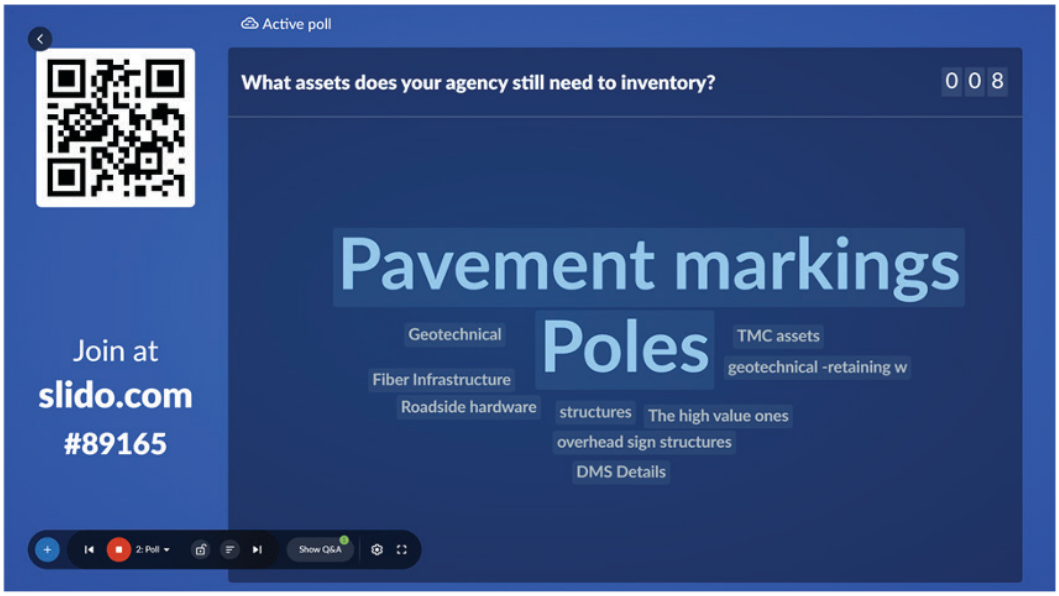


FIGURE 6 Comparison of TSMO inventory of asset types.

Topic 4: Operation and Maintenance of TSMO Assets

Operation and Maintenance of TSMO Assets was the fourth topic of discussion in the peer exchange. The following aspects of the topic were discussed:

- Developing budgets and business plans
- Investment decisions

The two sub-topics above are described in detail in the following section, Discussion **Highlights for Topic 4**. The highlights include some of the lessons learned and successes of Georgia DOT, Utah DOT and Maryland DOT.

DISCUSSION HIGHLIGHTS FOR TOPIC 4

Georgia DOT uses performance-based contracting for TSMO devices where the performance level target for vendor payment is broken down based on how essential the device is.

Georgia DOT – Asset Management: One Department, Different Systems

The first topic of discussion was Georgia DOT's asset management system. The system includes fleet, bridge and maintenance work. Georgia Asset Management System allows creating work orders from both work requests and outstanding work (inspection). Georgia currently does not include ITS devices in the asset management plan. However, the department uses a separate performance-based contract for ITS devices, meaning that the vendor payment is based on device uptime. The devices are owned by the agency and the performance-based payment to the vendor covers device maintenance. Throughout the years, the contract baseline has moved from 90% to 95% and in the latest version, the target performance level is broken down based on how essential the device is (general with 93% performance level, essential with 95% performance level, and vital with 97% performance level).

When categorizing devices, Georgia includes classification and asset status (operational, down, waiting, not ready, transition and decommissioned). Georgia's platform allows for real-time monitoring of device availability. If there are any issues with a device, a ticket will go out to TMC staff. The platform also includes dashboard and reporting tools. The reports are used for contract payment tracking per device. Additionally, the platform shows ITS device location by area, county and district, and the status of devices on the map. Georgia DOT utilizes a third system called TEAMS for inventory and tracking of all traffic signal equipment.

Utah DOT – Planning for ITS Asset Management

Participants discussed Utah DOT's ITS asset management planning. Utah DOT's ITS assets include variable message signs, CCTVs, transportation management systems, road weather information systems, ramp meters, fiber cables, traffic signals and other miscellaneous ITS elements. Utah recently reorganized its operations structure, making each of the following divisions responsible for an assigned set of ITS devices: (1) ITS deployment and maintenance, (2) freeway operations, (3) transportation technology and (4) IT. This re-organization allows better integration of maintenance and ITS deployment.

Historically, the 2002 winter Olympics jump started Utah DOT's ITS program. The program used various funds to maintain ITS devices with a budget of $800,000 per year. In 2016, Utah DOT designated

ITS assets as Tier 1 assets, which allowed for increased funding of $3 million per year, adding a dedicated end-of-life replacement budget for the first time. This dedicated end-of-life budget increased to $4.7 million in 2018. Utah DOT performed a comprehensive end-of-life assessment in 2019 and presented numbers to senior leaders including:

- Need for ITS maintenance crews
- Detailed lists of ITS replaceable components
- Estimated % of replacements needed per year

In 2016, Utah DOT designated ITS assets as Tier 1 assets, which allowed for increased funding, adding a dedicated end-of-life replacement budget for the first time.

As a result of this assessment, a need for a 50+% increase was requested and a 22% increase was accepted, increasing the budget to $6 million per year. The next steps for the ITS "End-of-Life" Assessment will include the development of a yearly plan by locations and yearly cost/system re-evaluation. Performance measures will also be tracked to demonstrate how the budget increase has caused improvements in the system.

Utah DOT tracks ITS assets in a proposed master plan with the philosophy that when roadway problems occur, the department identifies technology solutions. The estimated build-out cost far exceeds the dedicated deployment budget, so the current budget cannot adequately address needs. Moving forward, in addition to requesting dedicated deployment funds, Utah DOT will work with regions to fund projects and will integrate ITS deployment into the project concept process. The goal is to make regular updates to the master plan and identify prioritized needs by year.

Maryland DOT – How Maryland DOT Chooses which Assets to Address

Maryland DOT State Highway Administration (MDOT SHA) is responsible for maintaining and improving a major portion of Maryland's transportation infrastructure. The goal of the agency is to get the best performance out of all assets with available resources. MDOT SHA's strategy is to reimagine organizational structures and processes used to achieve and maintain assets in a state of good repair. Maryland has formalized the Operational Infrastructure Asset Management initiative and has taken steps to:

- Develop and integrate asset management best practices
- Prioritize the needs of the organization to meet the goal
- Build a culture that focuses on teamwork and strong stewardship of state resources

MDOT SHA recently formed an asset management office which is under the deputy administrator of operations. This structure has helped with better integration of operations and asset management. The asset management office includes the Asset Data Operations Division, Asset Optimization Division and Asset Preservation Delivery Division.

MDOT SHA links asset management to TSMO planning and projects through the 2020 MDOT SHA TSMO Master Plan and 2020 MDOT SHA ITS Communications Plan. The TSMO Master Plan identifies TSMO systems, projects and scopes that include ITS, telecommunications and decision-support infrastructure. The TSMO Master Plan also provides a performance-based approach to prioritize projects where traffic demand and asset conditions are key parameters. The ITS Communications Plan identifies telecommunications needs to support TSMO systems and resiliency. TSMO/ ITS assets are part of the MDOT SHA Asset Management Program and the plan identified fiscal needs (capital and operations and maintenance) for existing and upcoming projects and programs.

The asset management plan helps Maryland DOT decide which assets to address through defined goals, strategies and outcomes. Asset management goals are optimized lifecycle cost, predictable and reliable performance, and informed long-term investment decisions. Relevant asset management strategies in the TSMO strategic plan lays out the following strategies:

- Develop asset management systems for ITS devices and TSMO infrastructure
- Complete an assessment of Maryland DOT and MDOT SHA communications assets and incorporate enhancements into future projects

To keep up with performance management, MDOT SHA uses rehabilitation/replacement methods to fix assets that are poor, and preventive maintenance to keep the assets that are fair and good from becoming poor. In addition, the agency prioritizes infrastructure needs by determining risk and identifying conditions and functions for assets or systems.

When defining the most appropriate preventive maintenance strategy to optimize lifecycle and benefit/cost, risk is an important consideration. Employing the appropriate maintenance strategy at the start of the lifecycle is cost-effective and ensures condition and performance are consistently maintained throughout useful life. In a fiscally constrained environment, risk can help focus investments on the most critical needs but continuing to fund inspection and preventive maintenance is just as important.

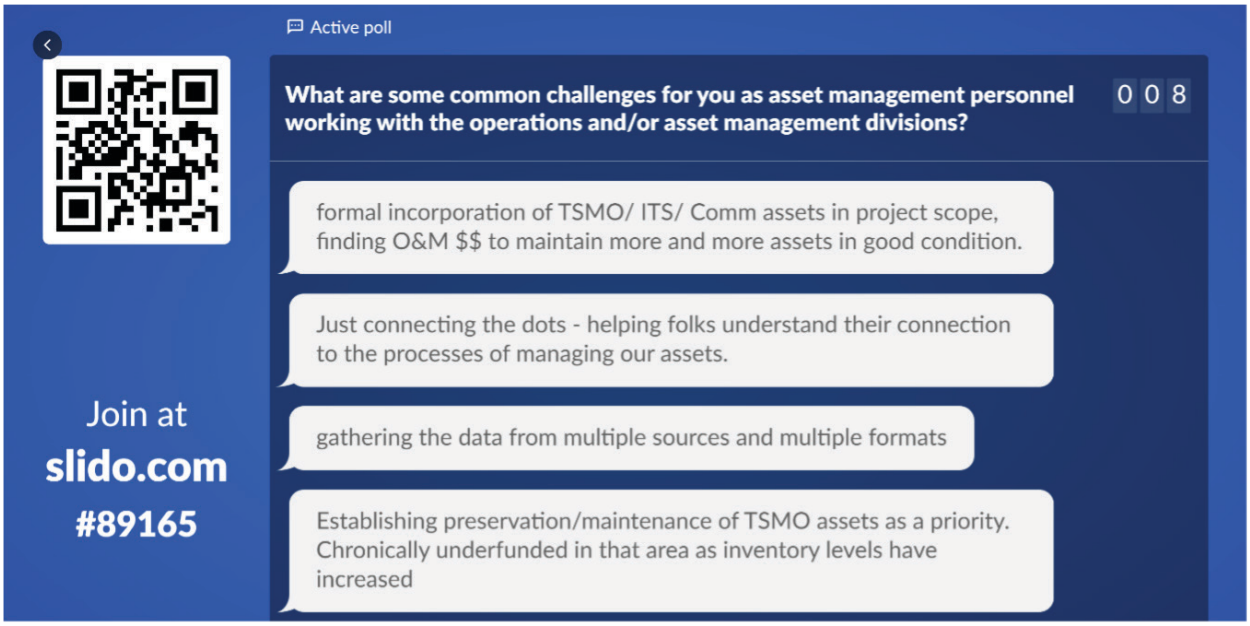


FIGURE 7 Some common challenges for operations and asset staff, as identified by peer exchange participants.

General Discussion on Operations and Maintenance of TSMO Assets

Participants compared long-term operations and maintenance of TSMO assets. They discussed common challenges faced by operations and asset staff, and resource commitment using cross-cutting objectives and strategies to link TSMO and asset management. The participants also discussed how the inclusion of high-level strategies to involve TSMO asset management in agency-wide strategic plans leads to funded tasks and deliverables. This session closed with a discussion on how ITS inventories continue to increase, while maintenance and preservation budgets remain constant. The group noted this often creates a disconnect on the appropriate maintenance of TSMO assets and systems, and requires planning far ahead when numerous assets have reached their life span and can no longer be maintained.

Roundtable Discussion: Other Considerations For TSMO Asset Management

The last day of the peer exchange included roundtable discussions on future evolutions and expectations in TSMO asset management. Three major subtopics were discussed by attendees:

- TSMO asset management: Getting buy-in from others
- TSMO asset end of life: Age versus condition
- Decision-making and prioritizing resources

The three sub-topics above are described in detail in the following section, **Discussion Highlights from Roundtable**. The highlights include lessons learned and successes of agencies and roundtable discussions.

DISCUSSION HIGHLIGHTS FROM ROUNDTABLE

TSMO Asset Management: Getting Buy-In from Others

Participants discussed how to get buy-in from others when working on TSMO asset management. Three main groups are crucial in this process:

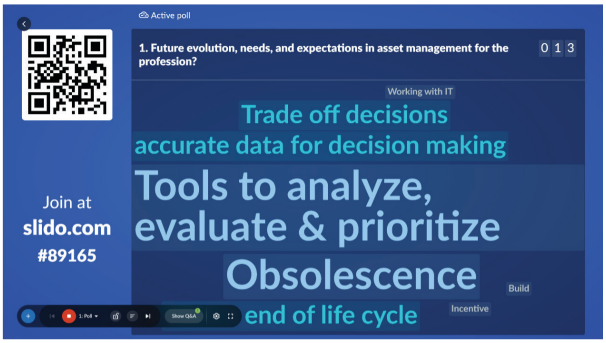


FIGURE 8 Identification of needs for asset management in the TSMO profession.

Executive and upper-level management: The peer exchange attendees shared ideas on how to explain the importance of this initiative to executive-level management to get their support. On-going and open conversation with leadership is key in sharing benefits and telling the story of why creating and maintaining an inventory of TMS assets is important. Getting this buy-in by making the business case will have a positive impact on securing funding. One agency shared that their commissioner did not come from an operations background but was previously placed at the district level, so he understood the importance of maintenance. When a new commissioner came on board, buy-in was passed on to the second generation of leadership as a legacy.

Other technical divisions within the DOT: ITS assets are vastly different from pavement and bridge. Deterioration is gradual for pavement but ITS assets either work or do not work. The loss of an ITS asset has a different impact on the system compared to the loss of a pavement section. Agencies need to treat them differently through the planning process, system selection and overall management. Tools that help define the importance of each piece will help agencies make better decisions. Health index data and other visual data can be shared more easily across the agency. In some agencies, the asset management division is overseen by a completely different office and is not under the responsibility of the chief engineer. In that case, educating the asset management team about the unique aspects of TSMO asset management is critical. The federal highway fact sheet[1] (Enhancing Transportation: Connecting TSMO and Asset Management) is a helpful resource in this area.

[1] https://ops.fhwa.dot.gov/publications/fhwahop18094/index.htm

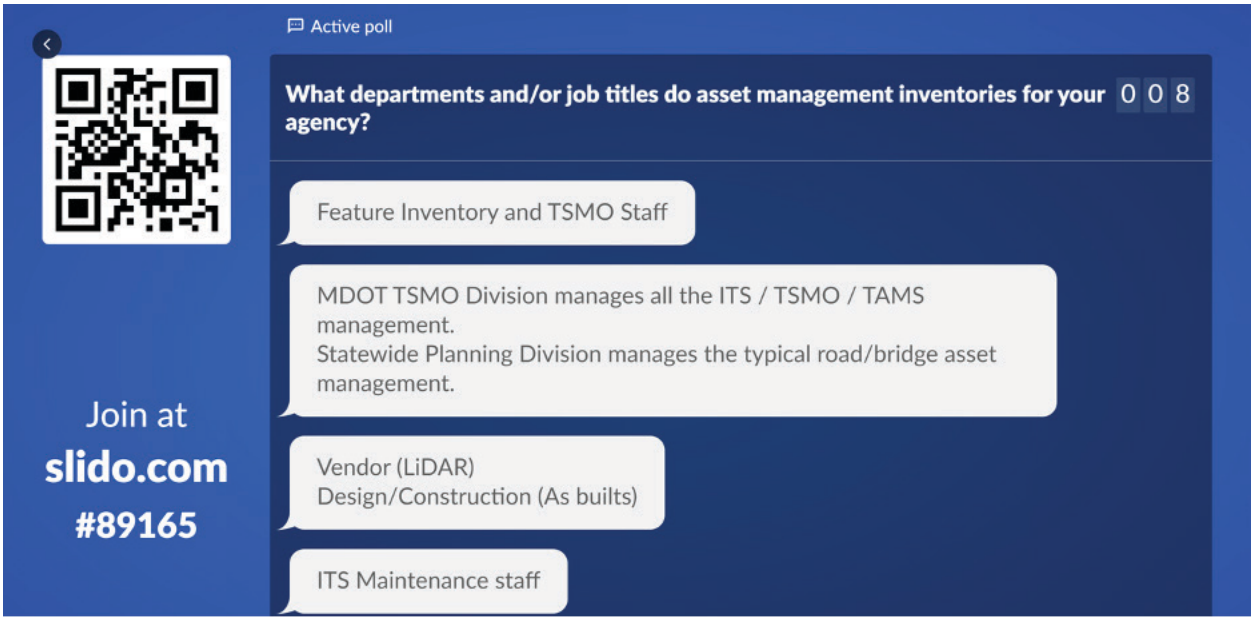


FIGURE 9 Example of common positions involved in TSMO asset management.

DOT Districts: It is important for the central office/headquarters to work with all the districts across the state. An example of positive collaboration is CalTrans' research and survey study across its 12 districts to establish the methodology for rating the condition of TMS assets. Districts responded that when rating the condition of a TMS asset, they want to be able to separate the technology from the structural element. If the technology or electronic components are obsolete/out of life cycle, but the structural components may still be good, the strategy should be to only replace the electric part. As a result, CalTrans chose the split life cycle method for its assets with buy-in from all the districts.

TSMO Asset End of Life: Age Versus Condition

A major topic of discussion in the peer exchange was how agencies assess the condition of a TMS device that is functioning but has an antiquated technology. Although an asset's condition and age are related, they are two distinct features of inventory. Since there is usually a subjective look at TSMO elements when it comes to end of life, technology obsolescence is a key factor for consideration. One of the attending agencies shared an example of this where they decided on a blanket replacement of analog cameras to digital.

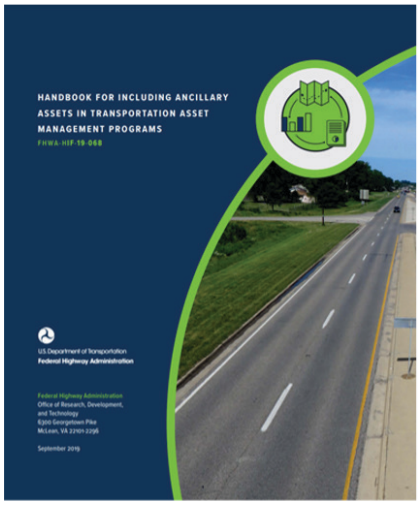


FIGURE 10 Cover of FHWA Handbook for Including Ancillary Assts in Transportation Asset Management Programs.

For tracking asset condition, agencies can undertake two methods: (1) Performance: conduct visual inspections on each of the technology assets and (2) Lifecycle: estimate remaining service life based on the manufacturer recommendation. Peer exchange attendees discussed how they choose one or a combination of these methods since this is a subjective decision and depends on the device type, agency policy and engineering judgment. The inclusion of field technicians in these conversations can also be helpful since they are knowledgeable about devices and are aware of the current state of the devices in

the field. Some technicians are very efficient and are creative in fixing devices numerous times until they cannot be fixed anymore.

When developing and updating the asset management program, agencies face several questions: (1) how to prioritize what assets to manage, (2) how to manage the selected assets, (3) how to limit the scope to only manage to the appropriate level and (4) making the business case to show a positive return on investment. Attending agencies shared experiences and examples in all these areas. In general, the decisions are made in a way that is more sustainable for the agency. For example, a group change for all the LEDs at the signal head might be more reasonable. Also, if TMS devices throughout an express lane/corridor use the same type of technology, it is more convenient to do a group replacement if needed.

Decision-making and Prioritizing Resources

When planning for asset management, agencies come across the dilemma of what needs to happen first (classic chicken and egg problem). On one hand, office employees are not inclined to use the data because they believe it is not high quality. On the other hand, field employees are not very motivated in their data collection efforts because they feel like not all the data will get used. To improve this cultural issue, it is important to show the benefits of actions to both field and office employees and get their buy-in. Another example is the situation where data gets collected but the agency does not have all the right tools/systems/software in place, so people ask why they are collecting data that they are not enabled to use. Additionally, when planning asset updates, the inventory updates and the condition updates are discussed in the same conversation but often the data are coming from various sources and updated on different cycles. These are all valid concerns that need to be taken into consideration for decisions and resources.

Agencies need to be better at utilizing the data they are collecting. Minnesota DOT shared their experience on how they use industry resources (including FHWA's Handbook[1] for Including Ancillary Assets Transportation Asset Management Programs) to tier their assets and determine the amount of data that needs to be collected per asset tier. With the help of a contractor, they are determining the answers to questions like what the value of each asset is, what the value of adding stationing to the TAMP is, etc. Depending on the type of asset, management needs are determined between the lowest minimum approach to highest optimized approach. In tiering assets, the final determining factor is the value of data collection per asset. As an example, in their review of 75 attributes collected for culverts, Minnesota DOT decided not to continue the updating of all attributes since all were not used in analysis and decision-making.

Agencies noted that creating a Capability Maturity Model (CMM) Framework for TSMO asset management would help a multitude of agencies and a National Cooperative Highway Research Program report on that may be the best route forward. The group also discussed that stressing the importance of gap analyses is important and noted some agency gap analysis plans are available through FWHA here: https://www.fhwa.dot.gov/asset/gap/.

[1] https://www.fhwa.dot.gov/publications/research/infrastructure/19068/19068.pdf

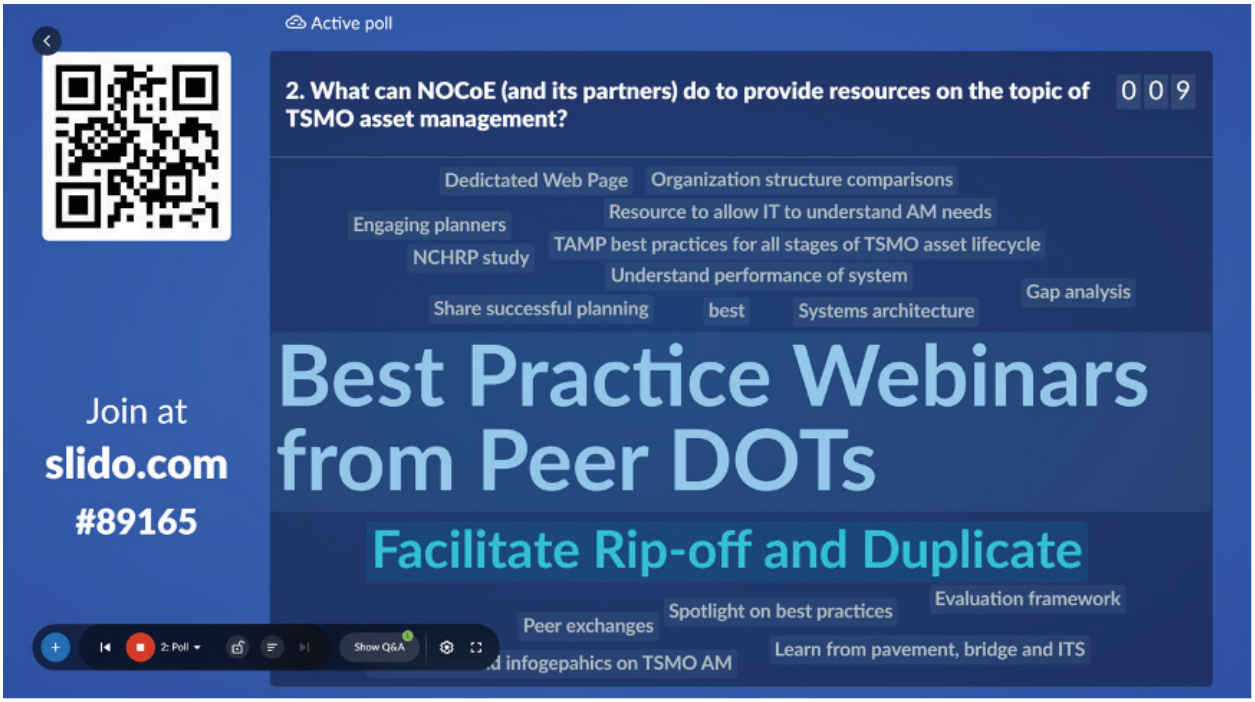


FIGURE 11 Examples of ways to carry TSMO asset management forward in the profession.

To close the peer exchange, participants identified topics to move the topic of TSMO asset management forward more broadly. Participants noted that more resource sharing, national guidance, webinars on agency practices, as well as organizations like FHWA, NOCoE, AASHTO, and TRB submitting TAM research problems would help advance TSMO asset management.

Supporting Documents & Resources

1. Peer Exchange Agenda & Attendee List
2. Download Day 1 Slides
3. Download Day 2 Slides
4. Presentations (by Agency)
    a. 2020 09 11 TSMO Peer Exchange_Brian Kary
    b. FHWA Asset Management NOCoE_Joe Gregory
    c. NOCoE NCTCOG AssetMgmt_Natalie Bettger
    d. TAM Community and Resources_Matthew Haubrich
    e. TMS Asset Mgmt_Brian Simi
    f. UDOT_ITS Assets_Jamie Mackey
    g. GDOT Asset Management NOCOE_John Hibbard
    h. Iowa DOT_Donna Matulac
    i. MDOT TAMS Presentation_Justin Droste
    j. NOCoE Peer Exchange 2020_Trisha Stefanski
    k. NOCoE_AssetMgmt and TSMO_Joey Sagal
5. Sample GDOT RFP For Statewide ITS Maintenance
6. MODAT Tool for Multi-Objective Decision Analysis
7. TAM ETG Paper on Cross-asset
8. NCHRP Report 921 on Cross-asset Allocation
9. AASHTO TAM Portal
10. TAMPs on FHWA Website
11. Handbook for Including Ancillary Assets Transportation Asset Management Programs
12. Proceeding report for 2019 Operations and Maintenance NOCoE Peer Exchange