MnDOT'S ASSET MANAGEMENT STRATEGIC IMPLEMENTATION PLAN

July 2021

DEPARTMENT OF TRANSPORTATION

Contents

MnDOT's Asset Management Strategic Implementation Plan (AMSIP)

Overview

The Minnesota DOT (MnDOT) is recognized nationally as a leader in asset management. Its reputation is based, in part, on the agency's commitment to asset management principles as evidenced by the alignment of the agency's long-term planning processes with its Transportation Asset Management Plan (TAMP), the inclusion of assets in the TAMP that exceed federally-established minimum requirements, its enterprise approach to managing risks, and its continued investment in business processes and analysis tools to support its asset management efforts. In 2019, MnDOT furthered its commitment to asset management by initiating the development of an Asset Management Strategic Implementation Plan (AMSIP) to guide the direction for improving the management of highway assets over the next 5 years.

The development of the AMSIP began in 2019 with a workshop to assess current asset management practices and factors that have hindered the implementation of asset management practices at the District level. The results from these activities were summarized and considered at a virtual workshop with Project Management Team (PMT) and Asset Management Steering Committee (AMSC) members on April 23, 2020. The workshop participants provided feedback on a vision for asset management at MnDOT and established expectations for integrating asset management with other MnDOT planning processes, using asset management to manage ancillary assets, and overcoming challenges that hinder the implementation of asset life-cycle strategies. Four virtual web meetings were also conducted with District Maintenance and Operations staff to address key issues related to asset inventories, asset prioritization and performance, and pavement preservation.

Following those activities, five work groups were identified to address specific issues raised during the workshops:

- Work Group 1: Asset Matrix Development

- Work Group 2: Geotechnical Assets

- Work Group 3: Pavement Preservation

- Work Group 4: Communication

- Work Group 5: TAMP Implementation

Work group leaders and participants representing a broad cross-section of the agency were selected and charged with identifying recommendations for addressing challenges that hindered the consistent use of asset management strategies in the agency.

In addition to the focus areas addressed by the five work groups, there were several broader organizational issues identified to achieve the vision for asset management. These include strategic approaches to aligning organizational resources to support asset management and the corresponding roles and responsibilities that need to be defined. These organizational issues were addressed

separately, and specific recommendations were identified to further institutionalize asset management at MnDOT.

The vision and the recommendations provided to address each specific issue serve as the basis for the following five action plans that will guide enhancements in asset management over the next 5 years:

- Data Action Plan (which combines the recommendations from Work Groups 1 and 2).

- Life Cycle Strategy Action Plan (which presents the recommendations from Work Group 3).

- Communication Action Plan (which presents the recommendations from Work Group 4).

- TAMP Implementation Action Plan (which presents the recommendations from Work Group 5).

- Organizational Action Plan (which presents the recommendations to address organizational issues).

MnDOT's Asset Management Vision and Objectives

MnDOT's Asset Management Vision

> *To effectively manage transportation assets by mitigating risk, optimizing return on investment, and using the best available information and tools. (April 2020)*

Vision Development

The vision for asset management emerged based on information provided by participants in a virtual workshop that took place in April 2020. Participants were asked to identify key considerations that should be incorporated into the vision for asset management. The largest number of responses suggested that:

VISION

STRATEGIC OBJECTIVES

ACTION PLANS

- The eventual goal should consider all maintenance, operational, and capital needs in asset management. (15 responses).
- Roles and responsibilities for asset management should be more clearly defined to eliminate gap areas. (8 responses).
- Asset management should help MnDOT place more of a focus on preventive maintenance and preservation than rehabilitation and replacement. (6 responses).
- The strategies should address the divide between doing asset management, providing funding to implement asset management, and evaluating the return on investment for the effort expended. (6 responses).

Break-out groups were held in which participants were asked to further explore characteristics that should be reflected in the vision. These activities resulted in several additional features as identified below.

- The vision should have an outward focus towards managing assets effectively.
- It should still be applicable beyond the 5-year period that will be covered in the AMSIP.
- It should encourage behaviors that:

◆ Are more transparent using data-driven decisions.

◆ Are strategic, proactive, and holistic in reducing life-cycle costs for MnDOT's most critical assets.

◆ Realize a long-term value from transportation assets.

◆ Integrate operational and capital decisions.

◆ Consider trade-offs between asset classes and programs (e.g., safety, mobility), recognizing that what is best for an individual asset may not be best for the system.

◆ Ensure the data, tools, and measures needed to support asset management are available.

◆ Establish reasonable expectations for performance based on expected resources.

To enable MnDOT to implement the vision, participants also described the steps that will need to be addressed, including:

- Having a clear set of expected accomplishments and performance measures to take asset management to the next level within a 5-year period.

- Strategically guiding the use of available resources to meet asset management business needs.

- Establishing clear processes that can be used to manage assets effectively.

- Building communication channels to ensure a widespread understanding of asset management.

- Describing roles and responsibilities for asset management implementation.

- Building individual and agency capacity in asset management.

Strategic Objectives

To achieve the vision, three strategic objectives were developed. These objectives served as the foundation for establishing the five work groups introduced earlier, each charged with identifying actions that would enable MnDOT to achieve the vision within the next 5 years. As presented, the strategic objectives address the four fundamental elements of a successful asset management implementation: people, processes, systems, and data.

PEOPLE   PROCESSES   SYSTEMS   DATA
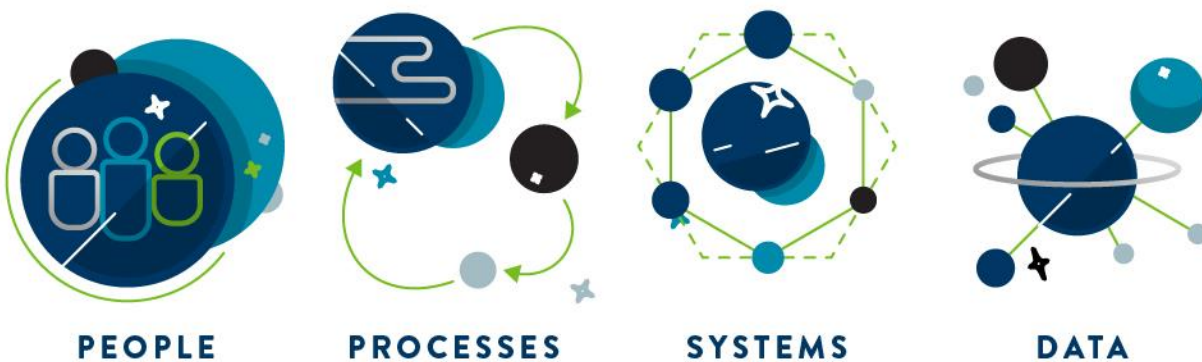
STRATEGIC OBJECTIVE 1

Use data effectively to strategically manage investments and assets, within available resources, in a proactive and holistic way to reduce life-cycle costs and maintain the value of our most critical assets.

This involves:

- Balancing the resources required to obtain and manage asset data with the associated risks and return on investment.
- Providing tools that supply the information needed in a useful format to make well-informed decisions.

To achieve this objective, the following actions were identified, some of which were addressed by the work groups:

- Develop a prioritized list of data needs for the assets MnDOT manages (completed).
- Recommend data collection procedures roles and responsibilities for obtaining the information, keeping in mind available resources, risks, and return on investment (completed).
- Address legislated requirements for managing geotechnical assets (completed).
- Develop strategies to ensure an adequate level of proactive preventive treatments are being used to lower life-cycle costs where appropriate (completed but requires on-going efforts).
- Develop data collection best practices that create economies of scale, use innovative technology solutions, consider available resources, and ensure data reliability (completed but requires on-going efforts).

STRATEGIC OBJECTIVE 2

Improve the ability to evaluate trade-offs between investment options in a consistent and transparent way that maximizes system performance.

This involves:

- Integrating operational and capital considerations to improve efficiency.
- Evaluating trade-offs between asset classes and programs, recognizing that what is best for an individual asset may not be best for the system.

To achieve this objective, the following actions were identified, some of which were addressed by the work groups:

- Identify processes for integrating operational and capital decisions that use available data and analysis tools to the greatest extent possible (completed but requires on-going efforts).
- Address factors that prevent planned investments from being implemented at the District level, including competing priorities, lack of familiarity with the TAMP, and fragmented responsibilities for asset management (completed but requires on-going efforts).

- Develop strategies for the holistic and transparent management of transportation assets and performance measures for monitoring progress towards the most strategic use of available resources (completed but requires on-going efforts).

STRATEGIC OBJECTIVE 3

Integrate asset management into MnDOT's culture through effective communication and a workforce with the skills needed to successfully fulfill their asset management duties and responsibilities.

This involves:

- Advancing the understanding of asset management at MnDOT.
- Defining asset management roles and responsibilities.
- Building individual and agency capabilities.
- Establishing succession plans for key positions.

To achieve this objective, the following actions were identified, some of which were addressed by the work groups and others which were addressed separately as organizational issues:

- Develop a communication plan with prioritized recommendations for informing internal and external stakeholders about asset management's role at MnDOT (completed for internal stakeholders but additional efforts will be required if MnDOT elects to address the needs of external stakeholders).
- Define asset management roles, responsibilities, and needed competencies for internal stakeholders (completed in the areas covered by the work groups, but additional efforts will be needed to define competencies and build an understanding of stakeholder roles and responsibilities).
- Develop strategies for building and sustaining needed competencies (identified in the AMSIP as a future action).

Taking Steps to Achieve the Vision

Armed with a clear vision and three strategic objectives, five work groups were identified to address gaps between current and desired objectives. Each work group was charged with developing a plan to address the gaps and meet objectives. The work groups met on a weekly or bi-weekly basis over a 3-month period, resulting in the planned actions reflected in this document. Descriptions of the expectations for work group are provided along with the names of the work group members.

Work Group 1

> *Asset Matrix Development*

Charge

Establish a prioritized approach for managing assets that considers the different ways that assets are maintained, their importance to the agency, and the risks associated with their failure. Where appropriate, evaluate options by analyzing the Return on Investment. Specify roles and responsibilities for owning and updating the asset inventory over time so the information can be incorporated into the Enterprise Asset Management Systems, which includes the following types of systems: Pavement and Bridge Management Systems, a Building Management System (known as ARCHIBUS), and the Transportation Asset Management System (TAMS).
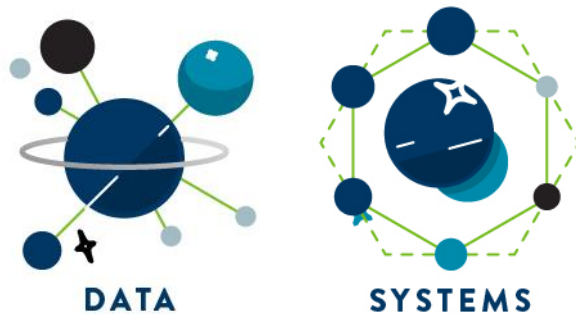
Membership

Chair: Trisha Stefanski

Members: Jay Heitpas, Mike Ginnaty, Pat Huston, Mark Schoenfelder, Mike Barnes, Bill Pirkl, Susann Karnowski, Paul Czech, Brad Utecht, Perry Collins, Todd Stevens, Mitch Webster, Michael Cremin, Dave Solsrud

Lead Facilitators: Brad Allen and Katie Zimmerman (APTech)

Expected Outcomes

A summary in matrix form that outlines asset classes by tier along with information related to the way each asset class is managed, the data required to manage the assets, responsibilities for collecting and maintain the data, and a schedule for acquiring the necessary data.

Work Group 2

Geotechnical Assets

Charge

Evaluate options for MnDOT's initial response to meet the legislative mandate to manage geotechnical assets. Consider resource requirements for each option in developing recommendations. Incorporate the recommended strategy into the asset matrix being developed by Work Group 1.

Membership

Chair: Brad Skow

Members: Shiloh Wahl, Steve Kirsch, Mary Safgren, Dustin Thomas, Doug Maki, Micah Holzbauer, Paul Rowekamp, Charlie Kremer, Amy Thorson, Michael Cremin, Dave Solsrud.

Facilitators: Bill Robert (Spy Pond Partners) and Brad Allen (APTech)

Expected Outcomes

A summary of the information needed to effectively manage geotechnical assets incorporated into the asset matrix developed by Work Group 1. Include the data required, responsibility for collecting and maintaining the data, and a schedule for obtaining the recommended information.

Work Group 3

Pavement Preservation

Charge

Establish a plan for increasing the reliable use of proactive preventive maintenance treatments to preserve asset conditions and reduce the life-cycle cost of managing assets. Include a timeline for the implementation of suggested activities and roles and responsibilities for ensuring proactive treatments are reliably determined, programmed, implemented, and tracked.

Membership

Chair: Glenn Engstrom

Members: Mark Gieseke, Greg Ous, Greg Paulson, Ronda Allis, Josh Pearson, Patrick Weidemann, Jamie Hukriede, Mike Leegaard, Curt Turgeon, Tom Meath, Dave VanDuesen, Tom Zimmerman, Dave Solsrud

Facilitators: Brad Allen (APTech) and Bill Robert (Spy Pond Partners)

Expected Outcomes

Recommendations for planned and on-going changes to promote the use of proactive preservation and preventive maintenance treatments. Include roles and responsibilities as well as a timeline for implementation.

Work Group 4

Communication

Charge

Suggest ways to build support for MnDOT's asset management program through outreach activities that build stakeholder knowledge and support for asset management, develop internal competency in asset management practices, and promote the understanding and use of asset management principles.

Membership

Chair: JT Anderson

Members: Jon Huseby, Sheila Kauppi, Jon Mason, Jed Falgren, Jeff Perkins, Domingo Aguilar, John Bieniek, Steve Lund, Mike Dougherty, Christina Joyce, Dave Solsrud

Facilitators: Katie Zimmerman (APTech) and Hyun-A Park (Spy Pond Partners)

Expected Outcomes

A comprehensive Communications Plan that identifies key stakeholders, messaging strategies, and frequency, and resources that can be used to increase familiarity with asset management throughout the agency. Include roles and responsibilities for the implementation of the Communication Plan.
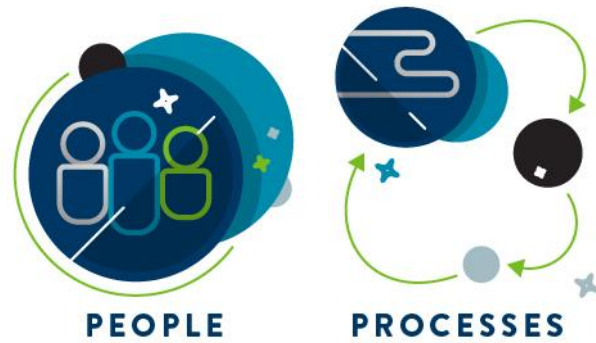
Work Group 5

TAMP Implementation

Charge

Provide recommendations to the TAMP PMT for changes to the TAMP that:

1. Improve the consideration of life-cycle management techniques in MnDOT's plans and programs.

2. Enhance its usefulness to a wider audience at MnDOT.

3. Strengthen the interrelationships and dependencies with MnSHIP.

PEOPLE   **PROCESSES**

Membership

Chair: Shannon Foss

Members: Jean Wallace, Duane Hill, Todd Campbell, Lynn Clarkowski, Lindsey Bruer, Shaker Rabban, Josh Pearson, Philip Schaffner, Mark Panek, Sheila Johnson, Sara Sondag, Trisha Stefanski, Dave Solsrud, Pete Eakman (FHWA)

Facilitators: Katie Zimmerman and Brad Allen (APTech)

Expected Outcomes

Recommendations for any changes to the 2022 TAMP related to format and/or the assets included that enhance its usefulness to the agency. Include suggestions for strengthening the consideration of asset maintenance and operational expenditures in MnSHIP to take advantage of the information becoming available in the TAMS software.

Work Group Activities and Approaches

The five work groups met regularly during the period from August through November 2020 to address their assignments. This section describes the approach each work group took and presents a high-level summary of the achievements they made. More detail on the recommendations provided by each work group is provided in the Appendices.
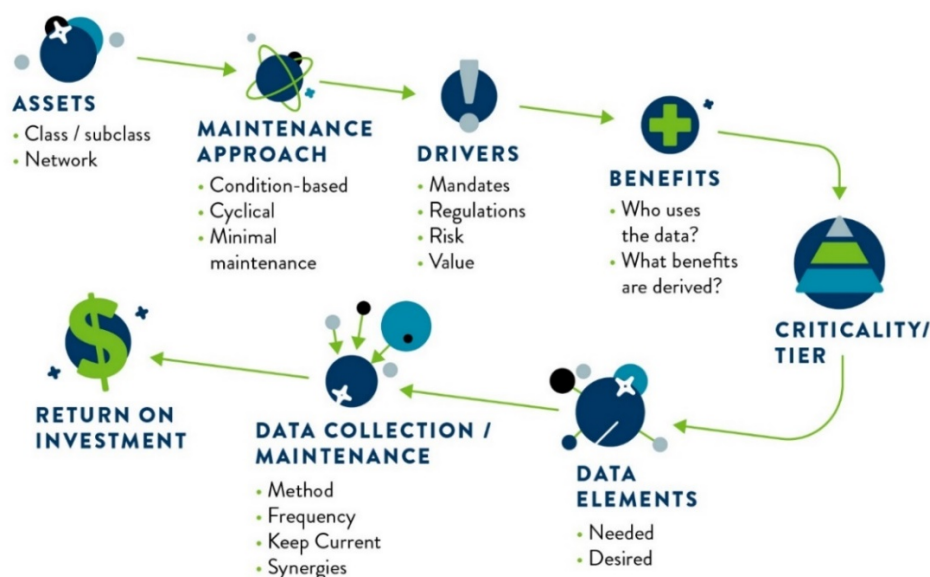
Work Group 1

Asset Matrix Development

This work group defined, analyzed, and categorized the data needs for 72 infrastructure assets to determine gaps between desired and current practices. Using a process built on national best practices, and considering MnDOT's resources and unique circumstances, the work resulted in six maintenance approaches, four levels of asset tiers, and a concise list of data gaps with strategic solutions and costs. A copy of the matrix can be found using this link (**Asset Matrix**).

In developing its recommendations, the work group considered the eight criteria shown in the figure in a linear progression. The assets considered by the work group were primarily physical assets, such as pavements and sign panels, but non-physical assets (such as plow routes and unstable slopes) were also considered. The primary factors used to identify asset classes were:

- Whether it was located on the highway system and

- Whether there is a need to assign work directly to the item, rather than to the highway segment along which the item is located.

For each asset class included in the matrix this work group developed, the desired and actual maintenance approaches were identified. As explained in the following table, approaches considered whether condition data is needed to drive maintenance decisions, whether maintenance is provided on a cyclical basis, or whether work is applied when an unacceptable defect is applied.

Maintenance Approaches

Approach	Definition
Condition-Driven PLUS (Optimal)	The condition of the asset is routinely monitored and modeled. Actions are taken proactively and reactively to **optimize the asset lifecycle** through minimum lifecycle cost, maximum benefit, maximum life-cycle length, or some similar approach
Condition-Driven	The condition of the asset is routinely monitored, and **actions are taken to manage the long-term performance** of the asset or the assets impact on system performance.
Cyclical-Driven PLUS	The asset is inspected and **maintained on a cyclical** basis, where the inspection and maintenance activities are performed in **simultaneously** or in concert and condition data is collected and maintained for analysis that could lead to additional condition-based decisions. **Condition data required**.
Cycle-Driven	The asset is **maintained on a cyclical** basis. Condition data may be collected on these assets to meet other business needs, but the inspection cycle is **managed separately** from the maintenance cycle. **Condition data not required.**
Reactive	An **inventory is maintained**, but there is **no regular condition data** collection, and **no maintenance performed to slow or address damage** or deterioration until an asset is reported as having an unacceptable defect. Annual work is planned at the aggregate level, without concern for the specific locations of potential future defects.
Minimal Maintenance	**No inventory or condition data** is collected or maintained. Maintenance is performed when assets are identified as having an unacceptable defect.

Differences in the types of data needed to support each maintenance approach are summarized in the following table. As the table indicates, the data requirements increase as the sophistication of the maintenance approach increases, with the Condition-Driven Plus approach requiring the most data.

| Question	Maintenance Approach					
	Minimal Maintenance	Reactive	Cycle-Driven	Cycle-Driven PLUS	Condition-Driven	Condition-Driven PLUS
Does it require an asset inventory?		X	X	X	X	X
Does it require an asset maintenance cycle?			X	X	X	X
Does it require asset condition data?				X	X	X
Does it require long-term performance management?					X	X
Are there strategies to optimize its life cycle?						X

Following the identification of the maintenance approach for each asset, data usage drivers were considered to help determine asset tiers. These drivers included internal or external factors that impact the need to collect and manage data for an asset class, such as regulations and mandates, customer needs, asset value, cost recovery/restitution, and budget allocations. Benefits were also qualitatively assessed to recognize the role the asset played in compliance issues, safety, risk reduction, or new technology. The assessment of benefits also considered the actual number of data consumers for each asset class using information from Work Group 4, Communications.

This information was then used to assign a criticality tier to represent the importance of each asset class to MnDOT's mission and the level of resources needed to manage it. Four tiers were established as described below with tier 1 representing the highest level and tier 4 representing the lowest level. Descriptions for each tier are presented below.

TIER 1

Tier 1 assets represent a combination of the highest monetary valued assets along with assets that are critical to public safety, mobility, and the economy. Failure of a single asset could lead to an immediate safety risk or impact the transportation network for an entire region. Poor performance by a group of similar assets could result in regional or even statewide impacts. As a result, these assets receive the greatest level of scrutiny and resources dedicated to inventory and condition data collection, investment decision making, maintenance, and capital investments to **provide the highest practical level of service and reliability.**

Tier 1 Asset Group	Asset Class	Statewide Key Contact
Bridges	Vehicle Bridges >10' and Tunnels	David Hedeen
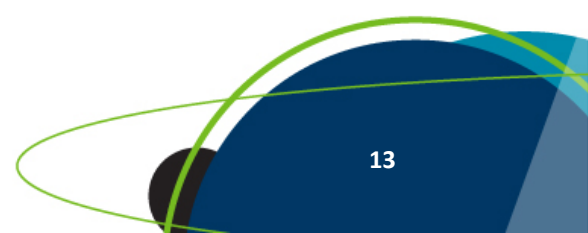
Tier 1 Asset Group	Asset Class	Statewide Key Contact
Pavements	Highway Mainline	Glenn Engstrom
Maintenance	Snow and Ice Winter Plow Route	Dan Flatgard
Facilities	Class 1 Rest Areas, Class 1 Truck Stations, Office Buildings, Salt Sheds (S&I Operations)	Tiffany Dagon
Structures	ARMER System - radio towers, equipment shelters, radio transmission equipment, facilities	Tim Lee
Traffic	Freeway Management Systems (TMS, RTMC operations, ITS)	Brian Kary
	Signal Systems	Ray Starr

TIER 2

Tier 2 assets are typically not as high value as tier 1 assets, but still represent a significant consequence to public safety upon failure for a corridor or municipality. As a result, MnDOT dedicates resources to pro-actively monitoring and subsequent interventions to prevent unacceptable performance. The agency collects and uses inventory and condition data on these assets to identify, prioritize, and deliver maintenance and repair actions to cost-effectively **manage the assets throughout their service lives**.

Tier 2 Asset Group	Asset Class	Statewide Key Contact
Bike and Ped	Accessible On-street ADA Parking	Kristie Billiar
	Pedestrian curb ramps, signals, and sidewalks	Kristie Billiar
	Bike Lane (not separated) and shared roadways	Michael Petesch
Bridges	Bridge Pedestrian/Bicycle/Utility	David Hedeen
Geotechnical	Earth Retaining Systems (gravity, soil nail, soldier pile, sheet pile, reinforced concrete cantilever, MSE, crib, bin, timber, other types on the TAMS list)	Brad Skow
	Reinforced Soil Slopes	Brad Skow
	Improved Ground Supports (column-support embankments and transfer platforms)	Brad Skow
Hydraulic Infra	Highway Culverts	Andrea Hendrickson

Tier 2 Asset Group	Asset Class	Statewide Key Contact
Maintenance	Stationary Anti-Icing Systems	Joe Huneke
Pavements	High ADT Frontage Roadway	Glenn Engstrom
	Bus Shoulders	Jason Junge
	Highway Ramps/loops	Glenn Engstrom
Traffic	Lighting - High Mast Towers	Scott Theisen

TIER 3

Tier 3 assets support safety and system performance at their specific locations. Individual failures of these assets can have significant local impacts but are of limited consequence to overall network performance. These assets typically benefit from routine or cyclic replacement, of components or whole assets to ensure proper performance. Inventory data is collected to support the efficient scheduling and delivery of appropriate cyclical work. Additionally, condition data may be collected for some assets to comply with mandates (e.g., municipal separate storm sewer systems), **optimize the maintenance and replacement cycles** (e.g. sign panels), or both.

Tier 3 Asset Group	Asset Class	Statewide Key Contact
Bike and Ped	Shared use paths, side paths, separate bike lanes	Michael Petesch
Facilities	Class 2 and 3 rest areas, Class 2 and 3 Truck Stations, Brine Buildings (S&I Operations), Weigh Stations	Tiffany Dagon
Geotechnical	Instrumentation Systems (inclinometer, pressure cell, gauge, cabinet, and piezometer)	Brad Skow
	Special Drainage Systems (chimney drain, perforated drain, herringbone drain, geomembrane cap and liner, and trench drain – does not include edge drains)	Brad Skow
Green Assets	Hazard – Noxious Weeds	Tina Markeson
Hydraulic Infrastructure	Deep Stormwater Tunnels	Beth Neuendorf
	Ponds, Infiltration Basins, and Underground Storage	Andrea Hendrickson
	Storm Sewer Pipe and Structures	Andrea Hendrickson

Tier 3 Asset Group	Asset Class	Statewide Key Contact
	Structural Pollution Control Devices (SPCDs)	Andrea Hendrickson
	Local Road Culverts	Andrea Hendrickson
Maintenance	Roadway Weather Information Systems (RWIS)	Joe Huneke
Pavements	Paved Shoulders	Glenn Engstrom
	Low-Volume Frontage Roads	To be determined
Structures	Wood Noisewalls	Peter Wasko
	Entrance Monuments	Office of Environmental Stewardship (OES)
Traffic	Sign Panels - Static	Josie Tayse
	Sign Structures – Static Panel Ground Mounted	Josie Tayse
	Sign Structures – Static Panel Overheads w/Foundations	Josie Tayse
	Sign Structures – I-Beam w/Static Panel	Josie Tayse
	Lighting - Roadway	Sue Zarling
	Barrier – Attenuators (Crash Cushions)	Mike Elle
	Barrier – Plate Beam End Treatments	Mike Elle
	High-Tension Cable Barrier	Mike Elle
	Barrier – Plate Beam	Mike Elle
	Pavement Markings - Message	Ken Johnson
	Pavement Markings - Striping	Brad Lechtenberg

TIER 4

Tier 4 assets represent limited risk to the transportation network. Failure of these assets generally impacts only the location served by that asset. To mitigate these risks, MnDOT has **guidelines regarding maintenance response times to repair** or replace assets within a certain period after being notified of the unacceptable condition to minimize the impact on safety and system performance. MnDOT collects and routinely updates inventory on these assets but doesn't collect condition data, to ensure the agency

has an accurate accounting of the current infrastructure and its needs. Work performed to maintain, improve, or replace these assets is tracked, specific to each individual asset or installation.

Tier 4 Asset Group	Asset Class	Statewide Key Contact
Facilities	Storage sheds, and misc. buildings (lift stations, hazmat, etc.)	Tiffany Dagon
Geotechnical	Natural Hazard Locations (locations off the ROW not otherwise addressed)	Brad Skow
	Improved Subgrade Fills (lightweight fill such as: wood chip, tire-derived aggregate, geofoam, lightweight aggregate, cellular concrete, and grouted fill)	Brad Skow
Green Assets	Replacement Wetlands	Sarma Straumanis
	Trees (Types: Historic, Notable, High-Risk, Land Bearing)	Tina Markeson
	Native/Pollinator Plantings	Tina Markeson
Maintenance	Snow Fence (Types: Living, Structural, Grading)	Dan Gullickson
Right of Way	Land, Boundary, Excess or Surplus Right of Way	Ricki Holzer
Structures	Concrete Noise Walls	Peter Wasko
Traffic Traffic	Concrete Barrier	Mike Elle
	Rumble Strips and Stripes	Ken Johnson

GAP ASSESSMENT

After categorizing the asset classes, the data elements and data collection methodologies were assessed. Where there were gaps between the desired and the current approach to maintenance, the work group identified data, system, and resource gaps that would need to be addressed. Data elements were defined as being either *essential* to making investment decisions or *desirable* to enhance decision making although not considered essential to business operations. Strategies for collecting the information considered six different approaches: visual inspection, physical field device inspection, MnDOT pavement van camera or sensor collection, satellite or aerial imagery, drone inspection, or mobile LiDAR. For culverts, an analysis was conducted to assess the Return on Investment (ROI) of adding side and entrance culverts to the existing inventory. The work group used the framework and tool from NCHRP Report 866, *Return on Investment in Transportation Asset Management,* to perform the calculations using data from District 2.

These efforts resulted in the development of a comprehensive asset matrix and recommended data collection strategy outlined in the section titled *Asset Data Action Plan*.

Work Group 2

Geotechnical Assets

The recommendations from Work Group 2 focused on geotechnical assets. This group focused on MnDOT's needs to improve the data available on geotechnical assets to comply with a legislative requirement to develop an inventory as well as MnDOT's desire to support asset management best practices. The recommendations from this Work Group were incorporated into the asset matrix recommendations developed by Work Group 1. Major data issues that the group recognized include:

- Districts are using various ad-hoc approaches for tracking geotechnical assets. For instance, Earth Retaining Systems (ERS) inventories have been established in some Districts, including the Metro District, but one has not been established on a statewide basis.

- MnDOT established a specification to begin collecting inventories of these assets as part of the preparation of as-built plans. When this group met, limited data had been collected based on the new specification and the data was limited to locations where projects were being performed.

- MnDOT is funding on-going research to identify the locations of certain types of geohazards.

- MnDOT has not defined specific inspection and maintenance practices for statewide use to manage geotechnical assets managed on a condition or cyclical basis.

The group considered the following list of geotechnical assets using the taxonomy suggested in NCHRP Report 903, *Geotechnical Asset Management for Transportation Agencies* (2019):

- ERS, including gravity, soil nail, soldier pile, sheet pile, reinforced concrete cantilever, mechanically stabilized earth (MSE), crib, bin, timber, and others.

- Slopes.

- Improved subgrade, including lightweight fill such as wood chip, tire-derived aggregate, geofoam, lightweight aggregate, cellular concrete, and grouted fill.

- Ground improvement or modification, including column-support embankments and transfer platforms.

- Unimproved subgrade.

- Special drainage features, such as chimney drains, perforated drains, herringbone drains, geomembrane cap and liner, and trench drains. This category does not include edge drains.

- Instrumentation, including inclinometers, pressure cells, gauges, cabinets, and piezometers.

- Natural hazard locations, including locations off the right-of-way not otherwise addressed.

To ensure their results could be incorporated into the asset matrix, the group defined the preferred management approach for each asset using the maintenance approaches define by Work Group 1. Depending on the maintenance approach, recommendations were developed regarding the establishment of an inventory and any inspection requirements or maintenance cycles.

As the AMSIP was being finalized, HF10 was passed by the House, approved by the Senate, and sent to the Governor for signature. The legislation became effective on July 1, 2021, and the initial performance implementation report related to asset management is due December 15, 2022. HF10 includes provisions that expand beyond the 2020 legislation that established the need for a complete inventory of bridge, pavement, geotechnical, pedestrian, bicycle, and transit assets. Since the Geotechnical Work

Group used the 2020 legislation as the basis for its recommendations, an additional recommendation was added to the *Asset Data Action Plan* to reconvene the Geotechnical Work Group to address any new actions that may be needed to meet the 2021 legislative requirements for geotechnical assets.

The complete set of recommendations from this group are incorporated into the *Asset Data Action Plan* section.

Work Group 3

Pavement Preservation

Work Group 3 focused on addressing the issues that prevented the use of a consistent, statewide approach for preventive maintenance treatments to lower the long-term life cycle cost of maintaining the highway network. The group began by identifying the most significant barriers that needed to be addressed, including the following.

- Performance expectations that are short-term focused do not encourage investing in the long-term benefits provided by preventive maintenance. Maintenance work planning suffers from the same focus on short-term needs so reactive maintenance is routinely prioritized over preventive maintenance.
- Performance measures are focused on ride quality, which is a customer-satisfaction measure, but is not indicative of pavement service life extensions provided by preventive maintenance.
- Preventive maintenance programs are most effective when they are delivered through consistent annual investment, but Districts are pressed to direct capital funding to more immediate or higher-profile needs.
- There are conflicts between current project development policies or procedures and best practice for implementing preventive maintenance. For instance, current pavement project development procedures are focused on addressing all the needs within the project limits, including American Disability Act (ADA) requirements or drainage needs. This increases the size and scope of projects and diverts the focus from extending service life through the application of preventive maintenance. This is not true on bridges, where other bridge needs can be deferred while preventive maintenance is applied to one or more elements. In addition, some policies conflict with the ability to apply preventive maintenance treatments. For example, a chip seal must be applied from edge-line to edge-line to avoid lane drop-off, but this requires the project to include rumble strips and lane striping.

To address these barriers, Work Group 3 developed recommendations to ensure that agency decision makers understand the benefits of preventive maintenance and are following processes that maximize long-term performance, extend service life, and minimize life-cycle costs. The group members recognized that the solutions do not eliminate all the barriers listed earlier, but they help provide accountability in terms of expectations, available resources, and actual accomplishments. In addition, the recommendations will:

- Better align planned and actual investments with life-cycle planning and the TAMP.
- Promote the costs and benefits of preventive maintenance investments with respect to other options.

- Establish a system of accountability for the level of planned and accomplished preventive maintenance work.

The solutions recommended by the group are presented in the section titled *Life Cycle Strategy Action Plan*. The group envisions that the solutions can be implemented within current management frameworks and budgets. They expect the results to ensure that Districts achieve expectations while maintaining their ability to consider local conditions and constraints when managing their networks.

Work Group 4

Communication

This Work Group was charged with developing a Communication Plan that would improve the understanding of asset management throughout the Department and build support for asset management activities by sharing information on the importance of data to support decisions and the resulting benefits that are being realized. The resulting Plan, presented in the section titled *Communication Action Plan*, is expected to evolve over time as initial steps are completed and the level of knowledge builds.

AUDIENCES

The Plan is structured around the six audiences shown in the following graphic, each of which has unique needs in terms of the level of information required and the best way to receive the information. The work group considered the needs of external stakeholders in their discussions but elected to focus on the needs of internal stakeholders since most external communication is handled by MnDOT's Office of Communications.
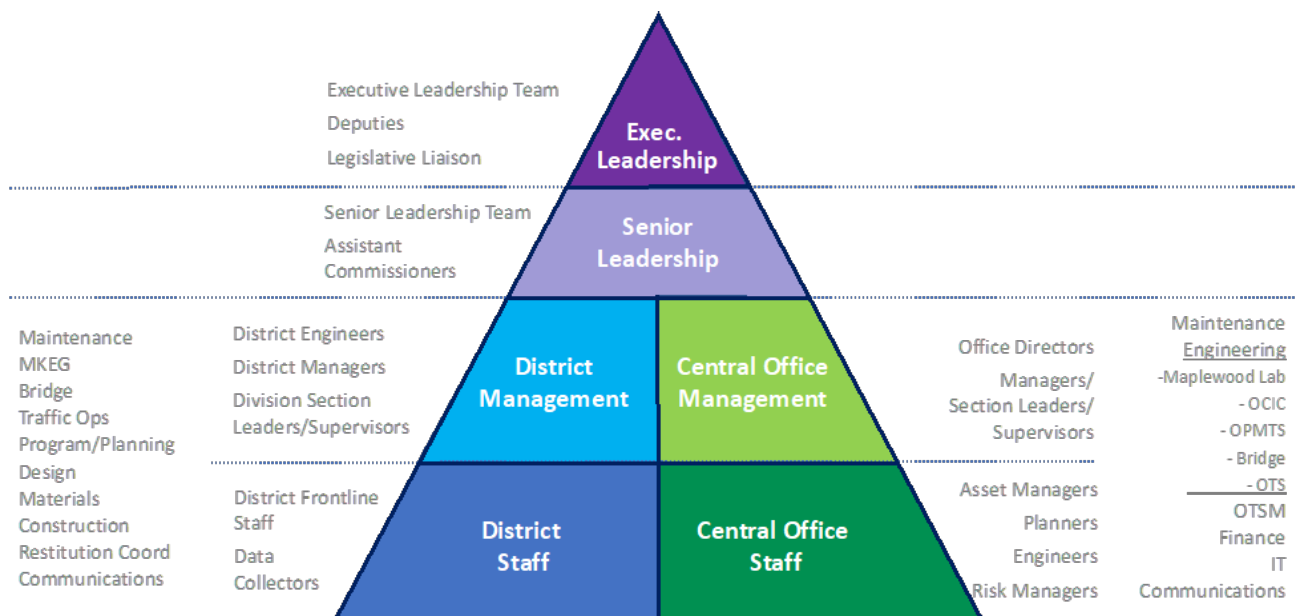
The six audiences include those described below.

- **Executive Leadership,** which includes the Commissioner, Deputy Commissioners, Chief Counsel, Chief of Staff, Chief Financial Officer, and the Directors of Government Affairs, Human Resources, and Communication/Public Engagement.
  Information Needs: This audience needs sufficient information on the asset management program to understand the long-term impacts of investment decisions and to address questions from stakeholders. At this level, asset management information is used to set MnDOT's strategic performance objectives. Messaging to this group is primarily provided through presentations at group meetings and the access to Frequently Asked Questions (FAQs). The information should be provided prior to high-level direction-setting meetings or at key milestones related to decision-making processes.

  Senior Leadership, including Assistant Commissioners, Deputy Division Directors, the Chief Information Officer, Division Business Managers, the State Rail Director, and the Directors of the Offices of Tribal Affairs, Equity/Diversity, and Civil Rights. Messaging to this group is primarily provided through presentations at Senior Leadership Team meetings, through dashboards and other performance measures, and meetings with Central Office or District Management personnel. The information should be provided at monthly Asset Management Steering Committee meetings and prior to other key milestones related to decision-making processes.
  Information Needs: This group needs sufficient information to guide policy and investment decisions at the Senior Level. They want to see that MnDOT is acting as a good steward of the system and is managing wisely over the long-term to reduce life-cycle costs and mitigate risks.

  District Management, which includes District Engineers, District Managers for functional units, Maintenance Superintendents and Supervisors, Division and Section leaders, and Supervisors for Program Development, Scoping, Design, and Construction.

  Information Needs: This group uses asset management principles to guide project selection and prioritization activities. This group is responsible for ensuring that asset management principles are followed at the District level. This includes ensuring that District field staff are aware of the importance of the data they collect and that asset management information is used to guide project selection activities and prioritize work for maintenance crews.. Messages to this group may be delivered through group meetings, targeted emails, a website, training, and a summary of FAQs. The information should be provided on an as-needed basis but having easy access to information documenting efficiencies gained or improved decisions is needed to better motivate District Staff.

- **Central Office Management,** which includes Office Directors for the functional units in the Central Office and the Managers/Section leaders under them.
  Information Needs: This group has primary responsibility for the development of planning and investment documents. They also oversee agency systems that provide supporting information to the Districts. In this way they help ensure that Central Office staff manage asset performance information to support MnDOT's efforts to achieve its strategic objectives. Messaging to this group may come from many different sources, including targeted emails from the Chief Engineer, discussions with Assistant Commissioners, or conversations with other MnDOT personnel. Information to support these decisions will be needed on a regular basis, which may be monthly or quarterly.

- **District Staff,** comprising the District Frontline Staff and the Data Collectors, including Maintenance Frontline, Construction Inspectors, and Engineering/Design personnel.
  Information Needs: This group records the field information that is used to support maintenance and preservation project selection decisions. This group needs to understand the importance of the data they record and how it can be used to improve decisions. The messaging is delivered primarily through group meetings, one-on-one meetings with a supervisor, E-learning, and FAQs. The

information should be delivered monthly, or at every opportunity, until the culture is established and then once or twice a year.

- **Central Office Staff,** which includes Asset Managers, Planners, Engineers, and Risk Managers who are in the Central Office functional groups.
  Information Needs: This group uses asset management principles to guide the development of planning and investment decisions by providing supporting information and expertise. They use asset performance information to support decisions that will allow MnDOT to achieve its strategic objectives. Information may be delivered through group meetings, one-on-one meetings with a supervisor, email, or E-learning. Information should be provided at least quarterly to build the culture and then twice a year.
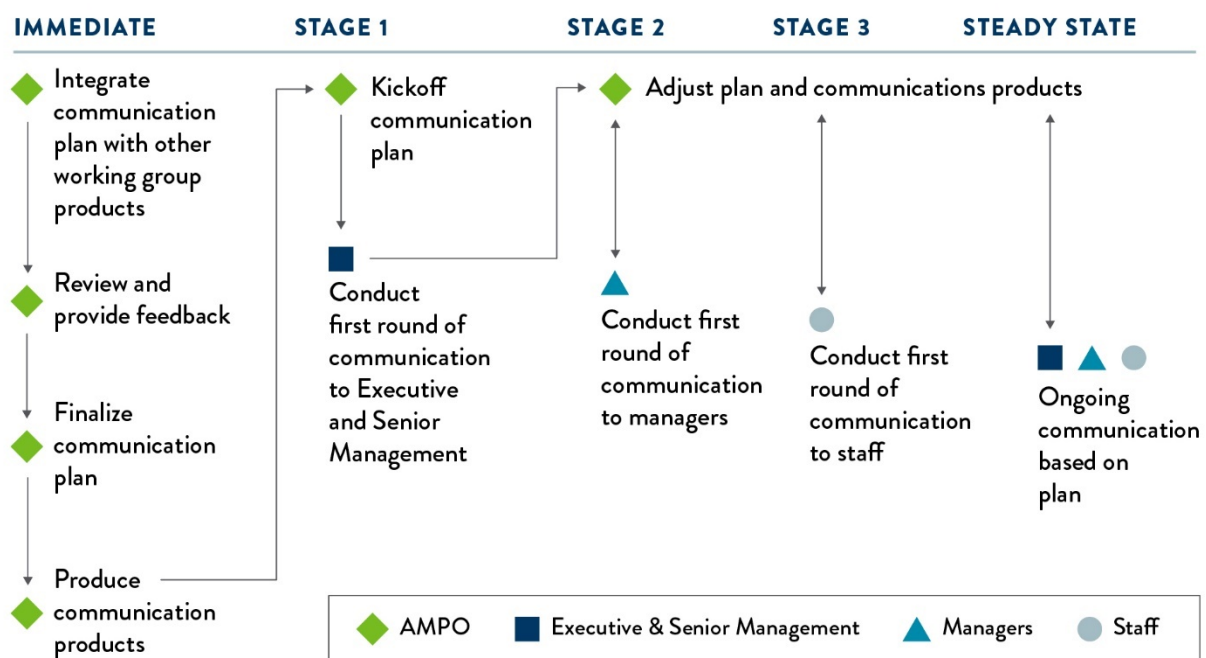
INFORMATION NEEDS

During its meetings, the Work Group identified categories of information that are needed by the various audiences and defined the types of messaging that might be needed. The Communication Action Plan summarizes these recommendations and puts forward a timeline for addressing the needs. The five categories included in the Plan are described here at a fairly high level.

- **General Asset Management Knowledge** – Information in this category contains messaging that builds general knowledge and support for asset management. At a high level, materials show that MnDOT strategically allocates its available resources to achieve its strategic objectives. The products in this category also provide an understanding of the various roles that support asset management so that personnel understand the importance of their work. Content in this category can also be used by agency personnel to answer questions posed by different stakeholder groups. Materials in this category support a wider knowledge of asset management goals and objectives, and its vision for building a stronger asset management culture at MnDOT.

- **Transportation Asset Management System (TAMS) Data** – Content in this category is primarily focused on the importance of quality data and the benefits realized from the use of quality data. It is intended to demonstrate the value MnDOT receives from the work being done by those collecting the data as well as those using the data to support decisions. Materials in this category will also be used to distribute any new TAMS data requirements, provide information on how to use TAMS effectively, and to support an understanding of the TAMS content and functionality.

- **Decision Making** – This category includes information that demonstrates the importance of using TAMS data and asset management principles to guide work planning, to understand trade-offs in budget-setting activities, and to manage performance. It includes information that conveys targeted life-cycle strategies for different asset classes and demonstrates the benefits to using preventive maintenance treatments to lower life-cycle costs and extend service life.

- **TAMP Implementation** – The materials in this category support the on-going implementation of the TAMP at MnDOT. It communicates the concepts of "managing to performance" and presents performance targets in several different areas. An objective at MnDOT is to make the TAMP more accessible to different audiences, so plans are underway to present information from the TAMP in new and more accessible ways, such as presenting information specific to each District. It also conveys the importance of aligning pavement and bridge project selection decisions with the TAMP.

- **Coordination With External Stakeholders** – Information in this category is available for MnDOT's use in communicating asset management information to external stakeholders. It is envisioned that this category could convey upcoming project priorities for the Long-Range Transportation Plan, share examples showing MnDOT is a good steward of available funding, demonstrate that asset management principles guide investments to meet MnSHIP's 20-year goals, and provide map

interfaces with information that could be useful regarding project priorities or scoping considerations.

ROLLOUT

Responsibility for the implementation of the Communication Plan rests with the Asset Management Program Office (AMPO) but the Communication Plan recognizes that all levels of personnel are involved in sharing and promoting asset management information. As shown in the following figure, the implementation of the Communication Plan is staged with a first round of information produced for consideration at the Executive and Senior levels followed by rollouts at the Managerial and Staff levels. This staging allows time to begin building a collection of resources to support the planned on-going messaging as well as opportunities to assess their effectiveness and make modifications. An important part of the Communication Plan also includes the development of an Asset Management Information Portal to facilitate the sharing, storage, and retrieval of the products developed.

INFORMATION NEEDS BY AUDIENCE

The information needs for each of the six different audiences introduced earlier are summarized in the following tables. Each table evaluates information needs in the following five categories introduced earlier and repeated here for convenience.

- **General Asset Management Knowledge** – Information in this category contains messaging that builds general knowledge and support for asset management.

- **TAMS Data** – Content in this category is primarily focused on the importance of quality data and the benefits realized from the use of quality data.

- **Decision** Making – This category includes information that demonstrates the importance of using TAMS data and asset management principles to guide work planning, to understand trade-offs in budget-setting activities, and to manage performance. -cycle costs and extend service life.
- **TAMP Implementation** – The materials in this category support the on-going implementation of the TAMP at MnDOT.
- **Coordination With External Stakeholders** – Information in this category is available for MnDOT's use in communicating asset management information to external stakeholders.

The tables summarize what message is needed, why the messaging is important, how it should be delivered, and how frequently it is needed.

Executive Leadership

The primary source of information for this audience is expected to be provided by the Asset Management Program Office (AMPO). This group needs sufficient information on the asset management program to understand long-term impacts on MnDOT investment decisions and to address questions from stakeholders. At this level, asset management information is used to set MnDOT's strategic performance objectives.

Executive Leadership Information Needs.

	General TAM Knowledge	TAMS Data	Decision Making	TAMP Implementation	Coordination with Stakeholders
What is the message?	• What asset management means at MnDOT and why we do it • How TAMS fits with MnDOT's strategic priorities and performance targets • How investing in TAMS will achieve MnDOT's objectives, help manage risks and lower long-term costs	• Importance of quality data • Benefits to the use of quality data • Value of data and tools • High-level knowledge of TAMS content & functions	• Understanding trade-offs in budget setting activities • Making equitable investments throughout the state	• Program & investments reflect TAMP commitments • Performance expectations to be achieved	• Documentation showing MnDOT is a good steward of assets and financial resources
Why do we need to communicate the message?	• To develop an understanding of each person's role in asset management • To enable audience members to answer questions from stakeholders • To convey MnDOT's asset management goals & objectives	• To provide examples showing good data leads to better, more informed decisions, that reduce risk and costs • To provide examples illustrating that the new data and tools	• To get more value from limited funds, preserve assets, deliver more value to traveling public	• To communicate the direction and importance of asset management to internal and external audiences	• To reassure stakeholders that communication and coordination is being done • To enhance customer trust

|	General TAM Knowledge	TAMS Data	Decision Making	TAMP Implementation	Coordination with Stakeholders
	• To convey the 5-year strategic plan implementation roles & responsibilities • To communicate MnDOT's commitment to TAM to external stakeholders	increase efficiency; improve processes			
How should we deliver the message?	• Group meetings • FAQs with links to answers				
When should we deliver it? (frequency)	• Prior to high-level direction setting	• Prior to high-level direction setting	• At key milestones related to decision-making	• At key milestones related to the TAMP	• As needed

Senior Leadership Team

The Senior Leadership Team (SLT) needs sufficient information to guide policy and investment decisions in the organization. This team oversees investments that demonstrate MnDOT is serving as a good steward of the system and is managing resources wisely over the long term to reduce life cycle costs and mitigate risks. This team receives messages from the Executive Leadership Team and AMPO and conveys the information received to Central Office and District management personnel.

Senior Leadership Team Needs.

	General TAM Knowledge	TAMS Data	Decision Making	TAMP Implementation	Coordination with Stakeholders
What is the message?	• What asset management means to MnDOT and why we do it • Build a general understanding of roles, responsibilities, and how these roles need to evolve across the agency functions • How to identify and fill gaps in knowledge • Why the required level of commitment is needed	• Demonstrate benefits to the use of quality data • What asset info exists, what doesn't, what should in the future • Differences in official financial vs planned investments • Provide a general understanding of software and databases	• There are best (cost based) practices determined by the use of accurate data/modeling etc. • Managing performance drives decisions • Time is of the essence (right time for preventive maintenance) • Preventive maintenance is cost effective (ROI) • What needs to be understood about MnSHIP and STIP tradeoffs	• We have obligations regarding the Federal statute • What the TAMP contains and how it illustrates best practices • The TAMP is not a detailed element level decision record • The TAMP embraces Maintenance and Capital investment strategies • The TAMP articulates a	• Demonstrate that MnDOT is a good steward of assets and financial resources • MnDOT has a data-driven approach • MnDOT carefully invests in and manages data and tools

	General TAM Knowledge	TAMS Data	Decision Making	TAMP Implementation	Coordination with Stakeholders
	• How TAMP reduces risk		• Future costs and commitments should be considered when programming expansion projects • What level of funding is available for maintenance budgets • Why maintenance work planning is important	MnDOT priority – Taking care of what we have •	
Why do we need to communicate the message?	• To explain that some things are required (e.g., TAMP, consistency determination) • To promote priorities established by the Senior Leadership Team	• To ensure commitment • To manage Employee expectations • To make effective use of data management resources (labor) and financial resources (software & data maintenance) • To ensure trust in data • To recoup investments (ROI)	• To demonstrate leadership • To establish transparency and credibility • To make better use of limited resources	• To promote accountability • To avoid FHWA sanctions • To ensure the SLT knows what TAMP is and is not • To make the link between data, tools, and TAMP practices	• To better respond to pressures to make new investments • To enhance credibility with the legislature • To enhance customer trust • To be granted sufficient resources to take care of assets
How should we deliver the message?	• Pre-existing YouTube or other clips • Materials or testimonials from other states • Attendance at National Asset Management Conferences to learn from peers	• Presentations at SLT meetings • Dashboards and metrics • Periodic emails • Training • YouTube video • Attendance at the AgileAssets Exchange	• Presentations at SLT meetings • Presentations during MnSHIP development	• Presentations on the TAMP at SLT meetings	• Use the Legislative Liaison • District Engineer legislative visits
When should we deliver it? (frequency)	• Quarterly at first (1 year)	• Meetings quarterly till topics covered • Mailings quarterly • Monthly AMSC minutes	• At key milestones related to decision-making	• At key milestones related to the TAMP	• Based on forums above • At least annually
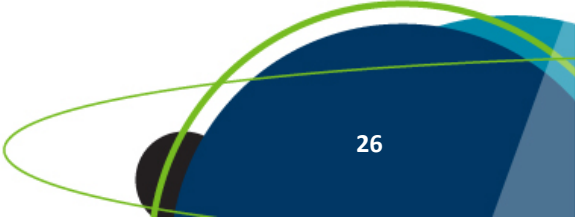
Central Office Management

This group has primary responsibility for the development of planning and investment documents. They also oversee agency systems that provide supporting information to the Districts. In this way they help ensure that central office staff manage asset performance information to support MnDOT's efforts to achieve its strategic objectives.

Central Office Management Needs

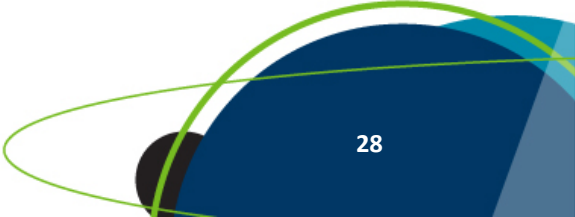|	General TAM Knowledge	TAMS Data	Decision Making	TAMP Implementation	Coordination with Stakeholders
What is the message?	• What asset management means at MnDOT and why we do it • Asset management is aligned with MnDOT's strategic objectives • Good data leads to better decisions • Asset management has already improved efficiency • Asset management makes your job easier/better • Why are you the one to do this particular job (e.g., collect or enter data)? • This is how we use the information you collect • MnSHIP and the TAMP drive infrastructure investments • MnDOT's strategic priorities are…. • MnDOT's performance targets are….	• By using the data we can better time our investments to increase the life of the asset and maximize the dollars spent • Helps manage investments across the system • Field staff and other resources are optimized by focusing on highest priority work	• Field staff and other resources are optimized by focusing on highest priority work • With limited budgets, helps to focus investments on highest priorities • Assists in making better decisions on the timing of asset investments • Better timing of investments leads to longer asset life and maximizing value	• Field staff and other resources are optimized by focusing on highest priority work • With limited budgets, helps to focus investments on highest priorities • Assists in making better decisions on the timing of asset investments • Better timing of investments leads to longer asset life and maximizing value	• MnDOT considers multiple factors and trade-offs prior to committing to investments • MnDOT uses data and performance measures to influence capital investments
Why do we need to communicate the message?	• To build a general understanding of MnDOT's asset management program and its importance among staff • To build an understanding of the importance of each individual's role in supporting asset management • To share MnDOT's asset management messaging to staff as necessary	• To build an understanding of the value of data and related tools • To document the benefits of making decisions using quality data • To illustrate that treatment effectiveness is improved by using data	• To explain how TAMS data and asset management principles help guide work planning • To develop an understanding of trade-offs in budget setting activities • To build skills in managing assets to performance targets	• To ensure that program goals and investments match TAMP commitments • To ensure performance expectations for each asset are achieved	• To demonstrate that MnDOT is a good steward of assets and financial resources • To enhance customer trust • To provide managers and supervisors with enough knowledge to be able to explain/ persuade the benefits to others

	General TAM Knowledge	TAMS Data	Decision Making	TAMP Implementation	Coordination with Stakeholders
How should we deliver the message?	• Targeted email(s) from Chief Engineer • Follow up discussion or communication from respective Assistant Commissioner • Additional messaging as needed throughout office organizational levels • Flyer or Pamphlet • Video • Training • FAQs with links to answers				
When should we deliver it? (frequency)	• In sequence identified above -- • Chief Engineer, followed by Assistant Commissioner, and then appropriate Office level follow up (1 message per month/3 months)				

District Management

This group uses asset management principles to guide project selection activities. This group is responsible for ensuring that asset management principles are followed in maintenance and engineering decisions at the District level and that District field staff are aware of the importance of the data they collect.
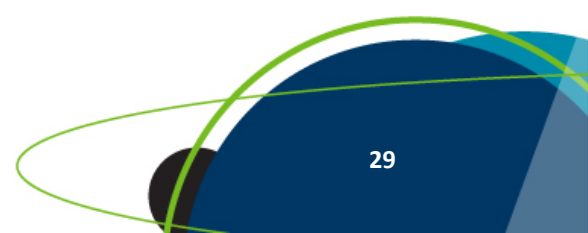
District Management Needs

	General TAM Knowledge	TAMS Data	Decision Making	TAMP Implementation	Coordination with Stakeholders
What is the message?	• What asset management means at MnDOT and why we do it • Asset management is aligned with MnDOT's strategic objectives: • Good data leads to better decisions • Asset management has already improved efficiency • Asset management makes your job easier/better • Why are you the one to do this particular job (e.g., collect or enter data)? • This is how we use the information you collect • MnSHIP and the TAMP drive infrastructure investments	• By using the data. we can better time our investments to increase the life of the asset and maximize the dollars spent • Asset management helps manage investments across the system • Field staff and other resources are optimized by focusing on highest priority work	• Field staff and other resources are optimized by focusing on highest priority work • Data helps identify better timing for asset investments • Data assists in making better work planning for maintenance	• Field staff and other resources are optimized by focusing on highest priority work • With limited budgets, data helps to focus investments on highest priorities • Data assists in making better decisions on the timing of asset investments • Better timing of investments leads to longer asset life and maximizing value	• MnDOT considers multiple factors and trade-offs prior to committing to investments • MnDOT utilizes data and performance measures to influence capital investments

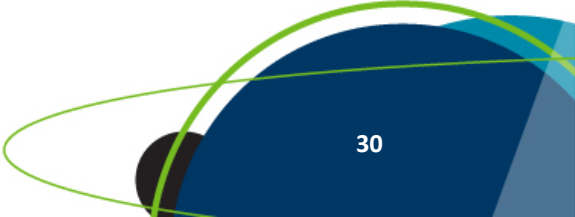|	General TAM Knowledge	TAMS Data	Decision Making	TAMP Implementation	Coordination with Stakeholders
	• MnDOT's strategic priorities are…. • MnDOT's performance targets are….				
Why do we need to communicate the message?	• To build a general understanding of MnDOT's asset management program and its importance among staff • To build an understanding of the importance of each individual's role in supporting asset management • To share MnDOT's asset management goals and objectives	• To build an understanding of the value of data and related tools • To demonstrate the benefits of making decisions using quality data • To show investment timing is improved by using data	• To explain how TAMS data and asset management principles help guide work planning • To build an understanding of trade-offs in budget setting activities • To explain how data assists in managing assets to performance targets	• To explain the match between program goals and the TAMP commitments • To ensure performance expectations for each asset are achieved	• To illustrate that MnDOT is a good steward of taxpayer dollars to enhance customer trust • To provide managers and supervisors with enough knowledge to be able to explain/persuade the benefits to others • To enhance customer trust
How should we deliver the message?	• Targeted emails • Group meetings • Website • Flyer/Pamphlet • Video • Training • FAQs with links to answers				
When should we deliver it? (frequency)	• As needed				

Central Office Staff

This group uses asset management principles to guide the development of planning and investment decisions by providing supporting information and expertise. They use asset performance information to support decisions that will allow MnDOT to achieve its strategic objectives.

Central Office Staff Needs

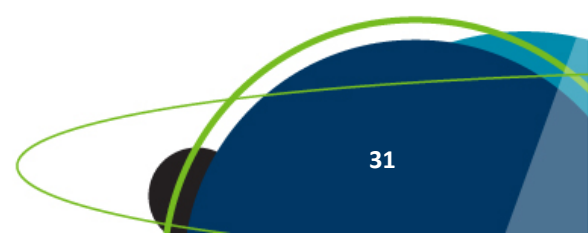|	General TAM Knowledge	TAMS Data	Decision Making	TAMP Implementation	Coordination with Stakeholders
What is the message?	• What asset management means at MnDOT and why we do it • How each person has a role in asset management • How to answer questions from the field or other stakeholders • Good data leads to better decisions and improves efficiency	• The importance of quality data • The benefits to the use of quality data • The value of data and tools • New TAMS data requirements • General knowledge of TAMS content & functions • TAMS- How to instructions	None identified	• Provide feedback to Supervisors and the Asset Management Team regarding system errors or suggestions for process improvement • Implementation of TAMS may impact/change the way you do your job (for the better)	• How to use TAMS to better support District staff and other areas
Why do we need to communicate the message?	• To communicate the important role each individual has in supporting TAM	• To build an understanding of the importance of their role in supporting the data collection and entry processes done by field staff • To reduce the effort required to collect effective information to support decision making	None identified	• To be the voice of the TAMS users as they may likely be the ones that are first to encounter a problem in the system – the sooner a concern is identified, the sooner it can be corrected and minimize the number of users affected • To provide information on how staffs' roles may change and why so they can prepare themselves	• To demonstrate that MnDOT is a good steward of assets and financial resources • To enhance customer trust
How should we deliver the message? Note: The delivery methods and timeframes need to be integrated	• Group meetings • Communication Products: Flyer/ Pamphlet, Video, Training, FAQ's with links to answers	• One-on-one meetings with a Supervisor or TAMS trainer • Group meetings with a Supervisor or TAMS trainer • E-Learning • Email info sharing	None identified	• One-on-one meetings with a Supervisor or TAMS trainer • Group meetings with a Supervisor or TAMS trainer • E-Learning	None identified
When should we deliver it? (frequency)	• Quarterly or at every opportunity until it is part of the culture, then annually	• Quarterly or at every opportunity until it is part of the culture, then annually (by Supervisor & TAMS staff members)	None identified	• Quarterly or at every opportunity until it is part of the culture, then annually (by Supervisor & TAMS staff members)	None identified

	General TAM Knowledge	TAMS Data	Decision Making	TAMP Implementation	Coordination with Stakeholders
		• Twice annually (by Manager) • Annually (by District Engineer/Office Director) • As necessary (by Commissioner, Deputy, Assistant Commissioner, or TAMS Office Director)		• Twice annually (by Manager) • Annually (by District Engineer/Office Director) • As necessary (by Commissioner, Deputy, Assistant Commissioner, or TAMS Office Director)	

District Staff

This group records the field information that is used to support maintenance and preservation project selection decisions. This group needs to understand the importance of the data they record and how it can be used to improve decisions.

District Staff Needs

	General TAM Knowledge	TAMS Data	Decision Making	TAMP Implementation	Coordination with Stakeholders
What is the message?	• What asset management means at MnDOT and why we do it • Good data leads to better decisions and improves efficiency • This is how we use the information you collect	• The importance of quality data • The benefits to the use of quality data • New data and tools have improved efficiency; improved processes; use examples such as damage restitution process improvements	None identified	• Provide feedback to Supervisors and the Asset Management Team regarding system errors or suggestions for process improvement • Implementation of TAMS may impact/change the way you do your job (for the better)	None identified
Why do we need to communicate the message?	• To share the important role each individual has in supporting TAM	• To build an understanding of the importance of their role in the data collection and entry process and its criticality in ensuring staff put forth the effort to enter accurate and timely information	None identified	• To be the voice of the TAMS users as they may likely be the ones that are first to encounter a problem in the system – the sooner a concern is identified, the sooner it can be corrected and minimize the number of users affected • To provide information on how staffs' roles may change and why so they can prepare themselves	None identified

	General TAM Knowledge	TAMS Data	Decision Making	TAMP Implementation	Coordination with Stakeholders
How should we deliver the message? Note: The delivery methods and timeframes need to be integrated	• Group meetings • Communication Products: Flyer/Pamphlet, Video, Training, FAQ's with links to answers	• One-on-one meetings with a Supervisor or TAMS trainer • Group meetings with a Supervisor or TAMS trainer • E-Learning • Email info sharing	None identified	• One-on-one meetings with a Supervisor or TAMS trainer • Group meetings with a Supervisor or TAMS trainer • E-Learning	None identified
When should we deliver it? (frequency)	• Monthly or at every opportunity until it is part of the culture, then annually	• Monthly or at every opportunity until it is part of the culture, then annually (by Supervisor & TAMS staff members) • Twice annually (by Manager) • Annually (by District Engineer/Office Director) • As necessary (by Commissioner, Deputy, Assistant Commissioner, or TAMS Office Director)	None identified	• Monthly or at every opportunity until it is part of the culture, then annually (by Supervisor & TAMS staff members) • Twice annually (by Manager) • Annually (by District Engineer/Office Director) • As necessary (by Commissioner, Deputy, Assistant Commissioner, or TAMS Office Director)	None identified

COMMUNICATIONS MATERIALS

Based on the information generated by the Communications Work Group, the following materials are suggested for development. It is envisioned that the materials will be stored on a central portal that makes access to the information easy and provides a forum for individuals to add materials to the site as the communication plan is rolled out.

Slides

It was suggested that a library of PowerPoint slides be developed for use in making presentations or for modifying to fit specific needs. Topics to be addressed within each of the five theme areas are listed with the top priority falling into the General TAM Information and TAMS Data categories.

- General TAM Information, including:
    - What TAM means at MnDOT (targeted to specific roles to foster understanding)
    - What elements are required by law and the importance of avoiding penalties
    - Why we do TAM at MnDOT
    - Why marketing and communicating TAM is important
    - How TAM fits with MnDOT's strategic priorities
    - How TAM fits with MnDOT's performance targets
    - Links between data, tools, and TAMP practices
    - Asset Management Strategic Implementation Plan recommendations (Add slides related to what other working groups have developed or are recommending)
- TAMS Data, including:

- ◆ Improved efficiencies and effectiveness at MnDOT due to TAM, such as:
  - ✴ ROI on TAMS and TAM
  - ✴ Examples of best practices on use of data and modeling for decision-making
  - ✴ Importance of making good investment decisions ASAP rather than waiting
  - ✴ Importance of ensuring performance expectations of each asset are achieved
  - ✴ How TAM brings greater transparency and credibility
  - ✴ Field staff and other resources are optimized by focusing on highest priority work
  - ✴ Making equitable investments throughout the state is important
  - ✴ With limited budgets, TAM helps to focus investments on highest priorities
  - ✴ Assists in making better decisions on the timing of asset investments
  - ✴ Better timing of investments leads to longer asset life and maximizing value
  - ✴ How the TAMP reduces risk
- ◆ Implementation of TAMS may impact/change the way you do your job (for the better)
  - ✴ Provide information on how staff's roles may change and why so they can prepare themselves for those changes
- ◆ Information specific to TAMS data collection, such as:
  - ✴ Importance of quality data
    - ▪ Good data leads to better, more informed decisions, that reduce risk and costs (Provide examples)
  - ✴ Benefits to the use of quality data
    - ▪ New data and tools increase efficiency; improve processes
      - » Example: Damage Restitution Process improvements
      - » Provide additional examples tailored to specific audience
      - » How the data that is collected is used (be specific about the data and its use)
  - ✴ What asset info exists, what doesn't, what should in the future (Matrix group)
- ◆ Information on why TAMS is important and how TAMS data is used at MnDOT, such as:
  - ✴ How investing in TAMS will:
    - ▪ Achieve MnDOT's objectives
    - ▪ Help manage risks
    - ▪ Lower long-term costs
  - ✴ How TAMS data and TAM principles help guide work planning
  - ✴ Value of good data and tools
- ◆ How-to information on TAMS, such as:
  - ✴ How to use TAMS and where to go to learn how to use it
  - ✴ General overview of TAMS
  - ✴ High-level knowledge of TAMS content & functions
- • Decision making to support project and treatment selection, such as:
  - ◆ Why program goals and investments should match TAMP commitments
  - ◆ Understanding trade-offs in budget setting activities

* Get more value from limited funds, preserve assets, deliver more value to traveling public
* MnSHIP and STIP tradeoffs
* MnDOT considers multiple factors and trade-offs prior to committing to investments
- Factoring future operating/maintenance/management costs when programming projects
- TAMP implementation, such as:
  * Program and investments should reflect TAMP commitments
  * Investment plans and performance expectations by District (from the TAMP)
  * Information on long-term performance expectations to be achieved with TAM
- Coordination with stakeholders, such as:
  * Demonstrate that MnDOT is a good steward of assets and financial resources
  * How asset management can make a difference in local agencies

Handouts and Flyers

The development of handouts or flyers provides a way to convey a message via email or the items can serve as a take-away after a presentation at a meeting. The intention is to make 1-page handouts based on content from the PowerPoint slides. To be most effective, these materials should be tailored to the specific audience. Potential topics include those listed below.

- TAMS is Making a Difference
- Quality Data Matters!
- The Data You Collect Makes a Difference!
- What Asset Management Means at MNDOT

Videos

Short, animated videos can be very effective in conveying a message uniformly to different audiences. For example, the Ohio DOT has an animated video posted on its website that explains why the agency invests in asset management and how it's making a difference on their bottom line. Michigan DOT has a more sophisticated video available that speaks to the importance of preservation to reduce the cost of maintaining the system. Potential topics for MnDOT to consider focus on the following:

- What asset management means and why it is important to reduce life cycle costs.
- How data collection efforts are improving the way MnDOT does business.

Other Materials

In addition to the items listed, MnDOT may find it beneficial to develop posters that can be hung in District offices to convey the importance of the data they are collecting and how it is making a difference in improving efficiency, providing access to needed information, and lowering the cost of managing the system. Depending on other needs, dashboard posters may be desired to monitor progress towards District goals to keep staff motivated. The Ohio DOT developed a football-themed *Playbook* that targeted specific steps that were being taken to implement asset management and what the expected results would be. The release of the *Playbook* included trading cards as a way to raise awareness for the campaign. As the Ohio DOT example illustrates, there is no limit to the imaginative way that a message can be conveyed.

Work Group 5

TAMP Implementation

Work Group 5 addressed a variety of topics at its meetings, focusing primarily on ways to improve the usefulness of the TAMP to a broader audience at MnDOT, better understand the interdependence between MnSHIP and the TAMP, and enhance the consideration of maintenance and operations costs in the updates to MnSHIP and the TAMP to improve life-cycle management at MnDOT. Another important question that the group wanted to address was whether any changes should be made to the number or types of assets that will be included in the 2022 TAMP update.

The Work Group members spent time discussing how the TAMP is currently being used and how it could be used to better support decisions. The TAMP is currently being used to provide inventory information, to present performance measures and targets, and to detail the level of investment that is needed on a statewide basis to achieve the targets. It was noted that the TAMP also enables MnDOT to satisfy federal regulations and document risks to asset condition, but several members of the Work Group admitted that they were not regular TAMP users. When asked how the TAMP could be used, the members envision it being more useful in establishing programming decisions and priorities for guiding Statement Transportation Investment Program (STIP) and Capital Highway Investment Program (CHIP) development. Others suggested that it could help explain the true cost of infrastructure ownership through comparisons between capital investments and maintenance costs. Several suggestions were offered for changing the format and access to the document, including suggestions to make a searchable version available, to make the TAMP a shorter, public-oriented document with separate, more detailed asset-specific documents, and separating out information by District. Suggestions were also made for organizing the document by asset class rather than topic area and having a web-oriented version available with annual data snapshots.

To address the remaining issues, the Work Group members sought a better understanding of how the TAMP and MnSHIP currently relate so that suggestions for improvement could be offered. A presentation on past interactions between these two plans was provided, highlighting coordination efforts related to asset performance targets, funding levels required to achieve performance outcomes, and consideration of both capital investments and maintenance/operations budgets. Suggestions for future updates to the two plans focused on:

- Consistent methods for prioritizing and grouping assets,
- Revisiting the approach used to estimate maintenance and operational needs based on capital investments,
- Evaluating the impact of underinvesting in capital improvements on maintenance budgets for pavement, bridge, and other assets, and
- Evaluating the impact of mobility/expansion investments on capital and maintenance needs using the total cost of ownership data.

The resulting recommendations from Work Group 5 are presented in the *TAMP Action Plan* section of this document.

Asset Data Action Plan

The recommended Asset Matrix developed through the efforts of Work Groups 1 and 2 is available using this link (**Asset Matrix**). It documents the gaps between desired and current maintenance strategies for each asset class, the factors that contributed to the suggested tiers, and the recommendations for acquiring any missing data. The Action Plan identifies the recommended actions and their resource implications. These efforts are suggested to help maintain asset inventories, ensure consistency in MnDOT's data collection efforts, and make the best use of the limited resources available.

Recommendation 1

Do not invest resources in data collection activities for certain assets.

Asset classes that were not included in tiers 1 through 4 do not require inventories or condition information at this time. These assets include those listed below.

- Facilities: storage sheds and other miscellaneous buildings (e.g. lift stations and hazmat).
- Geotechnical assets: natural hazard locations, improved subgrade fills, unimproved subgrade, cut slopes, and embankments.
- Green assets: landscaping, trees, native/pollinators, and roadway ditches.
- Hydraulic infrastructure assets: entrance culverts.
- Maintenance assets: mowing and debris removal.
- Pavement assets: edge drains, drain tile, curb and gutter, and gravel shoulders.
- Rail assets: rail/rail crossings (not maintained by MnDOT).
- Right of way assets: land/boundary/excess and fence.
- Structures: concrete noise walls and billboards (permit requirements only).

Recommendation 2

Stay the course in terms of how some assets are managed.

Several asset classes in tiers 1 through 3 are being managed in a way that requires no resources beyond those already being expended. The recommendation for the assets listed below is to "stay the course."

- Bike and ped: pedestrian curb ramps/signals/sidewalks.

- Bridges: vehicle bridges >10 feet/tunnels and pedestrian/bicycle/utility bridges.

- Facilities: Class 1 rest areas/Class 1 truck stations/office buildings/salt sheds and Class 2 and 3 rest areas/Class 2 and 3 truck stations/brine stations/weigh stations.

- Green assets: hazard-noxious weeds.

- Geotechnical assets: special drainage systems.

- Hydraulic infrastructure assets: highway culverts and deep stormwater tunnels.

- Maintenance assets: snow and ice winter plow routes, stationary anti-icing systems, and RWIS.

- Pavement assets: highway mainline, bus shoulders, paved shoulders, and low-volume frontage roads.

- Structures: ARMER system assets (e.g., radio towers, equipment shelters, radio transmission equipment, facilities) and entrance monuments.

- Traffic assets: Freeway Management Systems (e.g., TMS, RTMC operations, ITS) and high-mast tower lights.

Recommendation 3

Acquire necessary asset data for high-priority assets using contract labor.

The Strategic Plan Summary worksheet in the Asset Matrix includes several specific recommendations for establishing the baseline inventory for certain assets, recommending innovative approaches for using technology to maintain the currency of asset inventories, and collecting asset condition information needed to manage assets that may not currently be inspected. A summary of the recommendations is presented below.

A. **As-Builts** – Ensure that all relevant post-construction asset information is collected for each MnDOT construction project. AMPO will collaboration with PMLG to determine how to programmatically plan for and collect as-built information. Estimates for completing this activity are based on the following assumptions:

   o **Cyclical LiDAR** - A cyclical LiDAR asset data collection update will be used to collect construction project as-built data to maintain existing inventories.

   o **Consultant Contract** - A consultant contract will be executed to address asset inventory data for construction projects where as-builts were not specified.

B. **Focus on Culverts** - Over the next 5 years, focus on completing the side and mainline culvert inventories (note this excludes the entrance culverts listed under Recommendation 1)..

C. **Sign Inventory Baseline** - Execute a contract to refresh the state's sign inventory over a 2-year period.

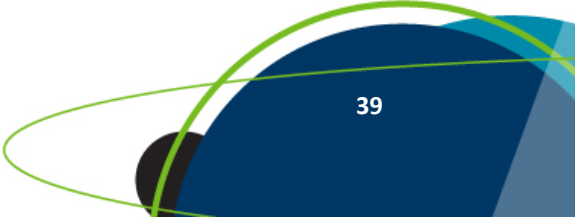Specific activities by Asset Group are summarized in the following tables.

BIKE AND PED

Asset Class	Tier	Desired AM Approach	Implementation Description (● = general strategy) (○ = inspection strategy) Costs shown may represent internal staff labor hours or financial costs, or cost estimates to outsource work. See the matrix for details (**Asset Matrix**)
Accessible On-street ADA Parking	2	Condition	● AMPO or ADA office define accessible on-street ADA parking and then perform inventory from imagery on roughly 200 locations ($63K). ● Evaluate best as-built collection methods per Recommendation 3. ○ Inspection of pavement surface in FY24 and could include innovative solutions like utilizing NASA satellite imagery or LiDAR robot ($4K/year).
Bike Lane (not separated) and shared roadways	2	Condition	○ Inspection of pavement surface in FY24 and could include innovative solutions like utilizing NASA satellite imagery or LiDAR robot ($4K/year).
Shared use paths, side paths, separated bike lanes	3	Cycle	○ Inspection of pavement surface in FY24 and could include innovative solutions like utilizing NASA satellite imagery or LiDAR robot ($10K/year).

GEOTECHNICAL

Asset Class	Tier	Desired AM Approach	Implementation Description (● = general strategy) (○ = inspection strategy) Costs shown may represent internal staff labor hours or financial costs, or cost estimates to outsource work. See the matrix for details (**Asset Matrix**)
Earth Retaining Systems (includes gravity, soil nail, soldier pile, sheet pile, reinforced concrete cantilever, MSE, crib, bin, timber, other types on the TAMS list)	2	Condition	● Materials/AMPO will build an initial inventory of geotechnical assets by populating a geotechnical asset inventory in TAMS through a combination of review of available data and expert judgement. The project manager will review pay item data to identify projects where geotechnical assets have been constructed and conduct interviews of district personnel to identify additional assets and/or geohazard locations. and geotechnical assets known to require significant maintenance. ● Add any assets, identified through the interviews

Asset Class	Tier	Desired AM Approach	Implementation Description (● = general strategy) (○ = inspection strategy) Costs shown may represent internal staff labor hours or financial costs, or cost estimates to outsource work. See the matrix for details (**Asset Matrix)**
			noted in the previous bullet, to the asset inventory. ○ Statewide Inspection program development TBD (ball-park costs based on a 5- to 10-year inspection frequency)
Improved Ground Supports (includes column-support embankments and transfer platforms)	2	Condition	● Same as Earth Retaining Systems implementation description
Reinforced Soil Slopes	2	Condition	● Same as Earth Retaining Systems implementation description
Instrumentation Systems (includes inclinometer, pressure cell, gauge, cabinet, and piezometer)	3	Cycle+	● Same as Earth Retaining Systems implementation description

GREEN ASSETS

Asset Group	Asset Class	Tier	Desired AM Approach	Implementation Description (● = general strategy) (○ = inspection strategy) Costs shown may represent internal staff labor hours or financial costs, or cost estimates to outsource work. See the matrix for details (**Asset Matrix**)
Green Assets	Replacement Wetlands	4	Reactive	● AMPO or OLM digitize wetland banking permits into GIS layer ($7k)

HYDRAULIC INFRASTRUCTURE

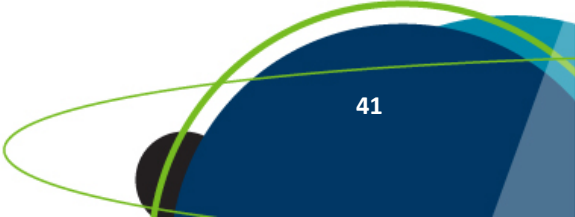| Asset Group	Asset Class	Tier	Desired AM Approach	Implementation Description (● = general strategy) (○ = inspection strategy) Costs shown may represent internal staff labor hours or financial costs, or cost estimates to outsource work. See the matrix for details (**Asset Matrix**)
Hydraulic Infra	Local Road Culverts	3	Cycle	● Districts perform inspection and inventory of highway culverts, local road culverts and pipe flumes on a corridor approach within 4-5 years per District. After 2 years this process will be reassessed. ● Inventory currency through SRC as-builts ($12K/year)
Hydraulic Infra	Storm Sewer Pipe and Structures	3	Cycle+	● AMPO and Districts will conflate catch basins from 2018 Consultant Lidar GIS dataset ($75K). ● AMPO and Districts keeping inventory current of roughly 3,000 pipes/structures per year occurring through SRC as-built processing ($170K/year). ○ Inspections (and inventory) occurring through scoping process and added throughout time (no additional resource need at this time).

Asset Group	Asset Class	Tier	Desired AM Approach	Implementation Description (● = general strategy) (○ = inspection strategy) Costs shown may represent internal staff labor hours or financial costs, or cost estimates to outsource work. See the matrix for details (**Asset Matrix)**
Hydraulic Infra	Ponds, Infiltration Basins, and Underground Storage	3	Cycle+	● AMPO will utilize imagery, plan data, and internal knowledge to obtain full inventory of ponds and basins with District input, and review with Bridge Hydraulics direction in FY22/23 ($50K). Typical process may include district questionnaire (hydraulics & maintenance) about where ponds and basin are at, review plans / imagery per control section in reverse date order (grading plans). ● AMPO and Districts inventory currency occurring through SRC as-built processing ($25K/year). ○ Inspection cycle to be determined by current requirements from permits, MS4 SWPPP or District needs (10-year frequency inspection ball-park costs).
Hydraulic Infra	Structural Pollution Control Devices (SPCD's)	3	Cycle+	● AMPO utilize internal knowledge and plan data to obtain full inventory SPCD's with District input and review with Bridge Hydraulics direction in FY23/24 ($25K). Typical process may be district questionnaire (hydraulics & maintenance) about where SPCD's are at, review plans per control section in reverse date order (grading plans). ● Inventory currency occurring through SRC as-built processing. ○ Inspection cycle to be determined by current requirements from permits, MS4 SWPPP or District needs (2-year frequency inspection ball-park costs).

MAINTENANCE

Asset Group	Asset Class	Tier	Desired AM Approach	Implementation Description (● = general strategy) (○ = inspection strategy) Costs shown may represent internal staff labor hours or financial costs, or cost estimates to outsource work. See the matrix for details (**Asset Matrix**)
Maintenance	Snow Fence (Types: Living, Structural, Grading)	4	Cycle+	● AMPO or OLM perform one-time base inventory update of construction changes since 2016 ($5K). ● Inventory currency through SRC as-builts or CADD digitization ($10k/year) ○ Inspection planned to start in 24/25 ($40k/year)

PAVEMENTS

Asset Group	Asset Class	Tier	Desired AM Approach	Implementation Description (● = general strategy) (○ = inspection strategy) Costs shown may represent internal staff labor hours or financial costs, or cost estimates to outsource work. See the matrix for details (**Asset Matrix**)
Pavements	High Volume Frontage Roadway	2	Cycle+	● New frontage roads are not typically being added to MnDOT system. OTSM documents geometry and route types current in LRS but no ownership status. Metro District Asset ● Management unit will perform one-time documentation of ownership ($2K). ○ Current method of visual inspection of frontage roads when scoping mainline paving project.
Pavements	Highway Ramps/loops	2	Cycle+	● Highway ramps/loop inventories are kept current by OTSM. ○ Inspection of pavement surface in FY24 and could include innovative solutions like utilizing NASA satellite imagery or LiDAR robot ($4K/year).

STRUCTURES

Asset Group	Asset Class	Tier	Desired AM Approach	Implementation Description (● = general strategy) (○ = inspection strategy) Costs shown may represent internal staff labor hours or financial costs, or cost estimates to outsource work. See the matrix for details (**Asset Matrix**)
Structures	Wood Noisewalls	3	Cycle+	● Consultant one-time project to update asset inventory from 2018-present with Metro District review ($9K). ● Evaluate best as-built collection methods per Recommendation 3. ○ Most noise walls have been inspected one time but have reinspection needs ($28k/year).

TRAFFIC

Asset Group	Asset Class	Tier	Desired AM Approach	Implementation Description (● = general strategy) (○ = inspection strategy) Costs shown may represent internal staff labor hours or financial costs, or cost estimates to outsource work. See the matrix for details (**Asset Matrix**)
Traffic	Signal Systems	1	Cycle+	● AMPO and ESS will conflate signal system poles into the TAMS asset inventory utilizing the 2018 Consultant LiDAR GIS dataset with greater MN District review ($38K). ● Current resources being utilizing to process and review as-builts (ESS and District staff). ● District meetings underway to determine status of structural inspections. ● Signal performance measures have been drafted.
Traffic	Lighting - Roadway	3	Cycle+	● AMPO, OTE, and Districts will conflate lighting into the TAMS asset inventory utilizing the 2018 Consultant LiDAR GIS dataset.

Asset Group	Asset Class	Tier	Desired AM Approach	Implementation Description (● = general strategy) (○ = inspection strategy) Costs shown may represent internal staff labor hours or financial costs, or cost estimates to outsource work. See the matrix for details (**Asset Matrix)**
Traffic	Pavement Markings - Striping	3	Cycle	● Consultant performs one-time base inventory update of construction project changes since statewide LiDAR inventory project 2018-current ($5K). ○ Purchase data logging equipment for central office striping business stripers ($160K). ● Utilize data logging data for integration with TAMS annual "Epic" fee ($35k/year).
Traffic	Barrier - Attenuators (Crash Cushions)	3	Cycle+	● Consultant performs one-time base inventory update of construction project changes since statewide LiDAR inventory project 2018-current ($30K). ● Inventory currency through annual consultant LiDAR collection instead of current SRC as-built process ($1K/year).
Traffic	Barrier - Plate beam	3	Cycle+	● Consultant performs one-time base inventory update of construction project changes since statewide LiDAR inventory project 2018-current ($30K). ● Inventory currency through annual consultant LiDAR collection instead of current SRC as-built process ($1K/year).
Traffic	Barrier - Plate beam End treatments	3	Cycle+	● Consultant performs one-time base inventory update of construction project changes since statewide LiDAR inventory project 2018-current ($30K). ● Inventory currency through annual consultant LiDAR collection instead of current SRC as-built process ($75K/year).
Traffic	High Tension Cable Barrier	3	Cycle+	● Consultant performs one-time base inventory update of construction project changes since statewide LiDAR inventory project 2018-current ($30K). ● Inventory currency through annual

Asset Group	Asset Class	Tier	Desired AM Approach	Implementation Description (● = general strategy) (○ = inspection strategy) Costs shown may represent internal staff labor hours or financial costs, or cost estimates to outsource work. See the matrix for details (**Asset Matrix)**
				consultant LiDAR collection instead of current SRC as-built process ($5K/year).
Traffic	Low Tension Cable Barrier	3	Cycle+	● Consultant performs one-time base inventory update of construction project changes since statewide LiDAR inventory project 2018-current ($30K). ● Inventory currency through annual consultant LiDAR collection instead of current SRC as-built process ($5K/year).
Traffic	Sign Structures - I-beam w/Static Panel	3	Cycle+	● Consultant performs one-time baseline inventory for 5 Districts to get accurate and updated dataset ($750K). ● Inventory currency through annual consultant LiDAR collection instead of current SRC as-built process ($80K/year).
Traffic	Concrete Barrier	4	Reactive	● Metro District conflation of existing inventory into TAMS. ● Evaluate best as-built collection methods per Recommendation 3. ● Inventory currency through annual consultant LiDAR collection instead of current SRC as-built process ($2K/year)
Traffic	Rumble Strips and Stripes	4	Reactive	● Consultant performs one-time base inventory update of construction changes since statewide LiDAR inventory project 2018-current ($10K) ● Evaluate best as-built collection methods per Recommendation 3.
Traffic	Pavement Markings - Messages	3	Cycle	● Baseline inventory is incomplete but obtaining location and material type is a high-cost effort, so inventory will be added over time through maintenance staff and

Asset Group	Asset Class	Tier	Desired AM Approach	Implementation Description (● = general strategy) (○ = inspection strategy) Costs shown may represent internal staff labor hours or financial costs, or cost estimates to outsource work. See the matrix for details (**Asset Matrix)**
				annual consultant LiDAR collection ($25k/year).
Traffic	Sign Panels - Static	3	Cycle+	● Consultant performs one-time baseline inventory for 5 Districts to get accurate and updated dataset ($750K for panels, $1.25M total). ● Inventory currency through annual consultant LiDAR collection instead of current SRC as-built process ($80K/year). ○ Future sign panel night-time inspection program development planned for FY24 (ball-park costs via consultant).
Traffic	Sign Structures - Static Panel Ground Mounted	3	Cycle+	● Consultant performs one-time baseline inventory for 5 Districts to get accurate and updated dataset ($750K). ○ Inventory currency through annual consultant LiDAR collection instead of current SRC as-built process ($80K/year).
Traffic	Sign Structures - Static Panel Overheads w/Foundations	3	Cycle+	● Consultant performs one-time baseline inventory for 5 Districts to get accurate and updated dataset ($750K). ○ Inventory currency through annual consultant LiDAR collection instead of current SRC as-built process ($1K/year).

IMPLEMENTATION COSTS

A summary of the expected costs to complete the additional data collection recommendations is summarized below. Costs are divided into new one-time costs (for building the baseline inventories and conducting some initial inspections) and new on-going costs that are expected to be incurred annually. For each activity, the costs are separated by consultant or Central Office costs and District labor hours so the direct impact on District resources can easily be assessed.

	New One-Time Costs		New On-Going Annual Costs		
Fiscal Year	**Consultant or Central Office Cost**	**District Labor Hours**	**Maintaining the Inventory**	**Inspection Costs**	**District Labor Hours**
FY 20/21	$1,879,000	13,920			
	The largest expenditures include a $750,000 one-time expenditure to hire a consultant to build the baseline sign panel inventory and 10,080 hours for District personnel to inventory highway culverts, local road culverts, and pipe flumes on a corridor approach within a 4- or 5-year period. An analysis of the ROI on the culvert inventory showed a 7-year payback in terms of improved efficiencies.				
FY 22/23	$1,670,000	12,782			
	The consultant costs include $230,000 to inventory ponds, infiltration basins, and underground storage. In addition, $336,000 is estimated to inventory storm sewer pipes and structures. In addition, the consultant costs reflect $968,000 for building baseline inventories for the traffic assets included in the matrix. The District hours include 10,080 hours for on-going efforts to inspect the local road culverts.				
FY 24/25	$2,560,000	12,152			
	The largest consultant cost is $519,000 to conduct nigh-time inspections for sign panels. Other significant costs include $336,000 for continuing the storm sewer pipe and structure inventory. It also includes $180,000 to complete the pond, infiltration basin, and underground storage inventory. Other significant consultant expenses includes $376,000 for building the inventory of Earth Retaining Systems and $808,000 for the remaining traffic asset inventories. The District hours include 10,080 for on-going efforts to inspect the local road culverts.				
FY 26 and Beyond			$764,000	$784,000	12,152
			The largest on-going inventory costs include $168,000 for the storm sewer pipe and structures inventory and $180,000 for the update to the rumble strip and stripes inventory. Included in the inspection costs is $188,000 for a statewide Earth Retaining System inspection program and $360,000 for the sign panel inspection program. he District estimate includes 10,080 hours to continue the culvert inventory.		

BENEFITS

The accomplishment of these efforts will provide the benefits listed in the following table. In general, these benefits capture general improvements in efficiency that can be realized from the suggested activities. However, an analysis was conducted for culverts to assess the ROI of adding side and entrance

culverts to the existing inventory. The work group used the framework and tool from NCHRP Report 866, *Return on Investment in Transportation Asset Management* to perform the calculations using data from District 2. The analysis found that the recommendation yielded a net present value of $23K with a 7-year payback period. The ROI was heavily influenced by the reduced resource requirements for MnDOT staff due to the availability of data for planning, scoping, and design. A similar analysis was conducted for the baseline sign inventory and the improved efficiencies realized were estimated at $19,000 annually.

A – Cyclical LiDAR	B – Focus on Culverts	C – Inventory Update	D – Sign Inventory Baseline
Utilizing LiDAR technology with desktop extraction is safe and efficient.	Return on Investment Analysis yielded net present value of $23K with 7-year payback period.	Updated data to use for planning, scoping, and design saves MnDOT staff time.	MnDOT efficiency report documented staff time savings of $19K/year using inventory data for design.
Annual cyclical collection using LiDAR is ~½ the cost of GPS field collection.	Updated data to use for planning, scoping, and design saves MnDOT staff time.	Innovative technology, economies of scale, and safe collection solution.	Collection using LiDAR is ~½ the cost of GPS field collection by Maintenance crews.
More accurate data and efficient review.	Reduced environmental impacts	More accurate data and efficient review.	Improved investment (planning) outcomes.

Recommendation 4

Address other identified data-related needs to support asset management as resources allow.

In addition to the specific actions recommended to build and maintain asset inventory and condition information, 42 other recommendations were generated to improve MnDOT's asset management practices, as summarized in the following table.

Asset Group	Asset Class	Task ID	Implementation Tasks
Pavements	Highway Mainline	1	IT Project Request for HPMA Replacement Project (Active, Maplewood Lab)
Traffic	Signal Systems	2	Analyze level of attribution and detail in TAMS ($)
Traffic	Signal Systems	3	Report on MBMT performance measures (PM, Operations, Electrical, Timing)
Traffic	Signal Systems	4	Evaluate Incorporating underground GIS data into TAMS ($)
Traffic	Signal Systems	5	TAMS Phase 3 Structural Inspection App Development
Traffic	Signal Systems	6	Discuss next Gen MnSHIP to include modernization

Asset Group	Asset Class	Task ID	Implementation Tasks
Traffic	Signal Systems	7	Transportation Research Synthesis of Preventive maintenance improvement
Bike and Ped	Accessible On-street ADA Parking	8	Utilize innovative technologies to measure condition (cracks), ancillary pavement project satellite imagery could be a low cost solution ($)
Bike and Ped	Accessible On-street ADA Parking	9	Determine cyclical frequency of condition data
Bike and Ped	Accessible On-street ADA Parking	10	Determine how to share condition data
Bike and Ped	Pedestrian curb ramps, signals, and sidewalks	11	TAMS Phase 3 will align current collector application with TAMS full application to track and document maintenance needs.
Bike and Ped	Pedestrian curb ramps, signals, and sidewalks	12	Emphasize proactive public engagement; difficult to meet standards when multiple constraints surrounding each project due to linkages to local non-compliant areas.
Bike and Ped	Pedestrian curb ramps, signals, and sidewalks	13	To keep inventory data current, this winter there is an effort to move construction inspectors from using current electronic form completion (prior to construction close-out) to a user friendly MnDOT GIS web-application (similar to survey123) with data sorting and analysis.
Geotechnical	Earth Retaining Systems (includes gravity, soil nail, soldier pile, sheet pile, reinforced concrete cantilever, MSE, crib, bin, timber, other types on the TAMS list)	14	Establish a statewide program for periodic inspection of ERS. Review the approach developed by the Metro District for ERS inspection. Revise and adapt it to apply statewide. Inspections of these assets should be performed using a risk-based approach in which the inspection interval is established based on the age and/or condition of the asset.
Geotechnical	Earth Retaining Systems (includes gravity, soil nail, soldier pile, sheet pile, reinforced concrete cantilever, MSE, crib, bin, timber, other types on the TAMS list)	15	Improve decision support tools. Implement tools and approaches for analyzing and prioritizing investment needs for ERS, RSS and subgrade ground improvements/modifications similar to those used for other MnDOT assets managed using a condition-based approach.

Asset Group	Asset Class	Task ID	Implementation Tasks
Geotechnical	Reinforced Soil Slopes	16	Enhance MnDOT's Transportation Asset Management System (TAMS). Add the geotechnical asset inventory to TAMS. Specify the initial set of attributes for each type of geotechnical asset based on staff knowledge of current needs. Allow maintenance personnel to create new geotechnical assets in TAMS. Also, add business rules to the system to force creation of a new asset if one is not defined following specific activities (e.g., creation of a geohazard location following mitigation of a rock slide). Revise TAMS documentation to reflect these changes.
Geotechnical	Improved Ground Supports (includes column-support embankments and transfer platforms)	17	Build an initial inventory of geotechnical assets. Populate the geotechnical asset inventory in TAMS through a combination of review of available data and expert judgement. Add assets previously identified to the inventory (e.g., through research and efforts to identify ERS). Review pay item data to identify projects where geotechnical assets have been constructed. Review project plans to help establish the geotechnical asset inventory, supplementing the plan review with analysis of emergency projects and targeted field data collection where a specific need for more detailed data is identified. Conduct interviews of district personnel to identify additional geohazard locations and geotechnical assets known to require significant maintenance. Add any assets identified through the interviews to the asset inventory. Note this could be performed on a pilot basis to better assess required resources and test the approach.
Hydraulic Infra	Highway Culverts	18	Adding TAMS ID to design plans to align data imports with TAMS (Active)
Hydraulic Infra	Highway Culverts	19	Reporting and communicating with Districts on performance measures (Active)
Hydraulic Infra	Highway Culverts	20	Improve as-built process - create TAMS records prior to as-built imports ($, AMPO and Bridge Hydraulics)
Hydraulic Infra	Highway Culverts	21	Improve on data quality in TAMS (for example, picking individual asset where maintenance work is done) ($, AMPO)
Hydraulic Infra	Highway Culverts	22	Analyze level of attribution in TAMS for both data inventory and inspection ($, AMPO)
Hydraulic Infra	Highway Culverts	23	Analyze the planning, project scoping, and design level of data collection ($, AMPO)
Hydraulic Infra	Highway Culverts	24	TAMS Phase 3 scope includes capturing construction project repair work (Active)

Asset Group	Asset Class	Task ID	Implementation Tasks
Hydraulic Infra	Highway Culverts	25	Streamline data and business process for re-inspecting assets that have been repaired ($, ?)
Bike and Ped	Shared use paths, side paths, sep bike lanes	26	Set performance measures and targets
Bike and Ped	Shared use paths, side paths, sep bike lanes	27	Maintenance assigning work at Section level, per complaints - should we add activities to TAMS for Bike Network ($, AMPO)
Geotechnical	Instrumentation Systems (includes inclinometer, pressure cell, gauge, cabinet, and piezometer)	28	Proceed with the as-built specifications. Complete the implementation of the specification to collect data on the geotechnical asset inventory as part of the preparation of as-built plans.
Geotechnical	Special Drainage Systems (includes chimney drain, perforated drain, herringbone drain, geomembrane cap and liner, and trench drain - does not include edge drains)	29	Assess the results of the initial effort to establish the geotechnical asset inventory. Explore the feasibility of additional targeted data collection and/or feature extraction from LiDAR data to supplement the inventory. Establish whether additional attributes need to be added for existing assets.
Geotechnical	Special Drainage Systems (includes chimney drain, perforated drain, herringbone drain, geomembrane cap and liner, and trench drain - does not include edge drains)	30	Address special drainage and instrumentation. Define inspection and maintenance practices recommended for special drainage and instrumentation.
Structures	Wood Noisewalls	31	Analyze level of detail for inspection ($)
Traffic	Pavement Markings - Messages	32	TAMS Phase 3 includes streamlining options in TAMS and Collector-TAMS update (Active, AMPO)
Traffic	Sign Structures - Static Panel Overheads w/Foundations	33	TAMS Phase 3 Application for inspection
Traffic	Sign Structures - Static Panel Overheads w/Foundations	34	Develop inspection guide and communicate TAMS data entry options (Active)
Traffic	Lighting - Roadway	35	TAMS Phase 3 inventory and inspection app development (Active)
Traffic	Lighting - Roadway	36	Performance Measure development (Active)
Traffic	Barrier - Attenuators (Crash Cushions)	37	Report on and monitor documentation of defects being addressed through SRC and Maintenance fixes ($, ?)
Maintenance	Snow Fence (Types: Living, Structural, Grading)	38	Perform value engineering studies when snow fence mitigates snow traps/S&I costs (existing inventory needs updating and user interface developed using Survey123 or Collector)
Maintenance	Snow Fence (Types: Living, Structural, Grading)	39	Collector app under development through U of M that connects to Farmer-to-Farmer website. Project ends by Nov 2021 and next couple meetings discussion of data interoperability; important for TAMS Phase 3.

Asset Group	Asset Class	Task ID	Implementation Tasks
Geotechnical	Natural Hazard Locations (includes locations off of the ROW not otherwise addressed)	40	Continue geohazard research. Complete ongoing research to identify potential geohazard locations.
Geotechnical	Improved Subgrade Fills (includes lightweight fill such as: wood chip, tire-derived aggregate, geofoam, lightweight aggregate, cellular concrete, and grouted fill)	41	Expand the inspection of geotechnical assets. Establish a statewide program for periodic inspection of RSS and subgrade ground improvements/modifications patterned on the program for inspection of ERS.
All	All	42	Develop best way to capture flooding repair work for resiliency efforts.

Recommendation 5

Reconvene the Asset Matrix and Geotechnical Work Groups to address any additional actions that may be needed to address the asset management requirements in HF10.

In 2020, Subdivision 12 of Sec. 88 Minnesota Statutes 2020, Section 174.03 required an inventory of transportation asset, including but not limited to bridge, pavement, geotechnical, pedestrian, bicycle, and transit asset categories. Since complete inventories had been established for all assets other than geotechnical assets, Work Group 2, Geotechnical Assets, was established to develop recommendations for establishing the required inventory. On July 1, 2021, amended legislation under HR10 expanded the asset management requirements to "implement performance measures and annual targets for the trunk highway system in order to construct resilient infrastructure, enhance the project selection for all transportation models, improve economic security, and achieve the State transportation goals established in Section 174.01."

The initial recommendations included in this *Asset Data Action Plan* were limited to the requirements in place under the 2020 legislation. Therefore, the recommendations related to geotechnical assets focus exclusively on establishing a complete inventory of geotechnical assets. Under this recommendation, the Asset Matrix and Geotechnical Work Groups (Work Groups 1 and 2) will reconvene and address any additional requirements under HF10.

Recommended Actions	Targeted Completion Date	Responsible Party
Reconvene the Asset Matrix and Geotechnical Work Groups to review HF10 and identify any additional actions needed to meet the requirements	4Q 2021	Trisha Stefanski and Brad Skow

Recommended Actions	Targeted Completion Date	Responsible Party
Develop recommendations for addressing the requirements under HF10, including changes to data collection costs and approaches proposed in this document.	1Q 2022	Office of Transportation System Management (OTSM)
Present the recommendations to the Asset Management PMT and address any comments received.	1Q 2022	OTSM
Prepare material to support the initial performance implementation report required under the legislation.	3Q 2022	OTSM

Recommendation 6

At least annually review the data collection recommendations to reflect changes in practice, technology, resources, and priorities.

The recommendations contained in the *Asset Data Action Plan* reflect practices, costs, and technology available at the time the AMSIP was developed. Over time, the factors that influence the need for on-going data to be collected or the way in which the data is collected are expected to change. This recommendation provides for an annual review of the information contained in the asset matrix so that any changes that impact the asset management data collection activities are reflected.

Recommended Actions	Targeted Completion Date	Responsible Party
At least annually, reconvene the Asset Matrix Work Group to review changes that need to be reflected.	4Q Each Calendar Year	AMPO
Support the implementation of any changes that are needed.	Annually	AMPO

Life Cycle Strategy Action Plan

Three recommendations are suggested for increasing the cost-effective use of preventive maintenance to maximize long-term performance, extend service life, and minimize life-cycle costs. These solutions are not expected to eliminate the barriers introduced earlier, but they will help provide accountability in terms of expectations, available resources, and actual accomplishments. At the same time, these solutions will:

- Better align planned and actual investments with life-cycle planning and the TAMP.
- Provide a means for comparing the costs and benefits of preventive maintenance investments to other options.
- Establish a system of accountability for the level of planned and accomplished preventive maintenance work.

Each of these solutions can be implemented by MnDOT within the current management framework and the investment levels presented in MnSHIP, the TAMP, and those being used by District maintenance personnel. By leveraging these current business processes the solutions will ensure that Districts are able to achieve expectations while considering local conditions and constraints.

Recommendation 1

Establish performance measures and an accountability system for tracking annual preventive maintenance (PM) goals and accomplishments.

Preventive maintenance is a cost-effective way of maximizing asset service lives and minimizing life-cycle costs. However, the benefits of preventive maintenance are not always obvious in the short term. The suggested measures and targets presented here will build on efforts already begun by the Maintenance Business Management Team (MBMT) to provide short-term expectations for PM work so the long-term benefits can be accomplished. As the name suggests, preventive maintenance treatments are intended to be applied early in an asset's life to slow deterioration. Late application can significantly reduce or negate treatment effectiveness. The need to apply these treatments before significant deterioration has occurred creates a "window of opportunity" within which these treatments should be applied. The length of the window of opportunity can vary between assets and locations for several reasons. The proposed measures and targets are based on the typical performance of assets on the Minnesota state highway system and the resulting typical windows of opportunity for specific types of PM treatments.

In the case of pavement and bridge preventive maintenance, the MBMT has already adopted the measures described below but has not adopted specific targets. The targets suggested are intended to establish the level of needed work, so Districts can appropriately balance resources across their full programs. In the case of traffic signals, the current cyclical inspections and preventive maintenance checks are currently being conducted but the targets have not been yet adopted. The targets listed in this section are initial recommendations to support internal decision making.

Preventive maintenance needs for pavements and bridges will be established using existing analysis tools and approaches. For pavements the pavement management system (PMS) will be used and for bridges the bridge management system (BMS) will be used.

Suggested measures and targets to be reported on a District basis at the end of each calendar year are listed below. AMPO will be responsible for ensuring the numbers are reported to the Districts each year.

- Pavements
  - At least 80 percent of bituminous overlays on pavements will be crack sealed (or filled) by age 5. Maintenance will track the data, but Districts may perform the work by either contract or maintenance personnel. The results will be analyzed and reported on a District basis at the end of each calendar year using a combination of STIP, CHIMES and TAMS data.
  - Address at least 80 percent of the 7-year rolling average bituminous paving miles using seal coats, micro surfacing, and other full-width treatments. This value will be reported on a District basis at the end of each calendar year.
  - Address at least 70 percent of the 5-year rolling average concrete paving miles using light Concrete Pavement Repair (CPR) treatments (excluding urban areas with speed limits ≤ 45 mph). This value will be reported on a District basis at the end of each calendar year.
- Bridges
  - Flush 90 percent of the bridges annually. The results will be reported by the Office of Bridges and Structures on a District basis at the end of each calendar year.
  - Crack at least 95 percent of the bridge decks on a 5-year cycle. This value will be reported by the Office of Bridges and Structures on a District basis at the end of each calendar year.
  - Replace at least 95 percent of the poured joints on an 8-year cycle. This value will be reported by the Office of Bridges and Structures on a District basis at the end of each calendar year.
  - Repair at least 95 percent (by linear feet) of the strip seals and modular joints in Good condition each year. This value will be reported by the Office of Bridges and Structures on a District basis at the end of each calendar year.
  - Establish performance measures and targets for preventive bridge painting, including spot-, zone-, and element-level painting.
- Traffic Signals
  - Establish targets once one or two reporting cycles have been completed.
  - Perform an annual operational check on each signal system and report percent checked on a District basis at the end of each calendar year.
  - Perform an electrical check on each signal system every other year and report the percent checked on a District basis at the end of each calendar year.
  - Perform a check on each signal's electronics system on a 3-year cycle and report the percent checked on a District basis at the end of each calendar year.
- High-Mast Light Towers
  - Establish targets once one or two reporting cycles have been completed.
  - Annually inspect and repair each lighting installation. The percent of operational light towers will be reported on a District basis at the end of each calendar year.

A workplan for completing these activities is provided in the following table.

Preventive Maintenance Recommendation 1 Workplan

Recommended Actions	Target Completion Date	Estimated Level of Effort (Low, Medium, High)	Suggested Responsible Party	Dependencies To Other Actions
Initial Outreach	Completed	Medium	WG 3	
CHIP/STIP Guidance	Completed		Ronda Allis	
Planning	Completed		Ronda Allis	
Materials Engineers	Completed		Glenn Engstrom	
PCMG/CMG	Completed		Greg Paulson	
Bridge	Completed		Dave Solsrud	
Operations Division	Completed		Dave Solsrud	
Maintenance (MBMT)	Completed		Dave Solsrud	
Coordinate with PRIA on Policy AD006 (MnDOT's policy on the adoption of performance measures and targets)	Completed	Low	Dave Solsrud & Glenn Engstrom	
Form a technical team with one member from each technical area, and one member from the Performance, Risk, and Investment Analysis Unit to develop a strategy to present recommendations to the Management Group and revise recommendations as needed.	3Q 2021	Low	Dave Solsrud	

Recommendation 2

Formalize preventive maintenance planning.

The intent behind the second recommendation is to ensure that agency decisionmakers understand the benefits associated with preventive maintenance and are following processes that maximize long-term performance, extend service life, and minimize life-cycle costs. The steps outlined in this recommendation create a mechanism to plan preventive maintenance activities more formally as part of the MnSHIP and STIP development processes. The steps involved in developing this mechanism are described below.

1. Establish planned investment levels based on management system (e.g., pavement management system and bridge management system) outputs and the measures including in Recommendation #1.

2. Enhance the *Pavement Investment Evaluator* to include preventive maintenance treatments to support Districts in developing balanced paving programs.

3. Consider preventive maintenance projects in the tradeoff decisions that normally take place as part of the STIP development.

4. Program a sufficient level of preventive maintenance projects into the STIP and through maintenance work planning (TAMS) at the District level to achieve annual goals.

    a. This may require a modification to project scoping procedures to include preventive maintenance projects with a simplified scoping packet that includes work type and budget, but not necessarily specific locations, and may refer to another document such as a work order.

    b. In the year prior to planned work, the preventive maintenance projects with a simplified scoping packet will be reprogrammed as fully-scoped projects by the District.

5. Estimate the value of programmed work and needed accomplishments by the management systems (pavement and bridge management systems).

6. Report on programmed and delivered preventive maintenance funding and accomplishments during District check-in meetings.

Recommendation 3

Develop a common web-portal for preventive maintenance guidance.

Guidance on the selection, design, and application of preventive maintenance treatments has already been developed for several assets, including pavements and bridges. However, this information is not organized or easily accessible. The following actions are suggested to support the use of preventive maintenance and the implementation of the two previous recommendations.

1. Develop a web portal on the MnDOT intranet to organize, house, and disseminate guidance and other information on preventive maintenance, including the following:

    a. Current relevant policies.

    b. Current relevant guidance.

    c. A preventive maintenance dashboard that reports on the needed, planned, and actual preventive maintenance investments and accomplishments for each District, using the structure established in the earlier recommendations.

    d. Links to, or instructions to access, relevant data sources such as TAMS, Georilla, the TAMP, MnSHIP, TIPs, and the STIP.

    e. Project development resources, such as special provisions, estimating tools, and so on.

2. Charge the Asset Management Steering Committee and the MBMT with the responsibility to identify gaps in existing guidance or information and the authority to collaborate with appropriate business units to address those gaps.

3. Update the portal at least quarterly with the most recent policies, guidance, and other information.

A workplan for completing the activities associated with Recommendations 2 and 3 is provided in the following table.

Preventive Maintenance Workplan For Recommendations 2 and 3.

Recommended Actions	Target Completion Date	Estimated Level of Effort (Low, Medium, High)	Suggested Responsible Party	Dependencies To Other Actions
Assemble an implementation team	4Q 2021	Low	Dave Solsrud & Patrick Weidemann	
Develop PMS report on PM needs and candidates	1Q 2022	Low	Dave Janisch's Successor	Assume this exists but needs to be formalized
Develop BMS report on PM needs and candidates	1Q 2022	Medium	Sarah Sondag	Assume this exists but needs to be formalized
Develop report on signals needs	1Q 2022	Medium	Steve Misgen	Assume this exists but needs to be formalized
Develop report on high-mast lighting needs	1Q 2022	Medium	Steve Misgen	Assume this exists but needs to be formalized
Draft instructions on scoping PM projects if not already available	1Q 2022	Low/medium	Office of Project Management and Technical Support (OPMTS)	Determine whether this already exists
Review instructions on scoping PM projects	2Q 2022	Low	OPMTS	
Finalize and distribute instructions on scoping PM projects	3Q 2022	Medium	OPMTS	
Establish reporting protocols for pavement PM accomplishments	Completed	Medium	Dave Solsrud	Already established
Establish reporting protocols for bridge PM accomplishments	Completed	Medium	Sarah Sondag	Already exists
Establish reporting protocols for signals PM accomplishments	1Q 2022	Medium	Steve Misgen	
Establish reporting protocols for high-mast lighting PM accomplishments	1Q 2022	Medium	Steve Misgen	
Develop reports (map and tabular) for PM needs v. planned v. accomplished	2Q 2022	Medium	Specialty Offices and AMPO	
Develop instructions to Districts for including PM reports in check-in meetings	2Q 2022	Low	OPMTS	
Add needs reports to annual Investment Guidance	3Q 2022	Medium	OPMTS	

Recommended Actions	Target Completion Date	Estimated Level of Effort (Low, Medium, High)	Suggested Responsible Party	Dependencies To Other Actions
Develop a strategy for using the Communications Portal developed under the Communication Action Plan to promote and advance the use of PM treatments.	4Q 2022	Medium	PM Work Group	

Communication Action Plan

The Work Group's efforts to identify target audiences and information categories led to the development of the recommendations included in this action plan. This plan provides specifics outlining the type of information needed by each of the audiences identified and prioritizes an approach for preparing the information. Additionally, the action plan describes the need for a centralized location for storing presentations, flyers, and other educational and promotional materials to be shared or modified, depending on the specific need.

To assist AMPO in addressing the messaging needs at all levels of the organization, a staged implementation process was introduced earlier that starts at the top of the communication pyramid and evolves to meet the needs at each level of the pyramid. This approach helps ensure that as resources are being implemented for one audience, resources are being developed for the next stage based on lessons learned. This allows resources to be developed as the plan is implemented and should result in a collection of useful materials that can be used or modified to satisfy the needs at each level of the organization.

With the staging approach as the model, the following implementation actions are recommended.

Recommendation 1

Communicate roles and develop initial resources

Completion Target: September 30, 2021

Under this action item, AMPO will complete the following activities:

- Add any additional communication needs generated by the work groups to the messaging needs introduced earlier.
- Confirm membership in an on-going Communication Work Group to provide AMPO feedback during the rollout of the communication plan.
- Prepare initial materials to serve as the basis for the communication rollout.
- Include general information about what asset management is and why it is important to MnDOT.
- Provide examples showing how TAMS has benefited MnDOT.
- Establish a central, shared portal for posting communications materials.
- Present the communication plan to the Senior Leadership Team and obtain feedback on sample materials.
- Revise materials based on the feedback received.
- Work with the Senior Leadership Team to provide information to share with the Executive Leadership Team describing the planned activities.

Recommendation 2

Initiate District rollout

Completion Target: December 31, 2021

Under this action item, AMPO will complete the following activities:

- Develop materials targeted to Districts focused on the importance of TAMS data to decision making.
  - Customize examples used to each District for relevance.
  - Include a variety of formats for presenting the information, including PowerPoints, handouts, posters, how-to training, and a short video.
- Review and finalize the materials with the assistance of the Communication Work Group.
- Post the final materials on the shared portal.
- Meet with District Management to explain the communication objectives, present the materials available to support these efforts, and explain how to access the information on the portal.
- Working with each District, establish a plan for sharing available information with District personnel and identifying other communication needs.

Recommendation 3

Initiate Central Office rollout

Completion Target: March 2022

Under this action item, AMPO will:

- Meet with Central Office Management personnel to explain the communication objectives, present the materials available to support these efforts, and explain how to access the information on the portal. Seek ideas for additional materials needed to support Central Office functions.
- Develop additional communication materials in collaboration with the Communication Work Group to address the needs identified by District and Central Office Management.
- Share the additional information developed with District and Central Office Management.

Recommendation 4

Initiate the MnSHIP and TAMP rollout

Completion Target: December 2022

Under this action item, AMPO will:

- Work with the MnSHIP and TAMP PMTs to identify specific communication topics that need to be shared with various audiences specified in the communication plan.
- Develop the suggested materials in collaboration with the Communication Work Group and the PMT members.
- Develop a plan for distributing the materials to the appropriate audiences using formats suggested in this document.
- Communicate the roles and responsibilities for rolling out the MnSHIP and TAMP materials to the appropriate audiences.
- Monitor the activities specified in the rollout plan and provide needed support when appropriate.
- Assess the success of the rollout and make any necessary adjustments.

Recommendation 5

Conduct on-going communication efforts

Completion Target: December 2025

Under this action item, AMPO will:

- Monitor District and Central Office management activities to promote asset management and provide support where appropriate.
- Present results to the Executive and Senior Leadership Teams to maintain on-going support for asset management efforts.
- Annually review the success of the communication plan and make needed adjustments to address specific issues that arise.
- Continue to develop and share communication materials to support the use of asset management.
- Update the shared portal with current examples that illustrate the benefits provided by TAMS and other uses of asset management at MnDOT. Coordinate these efforts with the activities suggested in the Pavement Preservation Action Plan Recommendation #3

TAMP Implementation Action Plan

The TAMP Work Group's recommendations arose from its focus on the following three objectives:

- Improving the consideration of life-cycle management techniques in MnDOT's plans and programs.
- Improving the TAMP's usefulness to a wider audience at MnDOT.
- Better coordinating and understanding interrelationships and dependences between MnSHIP and the TAMP.

To accomplish these objectives, five recommendations, each with specific action items, are suggested.

Recommendation 1

Implement a process for adding assets to the TAMP based on the asset tiers developed by Work Group 1.

The TAMP Work Group recommends using the tiers established in the new asset matrix to prioritize the order in which assets are added to future TAMPs. For the 2022 TAMP, it was suggested that all remaining Tier 1 assets be added (i.e., winter plow routes and ARMER radio systems) as well as pedestrian and bike bridges from Tier 2 since they are expected to be included in the upcoming MnSHIP revisions. However, after evaluating the resources available to support the 2022 TAMP development, a recommendation was made to the AMSC to retain the assets that were included in the 2019 TAMP in the update and to reconsider adding additional assets in the 2026 TAMP. The group considered reducing the number of assets in the TAMP to only those required by FHWA (i.e., pavements and bridges), but decided against that option because they found value in having one document with all of the asset data in one place.

For assets that will not be included in the 2022 TAMP, and others that have asset data available statewide, the Work Group recommends establishing a priority for developing electronic Asset Folios that summarize (by District) what is known about the asset inventory, management strategy, and funding needs.

The specific action items related to this recommendation are provided in the following table.

Recommended Action	Target Completion Date	Estimated Level of Effort (L, M, H)	Responsible Party
A. Based on the asset tiers developed by Work Group #1, and input from the TAMP Advisory Group, develop and implement a recommendation for specific assets to be included in the 2022 TAMP that is subject to approval by Asset Management Steering Committee (AMSC).	Completed	L	TAMP Project Management Team (PMT)

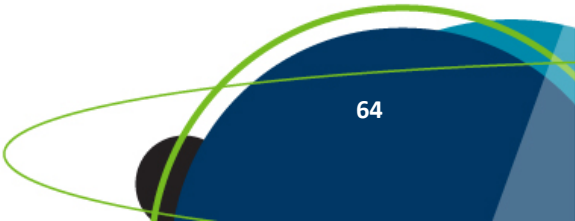| Recommended Action	Target Completion Date	Estimated Level of Effort (L, M, H)	Responsible Party
B. Prioritize assets not included in the 2022 TAMP for the development of Asset Folios for approval by AMSC.	3Q 2021	L	Asset Management Project Office (AMPO)
C. Develop a minimum of 5 online Asset Folios per year, beginning in Fall 2022.	5 annually beginning in 2022	L	TAMP PMT
D. Repeat the process for seeking approval of any additional assets to be added to the 2026 TAMP, focusing on any remaining Tier 1 assets and Tier 2 assets.	3Q 2024	L	TAMP Advisory Group
E. Repeat the process on a 4-year cycle that corresponds to required TAMP updates.	Every 4 years	L	TAMP Advisory Group

Recommendation 2

Identify and implement changes to the TAMP format that will improve its functionality within MnDOT.

The federally-compliant TAMP that MnDOT prepares every 4 years must meet certain minimum requirements that impact its layout and content. However, the current organization of the document by function rather than asset makes it time-consuming for MnDOT users to obtain a complete picture for any individual asset. Additionally, the print version of the document does not lend itself to searching and periodic updating. The Work Group concluded that there are several practical, low-cost changes that could be implemented to help make the TAMP content more useful to District and Central Office staff. This recommendation suggests making these changes in conjunction with the 2022 TAMP update.

The specific action items related to this recommendation are presented in the following table.

Recommended Action	Target Completion Date	Estimated Level of Effort (L, M, H)	Responsible Party
A. Review the Work Group's suggestions for practical changes to improve the functionality of the TAMP, such as making a searchable HTML format or online dashboard; organizing information by asset, corridor, or district; shortening the document, or providing visualization features displaying targeted versus expected conditions, performance goals, and funding gaps. Identify those changes that will be adopted.	3Q 2021	L	TAMP Advisory Group
B. In conjunction with the TAMP update, implement the suggested changes	3Q 2022	M	TAMP Advisory Group

Recommended Action	Target Completion Date	Estimated Level of Effort (L, M, H)	Responsible Party
C. Better define roles and responsibilities for the action items included in the TAMP.	3Q 2023	L	TAMP PMT
D. At least every two years, review the TAMP format and content to ensure it stays relevant.	1Q 2024	L	TAMP Advisory Group

Recommendation 3

Evaluate the current method of incorporating pavement and bridge maintenance and operations costs in MnSHIP for suitability in the 2022 TAMP and make necessary adjustments. Refine the method of estimating maintenance and operations costs for other assets in the 2022 TAMP using TAMS.
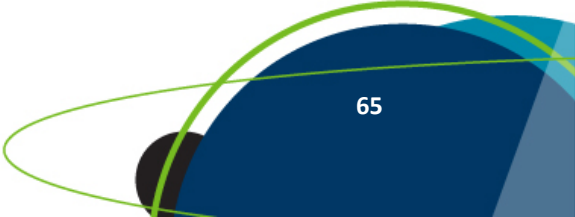
MnSHIP provides a 20-year, fiscally-constrained plan for making investments on the state highway network. It does not identify specific projects, but directs investments based on alternate revenue and investment scenarios that are evaluated based on input from both internal and external stakeholders. The TAMP provides a 10-year investment plan focused on the preservation of transportation assets, which is a subset of investments considered in MnSHIP. Both plans are currently in the process of being updated.

The 2017 MnSHIP included initial steps to consider the impact of underinvesting in pavement and bridge capital investments on operations and maintenance budgets. The results reflected reasonable trends (e.g., as capital investment increased, estimated maintenance needs decreased), but with bridges, the magnitude of the capital costs dwarfed the maintenance needs and the differences in estimated maintenance costs between different scenarios were negligible. The analysis results also noted that as systemwide conditions deteriorate, there is less opportunity to apply PM and MnDOT does not have a good way to predict the increased need for reactionary maintenance as conditions deteriorate. Maintenance needs for assets other than pavements and bridges were reflected in a Roadside Infrastructure investment category to capture the total cost of ownership for those assets.

Now that TAMS is being implemented and better maintenance cost information is becoming available, a pilot study has been conducted to evaluate the impact of new cost data on pavement management needs using the 2017 analysis approach. That study is currently underway; however, the results will be helpful in determining whether the methodology is reasonable for planning purposes.

To better align the consideration of maintenance and operations costs in the TAMP with MnSHIP, the Work Group recommends that the results from the pilot study be evaluated to determine the suitability of the current approach to estimate maintenance costs in MnSHIP. Further, the Work Group recommends that maintenance and operations cost data in TAMS, plus the suggested maintenance approaches in the new Asset Matrix, be considered inputs for estimated maintenance and operations costs for the additional assets included in the 2022 TAMP and the Roadside Infrastructure Investment included in MnSHIP.

The specific action items related to this recommendation are presented in the following table.

Recommended Action	Target Completion Date	Estimated Level of Effort (L, M, H)	Responsible Party
A. Using the communications framework developed by Work Group #4, communicate the results from the pilot study to the appropriate parties to share estimated pavement maintenance and operations costs using new TAMS data.	3Q 2021	M	MnSHIP PMT AMPO
B. Explore expanding this analysis to assets beyond pavements and bridges that are expected to be included in the 2022 TAMP. Consider the availability of necessary information, the level of investment in maintenance, and the return on investment.	4Q 2021	M	MnSHIP PMT TAMP PMT AMPO
C. Using the methodology, estimate maintenance needs for the investment scenarios being considered in MnSHIP and in the TAMP. Use estimated revenue and investment scenarios to establish planned maintenance investments and unmet maintenance needs.	1Q 2022	H	MnSHIP PMT TAMP PMT AMPO
D. Assess the 2022 TAMP's success at accounting for the sensitivity of maintenance to capital investments. Identify any further changes that are needed to better address this issue.	4Q 2022	M	TAMP PMT MnSHIP PMT AMPO
E. Work with AMPO to develop an approach for better communicating how future maintenance needs are impacted by capital investment.	2Q 2023	L	TAMP PMT AMPO
F. Develop more standardized life-cycle cost analysis approaches for assets expected to be included in the 2026 TAMP.	2Q 2024	H	TAMP PMT AMPO
G. Establish optimized investment strategies for each asset included in the 2026 TAMP and incorporate them into a future MnSHIP.	2Q 2025	M	TAMP PMT AMPO
H. Evaluate the impact of using the total cost of ownership to distribute maintenance funding to the Districts based on unfunded maintenance needs and assist with project prioritization using TAMP results.	4Q 2025	M	AMPO Office of Maintenance

Recommendation 4

Develop and distribute messaging to promote TAMP implementation in accordance with the communication framework developed by Work Group 4.

Each year, MnDOT undergoes a consistency determination by the FHWA to verify that investments on the National Highway System (NHS) reflect planned investments in the TAMP. A key to ensuring a match
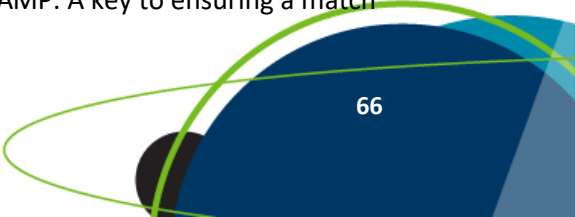
between planned investments and projects included in the STIP (State Transportation Improvement Program) and CHIP (Capital Highway Investment Program) is awareness. Another key is understanding the importance of planned investments that promote life cycle strategies. This recommendation involves the distribution of communication pieces to promote the TAMP content using the Communication Framework developed by Work Group #4.

The specific action items related to this recommendation are described in the following table.

| Recommended Action	Target Completion Date	Estimated Level of Effort (L, M, H)	Responsible Party
A. Prepare and distribute communication materials for the Districts that convey the importance of life cycle strategies and the consequences of delayed maintenance or complaint-driven maintenance on system performance.	Initial materials completed, but on-going development is needed	L	AMPO
B. Using the framework developed by WG #4 (Communication), develop and distribute messaging promoting the implementation of the 2022 TAMP, including annual commitments for maintenance and capital expenditures by District and expected targets.	4Q 2022	L	AMPO

Recommendation 5

Implement efforts to guide the scoping process to help ensure that planned TAMP investment strategies are reflected in the STIP and CHIP.

Since the TAMP investments are designed to consider a whole life approach to asset management, a strong alignment between planned investment strategies and funded projects helps ensure that asset life-cycle cost considerations are being implemented. Project changes that occur during the project scoping process influence the work that can be funded due to increased project costs that reflect additional activities added to a project scope. The Work Group recommends the following actions to help guide and support District decisions during the scoping process so that the program better aligns with the TAMP and MnSHIP performance expectations.

The specific action items related to this recommendation are presented in the following table.

Recommended Action	Target Completion Date	Estimated Level of Effort (L, M, H)	Responsible Party
A. Convene a team that includes District personnel to identify and prioritize the factors identified by Work Group #3 (Preservation) that influence the scoping process.	2Q 2022	L	TAMP PMT, MnSHIP PMT

Recommended Action	Target Completion Date	Estimated Level of Effort (L, M, H)	Responsible Party
B. For the highest-priority factors identified, develop strategies and identify potential tools (such as Geographic Information System interfaces) to better coordinate long-range project planning with design, scoping, and trade-off decisions that Districts make (e.g., use of project charters or the current Scoping and Project Improvement Process, asset prioritization).	1Q 2023	H	TAMP PMT, MnSHIP PMT, AMPO
C. Present the recommendations to the Senior Leadership Team for approval and make any needed changes prior to implementation.	2Q 2023	M	TAMP Advisory Group MnSHIP Team MnDOT Planning and Programming
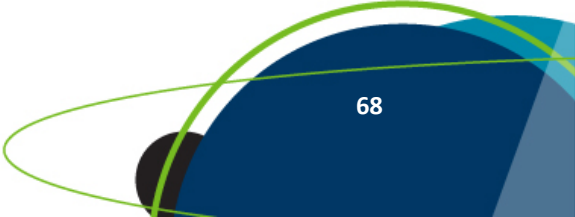
Organizational Action Plan

In addition to the focus areas addressed by the five work groups, the activities associated with developing the Asset Management vision identified several broader organizational issues that are important considerations for the successful implementation of asset management. These issues explore strategic approaches to aligning organizational resources to support asset management and the corresponding roles and responsibilities that need to be defined. Specifically, these needs relate to Strategic Objective 3: Integrate asset management into MnDOT's culture through effective communication and a workforce with the skills needed to successfully fulfill their asset management duties and responsibilities. In addition, they provide an organizational framework that supports leadership's commitment to broad agency action in support of performance-based investment decisions based on quality data and analysis tools.

To accomplish this objective, two recommendations, each with specific action items, are suggested.

Recommendation 1

Ensure organizational structures are in place that institutionalize Asset Management at MnDOT, lead the implementation of AMSIP recommendations, and ensure adherence to federal and state requirements and controls.

As the AMSIP demonstrates, MnDOT is ready to advance the effectiveness of its transportation system investments, with an emphasis on proactive strategies that reduce life cycle costs. In addition, the strategic objectives included in this document place a priority on institutionalizing asset management at MnDOT, so it becomes the way business is done. Success in this area relies on a focused, on-going communication strategy and a workforce with the knowledge and skills needed to fulfill their asset management duties and responsibilities.

Asset management is cross-functional in nature and dependent on the alignment of decisions across business units and stakeholders. The current MnDOT organizational structure includes the Asset Management Project Office (AMPO), which provides leadership, guidance, and expertise in asset management principles and practice. One of AMPO's primary responsibilities is the implementation of the Transportation Asset Management System (TAMS), a computerized system for storing data on most highway assets other than pavements and bridges. The TAMS implementation has led to numerous workflow and business process improvements to enhance the use of data to support MnDOT's performance-based investment decisions.

In addition to AMPO, an Asset Management Steering Committee oversees the development, update, and monitoring of the enhancements outlined in the TAMP and ensures that asset management principles are embraced at all levels of the agency so that strategic performance outcomes are met. The Asset Management Steering Committee is cross-functional, with representatives from Modal Planning and Program Management, Operations, and Engineering Services.

With this increased focus on asset management's implementation at MnDOT, it is an appropriate time to evaluate changes to the organizational structure to institutionalize leadership's commitment to asset management maturity, lead the implementation of the AMSIP, and address federal and state requirements and controls.

There are several matters that should be considered during this analysis, including the areas noted below.

INSTITUTIONALIZING ASSET MANAGEMENT

- MnDOT's asset management vision encompasses a comprehensive approach that considers all maintenance, operational, and capital needs. This cross-functional approach currently relies heavily on key individuals in positions that can turn this vision into reality. The long-term viability of this approach should be explored.

- The management of transportation agencies is always evolving in response to changes in technology, construction practices, the use of technology, and system demands. This benefits from a focused commitment on the part of asset management staff to stay abreast of these changes and guide the agency's implementation of adaptation strategies.

- Asset management relies on the availability of a trained workforce with the knowledge and skills needed to fulfill their asset management duties and responsibilities. There is currently no entity with the responsibility and authority to address this need.

- MnDOT relies on the strategic implementation of technology to support its data collection and analysis activities. There may be advantages to having a centralized body focused on how to best leverage technology to achieve the Department strategic initiatives.

ADHERENCE TO REGULATIONS

- Responsibility for adherence to state- and federally-mandated requirements for asset management should be clearly defined. For instance, it would benefit MnDOT to have a centralized "owner" for legislated mandates to monitor the agency's responses to ensure compliance.

- The federal legislation that requires a TAMP to be updated at least every four years identifies planned investments over a 10-year period. Each year, MnDOT submits a consistency determination to FHWA to show that actual investments are consistent with those identified in the TAMP. In the current structure, there is no clear line of responsibility if annual work plans vary from what is included in the TAMP.

AMSIP IMPLEMENTATION

- The recommendations in the Asset Data Action Plan identify strategies for collecting and maintaining asset inventories and inspections for most highway assets. With this increased focus on asset data, there is a corresponding need for a centralized data governance body that addresses data coverage, quality, and consistency on a statewide basis.

- The Life Cycle Strategy Action Plan recommends the establishment of performance measures and an accountability system for tracking annual preventive maintenance goals and accomplishments that support the preferred life cycle strategy. While AMPO can monitor annual expenditures for preventive maintenance, it does not have the authority to ensure that preventive maintenance work is a priority at the District levels.

- The Communication Action Plan included in this document places significant responsibility on District Managers to promote asset management among District personnel. However, there is a need for a centralized body to develop the messaging materials that are needed to support these efforts as well as on-going outreach to keep the messaging at the forefront.

The specific action items related to this recommendation are provided in the following table.

Recommended Action	Target Completion Date	Estimated Level of Effort (L, M, H)	Responsible Party
A. Assess the need to modify responsibilities for Asset Management at MnDOT based on the recommendations that emerged during the development of the AMSIP.	4Q 2021	L	Modal Planning & Program Management (MPPM) Leadership
B. Present the recommendations to the Chief Engineer.	2Q 2022	L	MPPM Leadership
D. Implement the recommendations following the approval of the Chief Engineer.	4Q 2022	L	AMSC

Recommendation 2

Define the roles and responsibilities for Asset Management in Districts and specialty offices, including planning and programming.

The Districts have a significant level of responsibility for the implementation of asset management at MnDOT, including data collection, analysis, and work planning for ancillary assets (e.g., high mast tower lighting, drainage facilities, and signs). Additional responsibilities are placed on the specialty offices (e.g., Materials and Road Research) and the Office of Transportation System Management (OTSM). The specialty offices are responsible for collecting and analyzing asset data for pavements and bridges while OTSM leads the programming efforts required for the development of the STIP and CHIP. As the implementation of TAMS has progressed, these responsibilities have increased in their importance to ensuring assets are managed as effectively as possible; however, the roles and responsibilities in support of asset management are not well defined or understood. Under this recommendation, these roles and responsibilities will be defined and communicated with the affected personnel.

The specific action items related to this recommendation are presented in the following table.

Recommended Action	Target Completion Date	Estimated Level of Effort (L, M, H)	Responsible Party
A. Establish the Framework			
A1. Create an Asset Management Roles & Responsibilities (AMRR) Work Group comprised of District and Central Office personnel to develop asset management roles and responsibilities for the agency.	4Q 2021	L	AMPO

Recommended Action	Target Completion Date	Estimated Level of Effort (L, M, H)	Responsible Party
A2. Develop a framework for defining roles and responsibilities at the asset level. Establish priorities for defining roles and responsibilities at MnDOT.	1Q 2022	L	AMRR Work Group
B. Address the Highest-Priorities			
B1. Define roles and responsibilities for the highest priority items identified in the framework.	1Q 2022	M	AMRR Work Group
B2. Present the highest-priority roles and responsibilities to AMPO to obtain feedback. Revise as appropriate based on the feedback provided.	2Q 2022	L	AMRR Work Group
B3. Roll out the roles and responsibilities in accordance with the framework developed by the Communication Work Group.	2Q 2022	M	AMPO
C. Address Remaining Priorities			
C1. Define roles and responsibilities for the remaining priority items identified in the framework. Establish a schedule for their development and roll out.	3Q 2022	M	AMRR Work Group
C2. Present the roles and responsibilities to AMPO to obtain feedback. Revise as appropriate based on the feedback provided.	3Q 2022	L	AMRR Work Group
C3. Roll out the roles and responsibilities in accordance with the framework developed by the Communication Work Group.	4Q 2022	M	AMPO
D. Evaluate and Adjust as Necessary			
D1. Evaluate the impact of the outreach activities and adjust as needed.	4Q 2022	L	AMPO

Closing

The action plans included in this AMSIP address the four elements critical to any asset management implementation: data, systems, people, and processes. As shown in the figure below, these four pillars provide the foundation for MnDOT's transportation asset management implementation. As MnDOT advances the implementation activities outlined in this Plan and extends the knowledge and understanding of asset management in the agency, it will deliver on the 5-year asset management vision and ultimately support the agency's vision of delivering mobility, safety, public health, environmental sustainability, and a prosperous economy through a strong, effectively-managed transportation system.