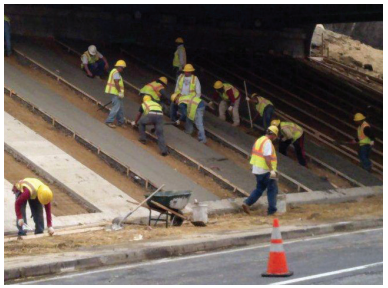
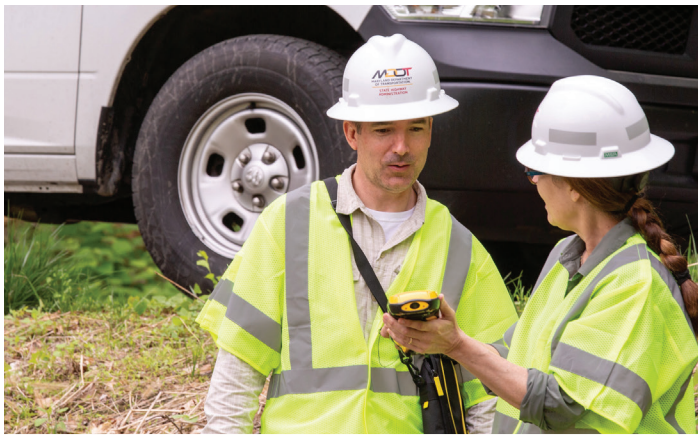
MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION





ASSET MANAGEMENT

JANUARY **2021**

Message from

MDOT SHA ADMINISTRATOR **TIM SMITH**

TIM
SMITH

The Maryland Department of Transportation State Highway Administration (MDOT SHA) is responsible for maintaining and improving a major portion of Maryland's transportation infrastructure. Every day, our employees strive to keep the State's transportation assets operating at peak performance. We need to evaluate the organizational structure and business processes used to build and maintain our infrastructure and re-imagine them through an asset management lens. This will allow us to achieve greater levels of collaboration and resource sharing, and enable us to continue to maintain our assets and optimize their performance.

Team MDOT SHA is working together to develop and integrate asset management best practices as we prioritize the needs of our organization across offices and build a culture of teamwork that empowers us to be even better stewards of our State's resources. Asset management is a long-term commitment, and our team is committed to embracing proactive strategies that employ data-driven decisions, apply lifecycle cost analysis, and deliver prioritized investment decisions to cost-effectively meet our service-level goals and commitments.

At MDOT SHA, we implement asset management based on a common set of principles: managing risk; prioritizing critical assets; making data-driven decisions; and providing the tools, systems, and resources required to deliver on our performance goals.

We are excited to tell the story of our infrastructure and provide an update on our asset management plans and program. We hope you find the information informative and reflective of our commitment to the customers we serve.

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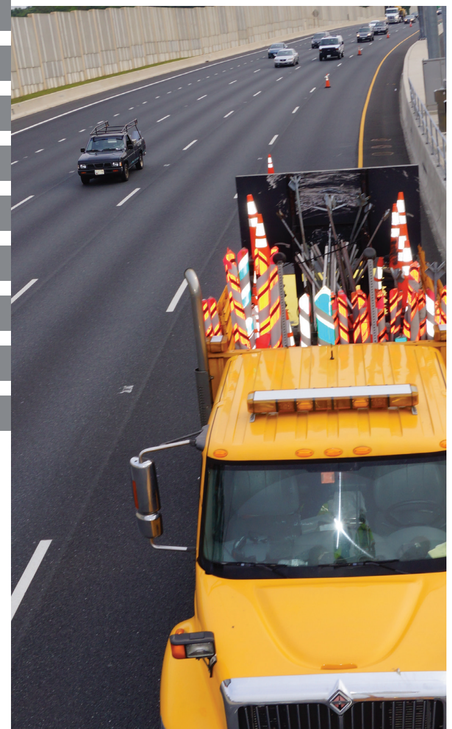
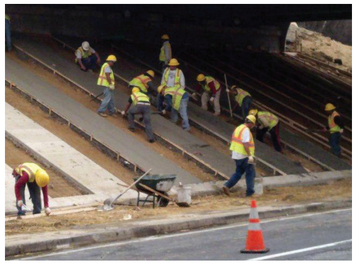




1 INTRODUCTION

The Maryland Department of Transportation State Highway Administration (MDOT SHA) is committed to asset management as a process of ongoing improvement. Asset lifecycle managers use best practice principles to enhance work practices and lifecycle decisions. These efforts are critical to meeting our service goals and delivering safe, reliable, and efficient infrastructure.

We are guided by an MDOT asset management vision and employ tactical maintenance strategies with a goal of achieving and maintaining a State of Good Repair (SGR) for all our assets. Using a risk-based management framework, SGR is prioritized for the critical assets first.

What Is Asset Management?

Asset management is considered an integrated set of processes to minimize the lifecycle costs of infrastructure assets, at an acceptable level of risk, while continuously delivering established levels of service. Asset management is a holistic approach that balances costs, opportunities, and risks against the desired performance of assets.

ASSET MANAGEMENT TECHNIQUES CAN BE APPLIED AT EVERY PHASE OF THE LIFECYCLE

MDOT SHA strives to go beyond basic compliance by applying industry-leading practices to drive better decisions and enhanced performance outcomes. In simple terms, asset management allows us to understand our assets; their condition; and the maintenance, preservation, and capital work programs required to achieve and maintain our desired performance.

MDOT SHA uses all available information to project how our most critical assets will perform, understand how they are likely to deteriorate, and to inform optimized investment decisions to maintain assets.

ASSET MANAGEMENT IS ABOUT DOING THE RIGHT AMOUNT OF WORK, AT THE RIGHT TIME, TO DELIVER THE RIGHT SERVICE LEVEL, AT THE RIGHT COST FOR THE MOST BENEFIT

2 MDOT SHA ASSET PORTFOLIO

MDOT SHA owns and maintains more than 75 types of transportation assets across 14 critical asset classes with a total replacement value of more than $39 billion. Our program is continually evaluating and prioritizing asset needs based on age, condition, criticality, and risk.

14 Critical Asset Classes

- **TRAFFIC CONTROL DEVICES** (SIGNALS)*
- **INTELLIGENT TRANSPORTATION SYSTEMS** (ITS)*
- **PAVEMENT MARKINGS***
- **LIGHTING***
- **BIKE AND PEDESTRIAN***
- **TRAFFIC BARRIERS***

**Additional asset classes included in the State of Good Repair (SGR) funding needs presented in Section 9 Capital Renewal Plan, Funding, and Gap.*

State of the Infrastructure Snapshot

PAVEMENT MILES
- $30,000M ESTIMATED REPLACEMENT VALUE
- 55 YEARS Average age
- 17,500+ Lane miles including interstate, major collector,ramps, etc.

BRIDGE STRUCTURES
- $5,190M ESTIMATED REPLACEMENT VALUE
- 15 YEARS Average age
- 2,550+ Including bridges, small structures, etc.

DRAINAGE
- $1,500M ESTIMATED REPLACEMENT VALUE
- 15 YEARS Average age
- 205,000+ Including ditches, pipes, dams, SWM facilities, etc.

FACILITIES
- $962M ESTIMATED REPLACEMENT VALUE
- 35 YEARS Average age
- 730+ Including district offices, maintenance facilities, rest areas, etc.

NOISE BARRIERS
- $725M ESTIMATED REPLACEMENT VALUE
- 19 YEARS Average age
- 270+ Including concrete, Timber, ground mounted, etc.

SIGN STRUCTURES
- $287M ESTIMATED REPLACEMENT VALUE
- 28 YEARS Average age
- 2,400+ Including cantilever, overhead, bridge-mounted , etc.

FLEET
- $239M ESTIMATED REPLACEMENT VALUE
- 6 YEARS Average age
- 2,400+ Including passenger, heavy trucks, construction, etc.

IT SYSTEMS
- $31M ESTIMATED REPLACEMENT VALUE
- 13 YEARS Average age
- 30+ Including finance, operations, customer systems, etc.

Estimated replacement values and key attributes are based on the latest inventory data available in 2020 and will be updated and refined periodically as additional information is available.

3 WHY ASSET MANAGEMENT?

We are responsible for maintaining and improving a major portion of Maryland's transportation infrastructure. Every day, our employees plan, operate, and maintain the State's transportation system and assets. To maintain our assets efficiently, we are re-imagining the organizational structures and business processes that drive system preservation.

The formalized MDOT SHA asset management program will improve delivery of a safe, reliable, and efficient transportation system. Directly aligning the asset management program with MDOT SHA operations and maintenance management supports enhanced lifecycle management of key assets. The asset management program will rely on data-driven and transparent business decisions about proactive and flexible maintenance strategies to achieve performance objectives. Asset management practices are mandated by U.S. Department of Transportation (USDOT) and Federal Highway Administration (FHWA) requirements, with additional guidance provided by the American Association of State Highway and Transportation Officials (AASHTO) and others.

THE ASSET MANAGEMENT PROGRAM SEEKS TO OPTIMIZE THE PERFORMANCE OF EACH ASSET FOR ITS COMPLETE LIFECYCLE FROM CONSTRUCTION TO REPLACEMENT OR REMOVAL

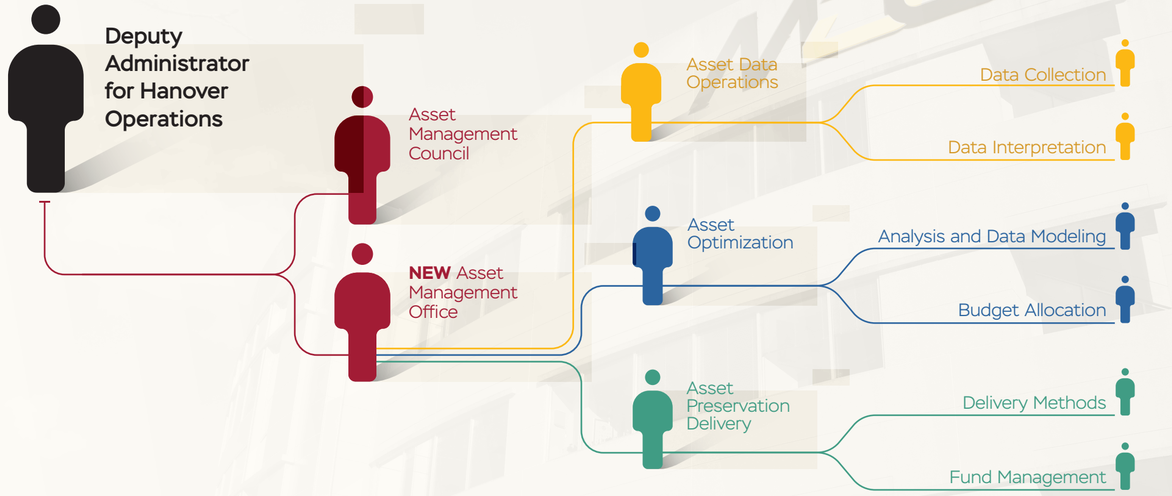
PROGRAM STRATEGIES	BENEFITS AND OUTCOMES
Improve data collection, interpretation, and analysis.	Better information that supports improved institutional knowledge and transparent decision making
Mature practices for all asset classes to prioritize proactive lifecycle planning and flexible maintenance and rehabilitation activities.	Efficient resource management and reduced lifecycle costs
Improve return on investments through centralized and performance-based fund management.	Enhanced fiscal management for safety, mobility, and system preservation needs
Define and adopt preservation, performance, and level of service goals	Risk-based decision making with multi-objective decision analysis
Facilitate cross-asset cooperation, coordination, and collaboration	Consistency of practice and improved efficiencies, communication, and transparency

Moving Forward

The MDOT SHA Asset Management Council (AMC) guides implementation of business practices for asset management and is chaired by the Deputy Administrator for Hanover Operations. The asset management program will be directed by the new Asset Management Office (AMO).

The AMO formalizes performance and risk management of all assets through data collection, interpretation, and modeling to maximize the return on investment (ROI) from the asset preservation project delivery. The centralized operational asset management program implements standards, improves systems and data, fosters collaboration, and strengthens institutional knowledge.

MDOT SHA ASSET MANAGEMENT OFFICE

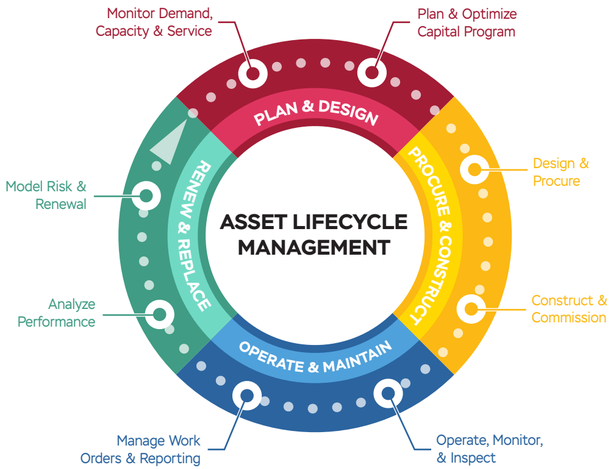


4 LIFECYCLE MANAGEMENT PLANNING

Our lifecycle management strategies are focused on formal inspection, maintenance, and renewal actions that result in long-term, cost-effective reliability. These practices are essential to fully understand the changing conditions of existing infrastructure and determine what is needed to maintain State of Good Repair (SGR) – both now and in the future.

Starting with MDOT critical asset classes, MDOT SHA uses sophisticated optimization modeling to develop a program of preventive and corrective maintenance treatments that optimize cost and sustain the useful life of our assets. Our approach incorporates important strategies at each phase of the asset lifecycle. During **planning and design**, consistent standards are used to ensure that materials and technologies comply with best practice, and during **procurement and construction** assets are proactively inspected during construction and before commissioning to ensure appropriate practices were applied. **Operations and maintenance** is the core of asset management activities including tracking of inspections, condition assessment, and preventive maintenance; while **renewal and replacement** strategies are used to extend the life of an asset through rehabilitation treatments until an asset is no longer cost effective to maintain and it is removed or replaced.

LIFECYCLE MANAGEMENT PHASES AND ACTIONS

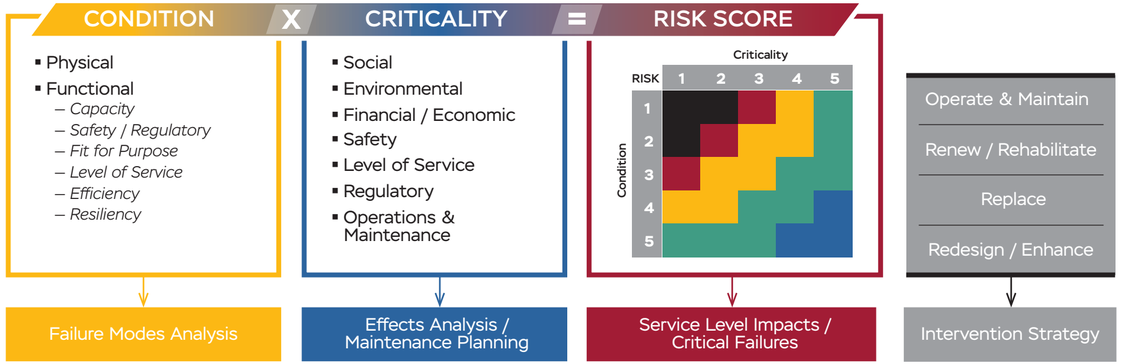


Understanding Our Risks and Prioritizing Needs

While we strive to ensure SGR across all our assets, understanding which ones are the most critical is important—both for assigning the appropriate maintenance strategy, and for helping to prioritize our dollars when funding levels are constrained.

Having a comprehensive understanding of the condition of our assets and their criticality to the system helps us to balance our needs across the asset portfolio and ensure cost-effective service to the public. Multi-tiered geospatial inventory tracking and comprehensive inspection programs provide foundational data needed to understand our SGR needs. Additionally, by defining criticality for all assets and implementing risk management approaches, we are better able to prioritize the greatest needs of our system and affect the largest impact and benefit.

MDOT SHA IS ACTIVELY IMPLEMENTING RISK-BASED APPROACHES THAT APPLY TRIPLE BOTTOM LINE (SOCIAL, ENVIRONMENTAL, AND FINANCIAL) CONSIDERATIONS TO DECISION MAKING



OUTCOMES

- **Proactive Maintenance and Risk Management**
- **Extended Service Life and Sustained Level of Service**
- **Maximized Reliability of Critical Assets**

5 GROWTH AND DEMAND

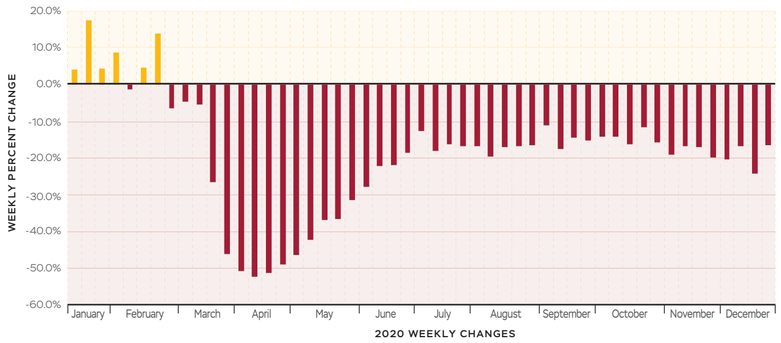
Managing transportation assets involves understanding the demands on the system from changes in the population, economy, travel patterns, mobility choices; and potential shocks and extreme events, like storms. Understanding long-term growth and demand forecasts is critical to planning and prioritizing our investment needs.

Asset management is the practice to understand how assets deteriorate, what are their expected lifecycles, and what risks affect the service life of assets. Aligning SGR objectives and strategies with preservation, enhancement, and expansion projects is a priority process improvement. Understanding factors of growth and demand for each asset class includes analysis and consideration for:

Land Use Development → **Population** → **Traffic Volumes** → **Regulations** → **Technology** → **Climate Change** → **Economic Shifts**

WEEKLY CHANGES AT PERMANENT COUNTERS FROM 2019 TO 2020

Impacts of COVID-19 to travel on Maryland's roads are a recent example of how changes in projected growth and demand directly impact performance, asset, and risk management decisions.



6 MANAGING RISK PROFILE

Managing for risk involves routine work to identify, monitor, and mitigate for all types of risks to the agency, programs, and assets to protect the value of investments.

Effective management of risks is critical to achieving our overall infrastructure goals and targeting appropriate resources towards the highest risks across the agency. MDOT SHA maintains a robust risk matrix to actively monitor, manage, and mitigate its highest risks through the asset management program. Risk-based planning allows asset managers to acknowledge, identify, assess, and prioritize risks that may impact performance. There are three main categories of risks to MDOT SHA:

- **Enterprise risks** include more systematic corporate, financial, and organizational risks—and can encompass diverse domains such as: climate change, operational resiliency, security, pandemics, and economic trends.
- **Program or project risks** apply most specifically to the capital and maintenance project portfolio and can include materials costs, construction and permitting uncertainties, and contractor and resource capabilities.
- **Asset and asset management risks** can be identified through asset condition and criticality assessment and addressed through appropriate intervention strategies. These include asset deterioration, material performance, rehabilitation techniques, failure modes, and data analysis accuracy.

MDOT SHA MANAGES A WIDE VARIETY OF RISKS, AT THE ASSET, SYSTEM, AND ORGANIZATIONAL LEVEL—FROM ONGOING ASSET DETERIORATION AND CONSTRUCTION COST VOLATILITY TO CATASTROPHIC EVENTS, CLIMATE CHANGE, AND REGULATORY COMPLIANCE

7 LEVEL OF SERVICE AND PERFORMANCE MANAGEMENT

A robust performance management and level of service (LOS) framework is a critical component of our asset management program and the business-focused decisions that tie investments to measurable outcomes.

PERFORMANCE MANAGEMENT AT MDOT SHA LINKS TO ASSET MANAGEMENT BY:

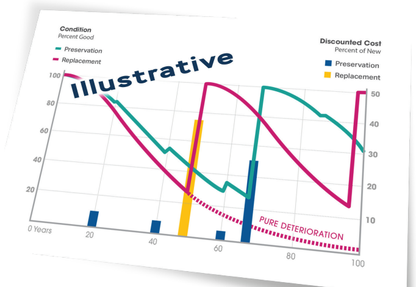
- ☑ Defining the asset management program in terms of specific and measurable outcomes.
- ☑ Measuring and evaluating progress towards defined performance targets.
- ☑ Adjusting treatment strategies to achieve targets and performance objectives

Clearly defined asset-specific LOS and performance targets encourage flexibility in the investment strategies to deliver a established outcome at the lowest practicable cost. This approach is currently used extensively for bridge and pavement preservation through advanced deterioration and lifecycle optimization models. For other assets such as fleet and facilities, MDOT SHA is applying useful life, condition, and maintenance history data to determine optimal replacement cycles that also help us to meet baseline condition and SGR targets. Establishing the right measures and targets is part of the natural plan, invest, evaluate, and adjust cycle that helps MDOT SHA deliver a safe, secure, and resilient transportation system with available resources.

ALIGNING MEASURES WITH GOALS

Enhancements for the Future

Empowered by improved collection and enhanced information systems, MDOT SHA is defining the right metrics needed to monitor and evaluate asset performance including tracking of defects and corrective maintenance activities, measuring asset reliability and downtime, and projecting our reinvestment/renewal rates.



8 INFORMATION SYSTEMS AND DATA

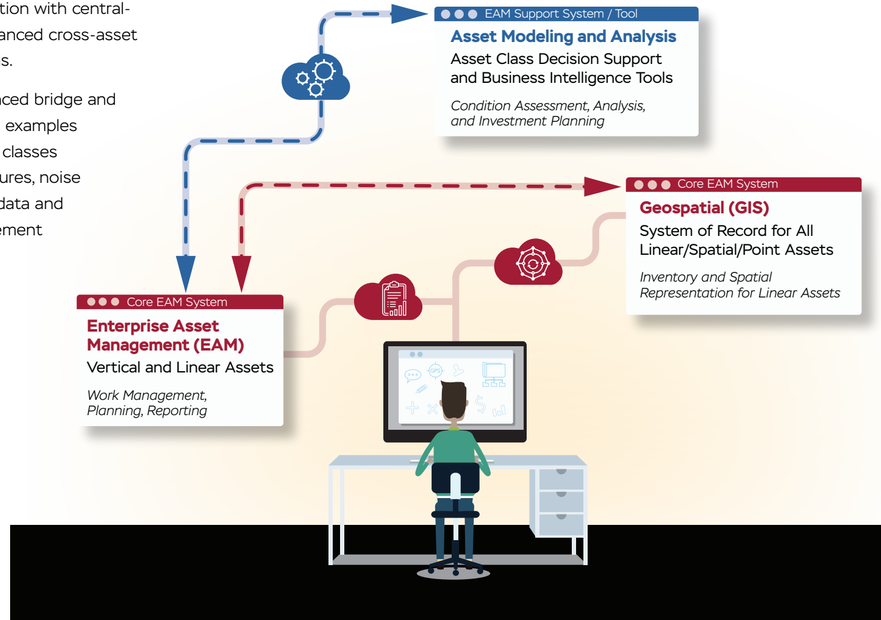
To meet the needs of a centralized asset management program, MDOT SHA relies on data collection tools, information management systems and software, and enterprise business systems – all creating a platform for inventory and condition tracking, deterioration modeling, lifecycle cost analysis, financial forecasting, and project prioritization.

Data Confidence and Future Vision

MDOT SHA is connecting field technology tools to capture condition and maintenance information with central-management systems used for advanced cross-asset planning and programming decisions.

MDOT SHA is using the most advanced bridge and pavement management systems as examples to improve systems for other asset classes including: fleet, facilities, sign structures, noise walls, and stormwater/drainage. As data and systems improve, our asset management program will be able to more accurately validate, project, and prioritize future needs.

ENTERPRISE AM SYSTEMS INTEGRATION



9 CAPITAL RENEWAL PLAN, FUNDING, AND GAP

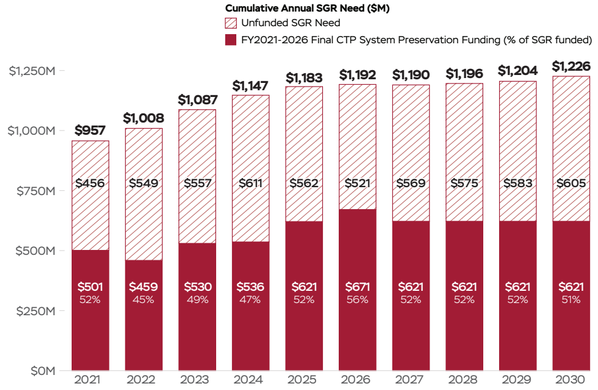
The MDOT SHA asset management plan supports a structured program to guide the system preservation projects needed to achieve and maintain the transportation system performance through managing risk and balancing available funding.

We optimize system performance and asset condition goals while managing our largest risks—within the prescribed level of funding. Applying appropriate lifecycle maintenance strategies also helps us to ensure minimum practical cost. The 2021 MDOT SHA capital needs analysis, developed from the FY2021-2026 Consolidated Transportation Program (CTP), estimates **the 10-year funding needed to achieve and then maintain all assets in a SGR is approximately $11.4 billion, of which MDOT SHA projects only 51% is funded through existing sources.**

The SGR need and gap forecast compares the unconstrained ($11.4 billion) maintenance, minor and major rehabilitation, and full replacement needs of the 14 critical asset classes to the 10-year constrained ($5.8 billion) financial forecast equating to a gap of $5.6 billion to meet the lifecycle needs of MDOT SHA assets.

The lifecycle and risk management strategies discussed earlier in this document help MDOT SHA to allocate our available funds to infrastructure assets, projects, and programs that represent the largest risk and/or are expected to deliver the largest positive impact to level of service. The asset management program also applies triple bottom line (social, financial, and environmental impacts) and cost/benefit analysis to validate, justify, and support our investments.

STATE OF GOOD REPAIR (SGR) FUNDING NEED, PROJECTED SYSTEM PRESERVATION (SPP) FUNDING, & FORECASTED FUNDING GAP



Note: *Analysis is based on December 2020 FY2021-2026 CTP funding estimates plus additional sources for asset classes not funded through the CTP.*

Note: *Available funding for years 7-10 is assumed to be equal to year 5 (FY2025) CTP estimates plus additional sources for asset classes not funded through the CTP.*

10 IMPROVEMENT ACTIVITIES AND MONITORING

Implementing a comprehensive asset management program is a long-term effort. Activities are ongoing and MDOT SHA has identified several initiatives that will build upon the organization's existing foundation and continue to deliver impactful improvements to business processes, asset lifecycle strategies, as well as significant enhancements to information systems, data, and analytics – all in support of the organizations' long-term asset management vision.

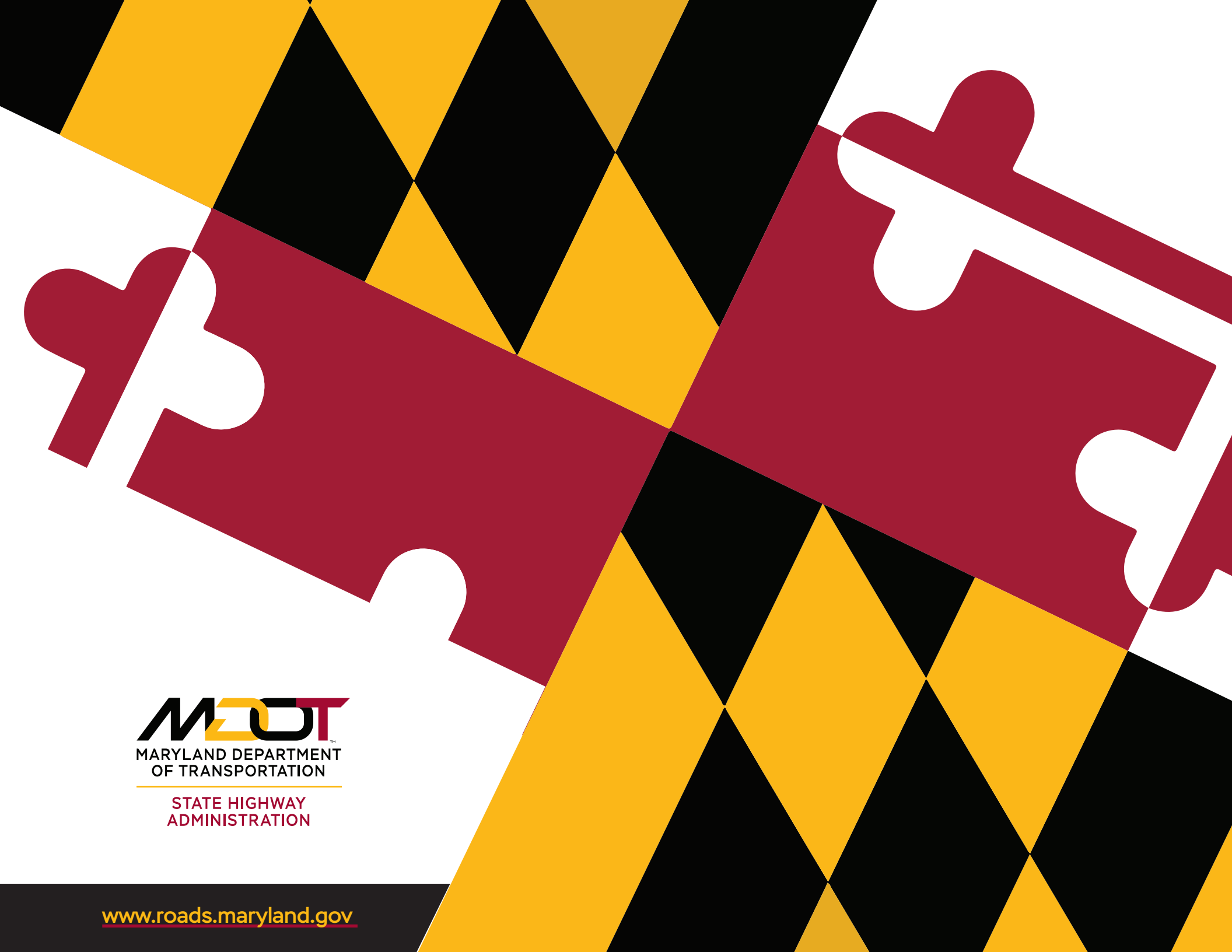
Through performance, asset, and risk management practices, MDOT SHA is improving how we do business every day. This effort is championed by MDOT SHA leadership, and the organization is moving the practices forward with new tools, resources, and the AMO.

We are building upon existing practices to build a more robust cross-asset program by focusing on **asset inventory and condition assessment, data availability and quality, information systems, asset analytics, and financial forecasting.**

Several of our highest priority initiatives are summarized below, and future documents will provide updates on these improvement efforts and the outcomes and benefits that MDOT SHA has achieved.

MDOT SHA STRATEGIC ROADMAP TO IMPLEMENT AN OPTIMIZED ASSET MANAGEMENT PROGRAM

MDOT AM GOAL	MDOT SHA IMPROVEMENT INITIATIVE PATHWAY	
	Initiatives	Outcomes
Commit to asset management practices	Lifecycle Plans for Critical Asset Classes	▪ Comprehensive lifecycle strategies with long-term funding projections for SGR—optimized lifecycle cost and performance/reliability and secured long-term funding.
Define and record the assets we own **Develop framework and guidance for asset management software**	Implementation of EAM (Enterprise Asset Management) System for Linear Assets	▪ Enhanced work order management and asset management analysis across all linear asset classes—centralized system with robust data for decision making. ▪ Fully configured and usable system with mobile workforce capability that is embraced by staff—improved productivity and work tracking.
Determine the condition of our assets **Establish a plan for maintaining a SGR**	Enhanced Condition & Inspection Methods Enterprise Risk and Resiliency Strategies	▪ Consistent approach to visual/physical and functional condition assessment to better enable future cross-asset comparisons. ▪ Consequence of failure (criticality) scoring incorporated into risk-based project prioritization and programming.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