OCTOBER 2022

MBTA Transit Asset Management Plan

massDOT
Massachusetts Department of Transportation

Release Details

Release Date	October 31, 2022	
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EXECUTIVE SUMMARY

The MBTA's 2022 Transit Asset Management (TAM) Plan documents its asset portfolio, current condition, and asset management practices while setting the direction, strategies, and actions to improve the management of its infrastructure. This TAM Plan covers a four-year period and aligns with other federal planning cycles, statewide transportation improvement programs and the MBTA's capital planning and budget development cycles.

While the structure and content of this plan is defined by the Federal Transit Administration (FTA), this plan serves as an actionable document detailing the MBTA's evolving asset management practices and increasing capacity to be strong public stewards and make effective resources decisions that maximize performance of the transportation system.

Accomplishments since the 2018 TAM Plan and what's new in the 2022 Update

Since the 2018 TAM Plan, the MBTA has made significant progress towards its asset management practice which is reflected in this update to the plan. Over the past 4 years, the MBTA has achieved the following milestones in its asset management program.

- ☑ Successfully decommissioned the old Asset Registry system in 2019.
- ☑ Completed additional asset class inventory updates and condition assessments.
- ☑ Developed Asset Condition and Criticality Standards for each asset class.
- ☑ Developed a Common Asset Framework to consistently organize and structure asset inventory data from various sources.
- ☑ Deployed mobile work management solution for timely and accurate recording of transit infrastructure maintenance.
- ☑ Safety critical asset preventive maintenance inspections fully loaded into the Enterprise Asset Management system in 2021.
- ☑ Supported the development of the Capital Investment Plan and capital planning process.
- ☑ Established the Asset Management Core Team
- ☑ Added staff resources to the Asset Management Team

The 2022 MBTA TAM Plan update takes a focused look at the key processes and actions identified to advance the state of asset management practice at the organization.

TAM Plan Objectives

This plan establishes the MBTA's approach to managing assets that provide safe, reliable, and accessible transportation to support a thriving region with a best-in-class transit system. Its purpose is to:

- Document the asset portfolio – including nature, extent, age and condition of the MBTA's physical infrastructure.

- Identify existing and / or proposed levels of service to be achieved with these assets.

- Identify lifecycle management needs by asset class – including maintenance, overhaul, renewal and replacement needs.

- Assess the resources required to support safe and reliable service delivery and to bring assets to a state of good repair (SGR).

- Document the key processes, organizational resources, and tools to enable effective asset management.

- Establish actions for improving the MBTA's approach to asset management practice.

Asset Management Policy

The MBTA is committed to implementing a strategic process for acquiring, operating, maintaining, upgrading, and replacing its transportation assets to support the agency's vision, mission, and values set forth in its strategic plan. The MBTA Asset Management Policy consists of seven principles by which the MBTA will manage its assets to effectively deliver public transportation services in the greater Boston region. The seven principles address state of good repair, transparency, delivering services efficiently and effectively, risk, fiscal responsibility, social responsibility, and industry leadership.

> *Section 2 for more details on the Asset Management Policy*

Asset Management Practice

Asset Management provides for better decision making through asset knowledge and validated information supported by technology and documented business processes to ensure consistent practices.

The MBTA General Manager has charged the Chief Engineer and the Director of Asset Management with development and implementation of the 2022 TAM Plan update, with support from the Asset Management Core Review Team made up of Business Unit leaders from across the MBTA. The MBTA's Budget and Finance via Capital Program Planning, Vehicle Maintenance and Engineering and Maintenance Teams also play a significant role in aligning asset management practice. The MBTA's Asset Management framework has been developed to align with ISO 55000, the internationally accepted standard for asset management practice.

> *Section 3 for more details on MBTA's Asset Management Practice*

Asset Portfolio

The MBTA manages a vast portfolio of infrastructure assets, consisting of over 75,000 individual records including 789 miles of track, 72 miles of tunnel, and over 3,400 revenue service vehicles. The inventory presented in this report represents a portion of the total MBTA's baseline asset inventory with full asset details. The remaining assets will be updated and included during annual asset review, capture, and validation cycles, bringing greater detail and resolution to the full asset portfolio. Asset information is stored across different systems across the organization and as MBTA consolidates these sources, a more accurate count and representation of the physical system will be reflected within this portfolio.

> *Section 4 for more details on the Asset Portfolio*

Asset and Asset Management Performance

An asset management framework shapes how performance is measured and managed organization-wide to meet the needs of customers and stakeholders. It establishes the relationship between the strategic goals of the MBTA, levels of service, and the required technical performance of the physical assets involved.

▸ *Section 5 for more details about the Asset Management Performance Framework*

Lifecycle Management

Lifecycle management strategies outline how an asset is managed over its life. The MBTA is reviewing the current infrastructure lifecycle management strategies and revising them to best capture the steady state capital maintenance activities and resources required to achieve and maintain a state of good repair.

The MBTA's lifecycle management strategies are primarily driven by inspections and preventative maintenance. These practices comply with industry standards, state requirements, and MBTA specific requirements.

▸ *Section 6 for more details on Lifecycle Management*

Risk Management

FTA requires that a transit provider must give due consideration to state of good repair projects to improve conditions that pose an identified unacceptable safety risk when developing its investment prioritization. Incorporating risk processes into the MBTA's asset management and asset lifecycle management strategies support the overall goal of maintaining infrastructure in a state of good repair and adopting industry best practice.

▸ *Section 7 for more details on Risk Management*

Work Plans and Budget

The MBTA's FY23-27 Capital Investment Plan (CIP) reflects a plan to invest over $9.6 Billion over the next five years to support critical safety enhancements, improve reliability, modernize our assets, enhance capacity, and expand the transit network.

The MBTA CIP is divided across two priority categories: (1) reliability and modernization, and (2) expansion. The reliability and modernization category forms MBTA's state of good repair investments.

▸ *Section 8 for more details on MBTA's Work Plans and Budget.*

Improvement Actions

The MBTA's asset management capability and practice are advanced through a process of continuous improvement and are documented through improvement actions detailed in this plan.   These actions represent those defined in the previous TAM Plan, new opportunities for improvement, and alignment with evolving regulatory requirements.

These actions are grouped into Asset Management areas defined by the Institute for Asset Management; include Organizational Transformation, Strategy & Planning, Asset Management Decision Making, Asset Information, Organization and People, and Risk & Review.

▸ *Section 9 for more details on specific improvement actions and timelines.*

Plan Structure and Required Components

The plan structure outlines the sections contained in this TAM Plan. The content of the plan is also guided by FTA.

See section 1.5 for more details.

1. INTRODUCTION

The MBTA's 2022 Transit Asset Management Plan sets the direction, strategies, and plans to improve the management practices of its physical infrastructure. This section introduces the organization, scope of infrastructure covered in this plan, the federal requirements, and how they are met within the structure of the document.

1.1   About the MBTA

The Massachusetts Bay Transportation Authority (MBTA) is one of the oldest and largest transit agencies in the United States, offering transportation across 175 cities and towns in the greater Boston area via light rail, heavy rail, commuter rail, bus, and ferries. In total, the MBTA has over 75,000 individual assets and provided pre-COVID more than 1.3 million daily passenger trips system wide. The COVID-19 pandemic severely impacted the average daily ridership, but ridership has slowly recovered from the low numbers seen early in the health emergency. The pandemic has had a disproportionate impact on those who most rely on public transit for essential trip, highlighting the importance of this TAM Plan and ensuring smart investments are made to maintain the state of the system and sustainability of service for those who need it most.

The MBTA is governed by the MBTA Board of Directors that consists of seven members, including the Secretary of Transportation and one member with municipal government experience. The rest are appointed by the Governor, and they include a rider and resident of an environmental justice population, and a person recommended by the President of the AFL-CIO.

The MBTA's subway system, the "T" is also known as America's First Subway, with the 1897 opening of the Tremont Street Subway. Many of the MBTA's assets pre-date the founding of the organization and have since been integrated into a cohesive system supported by the light and heavy rail modes. The age of many assets from these legacy systems requires extra care to maintain in a state of good repair.

The MBTA primarily generates operating revenues through its portion of the Commonwealth sales tax, passenger fares and formula assessment of cities and towns the MBTA serves. Supplemental funding for the operating budget is generated through parking lots, real estate operations, and advertising.

Capital funding comprises multiple sources including federal formula funds programmed through the Boston Metropolitan Planning Organization (MPO), federal discretionary grants, Commonwealth bond proceeds for specific projects, MBTA sources including bonds or loans and reimbursable, or outside funds through partnerships and formal agreements.

1.2 Scope of the Transit Asset Management Plan

The TAM Plan covers the physical assets owned, contracted, and/or managed by the MBTA and used to provide public transportation services – including rolling stock (commuter rail cars / locomotives, transit rail and bus fleet), guideway infrastructure (e.g., structures, track, power, signals, and communications), stations and facilities, and ferry assets as well as MBTA's demand response, shared-ride paratransit service, known as "The RIDE."

FIGURE 1-1   **MBTA Asset Categories and Types**

ASSET CATEGORIES	MBTA ASSET TYPES
Revenue Vehicles	▶ Heavy Rail Passenger Cars ▶ Light Rail Vehicles ▶ Buses ▶ Ferryboats ▶ Paratransit Vehicles ▶ Commuter Rail Locomotives and Passenger Coaches
Equipment (Non-Revenue Vehicles)	▶ Support Vehicles (Autos, SUVs, Vans, and Minibuses) ▶ Steel Wheel Vehicles ▶ Other Rubber Tire Vehicles
Infrastructure	▶ Track ▶ Bridges and Tunnels ▶ Culverts ▶ Power and Substations ▶ Signals ▶ Communications ▶ Retaining Walls ▶ Dams
Facilities	▶ Passenger Facilities ▶ Parking Facilities ▶ Maintenance and Administrative Support Facilities

1.3 Plan Objectives

The MBTA's TAM Plan describes the asset maintenance, overhaul, replacement, and enhancement strategies to provide public transportation services within the agency's service area in greater Boston.

The purpose of this plan is to:

▶ Document the asset portfolio – including nature, extend, age and condition of the MBTA's physical infrastructure.

▶ Identify sources of existing and proposed levels of service to be achieved by these assets.

▶ Identify sources of lifecycle management needs by asset class – including maintenance, overall renewal, and replacement.

▶ Assess the human and financial resources required to support safe and reliable service delivery and to bring infrastructure into a state of good repair.

▸ Document the key processes, organization and tools that enable effective asset management.

▸ Establish improvement actions to guide the MBTA's approach to asset management practice.

The MBTA TAM Plan provides a baseline from which the MBTA will continue to build and improve its asset management capability. Section 9 of this plan outlines the specific steps the MBTA will take in the next four years to improve on this baseline.

1.4 Accountable Executive and Strategic Alignment

The FTA requires an Accountable Executive to be defined and that individual is responsible for carrying out the TAM practices. At the MBTA, the accountable executive is the General Manager. The MBTA's leadership team consists of the following positions:

FIGURE 1-2 **MBTA Leadership Organization Chart**

The MBTA TAM Plan documents the agency's asset management framework and establishes the maintenance, overhaul, and renewal strategies for all MBTA owned or managed infrastructure. The plan is aligned to our values and consistent with multiple MBTA and regional planning documents:

▸ The MBTA's Strategic Planning Report 2020

▸ Boston Metropolitan Planning Organization's Destination 2040

▸ Focus 40 Plan, The 2040 Investment Plan for the MBTA

The MBTA is guided by organizational core values of Safety, Service, Equity, and Sustainability. Additionally, the MBTA leadership is in the process of setting high level goals to support organizational and staff decisions when prioritizing amongst important and competing needs.

1.5 Plan Structure

The plan structure illustrated below outlines the key sections contained in this TAM Plan.

Executive Summary

1. Introduction

2. Asset Management Policy

3. Asset Management Practice

4. Asset Portfolio

5. Asset Management Performance

6. Lifecycle Management

7. Risk Management

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9. Improvement Actions

Appendicies

1.6 Alignment with Federal Requirements

The MBTA has developed this plan consistent with the United States (US) Code of Federal Regulations (CFR) Title 49 Parts 625 and 630 which relate to Transit Asset Management and National Transit Database respectively.

Under the definitions of US 49 CFR Part 625, the MBTA is considered a Tier 1 transit provider which requires additional sections be included in the TAM Plan. The table below lists the TAM Plan requirements for Tier 1 transit providers and describes how this document meets these requirements.

FIGURE 1-3 **TAMP Alignment with Federal Requirements**

US 49 CFR 625 REF	REQUIREMENT	SECTION OF 2022 TAM PLAN FOR COMPLIANCE
49 CFR § 625.25 (b) (3)	Description of analytical processes or decision support tools to estimate capital investment needs over time and develop its investment prioritization.	Section 8 describes the MBTA's capital planning and investment prioritization approach. Section 3 summarizes the MBTA's core asset management business processes that support analysis and decision making
49 CFR § 625.25 (b) (4)	Project-based prioritization of investments	Section 8 summarizes the MBTA's investment priorities. The published FY23-27 MBTA Capital Investment Plan, provides a detailed listing of the MBTA's project-based investment priorities.
49 CFR § 625.25 (b) (5)	Provider's TAM and SGR Policy	Section 2 presents the MBTA's TAM / SGR Policy
49 CFR § 625.25 (b) (6)	Provider's TAM Plan implementation strategy	Section 9 presents the MBTA's TAM Plan implementation strategy.
49 CFR § 625.25 (b) (7)	A description of key TAM activities that a provider intends to engage in over the TAM Plan horizon period.	Section 9 presents the MBTA's TAM Plan implementation strategy.
49 CFR § 625.25 (b) (8)	A summary or list of resources including personnel, that a provider needs to develop and carry out the TAM Plan	Section 8 summarizes the MBTA's methodology to identify and address current estimated state of good repair backlog and assess capital needs. Section 9 summarizes the human resources required to implement the TAM Plan and key improvement actions.

US 49 CFR 625 REF	REQUIREMENT	SECTION OF 2022 TAM PLAN FOR COMPLIANCE
49 CFR § 625.25 (b) (9)	An outline of how a provider will monitor, update, and evaluate, as needed, its TAM Plan and related business practices, to ensure the continuous improvement of its TAM practices.	Section 9 includes the MBTA's TAM improvement roadmap and key action items to ensure continuous improvement of its TAM practices.
49 CFR § 625.33 (a)	Identify a program of projects to improve or manage the SGR of capital assets for which the provider has direct capital responsibility over the TAM Plan horizon period	Section 8 summarizes the MBTA's SGR program investments over the FY period to improve or manage the state of good repair for MBTA's capital assets. The published FY23-27 MBTA Capital Investment Plan, provides a detailed listing of MBTA's project-based investment priorities.
49 CFR § 625.33 (b)	Rank projects to improve or manage the SGR of capital assets in order of priority and anticipated project year.	Same as above
49 CFR § 625.33 (c)	Ensure project rankings are consistent with its TAM policy and strategies.	Same as above
49 CFR § 625.33 (d)	Give due consideration to state of good repair projects to improve those that pose an identified unacceptable safety risk.	Sections 8 describes the MBTA's capital planning and investment prioritization approach, including the project selection criteria that ensures that safety as well as other criteria is given due considerations. Section 7 outlines MBTA's approach to infrastructure risk management and infrastructure prioritization and protection.
49 CFR § 625.33 (e)	Take into consideration the estimation of funding levels from all available sources that it reasonably expects will be available in each fiscal year during the TAM Plan horizon period.	Section 8 provides a summary of MBTA funding sources. Additional detail can be found in the published FY23-27 MBTA Capital Investment Plan. Section 8 provides a summary of funding levels committed in the MBTA's CIP. The published FY23-27 MBTA Capital Investment Plan, provides a detailed listing of MBTA's project-based investment priorities.
49 CFR § 625.33 (f)	Take into consideration requirements under 49 CFR 37.161 and 37.163 concerning maintenance of accessible features and the requirements under 49 CFR 37.43 concerning alteration of transportation facilities.	Section 8 describes the MBTA's capital planning and investment prioritization approach, including the project selection criteria that ensures that mobility, social equity, and fairness, as well as other criteria are given due consideration.

The federal deadline to develop the updated TAM Plan is October 1, 2022, as stated in US 49 CFR 625.29 (a). Agencies are required to have their Accountable Executives certify their TAM Plans, as well as share them with the MPO. The MBTA may update the TAM Plan in interim years to incorporate significant changes to the asset inventory, condition assessment, and investments, and/or critical TAM policies and processes.

The MBTA formally requested a 30-day extension from the FTA due to a large portion of the staff identified as reviewers and signatories for the TAMP being significantly involved with addressing Corrective Action Plans in response to the FTA issued Special Directives as a result of a FTA Safety Management Inspection. The FTA reviewed and granted the request for extension requiring the MBTA to submit the 2022 Transit Asset Management Plan on November 1, 2022.

In addition to an updated TAM Plan, the FTA requires the MBTA to submit annual reports to the National Transit Database (NTD), as summarized in the table below. The capital asset inventory and condition data in the TAM Plan will be consistent with MBTA's inventory data which will be organized for submittal to NTD. The request for extension did not impact the deadlines for the MBTA's NTD reporting requirements.

REQUIRED SUBMISSION	ELEMENTS	DEADLINE
Data Submission	▸ Asset inventory data ▸ Condition assessments and performance results ▸ Performance targets for the next fiscal year	No later than four months after the end of MBTA's fiscal year.
Narrative Report	▸ Changes in the transportation system ▸ Progress towards achieving the performance targets from the previous year	No later than four months after the end of MBTA's fiscal year.

2. ASSET MANAGEMENT POLICY

The asset management policy defines the purpose and the guiding principles by which the MBTA will manage its infrastructure to effectively deliver public transportation service in the greater Boston area.

FIGURE 2-1   **MBTA Asset Management Principles**

Principle	Description
STATE OF GOOD REPAIR (SGR)	We will work to bring all of the MBTA's assets, including fleets and facilities, to a state of good repair.
TRANSPARENCY	We will ensure that all decisions are data driven, and are both transparent and consistent, enabling us to clearly demonstrate the prioritized investments across asset classes.
SERVICE DELIVERY	We will work to meet or exceed service delivery goals by ensuring necessary work is undertaken for all MBTA assets and opportunities for improving service delivery are considered.
RISK AWARENESS	We will effectively identify, prioritize, and manage asset and asset-related risks, including safety, reliability, financial, performance and climate-related risk.
FISCAL RESPONSIBILITY	We will continue and sustain the MBTA's fiscal discipline by optimizing available resources through lifecycle management, reliability-centered maintenance, business process improvement, and the adoption of other best practices.
SOCIAL RESPONSIBILITY	We will work to build the confidence and trust of all internal and external stakeholders demonstrating good practice in all that we do.
INDUSTRY LEADERSHIP	As one of the largest transit agencies in the U.S., we will work to achieve compliance with Federal and State requirements demonstrating leadership amongst our peer agencies

2.1   Purpose

The MBTA is committed to implementing a strategic process for acquiring, operating, maintaining, upgrading, and replacing its transit assets to support the agency's vision, mission, and values set forth in its strategic plan.

2.2   Principles

Guiding the MBTA's asset management program, plans, and strategies are seven core principles aligned to each of the organization's strategic objectives and priorities which support the delivery of safe, reliable, accessible, cost-effective, and sustainable transit service.

3. ASSET MANAGEMENT PRACTICES

Asset Management provides for better decision making through asset knowledge and validated information supported by technology and documented business processes to ensure consistent practice. MBTA's Asset Management framework has been developed to align with ISO 55000, the internationally accepted standard for asset management practice.

3.1 Overview

This section provides an overview of the organization, roles, responsibilities, and key business processes in place to assist and guide the MBTA in implementing asset management practices and the information systems that support planning, scheduling, and management.

3.2 Organization

The MBTA General Manager has charged the Chief Engineer and the Director of Asset Management with development and implementation of the 2022 TAM Plan update.

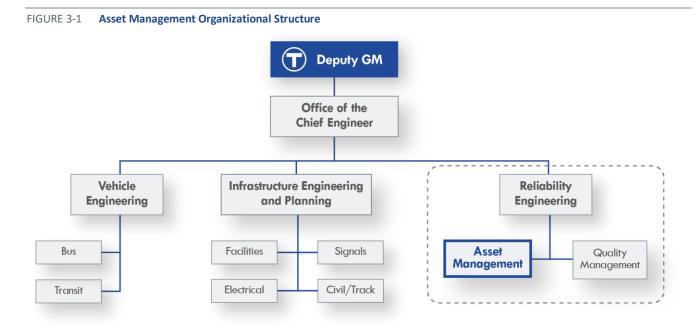The Office of the Chief Engineer is primarily responsible for:

▶ Medium- and long-term planning and standards development.

▶ Augmenting critical day-to-day maintenance functions that keep the transit system running and respond to immediate operational needs.

▶ Partnering with capital program development and project planning functions, as well as capital delivery, to ensure the pipeline of state-of-good repair projects is being addressed.

▶ Building out the asset management and lifecycle modeling function.

The Office of Reliability Engineering is responsible for oversight of the Asset Management and Quality Management functions of the organization. The Office of Reliability Engineering facilitates and assures the reliable service performance of each transport mode. Its role is to provide asset management leadership, modelling expertise and quality assurance to infrastructure, vehicles, capital programs and operations teams across the MBTA.

The Asset Management Department combines management, financial, economic, engineering, and other practices dedicated towards infrastructure assets whilst enabling the MBTA to realize best value level of service for the costs involved. The Asset Management department are key stakeholders in the entire life cycle of assets —including design, construction, commissioning, operating, maintaining, repairing, modifying, replacing and decommissioning / disposal of physical and infrastructure assets across the MBTA network and all its modes.

The Quality Management Department is responsible for auditing the inspection and maintenance activities for departments responsible for managing transportation assets. Quality Management supports the maintaining departments by validating the completeness of inspection and maintenance activities, assess accuracy and completeness of condition assessments and asset data being utilized by the

Asset Management Department. Quality Management provides assurance (QA) that essential activities are performed completely and in accordance with stated requirements and standards.

FIGURE 3-1   **Asset Management Organizational Structure**

3.3   Core Business Processes

This sub-section is intended to identify core business processes that support and contribute to asset management practice at the MBTA, these business processes are grouped into enterprise-level processes that cut across the MBTA departments and asset-level business processes that are primarily implemented by those closest to a specific asset type.

3.3.1   ENTERPRISE-LEVEL PROCESSES

KEY PROCESS	DESCRIPTION
Quality Management	▶ Quality Management supports the maintenance departments by validating the completeness of inspection and maintenance activities, and by assessing accuracy and completeness of condition assessments and asset data. ▶ Additionally, these inspections identify assets beyond a state-of-good repair, supporting Asset Management in driving capital spending on assets. ▶ In its mature state, the Quality Management department will establish lifecycle quality, performance, and maintenance standards for all asset classes. ▶ Finally, the Quality Management department develops standard management processes and data standards for the functional and physical attributes of assets, software, and documentation including links between the components of a system.
Safety	▶ As mandated by the MBTA's Strategic Plan, Federal and State requirements, and demonstrated further through training, briefings, and capital project selection, safety is at the core of how the MBTA makes and prioritizes decisions. ▶ The Safety Department is primarily responsible for leading safety culture, standards, and compliance at the organization. Safety processes integrate with asset management by identifying critical elements of the infrastructure inventory to evaluate and monitor. Asset management analysis can support resource prioritization related to safety standards development and highlighting potential safety risks.

KEY PROCESS	DESCRIPTION
Risk Management	▶ MBTA Risk Management focuses on the operational safety and hazards risks and the impacts on the business and its ability to deliver on its strategic goals and objectives. ▶ The MBTA Risk Management function primarily is rooted in the monitoring and evaluation of real property and insurance activities, but MBTA is expanding the focus to include other functions and departments to further integrate asset information, service performance, and resource allocation into a broader decision framework.
Capital Planning	▶ Capital Planning is the process in which the MBTA invests capital resources to support organizational goals and objectives. ▶ The Capital Investment Plan (CIP) is a short-term, financially constrained investment program that funds the planning, construction, and capital maintenance of assets across the MBTA. Proposed capital projects are evaluated and prioritized based on the following scoring criteria: system preservation, safety, mobility, cost effectiveness, economic impact, social equity and fairness, environmental and health effects, and policy support. ▶ Asset management supports this prioritization process by identifying areas of investment that directly support state of good repair, system preservation, and that would produce the most benefit for the transportation system.
Infrastructure Engineering and Planning	▶ Infrastructure Engineering & Planning (IEP) is grouped by discipline with subject matter experts in the Power, Signals, Facilities, and Maintenance of Way (Civil/Structural) fields. This structure complements the infrastructure maintenance groups within Engineering & Maintenance and Commuter Rail so that IEP can assist with coordination of asset needs and solutions across the entire MBTA system, including within Reliability Engineering, and supports agency-wide asset investment planning. ▶ The primary core mission of the IEP team is to work closely with all departments to develop a path that will bring the MBTA's assets into a state of good repair over time while developing a long-term plan to maintain these assets. ▶ A major initiative of IEP is to update all engineering and design standards for fixed infrastructure assets with the aim of better defining our expectations for our built environment and the public's expectations, and to do so while making our infrastructure safer, more accessible, more reliable, more environmentally conscious, and easier to maintain. ▶ IEP incorporates design standard guidance and input from the Systemwide Accessibility group in advance of asset renewal activities to ensure that the transportation system is accessible and meets the needs of all customers.
Vehicle Engineering	▶ The Vehicle Engineering department (VE) is a longstanding group of vehicle engineering and procurement management experts providing technical support to the Vehicle Maintenance and Operations departments. ▶ The prime role of the Vehicle Engineering department is to lead the development and purchases of new revenue vehicles, along with managing external overhauls of aging vehicles. ▶ VE works with internal and external stakeholders when developing programs for investing in Authority revenue vehicles, which consist of buses, light rail trolleys (Green and Mattapan), rapid transit heavy rail trains (Red, Blue, and Orange), and Commuter Rail coaches and locomotives. ▶ VE is focused on ensuring our revenue fleets are safe, accessible, affordable, reliable, maintainable, environmentally conscious, and ergonomically friendly. VE incorporates guidance and input from the Systemwide Accessibility group to inform design of vehicle renewals to ensure the fleet is accessible and meets the needs of all customers. `
Capital Program Delivery, Including Design Management	▶ Capital Programs manages the procurement, design, and construction, and project close-out for all infrastructure projects. ▶ Capital Programs supports asset management practice by identifying key infrastructure assets being added, retired, or replaced in the MBTA asset inventory. ▶ Asset management practices support capital project delivery by ensuring that design choices support overall lifecycle management, ease of maintenance, and long-term reliability of infrastructure assets.

KEY PROCESS	DESCRIPTION
Asset Handover	▶ Asset Handover refers to the process in which the MBTA officially accepts responsibility for an asset that is procured, built, or transferred.
	▶ The primary group responsible for asset handover depends on the asset type. Revenue vehicles are the responsibility of Vehicle Engineering, non-revenue vehicles are the responsibility of Vehicle Maintenance, and other infrastructure are managed by the Capital Programs group.
	▶ Asset handover is an important process supporting asset management because this is the step where important information related to maintenance, cost, and other asset attributes are transferred between responsible parties. Drawings, maintenance records, warranty, and contract close-out specifications all need to be preserved during this step.
Service Planning	▶ Service planning is managed by the Planning and Scheduling group and determines the level of service appropriate for assets that delivery transportation services.
	▶ MassDOT's Office of Performance Management and Innovation (OPMI) defines the standards and metrics related to service and the MBTA's Planning and Scheduling group is responsible for meeting those goals based on available resources, fleet, and staffing capacity.
	▶ These performance standards and the management of resources to meet the levels of service are a key component in asset management practice. Understanding level of effort required to meet a level of service informs important investment decisions across an asset's lifecycle.
	▶ Current, accurate, and transparent asset information also supports service planning with a clear line of sight of available resources and capacities.
Track Access Planning	▶ Track access for maintenance work is handled by a separate Planning and Scheduling group that controls the track access process.
	▶ Track access planning is key to coordinating the various Engineering and Maintenance groups responsible for guideway assets, maintenance of way, signals, and power as well as ensuring safety of crews operating on the guideway. Each group has generic work windows every night, but can request additional time in the schedule that is distributed through the Operations Control Center.
	▶ Understanding where work is being performed across the network is important to asset management to property document renewal and replacement work. Similarly, asset information supports track access planning by supporting efficient work phasing, coordinating between different asset maintainers, and efficiently coordinating limited nightly work windows.
Decommissioning and Disposal	▶ Asset decommissioning and disposal is the process that happens at the end of an assets lifecycle and are no longer needed by the operating department and removed from the asset register.
	▶ Depending on the scale of the asset being decommissioned or disposed of there are different responsible parties who initiate this process. Revenue vehicles are the responsibility of Vehicle Engineering, non-revenue vehicles are the responsibility of Vehicle Maintenance, and other infrastructure are managed by the Capital Programs group.
	▶ This process supports asset management by documenting the end of lifecycle for a specific asset, ensures that the asset registry and relevant records are updated, and that lifecycle costs and statistics are properly assessed.

3.3.2 ASSET-LEVEL BUSINESS PROCESSES

Asset lifecycle management processes define how the lifecycle management strategy is implemented. The processes documented below were developed based on a series of workshop conduced to understand the current state of practice at the agency.

Bus Fleet Asset Level Business Processes

PROCESS	RESPONSIBLE PARTY	DESCRIPTION
Inspections	Vehicle Engineering	Monitors and manages fleet defects and engages with component manufacturers for equipment changes and new fleet onboarding.
Preventative Maintenance	Bus Maintenance	Major rebuilds / overhauls and heavy maintenance activities are performed at the Central Maintenance Facility. Mid-life overhauls are not performed internally. Preventative maintenance complies with OEM and MBTA-specific recommendations, primarily usage-based intervals.
Performance Target Setting	Planning and Scheduling / Bus Maintenance	Buses are assigned to operate out of eight maintenance garages to meet route demands. Revenue bus fleet relies on mileage tracking to drive preventative maintenance and mean-distance-between-failure performance metrics. Mileage is recorded during nightly fueling and on each maintenance work order. Performance failure trend analysis is conducted to highlight repeating failure counts to drive maintenance campaigns.
Maintenance Management	Bus Maintenance	Work order requests and preventative maintenance are recorded in the same system.
Asset Tracking	Vehicle Engineering	Buses are recorded as individual assets; individual components are identified through the work order and maintenance management systems.
Key Systems	Various	Trapeze EAM (MCRS2) for asset and maintenance management. PeopleSoft and Supply Chain Management for materials management functions. Trapeze Transit Master is used for bus dispatch. HASTUS is used for resource scheduling planning and management.

Transit Rail Fleet

PROCESS	RESPONSIBLE PARTY	DESCRIPTION
Inspections	Vehicle Engineering	Preventative Maintenance is considered inspection activity for transit rail vehicles.
Preventative Maintenance	Rail Vehicle Maintenance	Work is performed during inspections as time allows within a shift. Any additional work is schedule for a following shift until open work is completed.
Performance Target Setting	Rail Vehicle Maintenance	Rail vehicle maintenance monitors performance based on proportion of planned verses corrective work.
Maintenance Management	Rail Vehicle Maintenance	Reliability Centered Maintenance practices have been used on the Blue Line with success and has supported informed decision-making regarding changes to maintenance practices. The success of these practices is being applied to the Orange and Red Lines. Green Line light rail vehicles are overhauled by an outside contractor.
Asset Tracking	Vehicle Engineering	Rail vehicles are recorded as individual assets, individual components are identified through the work order and maintenance management systems.
Key Systems	Various	Trapeze EAM (MCRS2) for asset and maintenance management. PeopleSoft and Supply Chain Management for materials management functions. HASTUS is used for resource scheduling planning and management.

Commuter Rail Fleet

PROCESS	RESPONSIBLE PARTY	DESCRIPTION
Inspections	Vehicle Engineering	Commuter Rail is operated and maintained through an external contractor.
Preventative Maintenance	Vehicle Engineering / External service provider	Contractor is responsible for following the Integrated Fleet and Facilities Plan (IFFP) which is a comprehensive document that includes strategies for maintaining commuter rail vehicles. Contractor is responsible for all maintenance on 16 major systems except for major overhauls.
Performance Target Setting	Railroad Operations Group	The Commuter Rail contract specifies service levels and data reporting needs among other performance related items. MBTA's Railroad Operations Group is responsible for enforcing this contract.
Maintenance Management	Vehicle Engineering / External service provider	Commuter Rail uses Trapeze EAM to record vehicle maintenance work, store lifecycle cost data, and OEM Lifecycle Management documentation.
Asset Tracking	Vehicle Engineering	MBTA owns the vehicles in the commuter rail fleet that are operated and maintained through an external contractor. Commuter rail locomotives and coaches are tracked as assets.
Key Systems	Various	Trapeze EAM for asset and maintenance management.

Non-Revenue Fleet

PROCESS	RESPONSIBLE PARTY	DESCRIPTION
Inspections	Superintendent of Non-Revenue Vehicles External service provider for Commuter Rail non-revenue vehicles	Departments are notified of regular inspections required for their assigned non-revenue vehicle fleet. Inspections are based on equipment type and asset class.
Preventative Maintenance	Superintendent of Non-Revenue Vehicles External service provider for Commuter Rail non-revenue vehicles	Departments are notified of preventative maintenance cycles for their assigned non-revenue vehicle fleet. Preventative maintenance cycles are based on equipment type and asset class they support.
Performance Target Setting	Superintendent of Non-Revenue Vehicles Railroad Operations Group	As part of the Capital Planning process, department are surveyed for their non-revenue vehicle needs. Replacements of non-revenue vehicles are based on age, miles, condition, and available resources.
Maintenance Management	Superintendent of Non-Revenue Vehicles External service provider for Commuter Rail non-revenue vehicles	Non-revenue vehicles are serviced at two maintenance facilities. Maintenance activities and work orders are tracked, but full lifecycle costs are not currently tracked.
Asset Tracking	Superintendent of Non-Revenue Vehicles External service provider for Commuter Rail non-revenue vehicles	MBTA owns the vehicles in the commuter rail fleet that are operated and maintained through an external contractor. Transit maintains non-revenue fleets with internal resources.
Key Systems	Various	Trapeze EAM for asset and maintenance management.

The RIDE

PROCESS	RESPONSIBLE PARTY	DESCRIPTION
Inspections	External service provider	The RIDE door to door paratransit service is operated by external contractors using contractor-owned vehicles. Inspections are performed by the operating contractor.
Preventative Maintenance	External service provider	Operating contractors are responsible for maintenance of vehicles.
Performance Target Setting	External service provider, Office of Transportation Access	Paratransit contract defines level of service and quality required by each external service provider.
Maintenance Management	External service provider	Operating contractors are responsible for the maintenance of vehicles. Vehicle maintenance records and condition are shared with the MBTA through a fleet management system.
Asset Tracking	External service provider	Paratransit contract defines data sharing requirements between the MBTA and service providers. Maintenance costs, labor, and materials are tracked by vehicle to determine lifecycle costs related to the program.
Key Systems	Various	Dossier Fleet Maintenance Information System is the key system used by this mode.

Ferry Fleet

PROCESS	RESPONSIBLE PARTY	DESCRIPTION
Inspections	External service provider	The Ferry Fleet is a mix of MBTA owned and Contractor owned vessels and is operated by an external service provider. This contractor is responsible for performing inspections necessary to maintain a state of good repair.
Preventative Maintenance	External service provider	The Ferry Fleet is a mix of MBTA owned and Contractor owned vessels and is operated by an external service provider. This contractor is responsible for performing preventative maintenance. Preventative maintenance is based on hours of operation per vessel.
Performance Target Setting	MBTA Railroad Operations and Water Transportation Group	MBTA contract specifies level of service and condition performance targets for the ferry fleet.
Maintenance Management	External service provider	External service providers are required to document and store maintenance records for fleet vessels. Data sharing specifications are outlined in the ferry service contract.
Asset Tracking	External service provider	Ferry fleet vessels are tracked as individual assets in the MBTA vehicle registry.
Key Systems	External service provider	WheelHouse Fleet Maintenance software is used to document corrective and maintenance work.

Track

PROCESS	RESPONSIBLE PARTY	DESCRIPTION
Inspections	Maintenance of Way External service provider for Commuter Rail assets	Inspections are subject to the requirements of the Massachusetts Department of Public Utilities (DPU). Compliance is demonstrated through documented maintenance records. Commuter Rail infrastructure operations and maintenance is the responsibility of an external contractor.
Preventative Maintenance	Maintenance of Way External service provider for Commuter Rail assets	The DPU standards dictate the preventative maintenance procedures based on asset type. Commuter Rail infrastructure operations and maintenance is the responsibility of an external contractor.
Performance Target Setting	Maintenance of Way Railroad Operations Group	Condition of track assets is monitored, and this determines the corrective action or maintenance adjustment necessary to address an issue. These performance levels are set through the DPU standards.
Maintenance Management	Maintenance of Way External service provider for Commuter Rail assets	MOW maintenance is typically performed during second shift, emergency work is performed during the other shifts. Commuter Rail infrastructure operations and maintenance is the responsibility of an external contractor.
Asset Tracking	Maintenance of Way External service provider for Commuter Rail assets	MOW assets are tracked by line and linear reference. Asset tracking is used to identify track segments, special work, and comply with various state and federal reporting requirements. Commuter Rail infrastructure operations and maintenance is the responsibility of an external contractor.
Key Systems	Maintenance of Way External service provider for Commuter Rail assets	Trapeze EAM is used to document and monitor MOW assets. OPTRAM and MaxTrax to support transit track assets.

Signals

PROCESS	RESPONSIBLE PARTY	DESCRIPTION
Inspections	Signals and Communication Maintenance External service provider for Commuter Rail assets	Inspections are subject to the requirements of the Massachusetts Department of Public Utilities (DPU). Compliance is demonstrated through documented maintenance records. Commuter Rail infrastructure operations and maintenance is the responsibility of an external contractor.
Preventative Maintenance	Signals and Communication Maintenance External service provider for Commuter Rail assets	The DPU standards dictate the preventative maintenance procedures based on asset type. Periodic testing is conducted on all signal assets. Commuter Rail infrastructure operations and maintenance is the responsibility of an external contractor.
Performance Target Setting	Signals and Communication Maintenance Railroad Operations Group	Condition of signal assets is monitored, and this determines the corrective action or maintenance adjustment necessary to address an issue. These performance levels are set through the DPU standards. Commuter Rail infrastructure operations and maintenance is the responsibility of an external contractor.

PROCESS	RESPONSIBLE PARTY	DESCRIPTION
Maintenance Management	Signals and Communication Maintenance External service provider for Commuter Rail assets	Line Supervisors and Technicians typically perform maintenance at night or during times of low revenue service volume. Commuter Rail infrastructure operations and maintenance is the responsibility of an external contractor.
Asset Tracking	Signals and Communication Maintenance External service provider for Commuter Rail assets	Signal assets are grouped by line, signal area, and at the component level. The MBTA asset registry contains fixed and linear assets. Commuter Rail infrastructure operations and maintenance is the responsibility of an external contractor.
Key Systems	Signals and Communication Maintenance External service provider for Commuter Rail assets	Trapeze EAM is used to document and monitor signals assets.

Power

PROCESS	RESPONSIBLE PARTY	DESCRIPTION
Inspections	Power Systems Maintenance	Visual inspections and periodic testing of equipment is performed to determine condition of power assets. Commuter Rail infrastructure operations and maintenance is the responsibility of an external contractor.
Preventative Maintenance	Power Systems Maintenance	Preventative maintenance cycles are guided by the Institute of Electrical and Electronic Engineers best practice for specific power components and systems. Commuter Rail infrastructure operations and maintenance is the responsibility of an external contractor.
Performance Target Setting	Power Systems Maintenance	Preventative maintenance completion targets are used to gauge the maintenance performance of the Power Department. Fault and failures are documented, and trend analysis of these instances guide maintenance activities. Commuter Rail infrastructure operations and maintenance is the responsibility of an external contractor.
Maintenance Management	Power Systems Maintenance	Defects are logged and the Maintenance Control Center, Operations Control Center, and Power Dispatcher coordinate to issue work orders and resolve faults. Commuter Rail infrastructure operations and maintenance is the responsibility of an external contractor.
Asset Tracking	Power Systems Maintenance	Power assets are grouped by line, line segment, and at the component level. The MBTA asset registry contains fixed and linear power assets. Commuter Rail infrastructure operations and maintenance is the responsibility of an external contractor.
Key Systems	Power Systems Maintenance	Trapeze EAM is used to document and monitor power assets.

Stations and Facilities

PROCESS	RESPONSIBLE PARTY	DESCRIPTION
Inspections	Transit Facilities Maintenance External service provider for Commuter Rail assets	The TFM Department schedules and ensures inspections are performed to scope for stations and facilities. Some sub-systems such as ticket vending, elevators, and escalators are managed through On-Call General Engineering contractors. The Massachusetts Building Code also defines required inspections for facilities and stations. Commuter Rail infrastructure operations and maintenance is the responsibility of an external contractor.
Preventative Maintenance	Transit Facilities Maintenance External service provider for Commuter Rail assets	Preventative maintenance cycles are based on asset class and type. Facility sub-systems are maintained by subject matter and technical experts specific to the appropriate field. Commuter Rail infrastructure operations and maintenance is the responsibility of an external contractor.
Performance Target Setting	Transit Facilities Maintenance Railroad Operations Group	Condition monitoring of facilities is required by the Federal Transit Administration. This sets a baseline that preventative and corrective maintenance activities contribute to meet the minimum target. The quality of the facilities is also informed by customer feedback through the MBTA's public facing channels. Commuter Rail infrastructure operations and maintenance is the responsibility of an external contractor.
Maintenance Management	Transit Facilities Maintenance External service provider for Commuter Rail assets	Maintenance management is informed through public feedback, OEM maintenance cycles for specific asset types and components, and specialized maintenance is performed by on-call contractors. Commuter Rail infrastructure operations and maintenance is the responsibility of an external contractor.
Asset Tracking	Transit Facilities Maintenance External service provider for Commuter Rail assets	Facilities and station assets typically follow the FTA recommended asset hierarchy and structure. Commuter Rail infrastructure operations and maintenance is the responsibility of an external contractor.
Key Systems	Transit Facilities Maintenance External service provider for Commuter Rail assets	Trapeze EAM is used to document and monitor facilities and station assets.

Bridges and Tunnels

PROCESS	RESPONSIBLE PARTY	DESCRIPTION
Inspections	Capital Delivery Bridge and Tunnel Transit Facilities Maintenance Commuter Rail Contractors	The MBTA utilizes standards and practices from MassDOT to obtain compliance with Federal Railroad Administration, Federal Highway Administration, and Federal Transit Administration inspection standards. This includes annual inspections, 5-year in-depth inspections with condition ratings, a 10-year load rating inspection, and a 4-year in water inspection for structures over water.

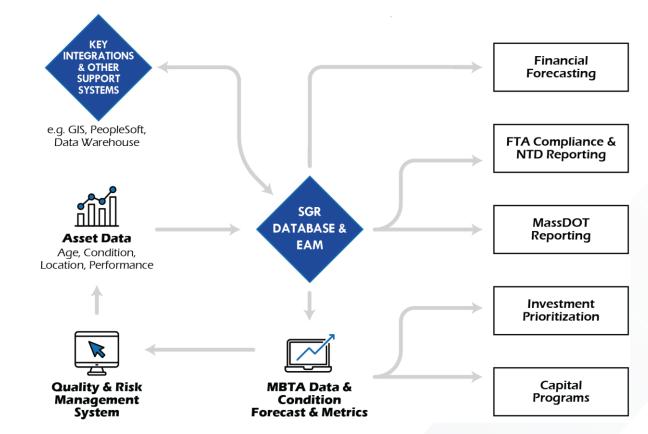| PROCESS	RESPONSIBLE PARTY	DESCRIPTION
Preventative Maintenance	Capital Delivery Bridge and Tunnel Transit Facilities Maintenance Commuter Rail Contractors	Preventative maintenance for bridges and tunnels is guided by current federal regulations. Regular inspections typically inform maintenance interventions. Maintenance is performed on a multi-level responsibility basis depending on the magnitude of the intervention and scope of work needing to be completed.
Performance Target Setting	Capital Delivery Bridge and Tunnel Transit Facilities Maintenance Commuter Rail Contractors	All bridges are inspected and rated based on the National Bridge Inventory Standards scale following FHWA and MassDOT standards. All highway tunnels are inspected and rated based on National Tunnel Inspection Standards (NTIS) scale and MassDOT standards. All transit tunnel inspection and load rating also follow these standards.
Maintenance Management	Capital Delivery Bridge and Tunnel Transit Facilities Maintenance Commuter Rail Contractors	Depending on the corrective issue, the work is directed to either Capital Delivery Bridge and Tunnel or Engineering and Maintenance. This is largely determined by the extent of work and immediacy of the response necessary to address a defect. Due to the criticality of these assets, there are on-call and emergency contracts in place to expedite resources to resolve serious issues or conditions.
Asset Tracking	Capital Delivery Bridge and Tunnel Transit Facilities Maintenance Commuter Rail Contractors	Bridges and tunnels are tracked as assets in the asset registry as well as culverts and dams.
Key Systems	Capital Delivery Bridge and Tunnel Transit Facilities Maintenance Commuter Rail Contractors	Trapeze EAM is used to document and monitor bridge and tunnel assets. MassDOT utilizes a system called 4D to document information related to bridge and tunnel structures including inspections, rating tracking, and other asset level attribute data.

3.4   Asset Information and Supporting Technologies

Asset information is stored and managed using software-based and manual digital and non-digital record keeping methods. The system and level of detail in information varies based on the asset class and type of asset information managed. The full set of asset information and level of detail may be supplied by multiple systems and formats. The goal is to be able to link or consolidate these systems so consistent and accurate asset information can support decisions at MBTA.

Currently, the following supporting technologies for asset information are in use:

▶ **Trapeze EAM,** primary system used by MBTA to manage asset information. Serves the maintenance management function for bus, transit rail, fixed-guideway, facilities, and non-revenue vehicles.

▶ **PeopleSoft Financials and Supply Chain Management (FMIS),** materials management system for transit assets.

▶ **Dossier Fleet Maintenance Information System,** used by contracted transportation operators supporting demand-response and paratransit services.

▶ **FaciliWorks,** A historic maintenance management and documentation system for stations and facility assets. Information in this system will be transferred to Trapeze EAM over the next reporting cycle.

▶ **WheelHouse Fleet Maintenance,** system used by the Ferry Fleet to document preventative maintenance and corrective work.

MBTA continues the work to migrate system data towards the Trapeze EAM implementation. Consolidation and standardization of asset data is a driving principle of improving asset management practice at the T; simplify systems and consolidate data towards a single source.

FIGURE 3-2   **Proposed Management System for Existing Assets and Data Process Flow**

4. ASSET PORTFOLIO

As the oldest transit system in the United States, the MBTA owns and manages a vast and diverse asset portfolio. This section defines the current portfolio of inventoried assets and respective conditions; these assets represent a significant portion but not all the assets for which the MBTA has responsibility. As the MBTA further implements the transition to the Trapeze EAM system, additional business processes will be developed to capture, retain, and maintain missing asset records from the full MBTA asset portfolio.

OVER
75,000
INDIVIDUAL
ASSET RECORDS

■ Number of Assets

Revenue Vehicles = Light Rail, Heavy Rail, Trolley Bus, Ferry, Automobile, Van, Commuter Locomotive, Commuter Rail Coach

Equipment / Non-revenue Vehicles = Automobile, Other Rubber Tire Vehicle, Steel Wheel Vehicles

Infrastructure Assets = Bridges and Tunnel Structures, Power, Signals

Facilities = Maintenance and/or Administrative, Passenger (Stations), Parking

THOUSANDS

	Revenue Vehicles	Equipment / Non-Revenue	Infrastructure Assets	Facilities
Number of Assets	3,478	1,527	(over 75,000)	727

4.1 Overview

MBTA, or the "T" is the primary provider of public transportation service throughout the greater Boston region. The multimodal agency operates Transit and Commuter Rail, Bus, Ferry, and Paratransit service. The table below provides a summary of MBTA's transit networks by mode.

MODE CATEGORY	MODE NAME	MODE TYPE	NUMBER OF LINES / ROUTES	TRACK MILES	REVENUE VEHICLES
Transit	Transit Rail	Heavy and Light Rail	5	166	718
	Bus	Bus	154	N/A	1,476
	Ferry	Ferry	5	N/A	16
	The RIDE	Demand Response	N/A	N/A	711
Commuter	Commuter Rail	Commuter Rail	13	794	557

4.1.1 TRANSIT

MBTA Transit covers transit rail – both heavy and light rail lines, bus service, ferry service, as well as door-to-door, shared-ride paratransit service called, "The RIDE."

Rail

The MBTA's transit rail system covers 166 miles of track, consisting of five major lines connecting riders across downtown Boston. Three are heavy rail rapid transit lines (Red, Orange, and Blue lines) and two are light rail lines (Green Line and the Mattapan High Speed Trolley Line). The Red, Orange, and Blue lines run on electric third rail, while the Green, Mattapan and part of the Blue Line utilize overhead catenary systems. The Red Line includes two branches to the south (Ashmont and Braintree) while the Green Line includes four branches to the west (Boston College, Cleveland Circle, Riverside, and Heath).

Bus

The MBTA bus system covers 154 bus routes, with 5 bus rapid transit lines (Silver Line), including one BRT line providing connection between the Boston Logan International Airport and downtown. Additionally, MBTA operates three crosstown bus lines with limited stops; all buses running on crosstown lines are equipped with bicycle racks.

Ferry

The MBTA ferry system is operated by an external contractor, providing service through the Boston Harbor and connections between Charlestown Navy Yard, Logan Airport Boat Ferry Dock, Hull, and Hingham.

The RIDE

The MBTA on-demand pick-up and drop-off transit service, The RIDE, is also operated by an external contractor and available in 58 cities and towns in the greater Boston area. In addition to The RIDE, the MBTA is running an on-demand paratransit service with Uber and Lyft where The RIDE customers can book subsidized rides instantly using a smartphone.

4.1.2 COMMUTER RAIL

The MBTA Commuter Rail system is a regional rail network covering over 622 miles of track, reaching from Boston into easter and central Massachusetts, and parts of Rhode Island. The system consists of 13 total lines including the following main lines:

Fairmount	Fitchburg	Framingham/Worcester
Franklin	Greenbush	Haverhill
Kingston/Plymouth	Lowell	Middleborough/Lakeville
Needham	Newburyport/Rockport	Providence/Stoughton

4.2 Asset Inventory

The MBTA manages an asset portfolio consisting of over 75,000 individual assets in addition to 789 miles of track and 72 miles of tunnel. The MBTA will refine this inventory through annual cycles of data validation, condition assessments, and core asset management business processes to add, update, and manage asset information. For more details regarding the upcoming improvement actions related to refining asset inventory information, see Section 10 of this plan.

The Federal Transit Administration (FTA) requires agencies to report all assets used in the provision of public transportation regardless of whether the agency has direct capital responsibility or not. Only for those assets for which the agency has capital responsibility is a condition assessment required.

The following tables provide a summary of the MBTA's capital asset inventory and are organized around FTA's four major capital asset categories.

- ▸ Rolling Stock: Revenue Transit Rail, Bus, Ferry, Paratransit, and Commuter Rail vehicles

- ▸ Equipment: (non-revenue) service vehicles

- ▸ Infrastructure: rail fixed guideway, track, signals, power, and systems

- ▸ Facilities: maintenance, administrative, passenger, and parking

Revenue and Non-Revenue Vehicles

The MBTA's rolling stock inventory consists of over 3,400 revenue vehicles. The MBTA's bus fleet makes up the largest portion (42%) of revenue vehicles, followed by transit rail vehicles (21%) and paratransit vehicles (20%), commuter rail fleet (16%), and ferry boats (16 vessels). In addition to its revenue vehicle fleet at least 1,527 support vehicles are accounted for split between transit (54%) and commuter rail (46%).

TABLE 4   **Revenue and Non-Revenue Quantities by Mode**

MODE CATEGORY	MODE	NTD VEHICLE TYPE	QUANTITY
Transit	Transit Rail	Heavy Rail	476
		Light Rail	242
	Bus	Bus	1,476
	Ferry	Ferryboat	16
	The RIDE	Automobile	278

MODE CATEGORY	MODE	NTD VEHICLE TYPE	QUANTITY
		Van	433
Commuter Rail	Commuter Rail	Commuter Rail Locomotive	105
		Commuter Rail Passenger Coach	452
		Revenue Vehicle Total	**3,478**

Source: 2022 Capital Needs Inventory

Table 4 - Non-Revenue Vehicle Inventory Summary

MODE CATEGORY	NTD VEHICLE TYPE	QUANTITY
Transit	Rubber Tire Vehicles	796
	Steel Wheel Vehicle	28
	Transit Revenue Vehicle Subtotal	**824**
Commuter Rail	Rubber Tire Vehicle	613
	Steel Wheel Vehicle	90
	Commuter Rail Revenue Vehicles Subtotal	**703**
	Non-Revenue Vehicle Total	**1,527**

Source: 2022 Capital Needs Inventory

Infrastructure

The MBTA's infrastructure inventory covers assets within the right-of-way, including track assets, bridges and tunnels, culverts, power assets, and signaling equipment.

The MBTA's rail network consists of over 789 track miles, including 166 track miles for transit rail (heavy and light rail) and 622 track miles for commuter rail. In addition, the MBTA's infrastructure asset portfolio includes 459 bridges.

TABLE 5 **Infrastructure - Track Inventory Summary**

MODE	TYPE	UNIT	QUANTITY
Transit	Track	Track-miles	166
	Grade Crossings	Each	55
	Crossovers	Each	124
	Turnouts	Each	343
Commuter Rail	Track	Track-miles	622
	Grade Crossings	Each	309
	Crossovers	Each	134
	Turnouts	Each	717

Source: 2021 NTD Submission

FIGURE 4-1   **Infrastructure - Signals Inventory Summary**

MODE	TYPE	UNIT	UNIT	QUANTITY
Transit	Signals	Each Signal Component	Count	34,013
Commuter Rail	Signals	Each Signal Component	Count	17,599

Source:2022 Capital Needs Inventory

FIGURE 4-2   **Infrastructure - Power Inventory Summary**

MODE	TYPE	SUB-TYPE	QUANTITY
Transit	Substations	Switches	232
		Transformers	158
		Circuit Breakers	1,061
		Other Power Components	1,988
Commuter Rail	Substations	Substation equipment	1,507
		Train Control & Signaling	10
		Substation Buildings	6

Source: 2022 Capital Needs Inventory

FIGURE 4-3   **Infrastructure - Bridge and Tunnel Inventory Summary**

MODE	INFRASTRUCTURE ASSET TYPE	INFRASTRUCTURE DETAILED TYPE	UNIT	QUANTITY
Transit	Bridges and Tunnels	Steel Bridges	Count	95
		Non-Steel Bridges	Count	57
		Culverts	Count	101
		Tunnels	Track Miles	50
Commuter Rail	Bridges and Tunnels	Steel Bridges	Count	172
Commuter Rail	Bridges and Tunnels	Non-Steel Bridges	Count	135
		Culverts	Count	1,202
		Tunnels	Track Miles	22
		Dams	Count	2

Source: 2022 Capital Needs Inventory

Facilities

There are 727 facilities supporting the MBTA's public transportation service. A facility is defined by a single building or structure sued in providing public transportation. There are three major types of facilities: support facilities (administrative and/or maintenance), passenger facilities, and parking facilities. The MBTA's largest portion of facilities consists of maintenance or administrative facilities (47%), followed by passenger facilities (36%), and parking facilities (17%).

FIGURE 4-4   **Facilities Inventory Summary**

MBTA MODE CATEGORY	FACILITY TYPE	QUANTITY
Transit	Maintenance and/or Administrative Facilities	176
	Passenger Facilities	130
	Parking Facilities	32
Commuter Rail	Maintenance and/or Administrative Facilities	165
	Passenger Facilities	131
	Parking Facilities	93
	Facilities Total	727

Source: 2021 NTD Submission

Asset Condition

Condition performance measures for the MBTA's assets vary depending on the asset type and current availability of data. At a minimum, asset condition is assessed using standards established by FTA. The list below describes this minimum standard to which the MBTA aligns.

▶ Vehicle condition performance is based on age per FTA and specifies reporting percentage of vehicles within an asset class that have met or exceeded their useful life benchmark.

▶ Facility condition performance is based on physical condition assessment and per FTA specifies reporting percentage of facilities within an asset class that is rated 2.9 or below on the 1-5 TERM scale.

▶ Bridge condition performance is based on physical condition assessments as rated in accordance with the National Bridge Inspection Standards (NBIS) and translated to the FTA's National Transit Database (NTD) Asset Inventory Module (AIM) scale.

▶ For all other assets where physical condition information may not be available, age, informed by installation dates, is utilized as a proxy to measure condition performance.

4.2.1   MBTA'S ASSET CONDITION STANDARD AND ASSET CLASS GUIDELINES

The MBTA is in the process of finalizing an Asset Condition Standard that establishes a framework to consistently assess the condition of the MBTA assets. The Asset Condition Standard sets the criteria and scale for scoring state of good repair to inform management actions and decision making associated with asset maintenance, renewal, and/or replacement.

Along with the Asset Condition Standard, the MBTA is finalizing a series of Asset Class Condition Guidelines. These guides instruct MBTA staff in the application of the Asset Condition Standard to specific classes of infrastructure assets. The MBTA Asset Management Team worked closely with asset class subject matter experts to develop these specific guides to align the Asset Condition Standard framework with the processes associated with class specific maintenance, renewal, and/or replacement activities.

The development and adoption of these standards and guidelines supports consistent data across asset classes and portfolios. This ensures the MBTA has quality information to prioritize resources, develop projects, and conduct effective capital and operations planning.

Revenue and Non-Revenue Vehicles

The table below shows the count of revenue vehicle assets that are in and out of a State of Good Repair. In this table, State of Good Repair is defined as vehicles whose age is within the useful life benchmark for the given asset type. When a vehicle exceeds the useful life benchmark age, it is considered not in a State of Good Repair.

FIGURE 4-5   **Revenue Vehicles Current Condition Summary**

MODE CATEGORY	MODE	ASSET TYPE	ULB	QUANTITY	QUANTITY BEYOND USEFUL LIFE	PERCENT BEYOND USEFUL LIFE
Transit	Rail	Light Rail	31	242	115	48%
		Heavy Rail	31	476	340	71%
	Bus	Bus	14	1,476	799	54%
Commuter Rail	Commuter Rail	Commuter Locomotive	39	105	63	60%
		Commuter Rail Coach	39	452	344	76%
Ferry	Ferry	Ferry	42	16	14	88%
Paratransit	The RIDE	Automobile	6	278	112	40%
		Van	7	433	302	70%

Source: 2022 Capital Need Assessment

FIGURE 4-6   **Non-Revenue Vehicles Current Condition Summary**

MODE CATEGORY	ASSET TYPE	AVERAGE ULB	QUANTITY	QUANTITY BEYOND USEFUL LIFE	PERCENT BEYOND USEFUL LIFE
Transit	Rubber Tire Vehicle	14	796	450	57%
	Steel Wheel Vehicle	25	28	27	96%
Commuter Rail	Rubber Tire Vehicle	14	613	400	65%
	Steel Wheel Vehicle	25	90	67	74%

Source: 2022 Capital Needs Assessment

Infrastructure

Per FTA, Infrastructure is reported differently than revenue and non-revenue vehicles. Track and other wayside equipment are reported by mode and based on age of the assets grouped by installation decade. Track assets are reported in track miles. Other wayside assets are based on the highest functional component and reported in quantity of units. Bridges and Tunnels are reported based on their actual condition assessment and use that condition assessment to determine if they are in a state of good repair or not.

FIGURE 4-7   **Infrastructure - Track: Current Condition Summary Table**

TRACK ASSETS			DISTRIBUTION BY AGE									
Mode	Total Miles	Unit	Pre-1940	1940-1949	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2009	2010-2019	2020-2029
Transit	167	Track Miles	0.0	0.0	0.0	0.0	33.5	85.5	7.1	7.6	25.1	8.1
Commuter Rail	623	Track Mile	60.7	35.3	6.1	24.1	59.0	118.2	142.6	129.8	47.2	0.0

Source: 2021 NTD Submission

FIGURE 4-8   **Infrastructure - Signals: Current Condition Summary Table**

SIGNALS ASSETS			DISTRIBUTION BY AGE									
Mode	Total Quantity	Unit	Pre-1940	1940-1949	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2009	2010-2019	2020-2029
Transit	100	%	0.0	0.0	0.0	0.0	7.5	7.5	36	36	13	0.0
Commuter Rail	100	%	0.0	0.0	1.8	2.1	9.7	22.5	33.4	15.6	14.9	0.0

Source: 2021 NTD Submission

FIGURE 4-9   **Infrastructure - Power: Current Condition Summary Table**

POWER ASSETS			DISTRIBUTION BY AGE									
Mode	Total Quantity	Unit	Pre-1940	1940-1949	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2009	2010-2019	2020-2029
Transit	100	%	0.3	0.0	0.0	10.5	32.7	27.1	11.8	9	5.9	2.5
Commuter Rail	100	%	0.0	0.0	0.6	0.7	3.5	12	67.2	7.8	8.3	0.0

Source: 2021 NTD Submission

FIGURE 4-10   **Infrastructure - Bridge and Tunnel Current Condition Summary**

MODE	INFRASTRUCTURE ASSET TYPE	ASSET SUB TYPE	UNIT	QUANTITY	QUANTITY NOT IN SGR	% NOT IN SGR
Transit	Bridge and Tunnel	Steel bridges	Count	95	7	7%
		Non-steel bridges	Count	57	3	5%
		Culverts	Count	101	8	8%
Transit	Bridge and Tunnel	Tunnels	Track-Miles	50	N/A	N/A
Commuter Rail	Bridge and Tunnel	Steel Bridges	Count	172	27	16%
		Non-steel bridges	Count	135	12	9%
		Culverts	Count	1,202	60	5%
		Tunnels	Track Miles	22	N/A	N/A
		Dams	Count	2	0	0%

Source: 2021 NTD Submission

Facilities

The table below provides a summary of the MBTA's facilities inventory and current performance where condition has been assessed.

MODE	FACILITY GROUP / TYPE	UNIT	QUANTITY	QUANTITY NOT IN SGR	% NOT IN SGR
Transit	Maintenance and/or Administrative Facilities`	Each	176	111	63%
	Passenger Facilities	Each	129	34	26%
	Parking Facilities	Each	31	10	32%
Commuter Rail	Maintenance and/or Administrative Facilities	Each	165	64	39%
	Passenger Facilities	Each	131	32	24%
	Parking Facilities	Each	93	3	3%

Source: 2022 Capital Needs Assessment
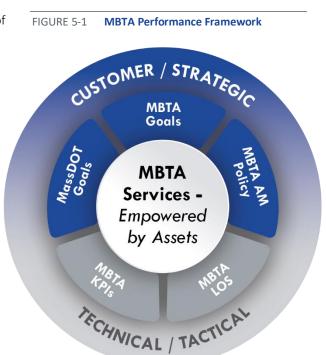
5. ASSET AND ASSET MANAGEMENT PERFORMANCE

This section provides a summary of the public transportation services provided by the MBTA and establishes the relationship between the strategic goals of the organization, customer levels of service, and the required technical performance of the physical assets.

5.1 Overview

An asset management framework shapes how performance is measured and managed organization-wide to meet the needs of customers and stakeholders.

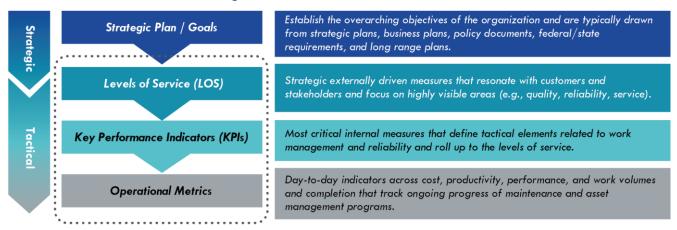A performance management framework links to asset management by:

▶ Defining asset management actions through specific and measurable outcomes.

▶ Grounding immediate and long-term decisions with tangible objectives.

▶ Establishing a framework to base investments on lifecycle cost, performance, risk, and level of service impacts.

▶ Providing a mechanism to measure the outcome of business process improvements and system changes.

▶ Enhancing decision making through robust information, defined objectives, clear measures, and improved stakeholder transparency.

FIGURE 5-1   **MBTA Performance Framework**

There are three primary categories of asset management performance metrics: Levels of Service (LOS); Key Performance Indicators (KPIs); and day-to-day Operational Metrics.

These categories are illustrated as a hierarchy and are aligned with the MBTA's overall asset management and strategic plan goals which transition from strategic to tactical measures.

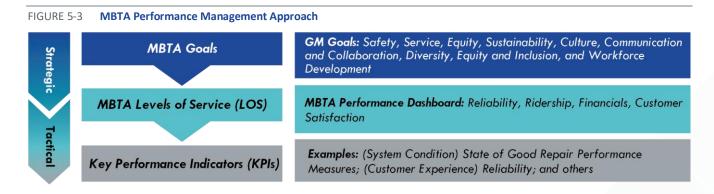FIGURE 5-2   **Illustrative Performance Management Structure**

5.2   MBTA Performance Management Approach

The MBTA tracks the performance of the transportation system through a few channels. The MBTA Performance Dashboard is a public facing website that provide transparent data related to system reliability, ridership, financials, and customer satisfaction.

The MBTA defines the Levels of Service for transit service through its Service Delivery Policy, a public document that states the objectives for delivering quality transit service to riders and sets standards for how this will be measured. This is reported on annually through the Service Delivery Policy annual report.

Levels of Service for other operating assets are defined by the department responsible for the infrastructure operations and maintenance. These levels of services are also guided by regulatory requirements, safety objectives, and high-level goals set by MassDOT's Office of Performance Management and Innovation.

FIGURE 5-3   **MBTA Performance Management Approach**
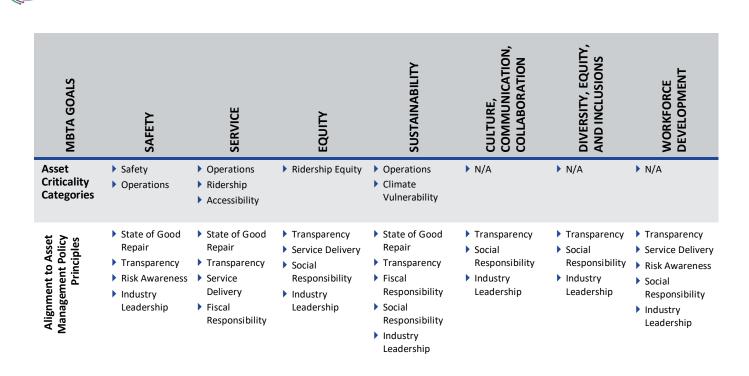
5.2.1 MBTA GOALS

The MBTA Goals and Objectives provide a strategic framework to align activities across the organization. The updated goals are:

FY22 PERFORMANCE GOALS	
Safety	We put safety at the forefront of our work
Service	We endeavor to deliver superior service connecting people and communities
Equity	We strive to treat all customers and employees fairly and to consult diverse voices and perspectives in decision making
Sustainability	We invest resources wisely in solutions for our team, our communities, and our environment
Culture, Communication and Collaboration	Improve internal engagement and collaborative decision-making processes
Diversity, Equity, and Inclusion	Invest in more diverse, equitable, and inclusive organization
Workforce Development	Recognize diverse talent that we have and provide opportunities for meaningful professional development and career pathways

5.2.2 LEVEL OF SERVICE

The MBTA reports on specific measures that aim to meet goals established at the organization, state and federal levels. These measures are summarized in the following table.

MBTA GOALS	SAFETY	SERVICE	EQUITY	SUSTAINABILITY	CULTURE, COMMUNICATION, COLLABORATION	DIVERSITY, EQUITY, AND INCLUSIONS	WORKFORCE DEVELOPMENT
MBTA Objectives	▶ Develop safety culture ▶ Invest in safety, quality assurance, and oversight functions ▶ Establish and monitor safety objectives, performance targets, and indicators	▶ Improve service reliability ▶ Decrease number of dropped trips and crowding ▶ Adjust services transparently ▶ Improve customer communications ▶ Ensure performance of contractors ▶ Meet capital program investment goals	▶ Minimize impacts to transit dependent riders ▶ Advance accessibility focused projects ▶ Deliver benefits to low income and EJ communities ▶ Improve public engagement	▶ Deliver on revenue and expenditure targets ▶ Establish sustainable capital delivery model ▶ Improve MBTA's climate resiliency ▶ Improve MBTA operations energy efficiency	▶ Communicate clearly to all stakeholders ▶ Actively encourage employees to report safety issues ▶ Improve internal engagement ▶ Support partnerships between departments ▶ Model collaborative environment	▶ Support diverse talent across organization ▶ Improve hiring process ▶ Grow organization capacity around diversity	▶ Build and maintain a strong executive leadership team ▶ Assess internal skill gaps and build tools to address need. ▶ Manage labor relations and collective bargaining strategy

MBTA GOALS	SAFETY	SERVICE	EQUITY	SUSTAINABILITY	CULTURE, COMMUNICATION, COLLABORATION	DIVERSITY, EQUITY, AND INCLUSIONS	WORKFORCE DEVELOPMENT
Asset Criticality Categories	▶ Safety ▶ Operations	▶ Operations ▶ Ridership ▶ Accessibility	▶ Ridership Equity	▶ Operations ▶ Climate Vulnerability	▶ N/A	▶ N/A	▶ N/A
Alignment to Asset Management Policy Principles	▶ State of Good Repair ▶ Transparency ▶ Risk Awareness ▶ Industry Leadership	▶ State of Good Repair ▶ Transparency ▶ Service Delivery ▶ Fiscal Responsibility	▶ Transparency ▶ Service Delivery ▶ Social Responsibility ▶ Industry Leadership	▶ State of Good Repair ▶ Transparency ▶ Fiscal Responsibility ▶ Social Responsibility ▶ Industry Leadership	▶ Transparency ▶ Social Responsibility ▶ Industry Leadership	▶ Transparency ▶ Social Responsibility ▶ Industry Leadership	▶ Transparency ▶ Service Delivery ▶ Risk Awareness ▶ Social Responsibility ▶ Industry Leadership

5.3 Current Performance

Annual performance on measures is reported through the Tracker Performance Management Report, the online MBTA Performance Dashboard, and the FTA's National Transit Database.

The table below summarizes MBTA's FY21 performance against FY20 targets. Improvement goals have also been established and are summarized below. For Rolling Stock and Equipment assets, useful life benchmark is used to measure the percentage of the total fleet that is beyond its useful life. For additional details on current performance and state of good repair measures refer to Chapter 4 "Asset Portfolio" of this plan.

FIGURE 5-4 **Rolling Stock – Percent of Revenue Vehicles that have met or exceeded their useful life benchmark**

MODE	ASSET TYPE	USEFUL LIFE BENCHMARK	2021 TARGET	2021 PERFORMANCE	PERFORMANCE	
					MET TARGET	MISSED TARGET
Bus	Bus	14	20%	**25%**		☒
	Articulated Bus	14	30%	**0%**	☑	
Light Rail	Light Rail Vehicles	31	39%	**0%**	☑	
Heavy Rail	Heavy Rail Vehicles	31	52%	**53%**		☒
Commuter Rail	Locomotive	39	24%	**23%**	☑	
	Passenger Coach	39	13%	**8%**	☑	
Ferry	Ferry Vessel	42	0%	**0%**	☑	
Paratransit	Automobile	6	50%	**33%**	☑	
	Van	7	19%	**50%**		☒

FIGURE 5-5 **Equipment – Percent of Non-Revenue Service Vehicles that have met or exceeded their useful life benchmark**

ASSET TYPE	ULB	2021 TARGET	2021 PERFORMANCE	PERFORMANCE	
				MET TARGET	MISSED TARGET
Automobiles	Varies	45%	60%		☒
Trucks and other Rubber Tire Vehicles	Varies	27%	17%	☑	
Steel Wheel Vehicles	Varies	40%	39%		☒

For Facilities assets, a 1-5 condition rating is used to determine the performance of these assets with a score of 2.9 or lower indicating the asset is out of a state of good repair.

FIGURE 5-6 **Facilities – Percent of facilities with a condition score of 3 or lower**

ASSET TYPE	2021 TARGET	2021 PERFORMANCE	PERFORMANCE	
			MET TARGET	MISSED TARGET
Passenger / Parking Facilities	7%	7%	☑	
Administrative and Maintenance Facilities	45%	49%		☒

For infrastructure assets, performance is measured based on the percent of the total network that is operating under restrictions. This means any section of the network that is operating below designed speeds or volumes due to the condition of the infrastructure.

FIGURE 5-7 **Infrastructure – Percent of track segments with performance restrictions**

ASSET TYPE	2021 TARGET	2021 PERFORMANCE	PERFORMANCE	
			MET TARGET	MISSED TARGET
Transit Heavy Rail	1%	3%		☒
Transit Light Rail	3%	2%	☑	
Commuter Rail	5%	4%	☑	

6. LIFECYCLE MANAGEMENT STRATEGIES

Key to the MBTA's asset management practice is the development and implementation of lifecycle management strategies. Lifecycle management acknowledges that assets have their own lifecycle and require different resources, actions, and information necessary to make the best decisions to maintain performance from acquisition, to operation, and finally decommissioning and disposal.

6.1 Overview

Lifecycle management strategies are being further developed as part of the 2023-2026 asset management program of work to capture the capital maintenance activities and resources necessary to achieve and maintain the MBTA's state of good repair goal. A major element of this strategy is to develop management plans for each asset class; these detailed plans outline the performance, condition, and lifecycle activities necessary to maintain a level of service. These asset management plans connect the day-to-day preventative maintenance actions with the long-range performance goals and objectives of the Asset Management program.
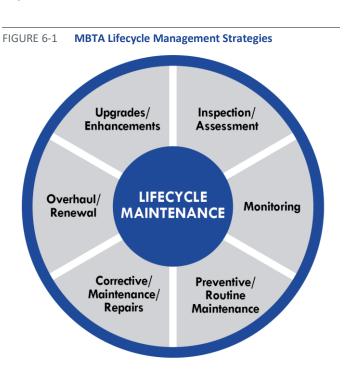
6.2 Current Lifecycle Management Strategies

The MBTA is committed to providing customers safe, accessible, cost-effective, resilient, sustainable, and responsive service. Current lifecycle management strategies implement at the MBTA to achieve this commitment are presented below. For the management of infrastructure assets (track, power, signal, and facilities), typical work activities to manage the infrastructure over its life are also described in the MBTA's Engineering and Maintenance Directorate Management Plan.
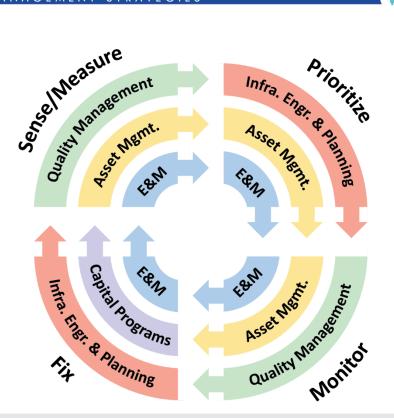
Execution of the Lifecycle Management Strategies require coordination and collaboration of each department within the Office of the Chief Engineer (OCE) which includes Engineering and Maintenance, Quality Management, and Asset Management, Infrastructure Engineering and Planning, and Capital Programs.

This collaboration is defined through four main actions: Sense/Measure, Prioritize, Monitor, and Fix. Every OCE department playing a specific role within each action.

FIGURE 6-1 **MBTA Lifecycle Management Strategies**

OCE DEPARTMENT	SENSE / MEASURE	PRIORITIZE	MONITOR	FIX
Engineering and Maintenance (E&M)	Daily maintenance and inspection of the system	Recommends maintenance actions	Reinspects and reviews prioritized assets	Performs short / medium term repairs which do not require design / permits
Quality Management	3rd party inspections to improve quality assurance practices		Validates inspections with 3rd party inspectors	
Asset Management	Monitors state of good repair throughout the system	Prioritize asset replacement schedule and define asset risk	Tracks prioritized assets due for repair or replacement	Documents significant repair and replacement activities against state of good repair
Infrastructure Engineering and Planning		Provides replacement recommendations consistent with codes and regulations		Facilitates extensive repair or replacement activities which require permits and design phases
Capital Programs				Performs moderate repairs which require some design phase

Strategies have been summarized and organized by the following categories:

▶ Inspection / Assessment includes visual inspection and technical testing to ensure safe operating capability. Inspection activities are typically on a time or milage interval. Asset assessment or asset health is typically graded on a scale and supports long-term planning for the asst.

▶ Monitoring may include real-time sensors or electronic equipment that continuously monitor the status of an asset and provide alerts when thresholds have been exceeded.

▶ Preventive / Routine Maintenance includes regular, sometimes daily activities or tasks to ensure the assets continue to operate in safe and acceptable conditions. They may also include seasonal preventative programs for extreme temperature in the summer or winter.

> ▶ Corrective Maintenance / Repairs includes standard repair tasks that occur due to a condition or fault issue discovered through inspection, monitoring, or during operations. Activities that fall under this category are also known as "running maintenance."

The MBTA's maintenance practices comply with industry standards, federal and state requirements, and MBTA specific requirements.

Beyond routine operations and maintenance, larger scale renewals, replacements, enhancements, or expansions may take place to improve service levels and performance. These would include the following categories and activities.

> ▶ Overhaul / Renewal includes more extensive capital maintenance activities required to bring a set of assets up to an acceptable condition or extend their useful life. These strategies are typically assigned on time, use, and and/or condition-based intervals.

> ▶ Upgrades / Enhancements include asset or system-wide capital improvement activities that go beyond like-for-like replacement and enhance current service levels, performance, reliability, capacity, or technology for existing assets, such as increasing track capacity, track class upgrades, vehicles upgrades, etc.

6.2.1 VEHICLES

The MBTA's revenue vehicles follow lifecycle maintenance strategies that comply or exceed Original Equipment Manufacturer requirements and MBTA specific requirements. Preventative maintenance activities are usage based with different scopes at various intervals. Fleet vehicles are continuously and frequently subject to preventative maintenance inspections. Parts replacements are on a programmed schedule to prevent component failure. Additionally, maintenance campaigns on specific lines have been instituted to improve reliability and performance based on specific operating environments.

The following tables outline the key lifecycle management strategies, primarily for inspection and preventative maintenance activities to ensure operating conditions for each major vehicle asset type.

ASSET CLASS	LIFECYCLE MANAGEMENT STRATEGY / ACTIVITY	FREQUENCY
Bus Fleet	Inspection and Services – Varies by Vehicle	500 miles or 7 days
	Preventative Maintenance	6,000-mile intervals
	Air Conditioning Systems PM Inspection	Annual
	Pre-Summer and Pre-Winter PM Inspection	Annual
Transit Car Fleet	Red Line PM Inspections – No 1 and 2 cars	8,500 miles or 90 days
	Red Line Pm Inspections – No. 3 cars	15,000 miles
	Redline HVAC System Inspections	Varies by Vehicle Type
	Orange Line PM Inspections	15,000 miles or 90 days
	Orange Line – HVAC Inspections	4 times / year
	Orange Line – Extensive PM Program	Annually
	Blue Line PM Inspections – No. 5 cars	6,000 and 12,000 miles
	Green Line PM Inspections – Type 7 cars	7,500 miles or 90 days
	Green Line PM Inspections – Type 8 cars	90 days
	Green Line PM Inspections – Type 9 cars	10,000

ASSET CLASS	LIFECYCLE MANAGEMENT STRATEGY / ACTIVITY	FREQUENCY
	Green Line PM Inspections – PCC cars	30 days
	Green Line HVAC System Inspections	Annually
	Green Line Air Compressor Inspections	Annually
Commuter Rail Fleet	Locomotive Inspections	45 days, 92 days, 1 year, 2 years, and 3 years.
	Locomotive top deck engine overhaul, mid-life overhaul	6-8 years
	Control Coach Inspections	92 days, 1 year, 2 years, and 3 years
	Blind Coach Inspections	180 days, 1 year, 2 years, and 3 years
Ferry Vessels	Vessel Condition Assessment	Annually

6.2.2 INFRASTRUCTURE (TRACK, SIGNALS, POWER, FACILITIES)

The MBTA's Transit Maintenance of Way (MOW) Department is responsible for the maintenance and repair of all track. MOW regularly performs all types of lifecycle management activities including inspection, preventative maintenance, corrective maintenance, repairs, renewals and replacements, capital improvements, construction support and asphalt paving necessary to maintain assets under its responsibility. Additionally, MOW is responsible for right of way trash removal, snow removal, and landscaping.

The Track Department is responsible for inspections performed under the MBTA Safety and Security Program Plan guidelines and the Light and Heavy Rail Maintenance and Safety Standards. Inspections fall under two categories: manual visual inspections and mechanized inspections. Visual inspections are typically performed on foot or by riding over the track at a speed slow enough for a person to accurately conduct the inspection. Mechanized inspections use specialized geometry, ultrasonic, or optical tool to measure wear and identify defects. Issues identified through these inspections are reported and if corrective repairs are required, these are schedule through the MBTA's Engineering and Maintenance Planning and Scheduling department.

The Signals and Communications Department is responsible for the maintenance and operation of signals assets including track circuits, wiring, bonds, switches, third rail heaters, and central instrument houses and wayside cases. Communication assets include telephone hardware, call boxes, public address system hardware and message boards.

The Power Department is responsible for the maintenance and operations of the: gas generation plant, bulk power yard, South Boston Switching Station, AC cabling and duct bank system, traction power substations, DC distribution systems, overhead catenary system, power SCADA system, and generator control system.

The Transit Facilities Maintenance (TFM) team is responsible for a large range of assets and asset types that span the transit system. They include buildings, subway facilities, passenger stations, bus stops, parking garages, bridges, tunnels, culverts and retaining walls. The TFM's maintenance routines comply with state building codes, the MBTA's insurance requirements, and national standards such as the National Bridge Inspection Standards, National Fire Protection Association, and other federal guidance.

ASSET CLASS	INSPECTION / ASSESSMENT ACTIVITY	FREQUENCY
Track	Light Rail Passenger Service – Green Line – Visual Track Inspection	3 times per week (with at least one calendar day interval between inspections)
	Rapid Transit Passenger Service – Red, Orange, Blue Lines – Visual Track Inspection	2 times per week (with at least one calendar day interval between inspections)

ASSET CLASS	INSPECTION / ASSESSMENT ACTIVITY	FREQUENCY
	Light and Heavy Rail Yard and Storage Track Visual Inspection	Weekly (with at least 3 calendar days interval between inspections, or before use, if track is used less than once a week)
	Light Rail Passenger Service – Green Line – Geometry Inspection	Quarterly
	Light Rail Passenger Service – Green Line – Ultrasonic Rail Inspection	Every 6 months
	Rapid Transit Passenger Service – Red, Orange, Blue Lines – Ultrasonic Rail Inspection	Every 6 months
	All Switches – Visual Inspection	Weekly
	Revenue Service Switches – Detailed Inspection	Every 3 months
	Non-Revenue Service Switches – Detailed Inspection	Every 4 months
	Track Expansion Joint – Summer Prep Inspection	Annual (Spring)
	Track Expansion Joint – Winter Prep Inspection	Annual (Fall)
	Light Rail Passenger Service – Green Line – Optical Rail Testing	Every 6 months
	Light Rail Passenger Service – Green Line – Seasonal Prep-Ballast Survey	Annual (Spring)
	Light Rail Passenger Service – Green Line – Seasonal Prep-Historic Rail Kink Site Inspection	Annual (Spring)
	Rapid Transit Passenger Service – Red, Orange, Blue Lines – Optical Rail Testing	Performed periodically with no specified frequency
	Rapid Transit Passenger Service – Red, Orange, Blue Lines – Seasonal Prep-Ballast Survey	Annual (Spring)
	Rapid Transit Passenger Service – Red, Orange, Blue Lines – Seasonal Prep-Historic Rail Kink Site Inspection	Annual (Spring)
Signals	All Signal Assets with Software Management - Testing	Annually
	Signal Wires and Cables – Insulation Resistance Testing	Every 10 years (standard) and annually (enhanced)
	AC Relays – Testing	Every 2 years
	DC Relays – Testing	Every 4 years
	Timing Relays – Testing	Annually
	Signal Event Recorders - Testing	Annually
	Signals – Testing and Inspection	Quarterly
	Switch Machines – Testing	Every 2 years
	Switch Machine (Local Time Release) – Testing	Annually
	Switch Machine (No Local Time Release) – Testing	Every 2 years
	TAK Head – Testing and Inspection	Annually

ASSET CLASS	INSPECTION / ASSESSMENT ACTIVITY	FREQUENCY
	AC Track Circuits – Testing	Every 2 years
	AF Track Circuit – Shunt and Ground Test	Every 6 months
	Track Circuit – Fouling Circuits and Shunt Wire Testing	Every 2 years
	VMI – Route Locking Testing	Every 2 years
	VMI – Traffic Locking Testing	Every 2 years
	Wayside Cases – Grounding Test	Monthly
	Control Point Houses – Grounding Test	Monthly
	Red and Orange Line Signal Section – Testing	Monthly
	Switch Machine (Hand Throw) – Obstruction Testing	Monthly
	Switch Machine (Powered) – Obstruction Testing	Monthly
	Tripstops – Automatic Train Stop Testing	Monthly
	Track Circuit – Insulating Rail Joint and Switch Insulation Inspection	Every 2 years
	VMIS – Signal Indication Testing	Every 2 years
	VMIS – Approach Locking Testing	Every 2 years
	VMIS – Time Locking Testing	Every 2 Years
Power	Passenger Substation Low-Voltage Circuit Breakers - Inspection	Every 2 months
	Passenger Substation Low-Voltage Circuit Breakers – Operationally Test	Annually
	Contact Wires – Inspection and Service	Annual (Mainline), Biennial (Branch Lines) and Triennial (Yards)
	Overhead Catenary System Cut Out - Manufacturer DBI	Quarterly (Mainline) and Every 6 months (Yards)
	Overhead Catenary System Cut Out – Generic Manufacturer	Quarterly (Mainline) and Every 6 months (Yards)
	Overhead Catenary Systems Cut Out – Manufacturer NOBO DOOR	Every 6 months (Yards)
	Overhead Catenary Systems Cut Out - Manufacturer NOBO	Quarterly (Mainline) and Every 6 months (Yards)
	DC Power Sections – Annual Negative Return Feeder Cable Inspection	Annually
	DC Power Section – Low level OCS Inspection	Quarterly
	DC Power Section – Third Rail Inspection	Quarterly
	DC Power Section – Trackless Trolley Inspection	Quarterly
	Substation Electro/Mechanical Relay – Test and Calibrate	Annually
	Substation Electro/Mechanical Overcurrent Relays – Test and Calibrate	Annually

ASSET CLASS	INSPECTION / ASSESSMENT ACTIVITY	FREQUENCY
	Passenger Substation Dry Type Transformer – Clean and Diagnostic Testing	Every 5 years
	Substation Transformers – Oil and Dissolved Gas Testing	Annually
	Power Transformers – Oil and Dissolved Gas Testing	Annually
	CNG Detection System – Inspection and Testing	Quarterly
	Fire Alarm Systems – Master Box Testing	Monthly
	Fire Alarm System – Inspection and Testing	Quarterly
	Fire Alarm System – Inspection and Testing	Every 6 months
	Fire Suppression System – Inspection and Testing	Every 6 months
	Emergency Generators – Load Testing and Mechanical Maintenance	Annually
	Emergency Generators – Inspection	Monthly
	Emergency Ventilation Systems – Inspection and Maintenance	Monthly
	Emergency Ventilation Systems – Remote Test Run	Quarterly
	South Boston Feeder Station Gas Turbines A&B – Maintenance	Every 6 months and annually
	South Boston Feeder Station Gas Turbine A&B – Inspection and Tests	Daily and weekly
	Substation AC Breakers – Inspection and Maintenance	Every 6 months
	Substation AC Breakers – Remote Operational Testing	Monthly
	Substation DC Breakers – Remote Operational Testing	Weekly
	Substation DC Breakers – Inspection and Maintenance	Every 6 months
	AC Cables – Inspection and Testing	As-Needed
	DC Cables – Inspection and Testing	Every 3 years
	Overhead Catenary System – Balance Weights and Seasonal Prep	Seasonal and Extreme Weather Conditions Only
	Substation Rectifiers – Inspection and Cleaning	Annually
	SCADA System – Master Software Updates	Every 2 years
	SCADA System – Operating System Updates	Monthly
	SCADA System – Functionality Testing	Daily
	Passenger Substation Dry Type Transformers – Inspection	Every 2 months
	UPS Backup Systems – Inspection and Battery Resistance Testing	Every 6 months
	Substation Control Battery Systems – Inspection, Watering, and Voltage Reading	Monthly

ASSET CLASS	INSPECTION / ASSESSMENT ACTIVITY	FREQUENCY
Stations / Facilities	Elevators and Escalators – Inspection and Testing	Frequency depends on level of service and performance
	Air Compressors – Rotary Screw Preventative Maintenance	Monthly, every 4 months, and annually
	Overhead Cranes – Inspection, Load Test, and Certification	Annually
	Facility and Building – Structure Inspection	Annually
	Fall Protection Systems – Inspection and Maintenance	Annually
	HVAC – Inspection and Testing	Every 2 months
	Mobile Vehicle Lifts – Inspection and Maintenance	Monthly
	Overhead Door – Inspection and Maintenance	Every 6 months
	Portable Chair Lift Hydraulic – Inspection	Every 6 months
	Retaining Wall – Inspection	Annually
	Sewers and Drains – Maintenance	Monthly
	Stationary Vehicle Lifts – Manufacturer KONI	Monthly, quarterly, and annually
	Stationary Vehicle Lifts – Manufacturer OMER	Monthly
	Stationary Vehicle Lifts – Manufacturer Other	Monthly
	Stations – Structural Inspections	Annually
	Vehicle Washer – Inspections	Monthly
	Line and Yard Fences – Inspections	Annually
	Snow Fences – Inspections	Annually
	Emergency Exits – Condition Inspections	Monthly
	Fire Extinguishers – Inspection	Annually
	Fire Suppression Systems – Inspection	Every 6 months
	Fire Hydrants – Inspection and Testing	Every 6 months
	Fire Sprinkler Systems – Inspection	Quarterly, every 6 months, and annually
	Standpipe System – Inspection and Testing	Every 5 years
	Boilers – Inspection and Repair	Annually
	Compressed Air Systems – Inspection and Maintenance	Annually
	Sewage Ejector Pumps – Inspection and Maintenance	Monthly
	HVAC Systems – Inspection	Monthly and quarterly
	Overhead Doors – Inspection and Maintenance	Monthly
	Overhead Door – Winter Prep	Annually
	Parking Garages – Inspection	Monthly

ASSET CLASS	INSPECTION / ASSESSMENT ACTIVITY	FREQUENCY
	Station and Platform Pit – Inspection	Annually
	Plumbing Systems – Inspection	Monthly
	Pump Rooms – Inspection	As-Needed
	Stations – Cleaning Inspections	Monthly
	Access Gates – Lubrication	As-Needed
	Facility and Buildings – Visual Inspection	Monthly, quarterly, and annually
	Facility Roofs – Inspection	Annually
	Sewers and Drains – Drainage Clearance	Annually
	Stations – Visual Inspection	Monthly, quarterly, and annually
Bridge and Tunnel	Routine Bridge Inspection	Varies on criticality – Every 6 to 24 months
	In-Depth Bridge Inspection	Every 5 years
	Bridge Load Rating	Every 10 years
	Tunnel – Inspections	Every 2 years
	Special Member / Overhead Catenary System – Inspections	Annually

7. RISK MANAGEMENT

The MBTA's risk management processes and procedures have historically focused on insurance, weather, and other incident management functions in the service of identifying and addressing safety risks related to its infrastructure and operations.

This TAM Plan highlights the MBTA's efforts to develop an enterprise risk management approach that not only supports identifying and addressing safety risks, but also supports decision making related to capital planning, reliability engineering, and resource prioritization.

7.1 Overview

FTA requires that asset management risks are to be captured to inform investment prioritization and that providers implement strategies to address operational risks. Critical to the safety and performance of a public transportation system is the condition of its capital assets. When transit assets are not in a state of good repair, the consequences include increased safety risks, but also decreased system reliability, higher maintenance costs, and lower system performance.

While FTA requires that risk is considered as part of its investment prioritization for state of good repair, it does not require a formal set of risk management processes and procedures as part of this plan. The MBTA demonstrates its commitment to quality management and best practices by taking actions to document and develop its risk management framework in alignment with its asset management practice.

The following section outlines the MBTA's current approach to risk management while offering a risk management framework to continue integrating risk identification and control activities in its asset management practice.

7.2 Risk Management Approach

7.2.1 CURRENT RISK MANAGEMENT ACTIVITIES

The MBTA has established approaches for addressing safety risks, managing incidents, ensuring business continuity. The Risk Management Team works with Asset Management and key stakeholders to develop a framework that allows for continued risk identification and risk mitigation to achieve Highly Protected Risk status for the MBTA's Property Profile while reducing risk and enhancing safety throughout the organization.

On an annual basis, loss control engineering site visits to existing facilities are conducted by the MBTA's property insurer following standards developed by the National Fire Protraction Association as the basis for evaluation and report preparation and are augmented with additional technical information based on the property projection specifications of the MBTA.

The risk assessment for Risk for Loss Control Engineering includes but is not limited to:

▶ Construction – Building construction, type of insulation, utility services, overall combustibility

▶ Occupancy – Operations that take place at site, special hazards protection

▶ Exposure – Flood, earthquake, windstorm, man-made hazards, etc

▶ Management Loss Control Programs – Emergency planning, business contingency planning and safety programs that are in place included hot work permit systems, confined space entry, sprinkler impairment notification, evacuation procedures, preventative maintenance programs, lockout/tagout programs, inspection of fire protection equipment.

Mitigation of safety risks is a top priority as demonstrated further through training, regular safety briefings, promotion (e.g. safety awards) and capital project selection criteria. Safety management working groups exist throughout the agency to review and address safety risk issues.

The MBTA also regularly addresses other forms of operational and hazard risk to ensure reliable operation of its modes, including:

▶ Developing and maintaining storm preparedness plans and emergency management plans

  » The enterprise Snow and Ice Plan and the complimentary documents produced by each department, for example, are completed and issued annually. The plan effectively services as a coordinated listing of roles and responsibilities to be followed in the event of a cold weather emergency / special events emergency. The plan lists the event and discusses such items as the risks, the actions plan, staging, the people management plans, and the equipment needs.

▶ Preparing for incident response and recovery

  » In preparation for events, the MBTA holds at least two major drills annually involving evacuation of commuter rail cars and subway cars from tunnels in addition to other preparedness activities like workshops and tabletop exercise. When an incident occurs, Operations plays a central role in coordinating the department that are responsible for resolving the issue. When an event, major storm, or other incident does occur, MBTA Leadership manages business continuity and the event through the Emergency Operations Center (EOC).

- ▶ Addressing climate risks

  - » The Environmental Department identifies climate risks to the system and develops resiliency plans addressing vulnerabilities to specific parts of the system.

- ▶ Regularly identifying risks and threats to, and vulnerability of, the MBTA assets and stations

  - » Threat and vulnerability assessments are conducted by a third party about every three years to identify which assets and stations are vulnerable to certain attacks. It is a collaborative effort with Transit Police and Safety and Security teams.

Recent Improvements

The MBTA is expanding the focus of existing operational safety and hazards risk management to look at the impact of operational and hazards risks on the business, socio-economic responsibility, and service delivery more holistically at the enterprise level. Efforts are underway to prioritize and address open recommendations for improvement and to reduce risk.

One of these efforts is the establishment of the Risk Improvement Committee, a working group made up of key stakeholders from across the MBTA functions to review, update, and improve current business processes related to risk management and to provide input on risk identification, prioritization, and remediation. Specifically, this committee will address and respond to finding from the Loss Control Engineer Site Visit Reports and is comprised of representatives from Risk Management, Safety, Engineering, Maintenance, Construction and Capital Programs, Asset Management, Climate Resiliency, and external Loss Control Engineers from the property insurance broker and property insurer. A risk management process is being developed in conjunction with these teams to prioritize and address critical risks and preventative maintenance work in a timely manner.

The MBTA's Strategic Plan also addresses asset management risks. "There is a direct correlation between asset condition and service reliability, maintenance costs, day-today operational challenges, and customer experience." The MBTA's recent effort to update and validate its complete capital asset inventory and perform asset condition assessments per new industry guidelines will further information the risk management process.

Future Plans

The MBTA Risk Management group will be establishing an Enterprise Risk Management Platform with a framework to identify, measure, manage, and report risks. The ERM process will set risk tolerance, identify exposures, analyze exposures, identify mitigation options, review risks and strategies with an Enterprise Risk Management Council. The ERM platform will include all operational and administrative functional areas of the MBTA.

7.2.2 A RISK MANAGEMENT PROCESS FRAMEWORK FOR ASSET MANAGEMENT
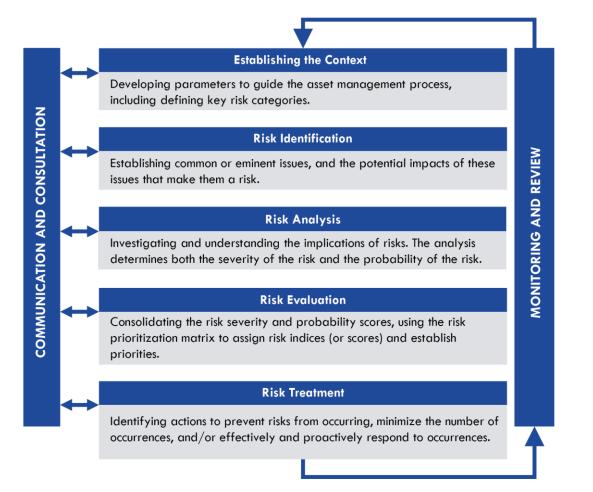
A risk management process not only represents good practice but also is essential for developing lifecycle strategies and achieving the benefits of an asset management plan. These benefits include effectively managing the asset lifecycle, confidently provide sustained performance at the lowest lifecycle cost, balancing asset related risk and justifying funding requirement to deliver on expected levels of service.

The MBTA's Asset Management framework has been developed to align with ISO 55000, the internationally accepted standard for asset management practice.   The MBTA's Asset Management Team's approach to integrating risk management practices aligns with ISO 31000, the internationally accepted standard for risk management practice.

The proposed framework for integrating risk management into the MBTA's asset management practices also is aligned to the ISO 31000 risk management standard as illustrated in the figure below and described in the following sections.

FIGURE 7-1   **ISO 31000 Risk Management Process**

Establishing the Context

Establishing the context defines the basic parameters for risk evaluation and determines the scope for the rest of the risk management process, focusing on specific area or areas of the business – whether at an enterprise level or asset level. The following risk categories embody the various functional areas represented on the MBTA's Risk Improvement Committee:

Legal Claims	Environmental	Finance
Procurement	Safety	Security
Chief of Staff	Transit Police	Asset Management
Real Estate	Operations	HR / Labor Relations
Infrastructure	Workers Comp	IT
Customer Experience	Capital Delivery	Contractor Management

Risk Identification

Risk identification is the process of finding, recognizing, and describing risks. Risk identification is a systematic and continual process to maintaining an up-to-date view of risks. As a starting point, the MBTA is committed to the development of a risk management system software to track and manage claims and provide the basis for data-driven decision making.

In addition, the systematic management of asset and asset management risk should engage those in the agency with direct asset-facing and other asset management responsibilities in identifying and describing potential risks.

Risk Analysis and Risk Evaluation

Risk analysis is the process used to determine the nature and level of risk. Risk evaluation compares the results of the analysis to determine whether the risk is tolerable or acceptable. In this phase, risk consequence, likelihood, and magnitude ratings would be established for risk and identified across the risk categories.

Risk Treatment

Risk treatment involves selecting one or more options for mitigating the risk.

Best practice risk management considers one or more of four typical strategies.

- Risk Prevention

  » Directed to eliminating sources of risk or substantially reducing its likelihood of occurring.

- Impact mitigation

  » Directed to the minimizing of the consequences of risk. Some risks cannot be avoided; therefore, this strategy is about minimizing the impact.

- Risk transfer

  » Directed to shifting the responsibility for the risk to another party, who ultimately bears the consequences of the risk.

- Risk acceptance

  » This occurs when risks cannot be avoided or transferred, or the cost benefit of addressing the risk outweighs the consequences of the risk. In this case, the risk is accepted and monitored.

Addressing Critical Assets

As part of the development of an improved risk management framework, criticality and condition should be defined for assets, and risk should be determined based on the defined asset criticality and condition factors.

The MBTA is developing an asset-based risk framework which is described in more detail in Section 9.4 of this document.

8. WORK PLANS AND BUDGET FORECASTS

The forecasted reliability and modernization investment in the FY23-27 MBTA Capital Investment Plan (CIP) totals $8.7 billion, representing 90% of the total $9.6 billion five-year capital program.

8.1 Overview

Strategic and thoughtful investment of financial resources is critical to maintaining a safe, reliable, and modernized transit network. This section provides an overview of the MBTA's CIP development process, which aims to create a portfolio of projects that reflects the agency's infrastructure needs and strategic priorities. The following sections describe the approach used to allocate funds across the portfolio of capital programs and provide an overview of the funding programmed in the FY23-27 CIP.

In alignment with FTA requirements, the work plans and investment priorities presented in this section are based on estimated funding available to the MBTA for each fiscal year over the four-year TAM Plan period.

8.2 Decision Support

8.2.1 CAPITAL PLANNING AND INVESTMENT PRIORITIZATION

Capital Investment Plan Overview

The MBTA Capital Investment Plan (CIP) is a short-term, financially constrained investment program that funds the planning, construction, and capital maintenance of assets across the MBTA. It is a rolling five-year plan, updated annually in coordination with the Massachusetts Department of Transportation and the Boston Region Metropolitan Planning Organization (Boston MPO).

The CIP, also referred to as the capital plan or the capital budget, encompasses over 550 unique capital projects across a variety of asset types. It includes all capital expenditures planned over the next five years. These investments aim to maintain a state of good repair, modernize the Authority's assets, expand service, and meet strategic priorities and performance goals.

The CIP is driven by two overarching priorities, which help to shape the overall strategy for capital investment: (1) Reliability and Modernization, and (2) Expansion.

Reliability and Modernization

▶ Aims to ensure a State of Good Repair and upgrade existing assets to accommodate current or anticipated growth

▶ Includes investments in system-wide accessibility, capacity and technology upgrades, and other improvements that enhance the existing system

Expansion

▶ Focuses on extending and expanding the system to provide more transit options, increase intermodal connections, and improve customer convenience

▶ Includes Green Line Extension, South Coast Rail, and additional targeted expansion projects

Each priority is broken out into programs, which are sized annually to align with the MBTA's identified needs and strategic goals. Programs under the Reliability and Modernization priority are largely asset-based while the Expansion programs fund South Coast Rail, Green Line Extension, and planning and design for additional targeted expansion projects.

State of Good Repair investment fall under Reliability and Modernization Programs.

CAPITAL PRIORITY	CAPITAL PROGRAM	PROGRAMMED SPEND
Reliability and Modernization	**Bridge and Tunnel** Repairs, reconstructs, and replaces Commuter Rail and transit bridges, tunnels, culverts, and dams	$857 M
	Guideway, Signal, and Power Rehabilitates, replaces, and upgrades guideway, signal, and power assets across Commuter Rail, transit, and bus	$2,179 M
	Maintenance and Administrative Facilities Rehabilitates and upgrades maintenance and administrative facilities	$1,240 M
	Passenger Facilities Rehabilitates and upgrades stations, stops, and parking facilities to improve accessibility and customer experience	$1,023 M
	Vehicles Rehabilitates and replaces the revenue and non-revenue fleet and equipment for reliable and safe operations	$2,368 M
	Business and Operational Support Investments in asset management, safety and security, communications, and other systems	$455 M
	Technology and Innovation Investments in technology to enhance productivity, modernize the system, and improve the quality of service	$579 M
Expansion	**Green Line Extension** Extension of Green Line service from Lechmere to Somerville and Medford	$383 M
	South Coast Rail (SCR) Extension of Commuter Rail service to Fall River, New Bedford, and Taunton on the South Coast of Massachusetts.	$533 M
	Expansion Projects Planning and design of targeted expansion projects identified as next priorities	$27 M

Investment Prioritization and Decision Support

The MBTA prioritizes proposed capital investments using a consistent, objective, and data-informed approach, as required by the MBTA's enabling legislation and recommendation by the MassDOT Project Selection Advisory Council (PSAC).

The CIP is updated on an annual basis to align with current investment priorities and allocate new funding sources. A key component of CIP development is the program sizing process, in which available funding sources for the upcoming five-year horizon are estimated. Once sources are identified, the MBTA Capital Planning and leadership teams determine initial investment program sizes based on the known state of relative needs by asset type and mode. This exercise is informed by annual asset performance measures, ongoing discussions with asset owners, and the Capital Needs Assessment (CNA).

The annual CIP development cycle runs from September to June, beginning with an internal Call for Projects and the evaluation and scoring of funding requests submitted for consideration in the upcoming CIP. This project evaluation process is necessary to understanding the impacts of proposed capital projects and determining their alignment with known capital needs and agency goals. Projects are evaluated against eight criteria recommended by PSAC. They include:

CRITERIA	DESCRIPTION
System Preservation	The extent to which the project contributes to a state of good repair on the transportation system and aligns with asset management goals.
Mobility	The extent to which the project is intended to provide modal options efficiently for all users through benefits to reliability, accessibility, and other measures of service quality.
Cost Effectiveness	The extent to which the project impacts operating costs and revenues and maximizes the return on the public's investment.
Environmental and Health Effects	The extent to which the project meets State goals of improving air quality and reducing greenhouse gases, and results in a reduction of pollution.
Policy Support	The extent to which the project is aligned with MBTA policy priorities, including Focus 40.
Economic Impact	The extent to which the project supports economic growth in the Commonwealth.
Social Equity	The extent to which the project equitably distributes social, economic, and health benefits to residents and local businesses.
Safety	The extent to which the project addresses documented or identified safety issues and hazards, and security vulnerabilities and risks.

The Safety criterion is scored by the Safety and Security departments using their expertise and resources. The remaining criteria are scored by cross-functional evaluation teams representing diverse perspectives across the MTBA and MassDOT. Teams review and score each funding request using information on the project's scope, condition of the existing asset(s), estimated ridership, flood and severe weather risk, and other attributes.

System Preservation is the criterion most closely related to asset management principles. It includes sub-criteria that aim to measure the extent to which a project contributes to a State of Good Repair by improving the condition of an asset or mitigating further deterioration. Where available, asset condition data is provided to evaluation teams to assist in their review of each project proposal.

While all Reliability and Modernization projects are scored using all eight criteria, Expansion projects represent the creation of new assets and are exempt from System Preservation and Safety scoring.

Scores submitted by each member of a scoring team are averaged, then weighted according to the investment priority. Projects are then grouped by investment program and ranked by total weighted score within each investment program. The Capital Planning team prepares a briefing with total weighted score, averaged criteria-level scores, a project summary, and notes from evaluation teams and presents it to the MBTA senior leadership team. In addition to this briefing, the

leadership team also considers project readiness, modal and geographic equity, resource availability, and other impacts in determining the relative priority of each funding request.

Following the prioritization stage, requests recommended for funding are matched to available sources and sequenced over the five-year period. A full draft of the five-year CIP, including both existing projects and new investments, is assembled and posted for public comment. Following the closing of the public comment period, the CIP is further refined as needed and submitted to the MBTA Board of Directors for approval before being finalized and published in June.

The Capital Planning team continually works to update and improve the project selection process. Scoring criteria and supporting data sources continue to evolve and change to better inform and support capital project decision-making.

8.2.2 FUNDING SOURCES

The primary funding sources available for capital investment fall under four categories: Federal funding, State funding; MBTA sources, and Others. The value represented in this table are the estimated sources for FY23-27

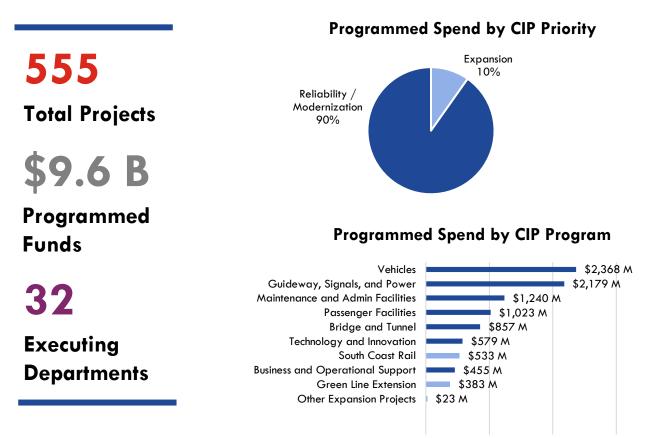| **FEDERAL FUNDING** $3,769 M	**STATE FUNDING** $1,426 M	**MBTA SOURCES** $4,384 M	**OTHERS** $66 M
FTA Formula Funds	**Project-Specific**	**Bond**	**Reimbursable**
▸ Urbanized Area Program (Section 5307)	▸ Commonwealth bond proceeds for specific projects including	▸ Taxable, tax-exempt, and sustainability bonds	▸ Outside funds through partnerships and formal agreements
▸ Buses and Bus Facilities (Section 5339)	» South Coast Rail Phase 1	**Loans**	
▸ State of Good Repair (Section 5337)	» Green Line Extension	▸ Build America Bureau (BAB) loans through TIFIA and RRIF	
Discretionary funds	» Red Line/Orange Line vehicles and infrastructure improvements	**Operating Budget Transfer**	
▸ Competitive processes run by federal agencies. Funds included in the CIP after award	» Procurement of Bi-Level Commuter Rail Coaches	▸ Funds transferred from MBTA's operating budget to the capital program	
		Capital Maintenance Fund (CMF)	
		▸ Authority's fund to be used at the discretion of the CFO	
		Note – The sum of MBTA bonds and loans is limited by the overall coverage ratio in order to maintain the MBTA's credit rating	

The Capital Program Planning and Capital Budget teams are responsible for estimating funding sources over the next five years based on existing funding agreements and reasonable assumptions regarding anticipated Federal formula funds, State and MBTA bonding capacity, third-party reimbursements, and carryover funds from previous years. These projections are then used as the funding constraints for the capital plan, with programmed funds at or below these anticipated sources of funds.
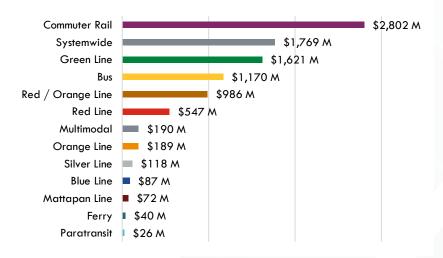
8.3 FY23-27 Capital Investment Plan

The FY23-27 Capital Investment Plan was approved by the MBTA Board of Directors in May 2022. It includes $9.6 billion in programmed funding over the next five years to make critical safety enhancements, improve reliability, modernize our assets, enhance capacity, and expand the transit network.

8.3.1 CIP BY THE NUMBERS

555
Total Projects

$9.6 B
Programmed Funds

32
Executing Departments

Programmed Spend by CIP Priority

Expansion 10%
Reliability / Modernization 90%

Programmed Spend by CIP Program

Program	Spend
Vehicles	$2,368 M
Guideway, Signals, and Power	$2,179 M
Maintenance and Admin Facilities	$1,240 M
Passenger Facilities	$1,023 M
Bridge and Tunnel	$857 M
Technology and Innovation	$579 M
South Coast Rail	$533 M
Business and Operational Support	$455 M
Green Line Extension	$383 M
Other Expansion Projects	$23 M

Programmed Spend by Mode

Mode	Spend
Commuter Rail	$2,802 M
Systemwide	$1,769 M
Green Line	$1,621 M
Bus	$1,170 M
Red / Orange Line	$986 M
Red Line	$547 M
Multimodal	$190 M
Orange Line	$189 M
Silver Line	$118 M
Blue Line	$87 M
Mattapan Line	$72 M
Ferry	$40 M
Paratransit	$26 M

8.4   MBTA Capital Needs Assessment

The MBTA Capital Needs Assessment uses a data-driven, risk-informed approach to identify and prioritize the capital needs of the MBTA. Following guidance from the FTA, the MBTA reports information about its capital assets to the National Transit Database (NTD) and sets forward-looking asset performance targets for fleet age, speed restrictions, and facility condition on an annual basis. These targets are reviewed and approved by the Boston Metropolitan Planning Organization and the FTA.

In addition to the above FTA mandated practices, the MBTA carries out an assessment of the agency's capital needs every three to four years. This process seeks to:

1. Understand the condition and age of MBTA's capital assets and the approximate costs to replace or repair them, and

2. Leverage this information to support smarter capital investment decision making.

The 2022 Capital Needs Assessment (CNA) aims to update and expand previous analyses performed by the agency and set a new standard for evaluating the MBTA's assets and prioritizing investments. Asset condition, criticality, counts, and costs are used to gain an understanding of the MBTA's capital needs at the asset class level. The goal of the assessment is to support the prioritization of reliability and modernization focused capital needs in a fiscally unconstrained environment.

The 2022 Capital Needs Assessment is currently underway and will be completed in late 2022. The 2022 TAM Plan will continue to track the evolution of this analysis and document areas of improvement to refine the analysis and support better data inputs to deliver a more accurate capital needs assessment in future cycles.

8.4.1   IMPROVEMENTS TO THE CAPITAL NEEDS ASSESSMENT PROCESS FOR 2022

The following discrete products have been developed to improve the Capital Needs Assessment process:

▸ Enterprise-level Asset Condition Assessment Standard

▸ Asset Class Condition Guidelines

▸ Asset Criticality Standard

▸ Common Attribute Framework which enables the creation of a master inventory by standardizing asset information from various sources across the organization.

Enterprise-Level Asset Condition Assessment Standard

The Enterprise-Level Asset Condition Assessment Standard applies to all equipment, rolling stock, facilities, and infrastructure assets that are owned, contracted, and/or managed by the MBTA to provide public transportation services.

This standard is not a replacement for asset inspections as part of a regularly schedule preventative maintenance activity but is intended to define data standards necessary for evaluating assets and collecting asset information that aligns with MBTA's data-driven decision-making processes.

The standard outlines 5 condition indicators that can be applied to all the MBTA assets and sets the foundation for a consistent approach. The condition indicator includes the following:
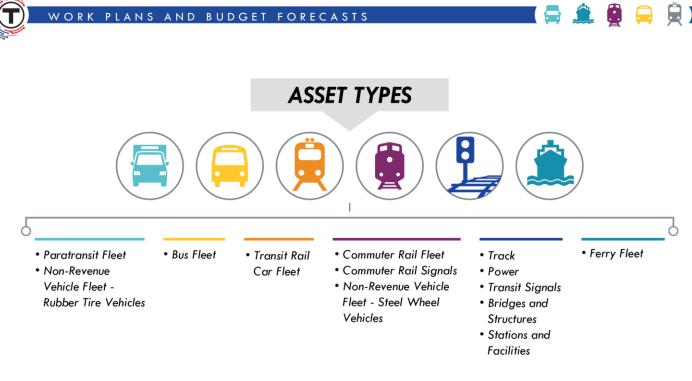
CONDITION INDICATOR	DESCRIPTION	EXAMPLE
Reliability	Assessment based on an asset's continued ability to function at its required standard, which should include consideration of the historic failure rates of the asset.	Asset availability may serve as the reliability measure for an asset, based on mechanical availability or asset functionality, not operational availability. For example, a bus that is not available because it is out for routine maintenance or does not have a driver does not count against this measure when in good functional standing.
Measured	Assessment based on repeatable, automated equipment-based or manual measurement of one or more specific asset characteristics which are indicative of the asset's overall condition.	A track gauge that is measured as designed with zero deviation.
Visual	Assessment based on visually identifiable signs of asset wear or deterioration.	A steel bridge substructure showing minor corrosion of steel surfaces with no signs of fatigue present, overload, impact damage, or scour.
Maintenance Condition	Assessment based on the ability to maintain condition (or performance of the asset) using planned maintenance activities, and the number of outstanding maintenance activities that exist within the system.	A van used for paratransit services with no historic breakdowns or failures and corrective maintenance count less than a vehicle of similar type and age.
Age	Estimated based on the share of an asset's expected useful life elapsed.	A support vehicle that is one year old, with expected service years of eight when new, would have 88% of its estimated useful life remaining.

Asset Class Condition Guidelines

Asset condition is a measure of the appearance, quality and working order of an asset, including its ability to deliver the required level of service at minimal risk. As stated in the Asset Condition Standard, the condition of an asset can be assessed by different types of indicators that are used to provide the overall condition score. Depending on the asset class and available data, different indicators may be weighted to determine the overall condition scores.

Since the MBTA is responsible for a wide variety of assets, the Asset Class Condition Guidelines provide specific guidance on how to apply the condition standard to different asset types. These guides were developed in conjunction with asset owners and subject matter experts.

Asset Class Condition Guidelines have been developed for the following asset types:

ASSET TYPES

- Paratransit Fleet
- Non-Revenue Vehicle Fleet - Rubber Tire Vehicles

- Bus Fleet

- Transit Rail Car Fleet

- Commuter Rail Fleet
- Commuter Rail Signals
- Non-Revenue Vehicle Fleet - Steel Wheel Vehicles

- Track
- Power
- Transit Signals
- Bridges and Structures
- Stations and Facilities

- Ferry Fleet

Asset Criticality Standard

The Asset Criticality Standard applies to all equipment, rolling stock, facilities, and infrastructure assets that are owned, contracted, and/or managed by the MBTA to provide public transportation services.

The criticality standard methodology includes six factors for assessing the criticality of all MBTA asset classes: safety, climate vulnerability, operations and maintenance, ridership (overall), ridership equity impact, and accessibility. These criticality factors are aligned to the MBTA's strategic priorities as identified in the 2020 Strategic Planning Report. Unlike the Asset Condition Standard, all these criticality factors apply to each asset class.

These criticality factors, combined with the asset condition indicators, determine the relative risk of an asset and its relative priority for capital investment.

CRITICALITY FACTOR	DESCRIPTION
Safety	Determines whether an asset is classified as safety-critical (if an unknown or uncontrolled risk of a safety incident or safety event exists if an asset is not maintained according to the defined requirements).
Climate Vulnerability	Determines the asset's vulnerability to climate stressors, including extreme heat, sea-level rise and storm surge, inland flooding, high winds, and winter weather.
Operations and Maintenance	Determines an asset's impacts on operations and maintenance, including operational importance, redundancy, time to repair, and regulatory compliance.
Ridership (Overall)	Determines the volume of riders impacted should an asset fail or go out of service for a period.
Ridership Equity Impact	Determines the proportion of impacted riders that are low-income, minority, low vehicle households, seniors, or persons with disabilities.
Accessibility	Determines whether an asset is an accessibility feature that would impact people with disabilities or seniors.

Common Attribute Framework

The Common Attribute Framework provides a structure for all assets with a uniform set of attribute fields for which asset condition and asset criticality standards can be applied. The framework also establishes a nested hierarchy in which assets can be linked to their parent assets as well as larger asset types and categories.

9. ASSET MANAGEMENT IMPROVEMENT ACTIONS

This section summarizes the MBTA's current asset management capability and provides a roadmap for asset management improvement. This section updates actions as defined in the MBTA's 2018 TAM Plan, incorporates new improvement opportunities and regulatory requirements, and best practice asset management standards.

Asset Management at the MBTA is a practice that matures over time through cycles of continuous improvement. The TAM Plan and cyclical updates documents this maturity and provides the MBTA a line of sight on the direction of asset management practice to align activities across the organization.

9.1 Overview

The commencement of MBTA's asset management journey pre-dates the publication of FTA's Asset Management Final Rule. The list below highlights major milestones in this journey:

▸ Dedicated resource to implement the Asset Management Program

▸ Established an Asset Management Core Team

▸ Provided Targeted Asset Management Training

▸ Supported ongoing improvement capital project prioritization and project selection process.

▸ Implementing Enterprise Asset Management System for transit infrastructure, including the development and formalization of asset management standards.

▸ Mapped the As-Is Asset Management Business Processes to support the establishment of MBTA's asset management baseline and inform the transition strategy to operate in its future target state.

▸ Initiated a Data Quality Improvement Initiative through the validation of its asset inventory and condition information.

▸ Benchmarked the MBTA against a recognized global Asset Management Maturity model

▸ Identified further opportunities for improvement for asset management capabilities at the MBTA.
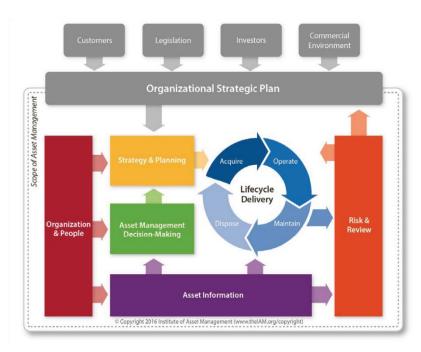
9.2 MBTA Current Asset Management Capability

9.2.1 ASSET MANAGEMENT ASSESSMENT METHODOLOGY

As part of the 2018 TAM Plan development, the MBTA undertook an independent assessment of the maturity of its asset management practice. This assessment served as a baseline from which the Asset Management Team and the organization could develop a comprehensive and organized set

of improvement actions to expand asset management capacity and improve the nature of the practice. The asset management maturity assessment uses the Institute of Asset Management's internationally accepted conceptual model for asset management. This model is comprised of a suite of six subject groups covering a total of 39 asset management subjects. These subjects connect to organizational functions across the MBTA and allow for a comprehensive understanding of how existing practice aligns with industry standards.

FIGURE 9-1 **Scope of Asset Management**

FIGURE 9-2 **MBTA Asset Management for Improvement**

The IAM Conceptual Model of Asset Management and 39 subject areas serves as a framework to organize improvement actions identified in this TAM plan. The Asset Management Team in coordination with the MBTA senior leadership will revisit this maturity assessment periodically and prioritize initiatives with the most benefit to the organization.

9.2.2 ASSET MANAGEMENT MATURITY RESULTS

Based on the 2018 Asset Management Maturity assessment and subsequent evaluation of the state of the practice at the MBTA the following areas of excellence and improvement have been identified.

Areas of Excellence:

▶ MBTA demonstrates good practice in Contingency Planning and Reliance Analysis with contingency plans that are rigorously tested and improved.

▶ Asset Operation activities are well documented in various existing manuals maintained by asset owners.

▶ Established dedicated Asset Management Program office and staffing to support asset management activities.

▶ Established asset focused condition and criticality standards across MBTA's infrastructure portfolio.

Areas for Improvement:

▶ Establishing processes to improve lifecycle costing, resourcing, and tactical planning

▶ Aligning asset information and systems to better support decision making and asset awareness

▶ Continue to improve organization-wide documentation and communication around asset management, capital planning, and day-to-day resourcing decisions

▶ Improve performance monitoring and target setting

9.3   MBTA Asset Management Improvement Actions

The set of improvement activities that follow are based on the MBTA's Asset Management team evaluation of the state of the practice, updates to actions identified in the Transportation Asset Management Improvement Plan, and the incorporation of evolving organizational priorities, goals, and objectives.

The areas identified for improvement are organized to align with the Asset Management Conceptual Model and Subject Groups.

ACTION	DESCRIPTION
1. Strategy and Planning	
Asset Management Plans	Develop Asset Management Plans for each key asset type. These would provide practitioner level – owner guides to document and preserve institutional knowledge
Update Strategic Asset Management Plan	Periodic updates of the MBTA SAMP which is essential to a cycle of continuous improvement in asset management practice.
2026 Transit Asset Management Plan Update	FTA required update of this plan.
Steady State Budget Analysis	Utilize improved asset information to develop funding targets to meet the needs necessary to maintain the as-built infrastructure.

ACTION	DESCRIPTION
2. Asset Management Decision – Making	
Preventative Maintenance and Inspections / Corrective Work Package Planning	Improving on the lifecycle maintenance planning processes detailed in Section 7 of this plan. PMI and Corrective work planning will help communicate and coordinate these activities.
2022 Capital Needs Analysis	Completion of the 2022 Capital Needs Assessment to support investment prioritization and planning.
2026 Capital Need Analysis	Following 4 year cycle of the Capital Need Assessment to support a path of continuous improvement
Develop Capital Needs Analysis to Capital Investment Plan / Operating Expense Process	Reinforce the links between these two important processes, socialize the purpose and engage staff in a seamless flow between these efforts.
Improve Criticality Factors from the Capital Needs Analysis	Continue to refine methodology used to determine criticality in the 2022 CNA so the 2026 CNA is more accurate and effective.
2022 Capital Needs Analysis results in 2023 Capital Improvement Program	Develop results from the 2022 CNA to support ongoing communications regarding the 2023 CIP project portfolio
Roll out State of Good Repair Enterprise Asset Management Module	Add functionality to the EAM system to support state of good repair analysis and planning.
Roll out Network Restrictions Module	Add functionality to the EAM system to support Maintenance of WAY and Signals work management of the right of way track restrictions.
Enhance overall GIS capability with Enterprise Asset Management	Continue further integration of GIS data and systems with the established EAM solution.
3. Lifecycle Delivery	
AM Specification Contract Language	Define contractor compliance with project close-out, asset handover, and data requirements to support asset management practice through MBTA contracting process.
Configuration Management Specification	Define a Configuration Management Approach that is scalable (high criticality vs low criticality) and defines the requirements for establishing, tracking and managing the configuration of assets over time, including: - asset register change management - process for establishing the baseline configuration of assets and their attributes - process for configuration change control - quality assurance of configuration information Ensure alignment with Asset Information Strategy
Asset Creation / Acquisition / Disposal Process	Document and make transparent the process for asset creation, acquisition, and disposal. Determine key stakeholders in these processes and align them to the overall asset management goals and objectives.

ACTION	DESCRIPTION
Create System Engineering Approach	Define a Systems Engineering approach that tailors the level of requirements management of a project to its complexity and criticality and is scalable: - low criticality projects - verification that standard designs have been installed correctly - medium criticality projects - verify and validate qualitative requirements through the project lifecycle - high criticality projects - full systems engineering approach based on fully quantitative disaggregation of requirements and the integration of system design (RAMS and 'V' model approach) *Note: ISO15288 provides guidance on this approach*
Define Reliability Engineering Approach	Develop a reliability engineering methodology setting out the approach to managing asset reliability and in particular how it relates to the Asset Management objectives and the impact of asset reliability on network reliability.
Deploy mobile solutions for E&M and 3rd Parties	Ensure E&M and on-call engineering contractors have the tools to leverage mobile platforms and digital workflow.
Improve overall usability of EAM	Establish a simple workflow to gather user feedback, prioritize issues, and implement usability changes to the EAM configuration in a way that is consistent and repeatable.
Roll out ACM EAM Module	Add functionality to the EAM system for the specification of an approved configuration for an asset type including components, attributes, and serialized parts. Implements an approval workflow upon changing the configuration.
Improve Linear Asset Work Management	Improve configuration of EAM to accommodate linear assets.

4. Asset Information

ACTION	DESCRIPTION
Overall creation of Asset Management standards	Add documentation that is transparent, simple, and easily accessible to communicate asset management standards across the organization.
Rolling stock hierarchy and naming convention	Establish standards for rolling stock hierarchy and naming conventions across modes.
Annual NTD reporting	Document and standardize data management process and report development for the Annual FTA NTD Report.
Document Repository of Condition Assessments	Develop internal tracker to maintain and manage condition assessment records, statuses, and outcomes that is accessible to staff within the MBTA.
Periodic updates to EAM System	Maintain a consistent cycle of EAM system updates and user announcements to ensure solution is meeting the needs of the MBTA.
Further mature asset registry: finish system critical, commence routing maintenance, stairs, retaining walls, capital projects, safety	Expand the classes and types of asses included in the capital asset registry, apply similar standards and documentation for all newly added asset classes and types.
Integration and consolidation of other systems	Identify other systems used in infrastructure inspection, maintenance, and management to be mapped, consolidated, and configured into the current EAM platform.

ACTION	DESCRIPTION
5. Organization and People	
Add 18 resources to team by FY27	Continue to build out asset management human resources to address the scope and scale of improvement actions identified in this plan and that are necessary to successfully bring the MBTA's asset management practices to the next level of maturity and competency.
Define roles and responsibilities between E&M and AM	Clearly identify roles and responsibilities between Engineering and Maintenance, Quality Management, and Asset Management teams so staff pull together to accomplish the MBTA's operational and strategic goals.
T Website Presence	Expand the Asset Management presence on the internal / external facing websites.
Develop AM Training Curriculum	Develop a standard curriculum to build asset management capacity and competency across the MBTA.
6. Risk and Review	
Start remote monitoring pilot	Pilot Internet of Things integration for remote monitoring of key asset types, this will reduce staff time necessary for certain inspections and allow for real-time monitoring of infrastructure assets.
Start linking with Financial System	Develop links between Financial System records and asset infrastructure records. Link historic costs, on-going expenses, and operating data to develop clearer perspective of asset lifecycle costs.
Continue annual condition assessments	Maintain the cycle of condition assessments and build this into an ongoing and consistent practice at the MBTA
Annual Board Presentations	Provide ongoing presentations to the MBTA Board and executive leadership so they are deeply connected to asset management practice.
Roll out network restriction EAM module	Implement the network restriction module to better track infrastructure restrictions, provide better data for NTD reporting, and management of linear infrastructure assets.
Participate in MBTA Risk Review Committee	Represent the asset management perspective in review of the MBTA's key infrastructure and ensure a line of sight across MBTA's official risk management practice.

10. INTERDEPENDENCIES

This section summarizes and introduces the interdependent nature in the management of infrastructure that the MBTA operates on or has capital responsibility over.

Nearly 60% of the active railroad system in Massachusetts is now publicly owned (25% MassDOT, 32% MBTA, 1% Amtrak/MWRA/Federal). The MBTA and Amtrak operate on MassDOT rail lines to provide daily passenger service; about 47% of MassDOT-owned rail lines have shared use between passenger and freight.

▸ MassDOT Worcester Line and Grand Junction Branch are used and maintained as part of the MBTA Commuter Rail system.

▸ The CapeFLYER and Foxboro special event trains operated by the MBTA use MassDOT rail lines to Cape Cod and the Framingham Secondary to Gillette Stadium, respectively.

In June 2010, MassDOT acquired the South Coast Lines. The South Coast Rail project is currently underway to extend Commuter Rail service to the Fall River, New Bedford, and Taunton on the South Coast of Massachusetts. The service will be operated by MBTA.

Additionally, the Passenger Rail Investment and Improvement Act (PRIIA) 212 required changes to the Attleboro Agreement by which Amtrak and MBTA share responsibilities on the MBTA-owned section of the Northeast Corridor (NEC) in Massachusetts. The new Attleboro Agreement established in 2017 and updated in 2022 governs the following:

▸ Amtrak access to MBTA line

▸ Amtrak right to dispatch line

▸ Amtrak maintenance of line

▸ MBTA and Amtrak payment of allocated share of costs

▸ MBTA control of jointly funded capital program

As capital responsibility for infrastructure within the Massachusetts border of the NEC now resides with MBTA, over $103 million has been allocated over FY23-27 for NEC capital commitments per the Attleboro Agreement. This includes reliability projects for track, signaling, bridges, and tunnels.

APPENDIX

Glossary of Acronyms

AC	Alternating Current
ADA	Americans with Disabilities Act
AFL-CIO	American Federation of Labor and Congress of Industrial Organizations
AGM	Assistant General Manager
AM	Asset Management
AREMA	American Railway Engineering and Maintenance Association
CFR	Code of Federal Regulations
CIP	Capital Investment Plan
CMF	Capital Maintenance Fund
CNA	Capital Needs Assessment
DC	Direct Current
DPU	Department of Public Utilities
E&M	Engineering and Maintenance
EAM	Enterprise Asset Management
EOC	Emergency Operations Center
FMIS	PeopleSoft Financials and Supply Chain Management
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
FY	Fiscal Year
GIS	Geographic Information System
GLX	Green Line Extension
GM	General Manager
HVAC	Heating, Ventilation, and Air Conditioning
IAM	Institute of Asset Management
IEP	Office of Infrastructure Engineering and Planning
ISO31000	The International Organization for Standardization (ISO) series of international risk management standards
ISO55000	The International Organization for Standardization (ISO) series of international asset management standards

KPI	Key Performance Indicator
LOS	Level of Service
MassDOT	Massachusetts Department of Transportation
MBTA	Massachusetts Bay Transportation Authority
MOW	Maintenance of Way
MPO	Metropolitan Planning Organization
NEC	Northeast Corridor
NFPA	National Fire Protection Association
NTD	National Transit Database
O&M	Operations and Maintenance
OCE	Office of the Chief Engineer
OCS	Overhead Catenary System
ODCR	Office of Diversity and Civil Rights
OEM	Original Equipment Manufacturer
OPMI	MassDOT Office of Performance Management and Innovation
ORE	Office of Reliability Engineering
PMI	Preventative Maintenance and Inspection
PRIIA	Passenger Rail Investment and Improvement Act
PSAC	Project Selection Advisory Council
PTC	Positive Train Control
QA	Quality Assurance
QMS	Quality Management System
RE	Reliability Engineering
SCADA	Supervisory control and data acquisition
SCR	South Coast Rail
SGR	State of Good Repair
SMS	Safety Management System
SUV	Sports Utility Vehicle
SWA	Systemwide Accessibility
TAM	Transit Asset Management

TAMP	Transit Asset Management Plan
TERM	Transit Economic Requirements Model
TFM	Transit Facilities Maintenance
ULB	Useful Life Benchmark
VE	Vehicle Engineering

Key Definitions

Accountable Executive	Defined by 49 CFR 625.5 as a "single, identifiable person who has ultimate responsibility for carrying out the safety management systems of a public transportation agency; responsibility for carrying out transit asset management practices; and control or direction over the human and capital resources needed to develop and maintain both the agency's public transportation agency safety plan, in accordance with 49 U.S.C. 5329(d), and the agency's transit asset management plan in accordance with 49 U.S.C. 5326."
Asset	An item, entity or thing that has actual or potential value to the organization.
	A tangible item of value that is owned, contracted, and/or managed by MBTA for the purposes of providing transit services. This includes fleet, equipment, facilities, and infrastructure assets that are repairable, replaceable and subject to a preventive maintenance schedule or inspection or calibration or need to be tracked from a capital depreciation point of view.
Asset Management	The integrated, multidisciplinary set of strategies in sustaining infrastructure. Generally, includes processes focused on the infrastructure lifecycle, maintenance, rehabilitation, and replacement.
Capital Asset	Defined by 49 CFR 625.5 as a "unit of rolling stock, a facility, a unit of equipment, or an element of infrastructure used for providing public transportation."
Capital Investment Plan	The annual fiscally constrained rolling five-year investment program that funds the planning, construction, and capital maintenance of asset across the MBTA.
Capital Needs Assessment	The Capital Needs Assessment is an effort performed by MBTA staff to evaluate the capital inventory of the organization, identify infrastructure assets in need of replacement due to documented age or condition, determine a cost estimate for the capital replacement need, and develop insights by asset category.
Directional Route Miles	The mileage in each direction over which public transportation vehicles travel while in revenue service. It excludes non-revenue track such as yards, turn-arounds, and storage tracks.
Lifecycle	The time interval that begins with the acquisition of a transit asset or land asset and ends with the disposal of the asset. Lifecycle phases may include planning, design, procurement, construction, operations, maintenance, rehabilitation, and asset replacement/disposal.
State of Good Repair (SGR)	Defined by 49 CFR 625.5 as the "condition in which a capital asset is able to [safely] operate at a full level of performance." The State of Good Repair is further defined by an asset's Useful Life Benchmark (for rolling stock and equipment) or physical condition (for facilities). Assets are considered in a State of Good Repair when they do not meet or exceed their ULB or physical condition threshold. Vehicle and equipment assets, for example, are considered in a State of Good Repair, when rated as a 2.5 or above on FTA's TERM Lite scale, where 2.5 is equivalent to the ULB set for an asset class. Additionally, facilities, are considered in a State of Good Repair when rated as a 3 or above on FTA's TERM scale. See also definition for Useful Life Benchmark.
State of Good Repair (SGR) Backlog	The cumulative dollar value of deferred capital maintenance and replacement needs.
TERM Scale	The five-category rating system used in the FTA's Transit Economic Requirement Model (TERM) to describe the condition of an asset, where 5 is excellent condition and 1 is poor condition.

Tier 1 Transit Provider	An entity that receives federal financial assistance under 49 U.S.C. Chapter 53, either directly from FTA or as a subrecipient, that owns, operates, or manages either (1) one hundred and one (101) or more vehicles in revenue service during peak regular service across all fixed route modes or in any one non-fixed route mode, or (2) rail transit.
Transit Asset Management	Defined by 49 CFR 625.5 as "the strategic and systematic practice of procuring, operating, inspecting, maintaining, rehabilitating, and replacing transit capital assets to manage their performance, risks, and costs over their lifecycles, for the purpose of providing safe, cost-effective, and reliable public transportation."
Transit Asset Management Plan	This document, which describes: the capital asset inventory; condition of inventoried assets; TAM performance measures, targets, and prioritization of investments aligned with the agency's TAM and SGR policy, strategic goals, and objectives; as well as the strategies, activities, and resources required for delivering this plan (including decision support tools and processes); and other agency-wide approaches to continually improve TAM practices. While this TAM Plan exists as a standalone document, Asset Class Plans may be considered an extension of the TAM Plan by reference.
Track Miles	The sum of the one-way linear miles of all trackage in a system, including all main track and trackage in yards, car barns, switches, and turnouts.
Useful Life	Defined by 49 CFR 625.5 as "either the expected lifecycle of a capital asset or the acceptable period of use in service determined by FTA." It generally defines the minimum eligibility for retirement, replacement, or disposal of an asset. See also definition for Estimated Useful Life (EUL).
Useful Life Benchmark (ULB)	Defined by 49 U.S.C. Chapter 53 as "the expected lifecycle or the acceptable period of use in service for a capital asset, as determined by a transit provider, or the default benchmark provided by FTA." The ULB is the realistic expectation for when an asset would be disposed or replaced based on operating environment and procurement timelines. It is not the same as "Useful Life" in FTA grant programs, is reported by age (in years), and usually only pertains to rolling stock or equipment. It is a single number shared for or within specified asset classes, although may vary across different asset classes and providers. See also definition for Estimated Useful Life (EUL)

State of Good Repair Performance Measures and Targets

Federal regulation (49 CFR 625.43) requires transit agencies to report on specific state of good repair performance measures. These asset performance measures support MassDOT performance measurement of system condition, but also feed into a common baseline of metrics across transit agencies in the United States to support the analysis of the nation's state of good repair backlog. In addition to measuring state of good repair performance, agencies are also required to set performance targets for each asset class annually. The required state of good repair performance measures and targets are defined further in the table below:

CAPITAL ASSET CATEGORY	SGR PERFORMANCE MEASURE	PERFORMANCE TARGET
Rolling Stock (Revenue Vehicles)	Age	% of revenue vehicles that have met or exceeded their Useful Life Benchmark by asset class.
Equipment (Non-revenue vehicles)	Age	% of non-revenue vehicles that have met or exceeded their Useful Life Benchmark (ULB)
Infrastructure (Rail Fixed Guideway, Track, Signals, and Systems)	Performance Restrictions (slow zones)	% of track segments with performance restrictions
Facilities (Passenger, Parking, Maintenance, Administration)	Condition	% of facilities with a condition rating below 3.0 on the FTA Transit Economic Requirements Model (TERM) scale

Revenue and non-revenue vehicles: For revenue and non-revenue vehicles, the state of good repair performance measure is set by age; the performance target is the percent of those vehicles that have met or exceeded their Useful Life

Benchmark (ULB). The ULB is defined as the expected lifecycle (in years) of an asset or the acceptable period of use in service for a capital asset, as determined by a transit provider, or the default benchmark provided by FTA. ULB is not to be confused with "useful life," where the useful life is the expected life cycle of a capital asset or the acceptable period of use in service determined by FTA prior to replacement eligibility. For example, a bus may have a useful life of 12 years and at this point is eligible for replacement by FTA standards, but the actual point of replacement and ULB may be 14 years.

Infrastructure: Rail fixed guideway, track, signals, and systems are measured using the percent of track segments with performance restrictions. While this is the required performance measure for reporting to the National Transit Database, this performance measure does not always accurately reflect the health of the track system. Therefore, MBTA is looking to other performance measures, such as age or Track Quality Index and geometric profile, specifically for track, power, and signals.

Facilities: Facility condition is measured using FTA's Transit Economic Requirements Model (TERM) one to five condition scale (where 5 is considered excellent condition). Historically, MBTA has assessed facility condition through in-house engineering expertise on the assets and has completed comprehensive physical condition assessments of its passenger support facilities.

MBTA Funding Sources

FY23-27 Sources

The FY23-27 CIP reflects an estimated $9.6B in programmed sources:

$66M → **$66M in Reimbursable funds** through partnerships and agreements

$1,426M in State funds, including Bond Cap and Rail Enhancement Program special obligation bonds tied to specific projects. Source is tied to project cashflows.

$4,385M in MBTA funds to support the 20% match for Federal projects and efforts funded solely by the Authority, including:
  » $500-590M per year in bonds, commercial paper, and USDOT loans
  » One-time $480M transfer from operating budget to support critical investments
  » $60M per year, assumed as state Bond Cap, now included as a five-year annual transfer

$3,769 in Federal funds reflecting Federal Formula funding levels included in the Bipartisan Infrastructure Law (BIL)

Chart bar labels (bottom to top): $3,769M, $4,384M, $1,426M, $66M

Legend: ■ Federal ■ MBTA ■ State ■ Reimbursable